New and Changed Information

As of Cisco DCNM Release 5.2, Cisco Fabric Manager and Cisco Data Center Network Manager for LAN are merged into one unified product called Cisco Data Center Network Manager (DCNM) that can manage both LAN and SAN environments. As a part of this product merger, the name Cisco DCNM for SAN replaces the name Cisco Fabric Manager.

The following documentation changes support the merged Cisco DCNM product:

- Cisco DCNM product documentation for Cisco DCNM Release 5.2 is retitled with the name Cisco DCNM for LAN.
- Cisco Fabric Manager product documentation for Cisco DCNM Release 5.2 is retitled with the name Cisco DCNM for SAN.
- Cisco DCNM for SAN product documentation is now published to the Data Center Network Manager listing page on Cisco.com: http://www.cisco.com/en/US/products/ps9369/tsd_products_support_configure.html

  This URL is also the listing page for Cisco DCNM for LAN product documentation.
- Cisco Fabric Manager documentation for software releases earlier than Cisco DCNM Release 5.2, retains the name Cisco Fabric Manager and remains available at its current Cisco.com listing page: http://www.cisco.com/en/US/products/ps10495/tsd_products_support_configure.html

  You should continue to use the Cisco Fabric Manager documentation if you are using a release of Cisco Fabric Manager software that is earlier than Cisco DCNM Release 5.2.
- The name DCNM-SAN is used in place of Cisco DCNM for SAN in the user interface of Cisco Data Center Network Manager; likewise, the name DCNM-LAN is used in place of Cisco DCNM for LAN in the user interface. To match the user interface, the product documentation also uses the names DCNM-SAN and DCNM-LAN.
- The following new publications support both Cisco DCNM for LAN and DCNM for SAN, and address the new licensing model, the new installation process, and the new features of Cisco DCNM:
  - *Cisco DCNM Installation and Licensing Guide*
  - *Cisco DCNM Release Notes*

For a complete list of Cisco DCNM documentation, see the “Related Documentation” section in the Preface.

As of Cisco MDS NX-OS Release 4.2(1), software configuration information is available in new feature-specific configuration guides for the following information:

- System management
- Interfaces
- Fabric

- Quality of service
- Security
- IP services
- High availability and redundancy

The information in these new guides previously existed in the *Cisco MDS 9000 Family CLI Configuration Guide* and in the *Cisco Fabric Manager Fabric Configuration Guide*. Those configuration guides remain available on Cisco.com and should be used for all software releases prior to MDS NX-OS Release 4.2(1). Each guide addresses the features introduced in or available in a particular release. Select and view the configuration guide that pertains to the software installed in your switch.

For a complete list of document titles, see the list of Related Documentation in the "Preface."

To find additional information about Cisco MDS NX-OS Release 4.2(x), see the *Cisco MDS 9000 Family Release Notes* available at the following Cisco Systems website:

http://www.cisco.com/en/US/products/ps5989/prod_release_notes_list.htm

About this Guide

The information in the new *Cisco MDS 9000 NX-OS System Management Configuration Guide* previously existed in the following parts of the *Cisco MDS 9000 Family CLI Configuration Guide:*

- Part 2: Installation and Switch Management
- Part 5: Security
- Part 8: Network and Switch Monitoring
- Part 9: Troubleshooting

Table 1 lists the New and Changed features for this guide, starting with MDS NX-OS Release 6.2(9).

Table 1-1 New and Changed Features

Feature	New or Changed Topics	Changed in Release	Where Documented
Static IP Peers for CFS	Modified details about Static IP Peers for CFS.	6.2(11)	Chapter 2, "Using the CFS Infrastructure"
Scale Restart	Enables the domain manager scale restart on a VSAN.	6.2(9)	Chapter 11, "Configuring Domain Parameters"
OBFL	Added a note.	6.2(9)	Chapter 6, "Monitoring System Processes and Logs"
Port Pacer	Paces the number of mode F ports that come up simultaneously so that ports are brought up in a phased manner.	6.2.(7)	Chapter 14, "Configuring Port Pacing"
Internal PortLoopback	Verifies connectivity to every port on every module, runs of all the ports irrespective of their state.	6.2.(7)	Chapter 9, "Configuring Online Diagnostics"
Generic Online Diagnostics	Add the generic online diagnostics (GOLD) feature.	6.2.(1)	Chapter 9, "Configuring Online Diagnostics"

Preface

This preface describes the audience, organization, and conventions of the *Cisco MDS 9000 Family NX-OS System Management Configuration Guide*. It also provides information on how to obtain related documentation.

Audience

This guide is for experienced network administrators who are responsible for configuring and maintaining the Cisco MDS 9000 Family of multilayer directors and fabric switches.

Organization

This guide is organized as follows:

Chapter	Title	Description
Chapter 1	System Management Overview	Provides an overview of the system management features to monitor and manage a switch using the CLI.
Chapter 2	Using the CFS Infrastructure	Explains the use of the Cisco Fabric Services (CFS) infrastructure to enable efficient database distribution.
Chapter 3	Configuring System Message Logging	Describes how system message logging is configured and displayed.
Chapter 4	Configuring Call Home	Provides details on the Call Home service and includes information on Call Home, event triggers, contact information, destination profiles, and e-mail options.
Chapter 5	Scheduling Maintenance Jobs	Describes the Cisco MDS command scheduler feature that helps you schedule configuration and maintenance jobs in any switch in the Cisco MDS 9000 Family.
Chapter 7	Configuring the Embedded Event Manager	Provides information about configuring Embedded Event Manager (EEM).

Chapter	Title	Description
Chapter 6	Monitoring System Processes and Logs	Provides information on displaying system processes and status. It also provides information on configuring core and log files, HA policy, heartbeat and watchdog checks, and upgrade resets.
Chapter 8	Configuring RMON	Provides details on using RMONs to configure alarms and events.
Chapter 9	Configuring Online Diagnostics	Describes how to configure online diagnostics to monitor the software and hardware.
Chapter 10	Configuring SNMP	Provides details on how you can use SNMP to modify a role that was created using CLI.
Chapter 11	Configuring Domain Parameters	Explains the Fibre Channel domain (fcdomain) feature, which includes principal switch selection, domain ID distribution, FC ID allocation, and fabric reconfiguration functions.
Chapter 12	Monitoring Network Traffic Using SPAN	Describes the Switched Port Analyzer (SPAN), SPAN sources, filters, SPAN sessions, SD port characteristics, and configuration details.
Chapter 13	Configuring Fabric Configuration Server	Describes how the fabric configuration server (FCS) feature is configured and displayed.

Document Conventions

Command descriptions use these conventions:

boldface font	Commands and keywords are in boldface.
italic font	Arguments for which you supply values are in italics.
[ ]	Elements in square brackets are optional.
[x | y | z]	Optional alternative keywords are grouped in brackets and separated by vertical bars.

Screen examples use these conventions:

`screen font`	Terminal sessions and information the switch displays are in screen font.
`boldface screen font`	Information you must enter is in boldface screen font.
italic screen font	Arguments for which you supply values are in italic screen font.
`< >`	Nonprinting characters, such as passwords, are in angle brackets.
`[ ]`	Default responses to system prompts are in square brackets.
`!, #`	An exclamation point (!) or a pound sign (#) at the beginning of a line of code indicates a comment line.

This document uses the following conventions:

Note Means reader *take note*. Notes contain helpful suggestions or references to material not covered in the manual.

Caution Means *reader be careful*. In this situation, you might do something that could result in equipment damage or loss of data.

Related Documentation

The documentation set for the Cisco MDS 9000 Family includes the following documents. To find a document online, use the Cisco MDS NX-OS Documentation Locator at:

http://www.cisco.com/en/US/docs/storage/san_switches/mds9000/roadmaps/doclocater.htm

Release Notes

- *Cisco MDS 9000 Family Release Notes for Cisco MDS NX-OS Releases*
- *Cisco MDS 9000 Family Release Notes for MDS SAN-OS Releases*
- *Cisco MDS 9000 Family Release Notes for Cisco MDS 9000 EPLD Images*
- *Cisco DCNM Release Notes*

Regulatory Compliance and Safety Information

- *Regulatory Compliance and Safety Information for the Cisco MDS 9000 Family*

Compatibility Information

- *Cisco Data Center Interoperability Support Matrix*
- *Cisco MDS 9000 NX-OS Hardware and Software Compatibility Information and Feature Lists*
- *Cisco MDS 9000 Family Switch-to-Switch Interoperability Configuration Guide*

Hardware Installation

- *Cisco MDS 9500 Series Hardware Installation Guide*
- *Cisco MDS 9200 Series Hardware Installation Guide*
- *Cisco MDS 9100 Series Hardware Installation Guide*
- *Cisco MDS 9124 and Cisco MDS 9134 Multilayer Fabric Switch Quick Start Guide*

Software Installation and Upgrade

- *Cisco MDS 9000 NX-OS Software Upgrade and Downgrade Guide*

Cisco NX-OS

- *Cisco MDS 9000 Family NX-OS Licensing Guide*
- *Cisco MDS 9000 Family NX-OS Fundamentals Configuration Guide*
- *Cisco MDS 9000 Family NX-OS Interfaces Configuration Guide*
- *Cisco MDS 9000 Family NX-OS Fabric Configuration Guide*
- *Cisco MDS 9000 Family NX-OS Quality of Service Configuration Guide*
- *Cisco MDS 9000 Family NX-OS Security Configuration Guide*
- *Cisco MDS 9000 Family NX-OS IP Services Configuration Guide*
- *Cisco MDS 9000 Family NX-OS Intelligent Storage Services Configuration Guide*
- *Cisco MDS 9000 Family NX-OS High Availability and Redundancy Configuration Guide*
- *Cisco MDS 9000 Family NX-OS Inter-VSAN Routing Configuration Guide*
- *Cisco MDS 9000 Family Cookbook for Cisco MDS SAN-OS*

Cisco DCNM-SAN

- *Cisco DCNM Fundamentals Guide, Release 6.x*
- *System Management Configuration Guide, Cisco DCNM for SAN, Release 6.x*
- *Interfaces Configuration Guide, Cisco DCNM for SAN, Release 6.x*
- *Fabric Configuration Guide, Cisco DCNM for SAN, Release 6.x*
- *Quality of Service Configuration Guide, Cisco DCNM for SAN, Release 6.x*
- *Security Configuration Guide, Cisco DCNM for SAN, Release 6.x*
- *IP Services Configuration Guide, Cisco DCNM for SAN, Release 6.x*
- *Intelligent Storage Services Configuration Guide, Cisco DCNM for SAN, Release 6.x*
- *High Availability and Redundancy Configuration Guide, Cisco DCNM for SAN, Release 6.x*
- *Inter-VSAN Routing Configuration Guide, Cisco DCNM for SAN, Release 6.x*
- *SMI-S and Web Services Programming Guide, Cisco DCNM for SAN, Release 6.x*

Command-Line Interface

- *Cisco MDS 9000 Family Command Reference*

Intelligent Storage Networking Services Configuration Guides

- *Cisco MDS 9000 Family I/O Acceleration Configuration Guide*

- *Cisco MDS 9000 Family SANTap Deployment Guide*
- *Cisco MDS 9000 Family Data Mobility Manager Configuration Guide*
- *Cisco MDS 9000 Family Storage Media Encryption Configuration Guide*

Troubleshooting and Reference

- *Cisco MDS 9000 Family and Nexus 7000 Series System Messages Reference*
- *Cisco MDS 9000 Family SAN-OS Troubleshooting Guide*
- *Cisco MDS 9000 Family NX-OS MIB Quick Reference*
- *Cisco DCNM for SAN Database Schema Reference*

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly *What's New in Cisco Product Documentation*, which also lists all new and revised Cisco technical documentation, at:

http://www.cisco.com/en/US/docs/general/whatsnew/whatsnew.html

- Subscribe to the *What's New in Cisco Product Documentation* as a Really Simple Syndication (RSS) feed and set content to be delivered directly to your desktop using a reader application. The RSS feeds are a free service and Cisco currently supports RSS version 2.0.

CHAPTER 1

System Management Overview

You can use the system management features to monitor and manage a switch using Cisco MDS NX-OS software. These features include Call Home, SNMP, RMON, SPAN, and the Embedded Event Manager (EEM).

This chapter describes these features and includes the following sections:

Cisco Fabric Services

The Cisco MDS NX-OS software uses the Cisco Fabric Services (CFS) infrastructure to enable efficient database distribution and to promote device flexibility. CFS simplifies SAN provisioning by automatically distributing configuration information to all switches in a fabric.

For information on configuring CFS, see Chapter 2, “Using the CFS Infrastructure.”

System Messages

System messages are monitored remotely by accessing the switch through Telnet, SSH, or the console port, or by viewing the logs on a system message logging server. Log messages are not saved across system reboots.

For information about configuring system messages, see Chapter 3, “Configuring System Message Logging.”

Call Home

Call Home provides e-mail-based notification of critical system events. A versatile range of message formats are available for optimal compatibility with pager services, standard e-mail, or XML-based automated parsing applications. Common uses of this feature may include direct paging of a network support engineer, e-mail notification to a Network Operations Center, and utilization of Cisco Smart Call Home services for direct case generation with the Technical Assistance Center.

For information about configuring Call Home, see Chapter 4, "Configuring Call Home."

Scheduler

The Cisco MDS command scheduler feature helps you schedule configuration and maintenance jobs in any switch in the Cisco MDS 9000 Family switches.You can use this feature to schedule jobs on a one-time basis or periodically. The Cisco NX-OS command scheduler provides a facility to schedule a job (set of CLI commands) or multiple jobs at a specified time in the future. The jobs can be executed once at a specified time in the future or at periodic intervals.

For information on configuring the Cisco MDS command scheduler feature, see Chapter 5, "Scheduling Maintenance Jobs."

System Processes and Logs

The health of a switch can be monitored by various system processes and logs. The Online Health Management System (system health) is a hardware fault detection and recovery feature. This Health Management System ensures the general health of switching, services, and supervisor modules in any switch in the Cisco MDS 9000 Family.

For information on monitoring the health of the switch, see Chapter 6, "Monitoring System Processes and Logs."

Embedded Event Manager

Embedded Event Manager (EEM) monitors events that occur on your device and takes action to recover or troubleshoot these events, based on your configuration. EEM consists of three major components:

- Event statements—Events to monitor from another Cisco NX-OS component that may require some action, workaround, or notification.
- Action statements —An action that EEM can take, such as sending an e-mail or disabling an interface, to recover from an event.
- Policies—An event paired with one or more actions to troubleshoot or recover from the event.

For information on configuring EEM, see Chapter 7, "Configuring the Embedded Event Manager."

SNMP

Simple Network Management Protocol (SNMP) is an application layer protocol that facilitates the exchange of management information between network devices. In all Cisco MDS 9000 Family switches, three SNMP versions are available: SNMPv1, SNMPv2c, and SNMPv3. The CLI and SNMP use common roles in all switches in the Cisco MDS 9000 Family. You can use SNMP to modify a role that was created using the CLI and vice versa.

Users, passwords, and roles for all CLI and SNMP users are the same. A user configured through the CLI can access the switch using SNMP (for example, the DCNM-SAN or the Device Manager) and vice versa.

For information on configuring SNMP, see Chapter 7, "Configuring SNMP."

RMON

RMON is an Internet Engineering Task Force (IETF) standard monitoring specification that allows various network agents and console systems to exchange network monitoring data. You can use the RMON alarms and events to monitor Cisco MDS 9000 Family switches running the Cisco SAN-OS Release 2.0(1b) or later or Cisco Release NX-OS 4.1(3) or later software.

For information on configuring RMON, see Chapter 8, "Configuring RMON."

Domain Parameters

The Fibre Channel domain (fcdomain) feature performs principal switch selection, domain ID distribution, FC ID allocation, and fabric reconfiguration functions as described in the FC-SW-2 standards. The domains are configured on a per-VSAN basis. If you do not configure a domain ID, the local switch uses a random ID.

For information on configuring the Fibre Channel domain feature, see Chapter 9, "Configuring Domain Parameters."

SPAN

The Switched Port Analyzer (SPAN) feature is specific to switches in the Cisco MDS 9000 Family. It monitors network traffic through a Fibre Channel interface. Traffic through any Fibre Channel interface can be replicated to a special port called the SPAN destination port (SD port). Any Fibre Channel port in a switch can be configured as an SD port. Once an interface is in SD port mode, it cannot be used for normal data traffic. You can attach a Fibre Channel analyzer to the SD port to monitor SPAN traffic.

For information on SPAN feature, see Chapter 10, "Monitoring Network Traffic Using SPAN."

Fabric Configuration Server

The Fabric Configuration Server (FCS) provides discovery of topology attributes and maintains a repository of configuration information of fabric elements. A management application is usually connected to the FCS on the switch through an N port. In the Cisco MDS 9000 Family switch environment, multiple VSANs constitute a fabric, where one instance of the FCS is present per VSAN.

For information on configuring FCS, see Chapter 13, “Configuring Fabric Configuration Server”.”

Using the CFS Infrastructure

Cisco Fabric Services (CFS) provides a common infrastructure for automatic configuration synchronization in the fabric. It provides the transport function as well as a rich set of common services to the applications. CFS has the ability to discover CFS-capable switches in the fabric and discover application capabilities in all CFS-capable switches.

This chapter contains the following sections:

- Information About CFS, page 2-1
- Guidelines and Limitations, page 2-9
- Default Settings, page 2-9
- Configuring CFS, page 2-9
- Configuring CFS Regions, page 2-14
- Verifying CFS Configurations, page 2-16
- Additional References, page 2-19
- Feature History for CFS, page 2-20

Information About CFS

The Cisco MDS NX-OS software uses the Cisco Fabric Services (CFS) infrastructure to enable efficient database distribution and to foster device flexibility. It simplifies SAN provisioning by automatically distributing configuration information to all switches in a fabric.

Several Cisco MDS NX-OS applications use the CFS infrastructure to maintain and distribute the contents of a particular application's database.

Many features in the Cisco MDS switches require configuration synchronization in all switches in the fabric. Maintaining configuration synchronization across a fabric is important to maintain fabric consistency. In the absence of a common infrastructure, such synchronization is achieved through manual configuration at each switch in the fabric. This process is tedious and error prone.

This section includes the following topics:

- Cisco MDS NX-OS Features Using CFS, page 2-2
- CFS Features, page 2-2
- Enabling CFS for an Application, page 2-3
- CFS Protocol, page 2-3

Cisco MDS NX-OS Features Using CFS

The following Cisco NX-OS features use the CFS infrastructure:

- N Port Virtualization
- FlexAttach Virtual pWWN
- NTP
- Dynamic Port VSAN Membership
- Distributed Device Alias Services
- IVR topology
- SAN device virtualization
- TACACS+ and RADIUS
- User and administrator roles
- Port security
- iSNS
- Call Home
- Syslog
- fctimer
- SCSI flow services
- Saved startup configurations using the Fabric Startup Configuration Manager (FSCM)
- Allowed domain ID lists
- RSCN timer
- iSLB

CFS Features

CFS has the following features:

- Peer-to-peer protocol with no client-server relationship at the CFS layer.
- Three scopes of distribution.
  - Logical scope—The distribution occurs within the scope of a VSAN.

  - Physical scope—The distribution spans the entire physical topology.
  - Over a selected set of VSANs—Some applications, such as Inter-VSAN Routing (IVR), require configuration distribution over some specific VSANs. These applications can specify to CFS the set of VSANs over which to restrict the distribution.
- Three modes of distribution.
  - Coordinated distributions—Only one distribution is allowed in the fabric at any given time.
  - Uncoordinated distributions—Multiple parallel distributions are allowed in the fabric except when a coordinated distribution is in progress.
  - Unrestricted uncoordinated distributions—Multiple parallel distributions are allowed in the fabric in the presence of an existing coordinated distribution. Unrestricted uncoordinated distributions are allowed to run in parallel with all other types of distributions.
- Supports a merge protocol that facilitates the merge of application configuration during a fabric merge event (when two independent fabrics merge).

Enabling CFS for an Application

All CFS-based applications provide an option to enable or disable the distribution capabilities. Features that existed prior to Cisco SAN-OS Release 2.0(1b) have the distribution capability disabled by default and must have distribution capabilities enabled explicitly.

Applications introduced in Cisco SAN-OS Release 2.0(1b) or later, or MDS NX-OS Release 4.1(1) or later have the distribution enabled by default.

The application configuration is not distributed by CFS unless distribution is explicitly enabled for that application.

CFS Protocol

The CFS functionality is independent of the lower layer transport. Currently, in Cisco MDS switches, the CFS protocol layer resides on top of the Fiber Channel 2 (FC2) layer and is peer-to-peer with no client-server relationship. CFS uses the FC2 transport services to send information to other switches. CFS uses a proprietary SW_ILS (0x77434653) protocol for all CFS packets. CFS packets are sent to or from the switch domain controller addresses.

CFS can also use IP to send information to other switches.

Applications that use CFS are completely unaware of the lower layer transport.

CFS Distribution Scopes

Different applications on the Cisco MDS 9000 Family switches need to distribute the configuration at various levels:

- VSAN level (logical scope)

  Applications that operate within the scope of a VSAN have the configuration distribution restricted to the VSAN. An example application is port security where the configuration database is applicable only within a VSAN.
- Physical topology level (physical scope)

Applications might need to distribute the configuration to the entire physical topology spanning several VSANs. Such applications include NTP and DPVM (WWN-based VSAN), which are independent of VSANs.

- Between selected switches

  Applications might only operate between selected switches in the fabric. An example application is SCSI flow services, which operates between two switches.

CFS Distribution Modes

CFS supports different distribution modes to support different application requirements: coordinated and uncoordinated distributions. Both modes are mutually exclusive. Only one mode is allowed at any given time.

Uncoordinated Distribution

Uncoordinated distributions are used to distribute information that is not expected to conflict with that from a peer. An example is local device registrations such as iSNS. Parallel uncoordinated distributions are allowed for an application.

Coordinated Distribution

Coordinated distributions can have only one application distribution at a given time. CFS uses locks to enforce this. A coordinated distribution is not allowed to start if locks are taken for the application anywhere in the fabric. A coordinated distribution consists of three stages:

1. A fabric lock is acquired.
2. The configuration is distributed and committed.
3. The fabric lock is released.

Coordinated distribution has two variants:

- CFS driven —The stages are executed by CFS in response to an application request without intervention from the application.
- Application driven—The stages are under the complete control of the application.

  Coordinated distributions are used to distribute information that can be manipulated and distributed from multiple switches, for example, the port security configuration.

Unrestricted Uncoordinated Distributions

Unrestricted uncoordinated distributions allow multiple parallel distributions in the fabric in the presence of an existing coordinated distribution. Unrestricted uncoordinated distributions are allowed to run in parallel with all other types of distributions.

CFS Connectivity in a Mixed Fabric

CFS is an infrastructure component that also runs on the Cisco Nexus 5000 Series switches and the Cisco MDS 9000 switches. A mixed fabric of different platforms (such as the Cisco Nexus 7000 Series, Cisco Nexus 5000 Series, and Cisco MDS 9000 switches) can interact with each other.

Using CFSoIP and CFSoFC, the respective CFS clients can also talk to their instances running on the other platforms. Within a defined domain and distribution scope, CFS can distribute the client's data and configuration to its peers running on other platforms.

All three platforms support both CFSoIP and CFSoFC. However, the Cisco Nexus 7000 Series and Cisco Nexus 5000 Series switches require an FC or FCoE plugin and corresponding configuration in order for CFSoFC to operate. Both options are available by default on the Cisco MDS 9000 switches.

Note Some applications are not compatible with their instances running on different platforms. Therefore, Cisco recommends that you carefully read the client guidelines for CFS distribution before committing the configuration.

For more information on CFS for the Cisco Nexus 5000 Series and Cisco MDS 9000 switches, see the *Cisco Nexus 5000 Series NX-OS System Management Configuration Guide* and the *Cisco MDS 9000 Family NX-OS System Management Configuration Guid*e, respectively.

Locking the Fabric

When you configure (first time configuration) a Cisco NX-OS feature (or application) that uses the CFS infrastructure, that feature starts a CFS session and locks the fabric. When a fabric is locked, the Cisco NX-OS software does not allow any configuration changes from a switch to this Cisco NX-OS feature, other than the switch holding the lock, and issues a message to inform the user about the locked status. The configuration changes are held in a pending database by that application.

If you start a CFS session that requires a fabric lock but forget to end the session, an administrator can clear the session. If you lock a fabric at any time, your user name is remembered across restarts and switchovers. If another user (on the same machine) tries to perform configuration tasks, that user's attempts are rejected.

For information on verifying CFS lock status, refer to "Verifying CFS Lock Status" section on page 2-18.

Committing Changes

A commit operation saves the pending database for all application peers and releases the lock for all switches.

In general, the commit function does not start a session; only a lock function starts a session. However, an empty commit is allowed if configuration changes are not previously made. In this case, a commit operation results in a session that acquires locks and distributes the current database.

When you commit configuration changes to a feature using the CFS infrastructure, you receive a notification about one of the following responses:

- One or more external switches report a successful status—The application applies the changes locally and releases the fabric lock.
- None of the external switches report a successful state—The application considers this state a failure and does not apply the changes to any switch in the fabric. The fabric lock is not released.

Note Once the "*feature* **commit**" is done the running configuration has been modified on all switches participating in the feature's distribution. You can then use the "copy running-config startup-config fabric" command to save the running-config to the startup-config on all the switches in the fabric.

CFS Merge Support

An application keeps the configuration synchronized in a fabric through CFS. Two such fabrics might merge as a result of an ISL coming up between them. These two fabrics could have two different sets of configuration information that need to be reconciled in the event of a merge. CFS provides notification each time an application peer comes online. If a fabric with M application peers merges with another fabric with N application peers and if an application triggers a merge action on every such notification, a link-up event results in M*N merges in the fabric.

CFS supports a protocol that reduces the number of merges required to one by handling the complexity of the merge at the CFS layer. This protocol runs per application per scope. The protocol involves selecting one switch in a fabric as the merge manager for that fabric. The other switches do not play any role in the merge process.

During a merge, the merge manager in the two fabrics exchange their configuration databases with each other. The application on one of them merges the information, decides if the merge is successful, and informs all switches in the combined fabric of the status of the merge.

In case of a successful merge, the merged database is distributed to all switches in the combined fabric and the entire new fabric remains in a consistent state.

CFS Distribution over IP

You can configure CFS to distribute information over IP for networks containing switches that are not reachable over Fibre Channel. CFS distribution over IP supports the following features:

- Physical distribution over an entirely IP network.
- Physical distribution over a hybrid Fibre Channel and IP network with the distribution reaching all switches that are reachable over either Fibre Channel or IP.

Note The switch attempts to distribute information over Fibre Channel first and then over the IP network if the first attempt over Fibre Channel fails. CFS does not send duplicate messages if distribution over both IP and Fibre Channel is enabled.

- Distribution over IP version 4 (IPv4) or IP version 6 (IPv6).

Note CFS cannot distribute over both IPv4 and IPv6 from the same switch.

- Keepalive mechanism to detect network topology changes using a configurable multicast address.
- Compatibility with Cisco MDS SAN-OS Release 2.x.
- Distribution for logical scope applications is not supported because the VSAN implementation is limited to Fibre Channel.

Figure 2-1 shows a network with both Fibre Channel and IP connections. Node A forwards an event to node B over Fibre Channel. Node B forwards the event node C and node D using unicast IP. Node C forwards the event to node E using Fibre Channel.

Figure 2-1 ***Network Example 1 with Fibre Channel and IP Connections***

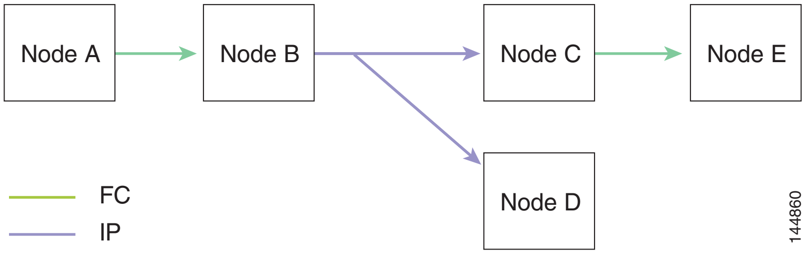


Figure 2-2 is the same as Figure 2-1 except that node D and node E are connected using Fibre Channel. All processes is the same in this example because node B has node C and node D the distribution list for IP. Node C does not forward to node D because node D is already in the distribution list from node B.

Figure 2-2 ***Network Example 2 with Fibre Channel and IP Connections***

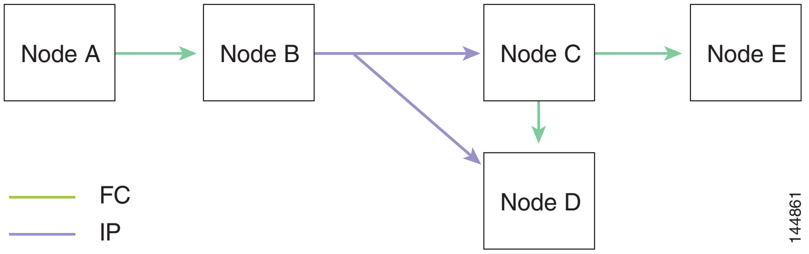
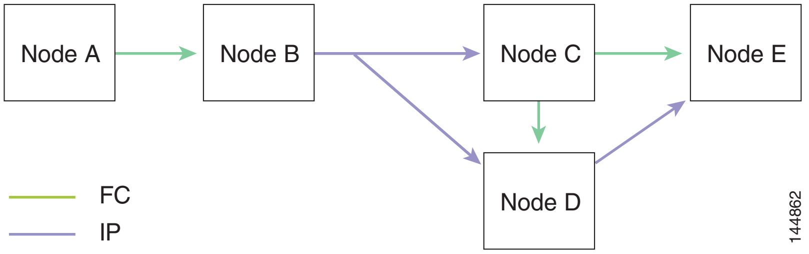


Figure 2-3 is the same as Figure 2-2 except that node D and node E are connected using IP. Both node C and node D forward the event to E because the node E is not in the distribution list from node B.

Figure 2-3 ***Network Example 3 with Fibre Channel and IP Connections***



Static IP Peers for CFS

CFS over IP can also be used with static IP peers. In this case, dynamic discovery over IP multicast is disabled and CFS distribution is done only on the peers configured statically.

CFS uses the list of configured IP addresses to communicate with each peer and learn the peer switch WWN. After learning the peer switch WWN, CFS marks the switch as CFS-capable and triggers application-level merging and database distribution.

Multicast forwarding is disabled by default in some devices. For example, the IBM Blade chassis has multicast forwarding disabled, especially on external Ethernet ports, and there is no method to enable it. N port virtualization devices use only IP as the transport medium and do not have ISL connectivity or a Fibre Channel domain. Such devices may benefit from using static IP peers for CFS.

The following MDS 9000 features require static IP peer configuration for CFS over IP distribution:

- N port virtualization devices have IP as the communication channel because NPV switches do not have FC domain. NPV devices use CFS over IP as the transport medium.
- FlexAttach virtual pWWN distribution on CFS region 201 that links only the NPV-enabled switches.

About CFS Regions

A CFS region is a user-defined subset of switches for a given feature or application in its physical distribution scope.When a SAN is spanned across a vast geography, you may need to localize or restrict the distribution of certain profiles among a set of switches based on their physical proximity. Before MDS SAN-OS Release 3.2.(1) the distribution scope of an application within a SAN was spanned across the entire physical fabric without the ability to confine or limit the distribution to a required set of switches in the fabric. CFS regions enables you to overcome this limitation by allowing you to create CFS regions, that is, multiple islands of distribution within the fabric, for a given CFS feature or application. CFS regions are designed to restrict the distribution of a feature's configuration to a specific set or grouping of switches in a fabric.

Note You can only configure a CFS region on physical switches in a SAN. You cannot configure a CFS region in a VSAN.

Example CFS Scenario: Call Home is an application that triggers alerts to Network Administrators when a situation arises or something abnormal occurs. When the fabric covers many geographies and with multiple Network Administrators who are each responsible for a subset of switches in the fabric, the Call Home application sends alerts to all Network Administrators regardless of their location. For the Call Home application to send message alerts selectively to Network Administrators, the physical scope of the application has to be fine tuned or narrowed down, which is achieved by implementing CFS regions.

CFS regions are identified by numbers ranging from 0 through 200. Region 0 is reserved as the default region, and contains every switch in the fabric. You can configure regions from 1 through 200. The default region maintains backward compatibility. If there are switches on the same fabric running releases of SAN-OS before Release 3.2(1), only features in Region 0 are supported when those switches are synchronized. Features from other regions are ignored when those switches are synchronized.

If the feature is moved, that is, assigned to a new region, its scope is restricted to that region; it ignores all other regions for distribution or merging purposes. The assignment of the region to a feature has precedence in distribution over its initial physical scope.

You can configure a CFS region to distribute configurations for multiple features. However, on a given switch, you can configure only one CFS region at a time to distribute the configuration for a given feature. Once you assign a feature to a CFS region, its configuration cannot be distributed within another CFS region.

Guidelines and Limitations

All switches in the fabric must be CFS capable. A Cisco MDS 9000 Family switch is CFS capable if it is running Cisco SAN-OS Release 2.0(1b) or later, or MDS NX-OS Release 4.1(1) or later. Switches that are not CFS capable do not receive distributions and result in part of the fabric not receiving the intended distribution.

CFS has the following guidelines and limitations:

- Implicit CFS usage—The first time you issue a CFS task for a CFS-enabled application, the configuration modification process begins and the application locks the fabric.
- Pending database—The pending database is a temporary buffer to hold uncommitted information. The uncommitted changes are not applied immediately to ensure that the database is synchronized with the database in the other switches in the fabric. When you commit the changes, the pending database overwrites the configuration database (also known as the active database or the effective database).
- CFS distribution enabled or disabled on a per-application basis—The default (enable or disable) for CFS distribution state differs between applications. If CFS distribution is disabled for an application, then that application does not distribute any configuration nor does it accept a distribution from other switches in the fabric.
- Explicit CFS commit—Most applications require an explicit commit operation to copy the changes in the temporary buffer to the application database, to distribute the new database to the fabric, and to release the fabric lock. The changes in the temporary buffer are not applied if you do not perform the commit operation.

Default Settings

Table 2-1 lists the default settings for CFS configurations.

Table 2-1 Default CFS Parameters

Parameters	Default
CFS distribution on the switch	Enabled.
Database changes	Implicitly enabled with the first configuration change.
Application distribution	Differs based on application.
Commit	Explicit configuration is required.
CFS over IP	Disabled.
Static IP Peers for CFS	Disabled.
IPv4 multicast address	239.255.70.83
IPv6 multicast address	ff15:efff:4653

Configuring CFS

This section describes the configuration process and includes the following topics:

- Disabling CFS Distribution on a Switch, page 2-10

- Committing Changes, page 2-10
- Committing Changes, page 2-10
- Clearing a Locked Session, page 2-11
- Enabling CFS over IP, page 2-11
- Configuring IP Multicast Address for CFS over IP, page 2-12
- Configuring Static IP Peers for CFS, page 2-13

Disabling CFS Distribution on a Switch

By default, CFS distribution is enabled. Applications can distribute data and configuration information to all CFS-capable switches in the fabric where the applications exist. This is the normal mode of operation.

You can globally disable CFS on a switch, including CFS over IP to isolate the applications using CFS from fabric-wide distributions while maintaining physical connectivity.

Restrictions

- When CFS is globally disabled on a switch, CFS operations are restricted to the switch and all CFS commands continue to function as if the switch were physically isolated.

Detailed Steps

To globally disable or enable CFS distribution on a switch, follow these steps:

	Command	Purpose

Step 1	`switch# `**`config t`**
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)# `**`no cfs distribute`**	Globally disables CFS distribution for all applications on the switch, including CFS over IP.
	`switch(config)# `**`cfs distribute`**	Enables (default) CFS distribution on the switch.

Committing Changes

You can commit changes for a specified feature by entering the **commit** command for that feature.

Discarding Changes

If you discard configuration changes, the application flushes the pending database and releases locks in the fabric. Both the abort and commit functions are only supported from the switch from which the fabric lock is acquired.

You can discard changes for a specified feature by using the **abort** command for that feature.

Saving the Configuration

Configuration changes that have not been applied yet (still in the pending database) are not shown in the running configuration. The configuration changes in the pending database overwrite the configuration in the effective database when you commit the changes.

Caution If you do not commit the changes, they are not saved to the running configuration.

The CISCO-CFS-MIB contains SNMP configuration information for any CFS-related functions. Refer to the *Cisco MDS 9000 Family MIB Quick Reference* for more information on this MIB.

Clearing a Locked Session

You can clear locks held by an application from any switch in the fabric. This option is provided to rescue you from situations where locks are acquired and not released.

Detailed Steps

The clear the CFS locks, follow these steps:

	Command	Purpose
Step 1	switch# **config t** switch(config)#	Enters configuration mode.
Step 2	Switch# **config t** Switch(conf)# **dpvm abort**	Aborts the configuration from the switch where the configuration lock was acquired previously. This method clears the CFS locks in the entire fabric. Clears the CFS locks for the DPVM application in the entire fabric.
	Switch# **conf t** Switch# **clear dpvm session**	Clears the sessions from any switch in the fabric. Clears the CFS locks for the DPVM application.

Enabling CFS over IP

Detailed Steps

To enable or disable CFS over IPv4, follow these steps:

	Command	Purpose
Step 1	switch# **config t** switch(config)#	Enters configuration mode.
Step 2	switch(config)# **cfs ipv4 distribute**	Globally enables CFS over IPv4 for all applications on the switch.
	switch(config)# **no cfs ipv4 distribute** This will prevent CFS from distributing over IPv4 network. Are you sure? (y/n) [n] **y**	Disables (default) CFS over IPv4 on the switch.

To enable or disable CFS over IPv6, follow these steps:

	Command	Purpose

Step 1	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)# cfs ipv6 distribute`	Globally enables CFS over IPv6 for all applications on the switch.
	`switch(config)# no cfs ipv6 distribute`	Disables (default) CFS over IPv6 on the switch.

Configuring IP Multicast Address for CFS over IP

All CFS over IP enabled switches with similar multicast addresses form one CFS over IP fabric. CFS protocol specific distributions, such as the keepalive mechanism for detecting network topology changes, use the IP multicast address to send and receive information.

Note CFS distributions for application data use directed unicast.

Detailed Steps

You can configure a CFS over IP multicast address value for either IPv4 or IPv6. The default IPv4 multicast address is 239.255.70.83 and the default IPv6 multicast address is ff15:efff:4653.

To configure an IP multicast address for CFS over IPv4, follow these steps:

	Command	Purpose

Step 1	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)# cfs ipv4 mcast-address 239.255.1.1`
	`Distribution over this IP type will be affected`
	`Change multicast address for CFS-IP ?`
	`Are you sure? (y/n)  [n] y`
		Configures the IPv4 multicast address for CFS distribution over IPv4. The ranges of valid IPv4 addresses are 239.255.0.0 through 239.255.255.255 and 239.192/16 through 239.251/16.

	`switch(config)# no cfs ipv4 mcast-address 239.255.1.1`
	`Distribution over this IP type will be affected`
	`Change multicast address for CFS-IP ?`
	`Are you sure? (y/n)  [n] y`
		Reverts to the default IPv4 multicast address for CFS distribution over IPv4. The default IPv4 multicast address for CFS is 239.255.70.83.

To configure an IP multicast address for CFS over IPv6, follow these steps:

	Command	Purpose

Step 1	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

	Command	Purpose

Step 2	`switch(config)#` **`cfs ipv6 mcast-address ff15::e244:4754`**
	`Distribution over this IP type will be affected`
	`Change multicast address for CFS-IP ?`
	`Are you sure? (y/n) [n]` **`y`**
		Configures the IPv6 multicast address for CFS distribution over IPv6. The range of valid IPv6 addresses is ff15::/16 (ff15::0000:0000 through ff15::ffff:ffff) and ff18::/16 (ff18::0000:0000 through ff18::ffff:ffff).

	`switch(config)#` **`no cfs ipv6 mcast-address ff15::e244:4754`**
	`Distribution over this IP type will be affected`
	`Change multicast address for CFS-IP ?`
	`Are you sure? (y/n) [n]` **`y`**
		Reverts to the default IPv6 multicast address for CFS distribution over IPv6. The default IPv6 multicast address for CFS over IP is ff15::efff:4653.

Configuring Static IP Peers for CFS

Detailed Steps

To configure a static IP peer address for CFS over IP, follow these steps:

	Command	Purpose

Step 1	`switch#` **`config t`**
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)#` **`cfs static-peers`**
	`WARNING: This mode will stop dynamic discovery and rely only on the static peers. For this mode to be in effect, at least one static peer will need to be configured.`
	`Do you wish to continue? (y/n) [n]` **`y`**
	`switch(config-cfs-static)#`
		Enters CFS static peers configuration mode and disables dynamic discovery of peers using multicast forwarding. For this to take effect, at least one static peer needs to be configured in Step 3.

	`switch(config)#` **`no cfs static-peers`**
	`WARNING: This will remove all existing peers and start dynamic discovery.`
	`Do you wish to continue? (y/n) [n]` **`y`**
	`switch(config)#`
		Disables CFS static peer discovery and enables dynamic peer discovery using multicast forwarding on all switches.

	Command	Purpose
Step 3	switch(config-cfs-static)# **ip address 1.2.3.4** switch(config-cfs-static)# **ip address 1.2.3.5** switch(config-cfs-static)# **end** switch#	Adds the IP address to the static peers list and marks the switch as CFS-capable. To display the static IP peers list, use the **show cfs static peers** command.
	switch(config-cfs-static)# **no ip address 1.2.3.3** switch(config-cfs-static)# **end** switch#	Removes the IP address from the static peers list and moves the switch to dynamic peer discovery using multicast forwarding.
Step 4	switch# **show cfs static peers**	Displays the IP address, WWN, and the status of CFS static peer request: • Discovery Inprogress • Local • Reachable • Unreachable • Local IP not present • Rediscovery and distribution disabled

Note The IP address and WWN must be configured on the local switch. If CFS does not receive the local switch information, then CFS cannot start any discovery for peer switches.

Configuring CFS Regions

This section contains the following topics:

- Creating CFS Regions, page 2-14
- Assigning Applications to CFS Regions, page 2-15
- Moving an Application to a Different CFS Region, page 2-15
- Removing an Application from a Region, page 2-15
- Deleting CFS Regions, page 2-16

Creating CFS Regions

Detailed Steps

To create a CFS region, perform this task:

	Command	Purpose
Step 1	switch# **config t** switch(config)#	Enters configuration mode.
Step 2	switch(config)# **cfs region 4**	Creates a region, for example, number 4.

Assigning Applications to CFS Regions

Detailed Steps

To assign an application on a switch to a region, perform this task:

	Command	Purpose

Step 1	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)# cfs region 4`	Creates a region, for example, number 4.

Step 3	`switch(config-cfs-region)# ntp`
	`switch(config-cfs-region)# callhome`
		Adds application(s).

Moving an Application to a Different CFS Region

You can move an application to a different CFS region, for example from Region 1 (originating region) with NTP and Call Home applications to Region 2 (target region).

Detailed Steps

To move an application, perform this task:

	Command	Purpose

Step 1	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)# cfs region 2`	Enters Region 2.

Step 3	`switch(config-cfs-region)# ntp`
	`switch(config-cfs-region)# callhome`
		Indicates application(s) to be moved into Region 2 that originally belong to Region 1. For example, here, the NTP and Call Home applications are moved to Region 2.

Note If you try adding an application to the same region more than once, you see the error message, “Application already present in the same region.”

Removing an Application from a Region

Removing an application from a region is the same as moving the application back to the default region or to Region 0, that is, bringing the entire fabric into the scope of distribution for the application.

Detailed Steps

To remove applications from Region 1, perform this task:

	Command	Purpose

Step 1	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

	Command	Purpose
Step 2	`switch(config)# cfs region 1`	Enters Region 1.

Step 3	`switch(config-cfs-region)# no ntp`
	`switch(config-cfs-region)# no callhome`
		Removes application(s) that belong to Region 1, which you want to move.

Deleting CFS Regions

Deleting a region is nullifying the region definition. All the applications bound by the region are released back to the default region by deleting that region.

Detailed Steps

To delete a region (for example, a region numbered 4), perform this task:

	Command	Purpose

Step 1	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)# no cfs region 4`
	`WARNING: All applications in the region`
	`wiil be  moved to default region.`
	`Are you sure? (y/n)  [n]`
		Deletes the Region 4.

Note After Step 2, you see the warning, “All the applications in the region will be moved to the default region.”

Verifying CFS Configurations

To display the CFS configuration information, perform one of the following tasks:

Command	Purpose
show cfs status	Displays the status of CFS distribution on the switch.
show cfs application	Displays the applications that are currently registered with CFS.
show cfs lock	Displays all the locks that are currently acquired by any application.
show cfs status	Verifies the CFS over IP configuration.
show cfs region brief	Displays brief information about the CFS regions.
show cfs region	Displays detailed information about the CFS regions.

For detailed information about the fields in the output from these commands, refer to the *Cisco MDS 9000 Family Command Reference*.

This section includes the following topics:

- Verifying CFS Distribution Status, page 2-17
- Verifying Application Registration Status, page 2-17
- Verifying CFS Lock Status, page 2-18
- Verifying the CFS over IP Configuration, page 2-18
- Verifying IP Multicast Address Configuration for CFS over IP, page 2-19
- Verifying Static IP Peer Configuration, page 2-19
- Verifying CFS Regions, page 2-19

Verifying CFS Distribution Status

The **show cfs status** command displays the status of CFS distribution on the switch.

```
switch# show cfs status
Distribution : Enabled
Distribution over IP : Disabled
IPv4 multicast address : 239.255.70.83
IPv6 multicast address : ff15::efff:4653
```

Verifying Application Registration Status

The **show cfs application** command displays the applications that are currently registered with CFS. The first column displays the application name. The second column indicates whether the application is enabled or disabled for distribution (enabled or disabled). The last column indicates the scope of distribution for the application (logical, physical, or both).

Note The **show cfs application** command only displays applications registered with CFS. Conditional services that use CFS do not appear in the output unless these services are running.

```
switch# show cfs application
----------------------------------------------
 Application    Enabled   Scope
----------------------------------------------
 ntp            No        Physical-fc-ip
 fscm           Yes       Physical-fc
 role           No        Physical-fc-ip
 rscn           No        Logical
 radius         No        Physical-fc-ip
 fctimer        No        Physical-fc
 syslogd        No        Physical-fc-ip
 callhome       No        Physical-fc-ip
 fcdomain       No        Logical
 fc-redirect    Yes       Physical-fc
 device-alias   Yes       Physical-fc

Total number of entries = 11
```

The **show cfs application name** command displays the details for a particular application. It displays the enabled/disabled state, timeout as registered with CFS, merge capability (if it has registered with CFS for merge support), and the distribution scope.

```
switch# show cfs application name ntp

 Enabled        : Yes
 Timeout        : 5s
 Merge Capable  : Yes
 Scope          : Physical
 Region        : Default
```

Verifying CFS Lock Status

The **show cfs lock** command displays all the locks that are currently acquired by any application. For each application the command displays the application name and scope of the lock taken. If the application lock is taken in the physical scope, then this command displays the switch WWN, IP address, user name, and user type of the lock holder. If the application is taken in the logical scope, then this command displays the VSAN in which the lock is taken, the domain, IP address, user name, and user type of the lock holder.

```
switch# show cfs lock

Application: ntp
Scope      : Physical
--------------------------------------------------------------------
 Switch WWN               IP Address       User Name    User Type
--------------------------------------------------------------------
 20:00:00:05:30:00:6b:9e  10.76.100.167    admin        CLI/SNMP v3
 Total number of entries = 1

Application: port-security
Scope      : Logical
-----------------------------------------------------------
 VSAN   Domain   IP Address       User Name    User Type
-----------------------------------------------------------
 1      238      10.76.100.167    admin        CLI/SNMP v3
 2      211      10.76.100.167    admin        CLI/SNMP v3
 Total number of entries = 2
```

The **show cfs lock name** command displays the lock details similar for the specified application.

Example 2-1 Displays the Lock Information for the Specified Application

```
switch# show cfs lock name ntp
Scope      : Physical
--------------------------------------------------------------------
 Switch WWN               IP Address       User Name    User Type
--------------------------------------------------------------------
 20:00:00:05:30:00:6b:9e  10.76.100.167    admin        CLI/SNMP v3

 Total number of entries = 1
```

Verifying the CFS over IP Configuration

To verify the CFS over IP configuration, use the **show cfs status** command.

```
switch# show cfs status
Distribution : Enabled
Distribution over IP : Disabled
IPv4 multicast address : 239.255.70.83
IPv6 multicast address : ff15::efff:4653
```

Verifying IP Multicast Address Configuration for CFS over IP

To verify the IP multicast address configuration for CFS over IP, use the **show cfs status** command.

```
switch# show cfs status
Fabric distribution Enabled
IP distribution Enabled mode ipv4
IPv4 multicast address : 10.1.10.100
IPv6 multicast address : ff13::e244:4754
```

Verifying Static IP Peer Configuration

To verify the IP peer configuration, use the **show cfs status** command.

```
switch# show cfs status
Distribution: Enabled
Distribution over IP: Enabled - mode IPv4 (static)
IPv4 multicast address : 239:255:70:83
IPv6 multicast address : ff15::efff:4563
```

To display the status of static IP peers discovery, use the **show cfs static peers** command.

```
switch# show cfs static peers

------------------------------------------------------------------
IP address                 WWN                     Status
------------------------------------------------------------------
192.0.2.4       00:00:00:00:00:00:00:00  Discovery in progress
192.0.2.5       20:00:00:0d:ec:06:55:b9  Reachable
192.0.2.6       20:00:00:0d:ec:06:55:c0  Local
```

Verifying CFS Regions

To display the CFS regions, perform this task:

	Command	Purpose

Step 1	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)# show cfs region brief`	Displays brief information about the CFS regions.
Step 3	`switch(config)# show cfs region`	Displays detailed information about the CFS regions.

Note To successfully form CFS peer you may configure common mcast IP on two different switches which are connected to two different management switches.

Additional References

For additional information related to implementing CFS, see the following section:

- MIBs, page 2-20

MIBs

MIBs	MIBs Link
• CISCO-CFS-CAPABILITY-MIB • CISCO-CFS-MIB	To locate and download MIBs, go to the following URL: http://www.cisco.com/en/US/products/ps5989/prod_technical_reference_list.html

Feature History for CFS

Table 2-2 lists the release history for this feature. Only features that were introduced or modified in Release 3.x or a later release appear in the table.

Table 2-2 Feature History for CFS

Feature Name	Releases	Feature Information
Static IP Peers for CFS (non-NPV)	6.2(11)	IP Static Peers enabled for non-NPV switches.
Static IP Peers for CFS (NPV)	4.1(1a)	New NPV CFS Setup wizard. Added IP static peers configuration steps for CFS distribution over IP.
CFS enhancements	3.2(1)	Support for CFS regions.
CFS over IP	3.0(1)	Allows CFS distributions over IP connections.
CFS support for allowed domain ID lists	3.0(1)	Allows the allowed domain ID lists to be distributed in the fabric using the CFS infrastructure.
CFS support for RCSN	3.0(1)	Allows the RSCN timer value to be distributed in the fabric using the CFS infrastructure.

CHAPTER 3

Configuring System Message Logging

This chapter describes how to configure system message logging on Cisco MDS 9000 Family switches. It includes the following sections:

- Information About System Message Logging, page 3-1
- Guidelines and Limitations, page 3-5
- Default Settings, page 3-6
- Configuring System Message Logging, page 3-6
- Additional References, page 3-17
- Additional References, page 3-17

Information About System Message Logging

With the system message logging software, you can save messages in a log file or direct the messages to other devices. By default, the switch logs normal but significant system messages to a log file and sends these messages to the system console. This feature provides you with the following capabilities:

- Provides logging information for monitoring and troubleshooting
- Allows you to select the types of captured logging information
- Allows you to select the destination server to forward the captured logging information properly configured system message logging server.

Note When the switch first initializes, the network is not connected until initialization completes. Therefore, messages are not redirected to a system message logging server for a few seconds.

Log messages are not saved across system reboots. However, a maximum of 100 log messages with a severity level of critical and below (levels 0, 1, and 2) are saved in NVRAM.

Table 3-1 describes some samples of the facilities supported by the system message logs.

Table 3-1 Internal Logging Facilities

Facility Keyword	Description	Standard or Cisco MDS Specific
acl	ACL manager	Cisco MDS 9000 Family specific
all	All facilities	Cisco MDS 9000 Family specific

Table 3-1 Internal Logging Facilities (continued)

Facility Keyword	Description	Standard or Cisco MDS Specific
auth	Authorization system	Standard
authpriv	Authorization (private) system	Standard
bootvar	Bootvar	Cisco MDS 9000 Family specific
callhome	Call Home	Cisco MDS 9000 Family specific
cron	Cron or at facility	Standard
daemon	System daemons	Standard
fcc	FCC	Cisco MDS 9000 Family specific
fcdomain	fcdomain	Cisco MDS 9000 Family specific
fcns	Name server	Cisco MDS 9000 Family specific
fcs	FCS	Cisco MDS 9000 Family specific
flogi	FLOGI	Cisco MDS 9000 Family specific
fspf	FSPF	Cisco MDS 9000 Family specific
ftp	File Transfer Protocol	Standard
ipconf	IP configuration	Cisco MDS 9000 Family specific
ipfc	IPFC	Cisco MDS 9000 Family specific
kernel	Kernel	Standard
local0 to local7	Locally defined messages	Standard
lpr	Line printer system	Standard
mail	Mail system	Standard
mcast	Multicast	Cisco MDS 9000 Family specific
module	Switching module	Cisco MDS 9000 Family specific
news	USENET news	Standard
ntp	NTP	Cisco MDS 9000 Family specific
platform	Platform manager	Cisco MDS 9000 Family specific
port	Port	Cisco MDS 9000 Family specific
port-channel	PortChannel	Cisco MDS 9000 Family specific
qos	QoS	Cisco MDS 9000 Family specific
rdl	RDL	Cisco MDS 9000 Family specific
rib	RIB	Cisco MDS 9000 Family specific
rscn	RSCN	Cisco MDS 9000 Family specific
securityd	Security	Cisco MDS 9000 Family specific
syslog	Internal system messages	Standard
sysmgr	System manager	Cisco MDS 9000 Family specific
tlport	TL port	Cisco MDS 9000 Family specific
user	User process	Standard
uucp	UNIX-to-UNIX Copy Program	Standard

Table 3-1 Internal Logging Facilities (continued)

Facility Keyword	Description	Standard or Cisco MDS Specific
vhbad	Virtual host base adapter daemon	Cisco MDS 9000 Family specific
vni	Virtual network interface	Cisco MDS 9000 Family specific
vrrp_cfg	VRRP configuration	Cisco MDS 9000 Family specific
vrrp_eng	VRRP engine	Cisco MDS 9000 Family specific
vsan	VSAN system messages	Cisco MDS 9000 Family specific
vshd	vshd	Cisco MDS 9000 Family specific
wwn	WWN manager	Cisco MDS 9000 Family specific
xbar	Xbar system messages	Cisco MDS 9000 Family specific
zone	Zone server	Cisco MDS 9000 Family specific

Table 3-2 describes the severity levels supported by the system message logs.

Table 3-2 Error Message Severity Levels

Level Keyword	Level	Description	System Message Definition
emergencies	0	System unusable	LOG_EMERG
alerts	1	Immediate action needed	LOG_ALERT
critical	2	Critical conditions	LOG_CRIT
errors	3	Error conditions	LOG_ERR
warnings	4	Warning conditions	LOG_WARNING
notifications	5	Normal but significant condition	LOG_NOTICE
informational	6	Informational messages only	LOG_INFO
debugging	7	Debugging messages	LOG_DEBUG

Note Refer to the *Cisco MDS 9000 Family System Messages Reference* for details on the error log message format.

This section includes the following topics:

- System Message Logging, page 3-3
- SFP Diagnostics, page 3-4
- Outgoing System Message Logging Server Facilities, page 3-4
- System Message Logging Configuration Distribution, page 3-5
- Fabric Lock Override, page 3-5

System Message Logging

The system message logging software saves the messages in a log file or directs the messages to other devices. This feature has the following capabilities:

- Provides logging information for monitoring and troubleshooting.
- Allows the user to select the types of captured logging information.
- Allows the user to select the destination server to forward the captured logging information.

By default, the switch logs normal but significant system messages to a log file and sends these messages to the system console. You can specify which system messages should be saved based on the type of facility and the severity level. Messages are time-stamped to enhance real-time debugging and management.

You can access the logged system messages using the CLI or by saving them to a correctly configured system message logging server. The switch software saves system messages in a file that can save up to 1200 entries. You can monitor system messages remotely by accessing the switch through Telnet, SSH, the console port, or by viewing the logs on a system message logging server.

SFP Diagnostics

The error message related to SFP failures is written to the syslog. You can listen to the syslog for events related to SFP failures. The values, low or high alarm, and the warning are checked for the following parameters:

- TX Power
- RX Power
- Temperature
- Voltage
- Current

The SFP notification trap indicates the current status of the alarm and warning monitoring parameters for all the sensors based on the digital diagnostic monitoring information. This notification is generated whenever there is a change in the status of at least one of the monitoring parameters of the sensors on the transceiver in an interface.

The CISCO-INTERFACE-XCVR-MONITOR-MIB contains the SFP notification trap information. Refer to the Cisco MDS 9000 Family MIB Quick Reference for more information on this MIB.

Outgoing System Message Logging Server Facilities

All system messages have a logging facility and a level. The logging facility can be thought of as *where* and the level can be thought of as *what*.

The single system message logging daemon (syslogd) sends the information based on the configured **facility** option. If no facility is specified, local7 is the default outgoing facility.

The internal facilities are listed in Table 3-1 and the outgoing logging facilities are listed in Table 3-3.

Table 3-3 Outgoing Logging Facilities

Facility Keyword	Description	Standard or Cisco MDS Specific
auth	Authorization system	Standard
authpriv	Authorization (private) system	Standard
cron	Cron or at facility	Standard

Table 3-3 Outgoing Logging Facilities (continued)

Facility Keyword	Description	Standard or Cisco MDS Specific
daemon	System daemons	Standard
ftp	File Transfer Protocol	Standard
kernel	Kernel	Standard
local0 to local7	Locally defined messages	Standard (local7 is the default)
lpr	Line printer system	Standard
mail	Mail system	Standard
news	USENET news	Standard
syslog	Internal system messages	Standard
user	User process	Standard
uucp	UNIX-to-UNIX Copy Program	Standard

System Message Logging Configuration Distribution

You can enable fabric distribution for all Cisco MDS switches in the fabric. When you perform system message logging configurations, and distribution is enabled, that configuration is distributed to all the switches in the fabric.

You automatically acquire a fabric-wide lock when you issue the first configuration command after you enabled distribution in a switch. The system message logging server uses the effective and pending database model to store or commit the commands based on your configuration. When you commit the configuration changes, the effective database is overwritten by the configuration changes in the pending database and all the switches in the fabric receive the same configuration. After making the configuration changes, you can choose to discard the changes by aborting the changes instead of committing them. In either case, the lock is released. See Chapter 2, "Using the CFS Infrastructure" for more information on the CFS application.

Fabric Lock Override

If you have performed a system message logging task and have forgotten to release the lock by either committing or discarding the changes, an administrator can release the lock from any switch in the fabric. If the administrator performs this task, your changes to the pending database are discarded and the fabric lock is released.

Tip The changes are only available in the volatile directory and are subject to being discarded if the switch is restarted.

Guidelines and Limitations

See the "CFS Merge Support" section on page 2-6 for detailed concepts.

When merging two system message logging databases, follow these guidelines:

- Be aware that the merged database is a union of the existing and received database for each switch in the fabric.
- Verify that the merged database will only have a maximum of three system message logging servers.

⚠ **Caution** If the merged database contains more that three servers, the merge will fail.

Default Settings

Table 3-4 lists the default settings for system message logging.

Table 3-4 Default System Message Log Settings

Parameters	Default
System message logging to the console	Enabled for messages at the critical severity level.
System message logging to Telnet sessions	Disabled.
Logging file size	4194304.
Log file name	Message (change to a name with up to 200 characters).
Logging server	Disabled.
Syslog server IP address	Not configured.
Number of servers	Three servers.
Server facility	Local 7.

Configuring System Message Logging

System logging messages are sent to the console based on the default (or configured) logging facility and severity values.

This sections includes the following topics:

Task Flow for Configuring System Message Logging

Follow these steps to configure system message logging:

Step 1 Enable or disable message logging.

Step 2 Configure console severity level.

Step 3 Configure monitor severity level.

Step 4 Configure module logging.

Step 5 Configure facility severity levels.

Step 6 Send log files.

Step 7 Configure system message logging servers.

Step 8 Configure system message logging distribution.

Enabling or Disabling Message Logging

You can disable logging to the console or enable logging to a specific Telnet or SSH session.

- When you disable or enable logging to a console session, that state is applied to all future console sessions. If you exit and log in again to a new session, the state is preserved.
- When you enable or disable logging to a Telnet or SSH session, that state is applied only to that session. If you exit and log in again to a new session, the state is not preserved.

Detailed Steps

To enable or disable the logging state for a Telnet or SSH session, follow these steps:

	Command	Purpose
Step 1	`switch# terminal monitor`	Enables logging for a Telnet or SSH session. **Note** A console session is enabled by default.
Step 2	`switch# terminal no monitor`	Disables logging for a Telnet or SSH session. **Note** A Telnet or SSH session is disabled by default.

Configuring Console Severity Level

When logging is enabled for a console session (default), you can configure the severity levels of messages that appear on the console. The default severity for console logging is 2 (critical).

Restrictions

- The current critical (default) logging level is maintained if the console baud speed is 9600 baud (default). All attempts to change the console logging level generates an error message. To increase the logging level (above critical), you must change the console baud speed to 38400 baud.

Detailed Steps

To configure the severity level for the console session, follow these steps:

	Command	Purpose

Step 1	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)# logging console 3`	Configures console logging at level 3 (error). Logging messages with a severity level of 3 or above are displayed on the console.
	`switch(config)# no logging console`	Reverts console logging to the factory set default severity level of 2 (critical). Logging messages with a severity level of 2 or above are displayed on the console.

