CHAPTER 11

Advanced Features and Concepts

This chapter describes the advanced features provided in switches in the Cisco MDS 9000 Family. It includes the following sections:

- Common Information Model, page 11-1
- Fibre Channel Time-Out Values, page 11-5
- World Wide Names, page 11-9
- FC ID Allocation for HBAs, page 11-11
- Switch Interoperability, page 11-13
- Default Settings, page 11-20

Common Information Model

Common Information Model (CIM) is an object-oriented information model that extends the existing standards for describing management information in a network/enterprise environment.

CIM messages are independent of platform and implementation because they are encoded in N Extensible Markup Language (XML). CIM consists of a specification and a schema. The specification defines the syntax and rules for describing management data and integrating with other management models. The schema provides the actual model descriptions for systems, applications, networks, and devices.

For more information about CIM, refer to the specification available through the Distributed Management Task Force (DMTF) website at the following URL: http://www.dmtf.org/

For further information about Cisco MDS 9000 Family support for CIM servers, refer to the *Cisco MDS 9000 Family CIM Programming Reference Guide*.

A CIM client is required to access the CIM server. The client can be any client that supports CIM.

This section contains the following sections:

- SSL Certificate Requirements and Format, page 11-2
- Configuring the CIM Server, page 11-2
- Displaying CIM Information, page 11-3

SSL Certificate Requirements and Format

To limit access to the CIM server to authorized clients, you can enable the HTTPS transport protocol between the CIM server and client. On the switch side, you must install a Secure Socket Library (SSL) certificate generated on the client and enable the HTTPS server. Certificates may be generated using third-party tools, such as openssl (available for UNIX, Mac and Windows), and may be certified by a CA or self-signed.

The SSL certificate that you install on the switch must meet the following requirements:

- The certificate file contains the certificate and the private key.
- The private key must be RSA type.
- The certificate file should be in Private Electronic Mail (PEM) style format and have .pem as the extension.

```
-----BEGIN CERTIFICATE-----
(certificate goes here)
-----END CERTIFICATE-----
-----BEGIN RSA PRIVATE KEY-----
(private key goes here)
-----END RSA PRIVATE KEY-----
```

Only one certificate file can be installed at a time.

Configuring the CIM Server

To configure the CIM server on the switch, follow these steps:

Step 1 (Optional) Install an SSL certificate.

Step 2 (Optional) Configure the transport protocol.

Step 3 Enable the CIM server.

This section includes the following topics:

- Installing an SSL Certificate for the CIM Server, page 11-2
- Configuring the Transport Protocol for the CIM Server, page 11-3
- Enabling the CIM Server, page 11-3

Installing an SSL Certificate for the CIM Server

To install a conforming SSL certificate for the CIM server, follow these steps:

	Command	Purpose
Step 1	`switch# **config t**`	Enters configuration mode.
Step 2	`switch(config)# **switch(config)# cimserver certificate bootflash:simserver.pem**`	Installs an SSL certificate specified in the file named with a .pem extension
	`switch(config)# **cimserver clearcertificate**`	(Optional) Uninstalls the currently installed SSL certificate.

Configuring the Transport Protocol for the CIM Server

The default transport protocol for the CIM server is HTTP. This protocol uses the wbem-http port (TCP port 5988). HTTPS for CIM uses the wbem-https port (TCP port 5989).

To configure the CIM server to use only the HTTPS protocol, follow these steps:

	Command	Purpose
Step 1	`switch# **config t**`	Enters configuration mode.
Step 2	`switch(config)# **cimserver enableHttps**`	Enables the HTTPS protocol for CIM.
	`switch(config)# **no cimserver enableHttp**`	Disables the HTTP protocol for CIM.

Enabling the CIM Server

The CIM server is disabled in all switches in the Cisco MDS 9000 Family by default. To use the CIM server, you must explicitly enable it on the required switches in the fabric.

To enable the CIM server, follow these steps:

	Command	Purpose
Step 1	`switch# **config t**`	Enters configuration mode.
Step 2	`switch(config)# **feature cimserver**`	Enables the CIM server.
	`switch(config)# **no feature cimserver**`	Disables the CIM server (default).

Displaying CIM Information

To display CIM information, use the **show cimserver** command (see Example 11-1 through Example 11-11).

