Configuring Interfaces

This document provides information about configuring and verifying interfaces on Cisco MDS 9000 Series Multilayer switches.

This chapter includes the following topics:

Finding Feature Information

Your software release might not support all the features documented in this module. For the latest caveats and feature information, see the Bug Search Tool at https://tools.cisco.com/bugsearch/ and the release notes for your software release. To find information about the features documented in this chapter, and to see a list of the releases in which each feature is supported, see the Chapter 1, "New and Changed Information" or the Feature Information table below.

Feature Information for Interfaces

Table 3-1 lists the new and changed features for Cisco MDS NX-OS Release 6.2(x).

Table 3-1 New and Changed Features for Cisco MDS NX-OS Release 6.2(x)

Feature Name	Release	Feature Information
Port Monitor	Cisco MDS NX-OS Release 6.2(17)	Port Monitor Counter—Users can configure the state-change counter to be monitored. This counter records port down-to-port up as one state change. The following command was modified: **monitor counter state-change** (port-monitor configuration mode)
Port Monitor	Cisco MDS NX-OS Release 6.2(15)	• Port Monitor Warning Threshold—Users can configure an optional lower threshold value than the rising threshold value (in addition to the rising and falling threshold) to generate syslogs. The following command was introduced: **counter** *counter_name* **poll-interval** *time interval* **delta rising-threshold** *value* **event** *event number* **warning-threshold** *value* **falling-threshold** *value* **event** *event number* Set the numerical **warning-threshold** limit in the range 0 to 9223372036854775807. • Port Monitor Check Interval—Users can check errors at frequent intervals before a poll interval expires. The following commands were introduced: – **port-monitor check-interval** *time interval* – **no port-monitor check-interval** *time interval*

Table 3-1 New and Changed Features for Cisco MDS NX-OS Release 6.2(x) (continued)

Feature Name	Release	Feature Information
Slow-Drain Detection and Mitigation Enhancements	Cisco MDS NX-OS Release 6.2(13)	• Slow-Drain Device Detection—Users can detect slow-drain devices that cause congestion in a network. The feature also provides a congestion-mitigation function. Slow-port monitoring is supported on 8 Gbps and advanced 8-Gbps modules. The following commands were introduced: – **show process creditmon slowport-monitor-events** – **system timeout slowport-monitor** • TxWait—The advanced 8 and 16 Gbps modules support slow-port monitoring using the transmit wait feature. The transmit credit unavailable history is graphically represented with a transmit-wait history graph. The following commands were introduced: – **show interface fc***x/y* **counters** – **show process creditmon txwait-history** • On-Board Failure Logging—The slow-port monitor events and the TxWait delta values were logged in Onboard Failure Logging (OBFL) periodically. The following commands were introduced: – **show logging onboard slowport-monitor-events** – **show logging onboard txwait** • Port Monitor Alerting—Three new counters were added to the port monitor policy: – **tx-slowport-count** – **tx-slowport-oper-delay** – **txwait** The following commands were introduced: – **counter tx-slowport-count** – **counter tx-slowport-oper-delay** – **counter txwait**
		• Slow Drain—Users can display various debug logs related to slow drain. The following command was introduced: **show tech-support slowdrain**

Prerequisites for Interfaces

Before you begin configuring interfaces, ensure that the modules in the chassis are functioning as designed. To verify the status of a module, enter the **show module** command in user EXEC mode. For information about verifying the module status, refer to the *Cisco MDS 9000 Series NX-OS Fundamentals Configuration Guide*.

Guidelines and Limitations for Interfaces

When you activate a port-monitor policy using the **port-monitor activate** *policyname* command, a syslog is generated to display that the policy is activated successfully. However, when you disable the policy using the **no port-monitor activate** *policyname* command and enable the policy again, there is no syslog message displayed about the policy activation. Use the **no logging rate-limit** command in the configuration mode to ensure that all syslogs are logged.

The guidelines and limitations for interfaces configuration are listed in the following topics:

Guidelines for Configuring Port Monitor Interval

- Check interval should be configured before activating port monitor policies.

Note The value of the check interval is common across counters and policies.

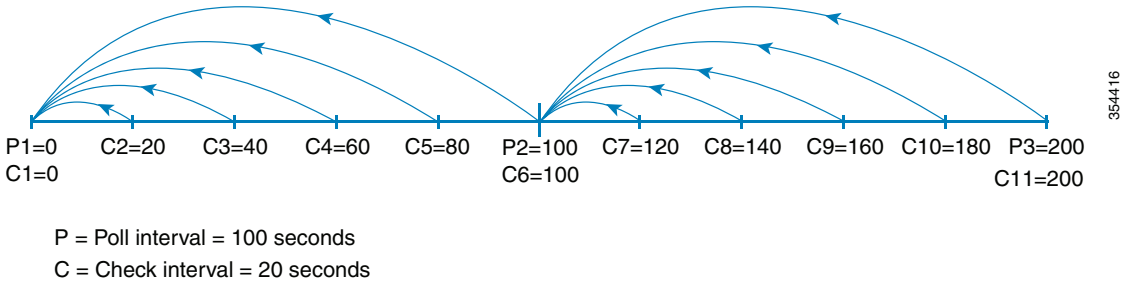
- Check interval should be less than the poll interval.
- Check interval is applicable to all the active port monitor policies configured.
- Users should deactivate all the active port monitor policies before enabling, modifying, or disabling the check interval functionality.
- Check interval cannot be enabled when an active policy is configured.
- Software downgrade to a version that does not support the check interval functionality is restricted when the check interval functionality is enabled.
- We recommend that you do not have a port guard action set to the state-change counter when an interface state is changed from down state to up state.
- We recommend that you do not use the default policy when the check interval is configured.

Example 3-1 Check Interval

Let us consider a scenario where the poll interval, rising threshold, and check interval are configured with the following values:

- Poll interval is 100 seconds
- Rising threshold is 30

- Check interval is 20 seconds



The check interval starts its interval, C1, along with the poll interval at P1. If an error occurs between the check intervals C2 and C3, the check intervals C2 and C3 are higher than the configured rising threshold value of 30, an alert (syslog or trap or both) is generated at C3, alerting the user that an error has occurred at that particular port.

Note You can configure longer poll intervals to capture events across poll intervals. For example, configure a poll interval of 24 hours with a check interval of 30 seconds, with the rising threshold value being checked cumulatively every 30 seconds.

Guidelines for Local Switching

- All the ports should be in shared mode, which is usually the default state. To place a port in shared mode, enter the **switchport rate-mode shared** command.
- E ports are not allowed in the module because they must be in dedicated mode.

Note Local switching is not supported on the Cisco MDS 9710 switch.

Guidelines for 10-Gbps Fibre Channel Mode

- To change the port speed from 10 to 16 Gbps, use only the **no 10g-speed-mode** command. We do not recommend using the **16g-speed-mode** command because the ports will move to unrecoverable state, and the only way to recover these ports is to issue the **no 10g-speed-mode** command.
- For Cisco MDS 9513, the ports in the module can be configured to 10-Gbps speed only when the DS-13SLT-FAB3 (fabric 3) module bandwidth is 256 Gbps. Any other combination of fabric modules or Cisco MDS 9506 or Cisco MDS 9509 will not let the ports come up in 10 Gbps.
- When the 8-Gbps modules are in 10-Gbps mode, the ports in the module that are not 10-Gbps capable are disabled and are in the out-of-service state. For DS-X9232-256K9, the ASIC range is eight ports, of which two ports will be out of service. For DS-X9248-256K9, the ASIC range is 12 ports, of which six ports will be out of service. For the 16-Gbps modules and fabric switch, all the ports have 10-G speed mode.
- The ports function only in full rate mode. They cannot be moved to shared rate mode.

- The ports cannot be configured in any other speed other than the speed values provided in the **switchport speed** command.
- Ports that are 10 Gbps capable and are disabled or are out of service cannot be put back in service using the **no out-of-service** command. To put these ports back in service, all the ports in the ASIC range need to be reconfigured with the **no 10g-speed-mode** command.
- Local switching must be disabled. Otherwise, ports cannot be configured in dedicated mode.

Thus, for interconnecting 16-Gbps Fibre Channel modules, 16 Gbps is the preferred speed. However, for interconnecting 8-Gbps modules, or for interconnecting 16-Gbps modules and 8-Gbps modules, we recommend 10 Gbps as the preferred speed.

Guidelines for VSAN Interface Configuration

- Create a VSAN before creating the interface for that VSAN. If a VSAN does not exist, the interface cannot be created.
- Create the interface VSAN; it is not created automatically.
- If you delete a VSAN, the attached interface is automatically deleted.
- Configure each interface only in one VSAN.

Tip After configuring a VSAN interface, you can configure an IP address or the Virtual Router Redundancy Protocol (VRRP) feature. See the *Cisco MDS 9000 Series NX-OS IP Services Configuration Guide*.

Default Settings for Interface Parameters

Table 3-2 lists the default settings for interface parameters.

Table 3-2 Default Settings for Interface Parameters

Parameter	Default
Interface mode	Auto
Interface speed	Auto
Administrative state	Shutdown (unless changed during initial setup)
Trunk mode	On (unless changed during initial setup) in non-NPV and NPIV core switches. Off in NPV switches.
Trunk-allowed VSANs or VF-IDs	1 to 4093
Interface VSAN	Default VSAN (1)
Beacon mode	Off (disabled)
EISL encapsulation	Disabled
Data field size	2112 bytes

Information About Interfaces

The main function of a switch is to relay frames from one data link to another. To relay frames, the characteristics of the interfaces through which the frames are received and sent must be defined. The configured interfaces can be Fibre Channel interfaces, Gigabit Ethernet interfaces, the management interface, or VSAN interfaces.

This section includes the following topics:

Interface Description

For Fibre Channel interfaces, you can configure the description parameter to provide a recognizable name for an interface. Using a unique name for each interface allows you to quickly identify an interface when you are looking at a listing of multiple interfaces. You can also use the description to identify the traffic or the use for a specific interface.

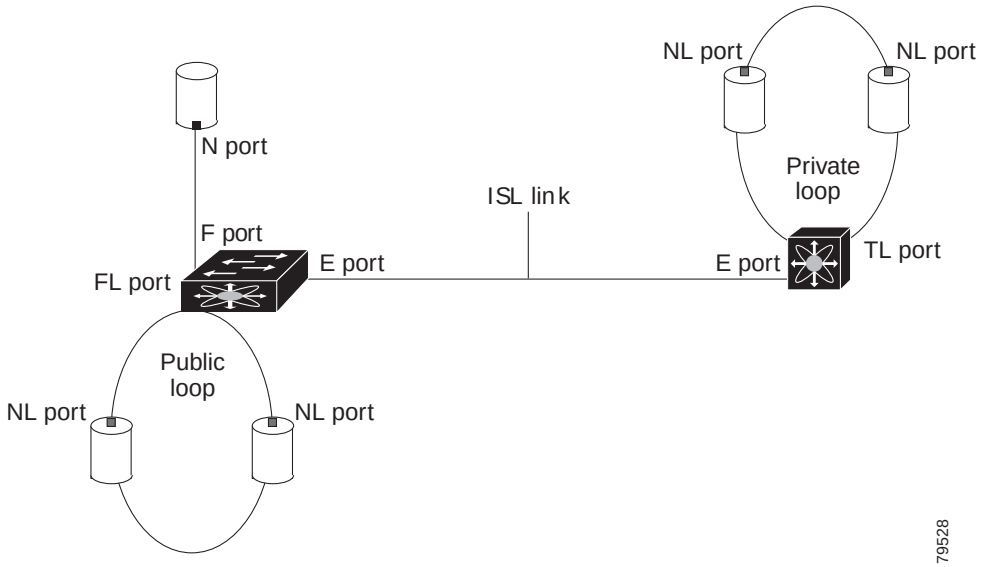
Interface Modes

Each physical Fibre Channel interface in a switch operates in one of the following port modes (see Figure 3-1):

- TF Port, page 3-10
- TNP Port, page 3-10
- SD Port, page 3-10
- ST Port, page 3-10
- Fx Port, page 3-10
- B Port, page 3-11
- Auto Mode, page 3-11

Note Besides these modes, each interface can be configured in auto port mode or Fx port mode. These two modes determine the port type during interface initialization.

Figure 3-1 Cisco MDS 9000 Series Switch Port Modes



Note Interfaces are created in VSAN 1 by default. For information about VSANs, see the *Cisco MDS 9000 Series NX-OS Fabric Configuration Guide*.

Each interface has an associated administrative configuration and an operational status:

- The administrative configuration does not change unless you modify it. This configuration has various attributes that you can configure in administrative mode.
- The operational status represents the current status of a specified attribute, such as the interface speed. This status cannot be changed and is read-only. Some values, for example, operational speed, may not be valid when the interface is down.

Note When a module is removed and replaced with the same type of module, the original configuration is retained. If a different type of module is inserted, the original configuration is no longer retained.

E Port

In expansion port (E port) mode, an interface functions as a fabric expansion port. This port can be connected to another E port to create an Inter-Switch Link (ISL) between two switches. E ports carry frames between switches for configuration and fabric management. They serve as a conduit between switches for frames destined for remote N ports and NL ports. E ports support Class 2, Class 3, and Class F services.

An E port connected to another switch can also be configured to form a port channel. For more details about configuring a port channel, see Chapter 6, “Configuring Port Channels”.

F Port

In fabric port (F port) mode, an interface functions as a fabric port. This port can be connected to a peripheral device (host or disk) operating as an N port. An F port can be attached to only 1 N port. F ports support Class 2 and Class 3 services.

FL Port

In fabric loop port (FL port) mode, an interface functions as a fabric loop port. This port can be connected to one or more NL ports (including FL ports in other switches) to form a public, arbitrated loop. If more than one FL port is detected on the arbitrated loop during initialization, only one FL port becomes operational and the other FL ports enter nonparticipating mode. FL ports support Class 2 and Class 3 services.

Note FL port mode is not supported on 4-port 10 Gbps switching module interfaces.

NP Ports

An NP port is a port on a device that is in NPV mode and connected to the core switch via an F port. NP ports function like N ports, except that in addition to providing N port operations, they also function as proxies for multiple physical N ports.

For more details about NP ports and NPV, see Chapter 7, “Configuring N Port Virtualization.”

TE Port

In trunking E port (TE port) mode, an interface functions as a trunking expansion port. It can be connected to another TE port to create an extended ISL (EISL) between two switches. TE ports are specific to Cisco MDS 9000 Series Multilayer Switches. These switches expand the functionality of E ports to support the following:

- VSAN trunking
- Transport quality of service (QoS) parameters
- Fibre Channel Trace (fctrace) feature

In TE port mode, all the frames are transmitted in EISL frame format, which contains VSAN information. Interconnected switches use the VSAN ID to multiplex traffic from one or more VSANs across the same physical link. This feature is referred to as trunking in the Cisco MDS 9000 Series Multilayer Switches. For more details about trunking, see Chapter 5, “Configuring Trunking”. TE ports support Class 2, Class 3, and Class F services.

TF Port

In trunking F port (TF port) mode, an interface functions as a trunking expansion port. It can be connected to another trunked N port (TN port) or trunked NP port (TNP port) to create a link between a core switch and an NPV switch or a host bus adapter (HBA) in order to carry tagged frames. TF ports are specific to Cisco MDS 9000 Series Multilayer Switches. They expand the functionality of F ports to support VSAN trunking.

In TF port mode, all the frames are transmitted in EISL frame format, which contains VSAN information. Interconnected switches use the VSAN ID to multiplex traffic from one or more VSANs across the same physical link. This feature is referred to as *trunking* in the Cisco MDS 9000 Series Multilayer Switches. For more details about trunking, see Chapter 5, "Configuring Trunking". TF ports support Class 2, Class 3, and Class F services.

TNP Port

In trunking NP port (TNP port) mode, an interface functions as a trunking expansion port. It can be connected to a trunked F port (TF port) to create a link to a core NPIV switch from an NPV switch in order to carry tagged frames.

SD Port

In SPAN destination port (SD port) mode, an interface functions as a switched port analyzer (SPAN). The SPAN feature is specific to switches in the Cisco MDS 9000 Series. It monitors network traffic that passes though a Fibre Channel interface. This is done using a standard Fibre Channel analyzer (or a similar switch probe) that is attached to an SD port. SD ports do not receive frames; they only transmit a copy of the source traffic. The SPAN feature is non-intrusive and does not affect switching of network traffic in SPAN source ports. For more details about SPAN, see the *Cisco MDS 9000 Series NX-OS System Management Configuration Guide*.

ST Port

In the SPAN tunnel port (ST port) mode, an interface functions as an entry point port in the source switch for the RSPAN Fibre Channel tunnel. The ST port mode and the remote SPAN (RSPAN) feature are specific to switches in the Cisco MDS 9000 Series Multilayer Switches. When configured in ST port mode, the interface cannot be attached to any device, and thus cannot be used for normal Fibre Channel traffic. For more details about SPAN, see the *Cisco MDS 9000 Series NX-OS System Management Configuration Guide*.

Note ST port mode is not supported on the Cisco MDS 9124 Fabric Switch, the Cisco Fabric Switch for HP c-Class BladeSystem, and the Cisco Fabric Switch for IBM BladeCenter.

Fx Port

Interfaces configured as Fx ports can operate in either F port mode or FL port mode. The Fx port mode is determined during interface initialization depending on the attached N port or NL port. This administrative configuration disallows interfaces to operate in any other mode, for example, preventing an interface to connect to another switch.