Configuring Monitor Severity Level

When logging is enabled for a monitor session (default), you can configure the severity levels of messages that appear on the monitor. The default severity for monitor logging is 5 (notifications).

Detailed Steps

To configure the severity level for a monitor session, follow these steps:

	Command	Purpose

Step 1	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)# logging monitor 3`	Configures monitor logging at level 3 (error). Logging messages with a severity level of 3 or above are displayed on the monitor.
	`switch(config)# no logging monitor`	Reverts monitor logging to the factory set default severity level of 5 (notifications). Logging messages with a severity level of 5 or above are displayed on the console.

Configuring Module Logging

By default, logging is enabled at level 7 for all modules. You can enable or disable logging for each module at a specified level.

Detailed Steps

To enable or disable the logging for modules and configure the severity level, follow these steps:

	Command	Purpose

Step 1	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

	Command	Purpose
Step 2	`switch(config)# logging module 1`	Configures module logging at level 1 (alerts) for all modules.
	`switch(config)# logging module`	Configures module logging for all modules in the switch at the default level 5 (notifications).
	`switch(config)# no logging module`	Disables module logging.

Configuring Facility Severity Levels

Detailed Steps

To configure the severity level for a logging facility (see Table 3-1), follow these steps:

	Command	Purpose

Step 1	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)# logging level kernel 4`	Configures Telnet or SSH logging for the kernel facility at level 4 (warning). As a result, logging messages with a severity level of 4 or above are displayed.
	`switch(config)# no logging level kernel 4`	Reverts to the default severity level 6 (informational) for the Telnet or SSH logging for the kernel facility. **Note** Use the **show logging info** command to display the default logging levels for the facilities listed in Table 3-1.

Sending Log Files

By default, the switch logs normal but significant system messages to a log file and sends these messages to the system console. Log messages are not saved across system reboots.The logging messages that are generated may be saved to a log file. You can configure the name of this file and restrict its size as required. The default log file name is messages.

The file name can have up to 80 characters and the file size ranges from 4096 bytes to 4194304 bytes.

Detailed Steps

To send log messages to a file, follow these steps:

	Command	Purpose

Step 1	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

	Command	Purpose
Step 2	`switch(config)# logging logfile messages 3`	Configures logging of information for errors or events above with a severity level 3 or above to the default log file named messages.
	`switch(config)# logging logfile ManagerLog 3`	Configures logging of information for errors or events with a severity level 3 or above to a file named ManagerLog using the default size of 10,485,760 bytes.
	`switch(config)# logging logfile ManagerLog 3 size 3000000`	Configures logging information for errors or events with a severity level 3 or above to a file named ManagerLog. By configuring a size, you are restricting the file size to 3,000,000 bytes.
	`switch(config)# no logging logfile`	Disables logging messages to the logfile.

You can rename the log file using the **logging logfile** command.

The configured log file is saved in the /var/log/external directory. The location of the log file cannot be changed. You can use the **show logging logfile** and **clear logging logfile** commands to view and delete the contents of this file. You can use the **dir log:** command to view logging file statistics. You can use the **delete log:** command to remove the log file.

You can copy the logfile to a different location using the **copy log:** command using additional copy syntax.

Configuring System Message Logging Servers

You can configure a maximum of three system message logging servers. To send log messages to a UNIX system message logging server, you must configure the system message logging daemon on a UNIX server. Log in as root, and follow these steps:

Step 1 Add the following line to the /etc/syslog.conf file.

```
local1.debug                    /var/log/myfile.log
```

Note Be sure to add five tab characters between **local1.debug** and **/var/log/*myfile*.log**. Refer to entries in the /etc/syslog.conf file for further examples.

The switch sends messages according to the specified facility types and severity levels. The **local1** keyword specifies the UNIX logging facility used. The messages from the switch are generated by user processes. The **debug** keyword specifies the severity level of the condition being logged. You can set UNIX systems to receive all messages from the switch.

Step 2 Create the log file by entering these commands at the UNIX shell prompt:

```
$ touch /var/log/myfile.log
$ chmod 666 /var/log/myfile.log
```

Step 3 Make sure the system message logging daemon reads the new changes by entering this command:

```
$ kill -HUP ~cat /etc/syslog.pid~
```

Detailed Steps

To configure system message logging server IPv4 addresses, follow these steps:

	Command	Purpose

Step 1	`switch# config t`
	`switch#`
		Enters configuration mode.

Step 2	`switch(config)# logging server 172.22.00.00`	Configures the switch to forward log messages according to the specified facility types and severity levels to remote multiple servers specified by its hostname or IPv4 address (172.22.00.00).
	`switch(config)# logging server 172.22.00.00 facility local1`	Configures the switch to forward log messages according to the specified facility (local1) for the server IPv4 address (172.22.00.00). The default outgoing facility is local7.
	`switch(config)# no logging server 172.11.00.00`	Removes the specified server (172.11.00.00) and reverts to factory default.

To configure system message logging server IPv6 addresses, follow these steps:

	Command	Purpose

Step 1	`switch# config t`
	`switch#`
		Enters configuration mode.

Step 2	`switch(config)# logging server 2001::0db8:800:200c:417a`	Configures the switch to forward log messages according to the specified facility types and severity levels to a remote server specified by its IPv6 address.
	`switch(config)# logging server 2001::0db8:800:200c:417a facility local1`	Configures the switch to forward log messages according to the specified facility (local1) for the server IPv6 address. The default outgoing facility is local7.
	`switch(config)# no logging server 2001::0db8:800:200c:417a`	Removes the specified server and reverts to factory default.

Configuring System Message Logging Distribution

Detailed Steps

To enable fabric distribution for system message logging server configurations, follow these steps:

	Command	Purpose
Step 1	`switch# config t`	Enters configuration mode.
Step 2	`switch(config)# logging distribute`	Enables the system message logging server configuration to be distributed to all switches in the fabric, acquires a lock, and stores all future configuration changes in the pending database.
	`switch(config)# no logging distribute`	Disables (default) system message logging server configuration distribution to all switches in the fabric.

To commit the system message logging server configuration changes, follow these steps:

	Command	Purpose
Step 1	`switch# config t`	Enters configuration mode.
Step 2	`switch(config)# logging commit`	Distributes the configuration changes to all switches in the fabric, releases the lock, and overwrites the effective database with the changes made to the pending database.

To discard the system message logging server configuration changes, follow these steps:

	Command	Purpose
Step 1	`switch# config t`	Enters configuration mode.
Step 2	`switch(config)# logging abort`	Discards the system message logging server configuration changes in the pending database and releases the fabric lock.

Fabric Lock Override

To use administrative privileges and release a locked system message logging session, use the **clear logging session** command.

```
switch# clear logging session
```

Displaying System Message Logging Information

To display the system message logging information, perform one of the following tasks:

Command	Purpose
show logging	Displays current system message logging.
show logging nvram	Displays NVRM log contents.
show logging logfile	Displays the log file.
show logging level	Displays logging facility.
show logging info	Displays logging information.
show logging last 2	Displays last few lines of a log file.
show logging module	Displays switching module logging status.
show logging monitor	Displays monitor logging status.
show logging server	Displays server information.

For detailed information about the fields in the output from these commands, refer to the *Cisco MDS 9000 Family Command Reference*.

Use the **show logging** command to display the current system message logging configuration. See Examples 3-1 to 3-10.

Note When using the **show logging** command, output is displayed only when the configured logging levels for the switch are different from the default levels.

Example 3-1 Displays Current System Message Logging

```
switch# show logging
Logging console:                enabled (Severity: critical)
Logging monitor:                enabled (Severity: debugging)
Logging linecard:               enabled (Severity: debugging)
Logging server:                 enabled
{172.20.102.34}
        server severity:        debugging
        server facility:        local7
{10.77.202.88}
        server severity:        debugging
        server facility:        local7
{10.77.202.149}
        server severity:        debugging
        server facility:        local7
Logging logfile:                enabled
        Name - messages: Severity - debugging Size - 4194304
Facility        Default Severity        Current Session Severity
--------        ----------------        ------------------------
kern                    6                       6
user                    3                       3
mail                    3                       3
daemon                  7                       7
auth                    0                       7
syslog                  3                       3
lpr                     3                       3
news                    3                       3
uucp                    3                       3
cron                    3                       3
authpriv                3                       7
ftp                     3                       3
local0                  3                       3
local1                  3                       3
local2                  3                       3
local3                  3                       3
local4                  3                       3
local5                  3                       3
local6                  3                       3
local7                  3                       3
vsan                    2                       2
fspf                    3                       3
fcdomain                2                       2
module                  5                       5
sysmgr                  3                       3
zone                    2                       2
vni                     2                       2
ipconf                  2                       2
ipfc                    2                       2
xbar                    3                       3
fcns                    2                       2
fcs                     2                       2
acl                     2                       2
tlport                  2                       2
port                    5                       5
flogi                   2                       2
port_channel            5                       5
```

```
wwn                     3                       3
fcc                     2                       2
qos                     3                       3
vrrp_cfg                2                       2
ntp                     2                       2
platform                5                       5
vrrp_eng                2                       2
callhome                2                       2
mcast                   2                       2
rdl                     2                       2
rscn                    2                       2
bootvar                 5                       2
securityd               2                       2
vhbad                   2                       2
rib                     2                       2
vshd                    5                       5
0(emergencies)          1(alerts)       2(critical)
3(errors)               4(warnings)     5(notifications)
6(information)          7(debugging)

Feb 14 09:50:57 excal-113 %TTYD-6-TTYD_MISC: TTYD TTYD started
Feb 14 09:50:58 excal-113 %DAEMON-6-SYSTEM_MSG: precision = 8 usec
...
```

Use the **show logging nvram** command to view the log messages saved in NVRAM. Only log messages with a severity level of critical and below (levels 0, 1, and 2) are saved in NVRAM.

Example 3-2 Displays NVRM Log Contents

```
switch# show logging nvram
Jul 16 20:36:46 172.22.91.204 %KERN-2-SYSTEM_MSG: unable to alloc and fill in a
new mtsbuf (pid=2209, ret_val = -105)
Jul 16 20:36:46 172.22.91.204 %KERN-2-SYSTEM_MSG: unable to alloc and fill in a
new mtsbuf (pid=2199, ret_val = -105)
Jul 16 20:36:46 172.22.91.204 %KERN-2-SYSTEM_MSG: unable to alloc and fill in a
new mtsbuf (pid=2213, ret_val = -105)
Jul 16 20:36:46 172.22.91.204 %KERN-2-SYSTEM_MSG: unable to alloc and fill in a
new mtsbuf (pid=2213, ret_val = -105)
...
```

Example 3-3 Displays the Log File

```
switch# show logging logfile
Jul 16 21:06:50 %DAEMON-3-SYSTEM_MSG: Un-parsable frequency in /mnt/pss/ntp.drift
Jul 16 21:06:56 %DAEMON-3-SYSTEM_MSG: snmpd:snmp_open_debug_cfg: no snmp_saved_dbg_uri ;
Jul 16 21:06:58 172.22.91.204 %PORT-5-IF_UP: Interface mgmt0 is up
Jul 16 21:06:58 172.22.91.204 %MODULE-5-ACTIVE_SUP_OK: Supervisor 5 is active
...
```

Example 3-4 Displays Console Logging Status

```
switch# show logging console
Logging console:                enabled (Severity: notifications)
```

Example 3-5 Displays Logging Facility

```
switch# show logging level
Facility        Default Severity        Current Session Severity
--------        ----------------        ------------------------
kern                    6                       6
```

```
user                    3                       3
mail                    3                       3
daemon                  7                       7
auth                    0                       7
syslog                  3                       3
lpr                     3                       3
news                    3                       3
uucp                    3                       3
cron                    3                       3
authpriv                3                       7
ftp                     3                       3
local0                  3                       3
local1                  3                       3
local2                  3                       3
local3                  3                       3
local4                  3                       3
local5                  3                       3
local6                  3                       3
local7                  3                       3
vsan                    2                       2
fspf                    3                       3
fcdomain                2                       2
module                  5                       5
sysmgr                  3                       3
zone                    2                       2
vni                     2                       2
ipconf                  2                       2
ipfc                    2                       2
xbar                    3                       3
fcns                    2                       2
fcs                     2                       2
acl                     2                       2
tlport                  2                       2
port                    5                       5
flogi                   2                       2
port_channel            5                       5
wwn                     3                       3
fcc                     2                       2
qos                     3                       3
vrrp_cfg                2                       2
ntp                     2                       2
platform                5                       5
vrrp_eng                2                       2
callhome                2                       2
mcast                   2                       2
rdl                     2                       2
rscn                    2                       2
bootvar                 5                       2
securityd               2                       2
vhbad                   2                       2
rib                     2                       2
vshd                    5                       5
0(emergencies)          1(alerts)       2(critical)
3(errors)               4(warnings)     5(notifications)
6(information)          7(debugging)
```

Example 3-6 Displays Logging Information

```
switch# show logging info
Logging console:                enabled (Severity: critical)
Logging monitor:                enabled (Severity: debugging)
Logging linecard:               enabled (Severity: debugging)
Logging server:                 enabled
```

```
{172.20.102.34}
        server severity:        debugging
        server facility:        local7
{10.77.202.88}
        server severity:        debugging
        server facility:        local7
{10.77.202.149}
        server severity:        debugging
        server facility:        local7
Logging logfile:                enabled
        Name - messages: Severity - debugging Size - 4194304
Facility        Default Severity        Current Session Severity
--------        ----------------        ------------------------
kern                    6                       6
user                    3                       3
mail                    3                       3
daemon                  7                       7
auth                    0                       7
syslog                  3                       3
lpr                     3                       3
news                    3                       3
uucp                    3                       3
cron                    3                       3
authpriv                3                       7
ftp                     3                       3
local0                  3                       3
local1                  3                       3
local2                  3                       3
local3                  3                       3
local4                  3                       3
local5                  3                       3
local6                  3                       3
local7                  3                       3
vsan                    2                       2
fspf                    3                       3
fcdomain                2                       2
module                  5                       5
sysmgr                  3                       3
zone                    2                       2
vni                     2                       2
ipconf                  2                       2
ipfc                    2                       2
xbar                    3                       3
fcns                    2                       2
fcs                     2                       2
acl                     2                       2
tlport                  2                       2
port                    5                       5
flogi                   2                       2
port_channel            5                       5
wwn                     3                       3
fcc                     2                       2
qos                     3                       3
vrrp_cfg                2                       2
ntp                     2                       2
platform                5                       5
vrrp_eng                2                       2
callhome                2                       2
mcast                   2                       2
rdl                     2                       2
rscn                    2                       2
bootvar                 5                       2
securityd               2                       2
vhbad                   2                       2
```

```
rib                      2                        2
vshd                     5                        5
0(emergencies)           1(alerts)       2(critical)
3(errors)                4(warnings)     5(notifications)
6(information)           7(debugging)
```

Example 3-7 Displays Last Few Lines of a Log File

```
switch# show logging last 2
Nov 8 16:48:04 excal-113 %LOG_VSHD-5-VSHD_SYSLOG_CONFIG_I: Configuring console from pts/1
(171.71.58.56)
Nov 8 17:44:09 excal-113 %LOG_VSHD-5-VSHD_SYSLOG_CONFIG_I: Configuring console from pts/0
(171.71.58.72)
```

Example 3-8 Displays Switching Module Logging Status

```
switch# show logging module
Logging linecard:                enabled (Severity: debugging)
```

Example 3-9 Displays Monitor Logging Status

```
switch# show logging monitor
Logging monitor:                 enabled (Severity: information)
```

Example 3-10 Displays Server Information

```
switch# show logging server
Logging server:                  enabled
{172.22.95.167}
        server severity:         debugging
        server facility:         local7
{172.22.92.58}
        server severity:         debugging
        server facility:         local7
```

Additional References

For additional information related to implementing system message logging, see the following section:

- MIBs, page 3-17

MIBs

MIBs	MIBs Link
• CISCO-SYSLOG-EXT-MIB • CISCO-SYSLOG-MIB	To locate and download MIBs, go to the following URL: http://www.cisco.com/en/US/products/ps5989/prod_technical_reference_list.html

CHAPTER 4

Configuring Call Home

Call Home provides email-based notification of critical system events. A versatile range of message formats are available for optimal compatibility with pager services, standard email, or XML-based automated parsing applications.

Note Cisco Autonotify is upgraded to a new capability called Smart Call Home. Smart Call Home has significant functionality improvement over Autonotify and is available across the Cisco product range. For detailed information on Smart Call Home, see the Smart Call Home page at this location: http://www.cisco.com/go/smartcall/

This chapter includes the following sections:

Information About Call Home

The Call Home feature provides message throttling capabilities. Periodic inventory messages, port syslog messages, and RMON alert messages are added to the list of deliverable Call Home messages. If required you can also use the Cisco Fabric Services application to distribute the Call Home configuration to all other switches in the fabric.

The Call Home service provides email-based notification of critical system events. A versatile range of message formats are available for optimal compatibility with pager services, standard email, or XML-based automated parsing applications.

Common features may include the following:

- Paging the network support engineer
- Emailing the Network Operations Center

- Raising a direct case with the Technical Assistance Center

The Call Home functionality is available directly through the Cisco MDS 9000 Family switches and the Cisco Nexus 5000 Series switches. It provides multiple Call Home messages, each with separate potential destinations. You can define your own destination profiles in addition to predefined profiles; you can configure up to 50 email addresses for each destination profile. Flexible message delivery and format options make it easy to integrate specific support requirements.

The Call Home feature offers the following advantages:

- Fixed set of predefined alerts for trigger events on the switch.
- Automatic execution and attachment of relevant command output.

This section includes the following topics:

Call Home Features

The Call Home functionality is available directly through the Cisco MDS 9000 Family switches and the Cisco Nexus 5000 Series switches. It provides multiple Call Home profiles (also referred to as *Call Home destination profiles*), each with separate potential destinations. You can define your own destination profiles in addition to predefined profiles.

The Call Home function can even leverage support from Cisco Systems or another support partner. Flexible message delivery and format options make it easy to integrate specific support requirements.

The Call Home feature offers the following advantages:

- Fixed set of predefined alerts and trigger events on the switch.
- Automatic execution and attachment of relevant command output.

- Multiple message format options:
  - Short Text—Suitable for pagers or printed reports.
  - Plain Text—Full formatted message information suitable for human reading.
  - XML—Matching readable format using Extensible Markup Language (XML) and document type definitions (DTDs) named Messaging Markup Language (MML). The MML DTD is published on the Cisco.com website at http://www.cisco.com/. The XML format enables communication with the Cisco Systems Technical Assistance Center.
- Multiple concurrent message destinations. You can configure up to 50 email destination addresses for each destination profile.
- Multiple message categories including system, environment, switching module hardware, supervisor module, hardware, inventory, syslog, RMON, and test.
- Secure messages transport directly from your device or through an HTTP proxy server or a downloadable transport gateway (TG). You can use a TG aggregation point to support multiple devices, or in cases where security requires that your devices not be connected directly to the Internet.

About Smart Call Home

Smart Call Home is a component of Cisco SMARTnet Service that offers proactive diagnostics, real-time alerts, and personalized web-based reports on select Cisco devices.

Smart Call Home provides fast resolution of system problems by analyzing Call Home messages sent from your devices and providing a direct notification path to Cisco customer support.

Smart Call Home offers the following features:

- Continuous device health monitoring and real-time diagnostics alerts.
- Analysis of Call Home messages from your device and where appropriate, automatic service request generation, routed to the appropriate TAC team, including detailed diagnostic information to speed problem resolution.
- Web-based access to Call Home messages and recommendations, inventory and configuration information for all Call Home devices. Provides access to associated Field Notices, Security Advisories and End-of-Life Information.

Table 4-1 lists the benefits of Smart Call Home.

Table 4-1 Benefits of Smart Call Home Compared to Autonotify

Feature	Smart Call Home	Autonotify
Low touch registration	The registration process is considerably streamlined. Customers no longer need to know their device serial number or contract information. They can register devices without manual intervention from Cisco by sending a message from those devices. The procedures are outlined at www.cisco.com/go/smartcall	Requires the customer to request Cisco to add each specific serial number to the database.
Recommendations	Smart Call Home provides recommendations for known issues including those for which SRs are raised and for which SRs are not appropriate but for which customers might want to still take action on.	Autonotify raises SRs for a set of failure scenarios but no recommendations are provided for these.
Device report	Device report includes full inventory and configuration details. Once available, the information in these reports will be mapped to field notices, PSIRTs, EoX notices, configuration best practices and bugs.	No.
History report	The history report is available to look up any message and its contents, including **show** commands, message processing, analysis results, recommendations and service request numbers for all messages sent over the past three months.	A basic version is available that does not include contents of message.

Table 4-1 Benefits of Smart Call Home Compared to Autonotify (continued)

Feature	Smart Call Home	Autonotify
Network summary report	A report that provides a summary of the make-up of devices and modules in the customer network (for those devices registered with Smart Call home)	No.
Cisco device support	Device Support will be extended across the Cisco product range. See the supported products table at www.cisco.com/go/smartcall	Deprecated in favor of Smart Call Home in October 2008.

Obtaining Smart Call Home

If you have a service contract directly with Cisco Systems, you can receive automatic case generation from the Technical Assistance Center by registering with the Smart Call Home service.

You need the following items to register:

- The SMARTnet contract number for your switch.
- Your email address
- Your Cisco.com ID

For detailed information on Smart Call Home, including quick start configuration and registration steps, see the Smart Call Home page at this location:

http://www.cisco.com/go/smartcall/

Call Home Destination Profiles

A destination profile contains the required delivery information for an alert notification. Destination profiles are typically configured by the network administrator.

Using alert groups you can select the set of Call Home alerts to be received by a destination profile (predefined or user defined). Alert groups are predefined subsets of Call Home alerts supported in all switches in the Cisco MDS 9000 Family and the Cisco Nexus 5000 Series. Different types of Call Home alerts are grouped into different alert groups depending on their type. You can associate one or more alert groups to each profile as required by your network.

Call Home Alert Groups

An alert group is a predefined subset of Call Home alerts supported in all switches in the Cisco MDS 9000 Family and Cisco Nexus 5000 Series. Alert groups allow you to select the set of Call Home alerts to be received by a destination profile (predefined or user-defined). A Call Home alert is sent to email destinations in a destination profile only if that Call Home alert belongs to one of the alert groups associated with that destination profile.

Using the predefined Call Home alert groups you can generate notification messages when certain events occur on the switch. You can customize predefined alert groups to execute additional **show** commands when specific events occur and to notify you of output other than from the predefined **show** commands.

Customized Alert Group Messages

An alert group is a predefined subset of Call Home alerts supported in all switches in the Cisco MDS 9000 Family and Cisco Nexus 5000 Series switches. Alert groups allow you to select the set of Call Home alerts to be received by a destination profile (predefined or user-defined). The predefined Call Home alert groups generate notification messages when certain events occur on the switch. You can customize predefined alert groups to execute additional **show** commands when specific events occur.

The output from these additional **show** commands is included in the notification message along with the output of the predefined **show** commands.

Call Home Message Level Feature

The Call Home message level feature allows you to filter messages based on their level of urgency. Each destination profile (predefined and user-defined) is associated with a Call Home message level threshold. Any message with a value lower than the urgency threshold is not sent. Call Home severity levels are not the same as system message logging severity levels.

Syslog-Based Alerts

You can configure the switch to send certain syslog messages as Call Home messages. The messages are sent based on the mapping between the destination profile and the alert group mapping, and on the severity level of the generated syslog message.

To receive a syslog-based Call Home alert, you must associate a destination profile with the syslog alert groups (currently there is only one syslog alert group—syslog-group-port) and configure the appropriate message level.

The syslog-group-port alert group selects syslog messages for the port facility. The Call Home application maps the syslog severity level to the corresponding Call Home severity level (see the "Call Home Message Levels" section on page 4-13). For example, if you select level 5 for the Call Home message level, syslog messages at levels 0, 1, and 2 are included in the Call Home log.

Whenever a syslog message is generated, the Call Home application sends a Call Home message depending on the mapping between the destination profile and the alert group mapping and based on the severity level of the generated syslog message. To receive a syslog-based Call Home alert, you must associate a destination profile with the syslog alert groups (currently there is only one syslog alert group—syslog-group-port) and configure the appropriate message level (see the "Call Home Message Levels" section on page 4-13).

Note Call Home does not change the syslog message level in the message text. The syslog message texts in the Call Home log appear as they are described in the *Cisco MDS 9000 Family System Messages Reference*.

RMON-Based Alerts

You can configure the switch to send Call Home notifications corresponding to RMON alert triggers. All RMON-based Call Home messages have their message level set to NOTIFY (2). The RMON alert group is defined for all RMON-based Call Home alerts. To receive an RMON-based Call Home alert, you must associate a destination profile with the RMON alert group.

General Email Options Using HTTPS Support

The HTTPS support for Call Home provides a transport method called HTTP. HTTPS support is used for a secure communication, and HTTP is used for nonsecure communication. You can configure an HTTP URL for the Call Home destination profile as a destination. The URL link can be from a secure server or nonsecure server. For a destination profile configured with the HTTP URL, the Call Home message is posted to the HTTP URL link.

Note The Call Home HTTP configuration can be distributed over CFS on the switches running NX-OS Release 4.2(1) and later. The Call Home HTTP configuration cannot be distributed to switches that support the nondistributable HTTP configuration. Switches running lower versions than NX-OS Release 4.2(1) and later will ignore the HTTP configuration.

Multiple SMTP Server Support

Cisco MDS NX-OS and Cisco NX-OS 5000 Series switches support multiple SMTP servers for Call Home. Each SMTP server has a priority configured between 1 and 100, with 1 being the highest priority and 100 being the lowest. If the priority is not specified, a default value of 50 is used.

You can configure up to five SMTP servers for Call Home. The servers are contacted based on their priority. The highest priority server is contacted first. If the message fails to be sent, the next server in the list is contacted until the limit is exhausted. If two servers have equal priority, the one that was configured earlier is contacted.

If a high-priority SMTP server fails, the other servers will be contacted. A time delay may occur while sending a message. The delay is minimal if the attempt to send the message through the first SMTP server is successful. The delay may increase depending on the number of unsuccessful attempts with different SMTP servers.

Note The new configuration process is not related to the old configuration. However, if the SMTP servers are configured using both the old and new schemes, the older configuration is of the highest priority.

Multiple SMTP servers can be configured on any MDS 9000 Family switch, Cisco Nexus 5000 Series switches, and Cisco Nexus 7000 Series switches running Release 5.0(1a) or later.

The new configuration will only be distributed to switches that have multiple SMTP servers. The older switches in the fabric will ignore the new configuration received over CFS.

In a mixed fabric that has CFS enabled, the switches running NX-OS Release 5.0 can configure new functionalities and distribute the new configuration to other switches with Release 5.0 in the fabric over CFS. However, if an existing switch running NX-OS Release 4.x upgrades to Release 5.0, the new configurations will not be distributed to that switch as a CFS merge is not triggered on an upgrade. There are two options to upgrade:

- Apply new configuration only when all the switches in the fabric support them. (Recommended option).
- Do an empty commit from an existing NX-OS Release 5.0 switch which has the new configuration

Periodic Inventory Notification

You can configure the switch to periodically send a message with an inventory of all software services currently enabled and running on the switch along with hardware inventory information. The inventory is modified each time the switch is restarted nondisruptively.

Duplicate Message Throttle

You can configure a throttling mechanism to limit the number of Call Home messages received for the same event. If the same message is sent multiple times from the switch within a short period of time, you may be swamped with a large number of duplicate messages.

Call Home Configuration Distribution

You can enable fabric distribution for all Cisco MDS 9000 Family switches and Cisco Nexus 5000 Series switches in the fabric. When you perform Call Home configurations, and distribution is enabled, that configuration is distributed to all the switches in the fabric. However, the switch priority and the Syscontact names are not distributed.

You automatically acquire a fabric-wide lock when you enter the first configuration command operation after you enable distribution in a switch. The Call Home application uses the effective and pending database model to store or commit the configuration changes. When you commit the configuration changes, the effective database is overwritten by the configuration changes in the pending database and all the switches in the fabric receive the same configuration. After making the configuration changes, you can choose to discard the changes by aborting the changes instead of committing them. In either case, the lock is released. See Chapter 2, "Using the CFS Infrastructure" for more information on the CFS application.

Note The switch priority and the Syscontact name are not distributed.

Fabric Lock Override

If you have performed a Call Home task and have forgotten to release the lock by either committing or discarding the changes, an administrator can release the lock from any switch in the fabric. If the administrator performs this task, your changes to the pending database are discarded and the fabric lock is released.

Tip The changes are only available in the volatile directory and are subject to being discarded if the switch is restarted.

Clearing Call Home Name Server Database

When the Call Home name server database is full, a new entry cannot be added. The device is not allowed to come online. To clear the name server database, increase the database size or perform a cleanup by removing unused devices. A total of 20,000 name server entries are supported.

EMC Email Home Delayed Traps

DCNM-SAN can be configured to generate EMC Email Home XML email messages. In SAN-OS Release 3.x or earlier, DCNM-SAN listens to interface traps and generates EMC Email Home email messages. Link traps are generated when an interface goes to down from up or vice versa. For example, if there is a scheduled server reboot, the link goes down and DCNM-SAN generates an email notification.

Cisco NX-OS Release 4.1(3) provides the ability to generate a delayed trap so that the number of generated email messages is reduced. This method filters server reboots and avoids generating unnecessary EMC Email Home email messages. In NX-OS Release 4.1(3), users have the ability to select the current existing feature or this new delayed trap feature.

Event Triggers

This section discusses Call Home trigger events. Trigger events are divided into categories, with each category assigned CLI commands to execute when the event occurs. The command output is included in the transmitted message. Table 4-2 lists the trigger events

Table 4-2 Event Triggers

Event	Alert Group	Event Name	Description	Call Home Message Level
Call Home	System and CISCO_TAC	SW_CRASH	A software process has crashed with a stateless restart, indicating an interruption of a service.	5
	System and CISCO_TAC	SW_SYSTEM_INCONSISTENT	Inconsistency detected in software or file system.	5
	Environmental and CISCO_TAC	TEMPERATURE_ALARM	Thermal sensor indicates temperature reached operating threshold.	6
		POWER_SUPPLY_FAILURE	Power supply failed.	6
		FAN_FAILURE	Cooling fan has failed.	5
	Line Card Hardware and CISCO_TAC	LINECARD_FAILURE	Line card hardware operation failed.	7
		POWER_UP_DIAGNOSTICS_FAILURE	Line card hardware failed power-up diagnostics.	7
	Line Card Hardware and CISCO_TAC	PORT_FAILURE	Hardware failure of interface port(s).	6
	Line Card Hardware, Supervisor Hardware, and CISCO_TAC	BOOTFLASH_FAILURE	Failure of boot compact flash card.	6
	Supervisor Hardware and CISCO_TAC	NVRAM_FAILURE	Hardware failure of NVRAM on supervisor hardware.	6
	Supervisor Hardware and CISCO_TAC	FREEDISK_FAILURE	Free disk space is below a threshold on supervisor hardware.	6
	Supervisor Hardware and CISCO_TAC	SUP_FAILURE	Supervisor hardware operation failed. **Note** When the active supervisor is removed, a switch over occurs. A call home notification for this event will not be sent.	7
		POWER_UP_DIAGNOSTICS_FAILURE	Supervisor hardware failed power-up diagnostics.	7
	Supervisor Hardware and CISCO_TAC	INBAND_FAILURE	Failure of in-band communications path.	7
	Supervisor Hardware and CISCO_TAC	EOBC_FAILURE	Ethernet out-of-band channel communications failure.	6

Table 4-2 Event Triggers (continued)

Event	Alert Group	Event Name	Description	Call Home Message Level
Call Home	Supervisor Hardware and CISCO_TAC	MGMT_PORT_FAILURE	Hardware failure of management Ethernet port.	5
	License	LICENSE_VIOLATION	Feature in use is not licensed, and are turned off after grace period expiration.	6
Inventory	Inventory and CISCO_TAC	COLD_BOOT	Switch is powered up and reset to a cold boot sequence.	2
		HARDWARE_INSERTION	New piece of hardware inserted into the chassis.	2
		HARDWARE_REMOVAL	Hardware removed from the chassis.	2
Test	Test and CISCO_TAC	TEST	User generated test.	2
Port syslog	Syslog-group-port	SYSLOG_ALERT	Syslog messages corresponding to the port facility.	2
RMON	RMON	RMON_ALERT	RMON alert trigger messages.	2

Call Home Message Levels

Table 4-3 Event Categories and Executed Commands

Event Category	Description	Executed Commands
System show module show version show tech-support platform show tech-support sysmgr show hardware show sprom all	Events generated by failure of a software system that is critical to unit operation.	**show tech-support** **show system redundancy status**
Environmental show module show version show environment show logging logfile | tail -n 200	Events related to power, fan, and environment sensing elements such as temperature alarms.	**show module** **show environment**
Line Card Hardware show module show version show tech-support platform show tech-support sysmgr show hardware show sprom all	Events related to standard or intelligent line card hardware.	**show tech-support**
Supervisor Hardware show module show version show tech-support platform show tech-support sysmgr show hardware show sprom all	Events related to supervisor modules.	**show tech-support**

Table 4-3 Event Categories and Executed Commands (continued)

Event Category	Description	Executed Commands
Inventory show module show version show hardware show inventory show system uptime show sprom all show license usage	Inventory status is provided whenever a unit is cold booted, or when FRUs are inserted or removed. This is considered a noncritical event, and the information is used for status and entitlement.	**show version**
Test show module show version	User generated test message.	**show version**

Call Home messages (sent for syslog alert groups) have the syslog severity level mapped to the Call Home message level (see the "Syslog-Based Alerts" section on page 4-6).

This section discusses the severity levels for a Call Home message when using one or more switches in the Cisco MDS 9000 Family and the Cisco Nexus 5000 Series. Call Home message levels are preassigned per event type.

Severity levels range from 0 to 9, with 9 having the highest urgency. Each syslog level has keywords and a corresponding syslog level as listed in Table 4-4.

Note Call Home does not change the syslog message level in the message text. The syslog message texts in the Call Home log appear as they are described in the *Cisco MDS 9000 Family System Messages Reference*.

Note Call Home severity levels are not the same as system message logging severity levels (see the *Cisco MDS 9000 Family System Messages Reference*).

Table 4-4 Severity and Syslog Level Mapping

Call Home Level	Keyword Used	Syslog Level	Description
Catastrophic (9)	**Catastrophic**	N/A	Network wide catastrophic failure.
Disaster (8)	**Disaster**	N/A	Significant network impact.
Fatal (7)	**Fatal**	Emergency (0)	System is unusable.
Critical (6)	**Critical**	Alert (1)	Critical conditions, immediate attention needed.
Major (5)	**Major**	Critical (2)	Major conditions.
Minor (4)	**Minor**	Error (3)	Minor conditions.
Warning (3)	**Warning**	Warning (4)	Warning conditions.

Table 4-4 Severity and Syslog Level Mapping (continued)

Call Home Level	Keyword Used	Syslog Level	Description
Notify (2)	**Notification**	Notice (5)	Basic notification and informational messages. Possibly independently insignificant.
Normal (1)	**Normal**	Information (6)	Normal event signifying return to normal state.
Debug (0)	**Debugging**	Debug (7)	Debugging messages.

Message Contents

The following contact information can be configured on the switch:

- Name of the contact person
- Phone number of the contact person
- Email address of the contact person
- Mailing address to which replacement parts must be shipped, if required
- Site ID of the network where the site is deployed
- Contract ID to identify the service contract of the customer with the service provider

Table 4-5 describes the short text formatting option for all message types.

Table 4-5 Short Text Messages

Data Item	Description
Device identification	Configured device name
Date/time stamp	Time stamp of the triggering event
Error isolation message	Plain English description of triggering event
Alarm urgency level	Error level such as that applied to system message

Table 4-6, Table 4-7, and Table 4-8 display the information contained in plain text and XML messages.

Table 4-6 Reactive Event Message Format

Data Item (Plain text and XML)	Description (Plain text and XML)	XML Tag (XML only)
Time stamp	Date and time stamp of event in ISO time notation: *YYYY-MM-DDTHH:MM:SS*. **Note** The time zone or daylight savings time (DST) offset from UTC has already been added or subtracted. T is the hardcoded limiter for the time.	/mml/header/time - ch:EventTime
Message name	Name of message. Specific event names are listed in the "Event Triggers" section on page 4-10.	/mml/header/name
Message type	Specifically "Call Home."	/mml/header/type - ch:Type
Message group	Specifically "reactive."	/mml/header/group

Table 4-6 Reactive Event Message Format (continued)

Data Item (Plain text and XML)	Description (Plain text and XML)	XML Tag (XML only)
Severity level	Severity level of message (see Table 4-4).	/mml/header/level - aml-block:Severity
Source ID	Product type for routing.	/mml/header/source - ch:Series
Device ID	Unique device identifier (UDI) for end device generating message. This field should empty if the message is non-specific to a fabric switch. Format is *type@Sid@serial*, where: • *type* is the product model number from backplane SEEPROM. • @ is a separator character. • *Sid* is "C," identifying the serial ID as a chassis serial number. • *serial* is the number identified by the Sid field. Example: DS-C9509@C@12345678	/mml/ header/deviceId
Customer ID	Optional user-configurable field used for contract info or other ID by any support service.	/mml/header/customerID - ch:CustomerId
Contract ID	Optional user-configurable field used for contract info or other ID by any support service.	/mml/header/contractId - ch:ContractId>
Site ID	Optional user-configurable field used for Cisco-supplied site ID or other data meaningful to alternate support service.	/mml/header/siterId - ch:SiteId
Server ID	If the message is generated from the fabric switch, it is the unique device identifier (UDI) of the switch. Format is *type@Sid@serial*, where: • *type* is the product model number from backplane SEEPROM. • @ is a separator character. • *Sid* is "C,," identifying the serial ID as a chassis serial number. • *serial* is the number identified by the Sid field. Example: DS-C9509@C@12345678	/mml/header/serverId - -blank-
Message description	Short text describing the error.	/mml/body/msgDesc - ch:MessageDescription
Device name	Node that experienced the event. This is the host name of the device.	/mml/body/sysName - ch:SystemInfo/Name
Contact name	Name of person to contact for issues associated with the node experiencing the event.	/mml/body/sysContact - ch:SystemInfo/Contact
Contact email	Email address of person identified as contact for this unit.	/mml/body/sysContactemail - ch:SystemInfo/Contactemail
Contact phone number	Phone number of the person identified as the contact for this unit.	/mml/body/sysContactPhone Number - ch:SystemInfo/ContactPhone Number

Table 4-6 Reactive Event Message Format (continued)

Data Item (Plain text and XML)	Description (Plain text and XML)	XML Tag (XML only)
Street address	Optional field containing street address for RMA part shipments associated with this unit.	/mml/body/sysStreetAddress - ch:SystemInfo/StreetAddress
Model name	Model name of the switch. This is the specific model as part of a product family name.	/mml/body/chassis/name - rme:Chassis/Model
Serial number	Chassis serial number of the unit.	/mml/body/chassis/serialNo - rme:Chassis/SerialNumber
Chassis part number	Top assembly number of the chassis.	/mml/body/fru/partNo - rme:chassis/Card/PartNumber
Chassis hardware version	Hardware version of chassis.	/mml/body/chassis/hwVersion - rme:Chassis/HardwareVersion
Supervisor module software version	Top level software version.	/mml/body/fru/swVersion - rme:chassis/Card/SoftwareIdentity
Affected FRU name	Name of the affected FRU generating the event message.	/mml/body/fru/name - rme:chassis/Card/Model
Affected FRU serial number	Serial number of affected FRU.	/mml/body/fru/serialNo - rme:chassis/Card/SerialNumber
Affected FRU part number	Part number of affected FRU.	/mml/body/fru/partNo - rme:chassis/Card/PartNumber
FRU slot	Slot number of FRU generating the event message.	/mml/body/fru/slot - rme:chassis/Card/LocationWithinContainer
FRU hardware version	Hardware version of affected FRU.	/mml/body/fru/hwVersion - rme:chassis/Card/SoftwareIdentity
FRU software version	Software version(s) running on affected FRU.	/mml/body/fru/swVersion - rme:chassis/Card/SoftwareIdentity
Command output name	The exact name of the issued command.	/mml/attachments/attachment/name - aml-block:Attachment/Name
Attachment type	Specifically command output.	/mml/attachments/attachment/type - aml-block:Attachment type
MIME type	Normally text or plain or encoding type.	/mml/attachments/attachment/mime - aml-block:Attachment/Data encoding
Command output text	Output of command automatically executed (see Table 4-3).	/mml/attachments/attachment/atdata - aml-block:Attachment/Data

Table 4-7 Inventory Event Message Format

Data Item (Plain text and XML)	Description (Plain text and XML)	XML Tag (XML only)
Time stamp	Date and time stamp of event in ISO time notation: *YYYY-MM-DD*T*HH:MM:SS*. **Note** The time zone or daylight savings time (DST) offset from UTC has already been added or subtracted. T is the hardcoded limiter for the time.	/mml/header/time - ch:EventTime
Message name	Name of message. Specifically "Inventory Update" Specific event names are listed in the "Event Triggers" section on page 4-10.	/mml/header/name
Message type	Specifically "Inventory Update."	/mml/header/type - ch-inv:Type
Message group	Specifically "proactive."	/mml/header/group
Severity level	Severity level of inventory event is level 2 (see Table 4-4).	/mml/header/level - aml-block:Severity
Source ID	Product type for routing at Cisco. Specifically "MDS 9000."	/mml/header/source - ch-inv:Series
Device ID	Unique Device Identifier (UDI) for end device generating message. This field should empty if the message is non-specific to a fabric switch. Format is *type@Sid@serial*, where: • *type* is the product model number from backplane SEEPROM. • @ is a separator character. • *Sid* is "C,," identifying the serial ID as a chassis serial number. • *serial* is the number identified by the Sid field. Example: DS-C9509@C@12345678	/mml/ header /deviceId
Customer ID	Optional user-configurable field used for contact info or other ID by any support service.	/mml/header/customerID - ch-inv:CustomerId
Contract ID	Optional user-configurable field used for contact info or other ID by any support service.	/mml/header/contractId - ch-inv:ContractId>
Site ID	Optional user-configurable field, can be used for Cisco-supplied site ID or other data meaningful to alternate support service.	/mml/header/siterId - ch-inv:SiteId
Server ID	If the message is generated from the fabric switch, it is the Unique device identifier (UDI) of the switch. Format is *type@Sid@serial*, where: • *type* is the product model number from backplane SEEPROM. • @ is a separator character. • *Sid* is "C,," identifying the serial ID as a chassis serial number. • *serial* is the number identified by the Sid field. Example: DS-C9509@C@12345678	/mml/header/serverId - -blank-
Message description	Short text describing the error.	/mml/body/msgDesc - ch-inv:MessageDescription

Table 4-7 Inventory Event Message Format (continued)

Data Item (Plain text and XML)	Description (Plain text and XML)	XML Tag (XML only)
Device name	Node that experienced the event.	/mml/body/sysName - ch-inv:SystemInfo/Name
Contact name	Name of person to contact for issues associated with the node experiencing the event.	/mml/body/sysContact - ch-inv:SystemInfo/Contact
Contact email	Email address of person identified as contact for this unit.	/mml/body/sysContactemail - ch-inv:SystemInfo/Contactemail
Contact phone number	Phone number of the person identified as the contact for this unit.	/mml/body/sysContactPhoneNumber - ch-inv:SystemInfo/ContactPhoneNumber
Street address	Optional field containing street address for RMA part shipments associated with this unit.	/mml/body/sysStreetAddress - ch-inv:SystemInfo/StreetAddress
Model name	Model name of the unit. This is the specific model as part of a product family name.	/mml/body/chassis/name - rme:Chassis/Model
Serial number	Chassis serial number of the unit.	/mml/body/chassis/serialNo - rme:Chassis/SerialNumber
Chassis part number	Top assembly number of the chassis.	/mml/body/fru/partNo - rme:chassis/Card/PartNumber
Chassis hardware version	Hardware version of chassis.	/mml/body/fru/hwVersion - rme:chassis/Card/SoftwareIdentity
Supervisor module software version	Top level software version.	/mml/body/fru/swVersion - rme:chassis/Card/SoftwareIdentity
FRU name	Name of the affected FRU generating the event message.	/mml/body/fru/name - rme:chassis/Card/Model
FRU s/n	Serial number of FRU.	/mml/body/fru/serialNo - rme:chassis/Card/SerialNumber
FRU part number	Part number of FRU.	/mml/body/fru/partNo - rme:chassis/Card/PartNumber
FRU slot	Slot number of FRU.	/mml/body/fru/slot - rme:chassis/Card/LocationWithinContainer
FRU hardware version	Hardware version of FRU.	/mml/body/fru/hwVersion - rme:chassis/Card/SoftwareIdentity
FRU software version	Software version(s) running on FRU.	/mml/body/fru/swVersion - rme:chassis/Card/SoftwareIdentity

Table 4-7 Inventory Event Message Format (continued)

Data Item (Plain text and XML)	Description (Plain text and XML)	XML Tag (XML only)
Command output name	The exact name of the issued command.	/mml/attachments/attachment /name - aml-block:Attachment/Name
Attachment type	Specifically command output.	/mml/attachments/attachment /type - aml-block:Attachment type
MIME type	Normally text or plain or encoding type.	/mml/attachments/attachment /mime - aml-block:Attachment/Data encoding
Command output text	Output of command automatically executed after event categories (see "Event Triggers" section on page 4-10).	/mml/attachments/attachment /atdata - aml-block:Attachment/Data

Table 4-8 User-Generated Test Message Format

Data Item (Plain text and XML)	Description (Plain text and XML)	XML Tag (XML only)
Time stamp	Date and time stamp of event in ISO time notation: *YYYY-MM-DD*T*HH:MM:SS*. **Note** The time zone or daylight savings time (DST) offset from UTC has already been added or subtracted. T is the hardcoded limiter for the time.	/mml/header/time - ch:EventTime
Message name	Name of message. Specifically test message for test type message. Specific event names listed in the "Event Triggers" section on page 4-10).	/mml/header/name
Message type	Specifically "Test Call Home."	/mml/header/type - ch:Type
Message group	This field should be ignored by the receiving Call Home processing application, but may be populated with either "proactive" or "reactive."	/mml/header/group
Severity level	Severity level of message, test Call Home message (see Table 4-4).	/mml/header/level - aml-block:Severity
Source ID	Product type for routing.	/mml/header/source - ch:Series
Device ID	Unique device identifier (UDI) for end device generating message. This field should empty if the message is nonspecific to a fabric switch. Format is *type@Sid@serial*, where: • *type* is the product model number from backplane SEEPROM. • @ is a separator character. • *Sid* is "C" identifying the serial ID as a chassis serial number. • *serial* is the number identified by the Sid field. Example: DS-C9509@C@12345678	/mml/ header /deviceId

Table 4-8 User-Generated Test Message Format (continued)

Data Item (Plain text and XML)	Description (Plain text and XML)	XML Tag (XML only)
Customer ID	Optional user-configurable field used for contract info or other ID by any support service.	/mml/header/customerID - ch:CustomerId
Contract ID	Optional user-configurable field used for contract info or other ID by any support service.	/mml/header/contractId - ch:ContractId
Site ID	Optional user-configurable field used for Cisco-supplied site ID or other data meaningful to alternate support service.	/mml/header/siterId - ch:SiteId
Server ID	If the message is generated from the fabric switch, it is the Unique device identifier (UDI) of the switch. Format is *type@Sid@serial*, where: • *type* is the product model number from backplane SEEPROM. • @ is a separator character. • *Sid* is “C” identifying the serial ID as a chassis serial number. • *serial* is the number identified by the Sid field. Example: “DS-C9509@C@12345678	/mml/header/serverId - -blank-
Message description	Short text describing the error.	/mml/body/msgDesc - ch:MessageDescription
Device name	Switch that experienced the event.	/mml/body/sysName - ch:SystemInfo/Name
Contact name	Name of person to contact for issues associated with the node experiencing the event.	/mml/body/sysContact - ch:SystemInfo/Contact
Contact email	Email address of person identified as contact for this unit.	/mml/body/sysContactemail - ch:SystemInfo/Contactemail
Contact phone number	Phone number of the person identified as the contact for this unit.	/mml/body/sysContactPhoneNumber - ch:SystemInfo/ContactPhoneNumber
Street address	Optional field containing street address for RMA part shipments associated with this unit.	/mml/body/sysStreetAddress - ch:SystemInfo/StreetAddress
Model name	Model name of the switch. This is the specific model as part of a product family name.	/mml/body/chassis/name - rme:Chassis/Model
Serial number	Chassis serial number of the unit.	/mml/body/chassis/serialNo - rme:Chassis/SerialNumber
Chassis part number	Top assembly number of the chassis. For example, 800-xxx-xxxx.	/mml/body/fru/partNo - rme:chassis/Card/PartNumber
Command output text	Output of command automatically executed after event categories listed in Table 4-3.	/mml/attachments/attachment/atdata - aml-block:Attachment/Data

Table 4-8 User-Generated Test Message Format (continued)

Data Item (Plain text and XML)	Description (Plain text and XML)	XML Tag (XML only)
MIME type	Normally text or plain or encoding type.	/mml/attachments/attachment/mime - aml-block:Attachment/Data encoding
Attachment type	Specifically command output.	/mml/attachments/attachment/type - aml-block:Attachment type
Command output name	The exact name of the issued command.	/mml/attachments/attachment/name - aml-block:Attachment/Name

Guidelines and Limitations

Call Home Database Merger Guidelines

When merging two Call Home databases, follow these guidelines:

- Be aware that the merged database contains the following information:
  - A superset of all the destination profiles from the dominant and subordinate switches that take part in the merge protocol.
  - The email addresses and alert groups for the destination profiles.
  - Other configuration information (for example, message throttling, periodic inventory) from the switch that existed in the dominant switch before the merge.

See the "CFS Merge Support" section on page 2-6 for detailed concepts.

Call Home Configuration Guidelines

When configuring Call Home, follow these guidelines:

- An email server and at least one destination profile (predefined or user-defined) must be configured. The destination profile(s) used depends on whether the receiving entity is a pager, email, or automated service such as Cisco Smart Call Home.
- Switches can forward events (SNMP traps/informs) up to 10 destinations.
- The contact name (SNMP server contact), phone, and street address information must be configured before Call Home is enabled. This configuration is required to determine the origin of messages received.
- The Cisco MDS 9000 Family switch and the Cisco Nexus 5000 Series switch must have IP connectivity to an email server.
- If Cisco Smart Call Home is used, an active service contract must cover the device being configured.

Default Settings

Table 4-9 lists the default Call Home settings.

Table 4-9 Default Call Home Default Settings

Parameters	Default
Destination message size for a message sent in full text format.	500,000
Destination message size for a message sent in XML format.	500,000
Destination message size for a message sent in short text format.	4000
DNS or IP address of the SMTP server to reach the server if no port is specified.	25
Alert group association with profile.	All
Format type.	XML
Call Home message level.	0 (zero)
HTTP proxy server use.	Disabled and no proxy server configured.
HTTP proxy server message size for full text destination.	1 MB
HTTP proxy server message size for XML.	1 MB

Configuring Call Home

How you configure the Call Home process depends on how you intend to use the feature.

This section includes the following topics:

- Task Flow for Configuring Call Home, page 4-24
- Enabling Call Home Function, page 4-25
- Configuring Destination Profiles, page 4-25
- Associating an Alert Group, page 4-28
- Customizing Alert Group Messages, page 4-30
- Configuring Event Trap Notifications, page 4-32
- Configuring General Email Options, page 4-32
- Configuring HTTPS Support, page 4-32
- Configuring an HTTP Proxy Server, page 4-33
- Enable or Disable Transport Method, page 4-33
- Enabling Periodic Inventory Notifications, page 4-36
- Configuring Duplicate Message Throttle, page 4-36
- Enabling Call Home Fabric Distribution, page 4-37
- Fabric Lock Override, page 4-38
- Call Home Communications Test, page 4-38
- Configuring Delayed Traps, page 4-38

Task Flow for Configuring Call Home

Follow these steps to configure Call Home:

Step 1 Configure contact information.

Step 2 Enable or disable Call Home.

Step 3 Configure destination profiles.

Step 4 Associate one or more alert groups to each profile as required by your network. Customize the alert groups, if desired.

Step 5 Configure email options.

Step 6 Test Call Home messages.

Configuring Contact Information

Switch priority is specific to each switch in the fabric. This priority is used by the operations personnel or TAC support personnel to decide which Call Home message they should respond to first. You can prioritize Call Home alerts of the same severity from each switch.

Prerequisites

- Each switch must include email, phone, and street address information. You can optionally include the contract ID, customer ID, site ID, and switch priority information.

Detailed Steps

To assign the contact information, follow these steps:

	Command	Purpose
Step 1	`switch# config t`	Enters configuration mode.
Step 2	`switch(config)# snmp-server contact personname@companyname.com`	Configures the SNMP contact name.

Step 3	`switch(config)# callhome`
	`switch(config-callhome)#`
		Enters the Call Home configuration submode.

Step 4	`switch(config-callhome)# email-contact username@company.com`	Assigns the customer's email address. Up to 128 alphanumeric characters are accepted in email address format. **Note** You can use any valid email address. You cannot use spaces.
Step 5	`switch(config-callhome)# phone-contact +1-800-123-4567`	Assigns the customer's phone number. Up to 20 alphanumeric characters are accepted in international format. **Note** You cannot use spaces. Be sure to use the + prefix before the number.

	Command	Purpose
Step 6	switch(config-callhome)# **streetaddress 1234 Picaboo Street, Any city, Any state, 12345**	Assigns the customer's street address where the equipment is located. Up to 256 alphanumeric characters are accepted in free format.
Step 7	switch(config-callhome)# **switch-priority 0**	Assigns the switch priority, with 0 being the highest priority and 7 the lowest. **Tip** Use this field to create a hierarchical management structure.
Step 8	switch(config-callhome)# **customer-id Customer1234**	Optional. Identifies the customer ID. Up to 256 alphanumeric characters are accepted in free format.
Step 9	switch(config-callhome)# **site-id Site1ManhattanNY**	Optional. Identifies the customer site ID. Up to 256 alphanumeric characters are accepted in free format.
Step 10	switch(config-callhome)# **contract-id Company1234**	Assigns the customer ID for the switch. Up to 64 alphanumeric characters are accepted in free format.

Enabling Call Home Function

Once you have configured the contact information, you must enable the Call Home function.

Detailed Steps

To enable the Call Home function, follow these steps:

	Command	Purpose
Step 1	switch# **config t**	Enters configuration mode.
Step 2	switch(config)# **callhome** switch(config-callhome)#	Enters Call Home configuration submode.
Step 3	switch(config-callhome)# **enable** callhome enabled successfully switch(config-callhome)#	Enables the Call Home function.
	switch(config-callhome)# **disable** switch(config-callhome)#	Disables the Call Home function. When you disable the Call Home function, all input events are ignored. **Note** Even if Call Home is disabled, basic information for each Call Home event is sent.

Configuring Destination Profiles

A destination profile contains the required delivery information for an alert notification. Destination profiles are typically configured by the network administrator.

You can configure the following attributes for a destination profile:

- Profile name—A string that uniquely identifies each user-defined destination profile and is limited to 32 alphanumeric characters. The format options for a user-defined destination profile are full-txt, short-txt, or XML (default).

- Destination address—The actual address, pertinent to the transport mechanism, to which the alert should be sent.
- Message formatting—The message format used for sending the alert (full text, short text, or XML).

Note If you use the Cisco Smart Call Home service, the XML destination profile is required (see http://www.cisco.com/en/US/partner/products/hw/ps4159/ps4358/products_configuration_example09186a0080108e72.shtml).

Prerequisites

- At least one destination profile is required. You can configure multiple destination profiles of one or more types. You can use one of the predefined destination profiles or define a desired profile. If you define a new profile, you must assign a profile name.

Detailed Steps

To configure predefined destination profile messaging options, follow these steps:

	Command	Purpose
Step 1	`switch# ` **`config t`**	Enters configuration mode.

Step 2	`switch(config)# ` **`callhome`**
	`switch(config-callhome)#`
		Enters the Call Home configuration submode.

Step 3	`switch(config-callhome)#` **`destination-profile full-txt-destination email-addr person@place.com`**	Configures an email address for the predefined full-txt-destination profile. The email addresses in this destination profile receives messages in full-txt format. The full-text format provides the complete, detailed explanation of the failure. **Tip** Use a standard email address that does not have any text size restrictions.
	`switch(config-callhome)#` **`destination-profile full-txt-destination message-size 1000000`**	Configures a maximum destination message size for the predefined full-txt-destination profile. The valid range is 0 to 1,000,000 bytes and the default is 500,000. A value of 0 implies that a message of any size can be sent. **Note** The maximum size of each individual attachment inside the message is 250,000 bytes. If any attachment is more than this maximum size, then the output captured in the attachment will be truncated.

	Command	Purpose
Step 4	switch(config-callhome)# **destination-profile short-txt-destination email-addr person@place.com**	Configures an email address for the predefined short-txt-destination profile. The email addresses in this destination profile receive messages in short-txt format. This format provides the basic explanation of the failure in the Call Home message. **Tip** Use a pager-related email address for this option.
	switch(config-callhome)# **destination-profile short-txt-destination message-size 100000**	Configures maximum destination message size for the predefined short-txt-destination profile. The valid range is 0 to 1,000,000 bytes and the default is 4000. A value of 0 implies that a message of any size can be sent. **Note** The maximum size of each individual attachment inside the message is 250,000 bytes. If any attachment is more than this maximum size, then the output captured in the attachment will be truncated.
Step 5	switch(config-callhome)# **destination-profile XML-destination email-addr findout@.cisco.com**	Configures an email address for the predefined XML-destination profile. The email addresses in this destination-profile receives messages in XML format. This format provides information that is compatible with Cisco Systems TAC support. **Tip** Do not add a pager-related email address to this destination profile because of the large message size.
	switch(config-callhome)# **destination-profile XML-destination message-size 100000**	Configures maximum destination message size for the predefined destination profile XML-destination. The valid range is 0 to 1,000,000 bytes and the default is 500,000. A value of 0 implies that a message of any size can be sent. **Note** The maximum size of each individual attachment inside the message is 250,000 bytes. If any attachment is more than this maximum size, then the output captured in the attachment will be truncated.

Note Steps 3, 4, and 5 in this procedure can be skipped or configured in any order.

To configure a new destination-profile (and related parameters), follow these steps:

	Command	Purpose
Step 1	switch# **config t**	Enters configuration mode.
Step 2	switch(config)# **callhome** switch(config-callhome)#	Enters the Call Home configuration submode.
Step 3	switch(config-callhome)# **destination-profile test**	Configures a new destination profile called test.
Step 4	switch(config-callhome)# **destination-profile test email-addr person@place.com**	Configures the email address for the user-defined destination profile (test) sent in default XML format.

	Command	Purpose
Step 5	`switch(config-callhome)# destination-profile test message-size 1000000`	Configures a maximum message size for the destination email addresses in the user-defined destination profile (test) sent in default XML format. The valid range is 0 to 1,000,000 bytes and the default is 500,000. A value of 0 implies that a message of any size can be sent.
Step 6	`switch(config-callhome)# destination-profile test format full-txt`	Configures message-format for the user-defined destination profile (test) to be full text format.
	`switch(config-callhome)# destination-profile test format short-txt`	Configures message-format for the user-defined destination profile (test) to be short text format.

Note Steps 4, 5, and 6 in this procedure can be skipped or configured in any order.

Associating an Alert Group

Different types of Call Home alerts are grouped into different alert groups depending on their type. You can associate one or more alert groups to each profile as required by your network.

The alert group feature allows you to select the set of Call Home alerts to be received by a destination profile (either predefined or user-defined). You can associate multiple alert groups with a destination profile.

Restrictions

- A Call Home alert is sent to email destinations in a destination profile only if that Call Home alert belongs to one of the alert groups associated with that destination profile.

Detailed Steps

To associate an alert group with a destination profile, follow these steps:

	Command	Purpose
Step 1	`switch# config t`	Enters configuration mode.

Step 2	`switch(config)# callhome`
	`switch(config-callhome)#`
		Enters Call Home configuration submode.

Step 3	`switch(config-callhome)# destination-profile test1 alert-group test`	Optional. Configures user-defined destination profile (test1) to receive all user-generated Call Home test notifications.
	`switch(config-callhome)# destination-profile short-txt-destination alert-group test`	Optional. Configures predefined short-text destination profile to receive all user-generated Call Home test notifications.

	Command	Purpose
Step 4	switch(config-callhome)# **destination-profile test1 alert-group all**	Optional. Configures user-defined destination profile (test1) to receive Call Home notifications for all events
	switch(config-callhome)# **destination-profile short-txt-destination alert-group all**	Optional. Configures predefined short-text destination message profile to receive Call Home notifications for all (default) events
Step 5	switch(config-callhome)# **destination-profile test1 alert-group Cisco-TAC**	Optional. Configures user-defined destination message profile (test1) to receive Call Home notifications for events that are meant only for Cisco TAC or the Auto-notify service.
	switch(config-callhome)# **destination-profile xml-destination alert-group Cisco-TAC**	Optional. Configures predefined XML destination message profile to receive Call Home notifications for events that are meant only for Cisco TAC or the auto-notify service.
Step 6	switch(config-callhome)# **destination-profile test1 alert-group environmental**	Optional. Configures user-defined destination message profile (test1) to receive Call Home notifications for power, fan, and temperature-related events.
	switch(config-callhome)# **destination-profile short-txt-destination alert-group environmental**	Optional. Configures predefined short-text destination message profile to receive Call Home notifications for power, fan, and temperature-related events.
Step 7	switch(config-callhome)# **destination-profile test1 alert-group inventory**	Optional. Configures user-defined destination message profile (test1) to receive Call Home notifications for inventory status events.
	switch(config-callhome)# **destination-profile short-txt-destination alert-group inventory**	Optional. Configures predefined short-text destination message profile to receive Call Home notifications for inventory status events.
Step 8	switch(config-callhome)# **destination-profile test1 alert-group linecard-hardware**	Optional. Configures user-defined destination message profile (test1) to receive Call Home notifications for module-related events.
	switch(config-callhome)# **destination-profile short-txt-destination alert-group linecard-hardware**	Optional. Configures predefined short-text destination message profile to receive Call Home notifications for module-related events.
Step 9	switch(config-callhome)# **destination-profile test1 alert-group supervisor-hardware**	Optional. Configures user-defined destination message profile (test1) to receive Call Home notifications for supervisor-related events.
	switch(config-callhome)# **destination-profile short-txt-destination alert-group supervisor-hardware**	Optional. Configures predefined short-text destination message profile to receive Call Home notifications for supervisor-related events.