Example 11-1 Displays CIM Server Status

```
switch# show cimserver status
cimserver is enabled
```

Example 11-2 Displays the CIM Server HTTPS Status

```
switch# show cimserver httpsstatus
 cimserver Https is enabled
```

Example 11-3 Displays the CIM Server HTTP Status

```
switch# show cimserver httpstatus
 cimserver Http is not enabled
```

Example 11-4 Displays CIM Server Indication

```
switch# show cimserver indication
Filter:             root/cimv2:Feb 7, 2008 2:32:11 PM
Query:              "SELECT * FROM CISCO_LinkUp"
Query Language:     WQL
```

```
-----------------------------------------
Handler:           root/cimv2:CIM_ListenerDestinationCIMXML.Thu Feb 07 14:32:44 IST
20081202374964083
Destination:       http://10.77.91.110:59901
PersistenceType:   Transient
-----------------------------------------
Namespace:         root/cimv2
Filter:            root/cimv2:Feb 7, 2008 2:32:11 PM
Handler:           root/cimv2:CIM_ListenerDestinationCIMXML.Thu Feb 07 14:32:44 IST
20081202374964083
Query:             "SELECT * FROM CISCO_LinkUp"
Destination:       http://10.77.91.110:59901
SubscriptionState: Enabled
-----------------------------------------
```

Example 11-5 Displays CIM Server Indication Filters

```
switch# show cimserver indication filters
Filter:           root/cimv2:Feb 7, 2008 2:32:11 PM
Query:            "SELECT * FROM CISCO_LinkUp"
Query Language:   WQL
```

Example 11-6 Displays CIM Server Indication Recipients

```
switch# show cimserver indication recipients
Handler:           root/cimv2:CIM_ListenerDestinationCIMXML.Thu Feb 07 14:32:44 IST
20081202374964083
Destination:       http://10.77.91.110:59901
PersistenceType:   Transient
```

Example 11-7 Displays CIM Server Indication Subscriptions

```
switch# show cimserver indication subscriptions
Namespace:         root/cimv2
Filter:            root/cimv2:Feb 7, 2008 2:32:11 PM
Handler:           root/cimv2:CIM_ListenerDestinationCIMXML.Thu Feb 07 14:32:44 IST
20081202374964083
Query:             "SELECT * FROM CISCO_LinkUp"
Destination:       http://10.77.91.110:59901
SubscriptionState: Enabled
cimserver certificate file name is servcert.pem
```

Example 11-8 Displays the CIM Server Configuration

```
switch# show cimserver
 cimserver is enabled
 cimserver Http is not enabled
 cimserver Https is enabled
 cimserver certificate file name is servcert.pem
 Current value for the property logLevel in CIMServer is 'WARNING'.
```

Example 11-9 Displays CIM Server Logs

```
switch# show cimserver logshttpsstatus
02/07/2008-16:38:14 INFO    cimserver: Sent response to: localhost
02/07/2008-16:38:26 INFO    cimserver: Received request from: 10.77.91.110
```

```
02/07/2008-16:38:27 INFO    cimserver: Sent response to: 10.77.91.110
```

Example 11-10 Configuring CIM Server Loglevel

```
switch# conf t
Enter configuration commands, one per line.  End with CNTL/Z.
switch(config)# cimserver logLevel ?
  <1-5>  1-trace;2-information;3-warning;4-severe;5-fatal
switch(config)# cimserver logLevel 2
Current value for the property logLevel is set to "INFORMATION" in CIMServer.
 cimserver Https is enabled
```

Example 11-11 Displays CIM Server Certificate Files

```
switch# show cimserver certificateName
cimserver certificate file name is servcert.pem
```

Fibre Channel Time-Out Values

You can modify Fibre Channel protocol related timer values for the switch by configuring the following time-out values (TOVs):

- Distributed services TOV (D_S_TOV)—The valid range is from 5,000 to 10,000 milliseconds. The default is 5,000 milliseconds.
- Error detect TOV (E_D_TOV)—The valid range is from 1,000 to 4,000 milliseconds. The default is 2,000 milliseconds. This value is matched with the other end during port initialization.
- Resource allocation TOV (R_A_TOV)—The valid range is from 5,000 to 10,000 milliseconds. The default is 10,000 milliseconds. This value is matched with the other end during port initialization.

Note The fabric stability TOV (F_S_TOV) constant cannot be configured.

This section includes the following topics:

Timer Configuration Across All VSANs

You can modify Fibre Channel protocol related timer values for the switch.

Caution The D_S_TOV, E_D_TOV, and R_A_ TOV values cannot be globally changed unless all VSANs in the switch are suspended.

Note If a VSAN is not specified when you change the timer value, the changed value is applied to all VSANs in the switch.

To configure Fibre Channel timers across all VSANs, follow these steps:

	Command	Purpose

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

Step 2	`switch(config)# fctimer R_A_TOV 6000`	Configures the R_A_TOV value for all VSANs to be 6000 msec. This type of configuration is not permitted unless all VSANs are suspended.

