C H A P T E R **1**

Configuring Fibre Channel Interfaces

Information About Fibre Channel Interfaces

This section includes the following topics:

Generations of Modules and Switches

Cisco MDS 9000 Family hardware modules and switches are categorized into generations based on the time of introduction, capabilities, features, and compatibilities:

- Generation 1—Modules and switches with a maximum port speed of 2 Gbps.
- Generation 2—Modules and switches with a maximum port speed of 4 Gbps.
- Generation 3—Modules and switches with a maximum port speed of 8 Gbps.
- Generation 4—Modules with a maximum port speed of 8-Gbps or 10-Gbps.

The Cisco MDS 9500 Series switches, Cisco MDS 9222i, Cisco MDS 9216A, and Cisco MDS 9216i switches support the Generation 2 modules. Each module or switch can have one or more ports in port groups that share common resources such as bandwidth and buffer credits.

In addition to supporting Generation 2 modules, the Cisco MDS 9500 Series switches and the Cisco MDS 9222i switch support the Generation 3 modules. Similar to Generation 2, each Generation 3 or Generation 4 module can have one or more ports in port groups that share common resources such as bandwidth and buffer credits.

Generation 3 modules are supported on the Cisco MDS 9506 and 9509 switches with Supervisor-2 modules. The MDS 9513 Director supports 4/44-port Host-Optimized Fibre Channel switching module with either Fabric 1 or Fabric 2 modules, but requires Fabric 2 module for support of the 48-port and the 24-port 8-Gbps Fibre Channel switching modules. The MDS 9222i switch supports the 4/44-port Host-Optimized Fibre Channel switching module.

The Cisco 9500 Series switches support the following Generation 4 modules: the 48-port 8-Gbps Advanced Fibre Channel switching module (DS-X9248-256K9) and the 32-port 8-Gbps Advanced Fibre Channel module (DS-X9232-256K9). Cisco MDS NX-OS Release 5.2(1) or higher is required to support the Generation 4 modules.

Table 1-1 identifies the Generation 2, Generation 3, and Generation 4 modules, as well as the Fabric switches.

Table 1-1   Fibre Channel Modules and Fabric Switches

Part Number	Product Name and Description
Generation 4 Modules	
DS-X9248-256K9	48-port 8-Gbps Advanced Fibre Channel switching module.
DS-X9232-256K9	32-port 8-Gbps Advanced Fibre Channel switching module.
DS-X9530-SF2A-K9	Supervisor-2A module for Cisco MDS 9500 Series switches.
DS-13SLT-FAB3	Fabric 3 module that enables the 32-port and the 48-port 8-Gbps Advanced Fibre Channel switching module to use the full 96-Gbps or 256-Gbps backplane crossbar bandwidth.
Generation 3 Modules	
DS-X9248-96K9	48-port 8-Gbps Fibre Channel switching module.
DS-X9224-96K9	24-port 8-Gbps Fibre Channel switching module.
DS-X9248-48K9	4/44-port 8-Gbps Host-Optimized Fibre Channel switching module
DS-13SLT-FAB2	Fabric 2 module that enables the 24-port and the 48-port 8-Gbps Fibre Channel switching module to use the full 96-Gbps backplane bandwidth with any-to-any connectivity.
Generation 3 Fabric Switch	
DS-C9148-K9	Cisco MDS 9148 Fabric switch. 48-port 8-Gbps Fabric switch.
Generation 2 Modules	
DS-X9148	48-port 4-Gbps Fibre Channel switching module.
DS-X9124	24-port 4-Gbps Fibre Channel switching module.
DS-X9304-18K9	18-port 4-Gbps Fibre Channel switching module with 4-Gigabit Ethernet ports.

Table 1-1   Fibre Channel Modules and Fabric Switches (continued)

Part Number	Product Name and Description
DS-X9112	12-port 4-Gbps Fibre Channel switching module.
DS-X9704	4-port 10-Gbps Fibre Channel switching module.
DS-X9530-SF2-K9	Supervisor-2 module for Cisco MDS 9500 Series switches.
Generation 2 Fabric Switches	
DS-C9134-K9	Cisco MDS 9134 Fabric switch.
	32-port 4-Gbps Fabric switch with 2 additional 10-Gbps ports.
DS-C9124-K9	Cisco MDS 9124 Fabric switch.
	24-port 4-Gbps Fabric switch.
DS-C9222i-K9	Cisco MDS 9222i Multiservice Modular switch.
	18-port 4-Gbps switch with 4-Gigabit Ethernet IP storage services ports, and a modular expansion slot to host Cisco MDS 9000 Family switching and services modules.

Note Generation 2 Fibre Channel switching modules are not supported on the Cisco MDS 9216 switch; however, they are supported by both the Supervisor-1 module and the Supervisor-2 module.

For detailed information about the installation and specifications for these modules and switches, refer to the hardware installation guide for your switch.

Port Groups

Each module or switch can have one or more ports in port groups that share common resources such as bandwidth and buffer credits. Port groups are defined by the hardware consisting of sequential ports. For example, ports 1 through 6, ports 7 through 12, ports 13 through 18, ports 19 through 24, ports 25 through 30, 31 through 36, and ports 37 through 42, 43 through 48 are the port groups on the 48-port 8-Gbps Advanced Fibre Channel switching modules.

Table 1-2 shows the bandwidth and number of ports per port group for the Generation 2, Generation 3, and Generation 4 Fibre Channel modules, and Generation 2 and Generation 3 Fabric switches.

Table 1-2   Bandwidth and Port Groups for the Fibre Channel Modules and Fabric Switches

Part Number	Product Name/ Description	Number of Ports Per Port Group	Bandwidth Per Port Group (Gbps)	Maximum Bandwidth Per Port (Gbps)
Generation 4 Modules				
DS-X9248-256K9	48-port 8-Gbps Advanced Fibre Channel switching module.	6	32.4^1 or 12.8^2	8 or 10 Gbps—depending on the configuration

Table 1-2 *Bandwidth and Port Groups for the Fibre Channel Modules and Fabric Switches (continued)*

Part Number	Product Name/ Description	Number of Ports Per Port Group	Bandwidth Per Port Group (Gbps)	Maximum Bandwidth Per Port (Gbps)
DS-X9232-256K9	32-port 8-Gbps Advanced Fibre Channel switching module.	4	32.4[1] or 12.8[2]	8 or 10 Gbps—depending on the configuration
Generation 3 Modules				
DS-X9248-96K9	48-port 8-Gbps Fibre Channel switching module	6	12.8	8 Gbps
DS-X9224-96K9	24-port 8-Gbps Fibre Channel switching module	3	12.8	8 Gbps
DS-X9248-48K9	4/44-port 8-Gbps Host-Optimized Fibre Channel switching module	12	12.8	8/4 Gbps[3]
Generation 3 Fabric Switches				
DS-C9148-K9 (Cisco MDS 9148 Fabric switch)	48-port 8-Gbps Fabric switch	4	32	8 Gbps
Generation 2 Modules				
DS-X9148	48-port 4-Gbps Fibre Channel switching module	12	12.8	4 Gbps
DS-X9124	24-port 4-Gbps Fibre Channel switching module	6	12.8	4 Gbps
DS-X9304-18K9 (MSM-18/4 Multiservice module)	18-port 4-Gbps Fibre Channel switching module with 4-Gigabit Ethernet ports	6	12.8	4 Gbps
DS-X9112	12-port 4-Gbps Fibre Channel switching module	3	12.8	4 Gbps
DS-X9704	4-port 10-Gbps Fibre Channel switching module	1	10	10 Gbps
Generation 2 Fabric Switches				

Table 1-2   Bandwidth and Port Groups for the Fibre Channel Modules and Fabric Switches (continued)

Part Number	Product Name/ Description	Number of Ports Per Port Group	Bandwidth Per Port Group (Gbps)	Maximum Bandwidth Per Port (Gbps)
DS-C9134-K9 (Cisco MDS 9134 Fabric switch)	32-port 4-Gbps Fabric switch	4	16	4 Gbps
	2-port 10-Gbps Fabric switch	1	10	10 Gbps
DS-C9124K9 (Cisco MDS 9124 Fabric switch)	24-port 4-Gbps Fabric switch	4	16	4 Gbps
DS-C9222i-K9 (Cisco MDS 9222i Multiservice Modular switch)	18-port 4-Gbps, 4 Gigabit Ethernet ports and a modular expansion slot.	6	12.8	4 Gbps

1. This bandwidth is available with the Fabric 3 module (DS-13SLT-FAB3) in the MDS 9513 switch.

2. This bandwidth is available with the Fabric 2 module (DS-13SLT-FAB2) in the MDS 9513 switch, and with the Supervisor-2 (DS-X9530-SF2-K9) or Supervisor-2A module (DS-X9530-SF2AK9) in the MDS 9509 switch or MDS 9506 switch.

3. A maximum of four ports (one per port group) in a 4/44-port 8-Gbps switching module can operate at 8-Gbps bandwidth in dedicated or shared mode. All the other ports can operate at a maximum of 4-Gbps in shared mode or dedicated mode.

Port Rate Modes

In Generation 2, Generation 3, and Generation 4 modules, you can configure the port rate modes. The *port rate mode* configuration is used to determine the bandwidth allocation for ports in a port group. Two port rate modes are supported:

- Dedicated Rate Mode—A port is allocated required fabric bandwidth to sustain line traffic at the maximum operating speed configured on the port. For more information, see the "Dedicated Rate Mode" section on page 1-7.

- Shared Rate Mode—Multiple ports in a port group share data paths to the switch fabric and share bandwidth. For more information, see the "Shared Rate Mode" section on page 1-8.

Note   In Generation 1 modules, you cannot configure the port rate modes. The mode is determined implicitly based on the port mode and line card type.

Note   Port rate modes are not supported on the Cisco Fabric Switch for HP c-Class Blade System, and the Cisco Fabric Switch for IBM Blade Center.

Table 1-3 shows the modules that support dedicated, shared, and the default rate modes.