	Command	Purpose
Step 10	`switch(config-callhome)# destination-profile test1 alert-group system`	Optional. Configures user-defined destination message profile (test1) to receive Call Home notifications for software-related events.
	`switch(config-callhome)# destination-profile short-txt-destination alert-group system`	Optional. Configures predefined short-text destination message profile to receive Call Home notifications for software-related events.

Customizing Alert Group Messages

To assign **show** commands to be executed when an alert is sent, you must associate the commands with the alert group. When an alert is sent, Call Home associates the alert group with an alert type and attaches the output of the **show** commands to the alert message.

Note Make sure the destination profiles for a non-Cisco-TAC alert group, with a predefined **show** command, and the Cisco-TAC alert group are not the same.

Restrictions

- You can assign a maximum of five user-defined **show** commands to an alert group. Only **show** commands can be assigned to an alert group.
- Customized **show** commands are only supported for full text and XML alert groups. Short text alert groups (short-txt-destination) do not support customized **show** commands because they only allow 128 bytes of text.

Detailed Steps

To customize Call Home alert group messages, follow these steps:

	Command	Purpose
Step 1	`switch# config t`	Enters configuration mode.

Step 2	`switch(config)# callhome`
	`switch(config-callhome)#`
		Enters Call Home configuration submode.

Step 3	`switch(config-callhome)# alert-group license user-def-cmd show license usage`	Configures a user-defined **show** command for an alert group license. **Note** Only valid **show** commands are accepted.
	`switch(config-callhome)# no alert-group license user-def-cmd show license usage`	Removes the user-defined **show** command from the alert group.

Setting the Call Home Message Levels

Restrictions

- The urgency level ranges from 0 (lowest level of urgency) to 9 (highest level of urgency), and the default is 0 (all messages are sent).

Detailed Steps

To set the message level for each destination profile for Call Home, follow these steps:

	Command	Purpose
Step 1	switch# **config t**	Enters configuration mode.
Step 2	switch(config)# **callhome** switch(config-callhome)#	Enters Call Home configuration submode.
Step 3	switch(config-callhome)# **destination-profile test message-level 5**	Optional. Configures the message level urgency as 5 and above for the user-defined profile (test1).
	switch(config-callhome)# **no destination-profile oldtest message-level 7**	Removes a previously configured urgency level and reverts it to the default of 0 (all messages are sent).

Configuring the Syslog-Based Alerts

Detailed Steps

To configure the syslog-group-port alert group, follow these steps:

	Command	Purpose
Step 1	switch# **config t**	Enters configuration mode.
Step 2	switch(config)# **callhome** switch(config-callhome)#	Enters Call Home configuration submode.
Step 3	switch(config-callhome)# **destination-profile short-txt-destination alert-group syslog-group-port**	Configures the predefined destination profile (short-txt-destination) to receive Call Home Notifications corresponding to syslog messages for the port facility.
Step 4	switch(config-callhome)# **destination-profile short-txt-destination message-level 5**	Optional. Configures the predefined destination-profile (short-txt-destination) to send a Call Home message for syslog messages whose severity levels map to Call Home severity level of 5 or greater. The default is message level 0 (all syslog messages).

Configuring RMON Alerts

Detailed Steps

To configure RMON alert groups, follow these steps:

	Command	Purpose
Step 1	switch# **config t**	Enters configuration mode.
Step 2	switch(config)# **callhome** switch(config-callhome)#	Enters Call Home configuration submode.
Step 3	switch(config-callhome)# **destination-profile xml-destination alert-group rmon**	Optional. Configures a destination message profile (rmon_group) to send Call Home notifications for configured RMON messages.

Configuring Event Trap Notifications

Detailed Steps

To configure a Call Home event notification trap (except Call Home periodic messages), follow these steps:

	Command	Purpose
Step 1	`switch# config t`	Enters configuration mode.

Step 2	`switch(config)# callhome`
	`switch(config-callhome)#`
		Enters Call Home configuration submode.

Step 3	`switch(config-callhome)# snmp-server enable traps callhome event-notify`	Enables the SNMP notification trap for Call Home.

Configuring General Email Options

You can configure the from, reply-to, and return-receipt email addresses. While most email address configurations are optional, you must configure the SMTP server address for the Call Home functionality to work.

Detailed Steps

To configure general email options, follow these steps:

	Command	Purpose
Step 1	`switch# config t`	Enters configuration mode.

Step 2	`switch(config)# callhome`
	`switch(config-callhome)#`
		Enters Call Home configuration submode.

Step 3	`switch(config-callhome)# transport email from user@company1.com`	Configures the from email address.
Step 4	`switch(config-callhome)# transport email reply-to person@place.com`	Optional. Configures the reply-to email address to which all responses should be sent.

Configuring HTTPS Support

Any predefined or user-defined destination profiles can be configured with the HTTPS URL address.

Detailed Steps

To configure the HTTPS URL address for any destination profile, follow these steps:

	Command	Purpose
Step 1	`switch# config t`	Enters configuration mode.

Step 2	`switch(config)# callhome`
	`switch(config-callhome)#`
		Enters Call Home configuration submode.

	Command	Purpose
Step 3	switch(config-callhome)# **destination-profile full-txt-destination http https://httpssever.com/Service**	Optional. Configures the predefined full-txt-destination profile with a HTTPS URL address. The Call Home message in full-txt format is uploaded at the configured HTTPS URL address.
Step 4	switch(config-callhome)# **destination-profile CiscoTAC-1 http https://httpssever.com/Service**	Optional. Configures the predefined CiscoTAC-1 profile with a HTTPS URL address. The Call Home message in XML format is uploaded at the configured HTTPS URL address.
Step 5	switch(config-callhome)# **destination-profile test1 http https://httpssever.com/Service**	Optional. Configures the user-defined destination profile with a HTTPS URL address. The Call Home message in the configured format is uploaded at the configured HTTPS URL address.

Enable or Disable Transport Method

Any predefined or user-defined destination profiles can be configured to enable or disable a particular transport method. The transport methods are HTTP and email.

Detailed Steps

To enable or disable transport method for a destination profile, follow these steps:

	Command	Purpose
Step 1	switch# **config t**	Enters configuration mode.
Step 2	switch(config)# **callhome** switch(config-callhome)#	Enters Call Home configuration submode.
Step 3	switch(config-callhome)# **destination-profile CiscoTAC-1 transport-method http**	Optional. Enables predefined destination profile CiscoTAC-1 for HTTP transport method. **Note** For user-defined destination profiles, email is the default. You can enable either or both transport mechanisms. If you disable both methods, email will be enabled.
Step 4	switch(config-callhome)# **no destination-profile CiscoTAC-1 transport-method email**	Optional. Disables predefined destination profile CiscoTAC-1 for email transport-method.
Step 5	switch(config-callhome)# **destination-profile full-txt transport-method http**	Optional. Enables predefined full-txt-destination profile for HTTP transport method.

Configuring an HTTP Proxy Server

Beginning with Cisco NX-OS Release 5.2, you can configure Smart Call Home to send HTTP messages through an HTTP proxy server. If you do not configure an HTTP proxy server, Smart Call Home sends HTTP messages directly to the Cisco Transport Gateway (TG).

Detailed Steps

To configure an HTTP proxy server, follow these steps:

	Command	Purpose
Step 1	`switch# config t`	Enters configuration mode.

Step 2	`switch(config)# callhome`
	`switch(config-callhome)#`
		Enters Call Home configuration submode.

Step 3	`switch(config-callhome)# transport http proxy server 192.0.2.1`	Configures the HTTP proxy server domain name server (DNS) name, IPv4 address, or IPv6 address. Optionally configures the port number. The port range is from 1 to 65535. The default port number is 8080.
Step 4	`switch(config-callhome)# transport http proxy enable`	Enables Smart Call Home to send all HTTP messages through the HTTP proxy server. **Note** You can execute this command only after the proxy server address has been configured.
Step 5	`switch(config-callhome)# show callhome transport`	(Optional) Displays the transport-related configuration for Smart Call Home.

Note The default value for full text destination and for XML is 1 MB.

This example shows how to configure Smart Call Home to send HTTP messages through an HTTP proxy server:

```
switch# config t
Enter configuration commands, one per line. End with CNTL/Z.
switch(config)# callhome
switch(config-callhome)# transport http proxy server 10.10.10.1 port 4
switch(config-callhome)# transport http proxy enable
```

Configuring SMTP Server and Ports

This section includes the following topic:

- Multiple SMTP Server Support, page 4-7

Detailed Steps

To configure the SMTP server and port, follow these steps:

	Command	Purpose
Step 1	`switch# config t`	Enters configuration mode.

Step 2	`switch(config)# callhome`
	`switch(config-callhome)#`
		Enters Call Home configuration submode.

Step 3	`switch(config-callhome)# transport email smtp-server 192.168.1.1`
	`switch(config-callhome)# transport email smtp-server 192.168.1.1 port 30`
		Configures the DNS, IPv4 address, or IPv6 address of the SMTP server to reach the server. The port usage defaults to 25 if no port is specified.
		Note The port number is optional and, if required, may be changed depending on the server location.

Configuring Multiple SMTP Server Support

To distribute the SMTP server configuration to devices running software releases prior to NX-OS Release 5.0 and earlier, use the following command:

```
switch(config-callhome)# transport email smtp-server
```

For multiple SMTP server capability, use the following command:

```
switch(config-callhome)# [no] transport email mail-server {ipv4 | IPV6 | hostname} [port
port number] [priority priority number]
```

Example 4-1 shows how to configure multiple SMTP servers for Call Home messages:

```
switch# config t
Enter configuration commands, one per line. End with CNTL/Z.
switch(config)# callhome
switch(config-callhome)# transport email mail-server 192.0.2.10 priority 4
switch(config-callhome)# transport email mail-server 172.21.34.193
switch(config-callhome)# transport email smtp-server 10.1.1.174
switch(config-callhome)# transport email mail-server 64.72.101.213 priority 60
switch(config-callhome)# transport email from person@company.com
switch(config-callhome)# transport email reply-to person@company.com
```

Based on the configuration above, the SMTP servers would be contacted in this order:

10.1.1.174 (priority 0)

192.0.2.10 (priority 4)

172.21.34.193 (priority 50 - default)

64.72.101.213 (priority 60)

The **transport email mail-server** command is distributed only to devices running NX-OS Release 5.0(1a) or later. The **transport email smtp-server** command is distributed only to devices running earlier software releases.

Enabling Periodic Inventory Notifications

When you enable this feature without configuring an interval value, the Call Home message is sent every 7 days. This value ranges from 1 to 30 days. By default, this feature is disabled in all switches in the Cisco MDS 9000 Family and Cisco Nexus 5000 Series switches.

Detailed Steps

To enable periodic inventory notification in a Cisco MDS 9000 Family switch or a Cisco Nexus 5000 Series switch, follow these steps:

	Command	Purpose
Step 1	`switch# config t`	Enters configuration mode.

Step 2	`switch(config)# callhome`
	`switch(config-callhome)#`
		Enters the Call Home configuration submode.

Step 3	`switch(config-callhome)# periodic-inventory notification`	Enables the periodic inventory notification feature. By default, the Call Home message is sent every 7 days.
	`switch(config-callhome)# no periodic-inventory notification`	Disables the periodic inventory notification feature (default).
Step 4	`switch(config-callhome)# periodic-inventory notification interval 15`	Configures the periodic inventory notification message to be sent every 15 days. This value ranges from 1 to 30 days.
	`switch(config-callhome)# no periodic-inventory notification interval 15`	Defaults to using the factory default of sending a Call Home message every 7 days.

Configuring Duplicate Message Throttle

You can configure a throttling mechanism to limit the number of Call Home messages received for the same event. If the same message is sent multiple times from the switch within a short period of time, you may be swamped with a large number of duplicate messages.

Restrictions

- By default, this feature is enabled in all switches in the Cisco MDS 9000 Family and the Cisco Nexus 5000 Series switches. When enabled, if the number of messages sent exceeds the maximum limit of 30 messages within the 2-hour time frame, then additional messages for that alert type are discarded within that time frame. You cannot modify the time frame or the message counter limit.
- If 2 hours have elapsed since the first such message was sent and a new message has to be sent, then the new message is sent and the time frame is reset to the time when the new message was sent and the count is reset to 1.

Detailed Steps

To enable message throttling in a Cisco MDS 9000 Family switch or a Cisco Nexus 5000 Series switch, follow these steps:

	Command	Purpose
Step 1	`switch# config t`	Enters configuration mode.

Step 2	`switch(config)# callhome`
	`switch(config-callhome)#`
		Enters the Call Home configuration submode.

Step 3	`switch(config-callhome)# no duplicate-message throttle`	Disables the duplicate message throttling feature.
	`switch(config-callhome)# duplicate-message throttle`	Enables the duplicate message throttling feature (default).

Enabling Call Home Fabric Distribution

Detailed Steps

To enable Call Home fabric distribution, follow these steps:

	Command	Purpose
Step 1	`switch# config t`	Enters configuration mode.

Step 2	`switch(config)# callhome`
	`switch(config-callhome)#`
		Enters Call Home configuration submode.

Step 3	`switch(config-callhome)# distribute`	Enables Call Home configuration distribution to all switches in the fabric. Acquires a fabric lock and stores all future configuration changes in the pending database.
	`switch(config-callhome)# no distribute`	Disables (default) Call Home configuration distribution to all switches in the fabric.

To commit the Call Home configuration changes, follow these steps:

	Command	Purpose
Step 1	`switch# config t`	Enters configuration mode.

Step 2	`switch(config)# callhome`
	`switch(config-callhome)#`
		Enters Call Home configuration submode.

Step 3	`switch(config-callhome)# commit`	Distributes the configuration changes to all switches in the fabric and releases the lock. Overwrites the effective database with the changes made to the pending database.

To discard the Call Home configuration changes, follow these steps:

	Command	Purpose
Step 1	`switch# config t`	Enters configuration mode.

	Command	Purpose

Step 2	`switch(config)# callhome`
	`switch(config-callhome)#`
		Enters Call Home configuration submode.

Step 3	`switch(config-callhome)# abort`	Discards the configuration changes in the pending database and releases the fabric lock.

Fabric Lock Override

To use administrative privileges and release a locked Call Home session, use the **clear callhome session** command.

```
switch# clear callhome session
```

Call Home Communications Test

You can test Call Home communications by sending a test message to the configured destination(s) or sending a test inventory message to the configured destination(s).

Detailed Steps

Use the **test** command to simulate a message generation.

To test the Call Home function, follow these steps:

	Command	Purpose

Step 1	`switch# callhome test`
	`trying to send test callhome message`
	`successfully sent test callhome message`
		Sends a test message to the configured destination(s).

Step 2	`switch# callhome test inventory`
	`trying to send test callhome message`
	`successfully sent test callhome message`
		Sends a test inventory message to the configured destination(s).

Configuring Delayed Traps

Detailed Steps

To enable the delayed trap feature, perform this task:

	Command	Purpose

Step 1	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)# system delayed-traps enable mode FX`	Enables the system-delayed trap feature.
Step 3	`switch(config)# system delayed-traps timer <1-60>`	Configures the system-delayed trap timeout value. If no value is entered, a default value of 4 minutes is used. You can choose any value between 1 to 60 minutes.

To disable the delayed trap feature, perform this task:

	Command	Purpose
Step 1	switch# **config t** switch(config)#	Enters configuration mode.
Step 2	switch(config)# **no system delayed-traps enable mode** *FX*	Disables the system-delayed trap feature. This command is used only for the F/FL operationally UP ports. This feature does not apply to E/TE links. By default, this feature is disabled. You have to explicitly enable this feature. Enabling the feature will not affect the existing link-level traps.

Verifying Call Home Configuration

To display the Call Home configuration information, perform one of the following tasks:

- Displaying Call Home Information, page 4-39
- Verifying Alert Group Customization, page 4-43
- Verifying Event Notification Trap, page 4-43Verifying Call Home Transport, page 4-43

Displaying Call Home Information

Use the **show callhome** command to display the configured Call Home information (see Examples 4-1 to 4-10).

Example 4-1 Displays Configured Call Home Information

```
switch# show callhome
callhome enabled
Callhome Information:
contact person name:who@where
contact person's email:person@place.com
contact person's phone number:310-408-4000
street addr:1234 Picaboo Street, Any city, Any state, 12345
site id:Site1ManhattanNewYork
customer id:Customer1234
contract id:Cisco1234
switch priority:0
```

Example 4-2 Displays Information for All Destination Profiles (Predefined and User-Defined)

```
switch# show callhome destination-profile
XML destination profile information
maximum message size:500000
message format:XML
message-level:0
email addresses configured:
alert groups configured:
cisco_tac

test destination profile information
maximum message size:100000
message format:full-txt
```

```
message-level:5
email addresses configured:
admin@yourcompany.com

alert groups configured:
test

full-txt destination profile information
maximum message size:500000
message format:full-txt
message-level:0
email addresses configured:

alert groups configured:
all

short-txt destination profile information
maximum message size:4000
message format:short-txt
message-level:0
email addresses configured:
alert groups configured:
all
```

Example 4-3 Displays Information for a User-defined Destination Profile

```
switch# show callhome destination-profile test
test destination profile information
maximum message size:100000
message format:full-txt
message-level:5
email addresses configured:
user@company.com
alert groups configured:
test
```

Example 4-4 Displays the Full-Text Profile

```
switch# show callhome destination-profile profile full-txt-destination
full-txt destination profile information
maximum message size:250000
email addresses configured:
person2@company2.com
```

Example 4-5 Displays the Short-Text Profile

```
switch# show callhome destination-profile profile short-txt-destination
Short-txt destination profile information
maximum message size:4000
email addresses configured:
person2@company2.com
```

Example 4-6 Displays the XML Destination Profile

```
switch# show callhome destination-profile profile XML-destination
XML destination profile information
maximum message size:250000
email addresses configured:
findout@.cisco.com
```

Example 4-7 Displays Email and SMTP Information

```
switch# show callhome transport-email
from email addr:user@company1.com
reply to email addr:pointer@company.com
return receipt email addr:user@company1.com
smtp server:server.company.com
smtp server port:25
```

Example 4-8 Displays the running configuration callhome information

```
switch# show running-config callhome

!Command: show running-config callhome
!Time: Tue Sep  9 12:16:45 2014

version 6.2(9)
logging level callhome 5
callhome
  contract-id contact1
  customer-id cust1
  site-id Site1
  email-contact sakpuri@cisco.com
  phone-contact +1-800-000-0000
  streetaddress 12345 Cisco Way, San Jose, CA
  destination-profile Inventory
  destination-profile Inventory format full-txt
  destination-profile Inventory message-size 1000000
  destination-profile Service
  destination-profile Service format full-txt
  destination-profile Service message-size 1000000
  destination-profile dest1
  destination-profile dest1 format XML
  destination-profile dest1 message-size 500000
  destination-profile full_txt message-size 1000000
  destination-profile httpProf
  destination-profile httpProf format XML
  destination-profile httpProf message-size 0
  destination-profile short_txt message-size 4000
  destination-profile xml message-size 1000000
  destination-profile xml message-size 1000000
  destination-profile Inventory email-addr sakpuri@cisco.com
  destination-profile Service email-addr sakpuri@cisco.com
  destination-profile full_txt email-addr sakpuri@cisco.com
  destination-profile short_txt email-addr sakpuri@cisco.com
  destination-profile xml email-addr sakpuri@cisco.com
  destination-profile Service alert-group environmental
  destination-profile xml alert-group environmental
  destination-profile Inventory alert-group inventory
  destination-profile xml alert-group inventory
  destination-profile Service alert-group linecard-hardware
```

Example 4-9 Displays the running configuration for callhome with defaults

```
switch# show running-config callhome all
EG-9506-1-176# show running-config callhome all

!Command: show running-config callhome all
!Time: Tue Sep  9 12:18:22 2014

version 6.2(9)
```

```
logging level callhome 5
callhome
  contract-id contact1
  customer-id cust1
  switch-priority 7
  site-id Site1
  email-contact sakpuri@cisco.com
  phone-contact +1-800-000-0000
  streetaddress 12345 Cisco Way, San Jose, CA
  destination-profile Inventory
  destination-profile Inventory format full-txt
  destination-profile Inventory transport-method email
  no destination-profile Inventory transport-method http
  destination-profile Inventory message-size 1000000
  destination-profile Inventory message-level 0
  destination-profile Service
  destination-profile Service format full-txt
  destination-profile Service transport-method email
  no destination-profile Service transport-method http
  destination-profile Service message-size 1000000
  destination-profile Service message-level 0
  destination-profile dest1
  destination-profile dest1 format XML
  destination-profile dest1 transport-method email
  no destination-profile dest1 transport-method http
  destination-profile dest1 message-size 500000
  destination-profile dest1 message-level 0
  destination-profile full_txt
  destination-profile full_txt format full-txt
  destination-profile full_txt transport-method email
  no destination-profile full_txt transport-method http
  destination-profile full_txt message-size 1000000
  destination-profile full_txt message-level 0
  destination-profile httpProf
```

Example 4-10 Displays the startup configuration for callhome

```
switch# show startup-config callhome
!Command: show startup-config callhome
!Time: Tue Sep  9 12:19:27 2014
!Startup config saved at: Fri Sep  5 12:13:53 2014

version 6.2(9)
logging level callhome 5
callhome
  contract-id contact1
  customer-id cust1
  site-id Site1
  email-contact sakpuri@cisco.com
  phone-contact +1-800-000-0000
  streetaddress 12345 Cisco Way, San Jose, CA
  destination-profile Inventory
  destination-profile Inventory format full-txt
  destination-profile Inventory message-size 1000000
  destination-profile Service
  destination-profile Service format full-txt
  destination-profile Service message-size 1000000
  destination-profile dest1
  destination-profile dest1 format XML
  destination-profile dest1 message-size 500000
  destination-profile full_txt message-size 1000000
  destination-profile httpProf
  destination-profile httpProf format XML
  destination-profile httpProf message-size 0
  destination-profile short_txt message-size 4000
  destination-profile xml message-size 1000000
  destination-profile xml message-size 1000000
  destination-profile Inventory email-addr sakpuri@cisco.com
  destination-profile Service email-addr sakpuri@cisco.com
  destination-profile full_txt email-addr sakpuri@cisco.com
  destination-profile short_txt email-addr sakpuri@cisco.com
  destination-profile xml email-addr sakpuri@cisco.com
  destination-profile Service alert-group environmental
  destination-profile xml alert-group environmental
  destination-profile Inventory alert-group inventory
  destination-profile xml alert-group inventory
```

Displaying Delayed Trap Information

Use the **show running-config | in delay** CLI command to display the system-delayed trap state as shown in Example 4-11 and Example 4-12. If no timer value is specified or if the timer value is set to 4 minutes, the following is displayed:

Example 4-11 Displays the Delayed Trap Information with No Timer Value (Set to the Default 4 Minutes)

```
switch# show running-config | in delay
system delayed-traps enable mode FX
switch#
```

If the timer value is set to any other value other than 4 minutes, Example 4-12 is displayed:

Example 4-12 Displays the Delayed Trap Information with a Timer Value Other Than 4 Minutes

```
switch# show running-config | in delay
system delayed-traps enable mode FX
system delayed-traps timer 5
```

Verifying Alert Group Customization

To verify the alert group customization, use the **show callhome user-def-cmds** command.

```
switch# show callhome user-def-cmds
User configured commands for alert groups :
alert-group test user-def-cmd "show version"
```

Verifying Event Notification Trap

To verify the SNMP event notification trap, use the **show snmp trap | inc callhome** command.

```
switch# show snmp trap | inc callhome
callhome : event-notify Yes
callhome : smtp-send-fail No
```

Verifying Call Home Transport

The **show callhome transport** command displays all of the transport-related configurations for Call Home.

```
switch# show callhome transport
http vrf:management

from email addr:xyz-1@cisco.com
reply to email addr:xyz-1@cisco.com

smtp server:72.163.62.211
smtp server port:25
smtp server vrf:management
smtp server priority:0

http proxy server:10.64.65.52
http proxy server port:8080
http proxy status:Enabled
```

The following example shows how to configure SMTP server port:

```
switch# callhome
switch(config-callhome)# transport email mail-server 192.168.10.23 port 4
switch# config t
```

The following example shows how to configure SMTP server priority:

```
switch(config-callhome)# transport email mail-server 192.168.10.23 priority 60
switch# config t
```

Monitoring Call Home

This section includes the following topics:

- Sample Syslog Alert Notification in Full-txt Format, page 4-44
- Sample Syslog Alert Notification in XML Format, page 4-45
- Sample RMON Notification in XML Format, page 4-48

Sample Syslog Alert Notification in Full-txt Format

```
source:MDS9000
Switch Priority:7
Device Id:DS-C9506@C@FG@07120011
Customer Id:basu
Contract Id:123
Site Id:San Jose
Server Id:DS-C9506@C@FG@07120011
Time of Event:2004-10-08T11:10:44
Message Name:SYSLOG_ALERT
Message Type:Syslog
Severity Level:2
System Name:10.76.100.177
Contact Name:Basavaraj B
Contact email:admin@yourcompany.com
Contact Phone:+91-80-310-1718
Street Address:#71 , Miller's Road
Event Description:2004 Oct  8 11:10:44 10.76.100.177 %PORT-5-IF_TRUNK_UP: %$VSAN 1%$
Interface fc2/5, vsan 1 is up

syslog_facility:PORT
start chassis information:
Affected Chassis:DS-C9506
Affected Chassis Serial Number:FG@07120011
Affected Chassis Hardware Version:0.104
Affected Chassis Software Version:3.1(1)
Affected Chassis Part No:73-8607-01
end chassis information:
```

Sample Syslog Alert Notification in XML Format

```
<?xml version="1.0" encoding="UTF-8" ?>
<soap-env:Envelope xmlns:soap-env="http://www.w3.org/2003/05/soap-envelope">
<soap-env:Header>
<aml-session:Session xmlns:aml-session="http://www.cisco.com/2004/01/aml-session"
soap-env:mustUnderstand="true"
soap-env:role="http://www.w3.org/2003/05/soap-envelope/role/next">
<aml-session:To>http://tools.cisco.com/neddce/services/DDCEService</aml-session:To>
<aml-session:Path>
<aml-session:Via>http://www.cisco.com/appliance/uri</aml-session:Via>
</aml-session:Path>
<aml-session:From>http://www.cisco.com/appliance/uri</aml-session:From>
<aml-session:MessageId>1004:FOX090306QT:3E55A81A</aml-session:MessageId>
</aml-session:Session>
</soap-env:Header>
<soap-env:Body>
<aml-block:Block xmlns:aml-block="http://www.cisco.com/2004/01/aml-block">
<aml-block:Header>
<aml-block:Type>http://www.cisco.com/2005/05/callhome/syslog</aml-block:Type>
<aml-block:CreationDate>2003-02-21 04:16:18 GMT+00:00</aml-block:CreationDate>
<aml-block:Builder>
<aml-block:Name>MDS</aml-block:Name>
<aml-block:Version>4.1</aml-block:Version>
</aml-block:Builder>
<aml-block:BlockGroup>
<aml-block:GroupId>1005:FOX090306QT:3E55A81A</aml-block:GroupId>
<aml-block:Number>0</aml-block:Number>
<aml-block:IsLast>true</aml-block:IsLast>
<aml-block:IsPrimary>true</aml-block:IsPrimary>
<aml-block:WaitForPrimary>false</aml-block:WaitForPrimary>
</aml-block:BlockGroup>
<aml-block:Severity>6</aml-block:Severity>
</aml-block:Header>
<aml-block:Content>
<ch:CallHome xmlns:ch="http://www.cisco.com/2005/05/callhome" version="1.0">
<ch:EventTime>2003-02-21 04:16:18 GMT+00:00</ch:EventTime>
<ch:MessageDescription>LICENSE_VIOLATION 2003 Feb 21 04:16:18 switch %$
%DAEMON-3-SYSTEM_MSG: &lt;&lt;%LICMGR-3-LOG_LICAPP_NO_LIC&gt;&gt; License file is missing
for feature SAN_EXTN_OVER_IP</ch:MessageDescription>
<ch:Event>
<ch:Type>syslog</ch:Type>
<ch:SubType>LICENSE_VIOLATION</ch:SubType>
<ch:Brand>Cisco</ch:Brand>
<ch:Series>MDS9000</ch:Series>
</ch:Event>
<ch:CustomerData>
<ch:UserData>
<ch:email>esajjana@cisco.com</ch:email>
</ch:UserData>
<ch:ContractData>
<ch:CustomerId>eeranna</ch:CustomerId>
<ch:SiteId>Bangalore</ch:SiteId>
<ch:ContractId>123</ch:ContractId>
<ch:DeviceId>DS-C9216I-K9@C@FOX090306QT</ch:DeviceId>
</ch:ContractData>
```

```
<ch:SystemInfo>
<ch:Name>switch</ch:Name>
<ch:Contact>Eeranna</ch:Contact>
<ch:Contactemail>esajjana@cisco.com</ch:Contactemail>
<ch:ContactPhoneNumber>+91-80-310-1718</ch:ContactPhoneNumber>
<ch:StreetAddress>#71, Miller&apos;s Road</ch:StreetAddress> </ch:SystemInfo>
</ch:CustomerData> <ch:Device> <rme:Chassis xmlns:rme="http://www.cisco.com/rme/4.0">
<rme:Model>DS-C9216I-K9</rme:Model>
<rme:HardwareVersion>1.0</rme:HardwareVersion>
<rme:SerialNumber>FOX090306QT</rme:SerialNumber>
</rme:Chassis>
</ch:Device>
</ch:CallHome>
</aml-block:Content>
<aml-block:Attachments>
<aml-block:Attachment type="inline">
<aml-block:Name>show logging logfile | tail -n 200</aml-block:Name> <aml-block:Data
encoding="plain">
<![CDATA[syslog_show:: command: 1055 param_count: 0
2003 Feb 21 04:11:48  %KERN-2-SYSTEM_MSG: Starting kernel... - kernel
2003 Feb 21 04:11:48  %KERN-3-SYSTEM_MSG: CMOS: Module initialized - kernel
2003 Feb 21 04:11:48  %KERN-2-SYSTEM_MSG: CARD TYPE: KING BB Index = 2344 - kernel
2003 Feb 21 04:12:04  %MODULE-5-ACTIVE_SUP_OK: Supervisor 1 is active (serial:
JAB100700MC)
2003 Feb 21 04:12:04  %PLATFORM-5-MOD_STATUS: Module 1 current-status is
MOD_STATUS_ONLINE/OK
2003 Feb 21 04:12:06  %IMAGE_DNLD-SLOT1-5-ADDON_IMG_DNLD_COMPLETE:  Addon module image
download process completed. Addon Image download completed, installing image please wait..
2003 Feb 21 04:12:07  %IMAGE_DNLD-SLOT1-5-ADDON_IMG_DNLD_SUCCESSFUL:  Addon module image
download and install process successful. Addon image installed.
2003 Feb 21 04:12:08  %KERN-3-SYSTEM_MSG: klm_af_xipc: Unknown parameter `start&apos; -
kernel
2003 Feb 21 04:12:08  %KERN-3-SYSTEM_MSG: klm_ips_portcfg: Unknown parameter `start&apos;
- kernel
2003 Feb 21 04:12:08  %KERN-3-SYSTEM_MSG: klm_flamingo: Unknown parameter `start&apos; -
kernel
2003 Feb 21 04:12:10  %PORT-5-IF_UP: Interface mgmt0 is up
2003 Feb 21 04:12:21 switch %LICMGR-3-LOG_LIC_FILE_MISSING: License file(s) missing for
feature ENTERPRISE_PKG.
2003 Feb 21 04:12:21 switch %LICMGR-3-LOG_LIC_FILE_MISSING: License file(s) missing for
feature SAN_EXTN_OVER_IP.
2003 Feb 21 04:12:21 switch %LICMGR-3-LOG_LIC_FILE_MISSING: License file(s) missing for
feature ENTERPRISE_PKG.
2003 Feb 21 04:12:21 switch %LICMGR-3-LOG_LIC_FILE_MISSING: License file(s) missing for
feature SAN_EXTN_OVER_IP.
2003 Feb 21 04:12:23 switch %PLATFORM-5-MOD_STATUS: Module 1 current-status is
MOD_STATUS_ONLINE/OK
2003 Feb 21 04:12:23 switch %MODULE-5-MOD_OK: Module 1 is online (serial: JAB100700MC)
2003 Feb 21 04:12:25 switch %PORT-5-IF_DOWN_ADMIN_DOWN: %$VSAN 1%$ Interface fc1/1 is down
(Administratively down)
2003 Feb 21 04:12:25 switch %PORT-5-IF_DOWN_ADMIN_DOWN: %$VSAN 1%$ Interface fc1/2 is down
(Administratively down)
2003 Feb 21 04:12:25 switch %PORT-5-IF_DOWN_ADMIN_DOWN: %$VSAN 1%$ Interface fc1/3 is down
(Administratively down)
2003 Feb 21 04:12:25 switch %PORT-5-IF_DOWN_ADMIN_DOWN: %$VSAN 1%$ Interface fc1/4 is down
(Administratively down)
2003 Feb 21 04:12:26 switch %PLATFORM-5-PS_STATUS: PowerSupply 1 current-status is PS_FAIL
2003 Feb 21 04:12:26 switch %PLATFORM-2-PS_FAIL: Power supply 1 failed or shut down
(Serial number QCS1007109F)
2003 Feb 21 04:12:26 switch %PLATFORM-5-PS_FOUND: Power supply 2 found (Serial number
QCS1007109R)
2003 Feb 21 04:12:26 switch %PLATFORM-2-PS_OK: Power supply 2 ok (Serial number
QCS1007109R)
2003 Feb 21 04:12:26 switch %PLATFORM-5-PS_STATUS: PowerSupply 2 current-status is PS_OK
```

```
2003 Feb 21 04:12:26 switch %PLATFORM-2-PS_FANOK: Fan in Power supply 2 ok
2003 Feb 21 04:12:26 switch %PLATFORM-5-FAN_DETECT: Fan module 1 (Serial number
NWG0901031X) ChassisFan1 detected
2003 Feb 21 04:12:26 switch %PLATFORM-2-FAN_OK: Fan module ok
2003 Feb 21 04:12:26 switch %PLATFORM-2-CHASSIS_CLKMODOK: Chassis clock module A ok
2003 Feb 21 04:12:26 switch %PLATFORM-2-CHASSIS_CLKSRC: Current chassis clock source is
clock-A
2003 Feb 21 04:12:26 switch %PORT-5-IF_DOWN_ADMIN_DOWN: %$VSAN 1%$ Interface fc1/5 is down
(Administratively down)
2003 Feb 21 04:12:26 switch %PORT-5-IF_DOWN_ADMIN_DOWN: %$VSAN 1%$ Interface fc1/6 is down
(Administratively down)
2003 Feb 21 04:12:26 switch %PORT-5-IF_DOWN_ADMIN_DOWN: %$VSAN 1%$ Interface fc1/7 is down
(Administratively down)
2003 Feb 21 04:12:26 switch %PORT-5-IF_DOWN_ADMIN_DOWN: %$VSAN 1%$ Interface fc1/8 is down
(Administratively down)
2003 Feb 21 04:12:26 switch %PORT-5-IF_DOWN_ADMIN_DOWN: %$VSAN 1%$ Interface fc1/9 is down
(Administratively down)
2003 Feb 21 04:12:26 switch %PORT-5-IF_DOWN_ADMIN_DOWN: %$VSAN 1%$ Interface fc1/10 is
down (Administratively down)
2003 Feb 21 04:12:27 switch %PORT-5-IF_DOWN_ADMIN_DOWN: %$VSAN 1%$ Interface fc1/11 is
down (Administratively down)
2003 Feb 21 04:12:27 switch %PORT-5-IF_DOWN_ADMIN_DOWN: %$VSAN 1%$ Interface fc1/12 is
down (Administratively down)
2003 Feb 21 04:12:27 switch %PORT-5-IF_DOWN_ADMIN_DOWN: %$VSAN 1%$ Interface fc1/13 is
down (Administratively down)
2003 Feb 21 04:12:27 switch %PORT-5-IF_DOWN_ADMIN_DOWN: %$VSAN 1%$ Interface fc1/14 is
down (Administratively down)
2003 Feb 21 04:12:30 switch %PLATFORM-2-MOD_DETECT: Module 2 detected (Serial number
JAB0923016X) Module-Type IP Storage Services Module Model DS-X9304-SMIP
2003 Feb 21 04:12:30 switch %MODULE-2-MOD_UNKNOWN: Module type [25] in slot 2 is not
supported
2003 Feb 21 04:12:45 switch %VSHD-5-VSHD_SYSLOG_CONFIG_I: Configured from vty by root on
console0
2003 Feb 21 04:14:06 switch %VSHD-5-VSHD_SYSLOG_CONFIG_I: Configured from vty by admin on
console0
2003 Feb 21 04:15:12 switch %VSHD-5-VSHD_SYSLOG_CONFIG_I: Configured from vty by admin on
console0
2003 Feb 21 04:15:52 switch %SYSMGR-3-BASIC_TRACE: core_copy: PID 1643 with message Core
not generated by system for licmgr(0). WCOREDUMP(9) returned zero .
2003 Feb 21 04:15:52 switch %SYSMGR-2-SERVICE_CRASHED: Service \"licmgr\" (PID 2272)
hasn&apos;t caught signal 9 (no core).
2003 Feb 21 04:16:18 switch %LICMGR-3-LOG_LIC_FILE_MISSING: License file(s) missing for
feature ENTERPRISE_PKG.
2003 Feb 21 04:16:18 switch %LICMGR-3-LOG_LIC_FILE_MISSING: License file(s) missing for
feature SAN_EXTN_OVER_IP.
2003 Feb 21 04:16:18 switch %LICMGR-3-LOG_LIC_FILE_MISSING: License file(s) missing for
feature ENTERPRISE_PKG.
2003 Feb 21 04:16:18 switch %LICMGR-3-LOG_LIC_FILE_MISSING: License file(s) missing for
feature SAN_EXTN_OVER_IP.
2003 Feb 21 04:16:18 switch %CALLHOME-2-EVENT: LICENSE_VIOLATION
2003 Feb 21 04:16:18 switch %CALLHOME-2-EVENT: LICENSE_VIOLATION
2003 Feb 21 04:16:18 switch %CALLHOME-2-EVENT: LICENSE_VIOLATION
2003 Feb 21 04:16:18 switch %CALLHOME-2-EVENT: LICENSE_VIOLATION ]]> </aml-block:Data>
</aml-block:Attachment> <aml-block:Attachment type="inline"> <aml-block:Name>show license
usage</aml-block:Name> <aml-block:Data encoding="plain">
<![CDATA[Feature                      Ins  Lic   Status Expiry Date Comments
                                 Count
--------------------------------------------------------------------------------
DMM_184_PKG                   No    0   Unused             Grace expired
FM_SERVER_PKG                 No    -   Unused             Grace expired
MAINFRAME_PKG                 No    -   Unused             Grace expired
ENTERPRISE_PKG                Yes   -   Unused never       license missing
DMM_FOR_SSM_PKG               No    0   Unused             Grace expired
SAN_EXTN_OVER_IP              Yes   8   Unused never       8 license(s) missing
```

```
PORT_ACTIVATION_PKG           No    0   Unused             -
SME_FOR_IPS_184_PKG           No    0   Unused             Grace expired
STORAGE_SERVICES_184          No    0   Unused             Grace expired
SAN_EXTN_OVER_IP_18_4         No    0   Unused             Grace expired
SAN_EXTN_OVER_IP_IPS2         No    0   Unused             Grace expired
SAN_EXTN_OVER_IP_IPS4         No    0   Unused             Grace expired
STORAGE_SERVICES_SSN16        No    0   Unused             Grace expired
10G_PORT_ACTIVATION_PKG       No    0   Unused             -
STORAGE_SERVICES_ENABLER_PKG  No    0   Unused             Grace expired
--------------------------------------------------------------------------------
**** WARNING: License file(s) missing. **** ]]> </aml-block:Data> </aml-block:Attachment>
</aml-block:Attachments> </aml-block:Block> </soap-env:Body> </soap-env:Envelope>
```

Sample RMON Notification in XML Format

```
<?xml version="1.0" encoding="UTF-8" ?>
<soap-env:Envelope xmlns:soap-env="http://www.w3.org/2003/05/soap-envelope">
<soap-env:Header>
<aml-session:Session xmlns:aml-session="http://www.cisco.com/2004/01/aml-session"
soap-env:mustUnderstand="true"
soap-env:role="http://www.w3.org/2003/05/soap-envelope/role/next">
<aml-session:To>http://tools.cisco.com/neddce/services/DDCEService</aml-session:To>
<aml-session:Path>
<aml-session:Via>http://www.cisco.com/appliance/uri</aml-session:Via>
</aml-session:Path>
<aml-session:From>http://www.cisco.com/appliance/uri</aml-session:From>
<aml-session:MessageId>1086:FHH0927006V:48BA26BD</aml-session:MessageId>
</aml-session:Session>
</soap-env:Header>
<soap-env:Body>
<aml-block:Block xmlns:aml-block="http://www.cisco.com/2004/01/aml-block">
<aml-block:Header>
<aml-block:Type>http://www.cisco.com/2005/05/callhome/diagnostic</aml-block:Type>
<aml-block:CreationDate>2008-08-31 05:06:05 GMT+00:00</aml-block:CreationDate>
<aml-block:Builder>
<aml-block:Name>MDS</aml-block:Name>
<aml-block:Version>4.1</aml-block:Version>
</aml-block:Builder>
<aml-block:BlockGroup>
<aml-block:GroupId>1087:FHH0927006V:48BA26BD</aml-block:GroupId>
<aml-block:Number>0</aml-block:Number>
<aml-block:IsLast>true</aml-block:IsLast>
<aml-block:IsPrimary>true</aml-block:IsPrimary>
<aml-block:WaitForPrimary>false</aml-block:WaitForPrimary>
</aml-block:BlockGroup>
<aml-block:Severity>2</aml-block:Severity>
</aml-block:Header>
<aml-block:Content>
<ch:CallHome xmlns:ch="http://www.cisco.com/2005/05/callhome" version="1.0">
<ch:EventTime>2008-08-31 05:06:05 GMT+00:00</ch:EventTime>
<ch:MessageDescription>RMON_ALERT WARNING(4) Falling:iso.3.6.1.4.1.9.9.305.1.1.1.0=1 &lt;=
89:1, 4</ch:MessageDescription>
<ch:Event>
<ch:Type>diagnostic</ch:Type>
<ch:SubType>GOLD-major</ch:SubType>
<ch:Brand>Cisco</ch:Brand>
<ch:Series>MDS9000</ch:Series>
</ch:Event>
<ch:CustomerData>
<ch:UserData>
<ch:email>mchinn@cisco.com</ch:email>
</ch:UserData>
```

```
<ch:ContractData>
<ch:CustomerId>12ss</ch:CustomerId>
<ch:SiteId>2233</ch:SiteId>
<ch:ContractId>rrr55</ch:ContractId>
<ch:DeviceId>DS-C9513@C@FHH0927006V</ch:DeviceId>
</ch:ContractData>
<ch:SystemInfo>
<ch:Name>sw172-22-46-174</ch:Name>
<ch:Contact>Mani</ch:Contact>
<ch:Contactemail>mchinn@cisco.com</ch:Contactemail>
<ch:ContactPhoneNumber>+1-800-304-1234</ch:ContactPhoneNumber>
<ch:StreetAddress>1234 wwee</ch:StreetAddress>
</ch:SystemInfo>
</ch:CustomerData>
<ch:Device>
<rme:Chassis xmlns:rme="http://www.cisco.com/rme/4.0">
<rme:Model>DS-C9513</rme:Model>
<rme:HardwareVersion>0.205</rme:HardwareVersion>
<rme:SerialNumber>FHH0927006V</rme:SerialNumber>
</rme:Chassis>
</ch:Device>
</ch:CallHome>
</aml-block:Content>
</aml-block:Block>
</soap-env:Body>
</soap-env:Envelope>
```

Additional References

For additional information related to implementing Call Home, see the following section:

- MIBs, page 4-49

MIBs

MIBs	MIBs Link
• CISCO-CALLHOME-CAPABILITY-MIB • CISCO-CALLHOME-MIB	To locate and download MIBs, go to the following URL: http://www.cisco.com/en/US/products/ps5989/prod_technical_reference_list.html

Feature History for Call Home

Table 4-10 lists the release history for this feature. Only features that were introduced or modified in Release 3.x or a later release appear in the table.

Table 4-10 Feature History for Call Home

Feature Name	Releases	Feature Information
Call Home HTTP Proxy Server	5.2	Added the Call Home HTTP Proxy Server support details.
Call Home HTTP Proxy Server	5.2	Added the Call Home HTTP Proxy Server support details. Added Verifying Callhome Transport commands.

Feature Name	Releases	Feature Information
Multiple SMTP Server Support	5.0(1a)	Added Multiple SMTP Server Support details. Added Verifying Callhome Transport commands.
Notification Enhancements	5.0(1a)	Added the enhancement in Notification in the Event Filter Using Device Manager.
Call Home	4.1(1b)	Added the HTTPS support for Call Home.
Call Home - Delayed Traps for EMC Call Home configuration window in DCNM-SAN.	4.1(1a)	Added the delayed traps enhancements for EMC Call Home.
Call Home Destination tab	4.2(1)	Added the enhancement in Destination tab.
Call Home HTTPs support	4.2(1)	Added Call Home HTTPs enhancement.
EMC Email Home	3.3(3)	EMC Email Home configuration information was added to this chapter.
EMC Call Home	3.0(1)	Enables the forwarding of traps as XML data using email, according to EMC specifications.
Call Home enhancement	3.0(1)	Enables customization of alert group messages.

Scheduling Maintenance Jobs

The Cisco MDS command scheduler feature helps you schedule configuration and maintenance jobs in any switch in the Cisco MDS 9000 Family.You can use this feature to schedule jobs on a one-time basis or periodically.

This chapter includes the following sections:

Information About the Command Scheduler

The Cisco NX-OS command scheduler provides a facility to schedule a job (set of CLI commands) or multiple jobs at a specified time in the future. The job(s) can be executed once at a specified time in the future or at periodic intervals.

You can use this feature to schedule zone set changes, make QoS policy changes, back up data, save the configuration and do other similar jobs.

Scheduler Terminology

The following terms are used in this chapter:

- Job—A job is a set of NX-OS CLI commands (EXEC and config mode) that are executed as defined in the schedule.
- Schedule—A schedule determines the time when the assigned jobs must be executed. Multiple jobs can be assigned to a schedule. A schedule executes in one of two modes: one-time or periodic.
- Periodic mode—A job is executed at the user-specified periodic intervals, until it is deleted by the administrator. The following types of periodic intervals are supported:
  - Daily—The job is executed once a day.

  - Weekly—The job is executed once a week.
  - Monthly—The job is executed once a month.
  - Delta—The job is executed beginning at the specified start time and thereafter at user-specified intervals (days:hours:minutes).
- One-time mode—The job is executed once at a user-specified time.

Licensing Requirements for Command Scheduler

To use the command scheduler, you do not need to obtain any license.

Guidelines and Limitations

Before scheduling jobs on a Cisco MDS switch, note the following guidelines:

- Prior to Cisco MDS SAN-OS Release 3.0(3), only users local to the switch could perform scheduler configuration. As of Cisco MDS SAN-OS Release 3.0(3), remote users can perform job scheduling using AAA authentication.
- Be aware that the scheduled job can fail if it encounters one of the following situations when executing the job:
  - If the license has expired for a feature at the time when a job containing commands pertaining to that feature is scheduled.
  - If a feature is disabled at the time when a job containing commands pertaining to that feature is scheduled.
  - If you have removed a module from a slot and the job has commands pertaining to the interfaces for that module or slot.
- Verify that you have configured the time. The scheduler does not have any default time configured. If you create a schedule and assign job(s) and do not configure the time, that schedule is not launched.
- While defining a job, verify that no interactive or disruptive commands (for example, **copy bootflash:** *file* **ftp:** *URI*, **write erase**, and other similar commands) are specified as part of a job because the job is executed noninteractively at the scheduled time.

Default Settings

Table 5-1 lists the default settings for command scheduling parameters.

Table 5-1 Default Command Scheduler Parameters

Parameters	Default
Command scheduler	Disabled.
Log file size	16 KB.

Configuring the Command Scheduler

The Cisco NX-OS command scheduler provides a facility to schedule a job (set of CLI commands) or multiple jobs at a specified time in the future.

This section includes the following tasks:

- Task Flow for Configuring the Command Scheduler, page 5-3
- Enabling the Command Scheduler, page 5-3
- Configuring Remote User Authentication, page 5-4
- Defining a Job, page 5-4
- Specifying a Schedule, page 5-6
- Configuring Execution Logs, page 5-8

Task Flow for Configuring the Command Scheduler

Follow these steps to configure the Command Scheduler:

Step 1 Enable the scheduler.

Step 2 Authorize remote user access (optional).

Step 3 Define the job.

Step 4 Specify the schedule and assign jobs to the schedule.

Step 5 Specify the time for the schedule(s).

Step 6 Verify the scheduled configuration.

Enabling the Command Scheduler

To use the scheduling feature, you must explicitly enable this feature on the required switches in the fabric. By default, this feature is disabled in all switches in the Cisco MDS 9000 Family.

The configuration and verification commands for the command scheduler feature are only available when this feature is enabled on a switch. When you disable this feature, all related configurations are automatically discarded.

Detailed Steps

To enable the command scheduling feature, follow these steps:

	Command	Purpose
Step 1	`switch# config t`	Enters configuration mode.
Step 2	`switch(config)# feature scheduler`	Enables the command scheduler.
	`switch(config)# no feature scheduler`	Discards the scheduler configuration and disables the command scheduler (default).

Examples

To display the command schedule status, use the **show scheduler config** command.

```
switch# show scheduler config
config terminal
  feature scheduler
  scheduler logfile size 16
end
```

Configuring Remote User Authentication

Prior to Cisco MDS SAN-OS Release 3.0(3), only users local to the switch could perform scheduler configuration. As of Cisco MDS SAN-OS Release 3.0(3), remote users can perform job scheduling using AAA authentication.

Prerequisites

- AAA authentication requires the clear text password of the remote user before creating and configuring command scheduler jobs.

Detailed Steps

To configure remote user authentication, follow these steps:

	Command	Purpose
Step 1	`switch# configuration terminal`	Enters configuration mode.
Step 2	`switch(config)# scheduler aaa-authentication password X12y34Z56a`	Configures a clear text password for remote users.
Step 3	`switch(config)# scheduler aaa-authentication password 0 X12y34Z56a`	Configures a clear text password for remote users.
Step 4	`switch(config)# no scheduler aaa-authentication password`	Removes the clear text password for remote users.
Step 5	`switch(config)#scheduler aaa-authentication user newuser password Z98y76X54b`	Configures a clear text password for remote user newuser.
Step 6	`switch(config)#scheduler aaa-authentication user newuser password 0 Z98y76X54b`	Configures a clear text password for remote user newuser.
Step 7	`switch(config)# no scheduler aaa-authentication password user newuser`	Removes the clear text password for remote user newuser.

Defining a Job

To define a job, you must specify the job name. This action places you in the job definition (config-job) submode. In this submode, you can define the sequence of CLI commands that the job has to perform. Be sure to exit the config-job submode to complete the job definition.

Restrictions

- Job configuration files created using MDS NX-OS or SAN-OS releases before Cisco MDS NX-OS Release 4.1(1b) are not supported. However, you can edit the job configuration file and combine the commands within a job into a single line using a semicolon (;).

- You must exit the config-job submode for the job definition to be complete.
- You cannot modify or remove a command after exiting the config-job submode. To make changes, you must explicitly delete the defined job name and then reconfigure the job with new commands.

Detailed Steps

To define a job for the command scheduler, follow these steps:

	Command	Purpose
Step 1	switch# **configuration terminal** switch(config)#	Enters the configuration mode.
Step 2	switch(config)# **scheduler job name addMemVsan99** switch(config-job)#	Defines a job name and enters the job definition submode.
Step 3	switch(config-job)# *command1*;[*command2*;*command3*;...] switch(config-job-submode)# **end** switch# Example 1: switch(config-job)# **config terminal;vsan database;vsan 99 interface fc1/1 - 4** switch(config-job-config-vsan-db)# **end** switch#	Specifies a sequence of actions for the specified job. The defined commands are checked for validity and stored for future use. **Note** Be sure you exit the config-job submode.
	Example 2: switch(config)# **scheduler job name offpeakQOS** switch(config-job)# configuration terminal; qos class-map offpeakbackupcmap match-all ; match source-wwn 23:15:00:05:30:00:2a:1f ; match destination-wwn 20:01:00:05:30:00:28:df ;exit ; qos policy-map offpeakbackuppolicy ; class offpeakbackupcmap ; priority high ; exit ; exit ; qos service policy offpeakbackuppolicy vsan 1 switch(config-job)# **end** switch#	Provides example of scheduling a set of configuration commands.
Step 4	**exit** Example: switch(config-job)# exit switch(config)#	Exits the job configuration mode and saves the job.
Step 5	**show scheduler job** [*name*] Example: switch(config)# show scheduler job	(Optional) Displays the job information.
Step 6	**copy running-config startup-config** Example: switch(config)# copy running-config startup-config	(Optional) Saves this configuration change.

Deleting a Job

To delete a job for the command scheduler, follow these steps:

	Command	Purpose

Step 1	`switch#` **`configuration terminal`**
	`switch(config)#`
		Enters the configuration mode.

Step 2	`switch(config)#` **`no scheduler job name addMemVsan99`**	Deletes a defined job and all commands defined within that job.

Specifying a Schedule

After defining jobs, you can create schedules and assign jobs to the schedule. Subsequently, you can configure the time of execution. The execution can be one-time or periodic depending on your requirements. If the time for the schedule is not configured, then it will never be executed.

You can specify a periodic job execution at the specified (daily, weekly, monthly, or delta) intervals.

Detailed Steps

To specify a periodic job for the command scheduler, follow these steps:

	Command	Purpose

Step 1	`switch#` **`configuration terminal`**
	`switch(config)#`
		Enters the configuration mode.

Step 2	`switch(config)#` **`scheduler schedule name weekendbackupqos`**
	`switch(config-schedule)#`
		Defines a job schedule (weekendbackup) and enters the submode for that schedule.

	`switch(config)#` **`no scheduler schedule name weekendbackup`**	Deletes the defined schedule.

Step 3	`switch(config-schedule)#` **`job name offpeakZoning`**
	`switch(config-schedule)#` **`job name offpeakQOS`**
		Assigns two jobs (offpeakZoning and offpeakQOS) for this schedule.

Step 4	`switch(config-schedule)#` **`no job name addMem99`**	Deletes the job assigned for this schedule.

Examples

The following examples are for reference:

`switch(config-schedule)#` **`time daily 23:00`**	Executes the specified jobs at 11 p.m. every day.
`switch(config-schedule)#` **`time weekly Sun:23:00`**	Specifies a weekly execution every Sunday at 11 p.m.
`switch(config-schedule)#` **`time monthly 28:23:00`**	Specifies a monthly execution at 11 p.m on the 28th of each month. If you specify the date as either 29, 30, or 31, the command is automatically executed on the last day of each month.

`switch(config-schedule)#` **`time start now repeat 48:00`**	Specifies a job to be executed every 48 hours beginning 2 minutes from *now* —if today is September 24, 2004, and the time is now 2:00 p.m., the command begins executing at 2 minutes past 2:00 p.m. on September 24, 2004, and continues to execute every 48 hours after that.
`switch(config-schedule)#` **`time start 14:00 repeat 14:00:00`**	If today is September 24, 2004, (Friday), this command specifies the job to be executed every alternate Friday at 2 p.m. (every 14 days).

The most significant fields in the **time** parameter are optional. If you omit the most significant fields, the values are assumed to be the same as the current time. For example, if the current time is September 24, 2004, 22:00 hours, then the commands are executed as follows:

- The **time start 23:00 repeat 4:00:00** command implies a start time of September 24, 2004, 23:00 hours.
- The **time daily 55** command implies every day at 22:55 hours.
- The **time weekly 23:00** command implies every Friday at 23:00 hours.
- The **time monthly 23:00** command implies the 24th of every month at 23:00 hours.

Note If the time interval configured for any schedule is smaller than the time taken to execute its assigned job(s), then the subsequent schedule execution occurs only after the configured interval amount of time has elapsed following the completion time of the last iteration of the schedule. For example, a schedule is executed at 1-minute intervals and a job assigned to it takes 2 minutes to complete. If the first schedule is at 22:00 hours, the job finishes at 22:02 after which the 1-minute interval is observed, and the next execution occurs at 22:03 and finishes at 22:05.

Specifying a One-Time Schedule

When you specify a one-time job execution, that job is only executed once.

Detailed Steps

To specify a one-time job for the command scheduler, follow these steps:

	Command	Purpose

Step 1	`switch#` **`configuration terminal`**
	`switch(config)#`
		Enters the configuration mode.

Step 2	`switch(config)#` **`scheduler schedule name configureVsan99`**
	`switch(config-schedule)#`
		Defines a job schedule (configureVsan99) and enters the submode for that schedule.

Step 3	`switch(config-schedule)#` **`job name addMemVsan99`**	Assigns a predefined job name (addMemVsan99) for this schedule.
Step 4	`switch(config-schedule)#` **`time start 2004:12:14:23:00`**	Specifies a one-time execution on December 14, 2004, at 11 p.m.
	`switch(config-schedule)#` **`no time`**	Deletes the time assigned for this schedule.

Deleting a Schedule

Detailed Steps

To delete a schedule, follow these steps:

	Command	Purpose

Step 1	`switch#` **`configuration terminal`**
	`switch(config)#`
		Enters the configuration mode.

Step 2	`switch(config)#` **`no scheduler schedule name weekendbackup`**	Deletes the defined schedule.

Removing an Assigned Job

Detailed Steps

To remove an assigned job, follow these steps:

	Command	Purpose

Step 1	`switch#` **`configuration terminal`**
	`switch(config)#`
		Enters the configuration mode.

Step 2	`switch(config)#` **`scheduler schedule name weekendbackupqos`**
	`switch(config-schedule)#`
		Specifies a job schedule (weekendbackupqos) and enters the submode for that schedule.

Step 3	`switch(config-schedule)#` **`no job name addMem99`**	Removes a job (addMem99) assigned to this schedule.

Deleting a Schedule Time

Detailed Steps

To delete the schedule time, follow these steps:

	Command	Purpose

Step 1	`switch#` **`configuration terminal`**
	`switch(config)#`
		Enters the configuration mode.

Step 2	`switch(config)#` **`scheduler schedule name weekendbackupqos`**
	`switch(config-schedule)#`
		Defines a job schedule (weekendbackup) and enters the submode for that schedule.

Step 3	`switch(config-schedule)#` **`no time`**	Deletes the schedule time configuration.The schedule will not be run until the time is configured again.

Configuring Execution Logs

The command scheduler maintains a log file. While you cannot modify the contents of this file, you can change the file size. This log file is a circular log that contains the output of the job executed. If the output of the job is greater than the log file, then the output stored in this file remains truncated.

You can configure the log file size to be a maximum of 1024 KB. The default size of the execution log file is 16 KB.

Detailed Steps

To configure the execution log file size, follow these steps:

	Command	Purpose

Step 1	`switch# configuration terminal`
	`switch(config)#`
		Enters the configuration mode.

Step 2	`switch(config)# scheduler logfile size 1024`	Configures the log file to be a maximum of 1024 KB
	`switch(config)# no scheduler logfile size`	Defaults to the log size of 16 KB.

Clearing the Execution Log File Contents

To clear the contents of the scheduler execution log file, issue the clear scheduler logfile command in EXEC mode.

```
switch# clear scheduler logfile
```

Verifying Scheduler Configuration

To display the command scheduler configuration information, perform one of the following tasks:

Command	Purpose
show scheduler config	Displays the scheduler configuration
show scheduler schedule	Verifies the command scheduler execution status
show scheduler job	Verifies the job definition
show scheduler logfile	Displays the execution log for all jobs executed in the system
clear scheduler logfile	Clear the contents of the scheduler execution log file

For detailed information about the fields in the output from these commands, refer to the *Cisco MDS 9000 Family Command Reference*.

This section includes the following topics:

- Verifying the Command Scheduler Configuration, page 5-9
- Verifying the Command Scheduler Execution Status, page 5-10
- Verifying the Job Definition, page 5-10
- Displaying Execution Log File Contents, page 5-10
- Clearing the Execution Log File Contents, page 5-11

Verifying the Command Scheduler Configuration

To display the scheduler configuration, use the **show scheduler config** command.

```
switch# show scheduler config
config terminal
```

```
  feature scheduler
  scheduler logfile size 512
end

config terminal
   scheduler job name addMemVsan99
     config terminal
       vsan database
       vsan 99 interface fc1/1
       vsan 99 interface fc1/2
       vsan 99 interface fc1/3
       vsan 99 interface fc1/4
end

config terminal
  scheduler schedule name configureVsan99
    time start 2004:8:10:9:52
    job name addMemVsan99
end
```

Verifying the Command Scheduler Execution Status

To verify the command scheduler execution status, use the **show scheduler schedule** command.

```
switch# show scheduler schedule configureVsan99
Schedule Name      : configureVsan99
------------------------------------
User Name          : admin
Schedule Type      : Run once on Tue Aug 10 09:48:00 2004
Last Execution Time: Tue Aug 10 09:48:00 2004
-----------------------------------------------
          Job Name                  Status
```

Verifying the Job Definition

To verify the job definition, use the **show scheduler job** command.

```
switch# show scheduler job addMemVsan99
Job Name: addMemVsan99
----------------------
  config terminal
   vsan database
    vsan 99 interface fc1/1
    vsan 99 interface fc1/2
    vsan 99 interface fc1/3
    vsan 99 interface fc1/4
```

Displaying Execution Log File Contents

To display the execution log for all jobs executed in the system, use the **show scheduler logfile** command.

```
switch# show scheduler logfile
Job Name       : addMemVsan99              Job Status: Success (0)
Schedule Name  : configureVsan99           User Name : admin
Completion time: Tue Aug 10 09:48:00 2004
--------------------------- Job Output ---------------------------
`config terminal`
```

```
`vsan database`
`vsan 99 interface fc1/1`
`vsan 99 interface fc1/2`
`vsan 99 interface fc1/3`
`vsan 99 interface fc1/4`
```

To display the scheduler password configuration for remote users, use the **show running-config** command.

```
switch# show running-config | include “scheduler aaa-authentication”
scheduler aaa-authentication username newuser password 7 "C98d76S54e"
```

Note The scheduler remote user passwords are always displayed in encrypted form in the **show running-config** command output. The encrypted option (**7**) in the command exists to support applying the ASCII configuration to the switch.