Timer Configuration Per-VSAN

You can also issue the fctimer for a specified VSAN to configure different TOV values for VSANs with special links like FC or IP tunnels. You can configure different E_D_TOV, R_A_TOV, and D_S_TOV values for individual VSANs. Active VSANs are suspended and activated when their timer values are changed.

Caution You cannot perform a nondisruptive downgrade to any earlier version that does not support per-VSAN FC timers.

Note This configuration must be propagated to all switches in the fabric—be sure to configure the same value in all switches in the fabric.

If a switch is downgraded to Cisco MDS SAN-OS Release 1.2 or 1.1 after the timer is configured for a VSAN, an error message is issued to warn against strict incompatibilities. Refer to the *Cisco MDS 9000 Family Troubleshooting Guide*.

To configure per-VSAN Fiber Channel timers, follow these steps:

	Command	Purpose

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

Step 2	`switch(config#)# fctimer D_S_TOV 6000 vsan 2`
	`Warning: The vsan will be temporarily suspended when`
	`updating the timer value This configuration would impact`
	`whole fabric. Do you want to continue? (y/n) y`
	`Since this configuration is not propagated to other`
	`switches, please configure the same value in all the`
	`switches`
		Configures the D_S_TOV value to be 6000 msec for VSAN 2. Suspends the VSAN temporarily. You have the option to end this command, if required.

About fctimer Distribution

You can enable per-VSAN fctimer fabric distribution for all Cisco MDS switches in the fabric. When you perform fctimer 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 fctimer application uses the effective and pending database model to store or commit the commands based on your configuration.

Refer to the *Cisco MDS 9000 Family NX-OS System Management Configuration Guide* for more information on the CFS application.

Enabling fctimer Distribution

To enable or disable fctimer fabric distribution, follow these steps:

	Command	Purpose
Step 1	`switch# config t`	Enters configuration mode.
Step 2	`switch(config)# fctimer distribute`	Enables fctimer configuration distribution to all switches in the fabric. Acquires a fabric lock and stores all future configuration changes in the pending database.
	`switch(config)# no fctimer distribute`	Disables (default) fctimer configuration distribution to all switches in the fabric.

Committing fctimer Changes

When you commit the fctimer 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. When you commit the fctimer configuration changes without implementing the session feature, the fctimer configurations are distributed to all the switches in the physical fabric.

To commit the fctimer configuration changes, follow these steps:

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

Discarding fctimer Changes

After making the configuration changes, you can choose to discard the changes by discarding the changes instead of committing them. In either case, the lock is released.

To discard the fctimer configuration changes, follow these steps:

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

Fabric Lock Override

If you have performed a fctimer fabric 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.

To use administrative privileges and release a locked fctimer session, use the **clear fctimer session** command.

```
switch# clear fctimer session
```

Database Merge Guidelines

For information about CFS merge support, refer to the *Cisco MDS 9000 Family NX-OS System Management Configuration Guide*.

When merging two fabrics, follow these guidelines:

- Be aware of the following merge conditions:
  - The merge protocol is not implemented for distribution of the fctimer values—you must manually merge the fctimer values when a fabric is merged.The per-VSAN fctimer configuration is distributed in the physical fabric.

  - The fctimer configuration is only applied to those switches containing the VSAN with a modified fctimer value.
  - The global fctimer values are not distributed.
- Do not configure global timer values when distribution is enabled.

Note The number of pending fctimer configuration operations cannot be more than 15. At that point, you must commit or abort the pending configurations before performing any more operations.

Displaying Configured fctimer Values

Use the **show fctimer** command to display the configured fctimer values (see Examples 11-12 and 11-13).

Example 11-12 Displays Configured Global TOVs

```
switch# show fctimer
F_S_TOV   D_S_TOV   E_D_TOV   R_A_TOV
----------------------------------------
5000 ms   5000 ms   2000 ms   10000 ms
```

Note The F_S_TOV constant, though not configured, is displayed in the output of the **show fctimer** command.

Example 11-13 Displays Configured TOVs for a Specified VSAN

```
switch# show fctimer vsan 10
vsan no.  F_S_TOV   D_S_TOV   E_D_TOV   R_A_TOV
-------------------------------------------------
10        5000 ms   5000 ms   3000 ms   10000 ms
```

World Wide Names

The world wide name (WWN) in the switch is equivalent to the Ethernet MAC address. As with the MAC address, you must uniquely associate the WWN to a single device. The principal switch selection and the allocation of domain IDs rely on the WWN. The WWN manager, a process-level manager residing on the switch's supervisor module, assigns WWNs to each switch.