B Port

While E ports typically interconnect Fibre Channel switches, some SAN extender devices, such as the Cisco PA-FC-1G Fibre Channel port adapter, implement a bridge port (B port) model to connect geographically dispersed fabrics. This model uses B ports as described in the T11 Standard FC-BB-2.

If an FCIP peer is a SAN extender device that supports only Fibre Channel B ports, you should enable the B port mode for the FCIP link. When a B port mode is enabled, the E port functionality is also enabled and they coexist. Even if the B port mode is disabled, the E port functionality remains enabled. For more details about SPAN, see the *Cisco MDS 9000 Series NX-OS IP Services Configuration Guide*.

Auto Mode

Interfaces configured in auto mode can operate in F port, FL port, E port, TE port, or TF port mode. The port mode is determined during interface initialization. For example, if the interface is connected to a node (host or disk), it operates in F port mode or FL port mode depending on the N port mode or NL port mode. If the interface is attached to a third-party switch, it operates in E port mode. If the interface is attached to another switch in the Cisco MDS 9000 Series Multilayer Switches, it may become operational in TE port mode. For more details about trunking, see Chapter 5, "Configuring Trunking".

TL ports and SD ports are not determined during initialization and are administratively configured.

Note Fibre Channel interfaces on Storage Services Modules (SSMs) cannot be configured in auto mode.

Interface States

An interface state depends on the administrative configuration of the interface and the dynamic state of the physical link.

The section includes the following topics:

Administrative States

Administrative state refers to the administrative configuration of an interface, as described in Table 3-3.

Table 3-3 Administrative States

Administrative State	Description
Up	Interface is enabled.
Down	Interface is disabled. If you administratively disable an interface by shutting down that interface, the physical link layer state change is ignored.

Operational States

Operational state indicates the current operational state of an interface, as described in Table 3-4.

Table 3-4 Operational States

Operational State	Description
Up	Interface is transmitting or receiving traffic, as required. To be in this state, an interface must be administratively up, the interface link layer state must be up, and the interface initialization must be completed.
Down	Interface cannot transmit or receive (data) traffic.
Trunking	Interface is operational in TE mode or TF mode.

Reason Codes

Reason codes are dependent on the operational state of an interface, as described in Table 3-5.

Table 3-5 Reason Codes for Interface States

Administrative Configuration	Operational Status	Reason Code
Up	Up	None.
Down	Down	Administratively down—If you administratively configure an interface as down, you disable the interface. No traffic is received or transmitted.
Up	Down	See Table 3-6. Only some of the reason codes are listed in Table 3-6.

If the administrative state is up and the operational state is down, the reason code differs based on the nonoperational reason code, as described in Table 3-6.

Table 3-6 Reason Codes for Nonoperational States

Reason Code (Long Version)	Description	Applicable Modes
Link failure or Not connected	The physical layer link is not operational.	All
SFP not present	The small form-factor pluggable (SFP) hardware is not plugged in.	
Initializing	The physical layer link is operational and protocol initialization is in progress.	
Reconfigure fabric in progress	The fabric is currently being reconfigured.	
Offline	The Cisco NX-OS software waits for the specified R_A_TOV time before retrying initialization.	
Inactive	The interface VSAN is deleted or is in a suspended state. To make the interface operational, assign that port to a configured and active VSAN.	
Hardware failure	A hardware failure is detected.	
Error disabled	Error conditions require administrative attention. Interfaces may be error-disabled for various reasons: • Configuration failure • Incompatible buffer-to-buffer credit configuration To make the interface operational, fix the error conditions causing this state, and administratively shut down or enable the interface.	
Fibre Channel redirect failure	A port is isolated because a Fibre Channel redirect is unable to program routes.	
No port activation license available	A port is not active because it does not have a port license.	
SDM failure	A port is isolated because SDM is unable to program routes.	

Table 3-6 Reason Codes for Nonoperational States (continued)

Reason Code (Long Version)	Description	Applicable Modes
Isolation due to ELP failure	The port negotiation failed.	Only E ports and TE ports
Isolation due to ESC failure	The port negotiation failed.	
Isolation due to domain overlap	The Fibre Channel domains (fcdomain) overlap.	
Isolation due to domain ID assignment failure	The assigned domain ID is not valid.	
Isolation due to the other side of the link E port isolated	The E port at the other end of the link is isolated.	
Isolation due to invalid fabric reconfiguration	The port is isolated due to fabric reconfiguration.	
Isolation due to domain manager disabled	The fcdomain feature is disabled.	
Isolation due to zone merge failure	The zone merge operation failed.	
Isolation due to VSAN mismatch	The VSANs at both ends of an ISL are different.	
Nonparticipating	FL ports cannot participate in loop operations. This might occur if more than one FL port exists in the same loop, in which case, all but one FL port in that loop automatically enters nonparticipating mode.	Only FL ports and TL ports
Port Channel administratively down	The interfaces belonging to a port channel are down.	Only port channel interfaces
Suspended due to incompatible speed	The interfaces belonging to a port channel have incompatible speeds.	
Suspended due to incompatible mode	The interfaces belonging to a port channel have incompatible modes.	
Suspended due to incompatible remote switch WWN	An improper connection is detected. All the interfaces in a port channel must be connected to the same pair of switches.	

Graceful Shutdown

Interfaces on a port are in a shut-down state by default (unless you modified the initial configuration).

The Cisco NX-OS software implicitly performs a graceful shutdown in response to either of the following actions for interfaces operating in E port mode:

- If you shut down an interface.
- If a Cisco NX-OS software application executes a port shutdown as part of its function.

A graceful shutdown ensures that no frames are lost when the interface is shutting down. When a shutdown is triggered either by you or the Cisco NX-OS software, the switches connected to the shutdown link coordinate with each other to ensure that all the frames in the ports are safely sent through the link before shutting down. This enhancement reduces the chance of frame loss.

A graceful shutdown is not possible in the following situations:

- If you physically remove the port from the switch.
- If In-Order Delivery (IOD) is enabled. For more details about IOD, see the *Cisco MDS 9000 Series NX-OS Fabric Configuration Guide*.
- If the Min_LS_interval is higher than 10 seconds. For information about Fabric Shortest Path First (FSPF) global configuration, see the *Cisco MDS 9000 Series NX-OS Fabric Configuration Guide*.

Note This feature is triggered only if both the switches at either end of the E port interface are Cisco MDS switches and are running Cisco SAN-OS Release 2.0(1b) or later, or Cisco MDS NX-OS Release 4.1(1a) or later.

10-Gbps Fibre Channel Mode

Some Cisco MDS Fibre Channel 8 and 16-Gbps modules and the Cisco MDS 9396S 16-Gbps Fabric Switch have the capability to run at 10-Gbps speed, and in two modes:

- 1/2/4/8-Gbps (for 8-Gbps modules) or 2/4/8/16-Gbps (for 16-Gbps modules and 9396S 16-Gbps Fabric Switch).
- 10 Gbps

This section includes the following topics:

Benefits of 10-Gbps Fibre Channel Mode

A 10-Gbps Fibre Channel uses a more efficient encoding and a faster clock rate than an 8-Gbps Fibre Channel. Therefore, it has an approximately 50-percent throughput advantage over an 8-Gbps Fibre Channel. Consequently, fewer links are needed to achieve a given bandwidth.

Supported Modules and Switches

The following modules and switches support 10-Gbps mode:

- 32-port Cisco MDS 1/2/4/8/10-Gbps Advanced Fibre Channel Module (DS-X9232-256K9)
- 48-port Cisco MDS 1/2/4/8/10-Gbps Advanced Fibre Channel Module (DS-X9248-256K9)
- 48-port Cisco MDS 2/4/8/10/16-Gbps Advanced Fibre Channel Module (DS-X9448-768K9)
- 96-port Cisco MDS 9396S 2/4/8/10/16-Gbps Fabric Switch (DS-C9396S-96EK9)

Note By default, all the above are in their native Fibre Channel speed (1/2/4/8 or 2/4/8/16 Gbps) mode.

The following tables contain information about each module and the port ranges that need to be configured in 10-Gbps speed:

Table 3-7 32-Port Cisco MDS 1/2/4/8/10-Gbps Advanced Fibre Channel Module (DS-X9232-256K9)

ASIC Port Range	10-G Port	Offline Port
1-8	2-6,8	1,7
9-16	10-14,16	9,15
17-24	18-22,24	17,23
25-32	26-30,32	25,31

Table 3-8 48-Port Cisco MDS 1/2/4/8/10-Gbps Advanced Fibre Channel Module (DS-X9248-256K9)

ASIC Port Range	10-G Port	Offline Port
1-12	4-8,10	1-3,9,11-12
13-24	16-20,22	13-15,21,23-24
25-36	28-32,34	25-27,33,35-36
37-48	40-44,46	37-39, 45,47-48

Table 3-9 48-Port Cisco MDS 2/4/8/10/16-Gbps Advanced Fibre Channel Module (DS-X9448-768K9)

ASIC Port Range	Offline Port
1-8	None
9-16	None
17-24	None
25-32	None
33-40	None
41-48	None

Table 3-10 96-Port Cisco MDS 9396S 2/4/8/10/16-Gbps Fabric Switch (DS-C9396S-96EK9)

ASIC Port Range	Offline Port
1-8	None
9-16	None
17-24	None
25-32	None
33-40	None
41-48	None
49-56	None
57-64	None
65-72	None

Table 3-10 96-Port Cisco MDS 9396S 2/4/8/10/16-Gbps Fabric Switch (DS-C9396S-96EK9) (continued)

ASIC Port Range	Offline Port
73-80	None
81-88	None
89-96	None

Port Administrative Speeds

By default, the port administrative speed for an interface is automatically calculated by the switch.

For internal ports on the Cisco Fabric Switch for HP c_Class BladeSystem and Cisco Fabric Switch for IBM BladeCenter, a port speed of 1 Gbps is not supported. Auto negotiation is supported between 2 and 4 Gbps only. Also, if the BladeCenter is a T chassis, then port speeds are fixed at 2 Gbps, and auto negotiation is not enabled.

Auto Sensing

Auto sensing speed is enabled on all 4 and 8-Gbps switching module interfaces by default. This configuration enables the interfaces to operate at speeds of 1, 2, or 4 Gbps on 4 Gbps switching modules, and 8 Gbps on 8-Gbps switching modules. When auto sensing is enabled for an interface operating in dedicated rate mode, 4 Gbps of bandwidth is reserved even if the port negotiates at an operating speed of 1 or 2 Gbps.

To avoid wasting unused bandwidth on 48-port and 24-port 4 and 8 Gbps Fibre Channel switching modules, you can specify that only 2 Gbps of required bandwidth be reserved, not the default of 4 or 8 Gbps. This feature shares the unused bandwidth within the port group, provided the bandwidth does not exceed the rate limit configuration for the port. You can also use this feature for shared rate ports that are configured for auto sensing.

Tip When migrating a host that supports up to 2-Gbps traffic (that is, not 4 Gbps with auto-sensing capabilities) to the 4 Gbps switching modules, use auto sensing with a maximum bandwidth of 2 Gbps. When migrating a host that supports up to 4-Gbps traffic (that is, not 8 Gbps with auto-sensing capabilities) to the 8 Gbps switching modules, use auto sensing with a maximum bandwidth of 4 Gbps.

Frame Encapsulation

The **switchport encap eisl** command applies only to SD port interfaces. This command determines the frame format for all the frames transmitted by the interface in SD port mode. If the encapsulation is set to EISL, all outgoing frames are transmitted in the EISL frame format, regardless of the SPAN sources. For information about encapsulation, see the *Cisco MDS 9000 Series NX-OS System Management Configuration Guide*.

The **switchport encap eisl** command is disabled by default. If you enable encapsulation, all outgoing frames are encapsulated, and you will see a new line (`Encapsulation is eisl`) in the **show interface** *SD_port_interface* command output. For information about encapsulation, see the *Cisco MDS 9000 Series NX-OS System Management Configuration Guide*.

Debounce Timer

The debounce timer delays the notification of a link change that can decrease traffic loss due to network reconfiguration. The default value for debounce timer link down is 100 ms for Fibre Channel interfaces. This value cannot be configured. If there is a synchronization loss for less than 100 ms, the Fibre Channel interface will not bounce.

Bit Error Rate Threshold

The bit error rate (BER) threshold is used by a switch to detect an increased error rate before performance degradation seriously affects traffic.

Bit errors occur because of the following reasons:

- Faulty or bad cable
- Faulty or bad Gigabit Interface Converter (GBIC) or Small Form-Factor Pluggable (SFP)
- GBIC or SFP is specified to operate at 1 Gbps, but is used at 2 Gbps
- GBIC or SFP is specified to operate at 2 Gbps, but is used at 4 Gbps
- Short-haul cable is used for long haul or long-haul cable is used for short haul
- Momentary synchronization loss
- Loose cable connection at one end or both ends
- Improper GBIC or SFP connection at one end or both ends

A BER threshold is detected when 15 error bursts occur in a 5-minute period. By default, the switch disables the interface when the threshold is reached. Use the **shutdown** and **no shutdown** command sequence to re-enable the interface.

Disabling the Bit Error Rate Action

By default, the threshold disables the interface. However, you can configure the switch to not disable an interface when the threshold is crossed.

To disable the BER threshold for an interface, perform these steps:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

Step 2 Select a Fibre Channel interface and enter interface configuration submode:

```
switch(config)# interface fc1/1
```

Step 3 Prevent the detection of BER events from disabling the interface:

```
switch(config-if)# switchport ignore bit-errors
```

(Optional) Prevent the detection of BER events from enabling the interface:

```
switch(config-if)# no switchport ignore bit-errors
```

Note Regardless of the setting of the **switchport ignore bit-errors** command, a switch generates a syslog message when the BER threshold is exceeded.

SFP Transmitter Types

The SFP hardware transmitters are identified by their acronyms when displayed using the **show interface brief** command. If the related SFP has a Cisco-assigned extended ID, the **show interface** and **show interface brief** commands display the ID instead of the transmitter type. The **show interface transceiver** and **show interface fc** *slot*/*port* **transceiver** commands display both values (ID and transmitter type) for Cisco-supported SFPs. Table 3-11 defines the acronyms used in the command output. For information about how to display interface information, see the Chapter 3, "Displaying Interface Information".

Table 3-11 SFP Transmitter Acronym Definitions

Definition	Acronym
Standard transmitters defined in the GBIC specifications	
Short wave laser	swl
Long wave laser	lwl
Long wave laser cost reduced	lwcr
Electrical	elec
Extended transmitters assigned to Cisco-supported SFPs	
CWDM-1470	c1470
CWDM-1490	c1490
CWDM-1510	c1510
CWDM-1530	c1530
CWDM-1550	c1550
CWDM-1570	c1570
CWDM-1590	c1590
CWDM-1610	c1610

Port Guard

The Port Guard feature is intended for use in environments where systems do not adapt quickly to a port going down and up (single or multiple times). For example, if a large fabric takes 5 seconds to stabilize after a port goes down, but the port actually goes up and down once per second, a severe failure might occur in the fabric, including devices becoming permanently unsynchronized.

The Port Guard feature provides the SAN administrator with the ability to prevent this issue from occurring. A port can be configured to stay down after a specified number of failures in a specified time period. This allows the SAN administrator to automate fabric stabilization, thereby avoiding problems caused by the up-down cycle.

Using the Port Guard feature, the SAN administrator can restrict the number of error events and bring a malfunctioning port to down state dynamically once the error events exceed the event threshold. A port can be configured such that it shuts down when specific failures occur.

There are two types of port guard, *Port Level* type and *Port Monitor* type. The former is a basic type where event thresholds are configurable on a per port basis, the latter allows the configuration of policies that are applied to all the ports of the same type, for example, all E ports or all F ports.

Note We recommend against the simultaneous use of both types of port guard for a given port.

This section includes the following topics:

Port-Level Port Guard

The following is the list of events that can be used to trigger port-level port guard actions:

- TrustSec violation—Link fails because of excessive TrsustSec violation events.
- Bit errors—Link fails because of excessive bit error events.
- Signal loss—Link fails because of excessive signal loss events.
- Signal synchronization loss—Link fails because of excessive signal synchronization events.
- Link reset—Link fails because of excessive link reset events.
- Link down—Link fails because of excessive link down events.
- Credit loss (Loop F ports only)—Link fails because of excessive credit loss events.

A link failure occurs when it receives two bad frames in an interval of 10 seconds and the respective interface will be error disabled. A general link failure caused by link down is the superset of all other causes. The sum of the number of all other causes equals the number of link-down failures. This means that a port is brought to down state when it reaches the maximum number of allowed link failures or the maximum number of specified causes.

Port-level Port Guard can be used to shut down misbehaving ports based on certain link event types. Event thresholds are configurable for each event type per port which makes them customizable between host, array, and tape F ports, or between intra- and inter-data center E ports, for example.

The events listed above might get triggered by certain events on a port, such as:

- Receipt of Not Operational Signal (NOS)
- Too many hardware interrupts
- The cable is disconnected
- The detection of hardware faults
- The connected device is rebooted (F ports only)
- The connected modules are rebooted (E ports only)

Port Monitor Port Guard

The Port Monitor Port Guard feature allows a port to be automatically error disabled or flapped when a given event threshold is reached.