To display the execution log file configuration, use the **show scheduler config** command.

```
switch# show scheduler config
config terminal
  feature scheduler
  scheduler logfile size 1024
end
```

Clearing the Execution Log File Contents

To clear the contents of the scheduler execution log file, issue the **clear scheduler logfile** command in EXEC mode.

```
switch# clear scheduler logfile

-----------------------------------------------
addMemVsan99                        Success (0)
```

Configuration Examples for Scheduler

```
conf t
scheduler job name start
 configure
 no cli var name time
 exit
 echo $(TIMESTAMP) | sed 's/^/cli var name time /' | vsh
 show switchname > debug-$(time)-1
 show switchname > debug-$(time)-2
 exit

scheduler job name part1
 show clock >> debug-$(time)-1
 show interface mgmt 0 >> debug-$(time)-1
 sleep 60
 show clock >> debug-$(time)-1
 show interface mgmt 0 >> debug-$(time)-1
 sleep 200
 gzip debug-$(time)-1
 exit
```

```
scheduler job name part2
 show clock >> debug-$(time)-2
 show processes cpu history >> debug-$(time)-2
 sleep 60
 show clock >> debug-$(time)-2
 show processes cpu history >> debug-$(time)-2
 show clock >> debug-$(time)-2
 gzip debug-$(time)-2
 exit

scheduler schedule name cpu-stats
  job name start
  job name part1
  job name part2
  time start 2001:12:31:01:00
  exit
end
```

CHAPTER 6

Monitoring System Processes and Logs

This chapter provides details on monitoring the health of the switch and includes the following sections:

Information About System Processes and Logs

This section includes the following topics:

Saving Cores

You can save cores (from the active supervisor module, the standby supervisor module, or any switching module) to an external CompactFlash (slot 0) or to a TFTP server in one of two ways:

- On demand—Copies a single file based on the provided process ID.
- Periodically—Copies core files periodically as configured by the user.

A new scheme overwrites any previously issued scheme. For example, if you perform another core log copy task, the cores are periodically saved to the new location or file.

Saving the Last Core to Bootflash

This last core dump is automatically saved to bootflash in the /mnt/pss/ partition before the switchover or reboot occurs. Three minutes after the supervisor module reboots, the saved last core is restored from the flash partition (/mnt/pss) back to its original RAM location. This restoration is a background process and is not visible to the user.

Tip The timestamp on the restored last core file displays the time when the supervisor booted up not when the last core was actually dumped. To obtain the exact time of the last core dump, check the corresponding log file with the same PID.

To view the last core information, enter the **show cores** command in EXEC mode.

To view the time of the actual last core dump, enter the **show process log** command in EXEC mode.

First and Last Core

The first and last core feature uses the limited system resource and retains the most important core files. Generally, the first core and the most recently generated core have the information for debugging and, the first and last core feature tries to retain the first and the last core information.

If the core files are generated from an active supervisor module, the number of core files for the service is defined in the service.conf file. There is no upper limit on the total number of core files in the active supervisor module.

To display the core files saved in the system, use the **show cores** command.

Online System Health Management

The Online Health Management System (OHMS) (system health) is a hardware fault detection and recovery feature. It ensures the general health of switching, services, and supervisor modules in any switch in the Cisco MDS 9000 Family.

The OHMS monitors system hardware in the following ways:

- The OHMS component running on the active supervisor maintains control over all other OHMS components running on the other modules in the switch.
- The system health application running in the standby supervisor module only monitors the standby supervisor module, if that module is available in the HA standby mode.

The OHMS application launches a daemon process in all modules and runs multiple tests on each module to test individual module components. The tests run at preconfigured intervals, cover all major fault points, and isolate any failing component in the MDS switch. The OHMS running on the active supervisor maintains control over all other OHMS components running on all other modules in the switch.

On detecting a fault, the system health application attempts the following recovery actions:

- Performs additional testing to isolate the faulty component.
- Attempts to reconfigure the component by retrieving its configuration information from persistent storage.
- If unable to recover, sends Call Home notifications, system messages and exception logs; and shuts down and discontinues testing the failed module or component (such as an interface).
- Sends Call Home and system messages and exception logs as soon as it detects a failure.
- Shuts down the failing module or component (such as an interface).
- Isolates failed ports from further testing.
- Reports the failure to the appropriate software component.
- Switches to the standby supervisor module, if an error is detected on the active supervisor module and a standby supervisor module exists in the Cisco MDS switch. After the switchover, the new active supervisor module restarts the active supervisor tests.
- Reloads the switch if a standby supervisor module does not exist in the switch.
- Provides CLI support to view, test, and obtain test run statistics or change the system health test configuration on the switch.
- Performs tests to focus on the problem area.

Each module is configured to run the test relevant to that module. You can change the default parameters of the test in each module as required.

Loopback Test Configuration Frequency

Loopback tests are designed to identify hardware errors in the data path in the module(s) and the control path in the supervisors. One loopback frame is sent to each module at a preconfigured frequency—it passes through each configured interface and returns to the supervisor module.

The loopback tests can be run at frequencies ranging from 5 seconds (default) to 255 seconds. If you do not configure the loopback frequency value, the default frequency of 5 seconds is used for all modules in the switch. Loopback test frequencies can be altered for each module.

Loopback Test Configuration Frame Length

Loopback tests are designed to identify hardware errors in the data path in the module(s) and the control path in the supervisors. One loopback frame is sent to each module at a preconfigured size—it passes through each configured interface and returns to the supervisor module.

The loopback tests can be run with frame sizes ranging from 0 bytes to 128 bytes. If you do not configure the loopback frame length value, the switch generates random frame lengths for all modules in the switch (auto mode). Loopback test frame lengths can be altered for each module.

Hardware Failure Action

The failure-action command controls the Cisco NX-OS software from taking any action if a hardware failure is determined while running the tests.

By default, this feature is enabled in all switches in the Cisco MDS 9000 Family—action is taken if a failure is determined and the failed component is isolated from further testing.

Failure action is controlled at individual test levels (per module), at the module level (for all tests), or for the entire switch.

Performing Test Run Requirements

Enabling a test does not guarantee that the test will run.

Tests on a specific interface or module only run if you enable system health for all of the following items:

- The entire switch
- The required module
- The required interface

Tip The test will not run if system health is disabled in any combination. If system health is disabled to run tests, the test status shows up as disabled.

Tip If the specific module or interface is enabled to run tests, but is not running the tests due to system health being disabled, then tests show up as enabled (not running).

Tests for a Specified Module

The system health feature in the NX-OS software performs tests in the following areas:

- Active supervisor’s in-band connectivity to the fabric.
- Standby supervisor’s arbiter availability.
- Bootflash connectivity and accessibility on all modules.
- EOBC connectivity and accessibility on all modules.
- Data path integrity for each interface on all modules.
- Management port’s connectivity.
- User-driven test for external connectivity verification, port is shut down during the test (Fibre Channel ports only).
- User-driven test for internal connectivity verification ~~(~~Fibre Channel ~~and iSCSI ports)~~.

Clearing Previous Error Reports

You can clear the error history for Fibre Channel interfaces, iSCSI interfaces, an entire module, or one particular test for an entire module. By clearing the history, you are directing the software to retest all failed components that were previously excluded from tests.

If you previously enabled the failure-action option for a period of time (for example, one week) to prevent OHMS from taking any action when a failure is encountered and after that week you are now ready to start receiving these errors again, then you must clear the system health error status for each test.

Tip The management port test cannot be run on a standby supervisor module.

Interpreting the Current Status

The status of each module or test depends on the current configured state of the OHMS test in that particular module (see Table 6-1).

Table 6-1 OHMS Configured Status for Tests and Modules

Status	Description
`Enabled`	You have currently enabled the test in this module and the test is not running.
`Disabled`	You have currently disabled the test in this module.
`Running`	You have enabled the test and the test is currently running in this module.
`Failing`	This state is displayed if a failure is imminent for the test running in this module—possibility of test recovery exists in this state.
`Failed`	The test has failed in this module—and the state cannot be recovered.
`Stopped`	The test has been internally stopped in this module by the Cisco NX-OS software.
`Internal failure`	The test encountered an internal failure in this module. For example, the system health application is not able to open a socket as part of the test procedure.
`Diags failed`	The startup diagnostics has failed for this module or interface.
`On demand`	The system health external-loopback or the system health internal-loopback tests are currently running in this module. Only these two commands can be issued on demand.
`Suspended`	Only encountered in the MDS 9100 Series due to one oversubscribed port moving to a E or TE port mode. If one oversubscribed port moves to this mode, the other three oversubscribed ports in the group are suspended.

The status of each test in each module is visible when you display any of the **show system health** commands. See the "Displaying System Health" section on page 6-24.

On-Board Failure Logging

The Generation 2 Fibre Channel switching modules provide the facility to log failure data to persistent storage, which can be retrieved and displayed for analysis. This on-board failure logging (OBFL) feature stores failure and environmental information in nonvolatile memory on the module. The information will help in post-mortem analysis of failed cards.

OBFL data is stored in the existing CompactFlash on the module. OBFL uses the persistent logging (PLOG) facility available in the module firmware to store data in the CompactFlash. It also provides the mechanism to retrieve the stored data.

The data stored by the OBFL facility includes the following:

- Time of initial power-on
- Slot number of the card in the chassis
- Initial temperature of the card
- Firmware, BIOS, FPGA, and ASIC versions
- Serial number of the card
- Stack trace for crashes
- CPU hog information
- Memory leak information
- Software error messages
- Hardware exception logs
- Environmental history
- OBFL specific history information
- ASIC interrupt and error statistics history
- ASIC register dumps

Default Settings

Table 6-2 lists the default system health and log settings.

Table 6-2 Default System Health and Log Settings

Parameters	Default
Kernel core generation	One module
System health	Enabled
Loopback frequency	5 seconds
Failure action	Enabled

Core and Log Files

This section includes the following topics:

- Saving Cores, page 6-7
- Clearing the Core Directory, page 6-8

Saving Cores

Prerequisites

- Be sure to create any required directory before performing this task. If the directory specified by this task does not exist, the switch software logs a system message each time a copy cores is attempted.

Detailed Steps

To copy the core and log files on demand, follow this step:

	Command	Purpose
Step 1	`switch# show cores`	Displays all the core files.
Step 2	`switch# copy core:7407 slot0:coreSample`	Copies the core file with the process ID 7407 as coreSample in slot 0.
	`switch# copy core://5/1524 tftp://1.1.1.1/abcd`	Copies cores (if any) of a process with PID 1524 generated on slot 5[1] or slot 7[2] to the TFTP server at IPv4 address 1.1.1.1. **Note** You can also use IPv6 addresses to identify the TFTP server.

[1] Cisco MDS 9506 or Cisco MDS 9509 switch

[2] Cisco MDS 9513 Director

To copy the core and log files periodically, follow these steps:

	Command	Purpose
Step 1	`switch# show system cores`	Displays all the core files.
Step 2	`switch# config t`	Enters configuration mode.
Step 3	`switch(config)# system cores slot0:coreSample`	Copies the core file (coreSample) to slot 0.
	`switch(config)# system cores tftp://1.1.1.1/abcd`	Copies the core file (abcd) in the specified directory on the TFTP server at IPv4 address 1.1.1.1. **Note** You can also use IPv6 addresses to identify the TFTP server.
	`switch(config)# no system cores`	Disables the core files copying feature.

Examples

If the core file for the specified process ID (PID) is not available, you see the following response:

```
switch# copy core://7/123 slot0:abcd
No matching core file found

switch# copy core:133 slot0:foo
Enter module number:7
No matching core file found

switch# copy core://7/133 slot0:foo
No matching core file found
```

To copy the same PID with different instance number, do as follows:.

```
switch# copy core:?
  core:  Enter URL "core://<module-number>/<process-id>[/instance-num]"
```

Clearing the Core Directory

Use the **clear cores** command to clean out the core directory. The software clears all the core files and other cores present on the active supervisor module.

```
switch# clear cores
```

Configuring System Health

The Online Health Management System (OHMS) (system health) is a hardware fault detection and recovery feature. It ensures the general health of switching, services, and supervisor modules in any switch in the Cisco MDS 9000 Family.

This section includes the following topics:

- Task Flow for Configuring System Health, page 6-9
- Enabling System Health Initiation, page 6-9
- Configuring Loopback Test Configuration Frequency, page 6-10
- Configuring Loopback Test Configuration Frame Length, page 6-10

- Configuring Hardware Failure Action, page 6-10
- Performing Test Run Requirements, page 6-11
- Clearing Previous Error Reports, page 6-11
- Performing Internal Loopback Tests, page 6-11
- Performing External Loopback Tests, page 6-12
- Performing Serdes Loopbacks, page 6-13

Task Flow for Configuring System Health

Follow these steps to configure system health:

Step 1 Enable System Health Initiation.

Step 2 Configure Loopback Test Configuration Frequency.

Step 3 Configure Loopback Test Configuration Frame Length.

Step 4 Configure Hardware Failure Action.

Step 5 Perform Test Run Requirements.

Step 6 Clear Previous Error Reports.

Step 7 Perform Internal Loopback Tests.

Step 8 Perform External Loopback Tests.

Step 9 Perform Serdes Loopbacks.

Enabling System Health Initiation

By default, the system health feature is enabled in each switch in the Cisco MDS 9000 Family.

Detailed Steps

To disable or enable this feature in any switch in the Cisco MDS 9000 Family, follow these steps:

	Command	Purpose

Step 1	`switch# config terminal`
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)# no system health`
	`System Health is disabled.`
		Disables system health from running tests in this switch.

	`switch(config)# system health`
	`System Health is enabled.`
		Enables (default) system health to run tests in this switch.

Step 3	`switch(config)# no system health interface fc8/1`
	`System health for interface fc8/13 is disabled.`
		Disables system health from testing the specified interface.

	`switch(config)# system health interface fc8/1`
	`System health for interface fc8/13 is enabled.`
		Enables (default) system health to test for the specified interface.

Configuring Loopback Test Configuration Frequency

Detailed Steps

To configure the frequency of loopback tests for all modules on a switch, follow these steps:

	Command	Purpose

Step 1	`switch#` **`config terminal`**
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)#` **`system health loopback frequency 50`**
	`The new frequency is set at 50 Seconds.`
		Configures the loopback frequency to 50 seconds. The default loopback frequency is 5 seconds. The valid range is from 5 to 255 seconds.

Configuring Loopback Test Configuration Frame Length

Detailed Steps

To configure the frame length for loopback tests for all modules on a switch, follow these steps:

	Command	Purpose

Step 1	`switch#` **`config terminal`**
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)#` **`system health loopback frame-length 128`**	Configures the loopback frame length to 128 bytes. The valid range is 0 to 128 bytes.
Step 3	`switch(config)#` **`system health loopback frame-length auto`**	Configures the loopback frame length to automatically generate random lengths (default).

Configuring Hardware Failure Action

Detailed Steps

To configure failure action in a switch, follow these steps:

	Command	Purpose

Step 1	`switch#` **`config terminal`**
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)#` **`system health failure-action`**
	`System health global failure action is now enabled.`
		Enables the switch to take failure action (default).

Step 3	`switch(config)#` **`no system health failure-action`**
	`System health global failure action now disabled.`
		Reverts the switch configuration to prevent failure action being taken.

Step 4	`switch(config)#` **`system health module 1 failure-action`**
	`System health failure action for module 1 is now enabled.`
		Enables switch to take failure action for failures in module 1.

Step 5	`switch(config)#` **`no system health module 1 loopback failure-action`**
	`System health failure action for module 1 loopback test is now disabled.`
		Prevents the switch from taking action on failures determined by the loopback test in module 1.

Performing Test Run Requirements

Detailed Steps

To perform the required test on a specific module, follow these steps:

	Command	Purpose

Step 1	`switch# config terminal`
	`switch(config)#`
		Enters configuration mode.

	Note The following steps can be performed in any order.	
	Note The various options for each test are described in the next step. Each command can be configured in any order. The various options are presented in the same step for documentation purposes.	
Step 2	`switch(config)# system health module 8 bootflash`	Enables the bootflash test on module in slot 8.
	`switch(config)# system health module 8 bootflash frequency 200`	Sets the new frequency of the bootflash test on module 8 to 200 seconds.
Step 3	`switch(config)# system health module 8 eobc`	Enables the EOBC test on module in slot 8.
Step 4	`switch(config)# system health module 8 loopback`	Enables the loopback test on module in slot 8.
Step 5	`switch(config)# system health module 5 management`	Enables the management test on module in slot 5.

Clearing Previous Error Reports

Use the EXEC-level **system health clear-errors** command at the interface or module level to erase any previous error conditions logged by the system health application. The **bootflash**, the **eobc**, the **inband**, the **loopback**, and the **mgmt** test options can be individually specified for a given module.

The following example clears the error history for the specified Fibre Channel interface:

```
switch# system health clear-errors interface fc 3/1
```

The following example clears the error history for the specified module:

```
switch# system health clear-errors module 3
```

The following example clears the management test error history for the specified module:

```
switch# system health clear-errors module 1 mgmt
```

Performing Internal Loopback Tests

You can run manual loopback tests to identify hardware errors in the data path in the switching or services modules, and the control path in the supervisor modules. Internal loopback tests send and receive FC2 frames to and from the same ports and provide the round-trip time taken in microseconds. These tests are available for Fibre Channel, IPS, and iSCSI interfaces.

Use the EXEC-level **system health internal-loopback** command to explicitly run this test on demand (when requested by the user) within ports for the entire module.

```
switch# system health internal-loopback interface iscsi 8/1
```

```
Internal loopback test on interface iscsi8/1 was  successful.
Sent 1 received 1 frames
Round trip time taken is 79 useconds
```

Use the EXEC-level **system health internal-loopback** command to explicitly run this test on demand (when requested by the user) within ports for the entire module and override the frame count configured on the switch.

```
switch# system health internal-loopback interface iscsi 8/1 frame-count 20
Internal loopback test on interface iscsi8/1 was  successful.
Sent 1 received 1 frames
Round trip time taken is 79 useconds
```

Use the EXEC-level **system health internal-loopback** command to explicitly run this test on demand (when requested by the user) within ports for the entire module and override the frame length configured on the switch.

```
switch# system health internal-loopback interface iscsi 8/1 frame-count 32
Internal loopback test on interface iscsi8/1 was  successful.
Sent 1 received 1 frames
Round trip time taken is 79 useconds
```

Note If the test fails to complete successfully, the software analyzes the failure and prints the following error:

```
External loopback test on interface fc 7/2 failed. Failure reason: Failed to loopback,
analysis complete Failed device ID 3 on module 1
```

Performing External Loopback Tests

You can run manual loopback tests to identify hardware errors in the data path in the switching or services modules, and the control path in the supervisor modules. External loopback tests send and receive FC2 frames to and from the same port or between two ports.

You need to connect a cable (or a plug) to loop the Rx port to the Tx port before running the test. If you are testing to and from the same port, you need a special loop cable. If you are testing to and from different ports, you can use a regular cable. This test is only available for Fibre Channel interfaces.

Use the EXEC-level **system health external-loopback interface** *interface* command to run this test on demand for external devices connected to a switch that is part of a long-haul network.

```
switch# system health external-loopback interface fc 3/1
This will shut the requested interfaces Do you want to continue (y/n)?  [n] y
External loopback test on interface fc3/1 was  successful.
Sent 1 received 1 frames
```

Use the EXEC-level **system health external-loopback source** *interface* **destination interface** *interface* command to run this test on demand between two ports on the switch.

```
switch# system health external-loopback source interface fc 3/1 destination interface fc
3/2
This will shut the requested interfaces Do you want to continue (y/n)?  [n] y
External loopback test on interface fc3/1 and interface fc3/2 was  successful.
Sent 1 received 1 frames
```

Use the EXEC-level **system health external-loopback** *interface* **frame-count** command to run this test on demand for external devices connected to a switch that is part of a long-haul network and override the frame count configured on the switch.

```
switch# system health external-loopback interface fc 3/1 frame-count 10
This will shut the requested interfaces Do you want to continue (y/n)?  [n] y
External loopback test on interface fc3/1 was  successful.
Sent 1 received 1 frames
```

Use the EXEC-level **system health external-loopback** *interface* **frame-length** command to run this test on demand for external devices connected to a switch that is part of a long-haul network and override the frame length configured on the switch.

```
switch# system health external-loopback interface fc 3/1 frame-length 64
This will shut the requested interfaces Do you want to continue (y/n)?  [n] y
External loopback test on interface fc3/1 was  successful.
Sent 1 received 1 frames
```

Use the **system health external-loopback** *interface* **force** command to shut down the required interface directly without a back out confirmation.

```
switch# system health external-loopback interface fc 3/1 force
External loopback test on interface fc3/1 was  successful.
Sent 1 received 1 frames
```

Note If the test fails to complete successfully, the software analyzes the failure and prints the following error:

```
External loopback test on interface fc 7/2 failed. Failure reason: Failed to loopback,
analysis complete Failed device ID 3 on module 1
```

Performing Serdes Loopbacks

Serializer/Deserializer (serdes) loopback tests the hardware for a port. These tests are available for Fibre Channel interfaces.

Use the EXEC-level **system health serdes-loopback** command to explicitly run this test on demand (when requested by the user) within ports for the entire module.

```
switch# system health serdes-loopback interface fc 3/1
This will shut the requested interfaces Do you want to continue (y/n)?  [n] y
Serdes loopback test passed for module 3 port 1
```

Use the EXEC-level **system health serdes-loopback** command to explicitly run this test on demand (when requested by the user) within ports for the entire module and override the frame count configured on the switch.

```
switch# system health serdes-loopback interface fc 3/1 frame-count 10
This will shut the requested interfaces Do you want to continue (y/n)?  [n] y
Serdes loopback test passed for module 3 port 1
```

Use the EXEC-level **system health serdes-loopback** command to explicitly run this test on demand (when requested by the user) within ports for the entire module and override the frame length configured on the switch.

```
switch# system health serdes-loopback interface fc 3/1 frame-length 32
This will shut the requested interfaces Do you want to continue (y/n)?  [n] y
Serdes loopback test passed for module 3 port 1
```

Note If the test fails to complete successfully, the software analyzes the failure and prints the following error:

```
External loopback test on interface fc 3/1 failed. Failure reason: Failed to loopback,
analysis complete Failed device ID 3 on module 3.
```

Configuring On-Board Failure Logging

The Generation 2 Fibre Channel switching modules provide the facility to log failure data to persistent storage, which can be retrieved and displayed for analysis. This on-board failure logging (OBFL) feature stores failure and environmental information in nonvolatile memory on the module. The information will help in post-mortem analysis of failed cards.

This section includes the following topics:

- Configuring OBFL for the Switch, page 6-15
- Configuring OBFL for a Module, page 6-16
- Clearing the Module Counters, page 6-16

Configuring OBFL for the Switch

Detailed Steps

To configure OBFL for all the modules on the switch, follow these steps:

	Command	Purpose
Step 1	switch# **config terminal** switch(config)#	Enters configuration mode.
Step 2	switch(config)# **hw-module logging onboard**	Enables all OBFL features. **Note** This CLI only enable OBFL features that are disabled by **no hw-module logging onboard** command. For OBFL features that were individually disabled, please enable those using **hw-module logging onboard** *obfl-feature* command.
	switch(config)# **hw-module logging onboard cpu-hog**	Enables the OBFL CPU hog events.
	switch(config)# **hw-module logging onboard environmental-history**	Enables the OBFL environmental history.
	switch(config)# **hw-module logging onboard error-stats**	Enables the OBFL error statistics.
	switch(config)# **hw-module logging onboard interrupt-stats**	Enables the OBFL interrupt statistics.
	switch(config)# **hw-module logging onboard mem-leak**	Enables the OBFL memory leak events.
	switch(config)# **hw-module logging onboard miscellaneous-error**	Enables the OBFL miscellaneous information.
	switch(config)# **hw-module logging onboard obfl-log**	Enables the boot uptime, device version, and OBFL history.
	switch(config)# **no hw-module logging onboard**	Disables all OBFL features.

Configuring OBFL for a Module

Detailed Steps

To configure OBFL for specific modules on the switch, follow these steps:

	Command	Purpose
Step 1	switch# **config terminal** switch(config)#	Enters configuration mode.
Step 2	switch(config)# **hw-module logging onboard module 1**	Enables all OBFL features on a module.
	switch(config)# **hw-module logging onboard module 1 cpu-hog**	Enables the OBFL CPU hog events on a module.
	switch(config)# **hw-module logging onboard module 1 environmental-history**	Enables the OBFL environmental history on a module.
	switch(config)# **hw-module logging onboard module 1 error-stats**	Enables the OBFL error statistics on a module.
	switch(config)# **hw-module logging onboard module 1 interrupt-stats**	Enables the OBFL interrupt statistics on a module.
	switch(config)# **hw-module logging onboard module 1 mem-leak**	Enables the OBFL memory leak events on a module.
	switch(config)# **hw-module logging onboard module 1 miscellaneous-error**	Enables the OBFL miscellaneous information on a module.
	switch(config)# **hw-module logging onboard module 1 obfl-log**	Enables the boot uptime, device version, and OBFL history on a module.
	switch(config)# **no hw-module logging onboard module 1**	Disables all OBFL features on a module.

Clearing the Module Counters

Restrictions

- The module counters cannot be cleared using Device Manager or DCNM-SAN.

Detailed Steps

To reset the module counters, follow these steps:

	Command	Purpose
Step 1	switch# **attach module 1** ModuleX#	Attaches module 1 to the chasiss.
Step 2	ModuleX# **clear asic-cnt all**	Clears the counters for all the devices in the module.
	ModuleX# **clear asic-cnt list-all-devices** ModuleX# **clear asic-cnt device-id** *device-id*	Clears the counters for only the specified device ID. The device ID can vary from 1 through 255.

To reset the counters for all the modules, follow these steps:

	Command	Purpose

Step 1	`switch# debug system internal clear-counters all`
	`switch#`
		Clears the counters for all the modules in the switch.

Verifying System Processes and Logs Configuration

To display the system processes and logs configuration information, perform one of the following tasks:

Command	Purpose
show processes	Displays system processes
show system	Displays system-related status information
show system cores	Display the currently configured scheme for copying cores
show system health	Displays system-related status information
show system health loopback frame-length	Verifies the loopback frequency configuration
show logging onboard status	Displays the configuration status of OBFL

For detailed information about the fields in the output from these commands, refer to the *Cisco MDS 9000 Family Command Reference*.

This section includes the following topics:

- Displaying System Processes, page 6-18
- Displaying System Status, page 6-21
- Displaying Core Status, page 6-23
- Verifying First and Last Core Status, page 6-24
- Displaying System Health, page 6-24
- Verifying Loopback Test Configuration Frame Length, page 6-27
- Displaying OBFL for the Switch, page 6-27
- Displaying the OBFL for a Module, page 6-27
- Displaying OBFL Logs, page 6-28
- Displaying the Module Counters Information, page 6-28

Displaying System Processes

Use the **show processes** command to obtain general information about all processes (see Example 6-1 to Example 6-6).

Example 6-1 Displays System Processes

```
switch# show processes
PID    State  PC        Start_cnt    TTY   Process
-----  -----  --------  -----------  ----  -------------
  868      S  2ae4f33e            1     -  snmpd
  869      S  2acee33e            1     -  rscn
  870      S  2ac36c24            1     -  qos
  871      S  2ac44c24            1     -  port-channel
  872      S  2ac7a33e            1     -  ntp
    -     ER         -            1     -  mdog
    -     NR         -            0     -  vbuilder
```

Where:

- ProcessId = Process ID
- State = process state.
  - D = uninterruptible sleep (usually I/O).
  - R = runnable (on run queue).
  - S = sleeping.
  - T = traced or stopped.
  - Z = defunct (“zombie”) process.
- NR = not running.
- ER = should be running but currently not-running.
- PC = current program counter in hex format.
- Start_cnt = number of times a process has been started (or restarted).
- TTY = terminal that controls the process. A hyphen usually means a daemon not running on any particular TTY.
- Process Name = name Name of the process.

Example 6-2 Displays CPU Utilization Information

```
switch# show processes cpu
PID    Runtime(ms)  Invoked   uSecs  1Sec   Process
-----  -----------  --------  -----  -----  -----------
  842         3807    137001     27    0.0  sysmgr
 1112         1220     67974     17    0.0  syslogd
 1269          220     13568     16    0.0  fcfwd
 1276         2901     15419    188    0.0  zone
 1277          738     21010     35    0.0  xbar_client
 1278         1159      6789    170    0.0  wwn
 1279          515     67617      7    0.0  vsan
```

Where:

- MemAllocated = Sum of all the dynamically allocated memory that this process has received from the system, including memory that may have been returned
- Runtime CPU Time (ms) = CPU time the process has used, expressed in milliseconds.microseconds
- Invoked = number of times the process has been invoked.
- uSecs = microseconds of CPU time on average for each process invocation.
- 1Sec = CPU utilization in percentage for the last one second.

Example 6-3 Displays Process Log Information

```
switch# show processes log
Process           PID     Normal-exit  Stack-trace  Core     Log-create-time
----------------  ------  -----------  -----------  -------  ---------------
fspf              1339              N            Y        N  Jan  5 04:25
lcm               1559              N            Y        N  Jan  2 04:49
rib               1741              N            Y        N  Jan  1 06:05
```

Where:

- Normal-exit = whether or not the process exited normally.
- Stack-trace = whether or not there is a stack trace in the log.

- Core = whether or not there exists a core file.
- Log-create-time = when the log file got generated.

Example 6-4 Displays Detail Log Information About a Process

```
switch# show processes log pid 1339
Service: fspf
Description: FSPF Routing Protocol Application

Started at Sat Jan  5 03:23:44 1980 (545631 us)
Stopped at Sat Jan  5 04:25:57 1980 (819598 us)
Uptime: 1 hours 2 minutes 2 seconds

Start type: SRV_OPTION_RESTART_STATELESS (23)
Death reason: SYSMGR_DEATH_REASON_FAILURE_SIGNAL (2)
Exit code: signal 9 (no core)
CWD: /var/sysmgr/work

Virtual Memory:

    CODE      08048000 - 0809A100
    DATA      0809B100 - 0809B65C
    BRK       0809D988 - 080CD000
    STACK     7FFFFD20
    TOTAL     23764 KB

Register Set:

    EBX 00000005         ECX 7FFFF8CC         EDX 00000000
    ESI 00000000         EDI 7FFFF6CC         EBP 7FFFF95C
    EAX FFFFFDFE         XDS 8010002B         XES 0000002B
    EAX 0000008E (orig)  EIP 2ACE133E         XCS 00000023
    EFL 00000207         ESP 7FFFF654         XSS 0000002B

Stack: 1740 bytes. ESP 7FFFF654, TOP 7FFFFD20

0x7FFFF654: 00000000 00000008 00000003 08051E95 ................
0x7FFFF664: 00000005 7FFFF8CC 00000000 00000000 ................
0x7FFFF674: 7FFFF6CC 00000001 7FFFF95C 080522CD ........\...."..
0x7FFFF684: 7FFFF9A4 00000008 7FFFFC34 2AC1F18C ........4......*
```

Example 6-5 Displays All Process Log Details

```
switch# show processes log details
======================================================
Service: snmpd
Description: SNMP Agent

Started at Wed Jan  9 00:14:55 1980 (597263 us)
Stopped at Fri Jan 11 10:08:36 1980 (649860 us)
Uptime: 2 days 9 hours 53 minutes 53 seconds

Start type: SRV_OPTION_RESTART_STATEFUL (24)
Death reason: SYSMGR_DEATH_REASON_FAILURE_SIGNAL (2)
Exit code: signal 6 (core dumped)
CWD: /var/sysmgr/work
Virtual Memory:

    CODE      08048000 - 0804C4A0
    DATA      0804D4A0 - 0804D770
    BRK       0804DFC4 - 0818F000
    STACK     7FFFFCE0
    TOTAL     26656 KB
...
```

Example 6-6 *Displays Memory Information About Processes*

```
switch# show processes memory
PID    MemAlloc  MemLimit    MemUsed     StackBase/Ptr      Process
-----  --------  ----------  ----------  -----------------  ----------------
    1    147456  0      1667072     7ffffe50/7ffff950   init
    2         0  0            0                0/0         ksoftirqd/0
    3         0  0            0                0/0         desched/0
    4         0  0            0                0/0         events/0
    5         0  0            0                0/0         khelper
```

Where:

- MemAlloc = total memory allocated by the process.
- StackBase/Ptr = process stack base and current stack pointer in hex format.

Displaying System Status

Use the **show system** command to display system-related status information (see Example 6-7 to Example 6-10).

Example 6-7 *Displays Default Switch Port States*

```
switch# show system default switchport
System default port state is down
System default trunk mode is on
```

Example 6-8 *Displays Error Information for a Specified ID*

```
switch# show system error-id 0x401D0019
Error Facility: module
Error Description: Failed to stop Linecard Async Notification.
```

Example 6-9 *Displays the System Reset Information*

```
switch# Show system reset-reason module 5
----- reset reason for module 5 -----
1) At 224801 usecs after Fri Nov 21 16:36:40 2003
    Reason: Reset Requested by CLI command reload
    Service:
    Version: 1.3(1)
2) At 922828 usecs after Fri Nov 21 16:02:48 2003
    Reason: Reset Requested by CLI command reload
    Service:
    Version: 1.3(1)
3) At 318034 usecs after Fri Nov 21 14:03:36 2003
    Reason: Reset Requested by CLI command reload
    Service:
    Version: 1.3(1)
4) At 255842 usecs after Wed Nov 19 00:07:49 2003
    Reason: Reset Requested by CLI command reload
    Service:
    Version: 1.3(1)
```

The **show system reset-reason** command displays the following information:

- In a Cisco MDS 9513 Director, the last four reset-reason codes for the supervisor module in slot 7 and slot 8 are displayed. If either supervisor module is absent, the reset-reason codes for that supervisor module are not displayed.
- In a Cisco MDS 9506 or Cisco MDS 9509 switch, the last four reset-reason codes for the supervisor module in slot 5 and slot 6 are displayed. If either supervisor module is absent, the reset-reason codes for that supervisor module are not displayed.
- In a Cisco MDS 9200 Series switch, the last four reset-reason codes for the supervisor module in slot 1 are displayed.
- The **show system reset-reason module** *number* command displays the last four reset-reason codes for a specific module in a given slot. If a module is absent, then the reset-reason codes for that module are not displayed.

Use the **clear system reset-reason** command to clear the reset-reason information stored in NVRAM and volatile persistent storage.

- In a Cisco MDS 9500 Series switch, this command clears the reset-reason information stored in NVRAM in the active and standby supervisor modules.
- In a Cisco MDS 9200 Series switch, this command clears the reset-reason information stored in NVRAM in the active supervisor module.

Example 6-10 Displays System Uptime

```
switch# show system uptime
Start Time: Sun Oct 13 18:09:23 2030
Up Time:    0 days, 9 hours, 46 minutes, 26 seconds
```

Use the **show system resources** command to display system-related CPU and memory statistics (see Example 6-11).

Example 6-11 Displays System-Related CPU and Memory Information

```
switch# show system resources
Load average:   1 minute: 0.43   5 minutes: 0.17   15 minutes: 0.11
Processes   :   100 total, 2 running
CPU states  :   0.0% user,   0.0% kernel,   100.0% idle
Memory usage:   1027628K total,    313424K used,    714204K free
                   3620K buffers,   22278K cache
```

Where:

- Load average—Displays the number of running processes. The average reflects the system load over the past 1, 5, and 15 minutes.
- Processes—Displays the number of processes in the system, and how many are actually running when the command is issued.
- CPU states—Displays the CPU usage percentage in user mode, kernel mode, and idle time in the last one second.
- Memory usage—Displays the total memory, used memory, free memory, memory used for buffers, and memory used for cache in KB. Buffers and cache are also included in the *used* memory statistics.

Displaying Core Status

Use the **show system cores** command to display the currently configured scheme for copying cores. See Examples 6-12 to 6-15.

Example 6-12 Displays the Message when Cores are Transferred to TFTP

```
switch# show system cores
Cores are transferred to tftp://171.69.21.28/ernguyen/CORE/
```

Example 6-13 Displays the Message when Cores are Transferred to the External CF

```
switch(config)# show system cores
Cores are transferred to slot0:abcd
```

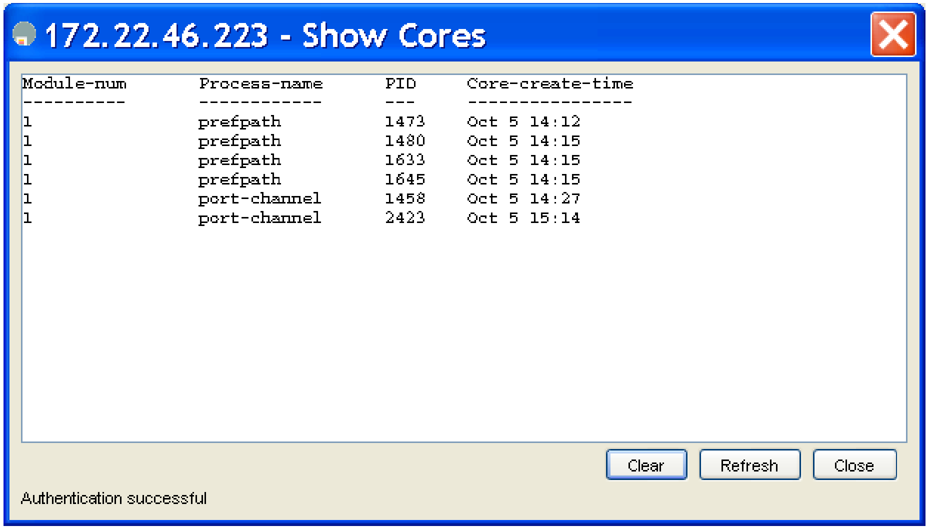
Example 6-14 Displays All Cores Available for Upload from the Active Supervisor Module

```
switch# show cores
Module-num  Process-name    PID     Core-create-time
----------  ------------    ---     ----------------
5           fspf            1524    Nov 9 03:11
6           fcc             919     Nov 9 03:09
8           acltcam         285     Nov 9 03:09
8           fib             283     Nov 9 03:08
```

Example 6-15 Displays Logs on the Local System

```
switch# show processes log
Process           PID     Normal-exit  Stack  Core   Log-create-time
----------------  ------  -----------  -----  -----  ---------------
ExceptionLog      2862              N      Y      N  Wed Aug  6 15:08:34 2003
acl               2299              N      Y      N  Tue Oct 28 02:50:01 2003
bios_daemon       2227              N      Y      N  Mon Sep 29 15:30:51 2003
capability        2373              N      Y      N  Tue Aug 19 13:30:02 2003
core-client       2262              N      Y      N  Mon Sep 29 15:30:51 2003
fcanalyzer        5623              N      Y      N  Fri Sep 26 20:45:09 2003
fcd               12996             N      Y      N  Fri Oct 17 20:35:01 2003
fcdomain          2410              N      Y      N  Thu Jun 12 09:30:58 2003
ficon             2708              N      Y      N  Wed Nov 12 18:34:02 2003
ficonstat         9640              N      Y      N  Tue Sep 30 22:55:03 2003
flogi             1300              N      Y      N  Fri Jun 20 08:52:33 2003
idehsd            2176              N      Y      N  Tue Jun 24 05:10:56 2003
lmgrd             2220              N      N      N  Mon Sep 29 15:30:51 2003
platform          2840              N      Y      N  Sat Oct 11 18:29:42 2003
port-security     3098              N      Y      N  Sun Sep 14 22:10:28 2003
port              11818             N      Y      N  Mon Nov 17 23:13:37 2003
rlir              3195              N      Y      N  Fri Jun 27 18:01:05 2003
rscn              2319              N      Y      N  Mon Sep 29 21:19:14 2003
securityd         2239              N      N      N  Thu Oct 16 18:51:39 2003
snmpd             2364              N      Y      N  Mon Nov 17 23:19:39 2003
span              2220              N      Y      N  Mon Sep 29 21:19:13 2003
syslogd           2076              N      Y      N  Sat Oct 11 18:29:40 2003
tcap              2864              N      Y      N  Wed Aug  6 15:09:04 2003
tftpd             2021              N      Y      N  Mon Sep 29 15:30:51 2003
vpm               2930              N      N      N  Mon Nov 17 19:14:33 2003
```

Figure 6-1 Show Cores Dialog Box



172.22.46.223 - Show Cores

```
Module-num        Process-name      PID     Core-create-time
----------        ------------      ---     ----------------
1                 prefpath          1473    Oct 5 14:12
1                 prefpath          1480    Oct 5 14:15
1                 prefpath          1633    Oct 5 14:15
1                 prefpath          1645    Oct 5 14:15
1                 port-channel      1458    Oct 5 14:27
1                 port-channel      2423    Oct 5 15:14
```

Authentication successful

Verifying First and Last Core Status

You can view specific information about the saved core files. Example 6-16 provides further details on saved core files.

Example 6-16 Regular Service on vdc 2 on Active Supervisor Module

There are five radius core files from vdc2 on the active supervisor module. The second and third oldest files are deleted to comply with the number of core files defined in the service.conf file.

```
switch# show cores vdc vdc2

VDC No Module-num        Process-name      PID     Core-create-time
------ ----------        ------------      ---     ----------------
2      5                 radius            6100    Jan 29 01:47
2      5                 radius            6101    Jan 29 01:55
2      5                 radius            6102    Jan 29 01:55
2      5                 radius            6103    Jan 29 01:55
2      5                 radius            6104    Jan 29 01:57

switch# show cores vdc vdc2

VDC No Module-num        Process-name      PID     Core-create-time
------ ----------        ------------      ---     ----------------
2      5                 radius            6100    Jan 29 01:47
2      5                 radius            6103    Jan 29 01:55
2      5                 radius            6104    Jan 29 01:57
```

Displaying System Health

Use the **show system health** command to display system-related status information (see Example 6-17 to Example 6-22).

Example 6-17 Displays the Current Health of All Modules in the Switch

```
switch# show system health

Current health information for module 2.

Test                       Frequency    Status          Action
-----------------------------------------------------------------
Bootflash                 5 Sec         Running         Enabled
EOBC                      5 Sec         Running         Enabled
Loopback                  5 Sec         Running         Enabled
-----------------------------------------------------------------

Current health information for module 6.

Test                       Frequency    Status          Action
-----------------------------------------------------------------
InBand                    5 Sec         Running         Enabled
Bootflash                 5 Sec         Running         Enabled
EOBC                      5 Sec         Running         Enabled
Management Port           5 Sec         Running         Enabled
-----------------------------------------------------------------
```

Example 6-18 Displays the Current Health of a Specified Module

```
switch# show system health module 8

Current health information for module 8.

Test                       Frequency    Status          Action
-----------------------------------------------------------------
Bootflash                 5 Sec         Running         Enabled
EOBC                      5 Sec         Running         Enabled
Loopback                  5 Sec         Running         Enabled
-----------------------------------------------------------------
```

Example 6-19 Displays Health Statistics for All Modules

```
switch# show system health statistics

Test statistics for module # 1
------------------------------------------------------------------------------
Test Name           State            Frequency Run    Pass    Fail CFail Errs
------------------------------------------------------------------------------
Bootflash           Running             5s    12900   12900       0     0    0
EOBC                Running             5s    12900   12900       0     0    0
Loopback            Running             5s    12900   12900       0     0    0
------------------------------------------------------------------------------

Test statistics for module # 3
------------------------------------------------------------------------------
Test Name           State            Frequency Run    Pass    Fail CFail Errs
------------------------------------------------------------------------------
Bootflash           Running             5s    12890   12890       0     0    0
EOBC                Running             5s    12890   12890       0     0    0
Loopback            Running             5s    12892   12892       0     0    0
------------------------------------------------------------------------------

Test statistics for module # 5
------------------------------------------------------------------------------
```

```
Test Name           State            Frequency Run    Pass    Fail CFail Errs
------------------------------------------------------------------------------
InBand              Running             5s    12911   12911       0     0    0
Bootflash           Running             5s    12911   12911       0     0    0
EOBC                Running             5s    12911   12911       0     0    0
Management Port     Running             5s    12911   12911       0     0    0
------------------------------------------------------------------------------

Test statistics for module # 6
------------------------------------------------------------------------------
Test Name           State            Frequency Run    Pass    Fail CFail Errs
------------------------------------------------------------------------------
InBand              Running             5s    12907   12907       0     0    0
Bootflash           Running             5s    12907   12907       0     0    0
EOBC                Running             5s    12907   12907       0     0    0
------------------------------------------------------------------------------

Test statistics for module # 8
------------------------------------------------------------------------------
Test Name           State            Frequency Run    Pass    Fail CFail Errs
------------------------------------------------------------------------------
Bootflash           Running             5s    12895   12895       0     0    0
EOBC                Running             5s    12895   12895       0     0    0
Loopback            Running             5s    12896   12896       0     0    0
------------------------------------------------------------------------------
```

Example 6-20 Displays Statistics for a Specified Module

```
switch# show system health statistics module 3

Test statistics for module # 3
------------------------------------------------------------------------------
Test Name           State            Frequency Run    Pass    Fail CFail Errs
------------------------------------------------------------------------------
Bootflash           Running             5s    12932   12932       0     0    0
EOBC                Running             5s    12932   12932       0     0    0
Loopback            Running             5s    12934   12934       0     0    0
------------------------------------------------------------------------------
```

Example 6-21 Displays Loopback Test Statistics for the Entire Switch

```
switch# show system health statistics loopback
-----------------------------------------------------------------
Mod Port Status                Run     Pass     Fail   CFail Errs
  1   16 Running             12953    12953        0       0    0
  3   32 Running             12945    12945        0       0    0
  8    8 Running             12949    12949        0       0    0
-----------------------------------------------------------------
```

Example 6-22 Displays Loopback Test Statistics for a Specified Interface

```
switch# show system health statistics loopback interface fc 3/1
-----------------------------------------------------------------
Mod Port Status                Run     Pass     Fail   CFail Errs
  3    1 Running                 0        0        0       0    0
-----------------------------------------------------------------
```

Note Interface-specific counters will remain at zero unless the module-specific loopback test reports errors or failures.

Example 6-23 Displays the Loopback Test Time Log for All Modules

```
switch# show system health statistics loopback timelog
-----------------------------------------------------------------
Mod        Samples     Min(usecs)     Max(usecs)     Ave(usecs)
  1           1872            149            364            222
  3           1862            415            743            549
  8           1865            134            455            349
-----------------------------------------------------------------
```

Example 6-24 Displays the Loopback Test Time Log for a Specified Module

```
switch# show system health statistics loopback module 8 timelog
-----------------------------------------------------------------
Mod        Samples     Min(usecs)     Max(usecs)     Ave(usecs)
  8           1867            134            455            349
-----------------------------------------------------------------
```

Verifying Loopback Test Configuration Frame Length

To verify the loopback frequency configuration, use the **show system health loopback frame-length** command.

```
switch# show system health loopback frame-length
Loopback frame length is set to auto-size between 0-128 bytes
```

Displaying OBFL for the Switch

Use the **show logging onboard status** command to display the configuration status of OBFL.

```
switch# show logging onboard status

    Switch OBFL Log:                                    Enabled

    Module:  6 OBFL Log:                                Enabled
    error-stats                                         Enabled
    exception-log                                       Enabled
    miscellaneous-error                                 Enabled
    obfl-log (boot-uptime/device-version/obfl-history)  Enabled
    system-health                                       Enabled
    stack-trace                                         Enabled
```

Displaying the OBFL for a Module

Use the **show logging onboard status** command to display the configuration status of OBFL.

```
switch# show logging onboard status

    Switch OBFL Log:                                    Enabled
Module:  6 OBFL Log:                                Enabled
```

```
error-stats                                         Enabled
exception-log                                       Enabled
miscellaneous-error                                 Enabled
obfl-log (boot-uptime/device-version/obfl-history)  Enabled
system-health                                       Enabled
stack-trace                                         Enabled
```

Displaying OBFL Logs

To display OBFL information stored in CompactFlash on a module, use the following commands:

Command	Purpose
show logging onboard boot-uptime	Displays the boot and uptime information.
show logging onboard cpu-hog	Displays information for CPU hog events.
show logging onboard device-version	Displays device version information.
show logging onboard endtime	Displays OBFL logs to an end time.
show logging onboard environmental-history	Displays environmental history.
show logging onboard error-stats	Displays error statistics.
show logging onboard exception-log	Displays exception log information.
show logging onboard interrupt-stats	Displays interrupt statistics.
show logging onboard mem-leak	Displays memory leak information.
show logging onboard miscellaneous-error	Displays miscellaneous error information.
show logging onboard module *slot*	Displays OBFL information for a specific module.
show logging onboard obfl-history	Displays history information.
show logging onboard register-log	Displays register log information.
show logging onboard stack-trace	Displays kernel stack trace information.
show logging onboard starttime	Displays OBFL logs from a specified start time.
show logging onboard system-health	Displays system health information.

Displaying the Module Counters Information

This example shows the device IDs of all the devices in a module:

```
switch# attach  module 4
Attaching to module 4 ...
To exit type 'exit', to abort type '$.'
Linux lc04 2.6.10_mvl401-pc_target #1 Tue Dec 16 22:58:32 PST 2008 ppc GNU/Linux
module-4# clear asic-cnt list-all-devices

        Asic Name  |        Device ID
     Stratosphere  |               63
      transceiver  |               46
     Skyline-asic  |               57
       Skyline-ni  |               60
     Skyline-xbar  |               59
      Skyline-fwd  |               58
     Tuscany-asic  |               52
     Tuscany-xbar  |               54
```

```
      Tuscany-que  |               55
      Tuscany-fwd  |               53
    Fwd-spi-group  |               73
       Fwd-parser  |               74
             eobc  |               10
         X-Bus IO  |                1
Power Mngmnt Epld  |               25
```

Configuring Alerts, Notifications, and Monitoring of Counters

This section provides information on how to configure alerts, notification, and monitor counters and includes the following topics:

- Monitoring the CPU Utilization, page 6-29
- Obtaining RAM Usage Information, page 6-29
- Monitoring Status of Interfaces, page 6-30
- Monitoring Transceiver Thresholds, page 6-30
- Configuring Supervisor Switchover Notification, page 6-31
- Configuring a Counter to Include CRC and FCS Errors, page 6-31
- Configuring CallHome for Alerts, page 6-32
- Monitoring User Authentication Failures, page 6-32

Monitoring the CPU Utilization

To display the system CPU utilization, use the **show processes cpu** command.

This example shows how to display processes and CPU usage in the current VDC:

```
switch# show processes cpu

PID    Runtime(ms)  Invoked   uSecs  1Sec    Process
-----  -----------  --------  -----  ------  -----------
    4       386829  67421866      5    0.9%  ksoftirqd/0
3667       270567    396229    682    9.8%  syslogd
3942          262       161   1632    7.8%  netstack
4006    106999945  354495641    301   28.2%  snmpd
4026      4454796    461564   9651    0.9%  sac_usd
4424        84187    726180    115    0.9%  vpc
4426       146378    919073    159    0.9%  tunnel

CPU util  :   25.0% user,   30.5% kernel,   44.5% idle
```

Obtaining RAM Usage Information

You can obtain the processor RAM usage by using this SNMP variable: **ceExtProcessorRam**.

```
ceExtProcessorRam OBJECT-TYPE
    SYNTAX  Unsigned32
    UNITS   "bytes"
        MAX-ACCESS  read-only
        STATUS  current
        DESCRIPTION
        "Total number of bytes of RAM available on the
         Processor."
        ::= { ceExtPhysicalProcessorEntry 1 }
```

Monitoring Rx and Tx Traffic Counters

When monitoring Rx and Tx traffic counters, you should include the Rx counter OID:

ifHCInOctets

Monitoring Status of Interfaces

To monitor status of interfaces, use the **IETF extended-linkDown** trap, which has ifAlias (this trap can set interface description) and ifDescr, which shows port name in the ascii format as shown below:

```
switch (config)# snmp-server enable traps link
  cieLinkDown                 Cisco extended link state down notification
  cieLinkUp                   Cisco extended link state up notification
  cisco-xcvr-mon-status-chg   Cisco interface transceiver monitor status change
                             notification
  delayed-link-state-change  Delayed link state change
  extended-linkDown           IETF extended link state down notification
  extended-linkUp             IETF extended link state up notification
  linkDown                   IETF Link state down notification
  linkUp                      IETF Link state up notification
switch (config)#
```

The following is an example of the trap:

```
[+]          10           16:41:39.79         IF-MIB:linkDown trap:SNMPv2c  from
[172.25.234.200  Port: 162 Community: public]

SNMPv2-MIB:sysUpTime.0 :  (35519336)      Syntax: TimeTicks
SNMPv2-MIB:snmpTrapOID.0 :  (IF-MIB:linkDown)      Syntax: ObjectID
IF-MIB:ifIndex.440414208 :   (440414208)  Syntax: INTEGER,  Instance IDs: (440414208)
IF-MIB:ifAdminStatus.440414208 :   (down)  Syntax: INTEGER,  Instance IDs: (440414208)
IF-MIB:ifOperStatus.440414208 :   (down)  Syntax: INTEGER,  Instance IDs: (440414208)
IF-MIB:ifDescr.440414208 :   (Ethernet9/4)  Syntax: RFC1213-MIB:DisplayString,  Instance
IDs: (440414208)
IF-MIB:ifAlias.440414208 :   (eth9/4)  Syntax: SNMPv2-TC:DisplayString,  Instance IDs:
(440414208)
SNMPv2-MIB:snmpTrapEnterprise.0 :  (IF-MIB:linkDown)      Syntax: ObjectID
```

Monitoring Transceiver Thresholds

Use the **cisco-xcvr-mon-status-chg** trap way to monitor digital diagnostics statistics for thresholds as shown below:

```
switch (config)# snmp-server enable traps link cisco-xcvr-mon-status-chg
switch (config)#
```

The trap MIB is as show below:

```
cIfXcvrMonStatusChangeNotif NOTIFICATION-TYPE
    OBJECTS         {
                        ifName,
                        cIfXcvrMonDigitalDiagTempAlarm,
                        cIfXcvrMonDigitalDiagTempWarning,
                        cIfXcvrMonDigitalDiagVoltAlarm,
                        cIfXcvrMonDigitalDiagVoltWarning,
                        cIfXcvrMonDigitalDiagCurrAlarm,
                        cIfXcvrMonDigitalDiagCurrWarning,
                        cIfXcvrMonDigitalDiagRxPwrAlarm,
                        cIfXcvrMonDigitalDiagRxPwrWarning,
                        cIfXcvrMonDigitalDiagTxPwrAlarm,
                        cIfXcvrMonDigitalDiagTxPwrWarning,
                        cIfXcvrMonDigitalDiagTxFaultAlarm
                    }
    STATUS          current
```

This example shows how to display transceiver details:

```
switch(config)# show interface ethernet 1/17 transceiver details
Ethernet1/17
    transceiver is present
    type is 10Gbase-SR
    name is CISCO-AVAGO
    part number is SFBR-7702SDZ
    revision is G2.3
    serial number is AGA1427618P
    nominal bitrate is 10300 MBit/sec
    Link length supported for 50/125um OM2 fiber is 82 m
    Link length supported for 62.5/125um fiber is 26 m
    Link length supported for 50/125um OM3 fiber is 300 m
    cisco id is --
    cisco extended id number is 4

           SFP Detail Diagnostics Information (internal calibration)
  ----------------------------------------------------------------------------
                Current              Alarms                  Warnings
                Measurement     High        Low         High          Low
  ----------------------------------------------------------------------------
  Temperature   27.65 C        75.00 C     -5.00 C     70.00 C        0.00 C
  Voltage        3.29 V         3.63 V      2.97 V      3.46 V        3.13 V
  Current        5.42 mA       10.50 mA     2.50 mA    10.50 mA       2.50 mA
  Tx Power      -2.51 dBm       1.69 dBm  -11.30 dBm   -1.30 dBm     -7.30 dBm
  Rx Power      -2.64 dBm       1.99 dBm  -13.97 dBm   -1.00 dBm     -9.91 dBm
  Transmit Fault Count = 0
  ----------------------------------------------------------------------------
  Note: ++  high-alarm; +  high-warning; --  low-alarm; -  low-warning
switch(config)#
```

Configuring Supervisor Switchover Notification

The supervisor switchover notification can be monitored by listening for the **ciscoRFSwactNotif** trap:

```
  ciscoRFSwactNotif NOTIFICATION-TYPE
  OBJECTS {
  cRFStatusUnitId,
  sysUpTime,
  cRFStatusLastSwactReasonCode
}
```

Configuring a Counter to Include CRC and FCS Errors

You can include CRC and FCS errors of interfaces by polling dot3StatsFCSErrors counter as shown in the example:

dot3StatsFCSErrors   Counter32

```
      Dot3StatsEntry ::= SEQUENCE {
dot3StatsIndex                     InterfaceIndex,
dot3StatsAlignmentErrors           Counter32,
    dot3StatsFCSErrors                 Counter32,
    dot3StatsSingleCollisionFrames     Counter32,
    dot3StatsMultipleCollisionFrames   Counter32,
    dot3StatsSQETestErrors             Counter32,
    dot3StatsDeferredTransmissions     Counter32,
    dot3StatsLateCollisions            Counter32,
    dot3StatsExcessiveCollisions       Counter32,
    dot3StatsInternalMacTransmitErrors Counter32,
    dot3StatsCarrierSenseErrors        Counter32,
    dot3StatsFrameTooLongs             Counter32,
    dot3StatsInternalMacReceiveErrors  Counter32,
    dot3StatsEtherChipSet              OBJECT IDENTIFIER,
    dot3StatsSymbolErrors              Counter32,
    dot3StatsDuplexStatus              INTEGER,
    dot3StatsRateControlAbility        TruthValue,
    dot3StatsRateControlStatus         INTEGER
}
```

Configuring CallHome for Alerts

The call home feature enables receive call home e-mail when exceptions occurs in the system. Use the CLI or SNMP to setup call home configurationss and to enable all alert-groups as shown below:

```
switch (config)# callhome
switch-FC-VDC(config-callhome)# destination-profile full-txt-destination alert-group
All                     This alert group consists of all of the callhome
                        messages
  Cisco-TAC             Events which are meant for Cisco TAC only
  Configuration         Events related to Configuration
  Diagnostic            Events related to Diagnostic
  EEM                   EEM events
  Environmental         Power,fan,temperature related events
  Inventory             Inventory status events
  License               Events related to licensing
  Linecard-Hardware     Linecard related events
  Supervisor-Hardware   Supervisor related events
  Syslog-group-port     Events related to syslog messages filed by port manager
  System                Software related events
  Test                  User generated test events
switch-FC-VDC(config-callhome)#
```

Monitoring User Authentication Failures

You can monitor any user authentication failures by listening the **authenticationFailure** trap:

```
SNMPv2-MIB: authenticationFailure trap
```

Additional References

For additional information related to implementing System Processes and Logs, see the following section:

- MIBs, page 6-33

MIBs

MIBs	MIBs Link
• CISCO-SYSTEM-EXT-MIB • CISCO-SYSTEM-MIB	To locate and download MIBs, go to the following URL: http://www.cisco.com/en/US/products/ps5989/prod_technical_reference_list.html

Feature History for System Processes and Logs

Table 6-3 lists the release history for this feature. Only features that were introduced or modified in Release 3.x or a later release appear in the table.

Table 6-3 Feature History for System Processes and Logs

Feature Name	Releases	Feature Information
Common Information Model	3.3(1a)	Added commands for displaying Common Information Model.
On-line system health maintenance (OHMS) enhancements	3.0(1)	Includes the following OHMS enhancements: • Configuring the global frame length for loopback test for all modules on the switch. • Specifying frame count and frame length on for the loopback test on a specific module. • Configuring source and destination ports for external loopback tests. • Providing serdes loopback test to check hardware.
On-board failure logging (OBFL)	3.0(1)	Describes OBFL, how to configure it for Generation 2 modules, and how to display the log information.

Configuring the Embedded Event Manager

This chapter describes how to configure the EEM to detect and handle critical events on a device.

This chapter includes the following sections:

Information About EEM

Embedded Event Manager monitors events that occur on your device and takes action to recover or troubleshoot these events, based on your configuration.

This section includes the following topics:

EEM Overview

EEM consists of three major components:

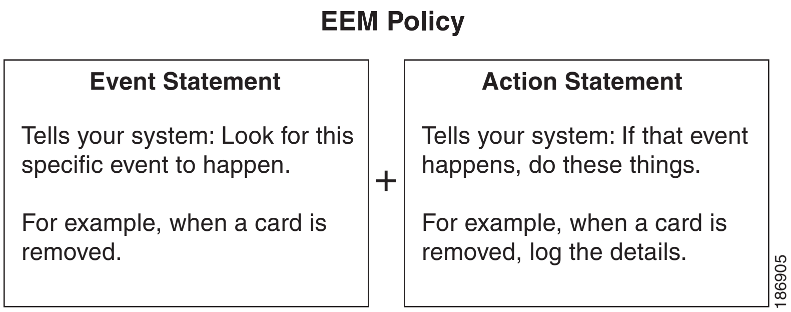
- Event statements—Events to monitor from another Cisco NX-OS component that may require some action, workaround, or notification.
- Action statements —Actions that EEM can take, such as sending an e-mail, or disabling an interface, to recover from an event.
- Policies—A combination of an event statement and an action statement. When the specified event occurs, the configured action is executed.

Policies

An EEM policy consists of an event statement and one or more action statements. The event statement defines the event to look for as well as the filtering characteristics for the event. The action statement defines the action EEM takes when the event occurs.