Cisco MDS 9000 Family switches support three network address authority (NAA) address formats (see Table 11-1).

Table 11-1 Standardized NAA WWN Formats

NAA Address	NAA Type	WWN Format	
IEEE 48-bit address	Type 1 = 0001b	000 0000 0000b	48-bit MAC address
IEEE extended	Type 2 = 0010b	Locally assigned	48-bit MAC address
IEEE registered	Type 5 = 0101b	IEEE company ID: 24 bits	VSID: 36 bits

Caution Changes to the world-wide names should be made by an administrator or individual who is completely familiar with switch operations.

This section includes the following topics:

- Displaying WWN Information, page 11-10
- Link Initialization WWN Usage, page 11-10
- Configuring a Secondary MAC Address, page 11-11

Displaying WWN Information

Use the **show wwn** commands to display the status of the WWN configuration. See Examples 11-14 to 11-16.

Example 11-14 Displays the Status of All WWNs

```
switch# show wwn status
         Type 1 WWNs: Configured:     64 Available:     48 (75%) Resvd.: 16
     Types 2 & 5 WWNs: Configured: 524288 Available: 450560 (85%) Resvd.: 73728
NKAU & NKCR WWN Blks: Configured:   1760 Available:   1760 (100%)
        Alarm Status:      Type1:   NONE Types 2&5:   NONE
```

Example 11-15 Displays Specified Block ID Information

```
switch# show wwn status block-id 51
WWNs in this block: 21:00:ac:16:5e:52:00:03 to 21:ff:ac:16:5e:52:00:03
Num. of WWNs:: Configured: 256 Allocated:     0 Available: 256
Block Allocation Status: FREE
```

Example 11-16 Displays the WWN for a Specific Switch

```
switch# show wwn switch
Switch WWN is 20:00:ac:16:5e:52:00:00
```

Link Initialization WWN Usage

Exchange Link Protocol (ELP) and Exchange Fabric Protocol (EFP) use WWNs during link initialization. The usage details differ based on the Cisco NX-OS software release.

Both ELPs and EFPs use the VSAN WWN by default during link initialization. However, the ELP usage changes based on the peer switch's usage:

- If the peer switch ELP uses the switch WWN, then the local switch also uses the switch WWN.
- If the peer switch ELP uses the VSAN WWN, then the local switch also uses the VSAN WWN.

Note As of Cisco SAN-OS Release 2.0(2b), the ELP is enhanced to be compliant with FC-SW-3.

Configuring a Secondary MAC Address

To allocate secondary MAC addresses, follow these steps:

	Command	Purpose
Step 1	switch# **config t** switch(config)#	Enters configuration mode.
Step 2	switch(config)# **wwn secondary-mac 00:99:55:77:55:55 range 64** This command CANNOT be undone. Please enter the BASE MAC ADDRESS again: **00:99:55:77:55:55** Please enter the mac address RANGE again: **64** From now on WWN allocation would be based on new MACs. Are you sure? (yes/no) **no** You entered: no. Secondary MAC NOT programmed	Configures the secondary MAC address. This command cannot be undone.

FC ID Allocation for HBAs

Fibre Channel standards require a unique FC ID to be allocated to an N port attached to a Fx port in any switch. To conserve the number of FC IDs used, Cisco MDS 9000 Family switches use a special allocation scheme.

Some HBAs do not discover targets that have FC IDs with the same domain and area. Prior to Cisco SAN-OS Release 2.0(1b), the Cisco SAN-OS software maintained a list of tested company IDs that do not exhibit this behavior. These HBAs were allocated with single FC IDs, and for others a full area was allocated.

The FC ID allocation scheme available in Release 1.3 and earlier, allocates a full area to these HBAs. This allocation isolates them to that area and are listed with their pWWN during a fabric login. The allocated FC IDs are cached persistently and are still available in Cisco SAN-OS Release 2.0(1b) (see the "FC ID Allocation for HBAs" section on page 11-11).

To allow further scalability for switches with numerous ports, the Cisco NX-OS software maintains a list of HBAs exhibiting this behavior. Each HBA is identified by its company ID (also known known as Organizational Unique Identifier, or OUI) used in the pWWN during a fabric login. A full area is allocated to the N ports with company IDs that are listed, and for the others a single FC ID is allocated. Regardless of the kind (whole area or single) of FC ID allocated, the FC ID entries remain persistent.

This section includes the following topics:

- Default Company ID List, page 11-11
- Verifying the Company ID Configuration, page 11-12

Default Company ID List

All switches in the Cisco MDS 9000 Family that ship with Cisco SAN-OS Release 2.0(1b) or later, or NX-OS 4.1(1) contain a default list of company IDs that require area allocation. Using the company ID reduces the number of configured persistent FC ID entries. You can configure or modify these entries using the CLI.