Table 1-3   Port Rate Mode Support on Generation 2, Generation 3, and Generation 4 Modules and Switches

Part Number	Product Name/ Description	Supports Dedicated Rate Mode	Supports Shared Rate Mode	Default Speed Mode and Rate Mode on All Ports
Generation 4 Modules				
DS-X9248-256K9	48-port 8-Gbps Advanced Fibre Channel switching module	Yes	Yes[1]	Auto, Shared
DS-X9232-256K9	32-port 8-Gbps Advanced Fibre Channel switching module	Yes	Yes[1]	Auto, Shared
Generation 3 Modules				
DS-X9248-96K9	48-Port 8-Gbps Fibre Channel switching module	Yes	Yes[2]	Auto, Shared
DS-X9224-96K9	24-Port 8-Gbps Fibre Channel switching module	Yes	Yes[2]	Auto, Shared
DS-X9248-48K9	4/44-Port 8-Gbps Host-Optimized Fibre Channel switching module	Yes	Yes[2]	Auto Max 4 Gbps, Shared
Generation 3 Fabric Switches				
DS-C9148-K9 (Cisco MDS 9148 Fabric switch)	48-port 8-Gbps Fabric switch	Yes	No	Auto, Dedicated
Generation 2 Modules				
DS-X9148	48-port 4-Gbps Fibre Channel switching module [3]	Yes	Yes	Auto, Shared
DS-X9124	24-port 4-Gbps Fibre Channel switching module	Yes	Yes	Auto, Shared
DS-X9304-18K9 (MSM-18/4 Multiservice module)	18-port 4-Gbps Fibre Channel switching module with 4-Gigabit Ethernet ports	Yes	Yes	Auto, Shared
DS-X9112	12-port 4-Gbps Fibre Channel switching module	Yes	No	Auto, Dedicated
DS-X9704	4-port 10-Gbps Fibre Channel switching module	Yes	No	Auto, Dedicated
Generation 2 Fabric Switches				

Table 1-3   Port Rate Mode Support on Generation 2, Generation 3, and Generation 4 Modules and Switches (continued)

Part Number	Product Name/ Description	Supports Dedicated Rate Mode	Supports Shared Rate Mode	Default Speed Mode and Rate Mode on All Ports
DS-C9134-K9 (Cisco MDS 9134 Fabric switch)	32-port 4-Gbps Fabric switch	Yes	Yes	Auto, Shared
	2-port 10-Gbps Fabric switch	Yes	No	Auto, Dedicated
DS-C9124-K9 (Cisco MDS 9124 Fabric switch)	24-port 4-Gbps Fabric switch[4]	Yes	No	Auto, Dedicated
DS-C9222i-K9 (Cisco MDS 9222i Multiservice Modular switch)	18-port 4-Gbps Fibre Channel switch with 4-Gigabit Ethernet IP storage services ports, and a modular expansion slot to host Cisco MDS 9000 Family Switching and Services Modules	Yes	Yes	Auto, Shared

1. Supports shared rate mode.

2. Shared rate mode is supported on Fx ports only and no ISLs.

3. All ports in a 48-port 4-Gbps switching module can operate in dedicated rate mode with a 1-Gbps operating speed. However, if you configure one or more ports to operate in 2-Gbps or 4-Gbps dedicated rate mode, some of the other ports in the port group would have to operate in shared mode.

4. All ports in a 24-port 4-Gbps switching module can operate in dedicated rate mode with a 2-Gbps operating speed. However, if you configure one or more ports to operate in 4-Gbps dedicated rate mode, some of the other ports in the port group would have to operate in shared mode.

Dedicated Rate Mode

When port rate mode is configured as dedicated, a port is allocated required fabric bandwidth and related resources to sustain line rate traffic at the maximum operating speed configured for the port. In this mode, ports do not use local buffering and all receive buffers are allocated from a global buffer pool (see the "Buffer Pools" section on page 1-2).

Table 1-4 shows the bandwidth provided by the various port speed configurations on the 8-Gbps Advanced Fibre Channel switching modules.

Table 1-4   Bandwidth Reserved for the Port Speeds on Generation 4 Switching Modules

Configured Speed	Reserved Bandwidth
Auto	8 Gbps
8-Gbps	
Auto with 4-Gbps maximum	4 Gbps
4-Gbps	

Table 1-4   Bandwidth Reserved for the Port Speeds on Generation 4 Switching Modules

Configured Speed	Reserved Bandwidth
Auto with 2-Gbps maximum	2 Gbps
2-Gbps	
1-Gbps	1 Gbps

Table 1-5 shows the bandwidth provided by the various port speed configurations on the 8-Gbps Fibre Channel switching modules.

Table 1-5   Bandwidth Reserved for the Port Speeds on Generation 3 Switching Modules

Configured Speed	Reserved Bandwidth
Auto	8 Gbps
8-Gbps	
Auto with 4-Gbps maximum	4 Gbps
4-Gbps	
Auto with 2-Gbps maximum	2 Gbps
2-Gbps	
1-Gbps	1 Gbps

Table 1-6 shows the amount of bandwidth reserved for a configured port speed on 4-Gbps switching modules.

Table 1-6   Bandwidth Reserved for the Port Speeds on Generation 2 Switching Modules

Configured Speed	Reserved Bandwidth
Auto	4 Gbps
4-Gbps	
Auto with 2-Gbps maximum	2 Gbps
2-Gbps	
1-Gbps	1 Gbps

Note   The 4-Port 10-Gbps Fibre Channel module ports in auto mode only support auto speed mode at 10 Gbps.

Shared Rate Mode

When port rate mode is configured as shared, multiple ports within a port group share data paths to the switch fabric so that fabric bandwidth and related resources are shared. Often, the available bandwidth to the switch fabric may be less than the negotiated operating speed of a port. Ports in this mode use local buffering for the BB_credit buffers.

All ports in 8-Gbps Advanced Fibre Channel switching modules where bandwidth is shared support 1-Gbps, 2-Gbps, 4-Gbps, or 8 Gbps traffic. However, it is possible to configure one or more ports in a port group to operate in dedicated rate mode with 1-Gbps, 2-Gbps, 4-Gbps, or 8 Gbps operating speed.

All ports in 4-Gbps Fibre Channel switching modules where bandwidth is shared support 1-Gbps, 2-Gbps, or 4-Gbps traffic. However, it is possible to configure one or more ports in a port group to operate in dedicated rate mode with 1-Gbps, 2-Gbps, or 4-Gbps operating speed.

All ports in the 32-Port or 48-Port 8-Gbps Advanced Fibre Channel modules where bandwidth is shared support 1-Gbps, 2-Gbps, 4-Gbps, or 8-Gbps traffic in a maximum or 32 or 48 ports.

All ports in the 48-Port and 24-Port 8-Gbps Fibre Channel switching modules where bandwidth is shared support 1-Gbps, 2-Gbps, 4-Gbps, or 8-Gbps traffic.

In the 4/44-Port 8-Gbps Host-Optimized Fibre Channel switching module, all the ports where bandwidth is shared support 1-Gbps, 2-Gbps, 4-Gbps in a maximum of 44 ports, or 8 Gbps in a maximum of 4 ports.

Dedicated Rate Mode Configurations for the 8-Gbps Modules

Table 1-7 shows the maximum possible dedicated rate mode configuration scenarios for the Generation 4 Fibre Channel modules.

Table 1-7   Dedicated Rate Mode Bandwidth Reservation for Generation 4 Fibre Channel Modules

Part Number	Product Name/ Description	Dedicated Bandwidth per Port	Maximum Allowed Ports That Can Come Up	Ports in Shared Mode
DS-X9248-256K9	48-port 8-Gbps Advanced Fibre Channel switching module	10 Gbps	24 Ports	All the remaining ports are 8 Gbps shared.
		8 Gbps	32 Ports	
		4 Gbps	48 Ports	
		2 Gbps	48 Ports	
		1 Gbps	48 Ports	
DS-X9232-256K9	32-port 8-Gbps Advanced Fibre Channel switching module	10 Gbps	24 Ports	All the remaining ports are 8 Gbps shared.
		8 Gbps	32 Ports	
		4 Gbps	32 Ports	
		2 Gbps	32 Ports	
		1 Gbps	32 Ports	

Table 1-8 shows the maximum possible dedicated rate mode configuration scenarios for the Generation 3 Fibre Channel modules.

Table 1-8   Dedicated Rate Mode Bandwidth Reservation for Generation 3 Fibre Channel Modules

Part Number	Product Name/ Description	Dedicated Bandwidth per Port	Maximum Allowed Ports That Can Come Up	Ports in Shared Mode
DS-X9224-96K9	24-port 8-Gbps Fibre Channel switching module	8 Gbps	8 Ports	All the remaining ports are 8 Gbps shared.
		4 Gbps	24 Ports	
DS-X9248-96K9	48-port 8-Gbps Fibre Channel switching module	8 Gbps	8 Ports	All the remaining ports are 8 Gbps shared.
		4 Gbps	24 Ports	
		2 Gbps	48 Ports	
DS-X9248-48K9	4/44-port 8-Gbps Host-Optimized Fibre Channel switching module	8 Gbps	4 Ports	All the remaining ports are 4 Gbps shared (8 Gbps of bandwidth can be provided only to one port per port group in dedicated or shared rate mode).
		4 Gbps	12 Ports	
		2 Gbps	24 Ports	
		1 Gbps	48 Ports	

Port Speed

The port speed on an interface, combined with the rate mode, determines the amount of shared resources available to the ports in the port group on a 48-port, 24-port 4-Gbps, or any 8-Gbps Fibre Channel switching module. Especially in the case of dedicated rate mode, the port group resources are reserved even though the bandwidth is not used. For example, on Generation 2 modules, if an interface is configured for autosensing (auto) and dedicated rate mode, then 4 Gbps of bandwidth is reserved even though the maximum operating speed is 2 Gbps. For the same interface, if autosensing with a maximum speed of 2 Gbps (auto max 2000) is configured, then only 2 Gbps of bandwidth is reserved and the unused 2 Gbps is shared with the other interface in the port group.

Note
- The Generation 2, 4-port 10-Gbps switching module supports 10-Gbps traffic only.

- On Generation 2, 4-Gbps modules, setting the port speed to auto enables autosensing, which negotiates to a maximum speed of 4 Gbps.

- On Generation 3, 8-Gbps modules, setting the port speed to auto enables autosensing, which negotiates to a maximum speed of 8 Gbps.

- On Generation 4, 8-Gbps modules, setting the port speed to auto enables autosensing, which negotiates to a maximum speed of 8 Gbps.

Dynamic Bandwidth Management

On port switching modules where bandwidth is shared, the bandwidth available to each port within a port group can be configured based on the port rate mode and speed configurations. Within a port group, some ports can be configured in dedicated rate mode while others operate in shared mode.

Ports configured in dedicated rate mode are allocated the required bandwidth to sustain a line rate of traffic at the maximum configured operating speed, and ports configured in shared mode share the available remaining bandwidth within the port group. Bandwidth allocation among the shared mode ports is based on the operational speed of the ports. For example, if four ports operating at speeds 1 Gbps, 1 Gbps, 2 Gbps, and 4 Gbps share bandwidth of 8 Gbps, the ratio of allocation would be 1:1:2:4.

Unutilized bandwidth from the dedicated ports is shared among only the shared ports in a port group as per the ratio of the configured operating speed. A port cannot be brought up unless the reserved bandwidth is quaranteed for the shared ports (see Table 1-9). For dedicated ports, configured bandwidth is taken into consideration while calculating available bandwidth for the port group. This behavior can be changed using bandwidth fairness by using the **rate-mode bandwidth-fairness module** *number* command.