Figure 7-1 shows the two basic statements in an EEM policy.

Figure 7-1 EEM Policy Statements


EEM Policy
Event Statement
Tells your system: Look for this specific event to happen.
For example, when a card is removed.
+
Action Statement
Tells your system: If that event happens, do these things.
For example, when a card is removed, log the details.
186905

You can configure EEM policies using the CLI or using a VSH script.

Note EEM policy matching is not supported on MDS switches.

EEM maintains event logs on the supervisor.

Cisco NX-OS has a number of preconfigured system policies. These system policies define many common events and actions for the device. System policy names begin with two underscore characters (__).

The following are some of the preconfigured system policies available in Cisco MDS 9000 Series Switches and all the three policies are over-ridable:

- Zone
  - __zone_dbsize_max_per_vsan: Syslog warning when Zone database size exceeds the maximum limit for a vsan.
  - __zone_members_max_per_sw: Syslog warning when Zone member count exceeds the maximum limit for the switch.
  - __zone_zones_max_per_sw: Syslog warning when Zone count exceeds the maximum limit for the switch.

  - __zone_zonesets_max_per_sw : Syslog warning when Zoneset count exceeds the maximum limit for the switch.
- Fabric Login (FLOGI)
  - __flogi_fcids_max_per_switch: Syslog warning when the number of flogis in the switch exceeds maximum limit.
  - __flogi_fcids_max_per_module: Syslog warning when the number of flogis in the module exceeds maximum limit.
  - __flogi_fcids_max_per_intf: Syslog warning when the number of flogis on the interface exceeds maximum limit.

Note During an In Service Software Upgrade (ISSU), EEM syslog messages for FLOGI are not printed in the terminal.

- Fibre Channel Name Server (FCNS)
  - __fcns_entries_max_per_switch : Configuring max limit for Name server entries verified across all VSANs per switch.

    Action: Display a syslogUser

Note User should not configure an event for a different component's policy.

You can create user policies to suit your network. Actions defined by the user policies are executed along with the actions defined by the system policies. To configure a user policy, see the "Defining a User Policy Using the CLI" section on page 7-7.

You can also override some system policies. The override policies replace the system policies. You can override the event or the actions.

Use the **show event manager system-policy** command to view the preconfigured system policies and determine which policies that you can override.

To configure an overriding policy, see the "Overriding a Policy" section on page 7-13.

Note

- You should use the **show running-config eem** command to check the configuration of each policy. An override policy that consists of an event statement and no action statement triggers no action and no notification of failures.
- Your override policy should always include an event statement. An override policy without an event statement overrides all possible events in the system policy.

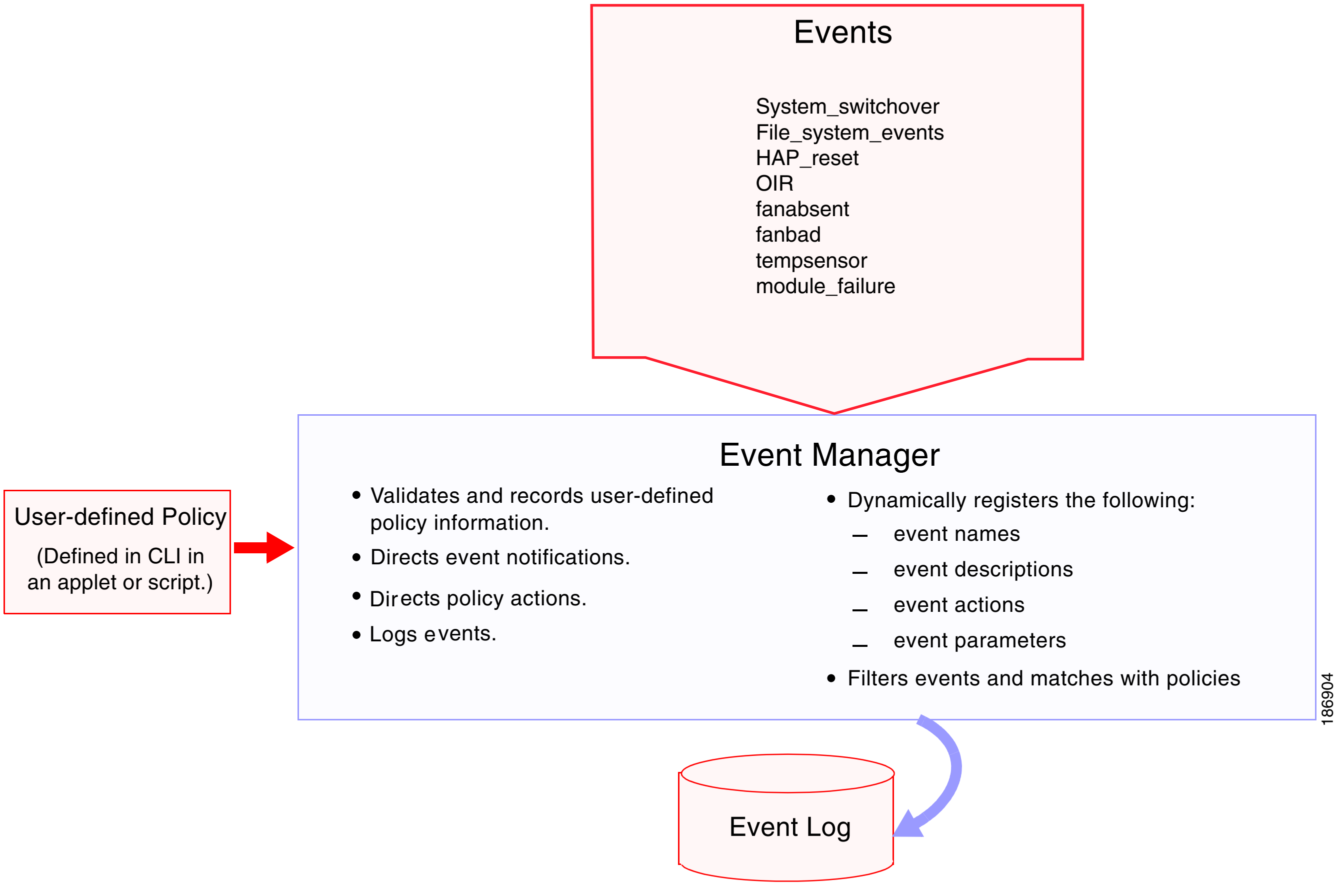
Event Statements

An event is any device activity for which some action, such as a workaround or a notification, should be taken. In many cases, these events are related to faults in the device such as when an interface or a fan malfunctions.

EEM defines event filters so only critical events or multiple occurrences of an event within a specified time period trigger an associated action.

Figure 7-2 shows events that are handled by EEM.

Figure 7-2 EEM Overview


Events
System_switchover
File_system_events
HAP_reset
OIR
fanabsent
fanbad
tempsensor
module_failure
Event Manager
• Validates and records user-defined policy information.
• Directs event notifications.
• Directs policy actions.
• Logs events.
• Dynamically registers the following:
– event names
– event descriptions
– event actions
– event parameters
• Filters events and matches with policies
User-defined Policy
(Defined in CLI in an applet or script.)
Event Log
186904

Event statements specify the event that triggers a policy to run. You can configure only one event statement per policy.

EEM schedules and runs policies on the basis of event statements. EEM examines the event and action commands and runs them as defined.

Action Statements

Action statements describe the action triggered by a policy. Each policy can have multiple action statements. If no action is associated with a policy, EEM still observes events but takes no actions.

EEM supports the following actions in action statements:

- Execute any CLI commands.
- Update a counter.
- Log an exception.
- Force the shut down of any module.
- Reload the device.

- Shut down specified modules because the power is over budget.
- Generate a syslog message.
- Generate a Call Home event.
- Generate an SNMP notification.
- Use the default action for the system policy.

Note If you want to allow the triggered event to process the default actions also, you must explicitly configure an EEM action with **event-default** or **policy-default**, based on the type of policy. For example, if you match a CLI command in a match statement, you must add the event-default action statement to the EEM policy. If the event-default action statement is not added, EEM will not allow the CLI command to execute.

Note Verify that your action statements within your user policy or overriding policy do not negate each other or adversely affect the associated system policy.

VSH Script Policies

You can also write policies in a VSH script, using a text editor. These policies have an event statement and action statement(s) just as other policies, and these policies can either augment or override system polices. After you write your script policy, copy it to the device and activate it. To configure a policy in a script, see the "Defining a Policy Using a VSH Script" section on page 7-12.

Environment Variables

You can define environment variables for EEM that are available for all policies. Environment variables are useful for configuring common values that you can use in multiple policies. For example, you can create an environment variable for the IP address of an external e-mail server.

You can use an environment variable in action statements by using the parameter substitution format.

Example 7-1 shows a sample action statement to force a module 1 shutdown, with a reset reason of "EEM action."

Example 7-1 Action Statement

```
switch (config-eem-policy)# action 1.0 forceshut module 1 reset-reason "EEM action"
```

If you define an environment variable for the shutdown reason, called default-reason, you can replace that reset reason with the environment variable, as shown in Example 7-2.

Example 7-2 Action Statement with Environment Variable

```
switch (config-eem-policy)# action 1.0 forceshut module 1 reset-reason $default-reason
```

You can reuse this environment variable in any policy. For more information on environment variables, see the "Defining an Environment Variable" section on page 7-14.

EEM Event Correlation

Beginning with Cisco NX-OS Release 5.2, you can trigger an EEM policy based on a combination of events. First, you use the **tag** keyword to create and differentiate multiple events in the EEM policy. Then using a set of boolean operators (**and**, **or**, **andnot**), along with the count and time, you can define a combination of these events to trigger a custom action.

High Availability

Cisco NX-OS supports stateless restarts for EEM. After a reboot or supervisor switchover, Cisco NX-OS applies the running configuration.

Licensing Requirements for EEM

The following table shows the licensing requirements for this feature:

Product	License Requirement
NX-OS	EEM requires no license. Any feature not included in a license package is bundled with the Cisco NX-OS system images and is provided at no extra charge to you.

Prerequisites for EEM

EEM has the following prerequisites:

- You must have network-admin user privileges to configure EEM.

Guidelines and Limitations

EEM has the following configuration guidelines and limitations:

- Action statements within your user policy or overriding policy should not negate each other or adversely affect the associated system policy.
- If you want to allow the triggered event to process the default actions also, you must explicitly configure an EEM action with **event-default** or **policy-default**, based on the type of policy. For example, if you match a CLI command in a match statement, you must add the event-default action statement to the EEM policy or EEM will not allow the CLI command to execute.
- An override policy that consists of an event statement and no action statement triggers no action and no notification of failures.

- An override policy without an event statement overrides all possible events in the system policy.
- When more than one event statement is included in an EEM policy, each event statement must have a **tag** keyword with a unique tag argument.
- Although multiple overriding is blocked at application-level (FCNS/zone/FLOGI), blank applets can saved by overriding the system policy.

Default Settings

Table 7-1 lists the default settings for EEM parameters.

Table 7-1 Default EEM Parameters

Parameters	Default
system policies	active

Configuring EEM

This section includes the following topics:

- Defining a User Policy Using the CLI, page 7-7
- Defining a Policy Using a VSH Script, page 7-12
- Registering and Activating a VSH Script Policy, page 7-13
- Overriding a Policy, page 7-13

Defining a User Policy Using the CLI

You can define a user policy using the CLI.

Detailed Steps

To define a user policy using the CLI, follow these steps:

	Command	Purpose
Step 1	**config t**	Enters configuration mode.
Step 2	**event manager applet** *applet-name*	Registers the applet with EEM and enters applet configuration mode. The *applet-name* can be any case-sensitive alphanumeric string up to 29 characters.
Step 3	**description** *policy-description*	(Optional) Configures a descriptive string for the policy. The string can be any alphanumeric string up to 80 characters. Enclose the string in quotation marks.
Step 4	**event** *event-statement*	Configures the event statement for the policy. See the "Configuring Event Statements" section on page 7-8.

	Command	Purpose
Step 5	**tag** *tagname1* {**and** | **andnot** | **or**} *tagname2* [{**and** | **andnot** | **or**} *tagname3* [{**and** | **andnot** | **or**} *tagname4*]] **happens** *occurs* **in** *seconds*	(Optional) Correlates multiple events in the policy. The range for *occurs* is from 1 to 4294967295. The range for *seconds* is from 0 to 4294967295 seconds.
Step 6	**action** *action-statement*	Configures an action statement for the policy. See the "Configuring Action Statements" section on page 7-11. Repeat Step 5 for multiple action statements.
Step 7	**show event manager policy internal** *name*	(Optional) Displays information about the configured policy.
Step 8	**copy running-config startup-config**	(Optional) Saves this configuration change.

Configuring Event Statements

Detailed Steps

To configure an event statement, use one the following commands in EEM configuration mode:

Command	Purpose
event cli [**tag** *tag_name*] **match** *expression* [**count** *repeats* | **time** *seconds*]	Triggers an event if you enter a CLI command that matches the regular expression. The **tag** *tag_name* keyword-argument pair identifies this specific event when multiple events are included in the policy. The *repeats* range is from 1 to 65000. The time range, in seconds, is from 0 to 4294967295, where 0 indicates no time limit.
event counter name *counter* **entry-val** *entry* **entry-op** {**eq** | **ge** | **gt** | **le** | **lt** |**ne**} [**exit-val** *exit* **exit-op** {**eq** | **ge** | **gt** | **le** | **lt** |**ne**}]	Triggers an event if the counter crosses the entry threshold (based on the entry operation—greater than, less than, and so on.) The event resets immediately. Optionally, you can configure the event to reset after the counter passes the exit threshold. The *counter* name can be any case-sensitive, alphanumeric string up to 28 characters. The *entry* and *exit* value ranges are from 0 to 2147483647.
event fanabsent [**fan** *number*] **time** *seconds*	Triggers an event if a fan is removed from the device for more than the configured time, in seconds. The fan *number* range is dependent on different switches (for example for 9513 switches the range is from1 to 2, for 9506/9509 switches the range is 1). The *seconds* range is from 10 to 64000.

Command	Purpose
event fanbad [**fan** *number*] **time** *seconds*	Triggers an event if a fan fails for more than the configured time, in seconds. The fan *number* range is dependent on different switches (for example for 9513 switches the range is from1 to 2, for 9506/9509 switches the range is 1). The *seconds* range is from 10 to 64000.
event memory {**critical** | **minor** | **severe**}	Triggers an event if a memory threshold is crossed.
event module-failure type *failure-type* ***module*** {*slot* | **all**} **count** *repeats* [**time** *seconds*]	Triggers an event if a module experiences the failure type configured. The *slot* range is dependent on different switches (for example for 9513 switches the range is from1 to 13, for 9509 switches the range is 1 to 9). The *repeats* range is from 0 to 4294967295. The *seconds* range is from 0 to 4294967295.
event oir {**fan** | **module** | **powersupply**} {**anyoir** | **insert** | **remove**} [*number*]	Triggers an event if the configured device element (fan, module, or power supply) is inserted or removed from the device. You can optionally configure a specific fan, module, or power supply number. The *number* range is as follows: • Fan number is dependent on different switches. • Module number is dependent on different switches. • Power supply number range is from 1 to 2.
event policy-default count *repeats* [**time** *seconds*]	Uses the event configured in the system policy. Use this option for overriding policies. The *repeats* range is from 1 to 65000. The *seconds* range is from 0 to 4294967295.
event poweroverbudget	Triggers an event if the power budget exceeds the capacity of the configured power supplies.
event snmp oid *oid* **get-type** {**exact** | **next**} **entry-op** {**eq** | **ge** | **gt** | **le** | **lt** |**ne**} **entry-val** *entry* [**exit-comb** {**and** | **or**}] **exit-op** {**eq** | **ge** | **gt** | **le** | **lt** |**ne**} **exit-val** *exit* **exit-time** *time* **polling-interval** *interval*	Triggers an event if the SNMP OID crosses the entry threshold (based on the entry operation—greater than, less than, and so on.) The event resets immediately, or optionally you can configure the event to reset after the counter passes the exit threshold. The OID is in dotted decimal notation. The *entry* and *exit* value ranges are from 0 to 18446744073709551615. The time range is from 0 to 2147483647. The interval range is from 1 to 2147483647.

Command	Purpose
event syslog {**occurs** *occurs number* | **pattern** *syslog pattern* | **period** *time intervals* | **priority** *syslog priority* | **tag** *tag_name* }	Triggers an event based on a message logged in the syslog logfile. occurs *occurs number*-Specifies the number of occurrences. The range is from 1 to 65000. pattern *syslog pattern*-Specifies the syslog pattern. Normal regular expression pattern matching is used. The maximum size is 256 alphanumerical characters. period *time intervals*-Specifies the maximum time interval between messages. The range is from 0 to 4294967295 seconds. priority *syslog priority*-Specifies the syslog priority. •alerts—Specifies the alert log message •critical—Specifies the critical log message •debugging—Specifies the debugging message •emergencies—Specifies the emergency log message •errors-Specifies the error log message •informational—Specifies the informational log message •notification—Specifies the notification log message •pattern—Specifies the pattern matching •warnings—Specifies the warning message tag *tag_name*-Specifies the tag name. Maximum size is 29 alphanumerical characters. The tag *tag_name* keyword argument pair identifies this specific event when multiple events are included in the policy.
event temperature [**module** *slot*] [*sensor number*] **threshold** {**any** | **major** | **minor**}	Triggers an event if the temperature sensor exceeds the configured threshold. The *slot* range is dependent on different switches. The *sensor range* is from 1 to 8 on MDS modules, but current MDS modules use the range from 1 to 3 only, some modules use the range from 1 to 2.

Configuring Action Statements

Detailed Steps

To configure action statements, use the following commands in EEM configuration mode:

Command	Purpose
action *number*[**.***number2*] **cli** *command1* [command2...] [**local**]	Executes the configured CLI commands. You can optionally execute the commands on the module where the event occurred. The action label is in the format number1.number2. *number* can be any number up to 16 digits. The range for *number2* is from 0 to 9.
action *number*[**.***number2*] **counter name** *counter* **value** *val* **op** {**dec** | **inc** | **nop** | **set**}	Modifies the counter by the configured value and operation. The action label is in the format number1.number2. *number* can be any number up to 16 digits. The range for *number2* is from 0 to 9. The counter name can be any case-sensitive, alphanumeric string up to 28 characters. The *val* can be an integer from 0 to 2147483647 or a substituted parameter.
action *number*[**.***number2*] **event-default**	Executes the default action for the associated event. The action label is in the format number1.number2. *number* can be any number up to 16 digits. The range for *number2* is from 0 to 9.
action number [.number2] **exceptionlog module** module syserr error **devid** id **errtype** type **errcode** code **phylayer** layer **ports** list **harderror** error [**desc** string]	Logs an exception if the specific conditions are encountered when an EEM applet is triggered.
action *number*[**.***number2*] **forceshut** [**module** *slot* | **xbar** xbar-*number*] **reset-reason** *seconds*	Forces a module, crossbar, or the entire system to shut down. The action label is in the format number1.number2. *number* can be any number up to 16 digits. The range for *number2* is from 0 to 9. The *slot* range is dependent on different switches. The *xbar-number* range is from 1 to 2 and is only available on MDS 9513 modules. The reset reason is a quoted alphanumeric string up to 80 characters.
action *number*[**.***number2*] **overbudgetshut** [**module** *slot* [**-** *slot*]]	Forces one or more modules or the entire system to shut down because of a power overbudget issue. *number* can be any number up to 16 digits. The range for *number2* is from 0 to 9. The *slot* range is dependent on different switches.

Command	Purpose
action *number*[**.***number2*] **policy-default**	Executes the default action for the policy that you are overriding. The action label is in the format number1.number2. *number* can be any number up to 16 digits. The range for *number2* is from 0 to 9.
action *number*[**.***number2*] **reload** [**module** *slot* [**-** *slot*]]	Forces one or more modules or the entire system to reload. *number* can be any number up to 16 digits. The range for *number2* is from 0 to 9. The *slot* range is dependent on different switches.
action *number*[**.***number2*] **snmp-trap** {[**intdata1** *data* [**intdata2** *data*] [strdata string]}	Sends an SNMP trap with the configured data. *number* can be any number up to 16 digits. The range for *number2* is from 0 to 9. The *data* arguments can by any number up to 80 digits. The *string* can be any alphanumeric string up to 80 characters.
action *number*[**.***number2*] **syslog** [**priority** *prio-val*] **msg** *error-message*	Sends a customized syslog message at the configured priority.*number* can be any number up to 16 digits. The range for *number2* is from 0 to 9. The *error-message* can be any quoted alphanumeric string up to 80 characters.

Note If you want to allow the triggered event to process the default actions also, you must explicitly configure an EEM action with **event-default** or **policy-default**, based on the type of policy. For example, if you match a CLI command in a match statement, you must add the **event-default** action statement to the EEM policy or EEM will not allow the CLI command to execute. You can bypass all CLI-based EEM policies using **terminal event-manager bypass** command. To revert use **terminal no event-manager bypass** command.

Defining a Policy Using a VSH Script

Detailed Steps

To define a policy using a VSH script, follow these steps:

Step 1 In a text editor, list the CLI commands that define the policy.

Step 2 Name the text file and save it.

Step 3 Copy the file to the following system directory:

bootflash://eem/user_script_policies

Registering and Activating a VSH Script Policy

Detailed Steps

To register and activate a policy defined in a VSH script, follow these steps:

	Command	Purpose
Step 1	**config t**	Enters configuration mode.
Step 2	**event manager policy** *policy-script*	Registers and activates an EEM script policy. The *policy-script* can be any case-sensitive alphanumeric string up to 29 characters.
Step 3	**show event manager internal policy** *name*	(Optional) Displays information about the configured policy.
Step 4	**copy running-config startup-config**	(Optional) Saves this configuration change.

Overriding a Policy

Detailed Steps

To override a system policy, follow these steps:

	Command	Purpose
Step 1	**config t**	Enters configuration mode.
Step 2	**show event manager policy-state** *system-policy*	(Optional) Displays information about the system policy that you want to override, including thresholds. Use the **show event manager system-policy** command to find the system policy names.
Step 3	[**no**] **event manager applet** *applet-name* **override** *system-policy*	Overrides a system policy and enters applet configuration mode. The *applet-name* can be any case-sensitive alphanumeric string up to 29 characters. The *system-policy* must be one of the existing system policies.
Step 4	**description** *policy-description*	(Optional) Configures a descriptive string for the policy. The string can be any alphanumeric string up to 80 characters. Enclose the string in quotation marks.
Step 5	[**no**] **event** *event-statement*	Configures the event statement for the policy. See the "Configuring Event Statements" section on page 7-8. Using the **no** keyword deletes the overridden event, if any. **Note** • Deleting an overridden policy does not remove the default system policy. • You can modify an overridden policy by changing the respective Zone, FCNS, or FLOGI limit values.

	Command	Purpose
Step 6	**action** *action-statement*	Configures an action statement for the policy. See the "Configuring Action Statements" section on page 7-11. Repeat Step 6 for multiple action statements. **Note** • Zone, FLOGI, and FCNS support only syslog message generation as the action. • If an action is not configured, the default action associated with the default system policy is executed. If an action is configured, both the configured and default actions are executed. This functionality is applicable only to Zone, FLOGI, and FCNS system policies.
Step 7	**show event manager policy-state** *name*	(Optional) Displays information about the configured policy.
Step 8	**copy running-config startup-config**	(Optional) Saves this configuration change.

Note Multiple overrides for Zone, FLOGI, and FCNS EEM policies are not allowed.

Defining an Environment Variable

Detailed Steps

To define a variable to serve as a parameter in an EEM policy, follow these steps:

	Command	Purpose
Step 1	**config t**	Enters configuration mode.
Step 2	**event manager environment** *variable-name variable-value*	Creates an environment variable for EEM. The *variable-name* can be any case-sensitive alphanumeric string up to 29 characters. The *variable-value* can be any quoted alphanumeric string up to 39 characters.
Step 3	**show event manager environment**	(Optional) Displays information about the configured environment variables.
Step 4	**copy running-config startup-config**	(Optional) Saves this configuration change.

Verifying the EEM Configuration

To display EEM configuration information, perform one of the following tasks:

Command	Purpose
show event manager environment [*variable-name* | **all**]	Displays information about the event manager environment variables.
show event manager event-types [*event* | **all** | **module** *slot*]	Displays information about the event manager event types.
show event manager history events [detail] [maximum *num-events*] **[severity {catastrophic | minor | moderate | severe}]**	Displays the history of events for all policies.
show event manager policy internal [*policy-name*] [**inactive**]	Displays information about the configured policies.
show event manager policy-state *policy-name*	Displays information about policy state, including thresholds.
show event manager script system [*policy-name* | **all**]	Displays information about the script policies.
show event manager system-policy [**all**]	Displays information about the predefined system policies.
show running-config eem	Displays information about the running configuration for EEM.
show startup-config eem	Displays information about the startup configuration for EEM.

Configuration Examples for EEM

This example overrides the __lcm_module_failure system policy by changing the threshold for just module 3 hitless upgrade failures. This example also sends a syslog message. The settings in the system policy, __lcm_module_failure, apply in all other cases.

```
event manager applet example2 override __lcm_module_failure
 event module-failure type hitless-upgrade-failure module 3 count 2
 action 1 syslog priority errors msg module 3 “upgrade is not a hitless upgrade!”
 action 2 policy-default
```

This example modifies an overridden policy by changing the number of FCNS database entries to 1500. It also generates both the configured and the default syslog messages of the default system policy.

```
event manager applet fcns_policy override __fcns_entries_max_per
_switch
event fcns entries max-per-switch 1500
      action 1.0 syslog priority warnings msg  FCNS DB entries have reached the EEM limit
```

This example deletes the event of an overridden policy:

```
no event manager applet zone_policy
```

This example creates an EEM policy that allows the CLI command to execute but triggers an SNMP notification when a user enters configuration mode on the device:

```
event manager applet TEST
event cli match "conf t"
```

```
action 1.0 snmp-trap strdata "Confiiguration change"
action 2.0 event-default
```

Note You must add the **event-default** action statement to the EEM policy or EEM will not allow the CLI command to execute.

Additional References

For additional information related to implementing EEM, see the following section:

- MIBs, page 7-16

MIBs

MIBs	MIBs Link
• CISCO-EMBEDDED-EVENT-MGR-MIB	To locate and download MIBs, go to the following URL: http://www.cisco.com/en/US/products/ps5989/prod_technical_reference_list.html

Feature History for EEM

Table 7-2 lists the release history for this feature. Only features that were introduced or modified in Release 3.x or a later release appear in the table.

Table 7-2 Feature History for EEM

Feature Name	Releases	Feature Information
Embedded Event Manager (EEM)	4.1(3)	New chapter on configuring Embedded Event Manager (EEM) has been added.
EEM—Zone, FCNS, and FLOGI	6.2(11)	This feature enables users to configure custom limits for default Zone, FCNS, and FLOGI system policies.

Configuring RMON

RMON is an Internet Engineering Task Force (IETF) standard monitoring specification that allows various network agents and console systems to exchange network monitoring data. You can use the RMON alarms and events to monitor Cisco MDS 9000 Family switches running the Cisco SAN-OS Release 2.0(1b) or later or Cisco NX-OS Release 4.1(3) or later software.

This chapter includes the following sections:

- Information About RMON, page 8-1
- Default Settings, page 8-3
- Configuring RMON, page 8-3
- Verifying the RMON Configuration, page 8-5
- Additional References, page 8-6
- Feature History for RMON, page 8-6

Information About RMON

RMON is disabled by default, and no events or alarms are configured in the switch.

All switches in the Cisco MDS 9000 Family support the following RMON functions (defined in RFC 2819):

- Alarm—Each alarm monitors a specific management information base (MIB) object for a specified interval. When the MIB object value exceeds a specified value (rising threshold), the alarm condition is set and only one event is triggered regardless of how long the condition exists. When the MIB object value falls below a certain value (falling threshold), the alarm condition is cleared. This allows the alarm to trigger again when the rising threshold is crossed again.
- Event—Determines the action to take when an event is triggered by an alarm. The action can be to generate a log entry, an SNMP trap, or both.

For agent and management information, see the *Cisco MDS 9000 Family MIB Quick Reference*.

For information on an SNMP-compatible network management station, see the *System Management Configuration Guide, Cisco DCNM for SAN*.

For SNMP security-related CLI configurations, see the “Information About SNMP Security” section on page 10-1.

This section includes the following topics:

- RMON Configuration Information, page 8-2

- RMON Configuration Using Threshold Manager, page 8-2
- RMON Alarm Configuration Information, page 8-2

RMON Configuration Information

RMON is disabled by default and no events or alarms are configured in the switch. You can configure your RMON alarms and events by using the CLI or an SNMP-compatible network management station.

Tip We recommend an additional, generic RMON console application on the network management station (NMS) to take advantage of RMON's network management capabilities. Refer to the *System Management Configuration Guide*, *Cisco DCNM for SAN*.

RMON Configuration Using Threshold Manager

RMON is disabled by default and no events or alarms are configured in the switch. You can configure your RMON alarms and events by using the CLI or by using Threshold Manager in Device Manager.

The Threshold Monitor allows you to trigger an SNMP event or log a message when the selected statistic goes over a configured threshold value. RMON calls this a rising alarm threshold. The configurable settings are as follows:

- Variable—The statistic you want to set the threshold value on.
- Value—The value of the variable that you want the alarm to trigger at. This value is the difference (delta) between two consecutive polls of the variable by Device Manager.
- Sample—The sample period (in seconds) between two consecutive polls of the variable. Select your sample period such that the variable does not cross the threshold value you set under normal operating conditions.
- Warning—The warning level used by Device Manager to indicate the severity of the triggered alarm. This is a DCNM-SAN and Device Manager enhancement to RMON.

Note To configure any type of RMON alarm (absolute or delta, rising or falling threshold) click **More** on the Threshold Manager dialog box. You should be familiar with how RMON defines these concepts before configuring these advanced alarm types. Refer to the RMON-MIB (RFC 2819) for information on how to configure RMON alarms.

Note You must also configure SNMP on the switch to access RMON MIB objects.

RMON Alarm Configuration Information

Threshold Manager provides a list of common MIB objects to set an RMON threshold and alarm on. The alarm feature monitors a specific MIB object for a specified interval, triggers an alarm at a specified value (rising threshold), and resets the alarm at another value (falling threshold).

You can also set an alarm on any MIB object. The specified MIB must be an existing SNMP MIB object in standard dot notation (1.3.6.1.2.1.2.2.1.14.16777216 16 16777216 for ifInOctets.167772161616777216).

Use one of the following options to specify the interval to monitor the MIB variable (ranges from 1 to 4294967295 seconds):

- Use the **delta** option to test the change between samples of a MIB variable.
- Use the **absolute** option to test each MIB variable directly.
- Use the **delta** option to test any MIB objects that are counters.

The range for the **rising threshold** and **falling threshold** values is -2147483647 to 2147483647.

Caution The **falling threshold** must be less than the **rising threshold**.

You can optionally specify the following parameters:

- The event-number to trigger if the rising or falling threshold exceeds the specified limit.
- The owner of the alarm.

Default Settings

Table 8-1 lists the default settings for all RMON features in any switch.

Table 8-1 Default RMON Settings

Parameters	Default
RMON alarms	Disabled
RMON events	Disabled

Configuring RMON

RMON is disabled by default, and no events or alarms are configured in the switch.

This section includes the following topics:

- Configuring the RMON Traps in SNMP, page 8-3
- Configuring the RMON Alarm, page 8-4
- Configuring the RMON Event, page 8-5

Configuring the RMON Traps in SNMP

Prerequisites

You must enable the RMON traps in the SNMP configuration for the RMON configuration to function correctly.

Detailed Steps

To enable RMON traps in the SNMP configuration, follow these steps:

	Command	Purpose
Step 1	switch# **config t**	Enters configuration mode.
Step 2	switch(config)# **snmp-server enable traps rmon**	Enables the RMON trap types.

Note You must also configure SNMP on the switch to access RMON MIB objects.

Configuring the RMON Alarm

Detailed Steps

To enable RMON alarms, follow these steps:

	Command	Purpose
Step 1	switch# **config t**	Enters configuration mode.
Step 2	switch(config)# **rmon alarm 20 1.3.6.1.2.1.2.2.1.14.16777216 2900 delta rising-threshold 15 1 falling-threshold 0 owner test**	Configures RMON alarm number 20 to monitor the 1.3.6.1.2.1.2.2.1.14.16777216 once every 900 seconds until the alarm is disabled and checks the change in the variables rise or fall. If the value shows a MIB counter increase of 15 or more, the software triggers an alarm. The alarm in turn triggers event number 1, which is configured with the RMON event command. Possible events can include a log entry or an SNMP trap. If the MIB value changes by 0, the alarm is reset and can be triggered again. **Note** You can also configure the following rmon events: – Event 1: Fatal – Event 3: Error – Event 4: Warning – Event 5: Information
	switch(config)# **no rmon alarm 2**	Deletes the specified entry from the alarm table.

Configuring the RMON Event

Detailed Steps

To enable RMON events, follow these steps:

	Command	Purpose
Step 1	`switch# config t`	Enters configuration mode.
Step 2	`switch(config)# rmon event 2 log trap eventtrap description CriticalErrors owner Test2`	Creates RMON event number 2 to define CriticalErrors and generates a log entry when the event is triggered by the alarm. The user Test2 owns the row that is created in the event table by this command. This example also generates an SNMP trap when the event is triggered. **Note** You can also configure the following RMON events: – Event 1: Fatal – Event 3: Error – Event 4: Warning – Event 5: Information
	`switch(config)# no rmon event 5`	Deletes an entry from the RMON event table.

Verifying the RMON Configuration

To display the RMON configuration information, perform one of the following tasks:

Command	Purpose
show rmon alarms	Displays Configured RMON Alarms
show rmon hcalarms	Displays Configured RMON High Capacity Alarms
show rmon events	Displays Configured RMON Events

For detailed information about the fields in the output from these commands, refer to the *Cisco MDS 9000 Family Command Reference*.

Use the **show rmon** and **show snmp** commands to display configured RMON and SNMP information (see Example 8-1 and 8-3).

Example 8-1 Displays Configured RMON Alarms

```
switch# show rmon alarms
Alarm 1 is active, owned by admin
 Monitors 1.3.6.1.2.1.2.2.1.16.16777216 every 1 second(s)
 Taking delta samples, last value was 0
 Rising threshold is 1, assigned to event 0
 Falling threshold is 0, assigned to event 0
 On startup enable rising or falling alarm
```

Example 8-2 Displays Configured RMON High Capacity Alarms

```
switch# show rmon hcalarms
High Capacity Alarm 10 is active, owned by Testuser
 Monitors 1.3.6.1.2.1.31.1.1.1.6.16785408 every 300 second(s)
 Taking absolute samples, last value was 0 (valuePositive)
 Rising threshold low is 4294967295 & high is 15 (valuePositive)
 Rising threshold assigned to event 1
 Falling threshold low is 0 & high is 0 (valueNotAvailable)
 Falling threshold assigned to event 0
 On startup enable rising alarm
 Number of Failed Attempts is 0
```

Note High capacity RMON alarms can be configured using the CISCO-HC-ALARM-MIB. See the *Cisco MDS 9000 Family MIB Quick Reference*.

Example 8-3 Displays Configured RMON Events

```
switch# show rmon events
Event 2 is active, owned by Test2
 Description is CriticalErrors
 Event firing causes log and trap to community eventtrap, last fired 0
Event 500 is active, owned by admin
 Description is
 Event firing causes log, last fired 138807208
```

Additional References

For additional information related to implementing RMON, see the following section:

- MIBs, page 8-6

MIBs

MIBs	MIBs Link
• CISCO-RMON-CAPABILITY.my • CISCO-RMON-CONFIG-CAPABILITY.my • CISCO-RMON-CONFIG-MIB	To locate and download MIBs, go to the following URL: http://www.cisco.com/en/US/products/ps5989/prod_technical_reference_list.html

Feature History for RMON

The following table lists the release history for this feature. Only features that were introduced or modified in Release 3.x or a later release appear in the table.

Table 8-2 Feature History for RMON

Feature Name	Releases	Feature Information
RMON high capacity alarms	3.0(1)	Provides the show rmon high capacity alarms command to display RMON high capacity alarm values.

CHAPTER 9

Configuring Online Diagnostics

Beginning with Cisco MDS NX-OS Release 6.2, the Cisco MDS 9700 Family supports the GOLD (Generic Online Diagnostics) feature. GOLD is a diagnostic service which is also supported on the Cisco Nexus 7000 and 7700 series switches. This chapter describes how to configure the GOLD feature on a Cisco MDS 9700 Family switch.

This chapter includes the following sections:

Information About Online Diagnostics

Online diagnostics verifies the hardware and data paths and identifies faulty devices.

This section includes the following topics:

Online Diagnostic Overview

The GOLD (Generic Online Diagnostics) framework tests and verifies the hardware devices and data path in a live system.

The GOLD tests can be executed in three modes:

—Bootup

—Health-monitoring (also called Runtime)

—On-demand

The following explains the diagnostics test suite attributes:

- B/C/* - Bypass bootup level test / Complete bootup level test / NA
- P/* - Per port test / NA
- M/S/* - Only applicable to active / standby unit / NA
- D/N/* - Disruptive test / Non-disruptive test / NA
- H/O/* - Always enabled monitoring test / Conditionally enabled test / NA
- F/* - Fixed monitoring interval test / NA
- X/* - Not a health monitoring test / NA
- E/* - Sup to line card test / NA
- L/* - Exclusively run this test / NA
- T/* - Not an ondemand test / NA
- A/I/* - Monitoring is active / Monitoring is / NA

Bootup Diagnostics

Bootup diagnostics run during bootup and detect faulty hardware before a Cisco MDS 9700 Family switch brings a module online. For example, if there is a faulty module in the device, the appropriate bootup diagnostics test fails indicating the fault.

Note The bootup diagnostics tests are triggered during bootup.

Table 9-1 describes the bootup diagnostic tests for a linecard and a supervisor.

Table 9-1 Bootup Diagnostics

Diagnostic	Attributes	Description
Linecard		
EOBCPortLoopback	C**D**X**T*	Verifies the health of EOBC (Ethernet Out-of-Band Connectivity) interface.
OBFL	C**N**X**T*	Verifies the integrity of the OBFL (Onboard Failure Logging) flash.
BootupPortLoopback	CP*N**XE*T*	PortLoopback test that runs only during module bootup. **Note** Beginning from the Cisco MDS NX-OS Release 6.2(11), BootupPortLoopback failure for FC ports (on the Cisco MDS 48-Port 16-Gbps Fibre Channel module) puts the failed ports in a diagfailure mode.
Supervisor		
USB	C**N**X**T*	Verifies the USB controller initialization on a module.

Table 9-1 Bootup Diagnostics (continued)

Diagnostic	Attributes	Description
ManagementPortLoopback	C**D**X**T*	Verifies the health of management interface of a module.
EOBCPortLoopback	C**D**X**T*	Verifies the health of EOBC (Ethernet Out-of-Band Connectivity) interface.
OBFL	C**N**X**T*	Verifies the integrity of the OBFL (Onboard Failure Logging) flash.

When the **show module** command is executed, the result of bootup diagnostics is displayed as Online Diag Status. The result of individual test is displayed when the **show diagnostic result** command is executed for appropriate module and test ID or test name.

The Cisco MDS 9700 Family switch can be configured to either bypass the bootup diagnostics or run the complete set of bootup diagnostics. See the "Setting the Bootup Diagnostic Level" section on page 9-10.

Health Monitoring Diagnostics

Health Monitoring (HM) diagnostics is enabled by default to verify the health of a live system at periodic intervals. The monitoring interval (within an allowed range) can be configured by the user, which is different for each test. See the Activating a Health Monitoring Diagnostic Test, page 9-11 for more information. The diagnostic tests detect hardware errors and data path issues.

Health Monitoring diagnostics are non-disruptive (does not disrupt the data or control traffic). The Health Monitoring tests can be disabled by the user. See the Deactivating a Health Monitoring Diagnostic Test, page 9-12 for more information.

Table 9-2 describes the health monitoring diagnostics for a supervisor.

Table 9-2 Health Monitoring Diagnostics

Diagnostic	Default Testing Interval	Attributes	Description
Supervisor			
ASICRegisterCheck	20 seconds	***N******A	Verifies read or write access to scratch registers for the ASICs on the supervisor.
NVRAM	5 minutes	***N******A	Verifies the sanity of the NVRAM blocks on a supervisor.
RealTimeClock	5 minutes	***N******A	Verifies that the real-time clock on the supervisor is ticking.
PrimaryBootROM	30 minutes	***N******A	Verifies the integrity of the primary boot device on the supervisor.
SecondaryBootROM	30 minutes	***N******A	Verifies the integrity of the secondary boot device on the supervisor.

Table 9-2 Health Monitoring Diagnostics (continued)

Diagnostic	Default Testing Interval	Attributes	Description
CompactFlash	30 minutes	***N******A	Verifies access to the compact flash devices.
ExternalCompactFlash	30 minutes	***N******A	Verifies access to the external compact flash devices.
PwrMgmtBus	30 seconds	**MN******A	Verifies the connectivity of line cards and crossbars from supervisors through the Power Management Bus. **Note** Starting from Cisco MDS NX-OS Release 6.2(17), PwrMgmtBus is supported on a standby supervisor. For accurate results, ensure that GOLD is enabled on both active and standby supervisors.
SystemMgmtBus	30 seconds	**MN******A	Verifies the availability of the standby system management bus.
StatusBus	30 seconds	**MN******A	Verifies the status transmitted by the status bus for the supervisor, modules, and fabric cards.
StandbyFabricLoopback	30 seconds	**SN******A	Verifies the connectivity of the standby supervisor to the fabric modules.

Table 9-3 describes the health monitoring diagnostics for the *Cisco MDS 48-Port 16-Gbps Fibre Channel module*.

Table 9-3 Health Monitoring Diagnostics

Diagnostic	Default Testing Interval	Attributes	Description
Linecard			
ASICRegisterCheck	1 minute	***N******A	Verifies read or write access to scratch registers for the ASICs on a module.
PrimaryBootROM	30 minutes	***N******A	Verifies the integrity of the primary boot device on a module.
SecondaryBootROM	30 minutes	***N******A	Verifies the integrity of the secondary boot device on a module.

Table 9-3 ***Health Monitoring Diagnostics***

Diagnostic	Default Testing Interval	Attributes	Description
Linecard			
SnakeLoopback	20 minutes	*P*N***E**	Verifies connectivity from sup to all the ports in the Linecard. It checks the integrity of the data path up to the MAC component in a progressive manner (a single run of tests covers all the ports). It runs on all the ports irrespective of their states. This is a non-disruptive test.
IntPortLoopback	5 minutes	*P*N***E***	Verifies connectivity from sup to all the ports in the Linecard (one port at a time). It checks the integrity of the data path up to the MAC component. This test runs in Health Monitoring (HM) mode as well as it can be triggered in “on-demand mode.” This test is Non-disruptive. **Note** The IntPortLoopback test is supported beginning from the Cisco MDS NX-OS Release 6.2(7).
RewriteEngine Loopback	1 minute	*P*N***E**A	Verifies the integrity of each link on the fabric module from sup to linecard.

Table 9-4 describes the health monitoring diagnostics for the *Cisco MDS 48-Port 10-Gbps Fibre Channel over Ethernet Module.*

Table 9-4 ***Health Monitoring Diagnostics***

Diagnostic	Default Testing Interval	Attributes	Description
Linecard			
ASICRegisterCheck	1 minute	***N******A	Verifies read or write access to scratch registers for the ASICs on a module.
PrimaryBootROM	30 minutes	***N******A	Verifies the integrity of the primary boot device on a module.
SecondaryBootROM	30 minutes	***N******A	Verifies the integrity of the secondary boot device on a module.

Table 9-4 Health Monitoring Diagnostics (continued)

Diagnostic	Default Testing Interval	Attributes	Description
Linecard			
PortLoopback	15 minutes	*P*D***E**A	Verifies connectivity from sup to all the ports in the linecard. It checks the integrity of the data path up to PHY. This test runs in Health Monitoring (HM) mode as well as it can be triggered in "on-demand mode." It runs only on ports which are down (administratively). This is a disruptive test. **Note** The PortLoopback test runs only on ports which are administratively down.
RewriteEngine Loopback	1 minute	*P*N***E**A	Verifies the integrity of each link between linecards or sup and linecard through fabric modules.
SnakeLoopback	20 minutes	*P*N***E**	Verifies connectivity from sup to all the ports in the linecard. It checks the integrity of the data path up to the MAC component in a progressive manner. It runs on all the ports irrespective of their states. This is a non-disruptive test.

On-Demand Diagnostics

All the Health Monitoring tests can be evoked on demand also. On-demand diagnostics runs only when invoked by the user.

Cisco MDS 48-Port 16-Gbps Fibre Channel module—There are only 2 tests which can be invoked in on-demand mode only, see Table 9-5.

Cisco MDS 48-Port 10-Gbps Fibre Channel over Ethernet Module—There are no tests which can be invoked only in on-demand mode.

Note The data paths (PHY and SFP) which are not verified by other Health Monitoring tests can be verified by the PortLoopback and ExtPortLoopback tests.

You can run on-demand diagnostics whenever required. See the Starting or Stopping an On-Demand Diagnostic Test, page 9-12 for more information.

On Cisco MDS 48-Port 16-Gbps Fibre Channel module, both the PortLoopback and ExtPortLoopback tests are available in *on-demand mode* only as they are disruptive.

Table 9-5 describes the on-demand diagnostics (for linecard only) on the *Cisco MDS 48-Port 16-Gbps Fibre Channel module.*

Table 9-5 On-Demand Diagnostics

Diagnostic	Attributes	Description
Linecard		
PortLoopback	*P*D**XE***	Verifies connectivity from sup to all the ports in the linecard. It checks the integrity of the data path up to PHY. This test is available only in “on-demand mode.” The test runs on all the ports irrespective of the port state. **Note** Portloopback test is equivalent to the Serdes Loopback test of OHMS.
ExtPortLoopback	*P*D**XE***	Identifies hardware errors in the entire data path up to PHY including the SFP. **Note** Connect a loopback plug to loop the Tx of the port to the Rx of the port before running the test. If the loopback plug is not connected this test fails. **Note** The ExtPortLoopback test is supported beginning from the Cisco MDS NX-OS Release 6.2(11c).

Caution The PortLoopback and ExtPortLoopback tests are disruptive as they bring down the port for the purpose of diagnostic operation.

Recovery Actions on Specified Health Monitoring Diagnostics

When the Health Monitoring Diagnostic test fails consecutively for a threshold number of up to 10 times, it takes default action through EEM, which includes generating alerts (callhome, syslog) and logging (OBFL, exception logs), and the diagnostic test gets disabled on the failed instance (port or fabric or device).

These actions are informative, but they do not remove faulty devices from the live system, which can lead to network disruption, traffic black holing, and so forth.

Note Restart the Health Monitoring tests on failed instances by clearing the test result, deactivating, and then activate the test on the same module. For more information see Clearing Diagnostic Results, Deactivating a Health Monitoring Diagnostic Test, and Activating a Health Monitoring Diagnostic Test.

Beginning with the Cisco MDS NX-OS Release 6.2(11), the system can be configured to take corrective (recovery) actions in addition to the default actions after reaching the threshold number of consecutive failures for any of the following Health Monitoring tests:

- PortLoopback test (supported only on Cisco MDS 48-Port 10-Gbps FCoE Module)
- RewriteEngineLoopback test

- StandbyFabricLoopback test
- Internal PortLoopback test

Note The corrective (recovery) actions are disabled by default.

Corrective (recovery) Action for Supervisor

The corrective action for sup is as follows:

StandbyFabricLoopback test—The system reloads the standby supervisor and after three retries, the system powers off the standby supervisor.

Note After reload, when the standby supervisor comes online, the Health Monitoring Diagnostics starts by default.

Note One retry means a complete cycle of reloading the standby supervisor followed by threshold number of consecutive failures of StandbyFabricLoopback test.

Corrective (Recovery) Action for Cisco MDS 48-Port 16-Gbps Fibre Channel Module

The corrective action for each test is as follows:

- Internal PortLoopback test—The system brings down the failed ports and puts them in a *diagfailure state*.
- RewriteEngineLoopback test—The system takes different corrective action depending on the faulty component (supervisor or fabric):
  - On a chassis with a standby supervisor (which is in *ha-standby* state), if the system detects a fault with the active supervisor, the system triggers a *switchover* and switches over to the standby supervisor. If there is no standby supervisor in the chassis, the system does not take any action.

Note As the PortLoopback test is available only in on-demand mode on the Cisco MDS 48-Port 16-Gbps Fibre Channel Module, it does not support corrective actions.

Note From the Cisco MDS NX-OS Release 6.2(13), RewriteEngineLoopback test and corrective actions for RewriteEngineLookpback test are supported on the Cisco MDS 48-Port 16-Gbps Fibre Channel Module.

Corrective (Recovery) Action for Cisco MDS 48-Port 10-Gbps FCoE Module

- PortLoopback test—The system brings down the failed ports and puts them in an *error disabled* state.

- RewriteEngineLoopback test—The system takes different corrective action depending on the faulty component (supervisor or fabric):
  - On a chassis with a standby supervisor (which is in *ha-standby* state), if the system detects a fault with the active supervisor, the system triggers a "switchover" and switches over to the standby supervisor. If there is no standby supervisor in the chassis, the system does not take any action.

Note If the standby supervisor present in the chassis is powered down in response to the corrective action (associated with StandbyFabricLoopback test), the system does not take any action.

  - After 10 consecutive failures of the RewriteEngineLoopback test, if the faulty component is determined as the fabric module, it will reload that particular fabric module. This cycle of 10 consecutive failures and reload occurs for 3 consecutive times and then the fabric module is powered down.
  - After 10 consecutive failures of the PortLoopback test, if the faulty component is determined as the port, the system moves the faulty port to an error-disabled state.

High Availability

A key part of high availability is detecting hardware failures and taking corrective action in a live system. GOLD contributes to the high availability of the system by detecting hardware failures and providing feedback to software components to make switchover decisions.

Cisco MDS 9700 Family switches support stateless restart for GOLD by applying the running configuration after a reboot. After supervisor switchover, GOLD resumes diagnostics from the new active supervisor.

Licensing Requirements for Online Diagnostics

Product	License Requirement
Cisco NX-OS	Online diagnostics require no license. Any feature not included in a license package is bundled with the Cisco NX-OS system images and is provided at no extra charge to you. For a complete explanation of the Cisco NX-OS licensing scheme, see the *Cisco MDS 9000 Family NX-OS Licensing Guide*.

Default Settings

Table 9-6 lists the default settings for online diagnostic parameters.

Table 9-6 Default Online Diagnostic Parameters

Parameters	Default
Bootup diagnostics level	complete
Health Monitoring tests	active
Corrective (Recovery) actions	disabled

Configuring Online Diagnostics

This section includes the following topics:

- Setting the Bootup Diagnostic Level, page 9-10
- Displaying the List of Available Tests, page 9-11
- Activating a Health Monitoring Diagnostic Test, page 9-11
- Deactivating a Health Monitoring Diagnostic Test, page 9-12
- Starting or Stopping an On-Demand Diagnostic Test, page 9-12
- Clearing Diagnostic Results, page 9-14
- Simulating Diagnostic Results, page 9-15

Setting the Bootup Diagnostic Level

To configure the bootup diagnostics to run the complete set of tests, or to bypass all bootup diagnostic tests for a faster module bootup time, perform these tasks:

Note It is recommended to set the bootup online diagnostics level to **complete**.

	Command	Purpose

Step 1	**`config terminal`**
	Example:
	`switch# config terminal`
	`Enter configuration commands, one per line.  End with CNTL/Z.`
	`switch(config)#`
		Places in the global configuration mode.

Step 2	**`diagnostic bootup level`** {**`complete`** | **`bypass`**}
	Example:
	`switch(config)# diagnostic bootup level complete`
		Configures the bootup diagnostic level to trigger diagnostics when the device boots:
		• **complete**—Performs all bootup diagnostics. The default is complete.
		• **bypass**—Does not perform any bootup diagnostics.

Step 3	**`show diagnostic bootup level`**
	Example:
	`switch(config)# show diagnostic bootup level`
		(Optional) Displays the bootup diagnostic level (bypass or complete) that is currently in place on the device.

Step 4	**`copy running-config startup-config`**
	Example:
	`switch(config)# copy running-config startup-config`
		(Optional) Copies the running configuration to the startup configuration.

Displaying the List of Available Tests

	Command	Purpose
Step 1	**show diagnostic content module** *slot* **Example:** `switch# show diagnostic content module 1`	(Optional) Displays the list of information about the diagnostics and their attributes on a given module. • *slot*—The module number on which the test is activated.

Activating a Health Monitoring Diagnostic Test

	Command	Purpose

Step 1	**config terminal**
	
	Example:
	`switch# config terminal`
	`Enter configuration commands, one per line.  End with CNTL/Z.`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**diagnostic monitor interval module** *slot* **test** [*test-id* | *name* | **all**] **hour** *hour* **min** *minutes* **second** *sec* **Example:** `switch(config)# diagnostic monitor interval module 6 test 3 hour 1 min 0 sec 0`	(Optional) Configures the interval at which the specified test is run. If no interval is set, the test runs at the interval set previously, or the default interval. The arguments are as follows: • *slot*—The module number on which the test is activated. • *test-id*—Unique identification number for the test. • *name*—Predefined name of the test. • *hour* —The range is from 0 to 23 hours. • *minutes*—The range is from 0 to 59 minutes. • *seconds*—The range is from 0 to 59 seconds.

Step 3	**diagnostic monitor module** *slot* **test** [*test-id* | *name* | **all**]
	
	Example:
	`switch(config)# diagnostic monitor module 6 test 3`
	
	Example:
	`switch(config)# diagnostic monitor module 6 test SecondaryBootROM`
		Activates the specified test.
		The arguments are as follows:
		• *slot*—The module number on which the test is activated.
		• *test-id*—Unique identification number for the test.
		• *name*—Predefined name of the test.

Step 4	**show diagnostic content module** {*slot* | **all**} **Example:** `switch(config)# show diagnostic content module 6`	(Optional) Displays information about the diagnostics and their attributes. The argument is as follows: • *slot*—The module number on which the test is activated.

Deactivating a Health Monitoring Diagnostic Test

Note Inactive tests keep their current configuration but do not run at the scheduled interval.

To deactivate a test, perform this task:

Command	Purpose

no diagnostic monitor module *slot* **test** [*test-id* | *name* | **all**]
Example:
`switch(config)# no diagnostic monitor interval module 8 test 3`
Example:
`switch(config)# no diagnostic monitor interval module 8 test SecondaryBootROM`
	Deactivates the specified test.
	The arguments are as follows:
	• *slot*—The module number on which the test is activated.
	• *test-id*—Unique identification number for the test.
	• *name*—Predefined name of the test.

Starting or Stopping an On-Demand Diagnostic Test

On-demand diagnostic test can be started or stopped, with actions (optional) to modify the number of iterations to repeat the test and determine the action to be taken on test failure.

Note It is recommended to manually start a disruptive diagnostic test during a scheduled network maintenance time.

To start or stop an on-demand diagnostic test, perform these tasks:

	Command	Purpose
Step 1	**diagnostic ondemand iteration** *number* **Example:** `switch# diagnostic ondemand iteration 5`	(Optional) Configures the number of times that the on-demand test runs. The range is from 1 to 999. The default is 1.

Step 2	**diagnostic ondemand action-on-failure** {**continue failure-count** *num-fails* | **stop**}
	Example:
	`switch# diagnostic ondemand action-on-failure stop`
		(Optional) Configures the action to take if the on-demand test fails.

Step 3	**show diagnostic ondemand setting**
	Example:
	`switch# show diagnostic ondemand setting`
	`        Test iterations = 1`
	`        Action on test failure = continue until test failure limit reaches 1`
		(Optional) Displays information about on-demand diagnostics.

	Command	Purpose
Step 4	**diagnostic start module** *slot* **test** [*test-id* | *name* | **all** | **non-disruptive**] [**port** *port-number* | **all**] **Example:** `switch# diagnostic start module 6 test all`	Starts one or more diagnostic tests on a module. The arguments are as follows: • *all*—All the tests are triggered. **Note** The multiple test- id or name can be specified separated by commas. • *non-disruptive*—All the non-disruptive tests are triggered. • *port*— The tests can be invoked on a single port or range of ports or all ports.

	diagnostic run module *slot* **test** {PortLoopback | RewriteEngineLoopback | SnakeLoopback | IntPortLoopback | ExtPortLoopback} {**port** *port-id*}
	Example:
	`switch# diagnostic run module 3 test PortLoopback port 1`
		Starts the selected test on a module and displays the result on the completion of the test.
		Note This command is introduced from the Cisco MDS NX-OS Release 6.2(11c).
		For more information, see Starting an On-Demand Diagnostic Test in On-demand Mode, page 9-13.

Step 5	**diagnostic stop module** *slot* **test** [*test-id* | *name* | **all**] **Example:** `switch# diagnostic stop module 6 test all`	(Optional) Stops one or more diagnostic tests on a module.
Step 6	**show diagnostic status module** *slot* **Example:** `switch# show diagnostic status module 6`	(Optional) Displays all the tests which are running and queued up with information about the testing mode for that module. When the tests are not running or enqueued on the given module, the status is displayed as NA.
Step 7	**show diagnostic result module** *slot* **test** [*test-id* | *name*] **Example:** `switch# show diagnostic result module 1 test 3 SecondaryBootROM`	(Optional) Displays the result of the specified test.

Starting an On-Demand Diagnostic Test in *On-demand Mode*

OHMS (Online Health Management System) supports invoking tests in an “on-demand mode” which displays the results immediately after running the test.

From the Cisco MDS NX-OS Release 6.2(11c), GOLD supports invoking a specific test from a set of tests in “on-demand mode” and displaying the test results immediately after running the test.

GOLD tests can be invoked in an 'on-demand' mode using the **diagnostic start module** command**.** The **diagnostic run module** command also supports the same action but there are a few key differences between the two. The following are the differences between the two commands:

- In contrast to the **diagnostic start module** command, the **diagnostic run module** command blocks the current CLI session till the completion of test. After the completion of the test the CLI session is unblocked, and the result is displayed on the same console.

Note The CLI session will be blocked till the completion of test or for a maximum of 15 seconds. If the test is not completed within the time frame of 15 seconds, then GOLD unblocks the CLI session and allows the test to run in the background till completion.

Note Only one test can be invoked on a particular module using the **diagnostic run module** command. If the user attempts to invoke another test on the same module, it displays an error and the test is not invoked.

- The **diagnostic start module** command requires the user to execute the **show diagnostic result** command in order to display the test result. As the test runs in the background (the current CLI session is not blocked), the user needs to issue **show diagnostic result** command to view the result, whereas the test result is implicitly displayed on the same console when the **diagnostic run module** command is executed.
- The results displayed through the **diagnostic run** command are more intuitive than those from the **show diagnostic results** command.

Note The maximum number of ports recommended for the **diagnostic run module** command is 5.

Clearing Diagnostic Results

To clear the diagnostic test results, use the following command:

Command	Purpose

diagnostic clear result module [*slot* | **all**] **test** {*test-id* | **all**}
Example:
`switch# diagnostic clear result module 2 test all`
Example:
`switch# diagnostic clear result module 2 test 3`
	Clears the test result for the specified test.

Simulating Diagnostic Results

To test the behavior of GOLD in case of a diagnostic test failure, GOLD provides a mechanism to simulate the test failure on a port, sup, or fabric.

Note Simulating a failure after enabling corrective actions will result in triggering an action (see Corrective action) on the component where the failure was simulated.

To simulate a diagnostic test result, use the following command:

Command	Purpose
diagnostic test simulation module *slot* **test** *test-id* {**fail** | **random-fail** | **success**} [**port** *number* | **all**] **Example:** `switch# diagnostic test simulation module 2 test 2 fail`	Simulates a test result.

To clear the simulated diagnostic test result, use the following command:

Command	Purpose
diagnostic test simulation module *slot* **test** *test-id* **clear** **Example:** `switch# diagnostic test simulation module 2 test 2 clear`	Clears the simulated test result.

Enabling Corrective (Recovery) Actions

To enable corrective (recovery) actions, use the following command:

	Command	Purpose
Step 1	**configure terminal**	Enters global configuration mode.

Step 2	**diagnostic eem action conservative**
	Example:
	`switch(config)# diagnostic eem action conservative`
	`switch(config)#`
		Enables corrective or recovery actions.
		Note This command is applicable to the system as a whole and cannot be specifically configured to any particular module or test.

Step 3	**no diagnostic eem action conservative**	Disables corrective (recovery) actions.

Verifying the Online Diagnostics

To display GOLD test results, status, and configuration information use one of these commands:

Command	Purpose
show diagnostic bootup level	Displays information about bootup diagnostics.
show diagnostic content module {*slot* | **all**}	Displays information about diagnostic test content for a module.
show diagnostic description module *slot* **test** [*test-name* | **all**]	Displays the diagnostic description.
show diagnostic events [**error** | **info**]	Displays diagnostic events by error and information event type.
show diagnostic ondemand setting	Displays information about on-demand diagnostics.
show diagnostic result module *slot* [**test** [*test-name* | **all**]] [**detail**]	Displays information about the results of a diagnostic.
show diagnostic simulation module *slot*	Displays information about a simulated diagnostic.
show diagnostic status module *slot*	Displays the test status for all tests on a module.
show module	Displays module information including the online diagnostic test status.
show diagnostic eem action	Displays the status of the corrective (recovery) action.

Configuration Examples for Online Diagnostics

This example shows how to start all on-demand tests on a module:

```
diagnostic start module 6 test all
```

This example shows how to activate a test and set the test interval for a test on a module:

```
configure terminal
 diagnostic monitor module 6 test 2
 diagnostic monitor interval module 6 test 2 hour 3 min 30 sec 0
```

Additional References

For additional information related to implementing online diagnostics, see the following sections:

- Related Documents, page 9-17
- Feature History for Online Diagnostics, page 9-17

Related Documents

Related Topic	Document Title
Online diagnostics CLI commands	*Cisco MDS 9000 Family Command Reference*

Feature History for Online Diagnostics

Table 9-7 lists the release history for this feature.