Caution Persistent entries take precedence over company ID configuration. If the HBA fails to discover a target, verify that the HBA and the target are connected to the same switch and have the same area in their FC IDs, then perform the following procedure:

1. Shut down the port connected to the HBA.
2. Clear the persistent FC ID entry.
3. Get the company ID from the Port WWN.
4. Add the company ID to the list that requires area allocation.
5. Bring up the port.

The list of company IDs have the following characteristics:

- A persistent FC ID configuration always takes precedence over the list of company IDs. Even if the company ID is configured to receive an area, the persistent FC ID configuration results in the allocation of a single FC ID.
- New company IDs added to subsequent releases are automatically added to existing company IDs.
- The list of company IDs is saved as part of the running and saved configuration.
- The list of company IDs is used only when the fcinterop FC ID allocation scheme is in auto mode. By default, the interop FC ID allocation is set to auto, unless changed.

Tip We recommend that you set the fcinterop FC ID allocation scheme to auto and use the company ID list and persistent FC ID configuration to manipulate the FC ID device allocation.

Use the **fcinterop FCID allocation auto** command to change the FC ID allocation and the **show running-config** command to view the currently allocated mode.

- When you issue a **write erase**, the list inherits the default list of company IDs shipped with a relevant release.

To allocate company IDs, follow these steps:

	Command	Purpose

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

Step 2	`switch(config)# fcid-allocation area company-id 0x003223`	Adds a new company ID to the default list.
	`switch(config)# no fcid-allocation area company-id 0x00E069`	Deletes a company ID from the default list.
	`switch(config)# fcid-allocation area company-id 0x003223`	Adds a new company ID to the default list.

Verifying the Company ID Configuration

You can view the configured company IDs by issuing the **show fcid-allocation area** command (see Example 11-17). Default entries are listed first and the user-added entries are listed next. Entries are listed even if they were part of the default list and you later removed them.

Example 11-17 Displays the List of Default and Configured Company IDs

```
switch# show fcid-allocation area
```

```
FCID area allocation company id info:
    00:50:2E <------------------- Default entry
    00:50:8B
    00:60:B0
    00:A0:B8
    00:E0:69
    00:30:AE + <----------------- User-added entry
    00:32:23 +

    00:E0:8B * <------------- Explicitly deleted entry (from the original default list)
Total company ids: 7
+ - Additional user configured company ids.
* - Explicitly deleted company ids from default list.
```

You can implicitly derive the default entries shipped with a specific release by combining the list of Company IDs displayed without any identification with the list of deleted entries.

You can also view or obtain the company IDs in a specific WWN by issuing the **show fcid-allocation company-id-from-wwn** command (see Example 11-18). Some WWN formats do not support company IDs. In these cases, you many need to configure the FC ID persistent entry.

Example 11-18 Displays the Company ID for the Specified WWN

```
switch# show fcid-allocation company-id-from-wwn 20:00:00:05:30:00:21:60
Extracted Company ID: 0x000530
```

Switch Interoperability

Interoperability enables the products of multiple vendors to interact with each other. Fibre Channel standards guide vendors towards common external Fibre Channel interfaces.

If all vendors followed the standards in the same manner, then interconnecting different products would become a trivial exercise. However, not all vendors follow the standards in the same way, thus resulting in interoperability modes. This section briefly explains the basic concepts of these modes.

Each vendor has a regular mode and an equivalent interoperability mode, which specifically turns off advanced or proprietary features and provides the product with a more amiable standards-compliant implementation.

Note For more information on configuring interoperability for the Cisco MDS 9000 Family switches, refer to the *Cisco MDS 9000 Family Switch-to-Switch Interoperability Configuration Guide*.

This section includes the following topics:

- About Interop Mode, page 11-13
- Configuring Interop Mode 1, page 11-16

About Interop Mode

Cisco NX-OS software supports the following four interop modes:

- Mode 1— Standards based interop mode that requires all other vendors in the fabric to be in interop mode.

- Mode 2—Brocade native mode (Core PID 0).
- Mode 3—Brocade native mode (Core PID 1).
- Mode 4—McData native mode.

For information about configuring interop modes 2, 3, and 4, refer to the *Cisco MDS 9000 Family Switch-to-Switch Interoperability Configuration Guide*.

Table 11-2 lists the changes in switch behavior when you enable interoperability mode. These changes are specific to switches in the Cisco MDS 9000 Family while in interop mode.