For example, consider a 48-port 8-Gbps module. This module has 6 ports per port group with 12.8 Gbps bandwidth. Ports 3 to 6 are configured at 4 Gbps. If the first port is configured at 8 Gbps dedicated rate mode, and the second port is configured at 4-Gbps dedicated rate mode, then no other ports can be configured at 4 Gbps or 8 Gbps because the left over bandwidth of 0.8 Gbps (12.8-(8+4)) cannot meet the required 0.96 Gbps for the remaining four ports. A minimum of 0.24 Gbps reserved bandwidth is required for the for the rest of the four ports. However, if the two ports (for example, 5 and 6) are taken out of service (which is not same as shutdown), required reserved bandwidth for the two ports (3 and 4) is 0.48 and port 2 can be configured at 4 Gbps in dedicated rate mode. This behavior can be overridden by the bandwidth fairness command in which case reserved bandwidth is not enforced. Once the port is up, ports 3 and 4 can share the unutilized bandwidth from ports 1 and 2.

Out-of-Service Interfaces

On supported modules and fabric switches, you might need to allocate all the shared resources for one or more interfaces to another interface in the port group or module. You can take interfaces out of service to release shared resources that are needed for dedicated bandwidth. When an interface is taken out of service, all shared resources are released and made available to the other interface in the port group or module. These shared resources include bandwidth for the shared mode port, rate mode, BB_credits, and extended BB_credits. All shared resource configurations are returned to their default values when the interface is brought back into service. Corresponding resources must be made available in order for the port to be successfully returned to service.

⚠

Caution   If you need to bring an interface back into service, you might disrupt traffic if you need to release shared resources from other interfaces in the same port group.

Oversubscription Ratio Restrictions

The 48-port and 24-port 4-Gbps, and all 8-Gbps Fibre Channel switching modules support oversubscription on switches with shared rate mode configurations. By default, all 48-port and 24-port 4-Gbps, and 8-Gbps Fibre Channel switching modules have restrictions on oversubscription ratios enabled. As of Cisco SAN-OS Release 3.1(1) and NX-OS Release 4.1(1), you can disable restrictions on oversubscription ratios.

Table 1-9 describes the bandwidth allocation for oversubscribed interfaces configured in shared mode on the 4-Gbps and 8-Gbps modules.

Table 1-9   Bandwidth Allocation for Oversubscribed Interfaces

Switching Module	Configured Speed	Reserved Bandwidth (Gbps)		Maximum Bandwidth (Gbps)
		Ratios enabled	Ratios disabled	
24-Port 8-Gbps Fibre Channel Module	Auto 8 Gbps	0.8	0.8	8
	Auto Max 4 Gbps	0.4	0.4	4
	Auto Max 2 Gbps	0.2	0.2	2
4/44-Port 8-Gbps Host-Optimized Fibre Channel Module	8 Gbps	0.87	0.16	8
	Auto Max 4 Gbps	0.436	0.08	4
	Auto Max 2 Gbps	0.218	0.04	2
	1 Gbps	0.109	0.02	1
48-port 4-Gbps Fibre Channel switching module	Auto 4 Gbps	0.8	0.09	4
	Auto Max 2 Gbps	0.4	0.045	2
	1 Gbps	0.2	0.0225	1
24-port 4-Gbps Fibre Channel switching module	Auto 4 Gbps	1	0.27	4
	Auto Max 2 Gbps	0.5	0.135	2
	1 Gbps	0.25	0.067	1

All ports in the 48-port and 24-port 4-Gbps modules can be configured to operate at 4 Gbps in shared mode even if other ports in the port group are configured in dedicated mode, regardless of available bandwidth. However, when oversubscription ratio restrictions are enabled, you may not have all shared 4-Gbps module ports operating at 4 Gbps.

All ports in the 48-port, 32-Port, and 24-port 8-Gbps modules can be configured to operate at 8 Gbps in shared mode even if other ports in the port group are configured in dedicated mode, regardless of available bandwidth. However, when oversubscription ratio restrictions are enabled you may not have all shared 8-Gbps module ports operating at 8 Gbps.

On the 48-port, 32-Port, and 24-port 8-Gbps modules, if you have configured one 8-Gbps dedicated port in one port group, no other ports in the same port group can be configured to operate at 8-Gbps dedicated mode. You can have any number of 8-Gbps shared and 4-Gbps dedicated or shared ports. On the 4/44-port 8-Gbps module, only one port per port group can be configured in 8-Gbps dedicated or shared mode.

In the following example, a 24-port 4-Gbps module has oversubscription ratios enabled and three dedicated ports in one port group operating at 4-Gbps. No other ports in the same port group can be configured to operate at 4 Gbps.

```
switch# show port-resources module 8
Module 8
  Available dedicated buffers are 5478

 Port-Group 1
  Total bandwidth is 12.8 Gbps
  Total shared bandwidth is 0.8 Gbps
  Allocated dedicated bandwidth is 12.0 Gbps
  -----------------------------------------------------------------
  Interfaces in the Port-Group      B2B Credit  Bandwidth  Rate Mode
                                      Buffers     (Gbps)
  -----------------------------------------------------------------
```

```
fc8/1                                        16      4.0   dedicated
fc8/2                                        16      4.0   dedicated
fc8/3                                        16      4.0   dedicated
fc8/4 (out-of-service)
fc8/5 (out-of-service)
fc8/6 (out-of-service)
```

For dedicated ports, oversubscription ratio restrictions do not apply to the shared pool in port groups. So if oversubscription ratio restrictions are disabled, and you have configured three 4-Gbps dedicated ports in one port group, then you can configure all other ports in the same port group to operate at a shared rate of 4 Gbps.

In the following example, a 48-port module has a group of six ports, four dedicated ports are operating at 8 Gbps, and the two shared ports are also operating at 8 Gbps:

```
switch# show port-resources module 5
Module 5
Available dedicated buffers for global buffer #0 [port-group 1] are 3970
  Available dedicated buffers for global buffer #1 [port-group 2] are 3970
  Available dedicated buffers for global buffer #2 [port-group 3] are 3970
  Available dedicated buffers for global buffer #3 [port-group 4] are 3970
  Available dedicated buffers for global buffer #4 [port-group 5] are 3058
  Available dedicated buffers for global buffer #5 [port-group 6] are 3058
  Available dedicated buffers for global buffer #6 [port-group 7] are 3970
  Available dedicated buffers for global buffer #7 [port-group 8] are 3970

Port-Group 1
  Total bandwidth is 32.4 Gbps
  Total shared bandwidth is 32.4 Gbps
  Allocated dedicated bandwidth is 0.0 Gbps
  --------------------------------------------------------------------
  Interfaces in the Port-Group      B2B Credit  Bandwidth  Rate Mode
                                      Buffers     (Gbps)
  --------------------------------------------------------------------
  fc5/1                                 32         8.0      shared
  fc5/2                                 32         8.0      shared
  fc5/3                                 32         8.0      shared
  fc5/4                                 32         8.0      shared

Port-Group 2
  Total bandwidth is 32.4 Gbps
  Total shared bandwidth is 32.4 Gbps
  Allocated dedicated bandwidth is 0.0 Gbps
  --------------------------------------------------------------------
  Interfaces in the Port-Group      B2B Credit  Bandwidth  Rate Mode
                                      Buffers     (Gbps)
  --------------------------------------------------------------------
  fc5/5                                 32         8.0      shared
  fc5/6                                 32         8.0      shared
  fc5/7                                 32         8.0      shared
  fc5/8                                 32         8.0      shared

Port-Group 3
  Total bandwidth is 32.4 Gbps
  Total shared bandwidth is 32.4 Gbps
  Allocated dedicated bandwidth is 0.0 Gbps
  --------------------------------------------------------------------
  Interfaces in the Port-Group      B2B Credit  Bandwidth  Rate Mode
                                      Buffers     (Gbps)
  --------------------------------------------------------------------
  fc5/9                                 32         8.0      shared
  fc5/10                                32         8.0      shared
  fc5/11                                32         8.0      shared
```

Cisco MDS 9000 Family NX-OS Interfaces Configuration Guide

```
fc5/12                                    32     8.0  shared

Port-Group 4
  Total bandwidth is 32.4 Gbps
  Total shared bandwidth is 32.4 Gbps
  Allocated dedicated bandwidth is 0.0 Gbps
  ---------------------------------------------------------------------
  Interfaces in the Port-Group        B2B Credit  Bandwidth  Rate Mode
                                        Buffers     (Gbps)
  ---------------------------------------------------------------------
  fc5/13                                    32     8.0  shared
  fc5/14                                    32     8.0  shared
  fc5/15                                    32     8.0  shared
  fc5/16                                    32     8.0  shared

Port-Group 5
  Total bandwidth is 32.4 Gbps
  Total shared bandwidth is 16.4 Gbps
  Allocated dedicated bandwidth is 16.0 Gbps
  ---------------------------------------------------------------------
  Interfaces in the Port-Group        B2B Credit  Bandwidth  Rate Mode
                                        Buffers     (Gbps)
  ---------------------------------------------------------------------
  fc5/17                                    32     8.0  shared
  fc5/18                                    32     8.0  shared
  fc5/19                                   500     8.0  dedicated
  fc5/20                                   500     8.0  dedicated

Port-Group 6
  Total bandwidth is 32.4 Gbps
  Total shared bandwidth is 16.4 Gbps
  Allocated dedicated bandwidth is 16.0 Gbps
  ---------------------------------------------------------------------
  Interfaces in the Port-Group        B2B Credit  Bandwidth  Rate Mode
                                        Buffers     (Gbps)
  ---------------------------------------------------------------------
  fc5/21                                   500     8.0  dedicated
  fc5/22                                   500     8.0  dedicated
  fc5/23                                    32     8.0  shared
  fc5/24                                    32     8.0  shared

Port-Group 7
  Total bandwidth is 32.4 Gbps
  Total shared bandwidth is 32.4 Gbps
  Allocated dedicated bandwidth is 0.0 Gbps
  ---------------------------------------------------------------------
  Interfaces in the Port-Group        B2B Credit  Bandwidth  Rate Mode
                                        Buffers     (Gbps)
  ---------------------------------------------------------------------
  fc5/25                                    32     8.0  shared
  fc5/26                                    32     8.0  shared
  fc5/27                                    32     8.0  shared
  fc5/28                                    32     8.0  shared

Port-Group 8
  Total bandwidth is 32.4 Gbps
  Total shared bandwidth is 32.4 Gbps
  Allocated dedicated bandwidth is 0.0 Gbps
  ---------------------------------------------------------------------
  Interfaces in the Port-Group        B2B Credit  Bandwidth  Rate Mode
                                        Buffers     (Gbps)
  ---------------------------------------------------------------------
  fc5/29                                    32     8.0  shared
  fc5/30                                    32     8.0  shared
```