Table 9-7 Feature History for Online Diagnostics

Feature Name	Releases	Feature Information
Support for RewriteEngine Loopback on Cisco MDS 48-Port 16-Gbps Fibre Channel Module	6.2(13)	This feature was introduced.
Support for ExtPortLoopback test on Cisco MDS 48-Port 16-Gbps Fibre Channel Module	6.2(11c)	This feature was introduced.
Support for corrective (recovery) actions in Cisco MDS 48-Port 16-Gbps Fibre Channel Module	6.2(11)	This feature was introduced.
PortLoopback testing to bring up sequence of FC ports	6.2(11)	This feature was introduced.
Support for corrective actions in Cisco MDS 48-Port 10 Gigabit Fibre Channel over Ethernet Module	6.2(11)	This feature was introduced.
GOLD support for RNG 10Gbps FCoE module	6.2(7)	This feature was introduced.
IntPortLoopback on Cisco MDS 48-Port 16-Gbps Fibre Channel Module	6.2(7)	This feature was introduced.
Generic Online Diagnostics (GOLD)	6.2	This feature was introduced.

Configuring SNMP

The CLI and SNMP use common roles in all switches in the Cisco MDS 9000 Family. You can use SNMP to modify a role that was created using the CLI and vice versa.

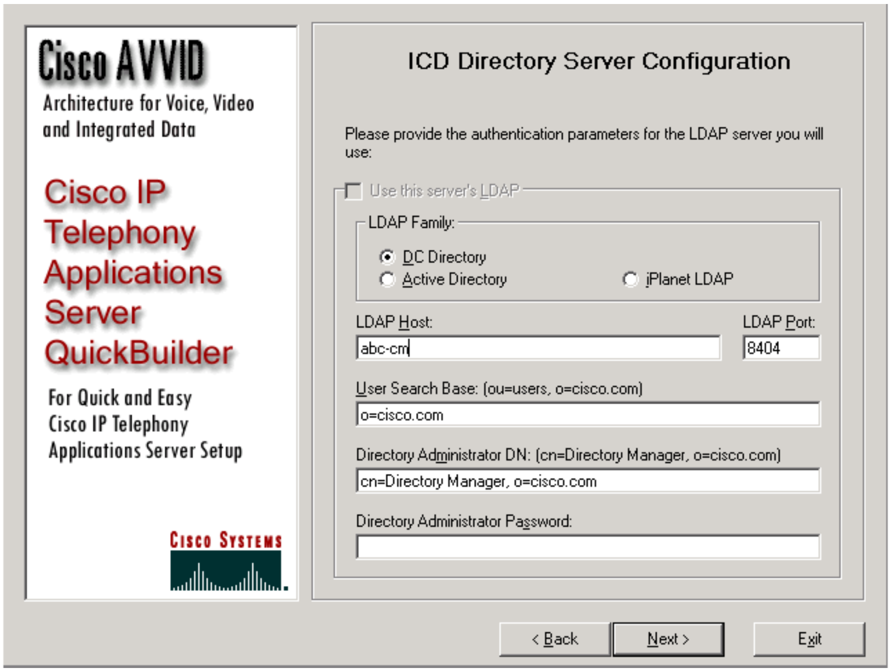
Users, passwords, and roles for all CLI and SNMP users are the same. A user configured through the CLI can access the switch using SNMP (for example, the Cisco DCNM-SAN or the Device Manager) and vice versa.

This chapter includes the following sections:

Information About SNMP Security

SNMP is an application layer protocol that facilitates the exchange of management information between network devices. In all Cisco MDS 9000 Family switches, three SNMP versions are available: SNMPv1, SNMPv2c, and SNMPv3 (see Figure 10-1).

Figure 10-1 SNMP Security


Cisco AVVID
Architecture for Voice, Video and Integrated Data
Cisco IP Telephony Applications Server QuickBuilder
For Quick and Easy Cisco IP Telephony Applications Server Setup
Cisco Systems
< Back
Next >
Exit

ICD Directory Server Configuration

Please provide the authentication parameters for the LDAP server you will use:

□ Use this server's LDAP

LDAP Family:

● DC Directory
○ Active Directory ○ iPlanet LDAP

LDAP Host: abc-cm

LDAP Port: 8404

User Search Base: (ou=users, o=cisco.com) o=cisco.com

Directory Administrator DN: (cn=Directory Manager, o=cisco.com) cn=Directory Manager, o=cisco.com

Directory Administrator Password:

85437

This section includes the following topics:

- SNMP Version 1 and Version 2c, page 10-4
- SNMP Version 3, page 10-4
- SNMPv3 CLI User Management and AAA Integration, page 10-4
- CLI and SNMP User Synchronization, page 10-5
- Restricting Switch Access, page 10-5
- Group-Based SNMP Access, page 10-5
- Creating and Modifying Users, page 10-6
- AES Encryption-Based Privacy, page 10-6
- Traps, Notifications, and Informs, page 10-6
- EngineID, page 10-7
- LinkUp/LinkDown Notifications for Switches, page 10-7

SNMP Version 1 and Version 2c

SNMP Version 1 (SNMPv1) and SNMP Version 2c (SNMPv2c) use a community string match for user authentication. Community strings provided a weak form of access control in earlier versions of SNMP. SNMPv3 provides much improved access control using strong authentication and should be preferred over SNMPv1 and SNMPv2c wherever it is supported.

SNMP Version 3

SNMP Version 3 (SNMPv3) is an interoperable standards-based protocol for network management. SNMPv3 provides secure access to devices by a combination of authenticating and encrypting frames over the network. The security features provided in SNMPv3 are:

- Message integrity—Ensures that a packet has not been tampered with in-transit.
- Authentication—Determines the message is from a valid source.
- Encryption—Scrambles the packet contents to prevent it from being seen by unauthorized sources.

SNMPv3 provides for both security models and security levels. A security model is an authentication strategy that is set up for a user and the role in which the user resides. A security level is the permitted level of security within a security model. A combination of a security model and a security level determines which security mechanism is employed when handling an SNMP packet.

SNMPv3 CLI User Management and AAA Integration

The Cisco NX-OS software implements RFC 3414 and RFC 3415, including user-based security model (USM) and role-based access control. While SNMP and the CLI have common role management and share the same credentials and access privileges, the local user database was not synchronized in earlier releases.

SNMPv3 user management can be centralized at the AAA server level. This centralized user management allows the SNMP agent running on the Cisco MDS switch to leverage the user authentication service of the AAA server. Once user authentication is verified, the SNMP PDUs are processed further. The AAA server also is used to store user group names. SNMP uses the group names to apply the access/role policy that is locally available in the switch.

CLI and SNMP User Synchronization

Any configuration changes made to the user group, role, or password results in database synchronization for both SNMP and AAA.

To create an SNMP or CLI user, use either the **username** or **snmp-server user** commands.

- The auth passphrase specified in the **snmp-server user** command is synchronized as the password for the CLI user.
- The password specified in the **username** command is synchronized as the auth and priv passphrases for the SNMP user.

Users are synchronized as follows:

- Deleting a user using either command results in the user being deleted for both SNMP and the CLI.
- User-role mapping changes are synchronized in SNMP and the CLI.

Note When the passphrase/password is specified in localized key/encrypted format, the password is not synchronized.

- Existing SNMP users continue to retain the auth and priv passphrases without any changes.
- If the management station creates an SNMP user in the usmUserTable, the corresponding CLI user is created without any password (login is disabled) and will have the network-operator role.

Restricting Switch Access

You can restrict access to a Cisco MDS 9000 Family switch using IP access control lists (IP-ACLs).

Group-Based SNMP Access

Note Because *group* is a standard SNMP term used industry-wide, we refer to role(s) as group(s) in this SNMP section.

SNMP access rights are organized by groups. Each group in SNMP is similar to a role through the CLI. Each group is defined with three accesses: read access, write access, and notification access. Each access can be enabled or disabled within each group.

You can begin communicating with the agent once your user name is created, your roles are set up by your administrator, and you are added to the roles.

Creating and Modifying Users

You can create users or modify existing users using SNMP, DCNM-SAN, or the CLI.

- SNMP—Create a user as a clone of an existing user in the usmUserTable on the switch. Once you have created the user, change the cloned secret key before activating the user. Refer to RFC 2574.
- DCNM-SAN.
- CLI—Create a user or modify an existing user using the **snmp-server user** command.

A network-operator and network-admin roles are available in a Cisco MDS 9000 Family switch. There is also a default-role if you want to use the GUI (DCNM-SAN and Device Manager). You can also use any role that is configured in the Common Roles database.

Tip All updates to the CLI security database and the SNMP user database are synchronized. You can use the SNMP password to log into either DCNM-SAN or Device Manager. However, after you use the CLI password to log into DCNM-SAN or Device Manager, you must use the CLI password for all future logins. If a user exists in both the SNMP database and the CLI database before upgrading to Cisco MDS SAN-OS Release 2.0(1b), then the set of roles assigned to the user becomes the union of both sets of roles after the upgrade.

AES Encryption-Based Privacy

The Advanced Encryption Standard (AES) is the symmetric cipher algorithm. The Cisco NX-OS software uses AES as one of the privacy protocols for SNMP message encryption and conforms with RFC 3826.

The **priv** option offers a choice of DES or 128-bit AES encryption for SNMP security encryption. The **priv** option along with the **aes-128** token indicates that this privacy password is for generating a 128-bit AES key. The AES priv password can have a minimum of eight characters. If the passphrases are specified in clear text, you can specify a maximum of 64 characters. If you use the localized key, you can specify a maximum of 130 characters.

Note For an SNMPv3 operation using the external AAA server, user configurations in the external AAA server require AES to be the privacy protocol to use SNMP PDU encryption.

Traps, Notifications, and Informs

A trap is an unacknowledged message sent from an SNMP agent to SNMP managers in SNMPv1. It is known as a notification in SNMPv2 and SNMPv3. An inform is an acknowledged message sent from an SNMP agent to an SNMP manager. If the response is not received by the agent, it sends the inform request again.

An inform consumes more resources in the agent and in the network. Unlike a trap or notification, which is discarded by the agent as soon as it is sent, an inform request must be held in memory until a response is received, or the request times out. Traps and notifications can be sent only once, while informs can be sent multiple times. Resending informs increases traffic and contributes to a higher overhead on the network. The same traps, notifications, and informs can be sent to multiple host receivers.

EngineID

An SNMP engineID is used to identify an entity independent of its source address. The entity consists of an SNMP engine and SNMP applications. The engineID is important when protocol data units (PDUs) must traverse proxies or Network Address Translator (NAT), or when the source entity itself has a dynamically assigned transport address or multiple source addresses.

In SNMPv3, engineIDs are also used for encoding and decoding secure PDUs. This is a requirement of the SNMPv3 user-based security model (USM).

There are two types of engineIDs, local and remote. On Cisco MDS 9000 Series switches, only remote engineIDs can be configured. The local engineID is automatically generated by the switch based on the MAC address and does not change.

LinkUp/LinkDown Notifications for Switches

You can configure which LinkUp/LinkDown notifications to enable on switches. You can enable the following types of LinkUp/LinkDown notifications:

- Cisco—Only notifications (cieLinkUp, cieLinkDown) defined in CISCO-IF-EXTENSION-MIB.my are sent for an interface, if ifLinkUpDownTrapEnable (defined in IF-MIB) is enabled for that interface.
- IETF—Only notifications (LinkUp, LinkDown) defined in IF-MIB are sent for an interface, if ifLinkUpDownTrapEnable (defined in IF-MIB) is enabled for that interface. Only the varbinds defined in the notification definition are sent with the notifications.
- IEFT extended—Only notifications (LinkUp, LinkDown) defined in IF-MIB are sent for an interface, if ifLinkUpDownTrapEnable (defined in IF-MIB) is enabled for that interface. In addition to the varbinds defined in the notification definition, varbinds defined in the IF-MIB specific to the Cisco Systems implementation are sent. This is the default setting.
- IEFT Cisco—Only notifications (LinkUp, LinkDown) defined in IF-MIB and notifications (cieLinkUp, cieLinkDown) defined in CISCO-IF-EXTENSION-MIB.my are sent for an interface, if ifLinkUpDownTrapEnable (defined in IF-MIB) is enabled for that interface. Only the varbinds defined in the notification definition are sent with the linkUp and linkDown notifications.
- IEFT extended Cisco—Only notifications (LinkUp, LinkDown) defined in IF-MIB and notifications (cieLinkUp, cieLinkDown) defined in CISCO-IF-EXTENSION-MIB.my are sent for an interface, if ifLinkUpDownTrapEnable (defined in IF-MIB) is enabled for that interface. In addition to the varbinds defined in linkUp and linkDown notification definition, varbinds defined in the IF-MIB specific to the Cisco Systems implementation are sent with the LinkUp and LinkDown notifications.

Note For more information on the varbinds defined in the IF-MIB specific to the Cisco Systems implementation, refer to the *Cisco MDS 9000 Family MIB Quick Reference.*

Scope of LinkUp and LinkDown Trap Settings

The LinkUp and LinkDown trap settings for the interfaces generate traps based on the following scope:

Switch-level Trap Setting	Interface-level Trap Setting	Trap Generated for Interface Links?
Enabled (default)	Enabled (default)	Yes
Enabled	Disabled	No
Disabled	Enabled	No
Disabled	Disabled	No

Default Settings

Table 10-1 lists the default settings for all SNMP features in any switch.

Table 10-1 Default SNMP Settings

Parameters	Default
User account	No expiry (unless configured)
Password	None

Configuring SNMP

SNMP is an application layer protocol that facilitates the exchange of management information between network devices.

This section includes the following topics:

- Assigning SNMPv3 Users to Multiple Roles, page 10-11
- Configuring SNMP Users from the CLI, page 10-9
- Enforcing SNMPv3 Message Encryption, page 10-10
- Assigning SNMPv3 Users to Multiple Roles, page 10-11
- Adding Communities, page 10-11

Assigning SNMP Switch Contact and Location Information

You can assign the switch contact information, which is limited to 32 characters (without spaces), and the switch location.

Detailed Steps

To configure contact and location information, follow these steps:

	Command	Purpose
Step 1	`switch#` **`config t`**	Enters configuration mode.
Step 2	`switch(config)#` **`snmp-server contact NewUser`**	Assigns the contact name for the switch.
	`switch(config)#` **`no snmp-server contact NewUser`**	Deletes the contact name for the switch.

	Command	Purpose
Step 3	switch(config)# **snmp-server location SanJose**	Assigns the switch location.
	switch(config)# **no snmp-server location SanJose**	Deletes the switch location.

Configuring SNMP Users from the CLI

The passphrase specified in the **snmp-server user** command and the **username** command are synchronized.

Restrictions

- When the passphrase or password is specified in the **localizedkey** or encrypted format, the password is not synchronized. If a configuration file is copied to the device, the passwords will not be set correctly if the configuration file was generated at a different device. Explicitly configure the desired passwords after copying the configuration into the device.

Detailed Steps

To create or modify SNMP users from the CLI, follow these steps:

	Command	Purpose
Step 1	switch# **config t** switch(config)#	Enters configuration mode.
Step 2	switch(config)# **snmp-server user joe network-admin auth sha abcd1234**	Creates or modifies the settings for a user (joe) in the network-admin role using the HMAC-SHA-96 authentication password (abcd1234).
	switch(config)# **snmp-server user sam network-admin auth md5 abcdefgh**	Creates or modifies the settings for a user (sam) in the network-admin role using the HMAC-MD5-96 authentication password (abcdefgh).
	switch(config)# **snmp-server user Bill network-admin auth sha abcd1234 priv abcdefgh**	Creates or modifies the settings for a user (Bill) in the network-admin role using the HMAC-SHA-96 authentication level and privacy encryption parameters.
	switch(config)# **no snmp-server user usernameA**	Deletes the user (usernameA) and all associated parameters.
	switch(config)# **no snmp-server usam role vsan-admin**	Deletes the specified user (usam) from the vsan-admin role.
	switch(config)# **snmp-server user user1 network-admin auth md5 0xab0211gh priv 0x45abf342 localizedkey**	Specifies the password to be in localized key format (RFC 2574). The localized key is provided in hexadecimal format (for example, 0xacbdef).
	switch(config)# **snmp-server user user2 auth md5 asdgfsadf priv aes-128 asgfsgkhkj**	Configures the user2 with the MD5 authentication protocol and AES-128 privacy protocol.
Step 3	switch(config)# **snmp-server user joe sangroup**	Adds the specified user (joe) to the sangroup role.
	switch(config)# **snmp-server user joe techdocs**	Adds the specified user (joe) to the techdocs role.

To create or modify passwords for SNMP users from the CLI, follow these steps:

	Command	Purpose

Step 1	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)# snmp-server user user1 role1 auth md5 0xab0211gh priv 0x45abf342 localizedkey`	Specifies the password to be in localized key format using the DES option for security encryption.
	`switch(config)# snmp-server user user1 role2 auth sha 0xab0211gh priv aes-128 0x45abf342 localizedkey`	Specifies the password to be in localized key format using the 128-bit AES option for security encryption

Note The **snmp-server user** command takes the engineID as an additional parameter. The engineID creates the notification target user (see the "Configuring the Notification Target User" section on page 10-17). If the engineID is not specified, the local user is created.

Enforcing SNMPv3 Message Encryption

By default the SNMP agent allows the securityLevel parameters of authNoPriv and authPriv for the SNMPv3 messages that use user-configured SNMPv3 message encryption with auth and priv keys.

Detailed Steps

To enforce the message encryption for a user, follow these steps:

	Command	Purpose

Step 1	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)# snmp-server user testUser enforcePriv`	Enforces the message encryption for SNMPv3 messages using this user. **Note** You can only use this command for previously existing users configured with both auth and priv keys. When the user is configured to enforce privacy, for any SNMPv3 PDU request using securityLevel parameter of either noAuthNoPriv or authNoPriv, the SNMP agent responds with authorizationError.
	`switch(config)# no snmp-server user testUser enforcePriv`	Disables SNMPv3 message encryption enforcement.

Alternatively, you can enforce the SNMPv3 message encryption globally on all the users using the following commands:

	Command	Purpose

Step 1	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)# snmp-server globalEnforcePriv`	Enforces the SNMPv3 message encryption for all the users on the switch.
	`switch(config)# no snmp-server globalEnforcePriv`	Disables global SNMPv3 message encryption enforcement.

Assigning SNMPv3 Users to Multiple Roles

The SNMP server user configuration is enhanced to accommodate multiple roles (groups) for SNMPv3 users. After the initial SNMPv3 user creation, you can map additional roles for the user.

Restrictions

- Only users belonging to a network-admin role can assign roles to other users.

Detailed Steps

To configure multiple roles for SNMPv3 users from the CLI, follow these steps:

	Command	Purpose
Step 1	switch# **config t** switch(config)#	Enters configuration mode.
Step 2	switch(config)# **snmp-server user NewUser role1**	Creates or modifies the settings for an SNMPv3 user (NewUser) for the role1 role.
	switch(config)# **snmp-server user NewUser role2**	Creates or modifies the settings for an SNMPv3 user (NewUser) for the role2 role.
	switch(config)# **no snmp-server user User5 role2**	Removes role2 for the specified user (User5).

Adding Communities

You can configure read-only or read-write access for SNMPv1 and SNMPv2 users. Refer to RFC 2576.

Detailed Steps

To create an SNMPv1 or SNMPv2c community, follow these steps:

	Command	Purpose
Step 1	switch# **config t**	Enters configuration mode.
Step 2	switch(config)# **snmp-server community snmp_Community ro**	Adds read-only access for the specified SNMP community.
	switch(config)# **snmp-server community snmp_Community rw**	Adds read-write access for the specified SNMP community.
	switch(config)# **no snmp-server community snmp_Community**	Deletes access for the specified SNMP community (default).

Configuring SNMP Trap and Inform Notifications

You can configure the Cisco MDS switch to send notifications to SNMP managers when particular events occur.

Note

- Switches can forward events (SNMP traps and informs) up to 10 destinations. When you try to configure the eleventh target host for SNMP, the following message is displayed:

```
switch(config)# snmp-server host 10.4.200.173 traps version 2c noauth
reached maximum allowed targets limit
```

- You must enable the RMON traps in the SNMP configuration. For more information, refer to "Configuring RMON" section on page 8-1.
- Use the SNMP-TARGET-MIB to obtain more information on the destinations to which notifications are to be sent either as traps or as informs. Refer to the *Cisco MDS 9000 Family MIB Quick Reference*.

This section includes the following topics:

Tip

The SNMPv1 option is not available with the **snmp-server host** *ip-address* **informs** command.

Configuring SNMPv2c Notifications

Detailed Steps

To configure SNMPv2c notifications using IPv4, follow these steps:

	Command	Purpose

Step 1	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)# snmp-server host 171.71.187.101 traps version 2c private udp-port 1163`	Configures the specified host to receive SNMPv2c traps using SNMPv2c community string (private).
	`switch(config)# no snmp-server host 171.71.187.101 traps version 2c private udp-port 2162`	Prevents the specified host from receiving SNMPv2c traps on the configured UDP port using SNMPv2c community string (private).

	Command	Purpose
Step 3	`switch(config)# snmp-server host 171.71.187.101 informs version 2c private udp-port 1163`	Configures the specified host to receive SNMPv2c informs using SNMPv2c community string (private).
	`switch(config)# no snmp-server host 171.71.187.101 informs version 2c private udp-port 2162`	Prevents the specified host from receiving SNMPv2c informs on the configured UDP port using SNMPv2c community string (private).

To configure SNMPv2c notifications using IPv6, follow these steps:

	Command	Purpose

Step 1	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)# snmp-server host 2001:0DB8:800:200C::417A traps version 2c private udp-port 1163`	Configures the specified host to receive SNMPv2c traps using SNMPv2c community string (private).
	`switch(config)# no snmp-server host 2001:0DB8:800:200C::417A traps version 2c private udp-port 2162`	Prevents the specified host from receiving SNMPv2c traps on the configured UDP port using SNMPv2c community string (private).
Step 3	`switch(config)# snmp-server host 2001:0DB8:800:200C::417A informs version 2c private udp-port 1163`	Configures the specified host to receive SNMPv2c informs using SNMPv2c community string (private).
	`switch(config)# no snmp-server host 2001:0DB8:800:200C::417A informs version 2c private udp-port 2162`	Prevents the specified host from receiving SNMPv2c informs on the configured UDP port using SNMPv2c community string (private).

To configure SNMPv2c notifications using the DNS Name of the SNMP notification host myhost.cisco.com, follow these steps:

	Command	Purpose

Step 1	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)# snmp-server host myhost.cisco.com traps version 2c private udp-port 1163`	Configures the specified host to receive SNMPv2c traps using SNMPv2c community string (private).
	`switch(config)# no snmp-server host myhost.cisco.com traps version 2c private udp-port 2162`	Prevents the specified host from receiving SNMPv2c traps on the configured UDP port using SNMPv2c community string (private).

	Command	Purpose
Step 3	switch(config)# **snmp-server host myhost.cisco.com informs version 2c private udp-port 1163**	Configures the specified host to receive SNMPv2c informs using SNMPv2c community string (private).
	switch(config)# **no snmp-server host myhost.cisco.com informs version 2c private udp-port 2162**	Prevents the specified host from receiving SNMPv2c informs on the configured UDP port using SNMPv2c community string (private).

Note Switches can forward events (SNMP traps and informs) up to 10 destinations.

Configuring SNMPv3 Notifications

Detailed Steps

To configure SNMPv3 notifications using IPv4, follow these steps:

	Command	Purpose
Step 1	switch# **config t** switch(config)#	Enters configuration mode.
Step 2	switch(config)# **snmp-server host 16.20.11.14 traps version 3 noauth testuser udp-port 1163**	Configures the specified host to receive SNMPv3 traps using SNMPv3 user (testuser) and securityLevel of noAuthNoPriv.
	switch(config)# **snmp-server host 16.20.11.14 informs version 3 auth testuser udp-port 1163**	Configures the specified host to receive SNMPv3 informs using SNMPv3 user (testuser) and securityLevel of AuthNoPriv.
	switch(config)# **snmp-server host 16.20.11.14 informs version 3 priv testuser udp-port 1163**	Configures the specified host to receive SNMPv3 informs using SNMPv3 user (testuser) and securityLevel of AuthPriv.
	switch(config)# **no snmp-server host 172.18.2.247 informs version 3 testuser noauth udp-port 2162**	Prevents the specified host from receiving SNMPv3 informs.

To configure SNMPv3 notifications using IPv6, follow these steps:

	Command	Purpose
Step 1	switch# **config t** switch(config)#	Enters configuration mode.
Step 2	switch(config)# **snmp-server host 2001:0DB8:800:200C::417A traps version 3 noauth testuser udp-port 1163**	Configures the specified host to receive SNMPv3 traps using SNMPv3 user (testuser) and securityLevel of noAuthNoPriv.
	switch(config)# **snmp-server host 2001:0DB8:800:200C::417A informs version 3 auth testuser udp-port 1163**	Configures the specified host to receive SNMPv3 informs using SNMPv3 user (testuser) and securityLevel of AuthNoPriv.
	switch(config)# **snmp-server host 2001:0DB8:800:200C::417A informs version 3 priv testuser udp-port 1163**	Configures the specified host to receive SNMPv3 informs using SNMPv3 user (testuser) and securityLevel of AuthPriv.
	switch(config)# **no snmp-server host 2001:0DB8:800:200C::417A informs version 3 testuser noauth udp-port 2162**	Prevents the specified host from receiving SNMPv3 informs.

To configure SNMPv3 notifications using the DNS Name of the SNMP notification host myhost.cisco.com, follow these steps:

	Command	Purpose

Step 1	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)# snmp-server host myhost.cisco.com traps version 3 noauth testuser udp-port 1163`	Configures the specified host to receive SNMPv3 traps using SNMPv3 user (testuser) and securityLevel of noAuthNoPriv.
	`switch(config)# snmp-server host myhost.cisco.com informs version 3 auth testuser udp-port 1163`	Configures the specified host to receive SNMPv3 informs using SNMPv3 user (testuser) and securityLevel of AuthNoPriv.
	`switch(config)# snmp-server host myhost.cisco.com informs version 3 priv testuser udp-port 1163`	Configures the specified host to receive SNMPv3 informs using SNMPv3 user (testuser) and securityLevel of AuthPriv.
	`switch(config)# no snmp-server host myhost.cisco.com informs version 3 testuser noauth udp-port 2162`	Prevents the specified host from receiving SNMPv3 informs.

Enabling SNMP Notifications

Table 10-2 lists the CLI commands that enable the notifications for Cisco NX-OS MIBs.

Table 10-2 Enabling SNMP Notifications

MIB	DCNM-SAN Check Boxes
CISCO-ENTITY-FRU-CONTROL-MIB	Click the **Other** tab and check **FRU Changes**.
CISCO-FCC-MIB	Click the **Other** tab and check **FCC**.
CISCO-DM-MIB	Click the **FC** tab and check **Domain Mgr RCF**.
CISCO-NS-MIB	Click the **FC** tab and check **Name Server**.
CISCO-FCS-MIB	Click the **Other** tab and check **FCS Rejects**.
CISCO-FDMI-MIB	Click the **Other** tab and check **FDMI**.
CISCO-FSPF-MIB	Click the **FC** tab and check **FSPF Neighbor Change**.
CISCO-LICENSE-MGR-MIB	Click the **Other** tab and check **License Manager**.
CISCO-IPSEC-SIGNALLING-MIB	Click the **Other** tab and check **IPSEC**.
CISCO-PSM-MIB	Click the **Other** tab and check **Port Security**.
CISCO-RSCN-MIB	Click the **FC** tab and check **RSCN ILS**, and **RCSN ELS**.
SNMPv2-MIB	Click the **Other** tab and check **SNMP AuthFailure**.
VRRP-MIB, CISCO-IETF-VRRP-MIB	Click the **Other** tab and check **VRRP.**
CISCO-ZS-MIB	Click the **FC** tab and check **Zone Rejects**, **Zone Merge Failures**, **Zone Merge Successes**, **Zone Default Policy Change**, and **Zone Unsuppd Mode**.

The following notifications are enabled by default:

- entity fru
- license
- link ietf-extended

All other notifications are disabled by default.

Summary Steps

You can enable or disable the supported traps at the following levels:

- Switch level—You can use **snmp-server enable traps** command to enable all the traps in the supported MIBs at the switch level.
- Feature level—You can use **snmp-server enable traps** command with the feature name to enable traps at the feature level.

```
switch =>snmp-server enable traps callhome ?
event-notify    Callhome External Event Notification
smtp-send-fail  SMTP Message Send Fail notification
```

- Individual traps - You can use **snmp-server enable traps** command with the feature name to enable traps at the individual level.

```
switch =>snmp-server enable traps callhome event-notify ?
```

Note The **snmp-server enable traps** CLI command enables both traps and informs, depending on how you configured SNMP. See the notifications displayed with the **snmp-server host** CLI command.

Detailed Steps

To enable individual notifications, follow these steps:

	Command	Purpose

Step 1	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)# snmp-server enable traps fcdomain`	Enables the specified SNMP (fcdomain) notification.
	`switch(config)# no snmp-server enable traps`	Disables the specified SNMP notification. If a notification name is not specified, all notifications are disabled.

Configuring the Notification Target User

You must configure a notification target user on the switch for sending SNMPv3 inform notifications to the SNMP manager.

For authenticating and decrypting the received INFORM PDU, the SNMP manager should have the same user credentials in its local configuration data store of users.

The number of SNMP hosts is limited to 10. When the number of SNMP hosts reaches 10, the switch generates following syslog message.

%SNMPD-3-ERROR: SNMP log error : SNMP reached maximum allowed target. Please delete any unused targets

Detailed Steps

To configure the notification target user, use the following command:

	Command	Purpose
Step 1	switch# **config t** switch(config)#	Enters configuration mode.
Step 2	switch(config)# **snmp-server user testusr auth md5 xyub20gh priv xyub20gh engineID 00:00:00:63:00:01:00:a1:ac:15:10:03**	Configures the notification target user with the specified credentials for the SNMP manager with the specified engine ID.
	switch(config)# **no snmp-server user testusr auth md5 xyub20gh priv xyub20gh engineID 00:00:00:63:00:01:00:a1:ac:15:10:03**	Removes the notification target user.

The credentials of the notification target user are used for encrypting the SNMPv3 inform notification messages to the configured SNMPmanager (as in the **snmp-server host** command).

Configuring LinkUp/LinkDown Notifications for Switches

Detailed Steps

To configure the LinkUp/LinkDown notification for a switch using NX-OS Release 4.1(x) and earlier, follow these steps:

	Command	Purpose
Step 1	switch# **config t** switch(config)#	Enters configuration mode.
Step 2	switch(config)# **snmp-server enable traps link**	Enables (default) only IETF extended LinkUp/LinkDown notifications.
	switch(config)# **snmp-server enable traps link cisco**	Enables Cisco Systems defined notifications.
	switch(config)# **snmp-server enable traps link ietf**	Enables only IETF LinkUp/LinkDown notifications.
	switch(config)# **snmp-server enable traps link ietf-extended**	Enables (default) only IETF extended LinkUp/LinkDown notifications with extra varbinds.
	switch(config)# **snmp-server enable traps link ietf cisco**	Enables IETF (LinkUp/LinkDown) and Cisco Systems defined (cieLinkUp/cieLinkDown) notifications.
	switch(config)# **snmp-server enable traps link ietf-extended cisco**	Enables IEFT (LinkUp/LinkDown) notifications with extra varbinds and Cisco Systems defined (cieLinkUp/cieLinkDown) notifications.
	switch(config)# **no snmp-server enable traps link**	Reverts to the default setting (IETF extended).

Note If both IETF and IETF extended are enabled, the **show snmp traps** command displays both as enabled. However, as a trap, you will receive only one trap with IETF extended payload.

To configure the LinkUp/LinkDown notification for a switch using NX-OS Release 4.2(1) and later, follow these steps:

	Command	Purpose

Step 1	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

	Command	Purpose
Step 2	`switch(config)# snmp-server enable traps link extended-link`	Enables only IETF extended linkUp notifications.
	`switch(config)# snmp-server enable traps link extended-linkDown`	Enables only IETF extended linkDown notifications.
	`switch(config)# snmp-server enable traps link cieLinkDown`	Enables Cisco extended link state down notification.
	`switch(config)# snmp-server enable traps link cieLinkUp`	Enables Cisco extended link state up notification.
	`switch(config)# snmp-server enable traps link connUnitPortStatusChange`	Enables FCMGMT The overall status of the connectivity unit Notification.
	`switch(config)# snmp-server enable traps link delayed-link-state-change`	Enables Delayed link state change. Disable the delayed link state traps to allow the device to generate port down SNMP alerts immediately. • Use the **no system delayed-traps enable mode FX** command on NX-OS versions 6.2(5) or lower. • Use the **no snmp-server enable traps link delayed-link-state-change** command on NX-OS version 6.2(7) and above. **Note** For upgrade between specific NX-OS release versions, ensure that delayed link state traps are disabled. When migrating from an earlier release like 5.(x) or 6.1(x) or 6.2(x) to a release 6.2(7) and above, ensure that you explicitly disable the delayed link state traps using **no snmp-server enable traps link delayed-link-state-change** command.
	`switch(config)# snmp-server enable traps link extended-linkDown`	Enables IETF extended link state down notification.
	`switch(config)# snmp-server enable traps link extended-linkUp`	Enables IETF extended link state down notification.
	`switch(config)# snmp-server enable traps link fcTrunkIfDownNotify`	Enables FCFE Link state down notification.
	`switch(config)# snmp-server enable traps link fcTrunkIfUpNotify`	Enables FCFE Link state up notification.
	`switch(config)# snmp-server enable traps link fcot-inserted`	Enables FCOT info trap.
	`switch(config)# snmp-server enable traps link fcot-removed`	Enables FCOT info trap.
	`switch(config)# snmp-server enable traps link linkDown`	Enables IETF Link state down notification.
	`switch(config)# snmp-server enable traps link linkUp`	Enables IETF Link state up notification.
	`switch(config)# no snmp-server enable traps link`	Reverts to the default setting (IETF extended).

Configuring Up/Down SNMP Link-State Traps for Interfaces

By default, SNMP link-state traps are enabled for all interfaces. Whenever a link toggles its state from Up to Down or vice versa, an SNMP trap is generated.

In some instances, you may find that you have numerous switches with hundreds of interfaces, many of which do not require monitoring of the link state. In such cases, you may elect to disable link-state traps.

Detailed Steps

To disable SNMP link-state traps for specific interfaces, follow these steps:

	Command	Purpose

Step 1	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)# interface bay 6`	Specifies the interface on which to disable SNMP link-state traps.
	`switch(config-if)# no link-state-trap`	Disables SNMP link-state traps for the interface.
	`switch(config-if)# link-state-trap`	Enables SNMP link-state traps for the interface.

Configuring Entity (FRU) Traps

Detailed Steps

To enable individual SNMP trap control, follow these steps:

	Command	Purpose

Step 1	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)# snmp-server enable traps entity`	Enables individual SNMP trap control.
	`switch(config)# snmp-server enable entity_fan_status_change`	Enables entity fan status change.
	`switch(config)# snmp-server enable entity_mib_change`	Enables entity MIB change.
	`switch(config)# snmp-server enable entity_module_inserted`	Enables entity module to be inserted.
	`switch(config)# snmp-server enable entity_module_removed`	Enables entity module to be removed.
	`switch(config)# snmp-server enable entity_module_status_change`	Enables entity module status change.
	`switch(config)# snmp-server enable entity_power_out_change`	Enables entity power out change.
	`switch(config)# snmp-server enable entity_power_status_change`	Enables entity power status change.
	`switch(config)# snmp-server enable entity_unrecognised_module`	Enables entity unrecognized module.

Note All these traps have to do with legacy FRU traps.

Verifying SNMP Configuration

To display the SNMP configuration information, perform one of the following tasks:

Command	Purpose
show running-config	Displays the running configuration
show interface	Displays the SNMP link-state trap configuration for a particular interface
show snmp trap	Displays all the notifications and their status
show snmp	Displays configured SNMP information, counter information for SNMP contact, location, and packet settings.

For detailed information about the fields in the output from these commands, refer to the *Cisco MDS 9000 Family Command Reference*.

This section covers the following topics:

- Viewing the Up/Down SNMP Link-State Traps for Interfaces, page 10-22
- Displaying SNMP Traps, page 10-23
- Displaying SNMP Security Information, page 10-24

Viewing the Up/Down SNMP Link-State Traps for Interfaces

Whenever you disable an SNMP link-state trap for an interface, the command is also added to the running configuration of the system.

To view the running configuration, use the **show running-config** command for the interface.

```
switch# show running-config
version 3.1(2)
....
interface bay5
interface bay6
  no link-state-trap <-----command is added to the running configuration for the interface
interface bay7...
```

To view the SNMP link-state trap configuration for a particular interface, enter the **show interface** command.

```
switch# show interface bay 6
bay6 is down (Administratively down)
    Hardware is Fibre Channel
    Port WWN is 20:0b:00:05:30:01:70:2c
    Admin port mode is auto, trunk mode is on
    snmp link-state traps are disabled
Port vsan is 1
    Receive data field Size is 2112
    Beacon is turned off
    5 minutes input rate 0 bits/sec, 0 bytes/sec, 0 frames/sec
    5 minutes output rate 0 bits/sec, 0 bytes/sec, 0 frames/sec
      0 frames input, 0 bytes
        0 discards, 0 errors
        0 CRC,  0 unknown class
        0 too long, 0 too short
      0 frames output, 0 bytes
        0 discards, 0 errors
      0 input OLS, 0 LRR, 0 NOS, 0 loop inits
      0 output OLS, 0 LRR, 0 NOS, 0 loop inits
```

Displaying SNMP Traps

You can use the **show snmp trap** command to display all the notifications and their status.

```
switch# show snmp trap
--------------------------------------------------------------------------------
Trap type                                                              Enabled
--------------------------------------------------------------------------------
entity               : entity_mib_change                            Yes
entity               : entity_module_status_change                  Yes
entity               : entity_power_status_change                   Yes
entity               : entity_module_inserted                       Yes
entity               : entity_module_removed                        Yes
entity               : entity_unrecognised_module                   Yes
entity               : entity_fan_status_change                     Yes
entity               : entity_power_out_change                      Yes
link                 : linkDown                                     Yes
link                 : linkUp                                       Yes
link                 : extended-linkDown                            Yes
link                 : extended-linkUp                              Yes
link                 : cieLinkDown                                  Yes
link                 : cieLinkUp                                    Yes
link                 : connUnitPortStatusChange                     Yes
link                 : fcTrunkIfUpNotify                            Yes
link                 : fcTrunkIfDownNotify                          Yes
link                 : delayed-link-state-change                    Yes
link                 : fcot-inserted                                Yes
link                 : fcot-removed                                 Yes
callhome             : event-notify                                 No
callhome             : smtp-send-fail                               No
cfs                  : state-change-notif                           No
cfs                  : merge-failure                                No
fcdomain             : dmNewPrincipalSwitchNotify                   No
fcdomain             : dmDomainIdNotAssignedNotify                  No
fcdomain             : dmFabricChangeNotify                         No
rf                   : redundancy_framework                         Yes
aaa                  : server-state-change                          No
license              : notify-license-expiry                        Yes
license              : notify-no-license-for-feature                Yes
license              : notify-licensefile-missing                   Yes
license              : notify-license-expiry-warning                Yes
scsi                 : scsi-disc-complete                           No
fcns                 : reject-reg-req                               No
fcns                 : local-entry-change                           No
fcns                 : db-full                                      No
fcns                 : remote-entry-change                          No
rscn                 : rscnElsRejectReqNotify                       No
rscn                 : rscnIlsRejectReqNotify                       No
rscn                 : rscnElsRxRejectReqNotify                     No
rscn                 : rscnIlsRxRejectReqNotify                     No
fcs                  : request-reject                               No
fcs                  : discovery-complete                           No
fctrace              : route                                        No
zone                 : request-reject1                              No
zone                 : merge-success                                No
zone                 : merge-failure                                No
zone                 : default-zone-behavior-change                 No
zone                 : unsupp-mem                                   No
port-security        : fport-violation                              No
port-security        : eport-violation                              No
port-security        : fabric-binding-violation                     No
vni                  : virtual-interface-created                    No
vni                  : virtual-interface-removed                    No
vsan                 : vsanStatusChange                             No
vsan                 : vsanPortMembershipChange                     No
fspf                 : fspfNbrStateChangeNotify                     No
upgrade              : UpgradeOpNotifyOnCompletion                  No
upgrade              : UpgradeJobStatusNotify                       No
feature-control      : FeatureOpStatusChange                        No
vrrp                 : cVrrpNotificationNewMaster                   No
fdmi                 : cfdmiRejectRegNotify                         No
snmp                 : authentication                               No
```

Displaying SNMP Security Information

Use the **show snmp** commands to display configured SNMP information (see Example 10-1 and 10-6).

Example 10-1 Displays SNMP User Details

```
switch# show snmp user
______________________________________________________________
                  SNMP USERS
______________________________________________________________

User                          Auth  Priv(enforce) Groups
____                          ____  _____________ ______
admin                         md5   des(no)       network-admin

testusr                       md5   aes-128(no)   role111
                                                  role222
______________________________________________________________
 NOTIFICATION TARGET USERS (configured  for sending V3 Inform)
______________________________________________________________
User                          Auth  Priv
____                          ____  ____
testtargetusr                 md5   des
(EngineID 0:0:0:63:0:1:0:0:0:15:10:3)
```

Example 10-2 Displays SNMP Community Information

```
switch# show snmp community
Community             Group / Access      context
_________             ______________      _______
dcnm_user             network-admin
admin                 network-admin
```

Example 10-3 Displays SNMP Host Information

```
switch# show snmp host
Host                            Port Version  Level  Type   SecName
____                            ____ _______  ______ ____  ______
```

```
171.16.126.34                   2162 v2c      noauth trap   public
171.16.75.106                   2162 v2c      noauth trap   public
...
171.31.58.97                    2162 v2c      auth   trap   public
...
```

The **show snmp** command displays counter information for SNMP contact, location, and packet settings. This command provides information that is used entirely by the Cisco MDS 9000 Family DCNM-SAN (refer to the *System Management Configuration Guide, Cisco DCNM for SAN*). See Example 10-4.

Example 10-4 Displays SNMP Information

```
switch# show snmp
sys contact:
sys location:
1631 SNMP packets input
        0 Bad SNMP versions
        0 Unknown community name
        0 Illegal operation for community name supplied
        0 Encoding errors
        64294 Number of requested variables
        1 Number of altered variables
        1628 Get-request PDUs
        0 Get-next PDUs
        1 Set-request PDUs
152725 SNMP packets output
        0 Too big errors
        1 No such name errors
        0 Bad values errors
        0 General errors
Community                      Group / Access
---------                      ------
public                          rw

______________________________________________________________
                  SNMP USERS
______________________________________________________________

User                          Auth  Priv(enforce) Groups
____                          ____  _____________ ______
admin                         md5   des(no)       network-admin

testusr                       md5   aes-128(no)   role111
                                                  role222

______________________________________________________________
 NOTIFICATION TARGET USERS (configured  for sending V3 Inform)
______________________________________________________________

User                          Auth  Priv
____                          ____  ____
testtargetusr                 md5   des
(EngineID 0:0:0:63:0:1:0:0:0:15:10:3)
```

Example 10-5 Displays SNMP Engine IDs

```
switch# show snmp engineID
Local SNMP engineID: [Hex] 8000000903000DEC2CF180
                     [Dec] 128:000:000:009:003:000:013:236:044:241:128
```

Example 10-6 Displays Information on SNMP Security Groups

```
switch# show snmp group
groupname: network-admin
security model: any
security level: noAuthNoPriv
readview: network-admin-rd
writeview: network-admin-wr
notifyview: network-admin-rd
storage-type: permanent
row status: active

groupname: network-admin
security model: any
security level: authNoPriv
readview: network-admin-rd
writeview: network-admin-wr
notifyview: network-admin-rd
storage-type: permanent
row status: active

groupname: network-operator
security model: any
security level: noAuthNoPriv
readview: network-operator-rd
writeview: network-operator-wr
notifyview: network-operator-rd
storage-type: permanent
row status: active

groupname: network-operator
security model: any
security level: authNoPriv
readview: network-operator-rd
writeview: network-operator-wr
notifyview: network-operator-rd
storage-type: permanent
row status: active
```

Additional References

For additional information related to implementing SNMP, see the following sections:

- MIBs, page 10-26

MIBs

MIBs	MIBs Link
• CISCO-SNMP-TARGET-EXT-MIB • CISCO-SNMP-VACM-EXT-MIB	To locate and download MIBs, go to the following URL: http://www.cisco.com/en/US/products/ps5989/prod_technical_reference_list.html

Feature History for SNMP

Table 10-3 lists the release history for this feature. Only features that were introduced or modified in Release 3.x or a later release appear in the table.

Table 10-3 Feature History for SNMP

Feature Name	Releases	Feature Information
SNMP Central Infra feature	4.2(1)	Added the new SNMP Central Infra feature details.
Configuring SNMP Users from the CLI	3.3(1a)	Removed des from the command switch(config)# snmp-server user user1 role1 auth md5 0xab0211gh priv 0x45abf342 localizedkey in To create or modify passwords for SNMP users from the CLI.

Configuring Domain Parameters

The Fibre Channel domain (fcdomain) feature performs principal switch selection, domain ID distribution, FC ID allocation, and fabric reconfiguration functions as described in the FC-SW-2 standards.

This chapter includes the following sections:

Information About Fibre Channel Domains

The Fibre Channel domain (fcdomain) feature performs principal switch selection, domain ID distribution, FC ID allocation, and fabric reconfiguration functions as described in the FC-SW-2 standards. The domains are configured on a per VSAN basis. If you do not configure a domain ID, the local switch uses a random ID.

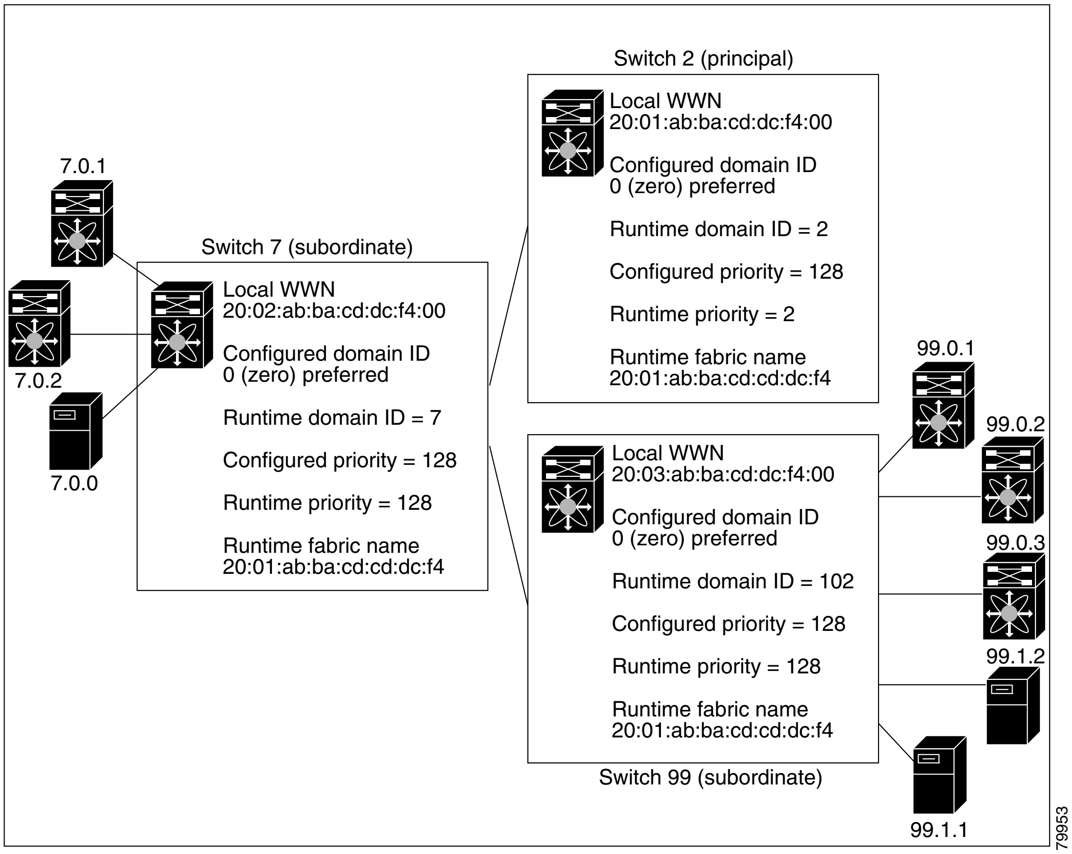
This section describes each fcdomain phase:

- Principal switch selection—This phase guarantees the selection of a unique principal switch across the fabric.
- Domain ID distribution—This phase guarantees each switch in the fabric obtains a unique domain ID.
- FC ID allocation—This phase guarantees a unique FC ID assignment to each device attached to the corresponding switch in the fabric.
- Fabric reconfiguration—This phase guarantees a resynchronization of all switches in the fabric to ensure they simultaneously restart a new principal switch selection phase.

Caution Changes to fcdomain parameters should not be performed on a daily basis. These changes should be made by an administrator or individual who is completely familiar with switch operations.

Figure 11-1 shows a sample fcdomain configuration.

Figure 11-1 Sample fcdomain Configuration



This section includes the following topics:

- Domain Restart, page 11-3
- Domain Manager All Optimization, page 11-3
- Domain Manager Fast Restart, page 11-4
- Domain Manager Scale Restart, page 11-4
- Domain Manager Selective Restart, page 11-4
- Switch Priority, page 11-4
- fcdomain Initiation, page 11-5
- Incoming RCFs, page 11-5
- Autoreconfiguring Merged Fabrics, page 11-5
- Domain IDs, page 11-5
- Locking the Fabric, page 11-8

Domain Restart

Fibre Channel domains can be started disruptively or nondisruptively. If you perform a disruptive restart, reconfigure fabric (RCF) frames are sent to other switches in the fabric and data traffic is disrupted on all the switches in the VSAN (including remotely segmented ISLs). If you perform a nondisruptive restart, build fabric (BF) frames are sent to other switches in the fabric and data traffic is disrupted only on the switch.

If you are attempting to resolve a domain ID conflict, you must manually assign domain IDs. A disruptive restart is required to apply most configuration changes, including manually assigned domain IDs. Nondisruptive domain restarts are acceptable only when changing a preferred domain ID into a static one (and the actual domain ID remains the same).

Note It is not recommended to use disruptive restart followed by VSAN suspend / no-suspend, since it is used only for recovery purpose when normal restart does not solve the problem.

Note A static domain is specifically configured by the user and may be different from the runtime domain. If the domain IDs are different, the runtime domain ID changes to take on the static domain ID after the next restart, either disruptive or nondisruptive.

Tip If a VSAN is in interop mode, you cannot restart the fcdomain for that VSAN disruptively.

You can apply most of the configurations to their corresponding runtime values. Each of the following sections provide further details on how the fcdomain parameters are applied to the runtime values.

The **fcdomain restart** command applies your changes to the runtime settings. Use the **disruptive** option to apply most of the configurations to their corresponding runtime values, including preferred domain IDs (see the "Domain IDs" section on page 11-5).

Domain Manager All Optimization

Domain Manager All Optimization feature can be used to enable or disable all of the optimization modes.

Note You cannot enable all the optimizations such as Selective Restart, Fast Restart, and Scale Restart in VSANs where Interop mode is enabled (non-native modes). Also you cannot move a VSAN where the optimizations are enabled into Interop mode 1 to 4.

Domain Manager Fast Restart

As of Cisco MDS SAN-OS Release 3.0(2), when a principal link fails, the domain manager must select a new principal link. By default, the domain manager starts a build fabric phase, followed by a principal switch selection phase. Both of these phases involve all the switches in the VSAN and together take at least 15 seconds to complete. To reduce the time required for the domain manager to select a new principal link, you can enable the domain manager fast restart feature.

When fast restart is enabled and a backup link is available, the domain manager needs only a few milliseconds to select a new principal link to replace the one that failed. Also, the reconfiguration required to select the new principal link only affects the two switches that are directly attached to the failed link, not the entire VSAN. When a backup link is not available, the domain manager reverts to the default behavior and starts a build fabric phase, followed by a principal switch selection phase. We recommend using fast restart on most fabrics, especially those with a large number of logical ports (3200 or more), where a logical port is an instance of a physical port in a VSAN.

Domain Manager Scale Restart

During fabric reconfiguration, as and when principal switch assigns a domain ID to a switch (including itself), it transmits an Exchange Fabric Parameter (EFP) request. This request basically carries domain list information of the fabric. So whenever domain list grows there will be a Exchange Fabric Parameter flooded to the fabric. With this feature optimization enabled, a single consolidated Exchange Fabric Parameter request will be flooded by the principal switch once the domain identifier allocation phase is completed. This feature optimization cannot be supported in interop mode.

Scale Restart will be enabled by default in all native VSANs. It will not be enabled in interop VSANs.

Domain Manager Selective Restart

In the Fibre Channel protocol, fabric reconfiguration starts with build fabric frame flooding, which indicates to all the switches in the fabric that the fabric is changing. This process is followed by principal switch selection and domain ID allocation phases. During the build fabric flooding phase, build fabric frames are flooded on all the links. A switch may have more than one link to a peer switch. In such cases, the build fabric frame can be sent to only one of the links to the peer switch. This situation reduces the number of build fabric frames that are to be exchanged during the build fabric phase of fabric reconfiguration. Enabling this feature optimization, sends the build frame to only one of the peer switch links which benefits scaling.

Switch Priority

Any new switch can become the principal switch when it joins a stable fabric. During the principal switch selection phase, the switch with the highest priority becomes the principal switch. If two switches have the same configured priority, the switch with the lower WWN becomes the principal switch.

The priority configuration is applied to runtime when the fcdomain is restarted (see the "Domain Restart" section on page 11-3). This configuration is applicable to both disruptive and nondisruptive restarts.

fcdomain Initiation

By default, the fcdomain feature is enabled on each switch. If you disable the fcdomain feature in a switch, that switch can no longer participate with other switches in the fabric. The fcdomain configuration is applied to runtime through a disruptive restart.

Incoming RCFs

You can configure the rcf-reject option on a per-interface, per-VSAN basis. By default, the rcf-reject option is disabled (that is, RCF request frames are not automatically rejected).

The **rcf-reject** option takes effect immediately. No fcdomain restart is required.

Autoreconfiguring Merged Fabrics

By default, the autoreconfigure option is disabled. When you join two switches belonging to two different stable fabrics that have overlapping domains, the following cases apply:

- If the autoreconfigure option is enabled on both switches, a disruptive reconfiguration phase is started.
- If the autoreconfigure option is disabled on either or both switches, the links between the two switches become isolated.
- RCF is expected only when auto-reconfigure is enabled in entire fabric.

The autoreconfigure option takes immediate effect at runtime. You do not need to restart the fcdomain. If a domain is currently isolated due to domain overlap, and you later enable the autoreconfigure option on both switches, the fabric continues to be isolated. If you enabled the autoreconfigure option on both switches before connecting the fabric, a disruptive reconfiguration (RCF) will occur. A disruptive reconfiguration may affect data traffic. You can nondisruptively reconfigure the fcdomain by changing the configured domains on the overlapping links and eliminating the domain overlap.

Domain IDs

Domain IDs uniquely identify a switch in a VSAN. A switch may have different domain IDs in different VSANs. The domain ID is part of the overall FC ID.

The configured domain ID can be preferred or static. By default, the configured domain ID is 0 (zero) and the configured type is preferred.

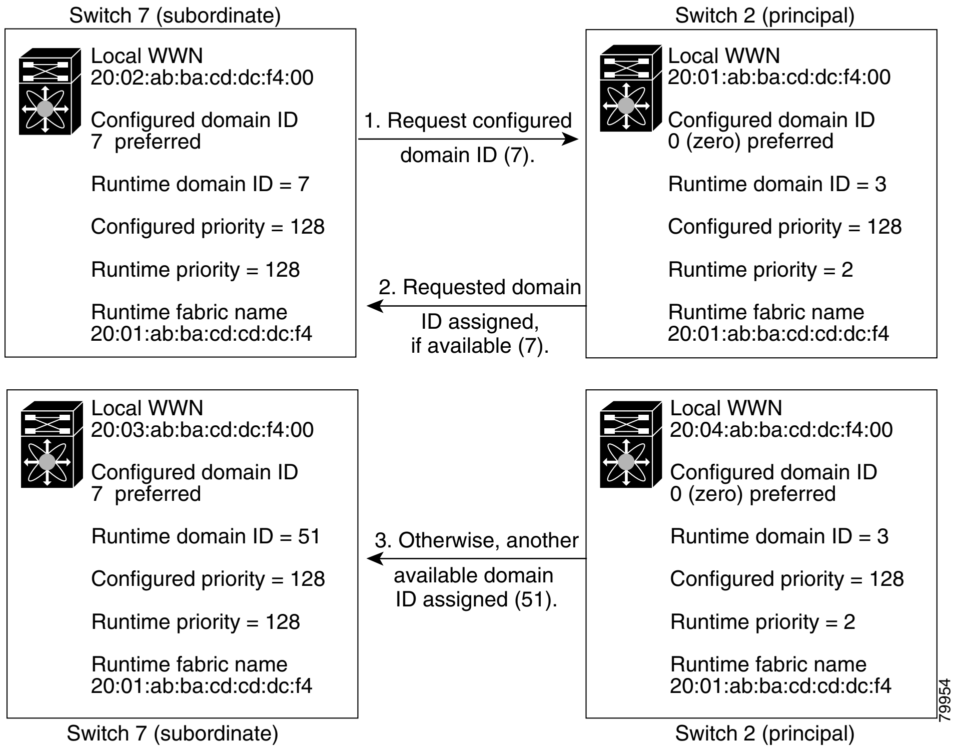
Note The 0 (zero) value can be configured only if you use the preferred option.

If you do not configure a domain ID, the local switch sends a random ID in its request. We recommend that you use static domain IDs.

When a subordinate switch requests a domain, the following process takes place (see Figure 11-2):

1. The local switch sends a configured domain ID request to the principal switch.
2. The principal switch assigns the requested domain ID if available. Otherwise, it assigns another available domain ID.

Figure 11-2 Configuration Process Using the preferred Option



The behavior for a subordinate switch changes based on three factors:

- The allowed domain ID lists.
- The configured domain ID.
- The domain ID that the principal switch has assigned to the requesting switch.

In specific situations, the changes are as follows:

- When the received domain ID is not within the allowed list, the requested domain ID becomes the runtime domain ID and all interfaces on that VSAN are isolated.
- When the assigned and requested domain IDs are the same, the preferred and static options are not relevant, and the assigned domain ID becomes the runtime domain ID.
- When the assigned and requested domain IDs are different, the following cases apply:
  - If the configured type is static, the assigned domain ID is discarded, all local interfaces are isolated, and the local switch assigns itself the configured domain ID, which becomes the runtime domain ID.
  - If the configured type is preferred, the local switch accepts the domain ID assigned by the principal switch and the assigned domain ID becomes the runtime domain ID.

If you change the configured domain ID, the change is only accepted if the new domain ID is included in all the allowed domain ID lists currently configured in the VSAN. Alternatively, you can also configure zero-preferred domain ID.

Tip When the FICON feature is enabled in a given VSAN, the domain ID for that VSAN remains in the static state. You can change the static ID value but you cannot change it to the preferred option.

Note In an IVR without NAT configuration, if one VSAN in the IVR topology is configured with static domain IDs, then the other VSANs (edge or transit) in the topology should also be configured with static domain IDs.
In an IVR NAT configuration, if one VSAN in the IVR topology is configured with static domain IDs, then the IVR domains that can be exported to that VSAN must also be assigned static domains.

Caution You must enter the **fcdomain restart** command if you want to apply the configured domain changes to the runtime domain.

Note If you have configured an allowed domain ID list, the domain IDs that you add must be in that range for the VSAN. See the "Configuring Allowed Domain ID Lists" section on page 11-16.

Specifying Static or Preferred Domain IDs

When you assign a static domain ID type, you are requesting a particular domain ID. If the switch does not get the requested address, it will isolate itself from the fabric. When you specify a preferred domain ID, you are also requesting a particular domain ID; however, if the requested domain ID is unavailable, then the switch will accept another domain ID.

While the static option can be applied at runtime after a disruptive or nondisruptive restart, the preferred option is applied at runtime only after a disruptive restart (see the "Domain Restart" section on page 11-3).

Allowed Domain ID Lists

By default, the valid range for an assigned domain ID list is from 1 to 239. You can specify a list of ranges to be in the allowed domain ID list and separate each range with a comma. The principal switch assigns domain IDs that are available in the locally configured allowed domain list.

Use allowed domain ID lists to design your VSANs with non-overlapping domain IDs. This helps you in the future if you need to implement IVR without the NAT feature.

CFS Distribution of Allowed Domain ID Lists

You can enable the distribution of the allowed domain ID lists configuration information to all Cisco MDS switches in the fabric using the Cisco Fabric Services (CFS) infrastructure. This feature allows you to synchronize the configuration across the fabric from the console of a single MDS switch. Since the same configuration is distributed to the entire VSAN, you avoid possible misconfiguration and the likelihood that two switches in the same VSAN have configured incompatible allowed domains.

Use CFS to distribute the allowed domain ID list to ensure consistency in the allowed domain ID lists on all switches in the VSAN.

Note We recommend configuring the allow domain ID list and committing it on the principle switch.

For more information about CFS, see Chapter 2, "Using the CFS Infrastructure".

Contiguous Domain ID Assignments

By default, the contiguous domain assignment is disabled. When a subordinate switch requests the principal switch for two or more domains and the domains are not contiguous, the following cases apply:

- If the contiguous domain assignment is enabled in the principal switch, the principal switch locates contiguous domains and assigns them to the subordinate switches. If contiguous domains are not available, the NX-OS software rejects this request.
- If the contiguous domain assignment is disabled in the principal switch, the principal switch assigns the available domains to the subordinate switch.

Locking the Fabric

The first action that modifies the existing configuration creates the pending configuration and locks the feature in the fabric. Once you lock the fabric, the following conditions apply:

- No other user can make any configuration changes to this feature.
- A pending configuration is created by copying the active configuration. Modifications from this point on are made to the pending configuration and remain there until you commit the changes to the active configuration (and other switches in the fabric) or discard them.