Note The Port Monitor Port Guard is not available for absolute counters.

The following is the list of events that can be used to trigger the Port Monitor Port Guard actions:

- Port-to-forwarding engine frame error
- Crossbar-to-forwarding engine frame error
- Forwarding engine-to-crossbar frame error
- Credit loss
- Link loss
- Signal loss
- Signal synchronization loss
- Received data rate
- Received invalid CRC
- Received invalid words
- Received logical link resets
- Transmit credit not available
- Transmit data rate
- Transmit discards
- Transmit logical link resets
- Transmit slow port events
- Transmit wait
- Transit timeout discards

Port Monitor

The Port Monitor feature can be used to monitor the performance and status of ports and generate alerts when problems occur. You can configure thresholds for various counters and enable event triggers when the values cross the threshold.

For rising and falling thresholds, a syslog is generated only when the error count crosses these threshold values.

Table 3-12 displays the default port monitor policy with threshold values. The unit for threshold values (rising and falling) differs across different counters.

Table 3-12 Default Port Monitor Policy with Threshold Values

Counter	Threshold Type	Interval (Seconds)	Rising Threshold	Event	Falling Threshold	Event	Warning Threshold	PMON Port Guard
Link Loss	Delta	60	5	4	1	4	Not enabled	Not enabled
Sync Loss	Delta	60	5	4	1	4	Not enabled	Not enabled

Table 3-12 Default Port Monitor Policy with Threshold Values (continued)

Counter	Threshold Type	Interval (Seconds)	Rising Threshold	Event	Falling Threshold	Event	Warning Threshold	PMON Port Guard
Signal Loss	Delta	60	5	4	1	4	Not enabled	Not enabled
State change	Delta	60	5	4	0	4	Not enabled	Not enabled
Invalid Words	Delta	60	1	4	0	4	Not enabled	Not enabled
Invalid CRCs	Delta	60	5	4	1	4	Not enabled	Not enabled
Transmit (TX) Discards	Delta	60	200	4	10	4	Not enabled	Not enabled
Link Reset (LR) Receive (RX)	Delta	60	5	4	1	4	Not enabled	Not enabled
LR TX	Delta	60	5	4	1	4	Not enabled	Not enabled
Timeout Discards	Delta	60	200	4	10	4	Not enabled	Not enabled
Credit Loss Reco	Delta	1	1	4	0	4	Not enabled	Not enabled
TX Credit Not Available	Delta	1	10%	4	0%	4	Not enabled	Not enabled
RX Datarate	Delta	60	80%	4	20%	4	Not enabled	Not enabled
TX Datarate	Delta	60	80%	4	20%	4	Not enabled	Not enabled
TX-Slowport-Count [1]	Delta	1	5	4	0	4	Not enabled	Not enabled
TX-Slowport-Oper-Delay[2]	Absolute	1	50 ms 80 ms (Advanced 8-Gbps modules)	4	0 ms	4	Not enabled	—
TXWait[3]	Delta	1	40%	4	0%	4	Not enabled	Not enabled

Table 3-12 Default Port Monitor Policy with Threshold Values (continued)

Counter	Threshold Type	Interval (Seconds)	Rising Threshold	Event	Falling Threshold	Event	Warning Threshold	PMON Port Guard
err-pkt-from-port_ ASIC Error Pkt from Port[4]	—	—	—	—	—	—	—	—
err-pkt-to-xbar_ ASIC Error Pkt to xbar[4]	—	—	—	—	—	—	—	—
err-pkt-from-xbar_ ASIC Error Pkt from xbar[4]	—	—	—	—	—	—	—	—

1. For all platforms, if the default value for tx-slowport-count is modified, ISSD will be restricted. To proceed with ISSD, use the **no** form of the **counter tx-slowport-count** command to roll back to the default value.
2. For all platforms, if the default value for tx-slowport-oper-delay is modified, ISSD will be restricted. To proceed with ISSD, use the **no** form of the **counter tx-slowport-oper-delay** command to roll back to the default value.
3. For all platforms, if the default value for TxWait is modified, ISSD will be restricted. To proceed with ISSD, use the **no** form of the **counter txwait** command to roll back to the default value.
4. The counter was introduced in Cisco NX-OS Release 5.2(2a).

Note

- TX-Slowport-Count is applicable only for 8-Gbps modules (DS-X9224-96K9, DS-X9248-96K9, and DS-X9248-48K9) in the Cisco MDS 9500 Series switches. In the default configuration, the port monitor sends an alert when a slow-port condition is detected 5 times in 1 second for the configured slow-port monitor timeout. (See the **system timeout slowport-monitor** command in the *Cisco MDS 9000 Series Command Reference*).
- TX-Slowport-Oper-Delay is applicable only for advanced 8 and 16 Gbps modules. There are two defaults based on the module type:
  - For advanced 8-Gbps modules, the default rising threshold is 80 ms in a 1-second polling interval.
  - For 16-Gbps modules, the default rising threshold is 50 ms in a 1-second polling interval.
- Configuring slow-port monitoring using the **system timeout slowport-monitor** command in order to get alerts for TX-Slowport-Count and TX-Slowport-Oper-Delay for a particular port type. (See the **system timeout slowport-monitor** command in the *Cisco MDS 9000 Series Command Reference*).
- Port guard action for TX-Slowport-Oper-Delay (for Absolute type counter) is not supported.
- TXWait is applicable only for advanced 8 and 16 Gbps modules. In the default configuration, the port monitor sends an alert if the transmit credit is not available for 400 ms (40%) in 1 second.

  TXWait sends alerts when there are multiple slow-port events that have not hit the slow-port monitor

threshold, but have together hit the TXWait threshold configured. For example, if there are 40 discrete 10-ms intervals of 0 TX credits in 1 second, TX-Slowport-Oper-Delay does not find these credits; TXWait finds the credits and sends an alert.

- The state-change counter records the port down-to-port up action as one state change that is similar to *flap*. This is the reason the state-change counter does not have the port guard action set as *flap*.
- When the port guard action is set as *flap*, users get alerts only through syslog.

Three more counters were added in Cisco Release NX-OS 5.2(2a); these are not included in the default policy:

- err-pkt-from-port_ASIC Error Pkt from port
- err-pkt-to-xbar_ ASIC Error Pkt to xbar
- err-pkt-from-xbar_ ASIC Error Pkt from xbar

Table 3-13 displays the threshold value of the slow-drain port-monitor policy:

Table 3-13 Slow-Drain Port-Monitor Policy Threshold Value

Counter	Threshold Type	Interval (Seconds)	Rising Threshold	Event	Falling Threshold	Event	PMON Port Guard
Credit Loss Reco	Delta	1	1	4	0	4	Not enabled
TX Credit Not Available	Delta	1	10	4	0	4	Not enabled

Note If no other Port Monitor policy is explicitly activated, the slow-drain policy is activated. The default policy shows only the default counter-monitor values.

This section includes the following topics:

- Warning Threshold, page 3-24
- Check Interval, page 3-25

Warning Threshold

From Cisco MDS NX-OS Release 6.2(15), the warning threshold functionality is available for each counter in a Port Monitor policy.

Port Monitor warning thresholds can be used to generate syslog messages before rising and falling thresholds are reached. A single threshold is configurable per Port Monitor counter. A syslog is generated whenever the counter crosses the configured warning threshold in either the rising or falling direction. This allows the user to track counters that are not severe enough to hit the rising threshold, but where nonzero events are of interest.

The warning threshold must be equal or less than the rising threshold and equal or greater than the falling threshold.

The warning threshold is optional; warning syslogs are only generated when it is specified in a counter configuration.

Check Interval

From Cisco MDS NX-OS Release 6.2(15), a new functionality called check interval is introduced to check errors at a shorter time interval than the poll interval.

Check interval polls for values more frequently within a poll interval so that the errors are detected much earlier and appropriate action can be taken.

With the existing poll interval, it is not possible to detect errors at an early stage. Users have to wait until the completion of the poll interval to detect the errors.

By default, the check interval functionality is not enabled.

Note

- The port monitor check interval feature is supported only on the Cisco MDS 9710 Multilayer Director, Cisco MDS 9718 Multilayer Directors, and Cisco MDS 9706 Multilayer Directors.
- Check interval is supported on both counters, absolute and delta.
- We recommend that you configure the poll interval as a multiple of the check interval.
- Check interval is supported on the Cisco MDS 9700 Series Multilayer Directors from Cisco MDS NX-OS Release 6.2(15) onwards, and on the Cisco MDS 9250i Multiservice Fabric Switch from Cisco MDS NX-OS Release 6.2(17) onwards.
- When a port comes up, the check interval will not provide an alert about invalid words for the port until the poll interval expires. We recommend that you bring up a set of ports at a given time in the module instead of all the ports.

Port Group Monitor

Note Port Group Monitor functionality only applies to line cards that support oversubscription.

The ports on a line card are divided into fixed groups called port groups that share a link of fixed bandwidth to the backplane. Since the total port bandwidth can exceed the backplane link bandwidth, frames will be queued, introducing traffic delays. The Port Group Monitor functionality can be used to monitor this oversubscription in both the transmit and receive directions to allow ports to be rebalanced between port groups before the delays become unacceptable.

When the Port Group Monitor feature is enabled and when a policy consisting of polling interval in seconds and the rising and falling thresholds in percentage are specified, the port group monitor generates a syslog if port group traffic goes above the specified percentage of the maximum supported bandwidth for that port group (for receive and for transmit). Another syslog is generated if the value falls below the specified threshold.

Table 3-14 shows the threshold values for the default Port Group Monitor policy:

Table 3-14 Default Port Group Monitor Policy Threshold Values

Counter	Threshold Type	Interval (Seconds)	% Rising Threshold	% Falling Threshold
RX Performance	Delta	60	80	20
TX Performance	Delta	60	80	20

Note Port group monitor is not supported on a 1-rack box when any of the threshold values is reached for the receive performance and transmit performance counters.

Local Switching

Local switching can be enabled in advanced 8-Gbps modules. This allows traffic to be switched directly with a local crossbar when the traffic is directed from one port to another on the same line card. By using local switching, an extra switching step is avoided, which in turn decreases the latency.

Slow-Drain Device Detection and Congestion Avoidance

Most SAN edge devices use Class 2 or Class 3 Fibre Channel services that have link-level flow control. This feature allows a receiving port to back pressure the sending peer port when the receiving port reaches its capacity to accept frames. When an edge device does not accept frames from the fabric for an extended time, it creates a condition in the fabric known as slow drain. If the upstream source of a slow-edge device is an ISL, it results in credit starvation in that ISL. This credit starvation then affects the unrelated flows that use the same ISL link.

Congestion avoidance focuses on minimizing or completely avoiding the held frames from consuming all the egress buffers of an edge port attached to a slow-drain device. To achieve congestion avoidance, configure a *no-credit* frame timeout value that is lower than the default 500-ms frame timeout, which in turn reduces the effects of the slow-drain device on the fabric. Thus, the slow-moving frames get dropped faster than the general frame timeout, freeing buffers in the upstream ISL and allowing the unrelated flows to move continuously.

Note The *no-credit timeout* functionality is used for edge ports because these ports are directly connected to slow-drain devices. Although the no-credit timeout functionality can be applied to core ports, we recommend that you do not use it. The no-credit timeout functionality is not supported on Generation 1 modules.

Interface Types

The following topics provide information about the interfaces types.

Management Interface

You can remotely configure a switch through the management interface (mgmt0). To configure a connection on the mgmt0 interface, configure either the IPv4 parameters (IP address, subnet mask, and default gateway), or the IPv6 parameters (IP address, subnet mask, and default gateway) so that the switch is reachable.

Before you configure the management interface manually, obtain the switch's IPv4 address, subnet mask, and default gateway, or the IPv6 address, depending on which IP version you are configuring.

The management port (mgmt0) auto senses and operates in full-duplex mode at a speed of 10, 100, or 1000 Mbps. Auto sensing supports both the speed mode and the duplex mode. On a Supervisor-1 module, the default speed is 100 Mbps and the default duplex mode is auto. On a Supervisor-2 module, the default speed and the default duplex mode are set to auto.

Note Explicitly configure a default gateway to connect to the switch and send IP packets or add a route for each subnet.

VSAN Interfaces

VSANs are applicable to Fibre Channel fabrics and enable you to configure multiple isolated SAN topologies within the same physical infrastructure. You can create an IP interface on top of a VSAN, and then use this interface to send frames to the corresponding VSAN. To use this feature, configure the IP address for this VSAN.

Note VSAN interfaces cannot be created for non existing VSANs.

Configuring Interfaces

This section includes the following topics:

For more details on configuring an mgmt0 interface, see the *Cisco MDS 9000 Series NX-OS Fundamentals Configuration Guide* and the *Cisco MDS 9000 Series NX-OS IP Services Configuration Guide*.

For more details on configuring a Gigabit Ethernet interface, see the *Cisco MDS 9000 Series NX-OS IP Services Configuration Guide*.

Configuring a Fibre Channel Interface

To configure a Fibre Channel interface, perform these steps:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

Step 2 Select a Fibre Channel interface and enter interface configuration submode:

```
switch(config)# interface fc1/1
```

When a Fibre Channel interface is configured, it is automatically assigned a unique world wide name (WWN). If the interface's operational state is up, it is also assigned a Fibre Channel ID (FC ID).

To configure a range of interfaces, perform these steps:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

Step 2 Select the range of Fibre Channel interfaces and enter interface configuration submode3:

```
switch(config)# interface fc1/1 - 4 , fc2/1 - 3
```

Note When using this command, provide a space before and after the comma.

For the Cisco Fabric Switch for HP c-Class BladeSystem and the Cisco Fabric Switch for IBM BladeCenter, you can configure a range of interfaces in internal ports or external ports, but you cannot mix both interface types within the same range. For example, bay 1-10 , bay 12 or ext 0 , ext 15-18 are valid ranges, but bay 1-5 , ext 15-17 is not.

Setting the Interface Administrative State

To set the interface administrative state, you must first gracefully shut down the interface and enable traffic flow.

To gracefully shut down an interface, perform these steps:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

Step 2 Select a Fibre Channel interface and enter interface configuration submode:

```
switch(config)# interface fc1/1
```

Step 3 Gracefully shut down the interface and administratively disable the traffic flow; this is the default state:

```
switch(config-if)# shutdown
```

To enable traffic flow, perform these steps:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

Step 2 Select a Fibre Channel interface and enter interface configuration submode:

```
switch(config)# interface fc1/1
```

Step 3 Enable traffic flow to administratively allow traffic when the **no** prefix is used (provided the operational state is up):

```
switch(config-if)# no shutdown
```

Configuring an Interface Mode

To configure an interface mode, perform these steps:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

Step 2 Select a Fibre Channel interface and enter interface configuration submode:

```
switch(config)# interface fc1/1
```

Step 3 Configure the administrative mode of the port. You can set the operational state to auto, E, F, FL, Fx, TL, NP, or SD port mode:

```
switch(config-if)# switchport mode {E | F | FL | Fx | NP | SD}
```

Note Fx ports refer to an F port or an FL port (host connection only), but not E ports.

Step 4 Configure interface mode to auto negotiate an E, F, FL, or TE port mode (not TL or SD port modes) of operation:

```
switch(config-if)# switchport mode auto
```

Note
- TL ports and SD ports cannot be configured automatically. They must be administratively configured.
- You cannot configure Fibre Channel interfaces on Storage Services Modules (SSM) in auto mode.

Configuring the MAX NPIV Limit

Both the **max-npiv-limit** and **trunk-max-npiv-limit** can be configured on a port or port channel. If the port or port channel becomes a trunking port, **trunk-max-npiv-limit** is used for limit checks.

To configure the maximum NPIV limit, perform these steps:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

Step 2 Select a Fibre Channel interface and enter interface configuration submode:

```
switch(config)# interface fc 3/29
```

Step 3 Configure switch port mode F on the Fibre Channel interface:

```
switch(config-if)# switchport mode F
```

Step 4 Specify the maximum login value for this port:

```
switch(config-if)# switchport max-npiv-limit 100
```

The valid range is from 1 to 256.

Configuring the System Default F Port Mode

The **system default switchport mode F** command sets the administrative mode of all Fibre Channel ports to mode F, while avoiding traffic disruption caused by the formation of unwanted ISLs. This command is part of the setup utility that runs during bootup after a **write erase** or **reload** command is issued. It can also be executed from the command line in configuration mode. This command changes the configuration of the following ports to administrative mode F:

- All ports that are down and are not out of service.
- All F ports that are up, whose operational mode is F, and whose administrative mode is not F.

The **system default switchport mode F** command does not affect the configuration of the following ports:

- All user-configured ports, even if they are down.
- All non-F ports that are up. However, if non-F ports are down, this command changes the administrative mode of those ports.

Guidelines and Restrictions

- To ensure that ports that are a part of ISLs do not get changed to port mode F, configure the ports in port mode E, rather than in auto mode.
- When the command is executed from the command line, the switch operation remains graceful. No ports are flapped.

To set the administrative mode of Fibre Channel ports to mode F in the CLI, perform these steps:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

Step 2 Sets administrative mode of Fibre Channel ports to mode F (if applicable):

```
switch(config)# system default switchport mode F
```

(Optional) Set the administrative mode of Fibre Channel ports to the default (unless user configured), use the following command:

```
switch(config)# no system default switchport mode F
```

Note For detailed information about the switch setup utility, see the *Cisco MDS 9000 Series NX-OS Fundamentals Configuration Guide*.