Send documentation comments to mdsfeedback-doc@cisco.com

```
   fc5/31                                  32      8.0   shared
   fc5/32                                  32      8.0   shared


Isola-13# show port-resources module 13
Module 13
  Available dedicated buffers for global buffer #0 [port-group 1] are 3880
  Available dedicated buffers for global buffer #1 [port-group 2] are 3880
  Available dedicated buffers for global buffer #2 [port-group 3] are 3880
  Available dedicated buffers for global buffer #3 [port-group 4] are 3056
  Available dedicated buffers for global buffer #4 [port-group 5] are 3880
  Available dedicated buffers for global buffer #5 [port-group 6] are 3880
  Available dedicated buffers for global buffer #6 [port-group 7] are 3880
  Available dedicated buffers for global buffer #7 [port-group 8] are 3880

Port-Group 1
  Total bandwidth is 32.4 Gbps
  Total shared bandwidth is 32.4 Gbps
  Allocated dedicated bandwidth is 0.0 Gbps
  --------------------------------------------------------------------
  Interfaces in the Port-Group       B2B Credit  Bandwidth  Rate Mode
                                       Buffers     (Gbps)
  --------------------------------------------------------------------
  fc13/1                                  32      8.0   shared
  fc13/2                                  32      8.0   shared
  fc13/3                                  32      8.0   shared
  fc13/4                                  32      8.0   shared
  fc13/5                                  32      8.0   shared
  fc13/6                                  32      8.0   shared

Port-Group 2
  Total bandwidth is 32.4 Gbps
  Total shared bandwidth is 32.4 Gbps
  Allocated dedicated bandwidth is 0.0 Gbps
  --------------------------------------------------------------------
  Interfaces in the Port-Group       B2B Credit  Bandwidth  Rate Mode
                                       Buffers     (Gbps)
  --------------------------------------------------------------------
  fc13/7                                  32      8.0   shared
  fc13/8                                  32      8.0   shared
  fc13/9                                  32      8.0   shared
  fc13/10                                 32      8.0   shared
  fc13/11                                 32      8.0   shared
  fc13/12                                 32      8.0   shared

Port-Group 3
  Total bandwidth is 32.4 Gbps
  Total shared bandwidth is 32.4 Gbps
  Allocated dedicated bandwidth is 0.0 Gbps
  --------------------------------------------------------------------
  Interfaces in the Port-Group       B2B Credit  Bandwidth  Rate Mode
                                       Buffers     (Gbps)
  --------------------------------------------------------------------
  fc13/13                                 32      8.0   shared
  fc13/14                                 32      8.0   shared
  fc13/15                                 32      8.0   shared
  fc13/16                                 32      8.0   shared
  fc13/17                                 32      8.0   shared
  fc13/18                                 32      8.0   shared

Port-Group 4
  Total bandwidth is 32.4 Gbps
  Total shared bandwidth is 0.4 Gbps
  Allocated dedicated bandwidth is 32.0 Gbps
```

```
------------------------------------------------------------------
Interfaces in the Port-Group         B2B Credit  Bandwidth  Rate Mode
                                       Buffers     (Gbps)
------------------------------------------------------------------
fc13/19                                  250         8.0   dedicated
fc13/20                                  250         8.0   dedicated
fc13/21                                  250         8.0   dedicated
fc13/22                                  250         8.0   dedicated
fc13/23                                   32         8.0   shared
fc13/24                                   32         8.0   shared


Port-Group 5
  Total bandwidth is 32.4 Gbps
  Total shared bandwidth is 32.4 Gbps
  Allocated dedicated bandwidth is 0.0 Gbps
  ------------------------------------------------------------------
  Interfaces in the Port-Group       B2B Credit  Bandwidth  Rate Mode
                                       Buffers     (Gbps)
  ------------------------------------------------------------------
  fc13/25                                 32         8.0   shared
  fc13/26                                 32         8.0   shared
  fc13/27                                 32         8.0   shared
  fc13/28                                 32         8.0   shared
  fc13/29                                 32         8.0   shared
  fc13/30                                 32         8.0   shared


Port-Group 6
  Total bandwidth is 32.4 Gbps
  Total shared bandwidth is 32.4 Gbps
  Allocated dedicated bandwidth is 0.0 Gbps
  ------------------------------------------------------------------
  Interfaces in the Port-Group       B2B Credit  Bandwidth  Rate Mode
                                       Buffers     (Gbps)
  ------------------------------------------------------------------
  fc13/31                                 32         8.0   shared
  fc13/32                                 32         8.0   shared
  fc13/33                                 32         8.0   shared
  fc13/34                                 32         8.0   shared
  fc13/35                                 32         8.0   shared
  fc13/36                                 32         8.0   shared


Port-Group 7
  Total bandwidth is 32.4 Gbps
  Total shared bandwidth is 32.4 Gbps
  Allocated dedicated bandwidth is 0.0 Gbps
  ------------------------------------------------------------------
  Interfaces in the Port-Group       B2B Credit  Bandwidth  Rate Mode
                                       Buffers     (Gbps)
  ------------------------------------------------------------------
  fc13/37                                 32         8.0   shared
  fc13/38                                 32         8.0   shared
  fc13/39                                 32         8.0   shared
  fc13/40                                 32         8.0   shared
  fc13/41                                 32         8.0   shared
  fc13/42                                 32         8.0   shared


Port-Group 8
  Total bandwidth is 32.4 Gbps
  Total shared bandwidth is 32.4 Gbps
  Allocated dedicated bandwidth is 0.0 Gbps
  ------------------------------------------------------------------
  Interfaces in the Port-Group       B2B Credit  Bandwidth  Rate Mode
                                       Buffers     (Gbps)
  ------------------------------------------------------------------
```

```
        fc13/43                                              32       8.0   shared
        fc13/44                                              32       8.0   shared
        fc13/45                                              32       8.0   shared
        fc13/46                                              32       8.0   shared
        fc13/47                                              32       8.0   shared
        fc13/48                                              32       8.0   shared

        ...
```

When disabling restrictions on oversubscription ratios, all ports in shared mode on 48-port and 24-port 4-Gbps or any 8-Gbps Fibre Channel switching modules must be shut down. When applying restrictions on oversubscription ratios, you must take shared ports out of service.

> **Note** When restrictions on oversubscription ratios are disabled, the bandwidth allocation among the shared ports is proportionate to the configured speed. If the configured speed is auto on Generation 2 modules, then bandwidth is allocated assuming a speed of 4 Gbps. For example, if you have three shared ports configured at 1, 2, and 4 Gbps, then the allocated bandwidth ratio is 1:2:4.
>
> As of Cisco SAN-OS Release 3.0 and NX-OS Release 4.1(1) or when restrictions on oversubscription ratios are enabled, the port bandwidths are allocated in equal proportions, regardless of port speed, so, the bandwidth allocation for the same three ports mentioned in the example would be 1:1:1.

Bandwidth Fairness

This feature improves fairness of bandwidth allocation among all ports and provides better throughput average to individual data streams. Bandwidth fairness can be configured per module.

As of Cisco SAN-OS Release 3.1(2), all 48-port and 24-port 4-Gbps Fibre Channel switching modules, as well as 18-port Fibre Channel/4-port Gigabit Ethernet Multiservice modules, have bandwidth fairness enabled by default. As of Cisco NX-OS Release 4.1(1), all the 8-Gbps Fibre Channel switching modules have bandwidth fairness enabled by default.

> **Caution** When you disable or enable bandwidth fairness, the change does not take effect until you reload the module.

Use the **show module bandwidth-fairness** command to check whether ports in a module are operating with bandwidth fairness enabled or disabled.

```
switch# show module 2 bandwidth-fairness
Module 2 bandwidth-fairness is enabled
```

> **Note** This feature is supported only on the 48-port and 24-port 4-Gbps modules, the 8-Gbps modules, and the 18/4-port Multiservice Module (MSM).

Upgrade or Downgrade Scenario

When you are upgrading from a release earlier than Cisco SAN-OS Release 3.1(2), all modules operate with bandwidth fairness disabled until the next module reload. After the upgrade, any new module that is inserted has bandwidth fairness enabled.

When you are downgrading to a release earlier than Cisco SAN-OS Release 3.1(2), all modules keep operating in the same bandwidth fairness configuration prior to the downgrade. After the downgrade, any new module that is inserted has bandwidth fairness disabled.

Note After the downgrade, any insertion of a module or module reload will have bandwidth fairness disabled.

Guidelines and Limitations

This section includes the following topics:

Combining Generation 1, Generation 2, Generation 3, and Generation 4 Modules

Cisco MDS NX-OS Release 5.2(x) and later supports combining Generation 1, Generation 2, Generation 3, and Generation 4 modules and switches with the following considerations:

- MDS NX-OS Release 4.1(1) and later features are not supported on the following Generation 1 switches and modules:
  - Supervisor 1 module
  - 4-Port IP Storage Services module
  - 8-Port IP Storage Services module
  - MDS 9216 switch
  - MDS 9216A switch
  - MDS 9020 switch
  - MDS 9120 switch
  - MDS 9140 switch
- Supervisor-1 modules must be upgraded to Supervisor-2 modules on the MDS 9506 and MDS 9509 Directors.
- IPS-4 and IPS-8 modules must be upgraded to the MSM-18/4 Multiservice modules.
- Fabric 1 modules must be upgraded to Fabric 2 modules on the MDS 9513 Director to use the 48-port or the 24-port 8-Gbps module.
- Fabric 2 modules must be upgraded to Fabric 3 modules on the MDS 9513 Director to get the maximum backplane bandwidth of 256 Gbps.
- Cisco Fabric Manager Release 4.x supports MDS SAN-OS Release 3.x and NX-OS 4.x in mixed mode through Interswitch Link (ISL) connectivity.

> **Note** When a Cisco or another vendor switch port is connected to a Generation 1 module port (ISL connection), the receive buffer-to-buffer credits of the port connected to the Generation 1 module port must not exceed 255.

Local Switching Limitations

- All ports in the module must be in shared mode. Use the **switchport ratemode shared** command to ensure that all the ports in the module are in shared mode.

- No E ports are allowed in the module because E ports must be in dedicated mode.

Port Index Limitations

Cisco MDS 9000 switches allocate index identifiers for the ports on the modules. These port indexes cannot be configured. You can combine Generation 1, Generation 2, Generation 3, and Generation 4 switching modules, with either Supervisor-1 modules or Supervisor-2 modules. However, combining switching modules and supervisor modules has the following port index limitations:

- Supervisor-1 modules only support a maximum of 252 port indexes, regardless of the type of switching modules.

- Supervisor-2 modules support a maximum of 1020 port indexes when all switching modules in the chassis are Generation 2 or Generation 3.

- Supervisor-2 modules only support a maximum of 252 port indexes when only Generation 1 switching modules, or a combination of Generation 1, Generation 2, Generation 3, or Generation 4 switching modules are installed in the chassis.

> **Note** On a switch with the maximum limit of 252 as port index, any new module that exceeds the limit does not power up when installed.