Committing Changes

To apply the pending domain configuration changes to other MDS switches in the VSAN, you must commit the changes. The pending configuration changes are distributed and, on a successful commit, the configuration changes are applied to the active configuration in the MDS switches throughout the VSAN and the fabric lock is released.

Clearing a Fabric Lock

If you have performed a domain configuration task and have not released the lock by either committing or discarding the changes, an administrator can release the lock from any switch in the fabric. If the administrator performs this task, your pending changes are discarded and the fabric lock is released.

The pending changes are only available in the volatile directory and are discarded if the switch is restarted.

FC IDs

When an N or NL port logs into a Cisco MDS 9000 Family switch, it is assigned an FC ID. By default, the persistent FC ID feature is enabled. If this feature is disabled, the following consequences apply:

- An N or NL port logs into a Cisco MDS 9000 Family switch. The WWN of the requesting N or NL port and the assigned FC ID are retained and stored in a volatile cache. The contents of this volatile cache are not saved across reboots.
- The switch is designed to preserve the binding FC ID to the WWN on a best-effort basis. For example, if one N port disconnects from the switch and its FC ID is requested by another device, this request is granted and the WWN with the initial FC ID association is released.

- The volatile cache stores up to 4000 entries of WWN to FC ID binding. If this cache is full, a new (more recent) entry overwrites the oldest entry in the cache. In this case, the corresponding WWN to FC ID association for the oldest entry is lost.
- The switch connection behavior differs between N ports and NL ports:
  - N ports receive the same FC IDs if disconnected and reconnected to any port within the same switch (as long as it belongs to the same VSAN).
  - NL ports receive the same FC IDs only if connected back to the same port on the switch to which they were originally connected.

Persistent FC IDs

When persistent FC IDs are enabled, the following consequences apply:

- The currently *in use* FC IDs in the fcdomain are saved across reboots.
- The fcdomain automatically populates the database with dynamic entries that the switch has learned about after a device (host or disk) is plugged into a port interface.

Persistent FC ID Configuration

When the persistent FC ID feature is enabled, you can enter the persistent FC ID submode and add static or dynamic entries in the FC ID database. By default, all added entries are static. Persistent FC IDs are configured on a per-VSAN basis. Follow these requirements to manually configure a persistent FC ID:

- Ensure that the persistent FC ID feature is enabled in the required VSAN.
- Ensure that the required VSAN is an active VSAN—persistent FC IDs can only be configured on active VSANs.
- Verify that the domain part of the FC ID is the same as the runtime domain ID in the required VSAN. If the software detects a domain mismatch, the command is rejected.
- Verify that the port field of the FC ID is 0 (zero) when configuring an area.

Note FICON uses a different scheme for allocating FC IDs based in the front panel port number. This scheme takes precedence over FC ID persistence in FICON VSANs.

About Unique Area FC IDs for HBAs

Note Read this section only if the HBA port and the storage port are connected to the same switch.

Some HBA ports require a different area ID than storage ports when they are both connected to the same switch. For example, if the storage port FC ID is 0x6f7704, the area for this port is 77. In this case, the HBA port’s area can be anything other than 77. The HBA port’s FC ID must be manually configured to be different from the storage port’s FC ID.

Switches in the Cisco MDS 9000 Family facilitate this requirement with the FC ID persistence feature. You can use this feature to preassign an FC ID with a different area to either the storage port or the HBA port.

Persistent FC ID Selective Purging

Persistent FC IDs can be purged selectively. Static entries and FC IDs currently in use cannot be deleted. Table 11-1 identifies the FC ID entries that are deleted or retained when persistent FC IDs are purged.

Table 11-1 Purged FC IDs

Persistent FC ID state	Persistent Usage State	Action
Static	In use	Not deleted
Static	Not in use	Not deleted
Dynamic	In use	Not deleted
Dynamic	Not in use	Deleted

Guidelines and Limitations

- When you change the configuration, be sure to save the running configuration. The next time you reboot the switch, the saved configuration is used. If you do not save the configuration, the previously saved startup configuration is used.
- Domain IDs and VSAN values used in all procedures are only provided as examples. Be sure to use IDs and values that apply to your configuration.

Default Settings

Table 11-2 lists the default settings for all fcdomain parameters.

Table 11-2 Default fcdomain Parameters

Parameters	Default
fcdomain feature	Enabled.
Configured domain ID	0 (zero).
Configured domain	Preferred.
auto-reconfigure option	Disabled.
contiguous-allocation option	Disabled.
Priority	128.
Allowed list	1 to 239.
Fabric name	20:01:00:05:30:00:28:df.
rcf-reject	Disabled.
Persistent FC ID	Enabled.
Allowed domain ID list configuration distribution	Disabled.

Configuring Fibre Channel Domains

This section describes the fcdomain feature and includes the following topics:

Restarting a Domain

Domain Configuration Scenarios:

Switch Configuration

Irrespective of how the switches in VSAN 6 are configured, **fcdomain restart disruptive vsan 6** causes all devices of all switches in VSAN 6 to log out, causing data traffic disruption.

Configured domain and the runtime domain are the same

Assuming that the configured domain and the runtime domain are the same on all switches, **fcdomain restart vsan 6** does not cause any devices in VSAN 6 to log out.

Configured domain and runtime domain are not the same

Assuming that on some switches in VSAN 6 the configured domain and the runtime domain are not the same, fcdomain **restart vsan 6** causes the devices in VSAN 6 attached to the switches whose statically configured and runtime domain differ to log out, causing data traffic disruption.

Detailed Steps

To restart the fabric disruptively or nondisruptively, follow these steps:

	Command	Purpose

Step 1	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)# fcdomain restart vsan 1`	Is nondisruptive of data traffic over the entire network, but it can be disruptive on a switch if its configured domain is static and numerically not the same as its runtime domain (For example, the configured domain is 11 static and the runtime domain is 99).
Step 3	`switch(config)# fcdomain restart disruptive vsan 1`	Distrupts data traffic across all switches in the VSAN.

Enabling Domain Manager All Optimization

To enable the Domain Manager All Optimization feature, follow these steps:

	Command	Purpose

Step 1	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)# fcdomain optimize all vsan 3`	Enables all domain manager optimization (selective-restart, fast-restart, scale-restart) on VSAN 3.
	`switch(config)# fcdomain optimize all vsan 7 - 10`	Enables domain manager all optimization on the range of VSANs from VSAN 7 to VSAN 10.
	`switch(config)# no fcdomain optimize all vsan 8`	Disables domain manager all optimization on VSAN 8.

Enabling Domain Manager Fast Restart

Detailed Steps

To enable the domain manager fast restart feature in Cisco SAN-OS Release 3.0(2) or later, or MDS NX-OS Release 4.1(1a) or later, follow these steps:

	Command	Purpose

Step 1	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)# fcdomain optimize fast-restart vsan 3`	Enables domain manager fast restart on VSAN 3.
	`switch(config)# fcdomain optimize fast-restart vsan 7 - 10`	Enables domain manager fast restart on the range of VSANs from VSAN 7 to VSAN 10.
	`switch(config)# no fcdomain optimize fast-restart vsan 8`	Disables (default) domain manager fast restart on VSAN 8.

Enabling Domain Manager Scale Restart

To enable the domain manager scale restart feature, follow these steps:

	Command	Purpose

Step 1	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)# fcdomain optimize scale-restart vsan 3`	Enables domain manager scale restart on VSAN 3.
	`switch(config)# fcdomain optimize scale-restart vsan 7 - 10`	Enables (default) domain manager scale restart on the range of VSANs from VSAN 7 to VSAN 10.
	`switch(config)# no fcdomain optimize scale-restart vsan 8`	Disables domain manager scale restart on VSAN 8.

Enabling Domain Manager Selective Restart

To enable the domain manager selective restart feature in Cisco SAN-OS Release 3.0(2) or later, or MDS NX-OS Release 4.1(1a) or later, follow these steps:

	Command	Purpose

Step 1	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)# fcdomain optimize selective-restart vsan 3`	Enables domain manager selective restart on VSAN 3.
	`switch(config)# fcdomain optimize selective-restart vsan 7 - 10`	Enables domain manager selective restart on the range of VSANs from VSAN 7 to VSAN 10.
	`switch(config)# no fcdomain optimize selective-restart vsan 8`	Disables (default) domain manager selective restart on VSAN 8.

Configuring Switch Priority

Restrictions

- By default, the configured priority is 128. The valid range to set the priority is between 1 and 254. Priority 1 has the highest priority. Value 255 is accepted from other switches, but cannot be locally configured.

Detailed Steps

To configure the priority for the principal switch, follow these steps:

	Command	Purpose
Step 1	switch# **config t** switch(config)#	Enters configuration mode.
Step 2	switch(config)# **fcdomain priority 25 VSAN 99**	Configures a priority of 25 for the local switch in VSAN 99.
	switch(config)# **no fcdomain priority 25 VSAN 99**	Reverts the priority to the factory default (128) in VSAN 99.

Configuring Fabric Names

Detailed Steps

To set the fabric name value for a disabled fcdomain, follow these steps:

	Command	Purpose
Step 1	switch# **config t** switch(config)#	Enters configuration mode.
Step 2	switch(config)# **fcdomain fabric-name 20:1:ac:16:5e:0:21:01 vsan 3**	Assigns the configured fabric name value in VSAN 3.
	switch(config)# **no fcdomain fabric-name 20:1:ac:16:5e:0:21:01 vsan 3010**	Changes the fabric name value to the factory default (20:01:00:05:30:00:28:df) in VSAN 3010.

Rejecting Incoming RCFs

Detailed Steps

To reject incoming RCF request frames, follow these steps:

	Command	Purpose
Step 1	switch# **config t** switch(config)#	Enters configuration mode.
Step 2	switch(config)# **interface fc1/1** switch(config-if)#	Configures the specified interface.
Step 3	switch(config-if)# **fcdomain rcf-reject vsan 1**	Enables the RCF filter on the specified interface in VSAN 1.
	switch(config-if)# **no fcdomain rcf-reject vsan 1**	Disables (default) the RCF filter on the specified interface in VSAN 1.

Enabling Autoreconfiguration

Detailed Steps

To enable automatic reconfiguration in a specific VSAN (or range of VSANs), follow these steps:

	Command	Purpose

Step 1	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)# fcdomain auto-reconfigure vsan 10`	Enables the automatic reconfiguration option in VSAN 10.
	`switch(config)# no fcdomain auto-reconfigure 69`	Disables the automatic reconfiguration option and reverts it to the factory default in VSAN 69.

Configuring Domain IDs

Domain IDs uniquely identify a switch in a VSAN. A switch may have different domain IDs in different VSANs. The domain ID is part of the overall FC ID.

The configured domain ID can be preferred or static. By default, the configured domain ID is 0 (zero) and the configured type is preferred.

This section includes the following topics:

- Specifying Static or Preferred Domain IDs, page 11-15
- Configuring Allowed Domain ID Lists, page 11-16
- Enabling Allowed Domain ID Distribution, page 11-17
- Enabling Contiguous Domain ID Assignments, page 11-18

Specifying Static or Preferred Domain IDs

Restrictions

- Within a VSAN all switches should have the same domain ID type (either static or preferred). If a configuration is mixed (some switches with static domain types and others with preferred), then you may experience link isolation.

Note When a new domain ID is configured, the new configuration has to be applied by manually restarting the domain using the **fcdomain restart** command; if a discrepancy is detected between the configured domain ID and the runtime domain ID during the subsequent fabric merge, the link will be isolated.

Detailed Steps

To specify a static or preferred domain ID, follow these steps:

	Command	Purpose
Step 1	switch# **config t** switch(config)#	Enters configuration mode.
Step 2	switch(config)# **fcdomain domain 3 preferred vsan 8**	Configures the switch in VSAN 8 to request a preferred domain ID 3 and accepts any value assigned by the principal switch. The domain is range is 1 to 239.
	switch(config)# **no fcdomain domain 3 preferred vsan 8**	Resets the configured domain ID to 0 (default) in VSAN 8. The configured domain ID becomes 0 preferred.
Step 3	switch(config)# **fcdomain domain 2 static vsan 237**	Configures the switch in VSAN 237 to accept only a specific value and moves the local interfaces in VSAN 237 to an isolated state if the requested domain ID is not granted.
	switch(config)# **no fcdomain domain 18 static vsan 237**	Resets the configured domain ID to factory defaults in VSAN 237. The configured domain ID becomes 0 preferred.

Configuring Allowed Domain ID Lists

Prerequisites

An allowed domain ID list must satisfy the following conditions:

- If this switch is a principal switch, all the currently assigned domain IDs must be in the allowed list.
- If this switch is a subordinate switch, the local runtime domain ID must be in the allowed list.
- The locally configured domain ID of the switch must be in the allowed list.
- The intersection of the assigned domain IDs with other already configured domain ID lists must not be empty.

If you configure an allowed list on one switch in the fabric, we recommend that you configure the same list in all other switches in the fabric to ensure consistency or use CFS to distribute the configuration.

Detailed Steps

To configure the allowed domain ID list, follow these steps:

	Command	Purpose
Step 1	switch# **config t** switch(config)#	Enters configuration mode.
Step 2	switch(config)# **fcdomain allowed 50-110 vsan 4**	Configures the list to allow switches with the domain ID 50 through 110 in VSAN 4.
	switch(config)# **no fcdomain allowed 50-110 vsan 5**	Reverts to the factory default of allowing domain IDs from 1 through 239 in VSAN 5.

Enabling Allowed Domain ID Distribution

CFS distribution of allowed domain ID lists is disabled by default. You must enable distribution on all switches to which you want to distribute the allowed domain ID lists.

Prerequisites

- All switches in the fabric must be running Cisco SAN-OS Release 3.0(1) or later to distribute the allowed domain ID list using CFS.

Detailed Steps

To enable (or disable) allowed domain ID list configuration distribution, follow these steps:

	Command	Purpose
Step 1	switch# **config t** switch(config)#	Enters configuration mode.
Step 2	switch(config)# **fcdomain distribute**	Enables domain configuration distribution.
	switch(config)# **no fcdomain distribute**	Disables (default) domain configuration distribution.

Committing Changes

Detailed Steps

To commit pending domain configuration changes and release the lock, follow these steps:

	Command	Purpose
Step 1	switch# **config t** switch(config)#	Enters configuration mode.
Step 2	switch(config)# **fcdomain commit vsan 10**	Commits the pending domain configuration changes.

Discarding Changes

At any time, you can discard the pending changes to the domain configuration and release the fabric lock. If you discard (abort) the pending changes, the configuration remains unaffected and the lock is released.

Detailed Steps

To discard pending domain configuration changes and release the lock, follow these steps:

	Command	Purpose
Step 1	switch# **config t** switch(config)#	Enters configuration mode.
Step 2	switch(config)# **fcdomain abort vsan 10**	Discards the pending domain configuration changes.

Enabling Contiguous Domain ID Assignments

Detailed Steps

To enable contiguous domains in a specific VSAN (or a range of VSANs), follow these steps:

	Command	Purpose

Step 1	`switch# `**`config t`**
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)# `**`fcdomain contiguous-allocation vsan 81-83`**	Enables the contiguous allocation option in VSAN 81 through 83. **Note** The **contiguous-allocation** option takes immediate effect at runtime. You do not need to restart the fcdomain.
	`switch(config)# `**`no fcdomain contiguous-allocation vsan 1030`**	Disables the contiguous allocation option and reverts it to the factory default in VSAN 1030.

Configuring FC IDs

When an N or NL port logs into a Cisco MDS 9000 Family switch, it is assigned an FC ID.

This section includes the following topics:

- Enabling the Persistent FC ID Feature, page 11-18
- Configuring Persistent FC IDs, page 11-20
- Configuring Unique Area FC IDs for an HBA, page 11-20
- Purging Persistent FC IDs, page 11-22

Enabling the Persistent FC ID Feature

If you connect to the switch from an AIX or HP-UX host, be sure to enable the persistent FC ID feature in the VSAN that connects these hosts.

A persistent FC ID assigned to an F port can be moved across interfaces and can continue to maintain the same persistent FC ID.

Restrictions

- FC IDs are enabled by default. This change of default behavior from releases prior to Cisco MDS SAN-OS Release 2.0(1b) prevents FC IDs from being changed after a reboot. You can disable this option for each VSAN.
- Persistent FC IDs with loop-attached devices (FL ports) need to remain connected to the same port in which they were configured.
- Due to differences in Arbitrated Loop Physical Address (ALPA) support on devices, FC ID persistency for loop-attached devices is not guaranteed.

Note For Cisco MDS 9124, 9134, 9148, 9148S, and 9250i switches, ensure that you allocate a complete FCID area per interface and that the last byte to the right of the FCID (port_id) is always zero for these platforms (except for an MDS 9148 running in the NPIV mode connected to an NPV switch). Hence, you cannot configure static FCIDs with non-zero port_ids. For example, the following will not work on MDS 9124, 9134, 9148, 9148S, and 9250i:

vsan 1000 **wwn** 33:e8:00:05:30:00:16:df **fcid** 0x070128

It should be changed to **vsan** 1000 **wwn** 33:e8:00:05:30:00:16:df **fcid** 0x070100.

Detailed Steps

To enable the persistent FC ID feature, follow these steps:

	Command	Purpose
Step 1	`switch# config t`	Enters configuration mode.

Step 2	`switch(config)# fcdomain fcid persistent vsan 1000`
	`FCID(s) persistent feature is enabled.`
		Activates (default) persistency of FC IDs in VSAN 1000.

	`switch(config)# no fcdomain fcid persistent vsan 20`	Disables the FC ID persistency feature in VSAN 20.

Configuring Persistent FC IDs

Detailed Steps

To configure persistent FC IDs, follow these steps:

	Command	Purpose

Step 1	`switch# config t`
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)# fcdomain fcid database`
	`switch(config-fcid-db)#`
		Enters FC ID database configuration submode.

Step 3	`switch(config-fcid-db)# vsan 1000 wwn 33:e8:00:05:30:00:16:df fcid 0x070128`	Configures a device WWN (33:e8:00:05:30:00:16:df) with the FC ID 0x070128 in VSAN 1000. **Note** To avoid assigning a duplicate FC ID, use the **show fcdomain address-allocation vsan** command to display the FC IDs in use.
	`switch(config-fcid-db)# vsan 1000 wwn 11:22:11:22:33:44:33:44 fcid 0x070123 dynamic`	Configures a device WWN (11:22:11:22:33:44:33:44) with the FC ID 0x070123 in VSAN 1000 in dynamic mode.
	`switch(config-fcid-db)# vsan 1000 wwn 11:22:11:22:33:44:33:44 fcid 0x070100 area`	Configures a device WWN (11:22:11:22:33:44:33:44) with the FC IDs 0x070100 through 0x701FF in VSAN 1000. **Note** To secure the entire area for this fcdomain, assign 00 as the last two characters of the FC ID.

Configuring Unique Area FC IDs for an HBA

Detailed Steps

To configure a different area ID for the HBA port, follow these steps:

Note The procedure in this example uses a switch domain of 111(6f hex). The HBA port connects to interface fc1/9 and the storage port connects to interface fc 1/10 in the same switch.

Step 1 Obtain the port WWN (Port Name field) ID of the HBA using the **show flogi database** command.

```
switch# show flogi database
---------------------------------------------------------------------------------------
INTERFACE   VSAN    FCID        PORT NAME                   NODE NAME
---------------------------------------------------------------------------------------
 fc1/9      3       0x6f7703    50:05:08:b2:00:71:c8:c2     50:05:08:b2:00:71:c8:c0
 fc1/10     3       0x6f7704    50:06:0e:80:03:29:61:0f     50:06:0e:80:03:29:61:0f
```

Note Both FC IDs in this setup have the same area 77 assignment.

Step 2 Shut down the HBA interface in the MDS switch.

```
switch# conf t
switch(config)# interface fc1/9
switch(config-if)# shutdown
switch(config-if)# end
switch#
```

Step 3 Verify that the FC ID feature is enabled using the **show fcdomain vsan** command.

```
switch# show fcdomain vsan 1
Local switch run time information:
        State: Stable
        Local switch WWN:    20:01:54:7f:ee:de:b3:01
        Running fabric name: 20:01:00:05:9b:2c:1c:71
        Running priority: 128
        Current domain ID: 0xee(238)

Local switch configuration information:
        State: Enabled
        FCID persistence: Disabled
        Auto-reconfiguration: Disabled
        Contiguous-allocation: Disabled
        Configured fabric name: 20:01:00:05:30:00:28:df
        Optimize Mode: Disabled
        Configured priority: 128
        Configured domain ID: 0x00(0) (preferred)

Principal switch run time information:
        Running priority: 2

Interface               Role          RCF-reject
----------------    -------------    ------------
fc1/1               Non-principal    Disabled
fc1/2               Upstream         Disabled
fc1/11              Non-principal    Disabled
fc1/37              Non-principal    Disabled
port-channel 1      Downstream       Disabled
----------------    -------------    ------------
```

If this feature is disabled, continue with this procedure to enable the persistent FC ID.

If this feature is already enabled, skip to Step 7.

Step 4 Enable the persistent FC ID feature in the Cisco MDS switch.

```
switch# conf t
switch(config)# fcdomain fcid persistent vsan 1
switch(config)# end
switch#
```

Step 5 Assign a new FC ID with a different area allocation. In this example, we replace 77 with ee.

```
switch# conf t
switch(config)# fcdomain fcid database
switch(config-fcid-db)# vsan 3 wwn 50:05:08:b2:00:71:c8:c2 fcid 0x6fee00 area
```

Step 6 Enable the HBA interface in the Cisco MDS switch.

```
switch# conf t
switch(config)# interface fc1/9
switch(config-if)# no shutdown
switch(config-if)# end
switch#
```

Step 7 Verify the pWWN ID of the HBA using the **show flogi database** command.

```
switch# show flogi database
-------------------------------------------------------------------------------------------
INTERFACE   VSAN    FCID        PORT NAME                    NODE NAME
-------------------------------------------------------------------------------------------
fc1/9       3       0x6fee00    50:05:08:b2:00:71:c8:c2      50:05:08:b2:00:71:c8:c0
fc1/10      3       0x6f7704    50:06:0e:80:03:29:61:0f      50:06:0e:80:03:29:61:0f
```

Note Both FC IDs now have different area assignments.

Purging Persistent FC IDs

Detailed Steps

To purge persistent FC IDs, follow this step:

	Command	Purpose
Step 1	`switch# purge fcdomain fcid vsan 4`	Purges all dynamic and unused FC IDs in VSAN 4.
	`switch# purge fcdomain fcid vsan 3-5`	Purges dynamic and unused FC IDs in VSAN 3, 4, and 5.

Clearing a Fabric Lock

To release a fabric lock, issue the **clear fcdomain session vsan** command in EXEC mode using a login ID that has administrative privileges.

```
switch# clear fcdomain session vsan 10
```

Verifying FC Domain Configuration

To display the domain ID configuration information, perform the following tasks:

Command	Purpose
show fcdomain status	Displays the status of CFS distribution for allowed domain ID lists.
show fcdomain pending	Displays the pending configuration changes.
show fcdomain session-status vsan	Displays the status of the distribution session.
show fcdomain	Displays global information about fcdomain configurations.
show fcdomain domain-list	Displays the list of domain IDs of all switches.
show fcdomain allowed vsan	Displays the list of allowed domain IDs configured on this switch.

Command	Purpose
show fcdomain fcid persistent	Displays all existing, persistent FC IDs for a specified VSAN.
show fcdomain statistics	Displays frame and other fcdomain statistics for a specified VSAN or PortChannel.
show fcdomain address-allocation	Displays FC ID allocation statistics including a list of assigned and free FC IDs.
show fcdomain address-allocation cache	Displays the valid address allocation cache.

For detailed information about the fields in the output from these commands, refer to the *Cisco MDS 9000 Family Command Reference*.

This section includes the following topics:

- Displaying CFS Distribution Status, page 11-23
- Displaying Pending Changes, page 11-23
- Displaying Session Status, page 11-24
- Displaying fcdomain Information, page 11-24

Displaying CFS Distribution Status

You can display the status of CFS distribution for allowed domain ID lists using the **show fcdomain status** command.

```
switch# show fcdomain status
CFS distribution is enabled
```

Displaying Pending Changes

You can display the pending configuration changes using the **show fcdomain pending** command:

```
switch# show fcdomain pending vsan 10

Pending Configured Allowed Domains
----------------------------------

VSAN 10
Assigned or unallowed domain IDs: 1-9,24,100,231-239.
[User] configured allowed domain IDs: 10-230.
```

You can display the differences between the pending configuration and the current configuration using the **show fcdomain pending-diff** command.

```
switch# show fcdomain pending-diff vsan 10
Current Configured Allowed Domains
----------------------------------

VSAN 10
Assigned or unallowed domain IDs: 24,100.
[User] configured allowed domain IDs: 1-239.

Pending Configured Allowed Domains
----------------------------------
```

```
VSAN 10
Assigned or unallowed domain IDs: 1-9,24,100,231-239.
[User] configured allowed domain IDs: 10-230.
```

Displaying Session Status

You can display the status of the distribution session using the **show fcdomain session-status vsan** command.

```
switch# show fcdomain session-status vsan 1
Last Action: Distribution Enable
Result: Success
```

Displaying fcdomain Information

Use the **show fcdomain** command to display global information about fcdomain configurations. See Example 11-1.

Note In Example 11-1, the fcdomain feature is disabled. Consequently, the runtime fabric name is the same as the configured fabric name.

Example 11-1 Displays the Global fcdomain Information

```
switch# show fcdomain vsan 2
The local switch is the Principal Switch.

Local switch run time information:
        State: Stable
        Local switch WWN:    20:01:00:0b:46:79:ef:41
        Running fabric name: 20:01:00:0b:46:79:ef:41
        Running priority: 128
        Current domain ID: 0xed(237)

Local switch configuration information:
        State: Enabled
        FCID persistence: Disabled
        Auto-reconfiguration: Disabled
        Contiguous-allocation: Disabled
        Configured fabric name: 20:01:00:05:30:00:28:df
        Optimize Mode: Disabled
        Configured priority: 128
        Configured domain ID: 0x00(0) (preferred)

Principal switch run time information:
        Running priority: 128

No interfaces available.
switch# show fcdomain vsan 1
The local switch is the Principal Switch.

Local switch run time information:
State: Stable
Local switch WWN: 20:01:54:7f:ee:46:5b:41
Running fabric name: 20:01:54:7f:ee:46:5b:41
Running priority: 128
Current domain ID: 0xe9(233)

Local switch configuration information:
State: Enabled
FCID persistence: Enabled
Auto-reconfiguration: Disabled
Contiguous-allocation: Disabled
Configured fabric name: 20:01:00:05:30:00:28:df
Optimize Mode: Enabled (Fast Restart, Selective Restart, Scale Restart)
Configured priority: 128
Configured domain ID: 0xe9(233) (static)

Principal switch run time information:
Running priority: 128

No interfaces available.
switch#
```

Note If a scale-restart feature was enabled and the other optimization modes were disabled when downgrading from Cisco MDS 6.2(9) release or later to 6.2(7) or older releases, the optimize mode will be a blank instead of disabled.

Use the **show fcdomain domain-list** command to display the list of domain IDs of all switches belonging to a specified VSAN. This list provides the WWN of the switches owning each domain ID. Example 11-2 shows the following:

- A switch with WWN of 20:01:00:05:30:00:47:df is the principal switch and has domain 200.
- A switch with WWN of 20:01:00:0d:ec:08:60:c1 is the local switch (the one where you typed the CLI command to show the domain-list) and has domain 99.
- The IVR manager obtained virtual domain 97 using 20:01:00:05:30:00:47:df as the WWN for a virtual switch.

Example 11-2 Displays the fcdomain Lists

```
switch# show fcdomain domain-list vsan 76

Number of domains: 3
Domain ID              WWN
---------    -----------------------
0xc8(200)    20:01:00:05:30:00:47:df [Principal]
 0x63(99)    20:01:00:0d:ec:08:60:c1 [Local]
 0x61(97)    50:00:53:0f:ff:f0:10:06 [Virtual (IVR)]
```

Use the **show fcdomain allowed vsan** command to display the list of allowed domain IDs configured on this switch. See Example 11-3.

Example 11-3 Displays the Allowed Domain ID Lists

```
switch# show fcdomain allowed vsan 1
Assigned or unallowed domain IDs: 1-96,100,111-239.
[Interoperability Mode 1] allowed domain IDs: 97-127.
[User] configured allowed domain IDs: 50-110.
```

Tip Ensure that the requested domain ID passes the Cisco NX-OS software checks, if **interop 1** mode is required in this switch.

Use the **show fcdomain fcid persistent** command to display all existing, persistent FC IDs for a specified VSAN. You can also specify the **unused** option to view only persistent FC IDs that are still not in use. See Examples 11-4 and 11-5.

Example 11-4 Displays Persistent FC IDs in a Specified VSAN

```
switch# show fcdomain fcid persistent vsan 1000
Total entries 2.

Persistent FCIDs table contents:
VSAN              WWN                FCID         Mask        Used    Assignment
----    -----------------------    --------    -----------    ----    ----------
1000    11:11:22:22:11:11:12:23    0x700101    SINGLE FCID      NO    STATIC
1000    44:44:33:33:22:22:11:11    0x701000    ENTIRE AREA      NO    DYNAMIC
```

Example 11-5 Displays All Persistent FC IDs in the fcdomain

```
switch# show fcdomain fcid persistent
Total entries 2.

Persistent FCIDs table contents:
VSAN              WWN                FCID         Mask        Used    Assignment
----    -----------------------    --------    -----------    ----    ----------
1000    11:11:22:22:11:11:22:22    0x700501    SINGLE FCID      NO    STATIC
1003    44:44:33:33:22:22:11:11    0x781000    ENTIRE AREA     YES    DYNAMIC
```

Use the **show fcdomain statistics** command to display frame and other fcdomain statistics for a specified VSAN or PortChannel. See Example 11-6 and Example 11-7.

Example 11-6 Displays fcdomain Statistics for a Specified VSAN

```
switch# show fcdomain statistics vsan 1
VSAN Statistics
        Number of Principal Switch Selections: 5
        Number of times Local Switch was Principal: 0
        Number of 'Build Fabric's: 3
        Number of 'Fabric Reconfigurations': 0
```

Example 11-7 Displays fcdomain Statistics for a Specified PortChannel

```
switch# show fcdomain statistics interface port-channel 10 vsan 1
        Interface Statistics:
                Transmitted      Received
                -----------      --------
                EFPs      13        9
                DIAs      7         7
                RDIs      0         0
                ACCs      21        25
                RJTs      1         1
                BFs       2         2
                RCFs      4         4
                Error     0         0
                Total     48        48
        Total Retries: 0
        Total Frames: 96
                -----------      --------
```

Use the **show fcdomain address-allocation** command to display FC ID allocation statistics including a list of assigned and free FC IDs. See Example 11-8.

Example 11-8 Displays FC ID Information

```
switch# show fcdomain address-allocation vsan 1
Free FCIDs: 0x020000 to 0x02fdff
            0x02ff00 to 0x02fffe

Assigned FCIDs: 0x02fe00 to 0x02feff
                0x02ffff

Reserved FCIDs: 0x020100 to 0x02f0ff
                0x02fe00 to 0x02feff
                0x02ffff


Number free FCIDs: 65279
Number assigned FCIDs: 257
Number reserved FCIDs: 61697
```

Use the **show fcdomain address-allocation cache** command to display the valid address allocation cache. The cache is used by the principal switch to reassign the FC IDs for a device (disk or host) that exited and reentered the fabric. In the cache content, VSAN refers to the VSAN that contains the device, WWN refers to the device that owned the FC IDs, and mask refers to a single or entire area of FC IDs. See Example 11-9.

Example 11-9 Displays Address Allocation Information

```
switch# show fcdomain address-allocation cache
Cache content:
line#    VSAN              WWN                 FCID         mask
-----    ----    -----------------------    --------    -----------
   1.      12    21:00:00:e0:8b:08:a2:21    0xef0400    ENTIRE AREA
   2.       6    50:06:04:82:c3:a1:2f:5c    0xef0002    SINGLE FCID
   3.       8    20:4e:00:05:30:00:24:5e    0xef0300    ENTIRE AREA
   4.       8    50:06:04:82:c3:a1:2f:52    0xef0001    SINGLE FCID
```

Feature History for Domain Parameters

Table 11-3 lists the release history for this feature. Only features that were introduced or modified in Release 3.x or a later release appear in the table.

Table 11-3 Feature History for Domain Parameters

Feature Name	Releases	Feature Information
Domain Manager Turbo Mode	4.2(1)	Added procedure to configure Domain Manager turbo mode.
CFS support for allowed domain ID lists	3.0(1)	Allows the allowed domain ID lists to be distributed in the fabric using the CFS infrastructure.
Domain manager fast restart	3.0(2)	Allows the domain manager to quickly recover from a principal link failure when a backup link is available.
Domain increase from 60 to 80	6.2(11)	Improves the scalability of the domain manager to hold up to 80 domains in a scale fabric.

Monitoring Network Traffic Using SPAN

This chapter describes the Switched Port Analyzer (SPAN) features provided in switches in the Cisco MDS 9000 Family.

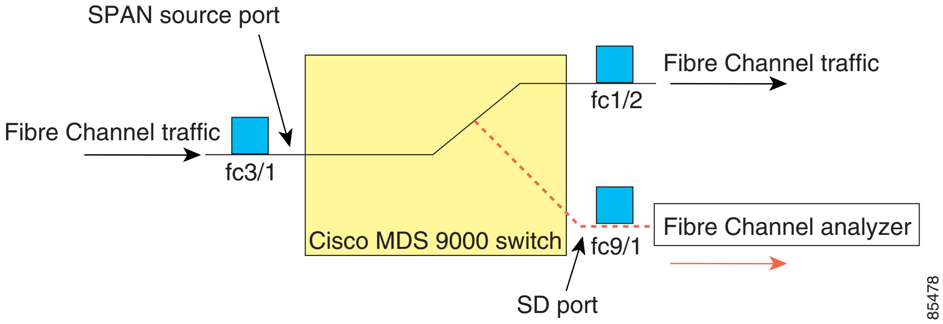
This chapter includes the following sections:

Information About SPAN

The SPAN feature is specific to switches in the Cisco MDS 9000 Family. It monitors network traffic through a Fibre Channel interface. Traffic through any Fibre Channel interface can be replicated to a special port called the SPAN destination port (SD port). Any Fibre Channel port in a switch can be configured as an SD port. Once an interface is in SD port mode, it cannot be used for normal data traffic. You can attach a Fibre Channel Analyzer to the SD port to monitor SPAN traffic.

SD ports do not receive frames, they only transmit a copy of the SPAN source traffic. The SPAN feature is nonintrusive and does not affect switching of network traffic for any SPAN source ports (see Figure 12-1).

Figure 12-1 SPAN Transmission



This section covers the following topics:

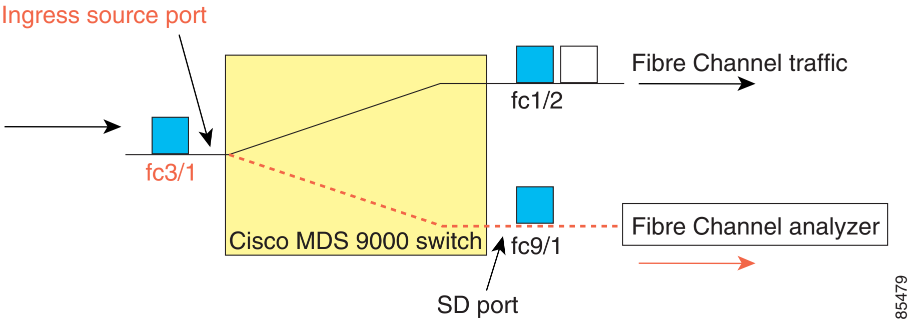
- SPAN Sources, page 12-3
- IPS Source Ports, page 12-3
- Allowed Source Interface Types, page 12-4
- VSAN as a Source, page 12-4
- SPAN Sessions, page 12-4
- Specifying Filters, page 12-5
- SD Port Characteristics, page 12-5
- SPAN Conversion Behavior, page 12-5
- Monitoring Traffic Using Fibre Channel Analyzers, page 12-7
- Monitoring Without SPAN, page 12-7
- Monitoring with SPAN, page 12-8
- Single SD Port to Monitor Traffic, page 12-9
- SD Port Configuration, page 12-10
- Mapping the FC Tunnel, page 12-10
- Creating VSAN Interfaces, page 12-11
- Remote SPAN, page 12-11
- Advantages of Using RSPAN, page 12-12
- FC and RSPAN Tunnels, page 12-12
- ST Port Configuration, page 12-13
- ST Port Characteristics, page 12-13
- Creating Explicit Paths, page 12-14

SPAN Sources

SPAN sources refer to the interfaces from which traffic can be monitored. You can also specify VSAN as a SPAN source, in which case, all supported interfaces in the specified VSAN are included as SPAN sources. When a VSAN as a source is specified, then all physical ports and PortChannels in that VSAN are included as SPAN sources. You can choose the SPAN traffic in the ingress direction, the egress direction, or both directions for any source interface:

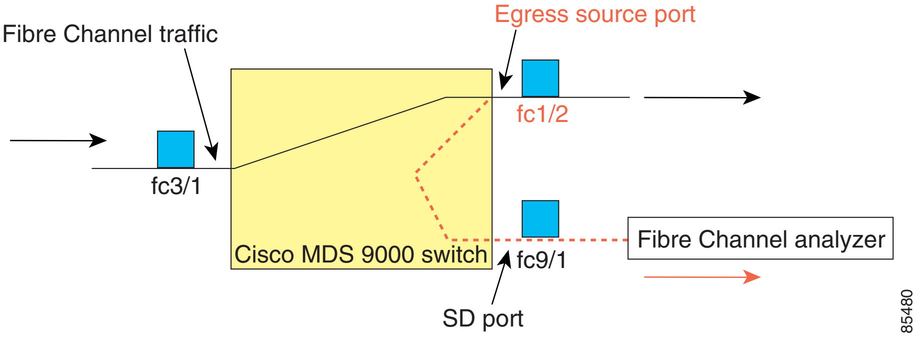
- Ingress source (Rx)—Traffic entering the switch fabric through this source interface is *spanned* or copied to the SD port (see Figure 12-2).

Figure 12-2 SPAN Traffic from the Ingress Direction



- Egress source (Tx)—Traffic exiting the switch fabric through this source interface is spanned or copied to the SD port (see Figure 12-3).

Figure 12-3 SPAN Traffic from Egress Direction



IPS Source Ports

SPAN capabilities are available on the IP Storage Services (IPS) module. The SPAN feature is only implemented on the FCIP and iSCSI virtual Fibre Channel port interfaces, not the physical Gigabit Ethernet ports. You can configure SPAN for ingress traffic, egress traffic, or traffic in both directions for all eight iSCSI and 24 FCIP interfaces that are available in the IPS module.

Note You can configure SPAN for Ethernet traffic using Cisco switches or routers connected to the Cisco MDS 9000 Family IPS modules.

Allowed Source Interface Types

The SPAN feature is available for the following interface types:

- Physical ports such as F ports, FL ports, TE ports, E ports, and TL ports.
- Interface sup-fc0 (traffic to and from the supervisor):
  - The Fibre Channel traffic from the supervisor module to the switch fabric through the sup-fc0 interface is called ingress traffic. It is spanned when sup-fc0 is chosen as an ingress source port.
  - The Fibre Channel traffic from the switch fabric to the supervisor module through the sup-fc0 interface is called egress traffic. It is spanned when sup-fc0 is chosen as an egress source port.
- PortChannels
  - All ports in the PortChannel are included and spanned as sources.
  - You cannot specify individual ports in a PortChannel as SPAN sources. Previously configured SPAN-specific interface information is discarded.
- IPS module specific Fibre Channel interfaces:
  - iSCSI interfaces
  - FCIP interfaces

Note In Cisco MDS 9700 Series Switches, iSCSI ports are not applicable for the Allowed Source Interface Types.

VSAN as a Source

SPAN sources refer to the interfaces from which traffic can be monitored. When a VSAN as a source is specified, then all physical ports and PortChannels in that VSAN are included as SPAN sources. A TE port is included only when the port VSAN of the TE port matches the source VSAN. A TE port is excluded even if the configured allowed VSAN list may have the source VSAN, but the port VSAN is different.

You cannot configure source interfaces (physical interfaces, PortChannels, or sup-fc interfaces) and source VSANs in the same SPAN session.

SPAN Sessions

Each SPAN session represents an association of one destination with a set of source(s) along with various other parameters that you specify to monitor the network traffic. One destination can be used by one or more SPAN sessions. You can configure up to 16 SPAN sessions in a switch. Each session can have several source ports and one destination port.

To activate any SPAN session, at least one source and the SD port must be up and functioning. Otherwise, traffic is not directed to the SD port.

Tip A source can be shared by two sessions, however, each session must be in a different direction—one ingress and one egress.

You can temporarily deactivate (suspend) any SPAN session. The traffic monitoring is stopped during this time.

Note On a Cisco MDS 9250i Multiservice Fabric switch, packet drops will occur if the SPAN port cannot keep up with incoming frame bursts. To avoid these packet drops, the speed of the SPAN destination port should be equal to the maximum speed of the source ports. However, when the source is an FCIP interface, the speed of the SPAN destination port should be more than 10G because the FCIP interface is running over a 10G Ethernet physical interface.

Specifying Filters

You can perform VSAN-based filtering to selectively monitor network traffic on specified VSANs. You can apply this VSAN filter to all sources in a session (see Figure 12-14). Only VSANs present in the filter are spanned.

You can specify session VSAN filters that are applied to all sources in the specified session. These filters are bidirectional and apply to all sources configured in the session. Each SPAN session represents an association of one destination with a set of source(s) along with various other parameters that you specify to monitor the network traffic.

SD Port Characteristics

An SD port has the following characteristics:

- Ignores BB_credits.
- Allows data traffic only in the egress (Tx) direction.
- Does not require a device or an analyzer to be physically connected.
- Supports only 1 Gbps or 2 Gbps speeds. The auto speed option is not allowed.
- Multiple sessions can share the same destination ports.
- If the SD port is shut down, all shared sessions stop generating SPAN traffic.
- The outgoing frames can be encapsulated in Extended Inter-Switch Link (EISL) format.
- The SD port does not have a port VSAN.
- SD ports cannot be configured using Storage Services Modules (SSMs).
- The port mode cannot be changed if it is being used for a SPAN session.

Note

- If you need to change an SD port mode to another port mode, first remove the SD port from all sessions and then change the port mode using the **switchport mode** command.
- In Cisco MDS 9700 Series Switches, the SD Port supports only 2 Gbps, 4 Gbps, 8 Gbps, and 16 Gbps speeds. The auto speed option is not allowed.

SPAN Conversion Behavior

SPAN features (configured in any prior release) are converted as follows:

- If source interfaces and source VSANs are configured in a given session, then all the source VSANs are removed from that session.

  For example, before Cisco MDS SAN-OS Release 1.0(4):

  ```
  Session 1 (active)
     Destination is fc1/9
     No session filters configured
     Ingress (rx) sources are
        vsans 10-11
       fc1/3,
     Egress (tx) sources are
       fc1/3,
  ```

  Once upgraded to Cisco MDS SAN-OS Release 1.1(1):

  ```
  Session 1 (active)
     Destination is fc1/9
     No session filters configured
     Ingress (rx) sources are
       fc1/3,
     Egress (tx) sources are
       fc1/3,
  ```

  For Cisco MDS 9700 Series Switches:

  ```
  switch(config-if)# monitor session 1
  switch(config-monitor)# source interface fc5/1
  switch(config-monitor)# destination interface fc2/9
  switch(config-monitor)# no shut
  switch(config-monitor)# show monitor session all
  session 1
  ---------------
  ssn direction : both
  state : up
  source intf :
  rx : fc5/1
  tx : fc5/1
  both : fc5/1
  source VLANs :
  rx :
  tx :
  both :
  source exception :
  rate-limit : Auto
  filter VLANs : filter not specified
  destination ports : fc2/9
  ```

  Session 1 had both source interfaces and source VSANs before the upgrade. After the upgrade, the source VSANs were removed (rule 1).

- If interface level VSAN filters are configured in source interfaces, then the source interfaces are also removed from the session. If this interface is configured in both directions, it is removed from both directions.

  For example, before Cisco MDS SAN-OS Release 1.0(4):

  ```
  Session 2 (active)
     Destination is fc1/9
     No session filters configured
     Ingress (rx) sources are
        vsans 12
       fc1/6 (vsan 1-20),
     Egress (tx) sources are
       fc1/6 (vsan 1-20),
  ```

Once upgraded to Cisco MDS SAN-OS Release 1.1(1):

```
Session 2 (inactive as no active sources)
   Destination is fc1/9
   No session filters configured
   No ingress (rx) sources
   No egress (tx) sources
```

Note The deprecated configurations are removed from persistent memory once a switchover or a new startup configuration is implemented.

Session 2 had a source VSAN 12 and a source interface fc1/6 with VSAN filters specified in Cisco MDS SAN-OS Release 1.0(4). When upgraded to Cisco MDS SAN-OS Release 1.1(1) the following changes are made:

- The source VSAN (VSAN 12) is removed (rule 1).
- The source interface fc1/6 had VSAN filters specified—it is also removed (rule 2).

Monitoring Traffic Using Fibre Channel Analyzers

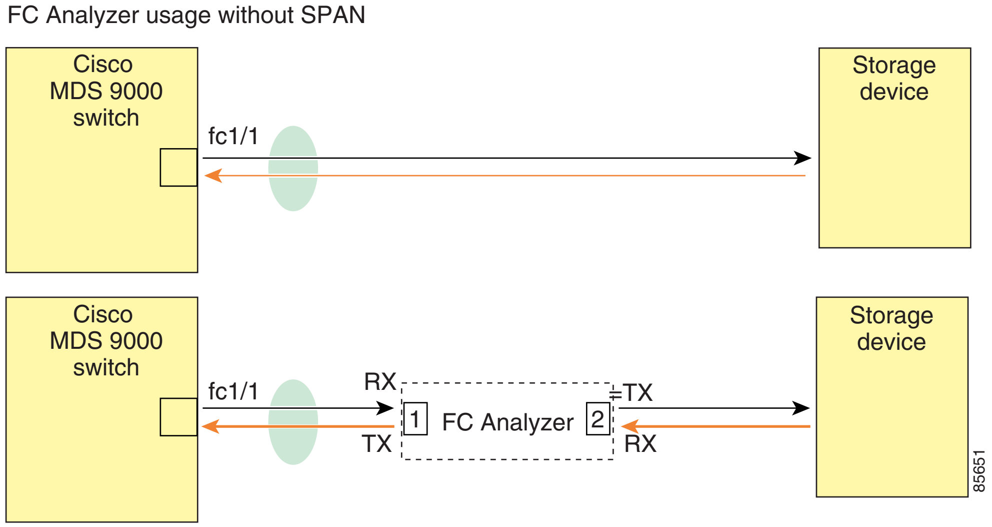
You can use SPAN to monitor traffic on an interface without any traffic disruption. This feature is especially useful in troubleshooting scenarios in which traffic disruption changes the problem environment and makes it difficult to reproduce the problem. You can monitor traffic in either of the following two ways:

- Without SPAN
- With SPAN

Monitoring Without SPAN

You can monitor traffic using interface fc1/1 in a Cisco MDS 9000 Family switch that is connected to another switch or host. You need to physically connect a Fibre Channel analyzer between the switch and the storage device to analyze the traffic through interface fc1/1 (see Figure 12-4).

Figure 12-4 Fibre Channel Analyzer Usage Without SPAN



This type of connection has the following limitations:

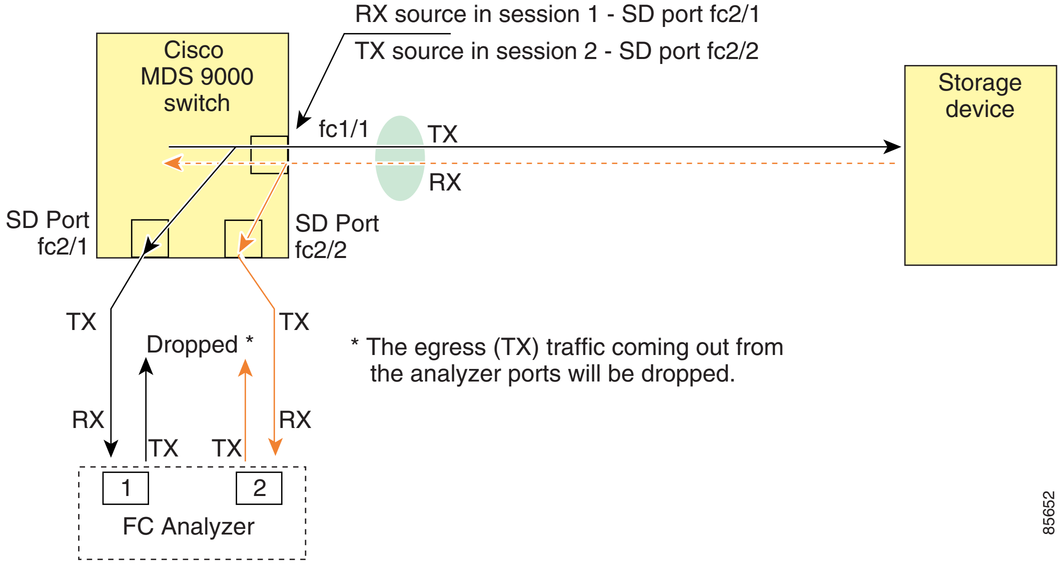
- It requires you to physically insert the FC analyzer between the two network devices.
- It disrupts traffic when the Fibre Channel analyzer is physically connected.
- The analyzer captures data only on the Rx links in both port 1 and port 2. Port 1 captures traffic exiting interface fc1/1 and port 2 captures ingress traffic into interface fc1/1.

Monitoring with SPAN

Using SPAN you can capture the same traffic scenario (see Figure 12-4) without any traffic disruption. The Fibre Channel analyzer uses the ingress (Rx) link at port 1 to capture all the frames going out of the interface fc1/1. It uses the ingress link at port 2 to capture all the ingress traffic on interface fc1/1.

Using SPAN you can monitor ingress traffic on fc1/1 at SD port fc2/2 and egress traffic on SD port fc2/1. This traffic is seamlessly captured by the FC analyzer (see Figure 12-5).

Figure 12-5 Fibre Channel Analyzer Using SPAN

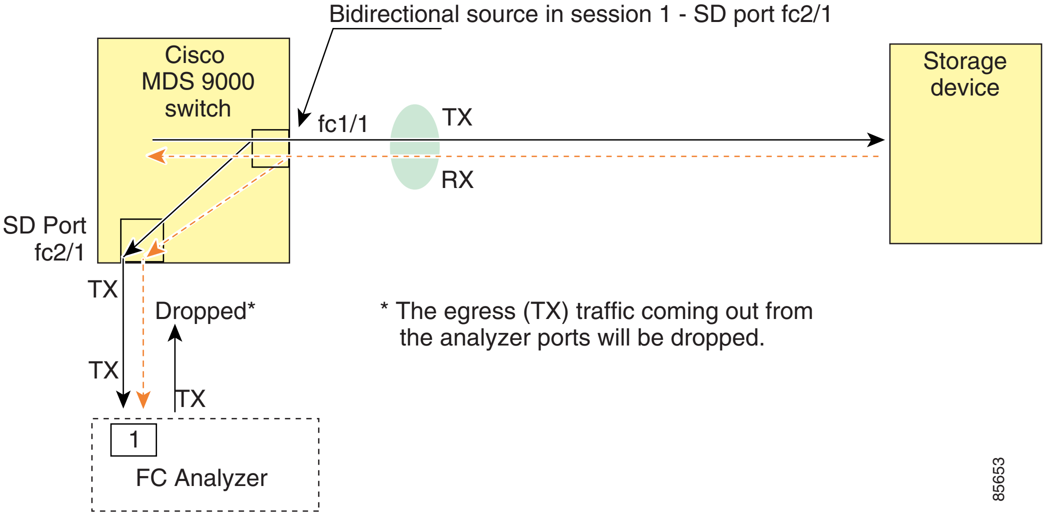

RX source in session 1 - SD port fc2/1
TX source in session 2 - SD port fc2/2
Cisco MDS 9000 switch
Storage device
fc1/1
TX
RX
SD Port fc2/1
SD Port fc2/2
TX
TX
Dropped *
* The egress (TX) traffic coming out from the analyzer ports will be dropped.
RX
RX
TX
TX
1
2
FC Analyzer
85652

Single SD Port to Monitor Traffic

You do not need to use two SD ports to monitor bidirectional traffic on any interface (see Figure 12-5). You can use one SD port and one FC analyzer port by monitoring traffic on the interface at the same SD port fc2/1.

Figure 12-6 shows a SPAN setup where one session with destination port fc2/1 and source interface fc1/1 is used to capture traffic in both ingress and egress directions. This setup is more advantageous and cost effective than the setup shown in Figure 12-5. It uses one SD port and one port on the analyzer, instead of using a full, two-port analyzer.

Figure 12-6 Fibre Channel Analyzer Using a Single SD Port

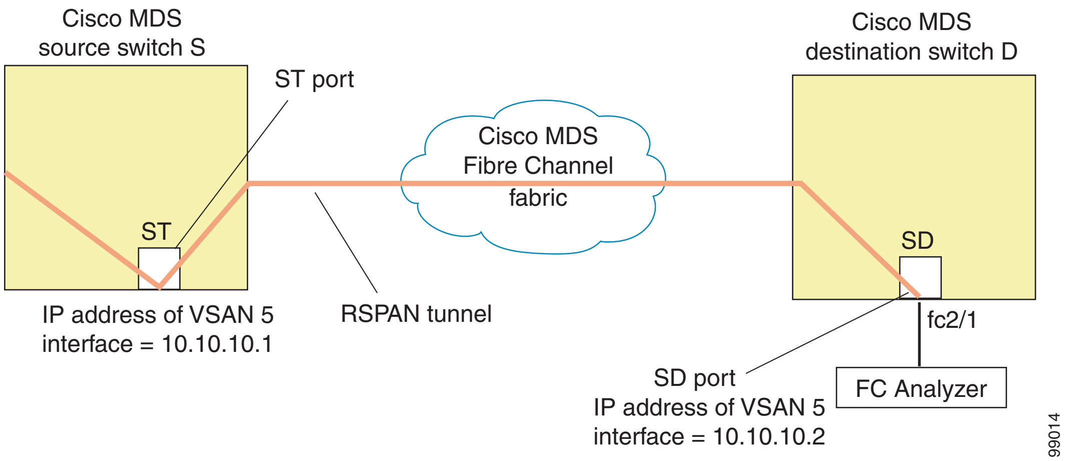

Bidirectional source in session 1 - SD port fc2/1
Cisco MDS 9000 switch
Storage device
fc1/1
TX
RX
SD Port fc2/1
TX
Dropped*
* The egress (TX) traffic coming out from the analyzer ports will be dropped.
TX
TX
1
FC Analyzer
85653

To use this setup, the analyzer should have the capability of distinguishing ingress and egress traffic for all captured frames.

SD Port Configuration

The SD port in the destination switch enables the FC analyzer to receive the RSPAN traffic from the Fibre Channel tunnel. Figure 12-7 depicts an RSPAN tunnel configuration, now that tunnel destination is also configured.

Figure 12-7 RSPAN Tunnel Configuration

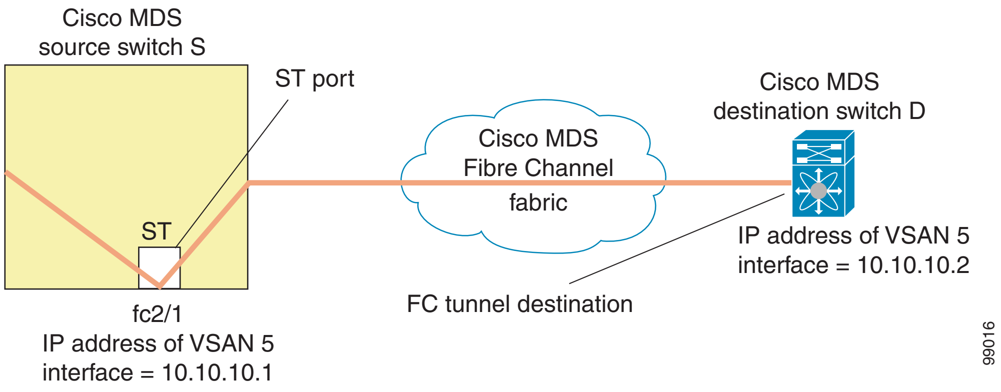


Note SD ports cannot be configured using Storage Services Modules (SSMs).

Mapping the FC Tunnel

The **tunnel-id-map** option specifies the egress interface of the tunnel at the destination switch (see Figure 12-8).

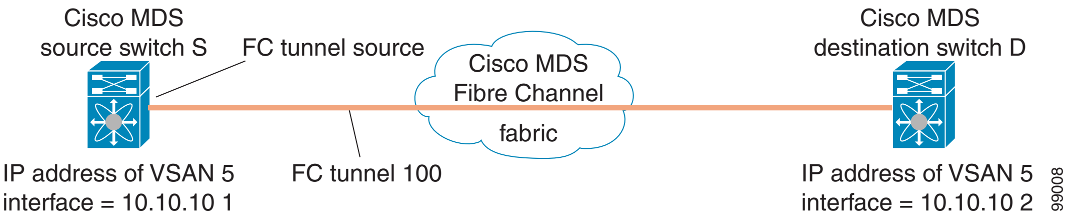
Figure 12-8 FC Tunnel Configuration



Creating VSAN Interfaces

Figure 12-9 depicts a basic FC tunnel configuration.

Figure 12-9 FC Tunnel Configuration



Note This example assumes that VSAN 5 is already configured in the VSAN database.

Remote SPAN

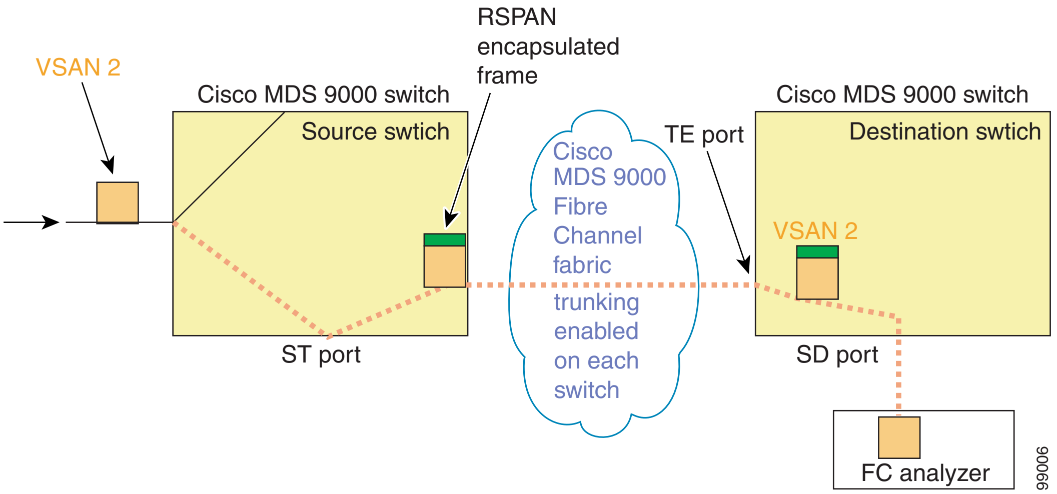
Note Remote SPAN is not supported on the Cisco Fabric Switch for HP c-Class BladeSystem, Cisco Fabric Switch for IBM BladeSystem, Cisco Fabric Switch 9250i, and Cisco Fabric Switch 9100S.

The Remote SPAN (RSPAN) feature enables you to remotely monitor traffic for one or more SPAN sources distributed in one or more source switches in a Fibre Channel fabric. The SPAN destination (SD) port is used for remote monitoring in a destination switch. A destination switch is usually different from the source switch(es) but is attached to the same Fibre Channel fabric. You can replicate and monitor traffic in any remote Cisco MDS 9000 Family switch or director, just as you would monitor traffic in a Cisco MDS source switch.

The RSPAN feature is nonintrusive and does not affect network traffic switching for those SPAN source ports. Traffic captured on the remote switch is tunneled across a Fibre Channel fabric which has trunking enabled on all switches in the path from the source switch to the destination switch. The Fibre Channel tunnel is structured using trunked ISL (TE) ports. In addition to TE ports, the RSPAN feature uses two other interface types (see Figure 12-10):

- SD ports—A passive port from which remote SPAN traffic can be obtained by the FC analyzer.
- ST ports—A SPAN tunnel (ST) port is an entry point port in the source switch for the RSPAN Fibre Channel tunnel. ST ports are special RSPAN ports and cannot be used for normal Fibre Channel traffic.

Figure 12-10 RSPAN Transmission



Advantages of Using RSPAN

The RSPAN features has the following advantages:

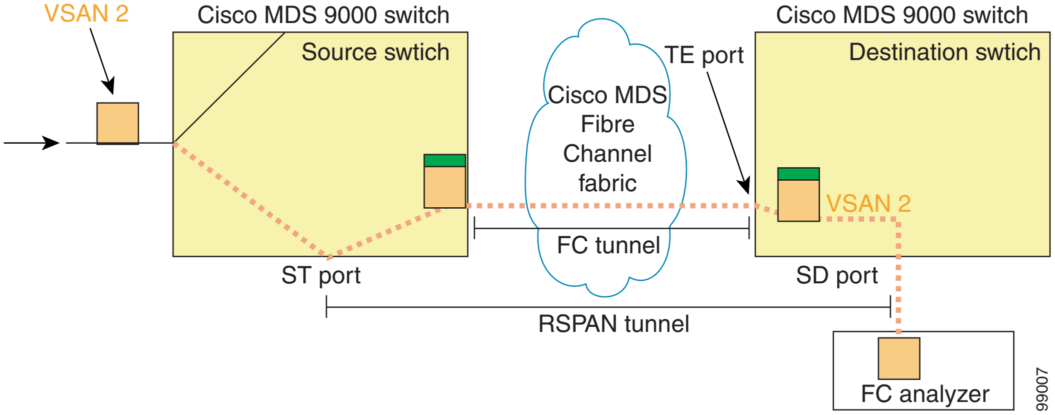
- Enables nondisruptive traffic monitoring at a remote location.
- Provides a cost effective solution by using one SD port to monitor remote traffic on multiple switches.
- Works with any Fibre Channel analyzer.
- Is compatible with the Cisco MDS 9000 Port Analyzer adapters.
- Does not affect traffic in the source switch, but shares the ISL bandwidth with other ports in the fabric.