Example 3-2 shows the command in the setup utility, and Example 3-3 shows the command from the command line.

Example 3-2 Setup Utility

```
Configure default switchport mode F (yes/no) [n]: y
```

Example 3-3 Command Line

```
switch(config)# system default switchport mode F
```

Configuring ISL Between Two Switches

Note Ensure that the Fibre Channel cable is connected between the ports and perform a **no-shut** operation on each port.

E-port mode is used when a port functions as one end of an ISL setting. When you set the port mode to E, you restrict the port coming up as an E port (trunking or nontrunking, depending on the trunking port mode).

To configure the port mode to E:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

Step 2 Select a Fibre Channel interface and enter interface configuration submode:

```
switch(config)# interface fc 3/29
```

Step 3 Configure switch port mode E on the Fibre Channel interface:

```
switch(config-if)# switchport mode E
```

Note Ensure that you perform the task of setting the port mode to E on both the switches between which you are attempting to bring up the ISL link.

Configuring the 10-Gbps Fibre Channel Mode via the CLI

There are two ways to configure the port speed to the 10-Gbps speed mode:

- Use the **10g-speed mode** command, which is the recommended method.

Note When 10-G speed mode is configured in an interface mode for 16-Gbps modules, all the ports in an interface mode will be in 10-Gbps mode, whereas in 8-Gbps modules, only certain ports in an interface mode will be in 10-Gbps mode and the rest will be in the out-of-service state.

- Use the generic **switchport speed** command.

To configure interface mode, perform these steps. The following is an example on a Cisco MDS 9396S DS-C9396S-96EK9.

Step 1 Enter configuration mode:

```
switch# configure terminal
```

Step 2 Select a Fibre Channel interface and enter interface configuration mode:

```
switch(config)# interface fc1/1-8
```

Ensure that a full ASIC range of ports is selected before executing this command. For example, fc**y**/1-12 for a 48-port 8-Gbps module or fc**y**/1-8 for an 8-Gbps 32-port, 48-port 16-Gbps module.

Step 3 Configure all the ports (1 to 8) in Fibre Channel module 1 to 10 Gbps:

```
switch(config-if)# 10g-speed-mode
```

For the DS-X9248-256K9 module, the **10g-speed-mode** command works only for interface ranges 1–12, 13–24, 25–36, or 37–48.

For the DS-X9232-256K9 module, the **10g-speed-mode** command works only for interface ranges 1–8, 9–16, 17–24, or 25–32.

For the DS-X9448-768K9 module, the **10g-speed-mode** command works only for interface ranges 1–8, 9–16, 17–24, 25–32, 33–40, or 41–48.

For the DS-C9396S-96EK9 module, the **10g-speed-mode** command works only for interface ranges 1-8, 9-16, 17-24, 25-32, 33-40, 41-48, 49-56, 57-64, 65-72, 73-80, 81-88, or 89-96.

(Optional) Revert the settings and put all the ports (1 to 8) in the Out-of-service state and move them to the In-service state:

```
switch(config-if)# no 10g-speed-mode
```

Configuring the 10-Gbps Fibre Channel Mode via the Device Manager

Perform these steps to convert a defined range of interfaces to 10-G mode for a module with 2//4/8/10/16-Gbps Advanced Fibre Channel module (DS-X9448-768K9):

Step 1 Launch the Device Manager for the device supporting 10-G speed.

Step 2 Right-click the module and select **Configure bandwidth Reservation**.

Step 3 Select one or more ASIC port ranges and click **Apply**. By default, all the ports are 1/2/4/8 or 2/4/8/16-Gbps speed capable.

Configuring the Port Administrative Speed

Caution Changing the port administrative speed is a disruptive operation.

To configure the port speed of an interface, perform these steps:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

Step 2 Select the Fibre Channel interface and enter interface configuration mode:

```
switch(config)# interface fc 1/1
```

Step 3 Configure the port speed of the interface to 1000 Mbps:

```
switch(config-if)# switchport speed 1000
```

All the 10 Gbps-capable interfaces, except the interface that is being configured, must be in the Out-of-service state. At least one other 10 Gbps-capable interface must be in the In-service state.

(Optional) Revert to the factory default (auto) administrative speed of the interface:

```
switch(config-if)# no switchport speed
```

Configuring the Interface Description

The interface description can be any alphanumeric string that is up to 80 characters long.

To configure a description for an interface, perform these steps:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

Step 2 Select a Fibre Channel interface and enter interface configuration submode:

```
switch(config)# interface fc1/1
```

Step 3 Configure the description of the interface:

```
switch(config-if)# switchport description cisco-HBA2
```

(Optional) Clear the description of the interface:

```
switch(config-if)# no switchport description
```

Specifying a Port Owner

Using the Port Owner feature, you can specify the owner of a port and the purpose for which a port is used so that the other administrators are informed.

Note The Port Guard and Port Owner features are available for all ports regardless of the operational mode.

To specify or remove a port owner, perform these steps:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

Step 2 Select the port interface:

```
switch(config)# interface fc1/1
```

Step 3 Specify the owner of the switch port:

```
switch(config)# switchport owner description
```

The description can include the name of the owner and the purpose for which the port is used, and can be up to 80 characters long.

(Optional) Remove the port owner description:

```
switch(config)# no switchport owner
```

(Optional) Display the owner description specified for a port, use one of the following commands:

- `switch# show running interface fc module-number/interface-number`
- `switch# show port internal info interface fc module-number/interface-number`

Configuring Beacon Mode

By default, the beacon mode is disabled on all switches. The beacon mode is indicated by a flashing green light that helps you identify the physical location of the specified interface. Note that configuring the beacon mode has no effect on the operation of the interface.

To configure a beacon mode for a specified interface or range of interfaces, perform these steps:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

Step 2 Select a Fibre Channel interface and enter interface configuration submode:

```
switch(config)# interface fc1/1
```

Step 3 Enable the beacon mode for the interface:

```
switch(config-if)# switchport beacon
```

(Optional) Disable the beacon mode for the interface:

```
switch(config-if)# no switchport beacon
```

Note The flashing green light turns on automatically when an external loopback that causes the interfaces to be isolated is detected. The flashing green light overrides the beacon mode configuration. The state of the LED is restored to reflect the beacon mode configuration after the external loopback is removed.

Configuring a Switch Port Attribute Default Value

You can configure default values for various switch port attributes. These attributes will be applied globally to all future switch port configurations, even if you do not individually specify them at that time.

To configure a default value for a switch port attribute, perform these steps:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

Step 2 Configure the default setting for the administrative state of an interface as up (the factory default setting is down):

```
switch(config)# no system default switchport shutdown
```

Note This command is applicable only to interfaces for which no user configuration exists for the administrative state.

(Optional) Configure the default setting for the administrative state of an interface as down:

```
switch(config)# system default switchport shutdown
```

Note This command is applicable only to interfaces for which no user configuration exists for the administrative state.

(Optional) Configure the default setting for the administrative trunk mode state of an interface as Auto:

```
switch(config)# system default switchport trunk mode auto
```

Note The default setting is On.

Configuring the Port Guard

All port guard causes are monitored over a common time interval with the same start and stop times. The *link down* counter is not a specific event, but the aggregation of all other cause counters in the same time interval.

To configure a port-level port guard for an interface, perform these steps:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

Step 2 Select the interface:

```
switch(config)# interface fc1/1
```

Step 3 Enable port guard error disabling of the interface if the link goes down once:

```
switch(config-if)# errdisable detect cause link-down
```

(Optional) Enable port guard error disabling of the interface if the link flaps a certain number of times within the specified time, in *seconds*:

```
switch(config-if)# errdisable detect cause link-down [num-times number duration seconds]
```

(Optional) Remove the port guard configuration for the interface:

```
switch(config-if)# no errdisable detect cause link-down
```

The link resumes flapping and sending error reports normally.

Step 4 Enable port guard error disabling of the interface if the specified error occurs once:

```
switch(config-if)# errdisable detect cause {bit-errors | credit-loss | link-down |
link-reset | signal-loss | sync-loss | trustsec-violation}
```

(Optional) Enable port guard error disabling of the interface if the specified error occurs a certain number of times within the specified time, in *seconds*:

```
switch(config-if)# errdisable detect cause {bit-errors | credit-loss | link-down |
link-reset | signal-loss | sync-loss | trustsec-violation} [num-times number duration
seconds]
```

(Optional) Remove the port guard configuration for the interface:

```
switch(config-if)# no errdisable detect cause {bit-errors | credit-loss | link-down |
link-reset | signal-loss | sync-loss | trustsec-violation}
```

The link resumes flapping and sending error reports normally.

Note The port guard credit loss event is triggered only on loop interfaces; it is not triggered on point-to-point interfaces.

This example shows how to configure port guard to set an interface to Error Disabled state if the link flaps five times within 120 seconds due to multiple causes. The port guard controls the interface in the following manner:

- The interface will be error disabled due to link down if there are link failures due to bit errors 2 times and link failures due to credit loss 3 times in 120 seconds.
- The interface will be error disabled due to bit errors if there are link failures due to bit errors 5 times in 120 seconds.
- The interface will be error disabled due to credit loss if there are link failures due to credit loss 5 times in 120 seconds.

```
Switch# configure terminal
Switch (config)# interface fc1/1
Switch (config-if)# errdisable detect cause link-down num-times 5 duration 120
Switch (config-if)# errdisable detect cause bit-errors num-times 5 duration 120
Switch (config-if)# errdisable detect cause credit-loss num-times 5 duration 120
```

Configuring Port Monitor

Configuring a port guard action is optional for each counter in a port monitor policy, and is disabled by default.

This section includes the following topics:

Enabling Port Monitor

To enable or disable port monitor, perform these steps:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

Step 2 Enable port monitoring:

```
switch(config)# port-monitor enable
```

(Optional) Disable port monitoring:

```
switch(config)# no port-monitor enable
```

Configuring the Check Interval

To configure the check interval, perform these steps:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

Step 2 Configure the check interval time to 30 seconds:

```
switch(config)# port-monitor check-interval 30
```

(Optional) Disable the check interval, use the following command:

```
switch(config)# no port-monitor check-interval
```

Configuring a Port Monitor Policy

To configure a port monitor policy, perform these steps:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

Step 2 Specify the policy name and enter port monitoring policy configuration mode:

```
switch(config)# port-monitor name policyname
```

(Optional) Remove the policy name:

```
switch(config)# no port-monitor name policyname
```

Step 3 Apply policy type:

```
switch(config-port-monitor)# port-type {access-port | trunks | all}
```

Step 4 Specify the counter parameters:

```
switch(config-port-monitor)# counter {credit-loss-reco | err-pkt-from-port |
err-pkt-from-xbar | err-pkt-to-xbar | invalid-crc | invalid-words | link-loss | lr-rx |
lr-tx | rx-datarate | signal-loss | state-change | sync-loss | timeout-discards |
tx-credit-not-available | tx-datarate | tx-discards | tx-slowport-count |
tx-slowport-oper-delay | txwait} poll-interval seconds {absolute | delta} rising-threshold
count1 event RMON-ID warning-threshold count2 falling threshold count3 event RMON-ID
portguard {errordisable | flap}
```

Note

- You must activate the **err-pkt-from-port**, **err-pkt-from-xbar**, and **err-pkt-to-xbar** counters using the **monitor counter** *name* command, before specifying the counter parameters.
- Counters **err-pkt-from-xbar**, **err-pkt-from-port**, and **err-pkt-to-xbar** support **delta** threshold type only.
- Counter **tx-slowport-oper-delay** supports **absolute** threshold type only.
- Counter **tx-slowport-oper-delay** does not support port guard action.
- Counter **tx-slowport-count** is supported only on DS-X9224-96K9, DS-X9248-96K9, and DS-X9248-48K9 modules.

(Optional) Revert to the default values for a counter:

```
switch(config-port-monitor)# no counter {credit-loss-reco | err-pkt-from-port |
err-pkt-from-xbar | err-pkt-to-xbar | invalid-crc | invalid-words | link-loss | lr-rx |
lr-tx | rx-datarate | signal-loss | state-change | sync-loss | timeout-discards |
tx-credit-not-available | tx-datarate | tx-discards | tx-slowport-count |
tx-slowport-oper-delay | txwait} poll-interval seconds {absolute | delta} rising-threshold
count1 event RMON-ID warning-threshold count2 falling threshold count3 event RMON-ID
portguard {errordisable | flap}
```

(Optional) Monitor a counter:

```
switch(config-port-monitor)# monitor counter {credit-loss-reco | err-pkt-from-port |
err-pkt-from-xbar | err-pkt-to-xbar | invalid-crc | invalid-words | link-loss | lr-rx |
lr-tx | rx-datarate | signal-loss | state-change | sync-loss | timeout-discards |
tx-credit-not-available | tx-datarate | tx-discards | tx-slowport-count |
tx-slowport-oper-delay | txwait}
```

A port monitor currently recognizes two kinds of ports:

- Port type access ports are normally F ports with a single end device logged in. However, a port monitor considers TF ports and F ports with multiple logins to be port type access as well.
- Port type trunk ports are ports that are E ports (ISLs) regardless of whether they are actually carrying multiple VSANs (TE, trunking) or not. Some of the access port counter thresholds and port guard actions might not be appropriate on the TF ports in port monitor configurations. Specifically, port guard *disable* or *flap* actions can affect multiple end devices on the F ports with multiple logins. Therefore, performing disable of flap actions should be avoided on an N Port Identifier Virtualization (NPIV) system.

Configuring a Port Monitor Port Actions

To configure a port monitor port guard action, perform these steps:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

Step 2 Specify the policy name and enter port monitoring policy configuration mode:

```
switch(config)# port-monitor name policyname
```

Step 3 Specify the delta link loss poll interval (in seconds), threshold limits, and event IDs of the events to be triggered:

```
switch(config-port-monitor)# counter link-loss poll-interval seconds delta
rising-threshold count1 event event-id warning-threshold count2 falling-threshold count3
event event-id portguard flap
```

This command also specifies if the port is flapped (port goes down and up) when the event occurs. It also specifies if the port guard action is set to flap for the port when the rising threshold is reached.

Step 4 Specify the delta link loss poll interval (in seconds), threshold limits, and event IDs of the events to be triggered:

```
switch(config-port-monitor)# counter link-loss poll-interval seconds delta
rising-threshold count1 event event-id warning-threshold count2 falling-threshold count3
event event-id portguard errordisable
```

This command also specifies if the interface is down (error disabled) when the event occurs. It also specifies if the port guard action set to error disable for the port when the rising threshold is reached.

Note Port guard action is not supported for absolute type counters.

Activating a Port Monitor Policy

To activate a port monitor policy, perform these steps:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

Step 2 Activate the specified port monitor policy:

```
switch(config)# port-monitor activate policyname
```

(Optional) Activate the default port monitor policy:

```
switch(config)# port-monitor activate
```

(Optional) Deactivate the specified port monitoring policy:

```
switch(config)# no port-monitor activate policyname
```

Warning Threshold Example

Let us consider two scenarios with the following configurations:

- Rising threshold is 30
- Warning threshold is 10
- Falling threshold is 0

This example displays the syslog generated when the error count is less than the rising threshold value, but has reached the warning threshold value:

Example 3-4 Syslog Generated When the Error Count is Less Than the Rising Threshold Value

%PMON-SLOT2-4-WARNING_THRESHOLD_REACHED_UPWARD: Invalid Words has reached warning threshold in the upward direction (port fc2/18 [0x1091000], value = 10).

%PMON-SLOT2-5-WARNING_THRESHOLD_REACHED_DOWNWARD: Invalid Words has reached warning threshold in the downward direction (port fc2/18 [0x1091000], value = 5).

In the first polling interval, the errors triggered for the counter (Invalid Words) are 10, and have reached the warning threshold value. A syslog is generated, indicating that the error count is increasing (moving in the upward direction).

In the next polling interval, the error count decreases (moves in the downward direction), and a syslog is generated, indicating that the error count has decreased (moving in the downward direction).

This example displays the syslog that is generated when the error count crosses the rising threshold value:

Example 3-5 Syslog Generated When the Error Count Crosses the Rising Threshold Value

%PMON-SLOT2-4-WARNING_THRESHOLD_REACHED_UPWARD: Invalid Words has reached warning threshold in the upward direction (port fc2/18 [0x1091000], value = 30).

%PMON-SLOT2-3-RISING_THRESHOLD_REACHED: Invalid Words has reached the rising threshold (port=fc2/18 [0x1091000], value=30).

%SNMPD-3-ERROR: PMON: Rising Alarm Req for Invalid Words counter for port fc2/18(1091000), value is 30 [event id 1 threshold 30 sample 2 object 4 fcIfInvalidTxWords]

%PMON-SLOT2-5-WARNING_THRESHOLD_REACHED_DOWNWARD: Invalid Words has reached warning threshold in the downward direction (port fc2/18 [0x1091000], value = 3).

%PMON-SLOT2-5-FALLING_THRESHOLD_REACHED: Invalid Words has reached the falling threshold (port=fc2/18 [0x1091000], value=0).