You can use the **show port index-allocation** command to display the allocation of port indexes on the switch.

```
switch# show port index-allocation

Module index distribution:
-----------------------------------------------------+
Slot| Allowed |     Allotted indices info            |
    |  range  | Total |        Index values          |
----|---------|-------|------------------------------|
1   | ----- |   -   | (None)                         |
2   | ----- |   -   | (None)                         |
3   | ----- |   -   | (None)                         |
4   | ----- |   -   | (None)                         |
5   |  0-1023|  32   | 0-31                           |
6   | ----- |   -   | (None)                         |
9   | ----- |   -   | (None)                         |
10  | ----- |   -   | (None)                         |
11  | ----- |   -   | (None)                         |
12  | ----- |   -   | (None)                         |
13  |  0-1023|  48   | 32-79                          |
SUP | 253-255 |   3   | 253-255                        |
```

Generation 1 switching modules have specific numbering requirements. If these requirements are not met, the module does not power up. The port index numbering requirements include the following:

- If port indexes in the range of 256 to 1020 are assigned to operational ports, Generation 1 switching modules do not power up.

- A block of contiguous port indexes is available. If this block of port indexes is not available, Generation 1 modules do not power up. Table 1-10 shows the port index requirements for the Generation 1 modules.

Note   If the switch has Supervisor-1 modules, the block of 32 contiguous port indexes must begin on the slot boundary. The slot boundary for slot 1 is 0, for slot 2 is 32, and so on. For Supervisor-2 modules, the contiguous block can start anywhere.

Table 1-10   Port Index Requirements for Generation 1 Modules

Generation 1 Module	Number of Port Indexes Required	
	Supervisor-1 Module	Supervisor-2 Module
16-port 2-Gbps Fibre Channel module	16	16
32-port 2-Gbps Fibre Channel module	32	32
8-port Gigabit Ethernet IP Storage Services module	32	32
4-port Gigabit Ethernet IP Storage Services module	32	16
32-port 2-Gbps Fibre Channel Storage Services Module (SSM).	32	32
14-port Fibre Channel/2-port Gigabit Ethernet Multiprotocol Services (MPS-14/2) module	32	22

The allowed mix of Generation 1 and Generation 2 switching modules in a chassis is determined at run-time, either when booting up the switch or when installing the modules. In some cases, the sequence in which switching modules are inserted into the chassis determines if one or more modules is powered up.

When a module does not power up because of a resource limitation, you can display the reason by using the **show module** command.

```
switch# show module
Mod   Ports   Module-Type                          Model              Status
---   -----   ------------------------------------ ------------------ ----------
5     32      1/2/4/8/10 Gbps Advanced FC Module   DS-X9232-256K9     ok
7     0       Supervisor/Fabric-2                  DS-X9530-SF2-K9    active *
13    48      1/2/4/8/10 Gbps Advanced FC Module   DS-X9248-256K9     ok

Mod   Sw              Hw      World-Wide-Name(s) (WWN)
---   -------------   ------  --------------------------------------------------
5     5.2(2)          0.207   21:01:00:0d:ec:b7:28:c0 to 21:20:00:0d:ec:b7:28:c0
7     5.2(2)          1.9     --
13    5.2(2)          0.212   23:01:00:0d:ec:b7:28:c0 to 23:30:00:0d:ec:b7:28:c0


Mod   MAC-Address(es)                      Serial-Num
---   ------------------------------------ ----------
5     68-ef-bd-a8-45-cc to 68-ef-bd-a8-45-d0  JAF1450CHQT
7     00-24-c4-60-00-f8 to 00-24-c4-60-00-fc  JAE141502L2
```

```
13   68-ef-bd-a8-40-00 to 68-ef-bd-a8-40-04   JAF1450BMBP


Xbar Ports  Module-Type                          Model              Status
---  -----  -----------------------------------  -----------------  ----------
1    0      Fabric Module 3                      DS-13SLT-FAB3      ok
2    0      Fabric Module 3                      DS-13SLT-FAB3      ok


Xbar Sw             Hw      World-Wide-Name(s) (WWN)
---  --------------  ------  --------------------------------------------------
1    NA              0.4     --
2    NA              0.4     --



Xbar MAC-Address(es)                          Serial-Num
---  ------------------------------------     ----------
1    NA                                       JAF1451AMHG
2    NA                                       JAF1451AMHN


* this terminal session
```

The running configuration is updated when modules are installed. If you save the running configuration to the startup configuration (using the **copy running-config startup-config** command), during reboot the switch powers up the same set of modules as before the reboot regardless of the sequence in which the modules initialize. You can use the **show port index-allocation startup** command to display the index allocation the switch uses at startup.

```
switch# show port index-allocation startup

Startup module index distribution:
-------------------------------------------------------+
Slot | Allowed |     Alloted indices info              |
     |  range  | Total |         Index values          |
-----|---------|-------|-------------------------------|
 1   | -----   |  34   | 0-31,80-81                    |
 2   | -----   |  32   | 32-63                         |
 3   | -----   |  16   | 64-79                         |(Slot 1 shares 80-81)
 4   | -----   |  48   | 96-127,224-239                |
SUP  | 253-255 |   3   | 253-255                       |
```

Note   The output of the **show port index-allocation startup** command does not display anything in the Allowed range column because the command extracts the indices from the persistent storage service (PSS) and displaying an allowed range for startup indices is meaningless.

If a module fails to power up, you can use the **show module** *slot* **recovery-steps** command to display the reason.

For information on recovering a module powered-down because port indexes are not available, refer to the *Cisco MDS 9000 Family Troubleshooting Guide*.

Tip   Whenever using mixed Generation 1 and Generation 2 modules, power up the Generation 1 modules first. During a reboot of the entire switch, the Generation 1 modules power up first (default behavior).

PortChannel Limitations

PortChannels have the following restrictions:

- The maximum number of PortChannels allowed is 256 if all switching modules are Generation 2 or Generation 3, or both.

- The maximum number of PortChannels allowed is 128 whenever there is a Generation 1 switching module in use with a Generation 2 or Generation 3 switching module.

- Ports need to be configured in dedicated rate mode on the Generation 2 and Generation 3 switching module interfaces to be used in the PortChannel.

Note   The number of PortChannels allowed does not depend on the type of supervisor module. However, Generation 3 modules require the Supervisor 2 module on the MDS 9506 and 9509 switches.

The Generation1, Generation 2, and Generation 3 modules have the following restrictions for PortChannel configuration:

- Generation 1 switching module interfaces do not support auto speed with a maximum of 2 Gbps.

- Generation 1 and Generation 2 module interfaces do not support auto speed with maximum of 4 Gbps.

- Generation 2 and Generation 3 switching module interfaces cannot be forcefully added to a PortChannel if sufficient resources are not available.

Note   Before adding a Generation 2 or Generation 3 interface to a PortChannel, use the **show port-resources module** command to check for resource availability.

When configuring PortChannels on switches with Generation 1, Generation 2, and Generation 3 switching modules, follow one of these procedures:

- Configure the PortChannel, and then configure the Generation 2 and Generation 3 interfaces to auto with a maximum of 2 Gbps.

- Configure the Generation 1 switching modules followed by the Generation 2 switching modules, and then the Generation 3 switching modules, and then configure the PortChannel.

When configuring PortChannels on switches with only Generation 2 and Generation 3 switching modules, follow one of these procedures:

- Configure the PortChannel, and then configure the Generation 3 interfaces to auto with a maximum of 4 Gbps.

- Configure the Generation 2 switching modules, followed by the Generation 3 switching modules, and then configure the PortChannel.

Table 1-11 describes the results of adding a member to a PortChannel for various configurations.

Table 1-11   PortChannel Configuration and Addition Results

PortChannel Members	Configured Speed		New Member Type	Addition Type	Result
	PortChannel	**New Member**			
No members	Any	Any	Generation 1 or Generation 2 or Generation 3 or Generation 4	Force	Pass
	Auto	Auto	Generation 1 or Generation 2 or Generation 3 or Generation 4	Normal or force	Pass
	Auto	Auto max 2000	Generation 2 or Generation 3 or Generation 4	Normal	Fail
				Force	Pass or fail[1]
	Auto	Auto max 4000	Generation 3 or Generation 4		
	Auto max 2000	Auto	Generation 2 or Generation 3 or Generation 4	Normal	Fail
				Force	Pass
	Auto max 2000	Auto max 4000	Generation 3 or or Generation 4		
	Auto max 4000	Auto	Generation 2 or Generation 3 or or Generation 4		
	Auto max 4000	Auto max 2000	Generation 2 or Generation 3 or or Generation 4		
Generation 1 interfaces	Auto	Auto	Generation 2 or Generation 3	Normal	Fail
				Force	Pass
	Auto max 2000	Auto	Generation 1	Normal or force	Pass
	Auto max 2000	Auto	Generation 2 or Generation 3	Normal	Fail
				Force	Pass or fail[1]
	Auto max 4000	Auto	Generation 1 or Generation 2		
	Auto max 4000	Auto	Generation 3		

Table 1-11   *PortChannel Configuration and Addition Results (continued)*

PortChannel Members	Configured Speed		New Member Type	Addition Type	Result
	PortChannel	New Member			
Generation 2 interfaces	Auto	Auto	Generation 1	Normal or force	Fail
	Auto max 2000	Auto	Generation 1	Normal or force	Pass
	Auto max 2000	Auto	Generation 2 or Generation 3	Normal	Fail
				Force	Pass
	Auto	Auto max 2000	Generation 2 or Generation 3	Normal	Fail
				Force	Pass
Generation 3 interfaces	Auto	Auto	Generation 1	Normal or force	Fail
	Auto max 2000	Auto	Generation 1	Normal or force	Pass
	Auto max 2000	Auto	Generation 2	Normal	Fail
				Force	Pass
	Auto	Auto max 2000	Generation 2	Normal	Fail
				Force	Pass
	Auto max 2000	Auto	Generation 3	Normal	Fail
				Force	Pass
	Auto	Auto max 2000	Generation 3	Normal	Fail
				Force	Pass
Generation 4 interfaces	Auto	Auto	Generation 1	Normal or force	Fail
	Auto max 2000	Auto	Generation 1	Normal or force	Pass
	Auto max 2000	Auto	Generation 2	Normal	Fail
				Force	Pass
	Auto	Auto max 2000	Generation 2	Normal	Fail
				Force	Pass
	Auto max 2000	Auto	Generation 3 or Generation 4	Normal	Fail
				Force	Pass
	Auto	Auto max 2000	Generation 3 or Generation 4	Normal	Fail
				Force	Pass

1.   If resources are not available.

Use the **show port-channel compatibility parameters** command to obtain information about PortChannel addition errors.

Default Settings

Table 1-12 lists the default settings for Generation 2 interface parameters.

Table 1-12   Default Generation 2 Interface Parameters

Parameter	Default			
	48-Port 4-Gbps Switching Module	24-Port 4-Gbps Switching Module	12-Port 4-Gbps Switching Module	4-Port 10-Gbps Switching Module
Speed mode	auto	auto[1]	auto[1]	auto[1]
Rate mode	shared	shared	dedicated	dedicated
Port mode	Fx	Fx	auto[2]	auto[3]
BB_credit buffers	16	16	250	250
Performance buffers	–	–	145[4]	145[5]

1. The 4-port 10-Gbps switching module only supports 10-Gbps traffic.

2. Auto port mode on the 12-port 4-Gbps switching module interfaces can operate in E port mode, TE port mode, and Fx port mode.