FC and RSPAN Tunnels

An FC tunnel is a logical data path between a source switch and a destination switch. The FC tunnel originates from the source switch and terminates at the remotely located destination switch.

RSPAN uses a special Fibre Channel tunnel (FC tunnel) that originates at the ST port in the source switch and terminates at the SD port in the destination switch. You must bind the FC tunnel to an ST port in the source switch and map the same FC tunnel to an SD port in the destination switch. Once the mapping and binding is configured, the FC tunnel is referred to as an RSPAN tunnel (see Figure 12-11).

Figure 12-11 FC and RSPAN Tunnel



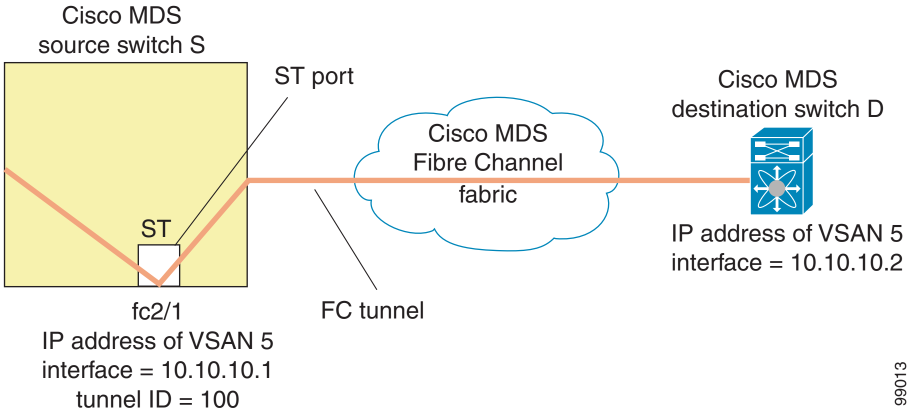
ST Port Configuration

Note In Cisco MDS 9700 Series Switches, SPAN tunnel port (ST port) is not supported.

Once the FC tunnel is created, be sure to configure the ST port to bind it to the FC tunnel at the source switch. The FC tunnel becomes an RSPAN tunnel once the binding and mapping is complete.

Figure 12-12 depicts a basic FC tunnel configuration.

Figure 12-12 Binding the FC Tunnel



ST Port Characteristics

ST ports have the following characteristics:

- ST ports perform the RSPAN encapsulation of the FC frame.
- ST ports do not use BB_credits.
- One ST port can only be bound to one FC tunnel.

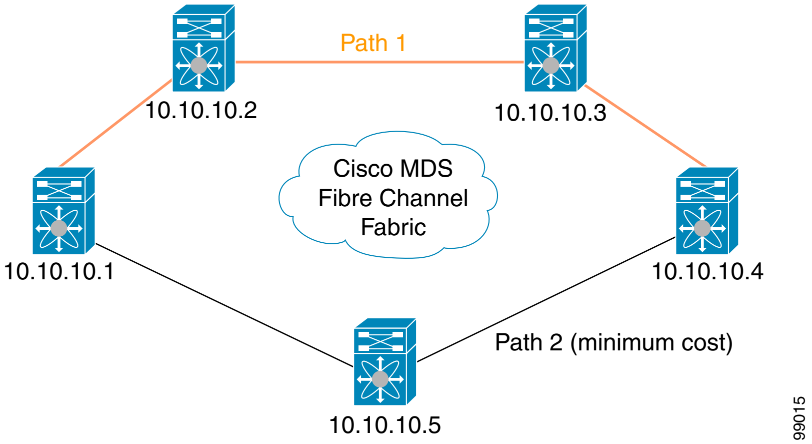
- ST ports cannot be used for any purpose other than to carry RSPAN traffic.
- ST ports cannot be configured using Storage Services Modules (SSMs).

Creating Explicit Paths

You can specify an explicit path through the Cisco MDS Fibre Channel fabric (source-based routing), using the **explicit-path** option. For example, if you have multiple paths to a tunnel destination, you can use this option to specify the FC tunnel to always take one path to the destination switch. The software then uses this specified path even if other paths are available.

This option is especially useful if you prefer to direct the traffic through a certain path although other paths are available. In an RSPAN situation, you can specify the explicit path so the RSPAN traffic does not interfere with the existing user traffic. You can create any number of explicit paths in a switch (see Figure 12-13).

Figure 12-13 Explicit Path Configuration



Guidelines and Limitations

Cisco MDS 9700 Series Switches Guidelines

The following guidelines and limitations apply for Cisco MDS 9700 Series Switches:

- In Cisco MDS 9700 Series Switches, SPAN is replaced by Monitor.
- In Cisco MDS 9700 Series Switches, SPAN tunnel port (ST port) is not supported.
- In Cisco MDS 9700 Series Switches, RSPAN is replaced by Remote Monitor.
- For Cisco MDS 9700 Series Switches, Generation 2 Fabric Switches is not supported.

SPAN Configuration Guidelines

The following guidelines and limitations apply for SPAN configurations:

- You can configure up to 16 SPAN sessions with multiple ingress (Rx) sources.

- You can configure a maximum of three SPAN sessions with one egress (Tx) port.
- In a 32-port switching module, you must configure the same session in all four ports in one port group (unit). If you wish, you can also configure only two or three ports in this unit.

Note This is not applicable for Cisco MDS 9700 Series Switches.

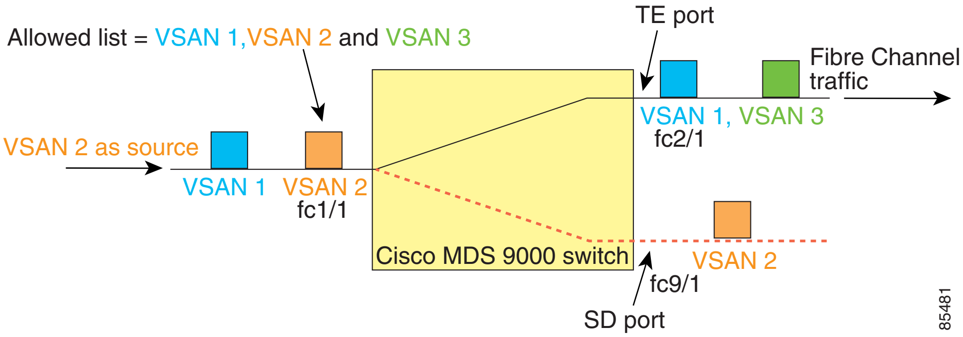
- SPAN frames are dropped if the sum of the bandwidth of the sources exceeds the speed of the destination port.
- Frames dropped by a source port are not spanned.
- SPAN does not capture pause frames in a Fibre Channel over Ethernet (FCoE) network because pause frames sent from the virtual expansion (VE) port are generated and terminated by the outermost MAC layer. For more information on FCoE, see the *Cisco NX-OS FCoE Configuration Guide for Cisco Nexus 7000 and Cisco MDS 9500*.

Guidelines to Configure VSANs as a Source

The following guidelines apply when configuring VSANs as a source:

- Traffic on all interfaces included in a source VSAN is spanned only in the ingress direction.
- If a VSAN is specified as a source, you cannot perform interface-level SPAN configuration on the interfaces that are included in the VSAN. Previously configured SPAN-specific interface information is discarded.
- If an interface in a VSAN is configured as a source, you cannot configure that VSAN as a source. You must first remove the existing SPAN configurations on such interfaces before configuring VSAN as a source.
- Interfaces are only included as sources when the port VSAN matches the source VSAN. Figure 12-14 displays a configuration using VSAN 2 as a source:
  - All ports in the switch are in VSAN 1 except fc1/1.
  - Interface fc1/1 is the TE port with port VSAN 2. VSANs 1, 2, and 3 are configured in the allowed list.
  - VSAN 1 and VSAN 2 are configured as SPAN sources.

Figure 12-14 VSAN as a Source



For this configuration, the following apply:

- VSAN 2 as a source includes only the TE port fc1/1 that has port VSAN 2.

- VSAN 1 as a source does not include the TE port fc1/1 because the port VSAN does not match VSAN 1.

Guidelines to Specifying Filters

The following guidelines apply to SPAN filters:

- PortChannel configurations are applied to all ports in the PortChannel.
- If no filters are specified, the traffic from all active VSANs for that interface is spanned by default.
- While you can specify arbitrary VSAN filters in a session, traffic can only be monitored on the port VSAN or on allowed-active VSANs in that interface.

RSPAN Configuration Guidelines

The following guidelines apply for a SPAN configuration:

- All switches in the end-to-end path of the RSPAN tunnel must belong to the Cisco MDS 9000 Family.
- All VSANs with RSPAN traffic must be enabled. If a VSAN containing RSPAN traffic is not enabled, it is dropped.
- The following configurations must be performed on *each* switch in the end-to-end path of the Fibre Channel tunnel in which RSPAN is to be implemented:
  - Trunking must be enabled (enabled by default) and the trunk enabled link must be the lowest cost link in the path.
  - VSAN interface must be configured.
  - The Fibre Channel tunnel feature must be enabled (disabled by default).
  - IP routing must be enabled (disabled by default).

  Note If the IP address is in the same subnet as the VSAN, the VSAN interface does not have to be configured for all VSANs on which the traffic is spanned.

- A single Fibre Channel switch port must be dedicated for the ST port functionality.
- Do not configure the port to be monitored as the ST port.
- The FC tunnel’s IP address must reside in the same subnet as the VSAN interface.

Default SPAN and RSPAN Settings

Table 12-1 lists the default settings for SPAN parameters.

Table 12-1 Default SPAN Configuration Parameters

Parameters	Default
SPAN session	Active. **Note** For Cisco MDS 9700 Series Switches, the default value for Monitor session is Shut.
If filters are not specified	SPAN traffic includes traffic through a specific interface from all active VSANs.
Encapsulation	Disabled.
SD port	Output frame format is Fibre Channel.

Table 12-2 lists the default settings for RSPAN parameters.

Table 12-2 Default RSPAN Configuration Parameters

Parameters	Default
FC tunnel	Disabled
Explicit path	Not configured
Minimum cost path	Used if explicit path is not configured

Configuring SPAN

The SPAN feature is specific to switches in the Cisco MDS 9000 Family. It monitors network traffic through a Fibre Channel interface.

This section covers the following topics:

- Configuring SD Ports for SPAN, page 12-17
- Configuring SPAN for Generation 2 Fabric Switches, page 12-19
- Suspending and Reactivating SPAN Sessions, page 12-21
- Encapsulating Frames, page 12-21
- Configuring Single SD Port to Monitor Traffic, page 12-22

Configuring SD Ports for SPAN

Detailed Steps

To configure an SD port for SPAN monitoring, follow these steps:

	Command	Purpose
Step 1	`switch# config t`	Enters configuration mode.
Step 2	`switch(config)# interface fc9/1`	Configures the specified interface.
Step 3	`switch(config-if)# switchport mode SD`	Configures the SD port mode for interface fc9/1.

	Command	Purpose
Step 4	`switch(config-if)# switchport speed 1000`	Configures the SD port speed to 1000 Mbps. **Note** In Cisco MDS 9700 Series Switches, the switch port speed is 8000 Mbps.
Step 5	`switch(config-if)# no shutdown`	Enables traffic flow through this interface.

To configure a SPAN session, follow these steps:

	Command	Purpose
Step 1	`switch# config t`	Enters configuration mode.

Step 2	`switch(config)# span session 1`
	`switch(config-span)#`
		Configures the specified SPAN session (1). If the session does not exist, it is created.
		Note In Cisco MDS 9700 Series Switches, SPAN is replaced by Monitor.

	`switch(config)# no span session 1`	Deletes the specified SPAN session (1).
Step 3	`switch(config-span)# destination interface fc9/1`	Configures the specified destination interface (fc 9/1) in a session.
	`switch(config-span)# no destination interface fc9/1`	Removes the specified destination interface (fc 9/1).
Step 4	`switch(config-span)# source interface fc7/1`	Configures the source (fc7/1) interface in both directions. **Note** While configuring SPAN sources on the Cisco MDS 9124 Fabric Switch, the direction (Rx and Tx) needs to be explicitly mentioned.
	`switch(config-span)# no source interface fc7/1`	Removes the specified destination interface (fc 7/1) from this session.

	Command	Purpose
Step 5	switch(config-span)# **source interface sup-fc0**	Configures the source interface (sup-fc0) in the session.
	switch(config-span)# **source interface fc1/5 - 6, fc2/1 -3**	Configures the specified interface ranges in the session.
	switch(config-span)# **source vsan 1-2**	Configures source VSANs 1 and 2 in the session.
	switch(config-span)# **source interface port-channel 1**	Configures the source PortChannel (port-channel 1).
	switch(config-span)# **source interface fcip 51**	Configures the source FCIP interface in the session.
	switch(config-span)# **source interface iscsi 4/1**	Configures the source iSCSI interface in the session. **Note** This is not applicable for MDS 9700 Series Switches.
	switch(config-span)# **source interface svc1/1 tx traffic-type initiator**	Configures the source SVC interface in the Tx direction for an initiator traffic type. **Note** This is not applicable for MDS 9700 Series Switches
	switch(config-span)# **no source interface port-channel 1**	Deletes the specified source interface (port-channel 1).
Step 6	switch(config-span)# **shutdown**	Temporarily suspends the session. **Note** This is applicable for MDS 9700 Series Switches.

To configure a SPAN filter, follow these steps:

	Command	Purpose
Step 1	switch# **config t**	Enters configuration mode.
Step 2	switch(config)# **span session 1** switch(config-span)#	Configures the specified session (1). **Note** In Cisco MDS 9700 Series Switches, SPAN is replaced by monitor session 1.
Step 3	switch(config-span)# **source interface fc9/1 tx**	Configures the source fc9/1 interface in the egress (Tx) direction.
	switch(config-span)# **source filter vsan 1-2**	Configures VSANs 1 and 2 as session filters.
	switch(config-span)# **source interface fc7/1 rx**	Configures the source fc7/1 interface in the ingress (Rx) direction.

Configuring SPAN for Generation 2 Fabric Switches

Cisco Generation 2 fabric switches (such as MDS 9124) support SPAN sessions in both directions, Rx and Tx.

Note While using Generation 2 fabric switches, you cannot create an additional active SPAN session when you already have one.

Restrictions

You can specify multiple SPAN source interfaces in Rx and Tx directions. However, the direction should be explicitly mentioned at the end of the command. The SPAN will reject any source interface configuration that fails to mention the direction.

Detailed Steps

To configure for ingress SPAN sessions, follow these steps:

	Command	Purpose
Step 1	`switch# config t`	Enters configuration mode.

Step 2	`switch(config)# span session 1`
	`switch(config-span)#`
		Configures the specified session (1).

Step 3	`switch(config-span)# destination interface fc1/1`	Configures interface fc1/1 as the destination.
Step 4	`switch(config-span)# source interface fc1/2 rx`	Configures the source interface fc1/2 in the ingress direction.

To configure for egress SPAN sessions, follow these steps:

	Command	Purpose
Step 1	`switch# config t`	Enters configuration mode.

Step 2	`switch(config)# span session 1`
	`switch(config-span)#`
		Configures the specified session (1).

Step 3	`switch(config-span)# destination interface fc1/1`	Configures interface fc1/1 as the destination.
Step 4	`switch(config-span)# source interface fc1/2 tx`	Configures the source interface fc1/2 in the egress direction.

Examples

This example shows how to configure Cisco MDS 9124 for Multiple SPAN Interfaces

```
switch(config-span)# span session 1
switch(config-span)# destination interface fc1/1
switch(config-span)# source interface fc1/2 rx
switch(config-span)# source interface fc1/2 tx
```

Generation 2 Fabric Switches support VSAN filters for one VSAN only in the egress direction; this restriction does not apply to the ingress direction. For example, if you have an interface that is a TE port, with an active VSAN of 1 to 5, and you specify a VSAN filter for VSAN 2, then only the traffic on VSAN 2 will be filtered.

```
switch(config-span)# span session 1
switch(config-span)# source filter vsan 2
switch(config-span)# destination interface fc1/1
switch(config-span)# source interface fc1/2 tx
```

However, if you specify the VSAN filter for VSANs 1 to 2, then traffic from all VSANs (1 to 5) is filtered, which makes the filter useless.

```
switch(config-span)# span session 1
switch(config-span)# source filter vsan 1-2
switch(config-span)# destination interface fc1/1
switch(config-span)# source interface fc1/2 tx
```

Suspending and Reactivating SPAN Sessions

You can temporarily deactivate (suspend) any SPAN session. The traffic monitoring is stopped during this time.

Detailed Steps

To temporarily suspend or reactivate a SPAN session filter, follow these steps:

	Command	Purpose
Step 1	`switch# config t`	Enters configuration mode.

Step 2	`switch(config)# span session 1`
	`switch(config-span)#`
		Configures the specified session (1).

Step 3	`switch(config-span)# suspend`	Temporarily suspends the session.
	`switch(config-span)# no suspend`	Reactivates the session.

Encapsulating Frames

The frame encapsulation feature is disabled by default. If you enable the encapsulation feature, all outgoing frames are encapsulated.

The **switchport encap eisl** command only applies to SD port interfaces. If encapsulation is enabled, you see a new line (`Encapsulation is eisl`) in the **show interface** *SD_port_interface* command output.

Detailed Steps

To encapsulate outgoing frames (optional), follow these steps:

	Command	Purpose
Step 1	`switch# config t`	Enters configuration mode.
Step 2	`switch(config)# interface fc9/32`	Configures the specified interface.
Step 3	`switch(config-if)# switchport mode SD`	Configures the SD port mode for interface fc9/32.
Step 4	`switch(config-if)# switchport encap eisl`	Enables the encapsulation option for this SD port.
	`switch(config-if)# no switchport encap eisl`	Disables (default) the encapsulation option.

Configuring Fibre Channel Analyzers Using SPAN

Detailed Steps

To configure SPAN on the source and destination interfaces, follow these steps:

	Command	Purpose
Step 1	switch# **config t**	Enters configuration mode.
Step 2	switch(config)# **span session 1** switch(config-span)#	Creates the SPAN session 1.
Step 3	switch(config-span)## **destination interface fc2/1**	Configures the destination interface fc2/1.
Step 4	switch(config-span)# **source interface fc1/1 rx**	Configures the source interface fc1/1 in the ingress direction.
Step 5	switch(config)# **span session 2** switch(config-span)#	Creates the SPAN session 2.
Step 6	switch(config-span)## **destination interface fc2/2**	Configures the destination interface fc2/2.
Step 7	switch(config-span)# **source interface fc1/1 tx**	Configures the source interface fc1/1 in the egress direction.

To configure Fibre Channel Analyzers using SPAN for the example in Figure 12-5, follow these steps:

Step 1 Configure SPAN on interface fc1/1 in the ingress (Rx) direction to send traffic on SD port fc2/1 using session 1.

Step 2 Configure SPAN on interface fc1/1in the egress (Tx) direction to send traffic on SD port fc2/2 using session 2.

Step 3 Physically connect fc2/1 to port 1 on the Fibre Channel analyzer.

Step 4 Physically connect fc2/2 to port 2 on the Fibre Channel analyzer.

Configuring Single SD Port to Monitor Traffic

Detailed Steps

To configure SPAN on a single SD port, follow these steps:

	Command	Purpose
Step 1	switch# **config t**	Enters configuration mode.
Step 2	switch(config)# **span session 1** switch(config-span)#	Creates the SPAN session 1.
Step 3	switch(config-span)## **destination interface fc2/1**	Configures the destination interface fc2/1.
Step 4	switch(config-span)# **source interface fc1/1**	Configures the source interface fc1/1 on the same SD port.

Configuring the Source Switch

This section identifies the tasks that must be performed in the source switch (Switch S):

- Creating VSAN Interfaces, page 12-23
- Enabling FC Tunnels, page 12-23
- Initiating the FC Tunnel, page 12-24
- Configuring the ST Port, page 12-24
- Configuring an RSPAN Session, page 12-24

Creating VSAN Interfaces

Detailed Steps

To create a VSAN interface in the source switch for the scenario in Figure 12-14, follow these steps:

	Command	Purpose
Step 1	`switchS# config t`	Enters configuration mode.

Step 2	`switchS(config)# interface vsan 5`
	`switchS(config-if)#`
		Configures the specified VSAN interface (VSAN 5) in the source switch (switch S).

Step 3	`switchS(config-if)# ip address 10.10.10.1 255.255.255.0`	Configures the IPv4 address and subnet for the VSAN interface 5 in the source switch (switch S).
Step 4	`switchS(config-if)# no shutdown`	Enables traffic flow through this interface.

Enabling FC Tunnels

Restrictions

- FC tunnels do not work over nontrunking ISLs.
- The interface cannot be operationally up until the FC tunnel mapping is configured in the destination switch.

Detailed Steps

To enable the FC tunnel feature, follow these steps:

	Command	Purpose
Step 1	`switchS# config t`	Enters configuration mode.
Step 2	`switchS(config)# fc-tunnel enable`	Enables the FC tunnel feature (disabled by default).

Note Be sure to enable this feature in each switch in the end-to-end path in the fabric.

Initiating the FC Tunnel

To initiate the FC tunnel in the source switch for the scenario in Figure 12-14, follow these steps:

	Command	Purpose
Step 1	`switchS# config t`	Enters configuration mode.

Step 2	`switchS(config)# interface fc-tunnel 100`
	`switchS(config-if)#`
		Initiates the FC tunnel (100) in the source switch (switch S). The tunnel IDs range from 1 to 255.

Step 3	`switchS(config-if)# source 10.10.10.1`	Maps the IPv4 address of the source switch (switch S) to the FC tunnel (100).
Step 4	`switchS(config-if)# destination 10.10.10.2`	Maps the IPv4 address of the destination switch (switch D) to the FC tunnel (100).
Step 5	`switchS(config-if)# no shutdown`	Enables traffic flow through this interface.

Configuring the ST Port

Restrictions

- ST ports cannot be configured using Storage Services Modules (SSMs).

Detailed Steps

To configure an ST port, follow these steps:

	Command	Purpose
Step 1	`switchS# config t`	Enters configuration mode.
Step 2	`switchS(config)# interface fc2/1`	Configures the specified interface.
Step 3	`switchS(config-if)# switchport mode ST`	Configures the ST port mode for interface fc2/1.
Step 4	`switchS(config-if)# switchport speed 2000`	Configures the ST port speed to 2000 Mbps.
Step 5	`switchS(config-if)# rspan-tunnel interface fc-tunnel 100`	Associates and binds the ST port with the RSPAN tunnel (100).
Step 6	`switchS(config-if)# no shutdown`	Enables traffic flow through this interface.

Configuring an RSPAN Session

A RSPAN session is similar to a SPAN session, with the destination interface being an RSPAN tunnel.

Detailed Steps

To configure an RSPAN session in the source switch for the scenario in Figure 12-15, follow these steps:

	Command	Purpose
Step 1	`switchS# config t`	Enters configuration mode.

Step 2	`switchS(config)# span session 2`
	`switchS(config-span)#`
		Configures the specified SPAN session (2). If the session does not exist, it is created. The session ID ranges from 1 to 16.

	Command	Purpose
Step 3	`switchS(config-span)# destination interface fc-tunnel 100`	Configures the specified RSPAN tunnel (100) in a session.
Step 4	`switchS(config-span)# source interface fc1/1`	Configures the source interface (fc1/1) for this session and spans the traffic from interface fc1/1 to RSPAN tunnel 100.

Configuring All Intermediate Switches

This section identifies the tasks that must be performed in all intermediate switches in the end-to-end path of the RSPAN tunnel:

- Configuring VSAN Interfaces, page 12-25
- Enabling IP Routing, page 12-25

Configuring VSAN Interfaces

Figure 12-7 on page 12-10 depicts an RSPAN tunnel configuration terminating in the destination switch (Switch D).

Note This example assumes that VSAN 5 is already configured in the VSAN database.

Detailed Steps

To create a VSAN interface in the destination switch for the scenario in Figure 12-16, follow these steps:

	Command	Purpose
Step 1	`switchD# config t`	Enters configuration mode.

Step 2	`switchD(config)# interface vsan 5`
	`switchD(config-if)#`
		Configures the specified VSAN interface (VSAN 5) in the destination switch (Switch D).

Step 3	`switchD(config-if)# ip address 10.10.10.2 255.255.255.0`	Configures the IPv4 address and subnet for the VSAN interface in the destination switch (Switch D).
Step 4	`switchD(config-if)# no shutdown`	Enables traffic flow to administratively allow traffic (provided the operational state is up).

Enabling IP Routing

The IP routing feature is disabled by default. Be sure to enable IP routing in each switch (including the source and destination switches) in the end-to-end path in the fabric. This procedure is required to set up the FC tunnel.

Configuring the Destination Switch

This section identifies the tasks that must be performed in the destination switch (Switch D):

- Configuring VSAN Interfaces, page 12-26
- Configuring the SD Port, page 12-26
- Mapping the FC Tunnel, page 12-26
- Creating Explicit Paths, page 12-27
- Monitoring RSPAN Traffic, page 12-28

Configuring VSAN Interfaces

Figure 12-16 depicts an RSPAN tunnel configuration terminating in the destination switch (Switch D).

Note This example assumes that VSAN 5 is already configured in the VSAN database.

Configuring the SD Port

Restrictions

Note SD ports cannot be configured using Storage Services Modules (SSMs).

Detailed Steps

To configure an SD port for the scenario in Figure 12-16, follow these steps:

	Command	Purpose
Step 1	switchD# **config t**	Enters configuration mode.
Step 2	switchD(config)# **interface fc2/1**	Configures the specified interface.
Step 3	switchD(config-if)# **switchport mode SD**	Configures the SD port mode for interface fc2/1.
Step 4	switchD(config-if)# **switchport speed 2000**	Configures the SD port speed to 2000 Mbps.
Step 5	switchD(config-if)# **no shutdown**	Enables traffic flow through this interface.

Mapping the FC Tunnel

Detailed Steps

To terminate the FC tunnel in the destination switch for the scenario in Figure 12-17, follow these steps:

	Command	Purpose
Step 1	switchD# **config t**	Enters configuration mode.
Step 2	switchD(config)# **fc-tunnel tunnel-id-map 100 interface fc2/1**	Terminates the FC tunnel (100) in the destination switch (switch D). The tunnel ID range is from 1 to 255.

Creating Explicit Paths

Prerequisites

- The explicit path must be created in the source switch. To configure an explicit path, you must first create the path and then configure the use of any one path. If an explicit path is not configured, the minimum cost path is used by default. If an explicit path is configured and is functioning, the specified path is used.

Detailed Steps

To create an explicit path for the scenario in Figure 12-13, follow these steps:

	Command	Purpose
Step 1	`switchS# config t`	Enters configuration mode.

Step 2	`switchS(config)# fc-tunnel explicit-path Path1`
	`switch(config-explicit-path)#`
		Places you at the explicit path prompt for the path named Path 1.

Step 3	`switchS(config-explicit-path)# next-address 10.10.10.2 strict`
	`switchS(config-explicit-path)# next-address 10.10.10.3 strict`
	`switchS(config-explicit-path)# next-address 10.10.10.4 strict`
		Specifies that the next hop VSAN interface IPv4 addresses and the previous hops specified in the explicit path do not require direct connection.

Step 4	`switchS(config)# fc-tunnel explicit-path Path2`
	`switch(config-explicit-path)#`
		Places you at the explicit path prompt for Path2.

Step 5	`switchS(config-explicit-path)# next-address 10.10.10.5 strict`
	`switchS(config-explicit-path)# next-address 10.10.10.4 strict`
		Specifies that the next hop VSAN interface IPv4 addresses and the previous hops specified in the explicit path do not require direct connection.

Step 6	`switchS(config)# fc-tunnel explicit-path Path3`
	`switch(config-explicit-path)#`
		Places you at the explicit path prompt for Path3.

Step 7	`switchS(config-explicit-path)# next-address 10.10.10.3 loose`	Configures a minimum cost path in which the 10.10.10.3 IPv4 address exists. **Note** In Figure 12-13, Path 3 is the same as Path 1—10.10.10.3 exists in Path 1. Using the **loose** option, you can achieve the same effect with one command instead of issuing three commands (using the **strict** option) in Step 3.

To reference the explicit path, follow these steps:

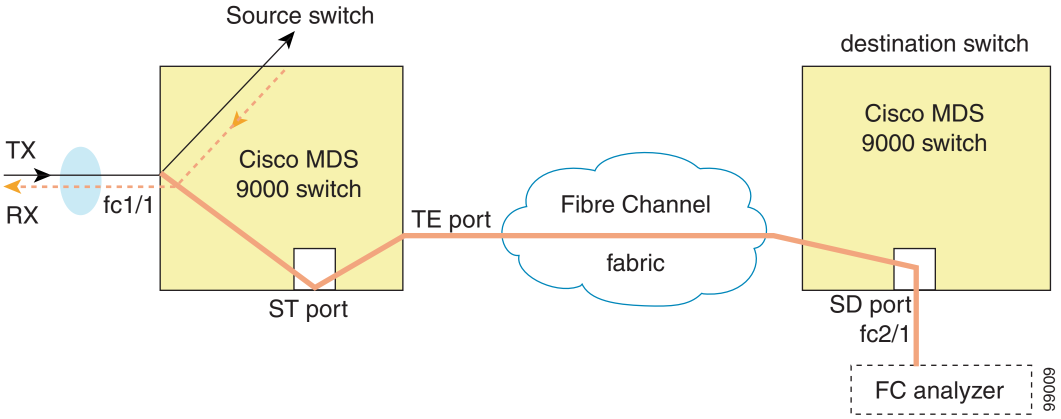
	Command	Purpose
Step 1	`switchS# config t`	Enters configuration mode.
Step 2	`switchS(config)# interface fc-tunnel 100`	References the tunnel ID for Path1.
Step 3	`switchS(config)# explicit-path Path1`	Links Path1 to the tunnel ID.

This configuration explicitly specifies Path 1 to be used for the RSPAN traffic. Refer to RFC 3209 for further details on explicit paths and source-based routing.

Monitoring RSPAN Traffic

Once the session is configured, other SPAN sources for this session can also be configured as required. Figure 12-15 shows an RSPAN setup where one session with destination port fc2/1 and source interface fc1/1 is used to capture traffic in both ingress and egress directions.

Figure 12-15 Fibre Channel Analyzer Using a Single SD Port to Monitor RSPAN Traffic



To use this setup, the analyzer should have the capability of distinguishing ingress and egress traffic for all captured frames.

Verifying SPAN Configuration

To display the SPAN configuration information, perform one of the following tasks:

Command	Purpose
show span	Displays SPAN Sessions in a Brief Format **Note** In Cisco MDS 9700 Series Switches, **show span** command is replaced by **show monitor** command.
show span session 7	Displays a Specific SPAN Session in Detail **Note** In Cisco MDS 9700 Series Switches, **show span session 7** command is replaced by **show monitor session 7** command.
show span session	Displays ALL SPAN Sessions **Note** In Cisco MDS 9700 Series Switches, **show span session** command is replaced by **show monitor session all** command.
show int fc9/32	Displays an SD Port Interface with Encapsulation Enabled
show interface brief	Displays ST Port Interface Information

Command	Purpose
show interface fc1/11	Displays Detailed Information for the ST Port Interface
show fc-tunnel	Displays the FC Tunnel Status
show fc-tunnel tunnel-id-map	Displays FC Tunnel Egress Mapping Information
show fc-tunnel explicit-path	Displays FC Tunnel Explicit Mapping Information
show interface fc-tunnel 200	Displays the FC Tunnel Interface

For detailed information about the fields in the output from these commands, refer to the *Cisco MDS 9000 Family Command Reference*.

This section includes the following topics:

- Displaying SPAN Information, page 12-29
- Displaying RSPAN Information, page 12-30

Displaying SPAN Information

Use the **show span** command to display configured SPAN information. See Examples 12-1 to 12-4.

Example 12-1 Displays SPAN Sessions in a Brief Format

```
switch# show span session brief
--------------------------------------------------------
 Session  Admin          Oper           Destination
          State          State          Interface
--------------------------------------------------------
 7        no suspend     active         fc2/7
 1        suspend        inactive       not configured
 2        no suspend     inactive       fc3/1
```

Example 12-2 Displays a Specific SPAN Session in Detail

```
switch# show span session 7
Session 7 (active)
   Destination is fc2/7
   No session filters configured
   No ingress (rx) sources
   Egress (tx) sources are
     port-channel 7,
```

Example 12-3 Displays ALL SPAN Sessions

```
switch# show span session
Session 1 (inactive as no destination)
Destination is not specified
   Session filter vsans are 1
   No ingress (rx) sources
   No egress (tx) sources
Session 2 (active)
   Destination is fc9/5
   No session filters configured
   Ingress (rx) sources are
```

```
      vsans 1
   No egress (tx) sources
Session 3 (admin suspended)
   Destination is not configured
   Session filter vsans are 1-20
   Ingress (rx) sources are
     fc3/2, fc3/3, fc3/4, fcip 51,
     port-channel 2, sup-fc0,
   Egress (tx) sources are
     fc3/2, fc3/3, fc3/4, sup-fc0,
```

Example 12-4 Displays an SD Port Interface with Encapsulation Enabled

```
switch# show int fc9/32
fc9/32 is up
    Hardware is Fibre Channel
    Port WWN is 22:20:00:05:30:00:49:5e
    Admin port mode is SD
    Port mode is SD
    Port vsan is 1
    Speed is 1 Gbps
    Receive Buffer Size is 2112
    Encapsulation is eisl <---------------- Displays the enabled encapsulation status
    Beacon is turned off
    5 minutes input rate 0 bits/sec, 0 bytes/sec, 0 frames/sec
    5 minutes output rate 0 bits/sec, 0 bytes/sec, 0 frames/sec
      0 frames input, 0 bytes, 0 discards
        0 CRC,  0 unknown class
        0 too long, 0 too short
      0 frames output, 0 bytes, 0 discards
      0 input OLS, 0 LRR, 0 NOS, 0 loop inits
      0 output OLS, 0 LRR, 0 NOS, 0 loop inits
```

Displaying RSPAN Information

Use the **show** commands to display configured RSPAN information. See Examples 12-5 to 12-11.

Example 12-5 Displays ST Port Interface Information

```
switch# show interface brief

-------------------------------------------------------------------------------
Interface   Vsan    Admin   Admin   Status      Oper    Oper    Port-channel
                    Mode    Trunk               Mode    Speed
                            Mode                        (Gbps)
-------------------------------------------------------------------------------
fc1/1       1       auto    on      trunking    TE           2      --
...
fc1/14      1       auto    on      trunking    TE           2      --
fc1/15      1       ST      on      up          ST           2      --
...
fc2/9       1       auto    on      trunking    TE           2      port-channel 21
fc2/10      1       auto    on      trunking    TE           2      port-channel 21
...
fc2/13      999     auto    on      up          F            1      --
fc2/14      999     auto    on      up          FL           1      --
fc2/15      1       SD      --      up          SD           2      --
fc2/16      1       auto    on      trunking    TE           2      --
--------------------------------------------------------------------------------------
Interface           Status      Speed
```

```
                                (Gbps)
--------------------------------------------------------------------------------------
sup-fc0             up          1

--------------------------------------------------------------------------------------
Interface           Status      IP Address              Speed       MTU
--------------------------------------------------------------------------------------
mgmt0               up          172.22.36.175/22        100 Mbps    1500

--------------------------------------------------------------------------------------
Interface           Status      IP Address              Speed       MTU--
--------------------------------------------------------------------------------------
vsan5               up          10.10.10.1/24           1 Gbps      1500
--------------------------------------------------------------------------------------
Interface           Vsan        Admin          Status      Oper    Oper
                                Trunk                      Mode    Speed
                                Mode                               (Gbps)
--------------------------------------------------------------------------------------
port-channel 21     1           on             trunking    TE      4
--------------------------------------------------------------------------------------
Interface           Status      Dest IP Addr    Src IP Addr     TID    Explicit Path
--------------------------------------------------------------------------------------
fc-tunnel 100       up          10.10.10.2      10.10.10.1      100
```

Example 12-6 Displays Detailed Information for the ST Port Interface

```
switch# show interface fc1/11
fc1/11 is up
    Hardware is Fibre Channel
    Port WWN is 20:0b:00:05:30:00:59:de
    Admin port mode is ST
    Port mode is ST
    Port vsan is 1
    Speed is 1 Gbps
    Rspan tunnel is fc-tunnel 100
    Beacon is turned off
    5 minutes input rate 248 bits/sec, 31 bytes/sec, 0 frames/sec
    5 minutes output rate 176 bits/sec, 22 bytes/sec, 0 frames/sec
      6862 frames input, 444232 bytes
        0 discards, 0 errors
        0 CRC, 0 unknown class
        0 too long, 0 too short
      6862 frames output, 307072 bytes
        0 discards, 0 errors
      0 input OLS, 0 LRR, 0 NOS, 0 loop inits
      0 output OLS, 0 LRR, 0 NOS, 0 loop inits
```

Example 12-7 Displays the FC Tunnel Status

```
switch# show fc-tunnel
fc-tunnel is enabled
```

Example 12-8 Displays FC Tunnel Egress Mapping Information

```
switch# show fc-tunnel tunnel-id-map
tunnel id egress interface
    150     fc3/1
    100     fc3/1
```

Note Multiple tunnel IDs can terminate at the same interface.

Example 12-9 Displays FC Tunnel Explicit Mapping Information

```
switch# show fc-tunnel explicit-path
Explicit path name: Alternate1
       10.20.1.2 loose
       10.20.1.3 strict
Explicit path name: User2
       10.20.50.1 strict
       10.20.50.4 loose
```

Example 12-10 Displays SPAN Mapping Information

```
switch# show span session
Session 2 (active)
   Destination is fc-tunnel 100
   No session filters configured
   Ingress (rx) sources are
     fc2/16,
   Egress (tx) sources are
     fc2/16,
```

Example 12-11 Displays the FC Tunnel Interface

```
switch# show interface fc-tunnel 200
fc-tunnel 200 is up
Dest   IP Addr: 200.200.200.7   Tunnel ID: 200
Source IP Addr: 200.200.200.4   LSP ID: 1
Explicit Path Name:
```

Configuration Examples for RSPAN

This section covers the following topics:

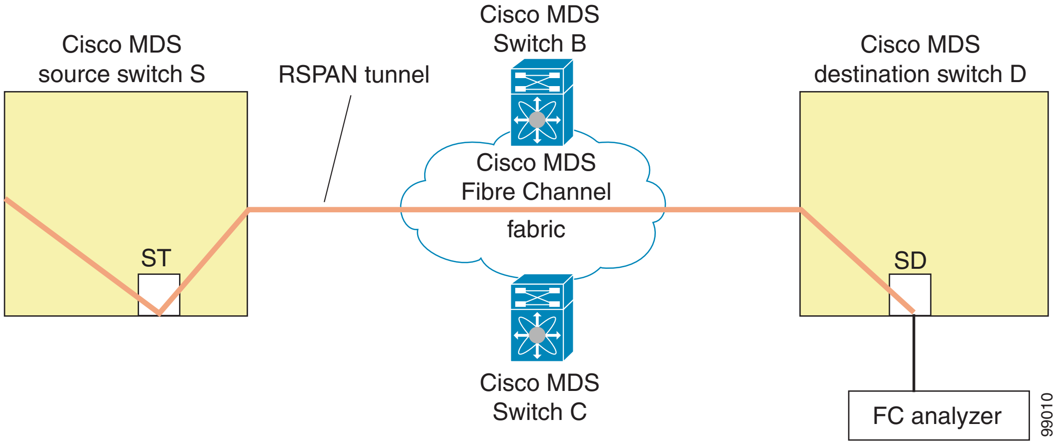
- Single Source with One RSPAN Tunnel, page 12-32
- Single Source with Multiple RSPAN Tunnels, page 12-33
- Multiple Sources with Multiple RSPAN Tunnels, page 12-33

Note RSPAN can be combined with the local SPAN feature so SD ports forward local SPAN traffic along with remote SPAN traffic. Various SPAN source and tunnel scenarios are described in this section.

Single Source with One RSPAN Tunnel

The source Switch S and the destination Switch D are interconnected through a Fibre Channel fabric. An RSPAN tunnel is configured as a destination interface for the SPAN session and the ST port forwards SPAN traffic through the RSPAN tunnel (see Figure 12-16).

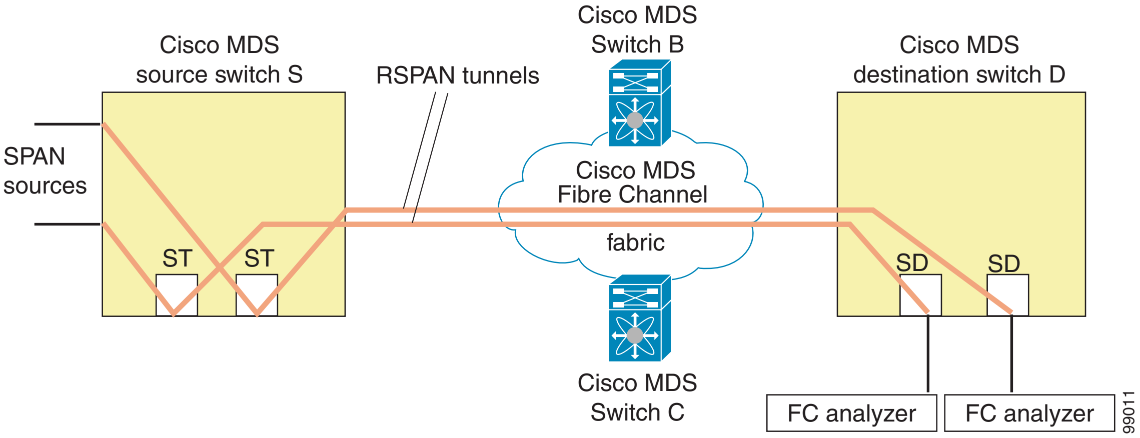
Figure 12-16 RSPAN Scenario with One Source Switch, One Destination Switch, and One Tunnel



Single Source with Multiple RSPAN Tunnels

Figure 12-17 displays two separate RSPAN tunnels configured between Switches S and N. Each tunnel has an associated ST port in the source switch and a separate SD port in the destination switch. This configuration is useful for troubleshooting purposes.

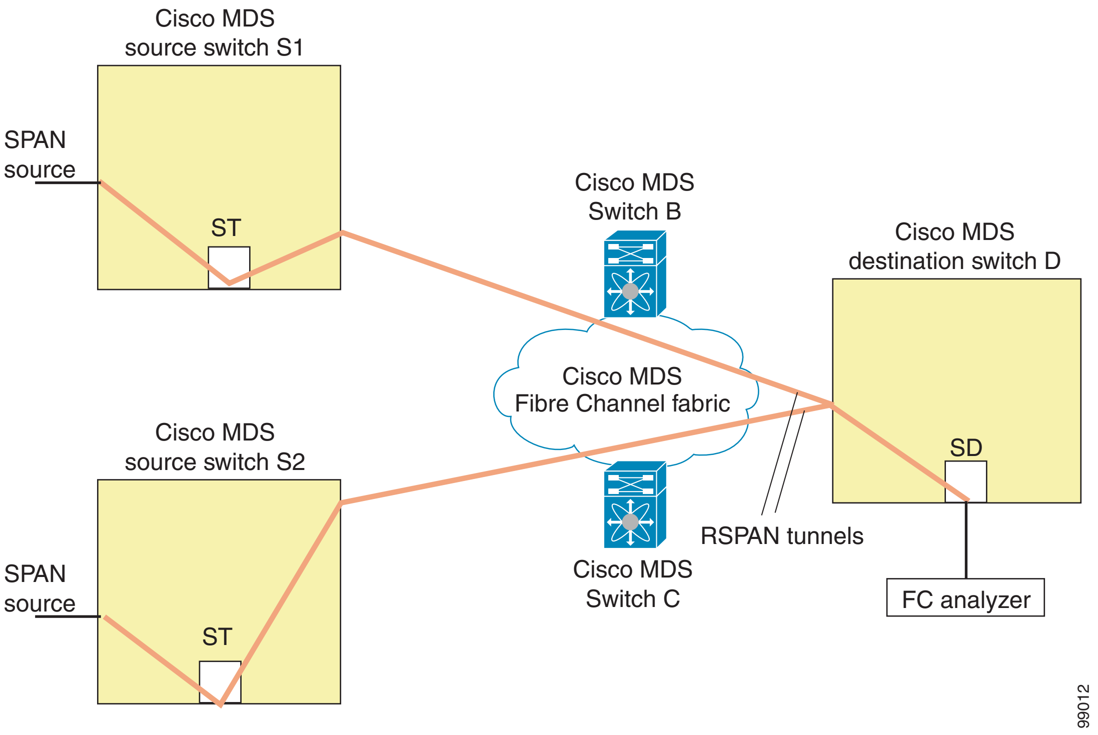
Figure 12-17 RSPAN Scenario with One Source Switch, One Destination Switch, and Multiple Tunnels



Multiple Sources with Multiple RSPAN Tunnels

Figure 12-18 displays two separate RSPAN tunnels configured between Switches S1 and S2. Both tunnels have an associated ST port in their respective source switch and terminate in the same SD port in the destination switch.

Figure 12-18 RSPAN Scenario with Two Source Switches, a Destination Switch, and Multiple Tunnels



This configuration is useful for remote monitoring purposes. For example, the administrator may be at the destination switch and can remotely monitor the two source switches.

CHAPTER 13

Configuring Fabric Configuration Server

This chapter describes the Fabric Configuration Server (FCS) feature provided in the Cisco MDS 9000 Family of directors and switches. It includes the following sections:

Information About FCS

The Fabric Configuration Server (FCS) provides discovery of topology attributes and maintains a repository of configuration information of fabric elements. A management application is usually connected to the FCS on the switch through an N port. The FCS views the entire fabric based on the following objects:

- Interconnect element (IE) object—Each switch in the fabric corresponds to an IE object. One or more IE objects form a fabric.
- Port object—Each physical port in an IE corresponds to a port object. This includes the switch ports (xE, Fx, and TL ports) and their attached Nx ports.
- Platform object—A set of nodes may be defined as a platform object to make it a single manageable entity. These nodes are end-devices (host systems, storage subsystems) attached to the fabric. Platform objects reside at the edge switches of the fabric.

Each object has its own set of attributes and values. A null value may also be defined for some attributes.

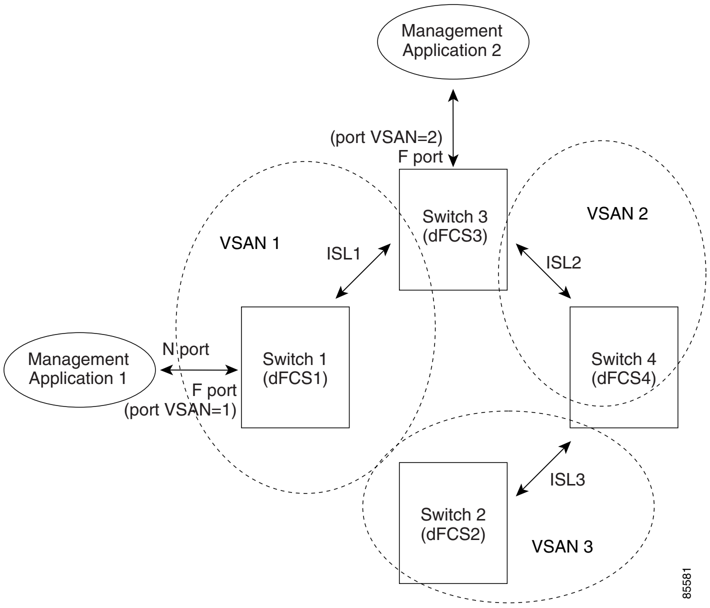
In the Cisco MDS 9000 Family switch environment, multiple VSANs constitute a fabric, where one instance of the FCS is present per VSAN.

As of Cisco NX-OS Release 4.1(1), FCS supports the discovery of virtual devices. The **fcs virtual-device-add** command, issued in FCS configuration submode, allows you to discover virtual devices in a particular VSAN or in all VSANs. The devices that are zoned for IVR must be discovered with this command and have request domain_ID (RDI) enabled, before activating the IVR zone set.

If you have attached a management application to a switch, all the frames directed towards the FCS in the switch are part of the port VSAN in the switch port (Fx port). Your view of the management application is limited only to this VSAN. However, information about other VSANs that this switch is part of can be obtained either through the SNMP or CLI.

In Figure 13-1 Management Application 1 (M1) is connected through an F port with port VSAN ID 1, and Management Application 2 (M2) is connected through an F port with port VSAN ID 2. M1 can query the FCS information of switches S1 and S3, and M2 can query switches S3 and S4. Switch S2 information is not known to both of them. FCS operations can be done only on those switches that are visible in the VSAN. Note that M2 can send FCS requests only for VSAN 2 even though S3 is also a part of VSAN 1.

Figure 13-1 FCSs in a VSAN Environment



Significance of FCS

This section lists the significance of FCSs.

- FCSs support network management including the following:
  - N port management application can query and obtain information about fabric elements.
  - SNMP manager can use the FCS management information base (MIB) to start discovery and obtain information about the fabric topology.
- FCSs support TE and TL ports in addition to the standard F and E ports.
- FCS can maintain a group of modes with a logical name and management address when a platform registers with it. FCSs maintain a backup of all registrations in secondary storage and update it with every change. When a restart or switchover happens, FCSs retrieve the secondary storage information and rebuild its database.
- SNMP manager can query FCSs for all IEs, ports, and platforms in the fabric.

Default Settings

Table 13-1 lists the default FCS settings.

Table 13-1 Default FCS Settings

Parameters	Default
Global checking of the platform name	Disabled.
Platform node type	Unknown.

Configuring FCS

The Fabric Configuration Server (FCS) provides discovery of topology attributes and maintains a repository of configuration information of fabric elements.

This section includes the following topic:

- Specifying a FCS Name, page 13-3

Specifying a FCS Name

You can specify if the unique name verification is for the entire fabric (globally) or only for locally (default) registered platforms.

Restrictions

- Set this command globally only if all switches in the fabric belong to the Cisco MDS 9000 Family.

Detailed Steps

To enable global checking of the platform name, follow these steps:

	Command	Purpose

Step 1	`switch# `**`config t`**
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)# `**`fcs plat-check-global vsan 1`**	Enables global checking of the platform name.
	`switch(config)# `**`no fcs plat-check-global vsan 1`**	Disables (default) global checking of the platform name.

To register platform attributes, follow these steps:

	Command	Purpose

Step 1	`switch# `**`config t`**
	`switch(config)#`
		Enters configuration mode.

Step 2	`switch(config)# `**`fcs register`**
	`switch(config-fcs-register)#`
		Enters the FCS registration submode.

	Command	Purpose
Step 3	switch(config-fcs-register)# **platform name SamplePlatform vsan 1** switch(config-fcs-register-attrib)#	Enters the FCS registration attributes submode.
	switch(config-fcs-register)# **no platform name SamplePlatform vsan 1** switch(config-fcs-register)#	Deletes a registered platform.
Step 4	switch(config-fcs-register-attrib)# **mgmt-addr 1.1.1.1**	Configures the platform management IPv4 address.
	switch(config-fcs-register-attrib)# **no mgmt-addr 1.1.1.1**	Deletes the platform management IPv4 address.
	switch(config-fcs-register-attrib)# **mgmt-addr 2001:0DB8:800:200C::417A**	Configures the platform management IPv6 address.
	switch(config-fcs-register-attrib)# **no mgmt-addr 2001:0DB8:800:200C::417A**	Deletes the platform management IPv6 address.
Step 5	switch(config-fcs-register-attrib)# **nwwn 11:22:33:44:55:66:77:88**	Configures the platform node name.
	switch(config-fcs-register-attrib)# **no nwwn 11:22:33:44:55:66:77:88**	Deletes the platform node name.
Step 6	switch(config-fcs-register-attrib)# **type 5**	Configures the fc-gs-3 defined platform type.
	switch(config-fcs-register-attrib)# **no type 5**	Deletes the configured type and reverts the switch to its factory default of unknown type.
Step 7	switch(config-fcs-register-attrib)# **exit**	Exits the FCS registration attributes submode.
Step 8	switch(config-fcs-register)# **exit** switch(config)#	Exits the FCS registration submode.

Verifying FCS Configuration

To display the FCS configuration information, perform one of the following tasks:

Command	Purpose
show fcs database	Displays FCS Local Database Information.
show fcs ie vsan 1	Displays a List of All IEs for a Specific VSAN.
show fcs ie nwwn 20:01:00:05:30:00:16:df vsan 1	Displays Interconnect Element Object Information for a Specific nWWN
show fcs platform name SamplePlatform vsan 1	Displays Information for a Specific Platform
show fcs platform vsan 1	Displays a List of Platforms for a Specified VSAN
show fcs port vsan 24	Displays a List of Switch Ports in a Specified VSAN
show fcs port pwwn 20:51:00:05:30:00:16:de vsan 24	Displays Port Information for a Specified pWWN
show fcs statistics	Displays FCS Statistics
show fcs vsan	Displays Platform Settings for Each VSAN

For detailed information about the fields in the output from these commands, refer to the *Cisco MDS 9000 Family Command Reference*.

This section includes the following topics:

- Displaying FCS Elements, page 13-5

Displaying FCS Elements

Use the **show fcs** commands to display the status of the WWN configuration (see Example 13-1 to 13-9).

Example 13-1 Displays FCS Local Database Information

```
switch# show fcs database
FCS Local Database in VSAN: 1
------------------------------
Switch WWN               : 20:01:00:05:30:00:16:df
Switch Domain Id         : 0x7f(127)
Switch Mgmt-Addresses    : snmp://172.22.92.58/eth-ip
                           http://172.22.92.58/eth-ip
Fabric-Name              : 20:01:00:05:30:00:16:df
Switch Logical-Name      : 172.22.92.58
Switch Information List  : [Cisco Systems*DS-C9509*0*20:00:00:05:30:00
Switch Ports:
------------------------------------------------------------------
Interface  pWWN                     Type     Attached-pWWNs
------------------------------------------------------------------
fc2/1      20:41:00:05:30:00:16:de  TE       20:01:00:05:30:00:20:de
fc2/2      20:42:00:05:30:00:16:de  Unknown  None
fc2/17     20:51:00:05:30:00:16:de  TE       20:0a:00:05:30:00:20:de

FCS Local Database in VSAN: 5
------------------------------
Switch WWN               : 20:05:00:05:30:00:12:5f
Switch Domain Id         : 0xef(239)
Switch Mgmt-Addresses    : http://172.22.90.171/eth-ip
                           snmp://172.22.90.171/eth-ip
                           http://10.10.15.10/vsan-ip
                           snmp://10.10.15.10/vsan-ip
Fabric-Name              : 20:05:00:05:30:00:12:5f
Switch Logical-Name      : 172.22.90.171
Switch Information List  : [Cisco Systems*DS-C9509**20:00:00:05:30:00:12:5e]
Switch Ports:
------------------------------------------------------------------
Interface  pWWN                     Type     Attached-pWWNs
------------------------------------------------------------------
fc3/1      20:81:00:05:30:00:12:5e  TE       22:01:00:05:30:00:12:9e
fc3/2      20:82:00:05:30:00:12:5e  TE       22:02:00:05:30:00:12:9e
fc3/3      20:83:00:05:30:00:12:5e  TE       22:03:00:05:30:00:12:9e
```

Example 13-2 Displays a List of All IEs for a Specific VSAN

```
switch# show fcs ie vsan 1
IE List for VSAN: 1
-------------------------------------------------------------------
IE-WWN                   IE-Type                           Mgmt-Id
-------------------------------------------------------------------
20:01:00:05:30:00:16:df  Switch (Local)                    0xfffc7f
20:01:00:05:30:00:20:df  Switch (Adjacent)                 0xfffc64
[Total 2 IEs in Fabric]
```

Example 13-3 Displays Interconnect Element Object Information for a Specific nWWN

```
switch# show fcs ie nwwn 20:01:00:05:30:00:16:df vsan 1
IE Attributes
-------------
Domain-Id = 0x7f(127)
Management-Id = 0xfffc7f
Fabric-Name = 20:01:00:05:30:00:16:df
Logical-Name = 172.22.92.58
Management Address List =
        snmp://172.22.92.58/eth-ip
        http://172.22.92.58/eth-ip
Information List:
        Vendor-Name = Cisco Systems
        Model Name/Number = DS-C9509
        Release-Code = 0
```

Example 13-4 Displays Information for a Specific Platform

```
switch# show fcs platform name SamplePlatform vsan 1
Platform Attributes
-------------------
Platform Node Names:
        11:22:33:44:55:66:77:88
Platform Type = Gateway
Platform Management Addresses:
        1.1.1.1
```

Example 13-5 Displays a List of Platforms for a Specified VSAN

```
switch# show fcs platform vsan 1
Platform List for VSAN: 1
Platform-Names
--------------
SamplePlatform
[Total 1 Platforms in Fabric]
```

Example 13-6 Displays a List of Switch Ports in a Specified VSAN

```
switch# show fcs port vsan 24
Port List in VSAN: 24
                 -- IE WWN: 20:18:00:05:30:00:16:df  --
-------------------------------------------------------------------------
Port-WWN                 Type      Module-Type            Tx-Type
-------------------------------------------------------------------------
20:41:00:05:30:00:16:de  TE_Port   SFP with Serial Id      Shortwave Laser
20:51:00:05:30:00:16:de  TE_Port   SFP with Serial Id      Shortwave Laser
[Total 2 switch-ports in IE]
                 -- IE WWN: 20:18:00:05:30:00:20:df  --
-------------------------------------------------------------------------
Port-WWN                 Type      Module-Type            Tx-Type
-------------------------------------------------------------------------
20:01:00:05:30:00:20:de  TE_Port   SFP with Serial Id      Shortwave Laser
20:0a:00:05:30:00:20:de  TE_Port   SFP with Serial Id      Shortwave Laser
[Total 2 switch-ports in IE]
```

Example 13-7 Displays Port Information for a Specified pWWN

```
switch# show fcs port pwwn 20:51:00:05:30:00:16:de vsan 24
Port Attributes
---------------
Port Type = TE_Port
Port Number = 0x1090000
Attached-Port-WWNs:
        20:0a:00:05:30:00:20:de
Port State = Online
```

Example 13-8 Displays FCS Statistics

```
switch# show fcs statistics
FCS Statistics for VSAN: 1
---------------------------
FCS Rx Get Reqs   :2
FCS Tx Get Reqs   :7
FCS Rx Reg Reqs   :0
FCS Tx Reg Reqs   :0
FCS Rx Dereg Reqs :0
FCS Tx Dereg Reqs :0
FCS Rx RSCNs      :0
...
FCS Statistics for VSAN: 30
---------------------------
FCS Rx Get Reqs   :2
FCS Tx Get Reqs   :2
FCS Rx Reg Reqs   :0
FCS Tx Reg Reqs   :0
FCS Rx Dereg Reqs :0
FCS Tx Dereg Reqs :0
FCS Rx RSCNs      :0
FCS Tx RSCNs      :0
...
```

Example 13-9 Displays Platform Settings for Each VSAN

```
switch# show fcs vsan
------------------------------
VSAN    Plat Check fabric-wide
------------------------------
0001    Yes
0010    No
0020    No
0021    No
0030    No
```

Additional References

For additional information related to implementing FCS, see the following section:

- MIBs, page 13-8

MIBs

MIBs	MIBs Link
• CISCO-FCS-MIB	To locate and download MIBs, go to the following URL: http://www.cisco.com/en/US/products/ps5989/prod_technical_reference_list.html

CHAPTER 14

Configuring Port Pacing

This chapter describes how to configure Port Pacer and includes the following section.

Information About Port Pacing

The Fibre Channel Port Pacer is supported only on Cisco MDS 9513 and MDS 9710 switches. The Port Pacer is designed to pace the number of mode F ports that come up simultaneously so that ports are brought up in a phased manner.

During an F port start up, the Port Pacer informs the F Port server that a port is starting up. The Port Pacer waits for the F port server to receive FLOGIs and FDISCs on that port. The Port Pacer attempts to bring up concurrent-ports number of ports simultaneously. However, after the F port server informs the Port Pacer that it has received FLOGI and FDISC for that port, and then the Port Pacer completes the port bring up and updates the port status as up. Subsequently, the next port is attempted for starting up.

By default, F port pacing is disabled. After enabling port pacing, number of FLOGI or FDISC received on the port are being tracked. In the case of all FLOGI or FDISC successfully logged in, which would take few seconds, another set of concurrent ports are brought up. At any given time, FLOGI is processed only for configured concurrent ports. This feature is useful in case of zero FLOGI retries in the hosts.

Guidelines and Limitations

Following are the recommended guidelines and requirements for enabling the Port Pacer:

- Port pacing configurations are supported only for admin port mode F.
- Concurrent-ports port-number needs to be set depending upon the topology and set this value on how many F ports can be brought up simultaneously.

Configuring Port Pacer

This section includes the following topics:

- Enabling Port Pacing, page 14-2
- Disabling the Port Pacing Configuration, page 14-2

Enabling Port Pacing

Note

- Port pacing configuration is supported only for admin port mode F.
- Port pacing command is a system wide command applicable for all admin port mode F ports.

Detailed Step

To enable the port pacer, perform these steps:

	Command	Purpose
Step 1	switch# **configure terminal**	Enters configuration mode.
Step 2	switch# (config)# **system port pacer mode** *F* **interface-login-threshold** *10* **concurrent-ports** 1 switch(config)#	Enables the pacer mode for F port with concurrency of 1 and threshold set as 10. **interface-login-threshold** specifies the number of FLOGI or FDISC expected on a port. **concurrent-ports** specifies the number of admin port mode F ports that can be brought up simultaneously.

Disabling the Port Pacing Configuration

Detailed Step

To disable the port pacing configuration, follow these steps:

	Command	Purpose
Step 1	switch# **configure terminal**	Enters configuration mode.
Step 2	switch# (config)# **no system port pacer mode** *F* **interface-login-threshold** *10* **concurrent-ports** 1 switch(config)#	Disables the pacer mode for F port.