%SNMPD-3-ERROR: PMON: Falling Alarm Req for Invalid Words counter for port fc2/18(1091000), value is 0 [event id 2 threshold 0 sample 2 object 4 fcIfInvalidTxWords]

This example displays the syslog generated when the error count is more than the warning threshold value and less than the rising threshold value:

Example 3-6 Syslog Generated When the Error Count is More than the Warning Threshold Value and Less than the Rising Threshold Value

%PMON-SLOT2-4-WARNING_THRESHOLD_REACHED_UPWARD: Invalid Words has reached warning threshold in the upward direction (port fc2/18 [0x1091000], value = 15).

%PMON-SLOT2-5-WARNING_THRESHOLD_REACHED_DOWNWARD: Invalid Words has reached warning threshold in the downward direction (port fc2/18 [0x1091000], value = 3).

The errors generated for the counter (Invalid Words) are 30 when the counter has crossed both the warning and rising threshold values. A syslog is generated when no further errors are triggered.

As there are no further errors in this poll interval, the consecutive polling interval will have no errors, and the error count decreases (moves in downward direction) and reaches the falling threshold value, which is zero. A syslog is generated for the falling threshold.

Configuring Port Group Monitor

This section includes the following topics:

Enabling Port Group Monitor

To enable port group monitor, perform these steps:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

Step 2 Enable port group monitoring:

```
switch(config)# port-group-monitor enable
```

(Optional) Disable port group monitoring:

```
switch(config)# no port-group-monitor enable
```

Configuring Port Group Monitor Policy

To configure port group monitor policy, perform these steps:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

Step 2 Specify the policy name and enter port group monitoring policy configuration mode:

```
switch(config)# port-group-monitor name policyname
```

(Optional) Remove the policy:

```
switch(config)# no port-group-monitor name policyname
```

Step 3 Specify the delta receive or transmit counter poll interval (in seconds) and thresholds (in percentage):

```
switch(config-port-group-monitor)# counter {rx-performance | tx-performance} poll-interval
seconds delta rising-threshold percentage1 falling-threshold percentage2
```

(Optional) Revert to the default policy:

```
switch(config-port-group-monitor)# no counter tx-performance
```

For more information on reverting to the default policy, see Chapter 3, “Reverting to the Default Value for a Specific Counter” and Chapter 3, “Port Group Monitor”.

Step 4 Turn on performance monitoring:

```
switch(config-port-group-monitor)# monitor counter {rx-performance | tx-performance}
```

(Optional) Turn off performance monitoring:

```
switch(config-port-group-monitor)# no monitor counter {rx-performance | tx-performance}
```

For more information on turning off transmit performance monitoring, see Chapter 3, “Turning Off Specific Counter Monitoring”.

Note On 8 Gbps and higher speed modules, port errors are monitored using the **invalid-crc** and **invalid-words** counters. The **err-pkt-from-port** counter is supported only on 4-Gbps modules.

Reverting to the Default Value for a Specific Counter

The following examples display the default values for counters:

```
switch(config)# port-group-monitor name PGMON_policy
switch(config-port-group-monitor)# counter rx-datarate poll-interval 200 delta
rising-threshold 75 falling-threshold 0
switch(config)# show port-group-monitor PGMON_policy

Policy Name  : PGMON_policy
Admin status : Not Active
Oper status  : Not Active
Port type    : All Port Groups
--------------------------------------------------------------------------------
Counter          Threshold  Interval %ge Rising Threshold %ge Falling Threshold
-------          ---------  -------- -------------------- ----------------------
RX Datarate      Delta      200      75                   0
```

```
TX Datarate      Delta      60       80                  20
-------------------------------------------------------------------------------------------

switch(config-port-group-monitor)# no  counter rx-datarate poll-interval 200 delta
rising-threshold 75 falling-threshold 0
switch(config)# show port-group-monitor PGMON_policy

Policy Name  : PGMON_policy
Admin status : Not Active
Oper status  : Not Active
Port type    : All Port Groups
-------------------------------------------------------------------------------------------
Counter          Threshold  Interval %ge Rising Threshold %ge Falling Threshold
-------          ---------  -------- -------------------- ----------------------
RX Datarate      Delta      60       80                  20
TX Datarate      Delta      60       80                  20
-------------------------------------------------------------------------------------------
```

Turning Off Specific Counter Monitoring

The following examples display turning off counter monitoring:

```
switch(config)# port-group-monitor name PGMON_policy
switch(config-port-group-monitor)# no monitor counter rx-performance

switch(config)# show port-group-monitor PGMON_policy

Policy Name  : PGMON_policy
Admin status : Not Active
Oper status  : Not Active
Port type    : All Port Groups
-------------------------------------------------------------------------------------------
Counter          Threshold  Interval %ge Rising Threshold %ge Falling Threshold
-------          ---------  -------- -------------------- ----------------------
TX Performance   Delta      60       100                 80
-------------------------------------------------------------------------------------------
```

Activating Port Group Monitor Policy

To activate port group monitor policy, perform these steps:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

Step 2 Activate the specified port group monitor policy:

```
switch(config)# port-group-monitor activate policyname
```

(Optional) Activate the default port group monitor policy:

```
switch(config)# port-group-monitor activate
```

(Optional) Deactivate the specified port group monitor policy:

```
switch(config)# no port-group-monitor activate policyname
```

Configuring the Management Interface

To configure the mgmt0 Ethernet interface to connect over IPv4, perform these steps:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

Step 2 Select the management Ethernet interface on the switch and enter interface configuration submode:

```
switch(config)# interface mgmt0
```

Step 3 Configure the IPv4 address and IPv4 subnet mask:

```
switch(config-if)# ip address 10.16.1.2 255.255.255.0
```

Step 4 Enable the interface:

```
switch(config-if)# no shutdown
```

Step 5 Return to configuration mode:

```
switch(config-if)# exit
```

Step 6 Configure the default gateway IPv4 address:

```
switch(config)# ip default-gateway 1.1.1.4
```

Step 7 Return to user EXEC mode:

```
switch(config)# exit
```

(Optional) Save your configuration changes to the file system:

```
switch# copy running-config startup-config
```

To configure the mgmt0 Ethernet interface to connect over IPv6, perform these steps:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

Step 2 Select the management Ethernet interface on the switch and enter interface configuration submode:

```
switch(config)# interface mgmt0
```

Step 3 Enable IPv6 and assign a link-local address on the interface:

```
switch(config-if)# ipv6 enable
```

Step 4 Specify an IPv6 unicast address and prefix length on the interface:

```
switch(config-if)# ipv6 address 2001:0db8:800:200c::417a/64
```

Step 5 Enable the interface:

```
switch(config-if)# no shutdown
```

Step 6 Return to user EXEC mode:

```
switch(config-if)# end
```

(Optional) Save your configuration changes to the file system:

```
switch# copy running-config startup-config
```

Creating a VSAN Interface

To create a VSAN interface, perform these steps:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

Step 2 Configure a VSAN with the ID 2:

```
switch(config)# interface vsan 2
```

Step 3 Enable the VSAN interface:

```
switch(config-if)# no shutdown
```

Configuring Slow-Drain Device Detection and Congestion Avoidance

Slow-drain devices are devices that do not accept frames at the configured rate. The presence of these slow-drain devices leads to traffic congestion in the Fibre Channel or Fibre Channel over Ethernet (FCoE) fabric. This traffic congestion can affect the unrelated flows in the fabric that use the same ISLs for its traffic as the slow-drain device. This is true although the destination devices are not slow-drain devices.

From Cisco MDS NX-OS Release 4.2(1), slow-drain device detection and congestion avoidance is supported on all Fibre Channel switching modules.

From Cisco MDS NX-OS Release 5.2(1), slow-drain device detection and congestion avoidance is supported on all FCoE switch modules.

From Cisco MDS NX-OS Release 5.2(1), slow-drain detection and congestion avoidance functionality for edge ports was enhanced.

Multiple features are available on the Cisco MDS 9000 Series Multilayer Switches to detect slow drain and avoid the resulting effects.

Table 3-15 describes the features that help detect slow drain:

Table 3-15 Features to Detect Slow Drain

Feature Name	Description
TX Credit Not Available Counter	Fibre Channel port monitor—Transmit credit not available is the continuous no-transmit credit condition. When the configured period expires, trap, flap, or error-disable the port.
Congestion Drop	Fibre Channel system—Congestion drop timeout is the maximum lifetime of a frame in a switch. When the configured period expires, the frames are dropped. FCoE system—Congestion drop timeout is the maximum lifetime of a frame in the switch. When the configured period expires, the frames are dropped.
Slow-Port Monitor	Fibre Channel system—Slow-port monitor credits return to a switch slowly; logs only events.
No-Credit Drop	Fibre Channel system—No-credit drop is the continuous no-transmit credit condition. All the queued and incoming frames for a port are dropped immediately.
Pause Timeout	FCoE system—Pause timeout is a continuous pause condition. When the configured period expires, all the queued and incoming frames for a port are dropped.
Credit Loss Recovery	Fibre Channel system—Credit loss recovery is its continuous no-transmit credit condition; credit loss recovery resets the port.

This section includes the following topics:

Configuring the Congestion Frame Timeout Value for FCoE

When an FCoE frame takes longer than the congestion timeout period to be transmitted by the egress port, the frame is dropped. This dropping of the frames is useful in controlling the effect of slow egress ports that are paused almost continuously (long enough to cause congestion), but not long enough to

trigger the pause timeout drop. Dropping of frames is counted as egress discard on the egress port. Egress discard releases buffers in the upstream ingress ports of the switch, allowing the unrelated flows to move continuously through them.

The congestion timeout value is 500 ms by default for all port types. We recommend that you retain the default timeout for core ports and consider configuring a lower value for edge ports. This value should be equal to or greater than the pause frame timeout value for that port type.

To configure the congestion frame timeout value for FCoE, perform these steps:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

Step 2 Configure the system-wide FCoE congestion timeout, in milliseconds, for either core or edge ports:

```
switch(config)# system default interface congestion timeout milliseconds mode {core | edge}
```

The range is 100-1000 ms

Configuring Pause Frame Timeout Value for FCoE

When an FCoE port is in a state of continuous pause for the pause frame timeout period, all the frames that are queued to that port are dropped immediately. As long as the port continues to remain in the pause state, the newly arriving frames destined for the port are dropped immediately. These drops are counted as egress discards on the egress port, and create buffers in the upstream ingress ports of the switch, allowing unrelated flows to continue moving through them.

To reduce the effect of a slow-drain device on unrelated traffic flows, configure a lower-pause frame timeout value than the congestion frame timeout value, for edge ports. This causes the frames destined for a slow port to be dropped immediately after the pause timeout period has occurred, rather than waiting for the congestion timeout period to drop them.

Pause timeout dropping can be enabled and disabled. By default, frame dropping is enabled. The pause timeout value is 500 ms by default for all ports. We recommend that you retain the default timeout core ports and consider configuring a lower value for edge ports.

To configure the pause frame timeout value for FCoE, perform these steps:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

Step 2 Configure the system-wide FCoE pause timeout, in milliseconds, for either edge or core ports:

```
switch(config)# system default interface pause timeout milliseconds mode {core | edge}
```

The range is 100–500 ms.

(Optional) Revert to the default pause timeout, in milliseconds:

```
switch(config)# no system default interface pause timeout milliseconds mode {core | edge}
```

Step 3 Enable the pause timeout drops for edge or core ports:

```
switch(config)# system default interface pause mode {core | edge}
```

(Optional) Disable the pause timeout drops for edge or core ports:

```
switch(config)# no system default interface pause mode {core | edge}
```

Configuring the Congestion Drop Timeout Value for Fibre Channel

When a Fibre Channel frame takes longer than the congestion timeout period to be transmitted by the egress port, the frame is dropped. This option of the frames being dropped is useful for controlling the effect of slow egress ports that lack transmit credits almost continuously; long enough to cause congestion, but not long enough to trigger the no-credit timeout drop. These drops are counted as egress discards on the egress port, and release buffers into the upstream ingress ports of the switch, allowing unrelated flows to continue moving through them.

By default, the congestion timeout value is 500 ms for all port types. We recommend that you retain the default timeout for core ports and configure a lower value (not less than 200 ms) for edge ports. The congestion timeout value should be equal to or greater than the no-credit frame timeout value for that port type.

To configure the congestion frame timeout value for the Fibre Channel, perform these steps:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

Step 2 Configure the Fibre Channel congestion drop timeout value, in milliseconds, for the specified port type:

```
switch(config)# system timeout congestion-drop milliseconds mode E | F
```

The range is 100-500 ms.

(Optional) Revert to the default value for the congestion timeout for the specified port type:

```
switch(config)# system timeout congestion-drop default mode E | F
```

Configuring the No-Credit Frame Timeout Value for Fibre Channel

When a Fibre Channel egress port has no transmit credits continuously for the no-credit timeout period, all the frames that are already queued to that port are dropped immediately. As long as the port remains in this condition, newly arriving frames destined for that port are dropped immediately. These drops are counted as egress discards on the egress port, and release buffers in the upstream ingress ports of the switch, allowing unrelated flows to continue moving through them.

No-credit dropping can be enabled or disabled. By default, frame dropping is disabled and the frame timeout value is 500 ms for all port types. We recommend that you retain the default frame timeout for core ports and configure a lower value (300 ms) for edge ports. If the slow-drain events continue to affect unrelated traffic flows, the frame timeout value for the edge ports can be lowered to drop the previous slow-drain frames. This frees the ingress buffers for frames of unrelated flows, thus reducing the latency of the frames through the switch.

Note

- The no-credit frame timeout value should always be less than the congestion frame timeout for the same port type, and the edge port frame timeout values should always be lower than the core port frame timeout values.
- The slow-port monitor delay value should always be less than the no-credit frame timeout value for the same port type.

For pre-16-Gbps-capable modules and systems, the no-credit timeout value can be 100 to 500 ms in multiples of 100 ms. On these systems, the no-credit condition is checked only at 100-ms intervals. At this point, if the no-credit condition exists, dropping starts. Depending on the timing of the actual onset of the no-credit condition, the task of checking port dropping can be delayed by up to 100 ms later than

the configured value. On 16 Gbps and later modules and systems, the no-credit timeout value can be 1 to 500 ms in multiples of 1 ms. Dropping starts immediately after the no-credit condition comes into existence for the configured timeout value.

To configure the no-credit timeout value, perform these steps:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

Step 2 Specify the no-credit timeout value for the switch's F ports:

```
switch(config)# system timeout no-credit-drop milliseconds mode F
```

(Optional) Revert to the default no-credit timeout value (500 ms) for edge ports:

```
switch(config)# system timeout no-credit-drop default mode F
```

The no-credit drop action is not changed.

(Optional) Disable no-credit dropping for edge ports:

```
switch(config)# no system timeout no-credit-drop mode F
```

Configuring the Slow-Port Monitor Timeout Value for Fibre Channel

The slow-port monitor functionality is similar to the no-credit frame timeout and drop functionality, except that it does not drop frames; it only logs qualifying events. When a Fibre Channel egress port has no transmit credits continuously for the slow-port monitor timeout period, the event is logged. No frames are dropped unless the no-credit frame timeout period is reached and no-credit frame timeout drop is enabled. If the no-credit frame timeout drop is not enabled, no frames are dropped until the congestion frame timeout period is reached.

Slow-port monitoring is implemented in the hardware, with the slow-port monitor functionality being slightly different in each generation of hardware. The 8-Gbps modules report a single slow-port monitor event for each 100-ms window in which the slow-port monitor threshold has crossed one or more times. They do not have the ability to report the exact number of slow-port events. The advanced 8 and 16 Gbps modules and switches are not restricted and can detect each instance of the slow-port monitor threshold being crossed. The slow-port monitor log is updated at 100-ms intervals. A log entry for a slow port on an 8-Gbps module can increment by a maximum of one. A log for a slow-port event on an advanced 8 or 16 Gbps module or system increments the exact number of times the threshold is reached.

Modules and switches that currently support slow-port monitor are:

- 8-Gbps modules:
  - Cisco MDS 9500 1, 2, 4, or 8-Gbps Fibre Channel Module DS-X9248-48K9
  - Cisco MDS 9500 1, 2, 4, or 8-Gbps Fibre Channel Module DS-X9224-96K9
  - Cisco MDS 9500 1, 2, 4, or 8-Gbps Fibre Channel Module DS-X9248-96K9
- Advanced 8-Gbps modules:
  - Cisco MDS 9500 1, 2, 4, 8, or 10-Gbps Advanced Fibre Channel Module DS-X9232-256K9
  - Cisco MDS 9500 1, 2, 4, 8, or 10-Gbps Advanced Fibre Channel Module DS-X9248-256K9
- 16-Gbps modules or switches:
  - Cisco MDS 9700 2, 4, 8, 10, or 16-Gbps Advanced Fibre Channel Module DS-X9448-768K9

- Cisco MDS 9250i Fabric Switch
- Cisco MDS 9148S Fabric Switch
- Cisco MDS 9396S Fabric Switch

Table 3-16 displays the slow port features supported on different Fibre Channel switching modules for Cisco MDS NX-OS Release 6.2(13):

Table 3-16 Slow-Port Support on Fibre Channel Switching Modules

Function	Hardware Support		
	8-Gbps Modules	Advanced 8-Gbps Modules	16-Gbps Modules and Switches
Slow-port monitor[1]	Yes	Yes	Yes
Transmit-wait history graph	No	Yes	Yes
Transmit-wait OBFL logging	Yes	Yes	Yes
Port monitor slow-port counter	No	Yes	Yes
Port monitor transmit-wait counter	Yes	Yes	Yes
Transmit-wait interface counter	No	Yes	Yes

1. From Cisco MDS NX-OS Release 6.2(9), slow-port monitoring is supported on 16-Gbps modules and switches. From Cisco MDS NX-OS Release 6.2(13), slow-port monitoring is supported on 8-Gbps modules.