3. Auto port mode on the 4-port 10-Gbps switching module interfaces can operate in E port mode, TE port mode, and F port mode.

4. Performance buffers are shared among all ports on the module.

Table 1-13 lists the default settings for Generation 3 interface parameters.

Table 1-13   Default Generation 3 Interface Parameters

Parameter	Default		
	48-Port 8-Gbps Switching Module	24-Port 8-Gbps Switching Module	4/44-Port 8-Gbps Host-Optimized Switching Module
Speed mode	auto	auto[1]	auto_max_4G[1]
Rate mode	shared	shared	shared
Port mode	Fx	Fx	Fx
BB_credit buffers	32	32	32

1. Auto_max_4G speed mode on the 4/44-port 8-Gbps switching module negotiates to a maximum speed of 4 Gbps.

Table 1-14 lists the default settings for Generation 4 interface parameters.

Table 1-14   Default Generation 4 Interface Parameters

Parameter	Default	
	48-Port 8-Gbps Advanced Fibre Channel Switching Module	32-Port 8-Gbps Advanced Fibre Channel Switching Module
Speed mode	auto	auto[1]
Rate mode	shared	shared

Table 1-14   Default Generation 4 Interface Parameters (continued)

Parameter	Default	
	48-Port 8-Gbps Advanced Fibre Channel Switching Module	32-Port 8-Gbps Advanced Fibre Channel Switching Module
Port mode	Fx	Fx
BB_credit buffers	32	32

Configuring Fibre Channel Interfaces

This section includes the following topics:

Task Flow for Migrating Interfaces from Shared Mode to Dedicated Mode

The 48-Port, 24-Port, and 4/44-Port 8-Gbps Fibre Channel switching modules support the following features:

- 1-Gbps, 2-Gbps, 4-Gbps, and 8-Gbps speed traffic
- Shared and dedicated rate mode
- ISL and Fx port modes
- Extended BB_credits

The 48-port and 24-port 4-Gbps Fibre Channel switching modules support the following features:

- 1-Gbps, 2-Gbps, and 4-Gbps speed traffic
- Shared and dedicated rate mode
- ISL (E or TE) and Fx (F or FL) port modes
- Extended BB_credits

> **Note** If you change the port bandwidth reservation parameters on a 48-port or 24-port 4-Gbps module, the change affects only the changed port. No other ports in the port group are affected.

To configure the 4-Gbps and 8-Gbps Fibre Channel switching modules when starting with the default configuration or when migrating from shared rate mode to dedicated rate mode, follow these steps:

Step 1 Take unused interfaces out of service to release resources for other interfaces, if necessary.

See the "Taking Interfaces Out of Service" section on page 1-41.

Step 2 Configure the traffic speed to use (1 Gbps, 2 Gbps, 4 Gbps, 8 Gbps, or autosensing with a maximum of 2 Gbps or 4 Gbps).

See the "Configuring Port Speed" section on page 1-29.

Step 3 Configure the rate mode (dedicated or shared).

See the "Configuring Rate Mode" section on page 1-30.

Step 4 Configure the port mode.

See the "Configuring Interface Modes" section on page 1-23.

> **Note** ISL ports cannot operate in shared rate mode.

Step 5 Configure the BB_credits and extended BB_credits, as necessary.

See the "Configuring Buffer-to-Buffer Credits" section on page 1-21 and the "Configuring Extended BB_credits" section on page 1-23.

Task Flow for Migrating Interfaces from Dedicated Mode to Shared Mode

To configure the 4-Gbps and 8-Gbps Fibre Channel switching modules migrating from dedicated rate mode to shared rate mode, follow these steps:

Step 1 Take unused interfaces out of service to release resources for other interfaces, if necessary.

See the "Taking Interfaces Out of Service" section on page 1-41.

Step 2 Configure the BB_credits and extended BB_credits, as necessary.

See the "Configuring Buffer-to-Buffer Credits" section on page 1-21, and the "Extended BB_Credits" section on page 1-17.

Step 3 Configure the port mode.

See the "Configuring Interface Modes" section on page 1-23.

> **Note** ISL ports cannot operate in shared rate mode.

Step 4 Configure the rate mode (dedicated or shared) to use.

See the "Configuring Rate Mode" section on page 1-30.

Step 5 Configure the traffic speed (1 Gbps, 2 Gbps, 4 Gbps, or autosensing with a maximum of 2 Gbps or 4 Gbps) to use.

See the "Configuring Port Speed" section on page 1-29.

Task Flow for Configuring 12-Port 4-Gbps Module Interfaces

The 12-port 4-Gbps switching modules support the following features:

- 1-Gbps, 2-Gbps, and 4-Gbps speed traffic
- Only dedicated rate mode
- ISL (E or TE) and Fx (F or FL) port modes
- Extended BB_credits
- Performance buffers

To configure 4-port 10-Gbps switching modules when starting with the default configuration, follow these steps:

Step 1 Configure the traffic speed (1 Gbps, 2 Gbps, 4 Gbps, or autosensing with a maximum of 2 Gbps or 4 Gbps) to use.

See the "Configuring Port Speed" section on page 1-29.

Step 2 Configure the port mode.

See the "Configuring Interface Modes" section on page 1-23.

Step 3 Configure the BB_credits, performance buffers, and extended BB_credits, as necessary.

See the "Configuring Buffer-to-Buffer Credits" section on page 1-21, and the "Configuring Extended BB_credits" section on page 1-23.

Task Flow for Configuring 4-Port 10-Gbps Module Interfaces

The 4-port 10-Gbps switching modules support the following features:

- Only 10-Gbps speed traffic
- Only dedicated rate mode
- ISL (E or TE) and F port modes
- Extended BB_credits
- Performance buffers

To configure 4-port 10-Gbps switching modules when starting with the default configuration, follow these steps:

Step 1 Configure the port mode.

See the "Configuring Interface Modes" section on page 1-23.

Step 2 Configure the BB_credits, performance buffers, and extended BB_credits, as necessary.

See the , and the .

Configuring Port Speed

Restrictions

- Changing port speed and rate mode disrupts traffic on the port. Traffic on other ports in the port group is not affected.

Detailed Steps

To configure the port speed on an interface on a 4-Gbps or 8-Gbps switching module, follow these steps:

	Command	Purpose
Step 1	switch# **config t** switch(config)#	Enters configuration mode.
Step 2	switch(config)# **interface fc 1/1** switch(config-if)#	Selects the interface and enters interface configuration submode.
Step 3	switch(config-if)# **switchport speed 4000**	Configures the port speed in megabits per second. Valid values are 1000, 2000, 4000 and auto. The auto parameter enables autosensing on the interface.
	switch(config-if)# **switchport speed 8000**	(8-Gbps modules only[1]) Configures the port speed in megabits per second to 8-Gbps. Valid values are 1000, 2000, 4000, 8000 and auto. The auto parameter enables autosensing on the interface.
	switch(config-if)# **switchport speed auto**	On 4-Gbps modules, configures autosensing for the interface with 4 Gbps of bandwidth reserved. On 8-Gbps modules, configures autosensing for the interface with 8 Gbps of bandwidth reserved. [2]
	switch(config-if)# **switchport speed auto max 2000**	Configures autosensing with a maximum of 2 Gbps of bandwidth reserved.
	switch(config-if)# **switchport speed auto max 4000**	(8-Gbps modules only[1]) Configures autosensing with a maximum of 4Gbps of bandwidth reserved.
	switch(config-if)# **no switchport speed**	Reverts to the default[2] speed for the interface (auto).

1. The 8000 and auto max 4000 speed configurations are available only for the 8-Gbps modules.
2. The default speed on 48-port and 24-port 4-Gbps modules is 4000. The default speed on 48-port and 24-port 8-Gbps modules is 8000. The default speed on the 4/44-port 8-Gbps module is auto max 4000.

Use the **show interface** command to verify the port speed configuration for an interface on a 4-Gbps or 8-Gbps Fibre Channel switching module.

```
switch# show interface fc 9/1
fc9/1 is up
    Hardware is Fibre Channel, SFP is short wave laser w/o OFC (SN)
    Port WWN is 22:01:00:05:30:01:9f:02
    Admin port mode is F
    snmp traps are enabled
    Port mode is F, FCID is 0xeb0002
    Port vsan is 1
    Speed is 2 Gbps
    Rate mode is shared
    Transmit B2B Credit is 64
    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
      226 frames input, 18276 bytes
        0 discards, 0 errors
        0 CRC, 0 unknown class
        0 too long, 0 too short
      326 frames output, 21364 bytes
        0 discards, 0 errors
      0 input OLS, 0 LRR, 1 NOS, 0 loop inits
      3 output OLS, 2 LRR, 0 NOS, 0 loop inits
      16 receive B2B credit remaining
      64 transmit B2B credit remaining
```

Configuring Rate Mode

Restrictions

- Changing port speed and rate mode disrupts traffic on the port.

Detailed Steps

To configure the rate mode (dedicated or shared) on an interface on a 48-port or 24-port 4-Gbps, or any 8-Gbps Fibre Channel switching module, follow these steps:

	Command	Purpose
Step 1	switch# **config t** switch(config)#	Enters configuration mode.
Step 2	switch(config)# **interface fc 1/1** switch(config-if)#	Selects the interface and enters interface configuration submode.

	Command	Purpose
Step 3	switch(config-if)# **switchport rate-mode dedicated**	Reserves dedicated bandwidth for the interface.
		Note If you cannot reserve dedicated bandwidth on an interface, you might have exceeded the port group maximum bandwidth. Use the **show port-resources** command to determine what resources are already allocated.
	switch(config-if)# **switchport rate-mode shared**	Reserves shared (default) bandwidth for the interface.
	switch(config-if)# **no switchport rate-mode**	Reverts to the default state (**shared**).

Displaying the Rate Mode Configuration for Interfaces

Use **show port-resources module** command to verify the rate mode configuration for interfaces on a 48-port or 24-port 4-Gbps, or any 8-Gbps Fibre Channel switching module.