Table 11-2 Changes in Switch Behavior When Interoperability Is Enabled

Switch Feature	Changes if Interoperability Is Enabled
Domain IDs	Some vendors cannot use the full range of 239 domains within a fabric. Domain IDs are restricted to the range 97-127. This is to accommodate McData's nominal restriction to this same range. They can either be set up statically (the Cisco MDS switch accept only one domain ID, if it does not get that domain ID it isolates itself from the fabric) or preferred. (If it does not get its requested domain ID, it accepts any assigned domain ID.)
Timers	All Fibre Channel timers must be the same on all switches as these values are exchanged by E ports when establishing an ISL. The timers are F_S_TOV, D_S_TOV, E_D_TOV, and R_A_TOV.
F_S_TOV	Verify that the Fabric Stability Time Out Value timers match exactly.
D_S_TOV	Verify that the Distributed Services Time Out Value timers match exactly.
E_D_TOV	Verify that the Error Detect Time Out Value timers match exactly.
R_A_TOV	Verify that the Resource Allocation Time Out Value timers match exactly.
Trunking	Trunking is not supported between two different vendor's switches. This feature may be disabled on a per port or per switch basis.
Default zone	The default zone behavior of permit (all nodes can see all other nodes) or deny (all nodes are isolated when not explicitly placed in a zone) may change.
Zoning attributes	Zones may be limited to the pWWN and other proprietary zoning methods (physical port number) may be eliminated. **Note** Brocade uses the **cfgsave** command to save fabric-wide zoning configuration. This command does not have any effect on Cisco MDS 9000 Family switches if they are part of the same fabric. You must explicitly save the configuration on each switch in the Cisco MDS 9000 Family.
Zone propagation	Some vendors do not pass the full zone configuration to other switches, only the active zone set gets passed. Verify that the active zone set or zone configuration has correctly propagated to the other switches in the fabric.
VSAN	Interop mode only affects the specified VSAN. **Note** Interop modes cannot be enabled on FICON-enabled VSANs.

Table 11-2 Changes in Switch Behavior When Interoperability Is Enabled (continued)

Switch Feature	Changes if Interoperability Is Enabled
TE ports and PortChannels	TE ports and PortChannels cannot be used to connect Cisco MDS to non-Cisco MDS switches. Only E ports can be used to connect to non-Cisco MDS switches. TE ports and PortChannels can still be used to connect an Cisco MDS to other Cisco MDS switches even when in interop mode.
FSPF	The routing of frames within the fabric is not changed by the introduction of interop mode. The switch continues to use src-id, dst-id, and ox-id to load balance across multiple ISL links.
Domain reconfiguration disruptive	This is a switch-wide impacting event. Brocade and McData require the entire switch to be placed in offline mode and/or rebooted when changing domain IDs.
Domain reconfiguration nondisruptive	This event is limited to the affected VSAN. Only Cisco MDS 9000 Family switches have this capability—only the domain manager process for the affected VSAN is restarted and not the entire switch.
Name server	Verify that all vendors have the correct values in their respective name server database.
IVR	IVR-enabled VSANs can be configured in **no interop** (default) mode or in any of the **interop** modes.

Configuring Interop Mode 1

The interop mode1 in Cisco MDS 9000 Family switches can be enabled disruptively or nondisruptively.

Note Brocade's **msplmgmtdeactivate** command must explicitly be run prior to connecting from a Brocade switch to either Cisco MDS 9000 Family switches or to McData switches. This command uses Brocade proprietary frames to exchange platform information, which Cisco MDS 9000 Family switches or McData switches do not understand. Rejecting these frames causes the common E ports to become isolated.

To configure interop mode 1 in any switch in the Cisco MDS 9000 Family, follow these steps:

Step 1 Place the VSAN of the E ports that connect to the OEM switch in interoperability mode.

```
switch# config t
switch(config)# vsan database
switch(config-vsan-db)# vsan 1 interop 1
switch(config-vsan-db)# exit
switch(config)#
```

Note You cannot enable interop modes on FICON-enabled VSANs.

Step 2 Assign a domain ID in the range of 97 (0x61) through 127 (0x7F).

Note This is an limitation imposed by the McData switches.

```
switch(config)# fcdomain domain 100 preferred vsan 1
```

In Cisco MDS 9000 switches, the default is to request an ID from the principal switch. If the preferred option is used, Cisco MDS 9000 switches request a specific ID, but still join the fabric if the principal switch assigns a different ID. If the static option is used, the Cisco MDS 9000 switches do not join the fabric unless the principal switch agrees and assigns the requested ID.

Note When changing the domain ID, the FC IDs assigned to N ports also change.

Step 3 Change the Fibre Channel timers (if they have been changed from the system defaults).