To configure the slow-port monitor timeout value, perform these steps:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

Step 2 Specify the slow-port monitor timeout value for E or F port mode for the switch:

```
switch(config)# system timeout slowport-monitor milliseconds mode E | F
```

Valid values for the slow-port monitor timeout are:

- 16-Gbps modules or switches—1 to 500 ms in 1-ms increments.
- 8-Gbps and advanced 8-Gbps modules—1 to 100 ms in 1-ms increments.

(Optional) Revert to the default slow-port monitor timeout value (500 ms) for the specified port type:

```
switch(config)# system timeout slowport-monitor default mode E | F
```

Displaying Credit Loss Recovery Actions

When a port is at zero transmit credits for 1 full second (F ports) and 1.5 seconds (E ports), it is called a credit loss condition. Cisco MDS initiates credit loss recovery by transmitting a Link Credit Reset (LCR). If the end device responds with a Link Credit Reset Response (LCRR), the port is back at its fully agreed number of B2B credits in both directions. If an LRR is not received, the port is shut down.

When the port detects the credit loss condition and recovers, some of the following actions might occur:

- An SNMP trap with interface details can be sent, indicating the credit loss event.
- The port can be error disabled.
- The port can be flapped.

When the configured threshold is exceeded, one or more of these actions can be combined together. These actions can be turned on or off depending on the situation. The Port Monitor feature provides the CLI to configure the thresholds and action.

The 1 second (F ports) and 1.5 seconds (E ports) timers that are set for the switch to initiate CLR are fixed and cannot be changed.

To verify a port monitor policy to generate SNMP alerts and take other actions in the quantity and timing of these events, perform these steps:

- Display the last 10 credit loss events per interface per module:

  switch# **show process creditmon credit-loss-events [module x]**

- Display a chronological log of credit loss events per module:

  switch# **show process creditmon credit-loss-event-history [module x]**

Note When a port sees the credit loss condition and fails to recover, the port flaps. This function is already a part of the port guard, and you can configure the supported actions using the Port Guard feature.

Configuring the Transmit Average Credit-Not-Available Duration Threshold and Action

Cisco MDS monitors its ports that are at zero transmit credits for 100 ms or more. This is called transmit average credit-not-available duration. The Port Monitor feature can monitor this using the TX Credit Not Available counter. When the transmit average credit-not-available duration exceeds the threshold set in the port monitor policy, some or all the following actions might occur:

- An SNMP trap with interface details can be sent, indicating the transmit average credit not available duration event.
- The port can be error disabled.
- The port can be flapped.

When the configured threshold is exceeded, one or more of these actions can be combined together. These actions can be turned on or off depending on the situation. The Port Monitor feature provides the CLI to configure the thresholds and action. The threshold configuration is configured as a percentage of the interval. The thresholds can be 0 to 100 percent in multiples of 10, and the interval can be 1 second to 1 hour. The default is 10 percent of a 1-second interval and generates a trap when the transmit-average-credit-not-available duration hits 100 ms.

For information about configuring the average-credit-not-available-duration threshold and action, refer to the Chapter 3, “Port Monitor”.

The following example shows how to configure credit loss recovery and the average credit-not-available duration threshold and action:

```
switch# show port-monitor PMON_policy
Policy Name  : PMON_policy
Admin status : Not Active
Oper status  : Not Active
Port type    : All Ports
------------------------------------------------------------------------------------------
Counter               Threshold  Interval Rising Threshold     event Falling Threshold
event  Warning Threshold    PMON Portguard
```

```
-------                   ---------  -------- ----------------       -----
------------------    -----  ------------------    --------------
Link Loss               Delta      60       5                    4     1
4       Not enabled           Not enabled
Sync Loss               Delta      60       5                    4     1
4       Not enabled           Not enabled
Signal Loss             Delta      60       5                    4     1
4       Not enabled           Not enabled
Invalid Words           Delta      60       1                    4     0
4       Not enabled           Not enabled
Invalid CRC's           Delta      60       5                    4     1
4       Not enabled           Not enabled
State Change            Delta      60       5                    4     0
4       Not enabled           Not enabled
TX Discards             Delta      60       200                  4     10
4       Not enabled           Not enabled
LR RX                   Delta      60       5                    4     1
4       Not enabled           Not enabled
LR TX                   Delta      60       5                    4     1
4       Not enabled           Not enabled
Timeout Discards        Delta      60       200                  4     10
4       Not enabled           Not enabled
Credit Loss Reco        Delta      1        1                    4     0
4       Not enabled           Not enabled
TX Credit Not Available  Delta      1        10%                  4     0%
4       Not enabled           Not enabled
RX Datarate             Delta      60       80%                  4     20%
4       Not enabled           Not enabled
TX Datarate             Delta      60       80%                  4     20%
4       Not enabled           Not enabled
TX-Slowport-Oper-Delay   Absolute   1        50ms                 4     0ms
4       Not enabled           Not enabled
TXWait                  Delta      1        40%                  4     0%
4       Not enabled           Not enabled
--------------------------------------------------------------------------------------------
```

The following edge port monitor policy is active by default. No port monitor policy is enabled for core ports by default.

```
switch# show port-monitor slowdrain

Policy Name  : slowdrain
Admin status : Not Active
Oper status  : Not Active
Port type    : All Access Ports
--------------------------------------------------------------------------------------------
Counter            Threshold  Interval  Rising Threshold  event  Falling Threshold  event
PMON Portguard
--------------------------------------------------------------------------------------------
Credit Loss Reco    Delta      1          1                 4           0             4
Not enabled
TX Credit Not
Available           Delta      1          10%               4           0%            4
Not enabled
--------------------------------------------------------------------------------------------
```

Verifying Interfaces Configuration

This section includes the following topics:

Displaying Interface Information

Run the **show interface** command from user EXEC mode. This command displays the interface configurations. Without any arguments, this command displays the information for all the configured interfaces in the switch.

The following example displays the status of interfaces:

```
switch# show interface
fc1/1 is up
    Hardware is Fibre Channel, SFP is short wave laser
    Port WWN is 20:0b:00:05:30:00:8d:de
    Admin port mode is F
    Port mode is F, FCID is 0x610000
    Port vsan is 2
    Speed is 2 Gbps
    Transmit B2B Credit is 3
    Receive B2B Credit is 16
    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
      134 frames input, 8468 bytes
        0 discards, 0 errors
        0 CRC, 0 unknown class
        0 too long, 0 too short
      154 frames output, 46072 bytes
        0 discards, 0 errors
      1 input OLS, 1 LRR, 0 NOS, 0 loop inits
      1 output OLS, 0 LRR, 1 NOS, 0 loop inits
      16 receive B2B credit remaining
      3 transmit B2B credit remaining.
.
.
.
fc1/9 is trunking
    Hardware is Fibre Channel, SFP is long wave laser cost reduced
    Port WWN is 20:09:00:05:30:00:97:9e
    Peer port WWN is 20:0b:00:0b:5f:a3:cc:00
    Admin port mode is E, trunk mode is on
    Port mode is TE
    Port vsan is 100
    Speed is 2 Gbps
    Transmit B2B Credit is 255
    Receive B2B Credit is 255
```

```
    Receive data field Size is 2112
    Beacon is turned off
    Trunk vsans (admin allowed and active) (1,100,3000)
    Trunk vsans (up)                       (1,100,3000)
    Trunk vsans (isolated)                 ()
    Trunk vsans (initializing)             ()
    5 minutes input rate 280 bits/sec, 35 bytes/sec, 0 frames/sec
    5 minutes output rate 176 bits/sec, 22 bytes/sec, 0 frames/sec
      4609939 frames input, 8149405708 bytes
        0 discards, 0 errors
        0 CRC, 0 unknown class
        0 too long, 0 too short
      4638491 frames output, 7264731728 bytes
        0 discards, 0 errors
      3 input OLS, 9 LRR, 1 NOS, 0 loop inits
      9 output OLS, 7 LRR, 1 NOS, 0 loop inits
      16 receive B2B credit remaining
      3 transmit B2B credit remaining.
.
.
.
fc1/13 is up
    Hardware is Fibre Channel, SFP is short wave laser
    Port WWN is 20:0d:00:05:30:00:97:9e
    Admin port mode is auto, trunk mode is on
    Port mode is F, FCID is 0x650100
    Port vsan is 100
    Speed is 2 Gbps
    Transmit B2B Credit is 3
    Receive B2B Credit is 16
    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
      8696 frames input, 3227212 bytes
        0 discards, 0 errors
        0 CRC, 0 unknown class
        0 too long, 0 too short
      16799 frames output, 6782444 bytes
        0 discards, 0 errors
      0 input OLS, 0 LRR, 0 NOS, 0 loop inits
      1 output OLS, 1 LRR, 0 NOS, 1 loop inits
      16 receive B2B credit remaining
      3 transmit B2B credit remaining.
.
.
.
sup-fc0 is up
    Hardware is Fibre Channel
    Speed is 1 Gbps
    139597 packets input, 13852970 bytes
      0 multicast frames, 0 compressed
      0 input errors, 0 frame, 0 overrun 0 fifo
    139516 packets output, 16759004 bytes, 0 underruns
      0 output errors, 0 collisions, 0 fifo
      0 carrier errors
```

You can also specify arguments (a range of interfaces or multiple specified interfaces) to display interface information. You can specify a range of interfaces by issuing a command in the following format:

```
interface fc1/1 - 5 , fc2/5 - 7
```

Note The spaces are required before and after the dash (**-**) and before and after the comma (**,**).

The following example displays the status of a range of interfaces:

```
switch# show interface fc3/13 , fc3/16
fc3/13 is up
    Hardware is Fibre Channel, SFP is short wave laser
    Port WWN is 20:8d:00:05:30:00:97:9e
    Admin port mode is FX
    Port mode is F, FCID is 0x7b0300
    Port vsan is 1
    Speed is 2 Gbps
    Transmit B2B Credit is 3
    Receive B2B Credit is 12
    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
      1856 frames input, 116632 bytes
        0 discards, 0 errors
        0 CRC,  0 unknown class
        0 too long, 0 too short
      1886 frames output, 887712 bytes
        0 discards, 0 errors
      0 input OLS, 0 LRR, 0 NOS, 1 loop inits
      1 output OLS, 1 LRR, 0 NOS, 1 loop inits
      16 receive B2B credit remaining
      3 transmit B2B credit remaining.

fc3/16 is up
    Hardware is Fibre Channel, SFP is short wave laser
    Port WWN is 20:90:00:05:30:00:97:9e
    Admin port mode is FX
    Port mode is F, FCID is 0x7d0100
    Port vsan is 3000
    Speed is 2 Gbps
    Transmit B2B Credit is 3
    Receive B2B Credit is 12
    Receive data field Size is 2112
    Beacon is turned off
    5 minutes input rate 504 bits/sec, 63 bytes/sec, 0 frames/sec
    5 minutes output rate 520 bits/sec, 65 bytes/sec, 0 frames/sec
      47050 frames input, 10311824 bytes
        0 discards, 0 errors
        0 CRC,  0 unknown class
        0 too long, 0 too short
      62659 frames output, 10676988 bytes
        0 discards, 0 errors
      0 input OLS, 0 LRR, 0 NOS, 0 loop inits
      1 output OLS, 1 LRR, 0 NOS, 1 loop inits
      16 receive B2B credit remaining
      3 transmit B2B credit remaining.
```

The following example displays the status of a specified interface:

```
switch# show interface fc2/2
fc2/2 is trunking
    Port description is Trunk to Core-4
    Hardware is Fibre Channel, SFP is short wave laser
    Port WWN is 20:42:00:05:30:00:97:9e
```

```
    Peer port WWN is 20:cc:00:05:30:00:50:9e
    Admin port mode is E, trunk mode is on
    Port mode is TE
    Port vsan is 1
    Speed is 2 Gbps
    Transmit B2B Credit is 255
    Receive B2B Credit is 255
    Receive data field Size is 2112
    Beacon is turned off
    Belongs to port-channel 2
    Trunk vsans (admin allowed and active) (1,100,3000)
    Trunk vsans (up)                       (1)
    Trunk vsans (isolated)                 (100,3000)
    Trunk vsans (initializing)             ()
    5 minutes input rate 0 bits/sec, 0 bytes/sec, 0 frames/sec
    5 minutes output rate 32 bits/sec, 4 bytes/sec, 0 frames/sec
      2214834 frames input, 98673588 bytes
        0 discards, 0 errors
        0 CRC, 0 unknown class
        0 too long, 0 too short
      2262415 frames output, 343158368 bytes
        0 discards, 0 errors
      1 input OLS, 1 LRR, 1 NOS, 0 loop inits
      2 output OLS, 1 LRR, 0 NOS, 0 loop inits
      16 receive B2B credit remaining
      3 transmit B2B credit remaining.
```

The following example displays the description of interfaces:

```
switch# show interface description
--------------------------------------------------------------------------------
Interface          Description
--------------------------------------------------------------------------------
fc3/1              test intest
fc3/2              --
fc3/3              --
fc3/4              TE port
fc3/5              --
fc3/6              --
fc3/10             Next hop switch 5
fc3/11             --
fc3/12             --
fc3/16             --
--------------------------------------------------------------------------------
Interface          Description
--------------------------------------------------------------------------------
port-channel 1     --
port-channel 5     --
port-channel 6     --
```

The following example displays a summary of information:

```
switch# show interface brief

--------------------------------------------------------------------------------
Interface  Vsan   Admin  Admin   Status          SFP   Oper  Oper   Port
                  Mode   Trunk                         Mode  Speed  Channel
                         Mode                                (Gbps)
--------------------------------------------------------------------------------
fc1/1      1      E      on      trunking         swl    TE      2    1
fc1/2      1      E      on      trunking         swl    TE      2    1
fc1/3      1      auto   on      SFPAbsent       --     --           --
```

```
fc1/4      1      auto   on      SFPAbsent       --     --           --
fc1/5      3000   auto   on      up               swl    F       2    --
...
fc2/2      1      E      on      trunking         swl    TE      2    2
fc2/3      1      auto   on      down             c1610  --           --
fc2/4      1      auto   on      down             c1590  --           --
fc2/5      3000   auto   on      notConnected     lwcr   --           --
fc2/6      1      auto   on      SFPAbsent       --     --           --
...
fc3/16     3000   FX     --      up               swl    F       2    --
fc3/17     1      FX     --      SFPAbsent       --     --           --
...
--------------------------------------------------------------------------------
Interface               Status     IP Address        Speed        MTU
--------------------------------------------------------------------------------
GigabitEthernet4/1      SFPAbsent --                auto         1500
...
GigabitEthernet4/6      down       10.1.1.2/8       auto         3000
GigabitEthernet4/7      down       10.1.1.27/24     auto         1500
GigabitEthernet4/8      down       --               auto         1500

--------------------------------------------------------------------------------
Interface           Status              Oper Mode           Oper Speed
                                                            (Gbps)
--------------------------------------------------------------------------------
iscsi4/1            down                --
...
--------------------------------------------------------------------------------
Interface          Status                           Speed
                                                    (Gbps)
--------------------------------------------------------------------------------
sup-fc0            up                               1

--------------------------------------------------------------------------------
Interface               Status     IP Address        Speed        MTU
--------------------------------------------------------------------------------
mgmt0                   up         172.19.48.96/25   100 Mbps     1500

--------------------------------------------------------------------------------
Interface               Vsan     Admin    Status           Oper   Oper
                                 Trunk                     Mode   Speed
                                 Mode                             (Gbps)
--------------------------------------------------------------------------------
port-channel 1          1        on       trunking         TE     4
port-channel 2          1        on       trunking         TE     4

--------------------------------------------------------------------------------
Interface  Vsan   Admin  Admin   Status       Oper  Profile  Port-channel
                  Mode   Trunk               Mode
                         Mode
--------------------------------------------------------------------------------
fcip10     1      auto   on      notConnected --     10       --
```

The following example displays a summary of information:

```
switch# show interface counters
fc3/1
    5 minutes input rate 24 bits/sec, 3 bytes/sec, 0 frames/sec
    5 minutes output rate 16 bits/sec, 2 bytes/sec, 0 frames/sec
    3502 frames input, 268400 bytes
      0 discards, 0 CRC, 0 unknown class
      0 too long, 0 too short
    3505 frames output, 198888 bytes
```

```
      0 discards
    1 input OLS, 1 LRR, 1 NOS, 0 loop inits
    2 output OLS, 1 LRR, 1 NOS, 0 loop inits
    1 link failures, 1 sync losses, 1 signal losses
.
.
.
fc9/8
    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 class-2 frames, 0 bytes
      0 class-3 frames, 0 bytes
      0 class-f frames, 0 bytes
      0 discards, 0 CRC, 0 unknown class
      0 too long, 0 too short
    0 frames output, 0 bytes
      0 class-2 frames, 0 bytes
      0 class-3 frames, 0 bytes
      0 class-f frames, 0 bytes
      0 discards
    0 input OLS, 0 LRR, 0 NOS, 0 loop inits
    0 output OLS, 0 LRR, 0 NOS, 0 loop inits
    0 link failures, 0 sync losses, 0 signal losses
      16 receive B2B credit remaining
      3 transmit B2B credit remaining.
.
.
.
sup-fc0
    114000 packets input, 11585632 bytes
      0 multicast frames, 0 compressed
      0 input errors, 0 frame, 0 overrun 0 fifo
    113997 packets output, 10969672 bytes, 0 underruns
      0 output errors, 0 collisions, 0 fifo
      0 carrier errors

mgmt0
    31557 packets input, 2230860 bytes
      0 multicast frames, 0 compressed
      0 input errors, 0 frame, 0 overrun 0 fifo
    26618 packets output, 16824342 bytes, 0 underruns
      0 output errors, 0 collisions, 7 fifo
      0 carrier errors

vsan1
    0 packets input, 0 bytes, 0 errors, 0 multicast
    0 packets output, 0 bytes, 0 errors, 0 dropped
.
.
.
port-channel 1
    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 class-2 frames, 0 bytes
      0 class-3 frames, 0 bytes
      0 class-f frames, 0 bytes
      0 discards, 0 CRC, 0 unknown class
      0 too long, 0 too short
    0 frames output, 0 bytes
      0 class-2 frames, 0 bytes
      0 class-3 frames, 0 bytes
      0 class-f frames, 0 bytes
```

```
      0 discards
    0 input OLS, 0 LRR, 0 NOS, 0 loop inits
    0 output OLS, 0 LRR, 0 NOS, 0 loop inits
    0 link failures, 0 sync losses, 0 signal losses
```

Note Interfaces 9/8 and 9/9 are not trunking ports and display Class 2, 3, and F information as well.