This example shows the port rate mode configuration for interfaces on a 4-Gbps module:

```
switch# show port-resources module 9
Module 9
Available dedicated buffers are 5400

 Port-Group 1
  Total bandwidth is 12.8 Gbps
  Total shared bandwidth is 12.8 Gbps
  Allocated dedicated bandwidth is 0.0 Gbps
  --------------------------------------------------------------------
  Interfaces in the Port-Group        B2B Credit  Bandwidth  Rate Mode
                                        Buffers     (Gbps)
  --------------------------------------------------------------------
  fc9/1                                    16         4.0    shared
  fc9/2                                    16         4.0    shared
  fc9/3                                    16         4.0    shared
  fc9/4                                    16         4.0    shared
  fc9/5                                    16         4.0    shared
  fc9/6                                    16         4.0    shared

 Port-Group 2
  Total bandwidth is 12.8 Gbps
  Total shared bandwidth is 12.8 Gbps
  Allocated dedicated bandwidth is 0.0 Gbps
  --------------------------------------------------------------------
  Interfaces in the Port-Group        B2B Credit  Bandwidth  Rate Mode
                                        Buffers     (Gbps)
  --------------------------------------------------------------------
  fc9/7                                    16         4.0    shared
  fc9/8                                    16         4.0    shared
  fc9/9                                    16         4.0    shared
  fc9/10                                   16         4.0    shared
  fc9/11                                   16         4.0    shared
  fc9/12                                   16         4.0    shared

 Port-Group 3
  Total bandwidth is 12.8 Gbps
```

```
  Total shared bandwidth is 12.8 Gbps
  Allocated dedicated bandwidth is 0.0 Gbps
  ------------------------------------------------------------------
  Interfaces in the Port-Group        B2B Credit  Bandwidth  Rate Mode
                                        Buffers     (Gbps)
  ------------------------------------------------------------------
  fc9/13                                   16        4.0    shared
  fc9/14                                   16        4.0    shared
  fc9/15                                   16        4.0    shared
  fc9/16                                   16        4.0    shared
  fc9/17                                   16        4.0    shared
  fc9/18                                   16        4.0    shared

 Port-Group 4
  Total bandwidth is 12.8 Gbps
  Total shared bandwidth is 12.8 Gbps
  Allocated dedicated bandwidth is 0.0 Gbps
  ------------------------------------------------------------------
  Interfaces in the Port-Group        B2B Credit  Bandwidth  Rate Mode
                                        Buffers     (Gbps)
  ------------------------------------------------------------------
  fc9/19                                   16        4.0    shared
  fc9/20                                   16        4.0    shared
  fc9/21                                   16        4.0    shared
  fc9/22                                   16        4.0    shared
  fc9/23                                   16        4.0    shared
  fc9/24                                   16        4.0    shared
```

This example shows the port rate mode configuration for interfaces on a 48-port 8-Gbps module:

```
switch# show port-resource module 4
Module 4
  Available dedicated buffers for global buffer #0 [port-groups 1-4] are 5016
  Available dedicated buffers for global buffer #1 [port-groups 5-8] are 5016

 Port-Group 1
  Total bandwidth is 12.8 Gbps
  Total shared bandwidth is 12.8 Gbps
  Allocated dedicated bandwidth is 0.0 Gbps
  ------------------------------------------------------------------
  Interfaces in the Port-Group        B2B Credit  Bandwidth  Rate Mode
                                        Buffers     (Gbps)
  ------------------------------------------------------------------
  fc4/1                                    32        8.0    shared
  fc4/2                                    32        8.0    shared
  fc4/3                                    32        8.0    shared
  fc4/4                                    32        8.0    shared
  fc4/5                                    32        8.0    shared
  fc4/6                                    32        8.0    shared

 Port-Group 2
  Total bandwidth is 12.8 Gbps
  Total shared bandwidth is 12.8 Gbps
  Allocated dedicated bandwidth is 0.0 Gbps
  ------------------------------------------------------------------
  Interfaces in the Port-Group        B2B Credit  Bandwidth  Rate Mode
                                        Buffers     (Gbps)
  ------------------------------------------------------------------
  fc4/7                                    32        8.0    shared
  fc4/8                                    32        8.0    shared
  fc4/9                                    32        8.0    shared
  fc4/10                                   32        8.0    shared
  fc4/11                                   32        8.0    shared
```

```
fc4/12                                  32      8.0   shared

Port-Group 3
 Total bandwidth is 12.8 Gbps
 Total shared bandwidth is 12.8 Gbps
 Allocated dedicated bandwidth is 0.0 Gbps
 ---------------------------------------------------------------------
 Interfaces in the Port-Group        B2B Credit  Bandwidth  Rate Mode
                                       Buffers    (Gbps)
 ---------------------------------------------------------------------
 fc4/13                                  32      8.0   shared
 fc4/14                                  32      8.0   shared
 fc4/15                                  32      8.0   shared
 fc4/16                                  32      8.0   shared
 fc4/17                                  32      8.0   shared
 fc4/18                                  32      8.0   shared

Port-Group 4
 Total bandwidth is 12.8 Gbps
 Total shared bandwidth is 12.8 Gbps
 Allocated dedicated bandwidth is 0.0 Gbps
 ---------------------------------------------------------------------
 Interfaces in the Port-Group        B2B Credit  Bandwidth  Rate Mode
                                       Buffers    (Gbps)
 ---------------------------------------------------------------------
 fc4/19                                  32      8.0   shared
 fc4/20                                  32      8.0   shared
 fc4/21                                  32      8.0   shared
 fc4/22                                  32      8.0   shared
 fc4/23                                  32      8.0   shared
 fc4/24                                  32      8.0   shared

Port-Group 5
 Total bandwidth is 12.8 Gbps
 Total shared bandwidth is 12.8 Gbps
 Allocated dedicated bandwidth is 0.0 Gbps
 ---------------------------------------------------------------------
 Interfaces in the Port-Group        B2B Credit  Bandwidth  Rate Mode
                                       Buffers    (Gbps)
 ---------------------------------------------------------------------
 fc4/25                                  32      8.0   shared
 fc4/26                                  32      8.0   shared
 fc4/27                                  32      8.0   shared
 fc4/28                                  32      8.0   shared
 fc4/29                                  32      8.0   shared
 fc4/30                                  32      8.0   shared

Port-Group 6
 Total bandwidth is 12.8 Gbps
 Total shared bandwidth is 12.8 Gbps
 Allocated dedicated bandwidth is 0.0 Gbps
 ---------------------------------------------------------------------
 Interfaces in the Port-Group        B2B Credit  Bandwidth  Rate Mode
                                       Buffers    (Gbps)
 ---------------------------------------------------------------------
 fc4/31                                  32      8.0   shared
 fc4/32                                  32      8.0   shared
 fc4/33                                  32      8.0   shared
 fc4/34                                  32      8.0   shared
 fc4/35                                  32      8.0   shared
 fc4/36                                  32      8.0   shared

Port-Group 7
 Total bandwidth is 12.8 Gbps
```

Cisco MDS 9000 Family NX-OS Interfaces Configuration Guide

```
Total shared bandwidth is 12.8 Gbps
Allocated dedicated bandwidth is 0.0 Gbps
-----------------------------------------------------------------------
Interfaces in the Port-Group        B2B Credit  Bandwidth  Rate Mode
                                      Buffers     (Gbps)
-----------------------------------------------------------------------
fc4/37                                  32          8.0    shared
fc4/38                                  32          8.0    shared
fc4/39                                  32          8.0    shared
fc4/40                                  32          8.0    shared
fc4/41                                  32          8.0    shared
fc4/42                                  32          8.0    shared

Port-Group 8
 Total bandwidth is 12.8 Gbps
 Total shared bandwidth is 12.8 Gbps
 Allocated dedicated bandwidth is 0.0 Gbps
-----------------------------------------------------------------------
Interfaces in the Port-Group        B2B Credit  Bandwidth  Rate Mode
                                      Buffers     (Gbps)
-----------------------------------------------------------------------
fc4/43                                  32          8.0    shared
fc4/44                                  32          8.0    shared
fc4/45                                  32          8.0    shared
fc4/46                                  32          8.0    shared
fc4/47                                  32          8.0    shared
fc4/48                                  32          8.0    shared
```

This example shows the port rate mode configuration for interfaces on a 4/44-port 8-Gbps module:

```
switch# show port-resources module 7
Module 7
  Available dedicated buffers are 3888

 Port-Group 1
  Total bandwidth is 12.8 Gbps
  Total shared bandwidth is 12.8 Gbps
  Allocated dedicated bandwidth is 0.0 Gbps
-----------------------------------------------------------------------
Interfaces in the Port-Group        B2B Credit  Bandwidth  Rate Mode
                                      Buffers     (Gbps)
-----------------------------------------------------------------------
fc7/1                                   32          4.0    shared
fc7/2                                   32          4.0    shared
fc7/3                                   32          4.0    shared
fc7/4                                   32          4.0    shared
fc7/5                                   32          4.0    shared
fc7/6                                   32          4.0    shared
fc7/7                                   32          4.0    shared
fc7/8                                   32          4.0    shared
fc7/9                                   32          4.0    shared
fc7/10                                  32          4.0    shared
fc7/11                                  32          4.0    shared
fc7/12                                  32          4.0    shared

Port-Group 2
 Total bandwidth is 12.8 Gbps
 Total shared bandwidth is 12.8 Gbps
 Allocated dedicated bandwidth is 0.0 Gbps
-----------------------------------------------------------------------
Interfaces in the Port-Group        B2B Credit  Bandwidth  Rate Mode
                                      Buffers     (Gbps)
-----------------------------------------------------------------------
```

```
fc7/13                                    32      4.0   shared
fc7/14                                    32      4.0   shared
fc7/15                                    32      4.0   shared
fc7/16                                    32      4.0   shared
fc7/17                                    32      4.0   shared
fc7/18                                    32      4.0   shared
fc7/19                                    32      4.0   shared
fc7/20                                    32      4.0   shared
fc7/21                                    32      4.0   shared
fc7/22                                    32      4.0   shared
fc7/23                                    32      4.0   shared
fc7/24                                    32      4.0   shared

Port-Group 3
 Total bandwidth is 12.8 Gbps
 Total shared bandwidth is 12.8 Gbps
 Allocated dedicated bandwidth is 0.0 Gbps
 -------------------------------------------------------------------
 Interfaces in the Port-Group       B2B Credit  Bandwidth  Rate Mode
                                       Buffers    (Gbps)
 -------------------------------------------------------------------
 fc7/25                                    32      4.0   shared
 fc7/26                                    32      4.0   shared
 fc7/27                                    32      4.0   shared
 fc7/28                                    32      4.0   shared
 fc7/29                                    32      4.0   shared
 fc7/30                                    32      4.0   shared
 fc7/31                                    32      4.0   shared
 fc7/32                                    32      4.0   shared
 fc7/33                                    32      4.0   shared
 fc7/34                                    32      4.0   shared
 fc7/35                                    32      4.0   shared
 fc7/36                                    32      4.0   shared

Port-Group 4
 Total bandwidth is 12.8 Gbps
 Total shared bandwidth is 12.8 Gbps
 Allocated dedicated bandwidth is 0.0 Gbps
 -------------------------------------------------------------------
 Interfaces in the Port-Group       B2B Credit  Bandwidth  Rate Mode
                                       Buffers    (Gbps)
 -------------------------------------------------------------------
 fc7/37                                    32      4.0   shared
 fc7/38                                    32      4.0   shared
 fc7/39                                    32      4.0   shared
 fc7/40                                    32      4.0   shared
 fc7/41                                    32      4.0   shared
 fc7/42                                    32      4.0   shared
 fc7/43                                    32      4.0   shared
 fc7/44                                    32      4.0   shared
 fc7/45                                    32      4.0   shared
 fc7/46                                    32      4.0   shared
 fc7/47                                    32      4.0   shared
 fc7/48                                    32      4.0   shared
```

Configuring Local Switching

Note   We recommend that you shut down all of the ports on the module before you execute the local switching command.