Note The Cisco MDS 9000, Brocade, and McData FC Error Detect (ED_TOV) and Resource Allocation (RA_TOV) timers default to the same values. They can be changed if needed. The RA_TOV default is 10 seconds, and the ED_TOV default is 2 seconds. Per the FC-SW2 standard, these values must be the same on each switch within the fabric.

```
switch(config)# fctimer e_d_tov ?
  <1000-4000>  E_D_TOV in milliseconds(1000-4000)
switch(config)# fctimer r_a_tov ?
  <5000-100000>  R_A_TOV in milliseconds(5000-100000)
```

Step 4 When making changes to the domain, you may or may not need to restart the Cisco MDS domain manager function for the altered VSAN.

- Force a fabric reconfiguration with the **disruptive** option.

```
switch(config)# fcdomain restart disruptive vsan 1
```

or

- Do not force a fabric reconfiguration.

```
switch(config# fcdomain restart vsan 1
```

 commandsTo verify the resulting status of issuing the interoperability command in any switch in the Cisco MDS 9000 Family, follow these steps:

Step 1 Use the **show version** command to verify the version.

```
switch# show version
Cisco Storage Area Networking Operating System (NX-OS) Software
TAC support: http://www.cisco.com/tac
Copyright (c) 2002-2003, Cisco Systems, Inc. All rights reserved.
The copyrights to certain works contained herein are owned by
Cisco Systems, Inc. and/or other third parties and are used and
distributed under license. Some parts of this software are covered
under the GNU Public License. A copy of the license is available
at http://www.gnu.org/licenses/gpl.html.

Software
  BIOS:      version 1.0.8
  loader:    version 1.1(2)
  kickstart: version 2.0(1) [build 2.0(0.6)] [gdb]
  system:    version 2.0(1) [build 2.0(0.6)] [gdb]

  BIOS compile time:       08/07/03
  kickstart image file is: bootflash:///m9500-sf1ek9-kickstart-mzg.2.0.0.6.bin
  kickstart compile time:  10/25/2010 12:00:00
  system image file is:    bootflash:///m9500-sf1ek9-mzg.2.0.0.6.bin
  system compile time:     10/25/2020 12:00:00


Hardware
  RAM 1024584 kB

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

  172.22.92.181 uptime is 0 days 2 hours 18 minute(s) 1 second(s)

  Last reset at 970069 usecs after Tue Sep 16 22:31:25 1980
    Reason: Reset Requested by CLI command reload
    System version: 2.0(0.6)
    Service:
```

Step 2 Use the **show interface brief** command to verify if the interface states are as required by your configuration.

```
switch# show int brief
Interface  Vsan   Admin  Admin  Status            Oper  Oper   Port-channel
                  Mode   Trunk                    Mode  Speed
                         Mode                           (Gbps)
--------------------------------------------------------------------
fc2/1      1      auto   on     up                E     2      --
fc2/2      1      auto   on     up                E     2      --
```

```
fc2/3      1      auto   on     fcotAbsent       --     --     --
fc2/4      1      auto   on     down             --     --     --
fc2/5      1      auto   on     down             --     --     --
fc2/6      1      auto   on     down             --     --     --
fc2/7      1      auto   on     up               E      1      --
fc2/8      1      auto   on     fcotAbsent       --     --     --
fc2/9      1      auto   on     down             --     --     --
fc2/10     1      auto   on     down             --     --     --
```

Step 3 Use the **show run** command to verify if you are running the desired configuration.

```
switch# show run
Building Configuration...

 interface fc2/1
no shutdown

 interface fc2/2
no shutdown

 interface fc2/3
 interface fc2/4
 interface fc2/5
 interface fc2/6
 interface fc2/7
no shutdown

 interface fc2/8
 interface fc2/9
 interface fc2/10

<snip>

interface fc2/32

 interface mgmt0
ip address 6.1.1.96 255.255.255.0
switchport encap default
no shutdown

vsan database
vsan 1 interop

boot system bootflash:/m9500-system-253e.bin sup-1
boot kickstart bootflash:/m9500-kickstart-253e.bin sup-1
boot system bootflash:/m9500-system-253e.bin sup-2
boot kickstart bootflash:/m9500-kickstart-253e.bin sup-2
callhome

fcdomain domain 100 preferred vsan 1

ip route 6.1.1.0 255.255.255.0 6.1.1.1
ip routing
line console
  databits 5
  speed 110
logging linecard
ssh key rsa 512 force
ssh server enable
switchname MDS9509
username admin password 5 $1$Li8/fBYX$SNc72.xt4nTXpSnR9OUFB/ role network-admin
```