The following example displays the brief counter information of interfaces:

```
switch# show interface counters brief

-------------------------------------------------------------------------------
Interface          Input (rate is 5 min avg)      Output (rate is 5 min avg)
                   ---------------------------  ---------------------------
                   Rate     Total               Rate     Total
                   Mbits/s  Frames              Mbits/s  Frames
-------------------------------------------------------------------------------
fc3/1              0        3871                0        3874
fc3/2              0        3902                0        4232
fc3/3              0        3901                0        4138
fc3/4              0        3895                0        3894
fc3/5              0        3890                0        3897
fc9/8              0        0                   0        0
fc9/9              0        5                   0        4
fc9/10             0        4186                0        4182
fc9/11             0        4331                0        4315

-------------------------------------------------------------------------------
Interface          Input (rate is 5 min avg)      Output (rate is 5 min avg)
                   ---------------------------  ---------------------------
                   Rate     Total               Rate     Total
                   Mbits/s  Frames              Mbits/s  Frames
-------------------------------------------------------------------------------
port-channel 1     0        0                   0        0
port-channel 2     0        3946                0        3946
```

You can run the **show interface transceiver** command only on a switch in the Cisco MDS 9100 Series if the SFP is present, as shown in the following example:

```
switch# show interface transceiver
fc1/1 SFP is present
    name is CISCO-AGILENT
    part number is QFBR-5796L
    revision is
    serial number is A00162193
    fc-transmitter type is short wave laser
    cisco extended id is unknown (0x0)
.
.
.
fc1/9 SFP is present
    name is FINISAR CORP.
    part number is FTRJ-1319-7D-CSC
    revision is
    serial number is H11A6ER
    fc-transmitter type is long wave laser cost reduced
    cisco extended id is unknown (0x0)
.
.
.
```

The following example displays the entire running configuration, with information about all the interfaces. The interfaces have multiple entries in the configuration files to ensure that the interface configuration commands execute in the correct order when the switch reloads.

```
switch# show running-config
.
.
.
interface fc9/1
  switchport speed 2000
.
.
.
interface fc9/1
  switchport mode E
.
.
.
interface fc9/1
  channel-group 11 force
  no shutdown
```

The following example displays the running configuration information for a specified interface. The interface configuration commands are grouped:

```
switch# show running-config interface fc1/1
interface fc9/1
  switchport speed 2000
  switchport mode E
  channel-group 11 force
  no shutdown
```

The following example displays the running configuration after the **system default switchport mode F** command is executed:

```
switch# show running-config
version 3.1(3)
system default switchport mode F
interface fc4/1
interface fc4/2
interface fc4/3
interface fc4/4
interface fc4/5
interface fc4/6
interface fc4/7
interface fc4/8
interface fc4/9
interface fc4/10
```

The following example displays the running configuration after two interfaces are individually configured for FL mode:

```
switch# show running-config
version 3.1(3)
system default switchport mode F
interface fc4/1
  switchport mode FL
interface fc4/2
interface fc4/3
  switchport mode FL
interface fc4/4
interface fc4/5
interface fc4/6
interface fc4/7
```

```
interface fc4/8
interface fc4/9
interface fc4/1
```

The following example displays interface information in a brief format after the **system default switchport mode F** command is executed:

```
switch# show interface brief
--------------------------------------------------------------------------------
Interface  Vsan   Admin  Admin   Status          SFP    Oper  Oper   Port
                  Mode   Trunk                         Mode  Speed  Channel
                         Mode                                (Gbps)
--------------------------------------------------------------------------------
fc4/1      1      F      --      notConnected     swl    --           --
fc4/2      1      F      --      notConnected     swl    --           --
fc4/3      1      F      --      notConnected     swl    --           --
fc4/4      1      F      --      notConnected     swl    --           --
fc4/5      1      F      --      sfpAbsent        --     --           --
fc4/6      1      F      --      sfpAbsent        --     --           --
fc4/7      1      F      --      sfpAbsent        --     --           --
fc4/8      1      F      --      sfpAbsent        --     --           --
fc4/9      1      F      --      sfpAbsent        --     --           --
```

The following example displays interface information in a brief format after two interfaces are individually configured for FL mode:

```
switch# show interface brief

--------------------------------------------------------------------------------
Interface  Vsan   Admin  Admin   Status          SFP    Oper  Oper   Port
                  Mode   Trunk                         Mode  Speed  Channel
                         Mode                                (Gbps)
--------------------------------------------------------------------------------
fc4/1      1      FL     --      notConnected     swl    --           --
fc4/2      1      F      --      notConnected     swl    --           --
fc4/3      1      FL     --      notConnected     swl    --           --
fc4/4      1      F      --      notConnected     swl    --           --
fc4/5      1      F      --      sfpAbsent        --     --           --
fc4/6      1      F      --      sfpAbsent        --     --           --
fc4/7      1      F      --      sfpAbsent        --     --           --
fc4/8      1      F      --      sfpAbsent        --     --           --
fc4/9      1      F      --      sfpAbsent        --     --           --
fc4/10     1      F      --      sfpAbsent        --     --           --
```

Displaying the Port-Level Port Guard

The following command displays information about an interface that is set to error-disabled state by the port guard because of a TrustSec violation:

```
switch# show interface fc8/3

fc8/3 is down (Error disabled - port down due to trustsec violation) Hardware is Fibre
Channel, SFP is short wave laser w/o OFC (SN) Port WWN is 21:c3:00:0d:ec:10:57:80
Admin port mode is E, trunk mode is on snmp link state traps are enabled
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
    11274 frames input, 1050732 bytes
        0 discards, 0 errors
```

```
        0 CRC, 0 unknown class
        0 too long, 0 too short
    11242 frames output, 971900 bytes
        0 discards, 0 errors
    11 input OLS, 34 LRR, 10 NOS, 0 loop inits
    72 output OLS, 37 LRR, 2 NOS, 0 loop inits
Interface last changed at Sun Nov 27 07:34:05 1988
```

Troubleshooting Tips

An interface may be error disabled for several reasons. To recover an error-disabled interface, use the **shutdown** and **no shutdown** commands in interface configuration mode to re-enable the link.

Displaying the Port Monitor Status and Policies

The following commands display information about the Port Monitor feature:

```
switch# show port-monitor status
Port Monitor    : Enabled
Active Policies : test
Last 100 logs :
send_alarm_tosup, the if_index is 1000000 (hex), value is 7 event id 4 high 5 low 0 sample
2 object link-loss prev_value is 2, curr_value is 9 alarm_sent is 1 portguard_type is 0
20:45:55 UTC Oct 17 2
016
send_alarm_tosup, the if_index is 1000000 (hex), value is 7 event id 4 high 5 low 0 sample
2 object state-change prev_value is 3, curr_value is 10 alarm_sent is 1 portguard_type is
0 20:45:55 UTC Oct
17 2016

switch# show port-monitor PMON_policy
--------------------------------------------------------------------------------------------
Port Monitor : enabled
--------------------------------------------------------------------------------------------
Policy Name  : PMON_policy
Admin status : Not Active
Oper status  : Not Active
Port type    : All Ports
--------------------------------------------------------------------------------------------
Counter         Threshold   Interval   Rising Threshold  event   Falling Threshold   event
PMON Portguard
--------------------------------------------------------------------------------------------
Link Loss       Delta         60             5               4          1              4
Not enabled
Sync Loss       Delta         60             5               4          1              4
Not enabled
Signal Loss     Delta         60             5               4          1              4
Not enabled
Invalid Words   Delta         60             1               4          0              4
Not enabled
Invalid CRC's   Delta         60             5               4          1              4
Not enabled
State Change    Delta         60             5               4          0              4
Not enabled
TX Discards     Delta         60             200             4          10             4
Not enabled
LR RX           Delta         60             5               4          1              4
Not enabled
LR TX           Delta         60             5               4          1              4
Not enabled
```

```
Timeout
Discards        Delta         60              200             4          10             4
Not enabled
Credit Loss
Reco            Delta         1               1               4          0              4
Not enabled
TX Credit Not
Available       Delta         1               10%             4          0%             4
Not enabled
RX Datarate     Delta         60              80%             4          20%            4
Not enabled
TX Datarate     Delta         60              80%             4          20%            4
Not enabled
TX-Slowport
-Count          Delta         1               5               4          0              4
Not enabled
TX-Slowport
-Oper-Delay     Absolute      1               50ms            4          0ms            4
Not enabled
TXWait          Delta         1               40%             4          0%             4
Not enabled
--------------------------------------------------------------------------------------------

switch# show port-monitor active
Policy Name  : sample
Admin status : Active
Oper status  : Active
Port type    : All Access Ports
--------------------------------------------------------------------------------------------
Counter        Threshold  Interval  Rising Threshold  event   Falling Threshold  event
portguard
--------------------------------------------------------------------------------------------
Link Loss       Delta      60             5               4          1              4
Not enabled
Sync Loss       Delta      60             5               4          1              4
Not enabled
Signal Loss     Delta      60             5               4          1              4
Not enabled
Invalid Words   Delta      60             1               4          0              4
Not enabled
Invalid CRC's   Delta      60             5               4          1              4
Not enabled
State Change    Delta     60              5               4          0              4
Not enabled
TX Discards     Delta      60            200              4          10             4
Not enabled
LR RX           Delta      60             5               4          1              4
Not enabled
LR TX           Delta      60             5               4          1              4
Not enabled
Timeout
Discards        Delta      60            200              4          10             4
Not enabled
Credit Loss
Reco            Delta      1              1               4          0              4
Not enabled
TX Credit Not
Available       Delta      1             10%              4          0%             4
Not enabled
RX Datarate     Delta      60            80%              4          20%            4
Not enabled
TX Datarate     Delta      60             80%             4          20%            4
Not enabled
TX-Slowport
```

```
-Count          Delta      1              5             4           0             4
Not enabled
TX-Slowport-
Oper-Delay      Absolute    1             50ms          4           0ms           4
Not enabled
TXWait          Delta       1             40%           4           0%            4
Not enabled
-------------------------------------------------------------------------------------

switch# show port-monitor sample
Policy Name  : sample
Admin status : Active
Oper status  : Active
Port type    : All Access Ports
-------------------------------------------------------------------------------------
Counter          Threshold  Interval  Rising Threshold  event   Falling Threshold   event
portgurard
-------------------------------------------------------------------------------------
Link Loss          Delta      60             5           4             1             4
Not enabled
Sync Loss          Delta      60             5           4             1             4
Not enabled
Signal Loss        Delta      60             5           4             1             4
Not enabled
Invalid Words      Delta      60             1           4             0             4
Not enabled
Invalid CRC's      Delta      60             5           4             1             4
Not enabled
State Change       Delta      60             5           4             0             4
Not enabled
TX Discards        Delta      60             200         4             10            4
Not enabled
LR RX              Delta      60             5           4             1             4
Not enabled
LR TX              Delta      60             5           4             1             4
Not enabled
Timeout Discards   Delta      60             200         4             10            4
Not enabled
Credit Loss Reco   Delta       1             1           4             0             4
Not enabled
TX Credit Not
Available          Delta       1             10%         4             0%            4
Not enabled
RX Datarate        Delta      60             80%         4             20%           4
Not enabled
TX Datarate        Delta      60             80%         4             20%           4
Not enabled
TX-Slowport-Count  Delta       1              5          4             0             4
Not enabled
TX-Slowport-Oper
-Delay             Absolute    1             50ms        4             0ms           4
Not enabled
TXWait             Delta       1             40%         4             0%            4
Not enabled
-------------------------------------------------------------------------------------

switch# show port-monitor default

Policy Name  : default
Admin status : Not Active
Oper status  : Not Active
Port type    : All Ports
-------------------------------------------------------------------------------------
```

```
Counter         Threshold  Interval  Rising Threshold   event    Falling Threshold   event
PMON Portguard
-------------------------------------------------------------------------------------------
Link Loss          Delta      60           5              4              1              4
Not enabled
Sync Loss          Delta      60           5              4              1              4
Not enabled
Signal Loss        Delta      60           5              4              1              4
Not enabled
Invalid Words      Delta      60           1              4              0              4
Not enabled
Invalid CRC's      Delta      60           5              4              1              4
Not enabled
State Change       Delta      60           5              4              0              4
Not enabled
TX Discards        Delta      60          200             4              10             4
Not enabled
LR RX              Delta      60           5              4              1             4
Not enabled
LR TX              Delta      60           5              4              1             4
Not enabled
Timeout Discards   Delta      60          200             4              10             4
Not enabled
Credit Loss Reco   Delta       1           1              4              0              4
Not enabled
TX Credit Not
Available          Delta       1          10%             4              0%             4
Not enabled
RX Datarate        Delta       60         80%             4              20%            4
Not enabled
TX Datarate        Delta       60         80%             4              20%            4
Not enabled
TX-Slowport-Count  Delta       1          5               4              0              4
Not enabled
TX-Slowport-Oper
-Delay             Absolute    1          50ms            4              0ms            4
Not enabled
TXWait             Delta       1          40%             4              0%             4
Not enabled
-------------------------------------------------------------------------------------------
```

Note TX-Slowport-Count is displayed only on switches that use DS-X9224-96K9, DS-X9248-96K9, or DS-X9248-48K9 modules.

```
switch# show port-monitor slowdrain

Policy Name  : slowdrain
Admin status : Not Active
Oper status  : Not Active
Port type    : All Access Ports
-------------------------------------------------------------------------------------------
Counter         Threshold   Interval   Rising Threshold   event   Falling Threshold  event
PMON Portguard
-------------------------------------------------------------------------------------------
Credit Loss Reco  Delta        1              1              4          0              4
Not enabled
TX Credit Not
Available          Delta       1              10%            4          0%             4
Not enabled
-------------------------------------------------------------------------------------------
```

Displaying Port Group Monitor Status and Policies

The following examples display information about the port group monitor:

```
switch# show port-group-monitor status
Port Group Monitor : Enabled
Active Policies : pgm2
Last 100 logs :
switch#


switch# show port-group-monitor
--------------------------------------------------------------------------------
Port Group Monitor : enabled
--------------------------------------------------------------------------------
Policy Name  : pgm1
Admin status : Not Active
Oper status  : Not Active
Port type    : All Port Groups
--------------------------------------------------------------------------------
Counter          Threshold  Interval %ge Rising Threshold %ge Falling Threshold
-------          ---------  -------- -------------------- ----------------------
RX Performance   Delta      60       50                   10
TX Performance   Delta      60       50                   10
--------------------------------------------------------------------------------
Policy Name  : pgm2
Admin status : Active
Oper status  : Active
Port type    : All Port Groups
--------------------------------------------------------------------------------
Counter          Threshold  Interval %ge Rising Threshold %ge Falling Threshold
-------          ---------  -------- -------------------- ----------------------
RX Performance   Delta      60       80                   10
TX Performance   Delta      60       80                   10
--------------------------------------------------------------------------------
Policy Name  : default
Admin status : Not Active
Oper status  : Not Active
Port type    : All Port Groups
--------------------------------------------------------------------------------
Counter          Threshold  Interval %ge Rising Threshold %ge Falling Threshold
-------          ---------  -------- -------------------- ----------------------
RX Performance   Delta      60       80                   20
TX Performance   Delta      60       80                   20
--------------------------------------------------------------------------------

switch# show port-group-monitor active
Policy Name  : pgm2
Admin status : Active
Oper status  : Active
Port type    : All Port Groups
--------------------------------------------------------------------------------
Counter          Threshold  Interval %ge Rising Threshold %ge Falling Threshold
-------          ---------  -------- -------------------- ----------------------
RX Performance   Delta      60       80                   10
TX Performance   Delta      60       80                   10
--------------------------------------------------------------------------------

switch# show port-group-monitor PGMON_policy
Policy Name  : PGMON_policy
Admin status : Not Active
Oper status  : Not Active
Port type    : All Port Groups
```

```
--------------------------------------------------------------------------------
Counter          Threshold  Interval %ge Rising Threshold %ge Falling Threshold
-------          ---------  -------- -------------------- ----------------------
RX Datarate      Delta      60       80                   20
TX Datarate      Delta      60       80                   20
--------------------------------------------------------------------------------
```

Displaying the Management Interface Configuration

The following command displays the management interface configuration:

```
switch# show interface mgmt 0
mgmt0 is up
    Hardware is FastEthernet
    Address is 000c.30d9.fdbc
    Internet address is 10.16.1.2/24
    MTU 1500 bytes, BW 100 Mbps full Duplex
    26388 packets input, 6101647 bytes
      0 multicast frames, 0 compressed
      0 input errors, 0 frame, 0 overrun 0 fifo
    10247 packets output, 2389196 bytes, 0 underruns
      0 output errors, 0 collisions, 0 fifo
      0 carrier errors
```

Displaying VSAN Interface Information

The following example displays the VSAN interface information:

```
switch# show interface vsan 2
vsan2 is up, line protocol is up
    WWPN is 10:00:00:05:30:00:59:1f, FCID is 0xb90100
    Internet address is 10.1.1.1/24
    MTU 1500 bytes, BW 1000000 Kbit
    0 packets input, 0 bytes, 0 errors, 0 multicast
    0 packets output, 0 bytes, 0 errors, 0 dropped
```

Displaying the Congestion Frame Timeout Value for FCoE

The following commands display the congestion frame timeout value for FCoE (pause counter log and pause event log, respectively, with timeout value):

(Optional) Display the pause counter log with time-stamp information:

```
switch# show logging onboard flow-control pause-count
```

(Optional) Display the pause event log with time-stamp information:

```
switch# show logging onboard flow-control pause-events
```

Displaying the Pause Frame Timeout Value for FCoE

The following commands display the pause frame timeout value for FCoE:

(Optional) Display the pause counter log with time-stamp information:

```
switch# show logging onboard flow-control pause-count
```

(Optional) Display the pause counters per module per interface with time-stamp information:

```
switch# show logging onboard flow-control pause-events
```

(Optional) Display the timeout drops per module per interface with time-stamp information:

```
switch# show logging onboard flow-control timeout-drops [module x] [last mm minutes] [last hh hours] [last dd days]
```

Displaying the Congestion Drop Timeout Value for Fibre Channel

The following command displays the timeout drops per module per interface with time-stamp information:

```
switch# show logging onboard flow-control timeout-drops [module x] [last mm minutes] [last hh hours] [last dd days]
```

Displaying the No-Credit Frame Timeout Value for Fibre Channel

The following command displays various error statistics per module per interface with time-stamp information:

```
switch# show logging onboard [module x] [starttime mm/dd/yy-hh:mm:ss] error-stats
```

The following counters indicate that the no-credit drop threshold has been reached:

- FCP_CNTR_FORCE_TIMEOUT_ON
- AK_FCP_CNTR_FORCE_TIMEOUT_ON
- FCP_SW_CNTR_FORCE_TIMEOUT_ON

The following counters indicate that a credit has been received on the interface, and the port no longer drops packets because of the no-credit drop condition:

- FCP_CNTR_FORCE_TIMEOUT_OFF
- AK_FCP_CNTR_FORCE_TIMEOUT_OFF
- FCP_SW_CNTR_FORCE_TIMEOUT_OFF

Displaying Slow-Port Monitor Events

The following commands display slow-port monitor events:

Note These commands are applicable for both supervisor and module prompts.

Display slow-port monitor events per module:

```
switch# show process creditmon slowport-monitor-events [module x [port y]]
```

Display the slow-port monitor events on the Onboard Failure Logging (OBFL):

```
switch# show logging onboard slowport-monitor-events
```

Note The slow-port monitor events are logged periodically into the OBFL.

The following example displays the credit monitor or output of the **creditmon slow-port monitor-events** command for the 16-Gbps modules:

```
switch# show process creditmon slowport-monitor-events

        Module: 06      Slowport Detected: YES
=====================================================================
Interface = fc6/3
---------------------------------------------------------------
| admin   | slowport   | oper  |            Timestamp            |
| delay   | detection | delay |                                 |
| (ms)    | count      | (ms)  |                                 |
---------------------------------------------------------------
|   1     |     46195 |    1   | 1. 10/14/12 21:46:51.615        |
|   1     |     46193 |   50   | 2. 10/14/12 21:46:51.515        |
|   1     |     46191 |   50   | 3. 10/14/12 21:46:51.415        |
|   1     |     46189 |   50   | 4. 10/14/12 21:46:51.315        |
|   1     |     46187 |   50   | 5. 10/14/12 21:46:51.215        |
|   1     |     46185 |   50   | 6. 10/14/12 21:46:51.115        |
|   1     |     46183 |   50   | 7. 10/14/12 21:46:51.015        |
|   1     |     46181 |   50   | 8. 10/14/12 21:46:50.915        |
|   1     |     46179 |   50   | 9. 10/14/12 21:46:50.815        |
|   1     |     46178 |   50   |10. 10/14/12 21:46:50.715        |
---------------------------------------------------------------
```

Note For 16-Gbps modules and Cisco MDS 9700, 9148S, 9250i, and 9396S switches, if **no-credit-drop** timeout is configured, the maximum value of **tx-slowport-oper-delay** as shown in slow-port monitor events is limited by the **no-credit-drop** timeout. So, the maximum value for **tx-slowport-oper-delay** can reach the level of the **no-credit-drop** timeout even if the actual slow-port delay from the device is higher because the frames are forcefully dropped by the hardware when **tx-slowport-oper-delay** reaches the level of the **no-credit-drop** timeout.

The following example displays the output of the **creditmon slowport-monitor-events** command for the Cisco MDS 9500 switches (8-Gbps modules):

```
switch# show process creditmon slowport-monitor-events
    Module: 04        Slowport Detected: YES
=========================================================================
Interface = fc4/13
-------------------------------------------------------
| admin   | slowport   |            Timestamp            |
| delay   | detection |                                 |
| (ms)    | count      |                                 |
-------------------------------------------------------
|  1      |       194 | 1. 04/29/15 17:19:13.345        |
|  1      |       193 | 2. 04/29/15 17:19:13.245        |
|  1      |       192 | 3. 04/29/15 17:19:13.145        |
|  1      |       191 | 4. 04/29/15 17:19:13.045        |
```

```
|  1     |       190 | 5. 04/29/15 17:19:12.945        |
|  1     |       189 | 6. 04/29/15 17:19:12.845        |
|  1     |       188 | 7. 04/29/15 17:19:12.745        |
|  1     |       187 | 8. 04/29/15 17:19:12.645        |
|  1     |       186 | 9. 04/29/15 17:19:12.545        |
|  1     |       185 |10. 04/29/15 17:19:12.445        |
-----------------------------------------------------
=====================================================================
```

Note The Cisco MDS 9500 Series 8-Gbps modules can only detect whether the slow-port monitor has reached the threshold (admin delay) or not for every 100-ms polling interval. The modules cannot determine the actual length of time, whether it is higher than the threshold, or when the port is in the zero-transmit-credits-remaining condition. Also, the modules cannot determine if the slow-port monitor has reached the threshold (admin delay) multiple times. The modules can record only one event per 100-ms polling interval.

The following example displays output of the **creditmon slow-port-monitor-events** command for the Cisco MDS 9500 switches (advanced 8-Gbps modules):

Note The Cisco MDS 9500 Series advanced 8-Gbps modules utilize the transmit wait functionality to implement slow-port monitoring. Hence, **tx-slowport-oper-delay** is the total amount of time the port was in the zero-transmit-credits-remaining condition during the 100-ms polling interval. No specific duration of time is indicated.

```
switch# show process creditmon slowport-monitor-events module 1
        Module: 01      Slowport Detected: YES
=====================================================================
 Interface = fc1/5
---------------------------------------------------------------
| admin  | slowport  | txwait|            Timestamp            |
| delay  | detection |  oper |                                 |
| (ms)   | count     | delay |                                 |
|        |           |  (ms) |                                 |
---------------------------------------------------------------
|  10    |       888 |   93  | 1. 04/30/15 21:33:42.561        |
|  10    |       887 |   81  | 2. 04/30/15 21:33:42.461        |
|  10    |       886 |   76  | 3. 04/30/15 21:33:42.361        |
|  10    |       885 |   99  | 4. 04/30/15 21:33:42.261        |
|  10    |       884 |   99  | 5. 04/30/15 21:33:42.161        |
---------------------------------------------------------------
=====================================================================
```

Note For advanced 8-Gbps modules, the transmit-wait value does not increment after the **no-credit-drop** threshold has been reached because the frames are forcefully dropped by the hardware, and no more frames are queued for transmit. Consequently, when slow-port monitor is used with **no-credit-drop**, the **tx-slowport-oper-delay** value, as shown in the output of the **slow-port monitor events** command may be lower than expected.

The following example displays the transmit-wait statistics for a particular interface for the Cisco MDS 9500 switches (advanced 8-Gbps modules and 16-Gbps modules):

```
switch# show interface fc1/1 counters
or
```

```
switch# show interface fc1/1 counters details

switch(config)# show int fc1/81 counters
fc1/81
    5 minutes input rate 0 bits/sec, 0 bytes/sec, 0 frames/sec
    5 minutes output rate 280288 bits/sec, 35036 bytes/sec, 15 frames/sec
    5206879 frames input, 11142684612 bytes
      0 class-2 frames, 0 bytes
      5206879 class-3 frames, 11142684612 bytes
      0 class-f frames, 0 bytes
      171 discards, 175 errors, 0 CRC/FCS
      0 unknown class, 0 too long, 4 too short
    2498081 frames output, 5345868788 bytes
      0 class-2 frames, 0 bytes
      2498081 class-3 frames, 5345868788 bytes
      0 class-f frames, 0 bytes
      7260927715 discards, 0 errors
    7260927715 timeout discards, 0 credit loss
    2 input OLS, 272 LRR, 0 NOS, 0 loop inits
    3 output OLS, 3 LRR, 2 NOS, 0 loop inits
    2 link failures, 0 sync losses, 0 signal losses
     2498321 Transmit B2B credit transitions to zero
     275 Receive B2B credit transitions to zero
      54867361792 2.5us TxWait due to lack of transmit credits
      Percentage Tx credits not available for last 1s/1m/1h/72h: 50%/50%/92%/52%
      32 receive B2B credit remaining
      0 transmit B2B credit remaining
      0 low priority transmit B2B credit remaining
    Last clearing of "show interface" counters  :never

================================================================================
switch(config)# show int fc1/81 counters  details
fc1/81
      5206879 frames, 11142684612 bytes received
      0 class-2 frames, 0 bytes received
      0 class-2 discards
      0 F_BSY frames, 0 F_RJT frames
          generated against class-2 frames
      0 port reject frames
      5206879 class-3 frames, 11142684612 bytes received
      0 class-f frames, 0 bytes received
      171 discards, 175 errors received
      7273423181 discards, 0 errors transmitted
      2499069 frames, 5347983108 bytes transmitted
      0 class-2 frames, 0 bytes transmitted
      2499069 class-3 frames, 5347983108 bytes transmitted
      171 class-3 frames discarded
      0 class-f frames, 0 bytes transmitted
      0 class-f frames discarded
      0 multicast packets received, 0 transmitted
      0 broadcast packets received, 0 transmitted
      5206879 unicast packets received, 2499069 transmitted
      7273423181 timeout discards, 0 credit loss
      2 link failures, 0 sync losses,       0 signal losses
      0 primitive sequence protocol errors
      31822 invalid transmission words
      0 invalid CRCs, 0 Delimiter Errors
      0 address identifier errors
      0 link reset received while link is active
      272 link reset transmitted while link is active
      2 Offline Sequence errors received
      3 Offline Sequence errors transmitted
      0 frames received that are shorter than
          the minimum allowable frame length
```

```
        regardless of the CRC/FCS error
      0 frames received that are longer than
        the maximum frame length and also have a
        CRC/FCS error
      54879203328 2.5us TxWait due to lack of transmit credits
      0 frames received with length greater
        than what was agreed to in FLOGI/PLOGI
      4 frames received with length less than
        the minimum indicated by the frame header
      272 link reset responses received
      3 link reset responses transmitted
      0 non-operational sequences received
      2 non-operational sequences transmitted
      0 fragmented frames received
      171 frames received with EOF aborts
      0 unknown class frames received
      0 8b10b disparity errors
      0 frames discarded
      0 Exchange Link Parameters switch fabric
        internal link service request failures
      2499309 Transmit B2B credit transitions to zero
      275 Receive B2B credit transitions to zero
      0 Enhanced Inter Switch Link (EISL) frames
        discarded
      0 framing errors
      0 F8 type LIP sequence errors received
      0 F8 type LIP sequence errors issued
      0 Non F8 type LIP sequence errors received
      0 Non F8 type LIP sequence errors issued
      0 fec corrected blocks
      0 fec uncorrected blocks
Percentage Tx credits not available for last 1s/1m/1h/72h: 50%/50%/92%/52%
```

Transmit-Wait History Graph

The transmit-wait history for the slow ports on advanced 8 and 16 Gbps modules and switches can be displayed in the form of a graph over a period of time. The total transmit-wait time for each time period is displayed as a column of #. The actual value appears above each column as a vertically printed number. The following graphs can be displayed:

- Seconds scale—The transmit-wait history for the port over the last 60 seconds. The Y-axis value is the total transmit-wait time for each second, in milliseconds.
- Minutes scale—The transmit-wait history for the port over the last 60 seconds. The Y-axis value is the total transmit-wait time for each minute, in seconds, to one decimal place.
- Hours scale—The transmit-wait history for the port over the last 60 seconds. The Y-axis value is the total transmit-wait time for each hour, in minutes.

To display the transmit-wait history for a given interval of time, use the following commands:

Display the transmit-wait history graph for the period when transmit credit is not available for a given interval of time (seconds, minutes, or hours):

```
switch# show process creditmon txwait-history [module x [port y]]
```

Display the transmit-wait time in 2.5-microsecond units, as well as in seconds:

```
switch# show logging onboard txwait
```

Note The transmit-wait delta values are logged periodically (every 20 seconds) into the OBFL when transmit wait increases by at least 100 ms in the 20-second interval.

Display the total transmit-wait value for a particular interface in 2.5-microsecond units:

```
switch# show interface fcx/y counters
```

The following example displays the transmit-wait history graph, in seconds, for advanced 8-Gbps modules and 16-Gbps modules:

```
switch(config)# show process creditmon txwait-history module 1 port 81

TxWait history for port fc1/81:
===============================

   455555555455555455555455559999999999999999999999999999999999
     900000000800009000008100011111231922322211321121112112113111
     433799991899990359909838608935137962088988254848894870461938
1000                                  #
900                           ####################################
800                           ####################################
700                           ####################################
600                           ####################################
500 ##################################################################
400 ##################################################################
300 ##################################################################
200 ##################################################################
100 ##################################################################
    0....5....1....1....2....2....3....3....4....4....5....5....6
              0    5    0    5    0    5    0    5    0    5    0

        Tx Credit Not Available per second (last 60 seconds)
                 # = TxWait (ms)
```

The following example displays the transmit-wait history graph, in minutes, for advanced 8-Gbps modules and 16-Gbps modules:

```
   555555555555555555555555555555555555555555555555555555555555555
   055555555555555555555555555555555555555555555555555555555555555
   .............................................................
   035444445444445445454444444445635363534375434453343554545344
60
54  ##############################################################
48 ##############################################################
42 ##############################################################
36 ##############################################################
30 ##############################################################
24 ##############################################################
18 ##############################################################
12 ##############################################################
6 ############################################################
  0....5....1....1....2....2....3....3....4....4....5....5....6
            0    5    0    5    0    5    0    5    0    5    0

         Tx Credit Not Available per minute (last 60 minutes)
                # = TxWait (secs)
```

The following example displays the transmit wait history graph, in hours, for advanced 8-Gbps modules and 16-Gbps modules:

```
     3333333333333333333333333333333333333333
     3333333333333333333333333333333333333332
     2222222222222222222222222222222222222229
     7777887777778778777787777877677777777876790000000000000000000000000000000000
3600
3240 ########################################
2880 ########################################
2520 ########################################
2160 ########################################
1800 ########################################
1440 ########################################
1080 ########################################
 720 ########################################
 360 ########################################
    0....5....1....1....2....2....3....3....4....4....5....5....6....6....7.7
              0    5    0    5    0    5    0    5    0    5    0    5    0 2

          Tx Credit Not Available per hour (last 72 hours)
                 # = TxWait (secs)
```

The following example displays the transmit-wait OBFL logging for advanced 8-Gbps modules and 16-Gbps modules:

```
switch# show logging onboard txwait
Notes:
    - sampling period is 20 seconds
    - only txwait delta value >= 100 ms are logged
---------------------------------
 Module: 1 txwait count
---------------------------------

-------------------------------------------------------------------------------
| Interface | Delta TxWait Time     | Congestion | Timestamp                |
|           | 2.5us ticks | seconds |            |                          |
-------------------------------------------------------------------------------
|   fc1/11  |  3435973    | 08      |      42%   | Sun Sep 30 05:23:05 2001 |
|   fc1/11  |  6871947    | 17      |      85%   | Sun Sep 30 05:22:25 2001 |
```