Step 4 Use the **show vsan** command to verify if the interoperability mode is active.

```
switch# show vsan 1
vsan 1 information
         name:VSAN0001 stalactites
         interoperability mode:yes <-------------------- verify mode
         loadbalancing:src-id/dst-id/oxid
         operational state:up
```

Step 5 Use the **show fcdomain vsan** command to verify the domain ID.

```
switch# show fcdomain vsan 1
The local switch is a Subordinated Switch.

Local switch run time information:
        State: Stable
        Local switch WWN:    20:01:00:05:30:00:51:1f
        Running fabric name: 10:00:00:60:69:22:32:91
        Running priority: 128
        Current domain ID: 0x64(100) <---------------verify domain id

Local switch configuration information:
        State: Enabled
        Auto-reconfiguration: Disabled
        Contiguous-allocation: Disabled
        Configured fabric name: 41:6e:64:69:61:6d:6f:21
        Configured priority: 128
        Configured domain ID: 0x64(100) (preferred)

Principal switch run time information:
        Running priority: 2

Interface               Role          RCF-reject
----------------    -------------    ------------
fc2/1               Downstream       Disabled
fc2/2               Downstream       Disabled
fc2/7               Upstream         Disabled
----------------    -------------    ------------
```

Step 6 Use the **show fcdomain domain-list vsan** command to verify the local principal switch status.

```
switch# show fcdomain domain-list vsan 1

Number of domains: 5
Domain ID              WWN
---------    -----------------------
 0x61(97)    10:00:00:60:69:50:0c:fe
 0x62(98)    20:01:00:05:30:00:47:9f
 0x63(99)    10:00:00:60:69:c0:0c:1d
0x64(100)    20:01:00:05:30:00:51:1f [Local]
0x65(101)    10:00:00:60:69:22:32:91 [Principal]
---------    -----------------------
```

Step 7 Use the **show fspf internal route vsan** command to verify the next hop and destination for the switch.

```
switch# show fspf internal route vsan 1

FSPF Unicast Routes
---------------------------
 VSAN Number  Dest Domain   Route Cost    Next hops
-----------------------------------------------
           1     0x61(97)          500      fc2/2
           1     0x62(98)         1000      fc2/1
                                            fc2/2
           1     0x63(99)          500      fc2/1
           1    0x65(101)         1000      fc2/7
```

Step 8 Use the **show fcns data vsan** command to verify the name server information.

```
switch# show fcns data vsan 1
VSAN 1:
------------------------------------------------------------------
FCID        TYPE  PWWN                    (VENDOR) FC4-TYPE:FEATURE
------------------------------------------------------------------
0x610400    N     10:00:00:00:c9:24:3d:90 (Emulex)     scsi-fcp
0x6105dc    NL    21:00:00:20:37:28:31:6d (Seagate)    scsi-fcp
0x6105e0    NL    21:00:00:20:37:28:24:7b (Seagate)    scsi-fcp
0x6105e1    NL    21:00:00:20:37:28:22:ea (Seagate)    scsi-fcp
0x6105e2    NL    21:00:00:20:37:28:2e:65 (Seagate)    scsi-fcp
0x6105e4    NL    21:00:00:20:37:28:26:0d (Seagate)    scsi-fcp
0x630400    N     10:00:00:00:c9:24:3f:75 (Emulex)     scsi-fcp
0x630500    N     50:06:01:60:88:02:90:cb              scsi-fcp
0x6514e2    NL    21:00:00:20:37:a7:ca:b7 (Seagate)    scsi-fcp
0x6514e4    NL    21:00:00:20:37:a7:c7:e0 (Seagate)    scsi-fcp
0x6514e8    NL    21:00:00:20:37:a7:c7:df (Seagate)    scsi-fcp
0x651500    N     10:00:00:e0:69:f0:43:9f (JNI)

Total number of entries = 12
```

Default Settings

Table 11-3 lists the default settings for the features included in this chapter.

Table 11-3 Default Settings for Advanced Features

Parameters	Default
CIM server	Disabled
CIM server security protocol	HTTP
D_S_TOV	5,000 milliseconds.
E_D_TOV	2,000 milliseconds.
R_A_TOV	10,000 milliseconds.
Timeout period to invoke fctrace	5 seconds.
Number of frame sent by the fcping feature	5 frames.
Remote capture connection protocol	TCP.
Remote capture connection mode	Passive.
Local capture frame limit s	10 frames.
FC ID allocation mode	Auto mode.
Loop monitoring	Disabled.
D_S_TOV	5,000 msec
E_D_TOV	2,000 msec
R_A_TOV	10,000 msec
Interop mode	Disabled