If local switching is enabled, then ports cannot be configured in dedicated mode.

If there are dedicated ports and you enter the local switching command, a warning is displayed and the operation is prevented.

Detailed Steps

To enable or disable local switching module, follow these steps:

	Command	Purpose
Step 1	switch# **config t** switch(config)#	Enters configuration mode.
Step 2	switch(config)# **local-switching module 5**	Enables local switching for a module. If you want to proceed with enabling local switching, when prompted press **Y** to continue or **N** to exit.
Step 3	switch(config)# **no local-switching module 5**	Disables local switching for a module. If you want to proceed with disabling local switching, when prompted press **Y** to continue or **N** to exit.
Step 4	switch(config)# **exit**	Exits configuration mode.

Use the **show system internal xbar local-switching** command to verify the local switching configuration status on a module.

```
switch# show system internal xbar local-switching
-------------------------------------
| Slot | Local-switching enabled  |
-------------------------------------
|   1  |          no              |
|   2  |          no              |
|   3  |          no              |
|   4  |          no              |
|   5  |          yes             |
|   6  |          no              |
|   9  |          no              |
|  10  |          no              |
|  11  |          no              |
|  12  |          no              |
|  13  |          no              |
-------------------------------------
```

Disabling Restrictions on Oversubscription Ratios

Prerequisites

- Before disabling restrictions on oversubscription ratios, ensure that you have explicitly shut down shared ports.

Detailed Steps

To disable restrictions on oversubscription ratios on a 48-port or 24-port 4-Gbps, or any 8-Gbps Fibre Channel switching module, follow these steps:

	Command	Purpose
Step 1	`switch# config t` `switch(config)#`	Enters configuration mode.
Step 2	`switch(config)# no rate-mode oversubscription-limit module 1`	Disables restrictions on oversubscription ratios for a module. **Note** You must enter this command separately for each module for which you want to remove the restrictions.
Step 3	`switch(config)# exit`	Exits configuration mode.
Step 4	`switch# copy running-config startup-config`	Saves the new oversubscription ratio configuration to the startup configuration, and then the new configuration is enforced upon subsequent reboots of the module.

Use the **show running-config** command to view oversubscription ratios for a module. If oversubscription ratios are enabled, then no restriction appears in the output.

Example 1-1   Module with Restrictions on Oversubscription Ratios Disabled

```
switch# show running-config
version 3.1(1)
...
no rate-mode oversubscription-limit module 2
interface fc2/1
  switchport speed 2000
interface fc2/1
...
```

Examples

To disable restrictions on oversubscription ratios for ports on a 48-port Generation 2 switch that is configured with both shared and dedicated ports, follow these steps:

Step 1   To disable restrictions on oversubscription ratios, you must shut down any shared ports. Use the **show port-resources** command to view the configuration on a module and to identify shared ports.

```
switch# show port-resources module 2
Module 2
Available dedicated buffers are 4656
```

```
Port-Group 1
 Total bandwidth is 12.8 Gbps
 Total shared bandwidth is 12.8 Gbps
 Allocated dedicated bandwidth is 0.0 Gbps
 ------------------------------------------------------------------------
 Interfaces in the Port-Group      B2B Credit  Bandwidth  Rate Mode
                                     Buffers     (Gbps)
 ------------------------------------------------------------------------
 fc2/1                                  16        4.0     shared
 fc2/2                                  16        4.0     shared
 fc2/3                                  16        4.0     dedicated
 fc2/4                                  16        4.0     shared
 fc2/5                                  16        4.0     shared
 fc2/6                                  16        4.0     dedicated
 fc2/7                                  16        4.0     dedicated
 fc2/8                                  16        4.0     shared
 fc2/9                                  16        4.0     shared
 fc2/10                                 16        4.0     shared
 fc2/11                                 16        4.0     shared
 fc2/12                                 16        4.0     shared
 ...

 Port-Group 4
 Total bandwidth is 12.8 Gbps
 Total shared bandwidth is 12.8 Gbps
 Allocated dedicated bandwidth is 0.0 Gbps
 ------------------------------------------------------------------------
 Interfaces in the Port-Group      B2B Credit  Bandwidth  Rate Mode
                                     Buffers     (Gbps)
 ------------------------------------------------------------------------
 fc2/37                                 16        4.0     shared
 fc2/38                                 16        4.0     shared
 fc2/39                                 16        4.0     dedicated
 fc2/40                                 16        4.0     dedicated
 fc2/41                                 16        4.0     dedicated
 fc2/42                                 16        4.0     shared
 fc2/43                                 16        4.0     shared
 fc2/44                                 16        4.0     shared
 fc2/45                                 16        4.0     shared
 fc2/46                                 16        4.0     shared
 fc2/47                                 16        4.0     shared
 fc2/48                                 16        4.0     shared
```

Step 2   Shut down all shared ports for which you want to remove restrictions on oversubscription ratios.

```
switch (config)# interface fc2/1-2, fc2/4-5, fc2/8-38, fc2/43-48
switch (config-if)# shutdown
```

Step 3   Display the interface status to confirm the shutdown of all shared ports.

```
switch(config-if)# end
switch# show interface brief
```

```
-------------------------------------------------------------------------------
Interface  Vsan   Admin   Admin   Status      SFP     Oper   Oper    Port
                  Mode    Trunk                        Mode   Speed   Channel
                          Mode                                (Gbps)
-------------------------------------------------------------------------------
fc2/1       1     FX      --      down        swl     --             --
fc2/2       1     FX      --      down        swl     --             --
fc2/3       1     T       --      up          swl     --             --
fc2/4       1     FX      --      down        swl     --             --
fc2/5       1     FX      --      down        swl     --             --
fc2/6       1     TE      --      up          swl     --             --
```

```
fc2/7     1     TE     --     up       swl     --       --
fc2/8     1     FX     --     down     swl     --       --
...
fc2/48    1     FX     --     down     sw1     --       --
```

Step 4   Disable restrictions on oversubscription ratios for the ports.

```
switch# config t
Enter configuration commands, one per line.  End with CNTL/Z.
switch(config)# no rate-mode oversubscription-limit module 2
```

Step 5   Bring up the ports that you shut down in step 2, and display their status to confirm that they are no longer shut down.

```
switch(config)# interface fc2/1-2, fc2/4-5, fc2/8-38, fc2/43-48
switch(config-if)# no shutdown
switch(config-if)# end
switch# show interface brief
```

```
-------------------------------------------------------------------------------
Interface  Vsan   Admin   Admin   Status     SFP     Oper   Oper    Port
                  Mode    Trunk                       Mode   Speed   Channel
                          Mode                                (Gbps)
-------------------------------------------------------------------------------
fc2/1      1      FX      --      up         swl     --              --
fc2/2      1      FX      --      up         swl     --              --
fc2/3      1      T       --      up         swl     --              --
fc2/4      1      FX      --      up         swl     --              --
fc2/5      1      FX      --      up         swl     --              --
fc2/6      1      TE      --      up         swl     --              --
fc2/7      1      TE      --      up         swl     --              --
fc2/8      1      FX      --      up         swl     --              --
...
fc2/48     1      FX      --      up         sw1     --              --
```

Step 6   Confirm that the ports are now operating with no restrictions on oversubscription ratios.

```
switch# show running-config | include oversubscription-limit
no rate-mode oversubscription-limit module 2 <---indicates no restrictions on
                                                 oversubscription ratios
```

Step 7   Save the new oversubscription ratio configuration to the startup configuration.

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

Enabling Restrictions on Oversubscription Ratios

Prerequisites

- You must enable restrictions on oversubscription ratios before you can downgrade modules to a previous release.
- Before enabling restrictions on oversubscription ratios, ensure that you have explicitly configured shared ports to out-of-service mode.

Detailed Steps

To enable restrictions on oversubscription ratios on a 48-port or 24-port 4-Gbps, or any 8-Gbps Fibre Channel switching module, follow these steps:

	Command	Purpose
Step 1	switch# **config t** switch(config)#	Enters configuration mode.
Step 2	switch(config)# **interface fc2/1-2, fc2/4-5, fc2/8-38, fc2/43-48**	Specifies the port interfaces for which you want to enable restrictions on oversubscription ratios.
Step 3	switch(config-if)# **shutdown**	Shuts down shared ports.
Step 4	switch(config-if)# **out-of-service**	Takes shared ports out of service.
Step 5	switch# **rate-mode oversubscription-limit module 1**	Enables restrictions on oversubscription ratios for the module. **Note** You must enter this command separately for each module for which you want to add the restriction.
	switch# **config t** switch(config)# **interface fc2/1-2, fc2/4-5, fc2/8-38, fc2/43-48** switch(config-if)# **no out-of-service** switch(config-if)# **no shutdown**	Returns all shared ports to service.
Step 6	switch(config)# **exit**	Exits configuration mode.
Step 7	switch# **copy running-config startup-config**	Saves the new oversubscription ratio configuration to the startup configuration, and then the new configuration is enforced upon subsequent reboots of the module.

Enabling Bandwidth Fairness

Detailed Steps

To enable bandwidth fairness on a switching module, follow these steps:

	Command	Purpose
Step 1	switch# **config t** switch(config)#	Enters configuration mode.
Step 2	switch(config)# **rate-mode bandwidth-fairness module 1**	Enables bandwidth fairness for a module. **Note** You must enter this command separately for each module for which you want to enable bandwidth fairness. You must reload the module for the command to take effect.
Step 3	switch(config)# **exit**	Exits configuration mode.

Disabling Bandwidth Fairness

Restrictions

- If you disable bandwidth fairness, up to a 20 percent increase in internal bandwidth allocation is possible for each port group; however, bandwidth fairness is not guaranteed when there is a mix of shared and full-rate ports in the same port group.

Detailed Steps

To disable bandwidth fairness on a switching module, follow these steps:

	Command	Purpose
Step 1	switch# **config t** switch(config)#	Enters configuration mode.
Step 2	switch(config)# **no rate-mode bandwidth-fairness module 1**	Disables bandwidth fairness for a module. **Note** You must enter this command separately for each module for which you want to disable bandwidth fairness. You must reload the module for the command to take effect.
Step 3	switch(config)# **exit**	Exits configuration mode.

Taking Interfaces Out of Service

You can take interfaces out of service on Generation 2 and Generation 3 switching modules. When an interface is out of service, all the shared resources for the interface are released as well as the configuration associated with those resources.

Prerequisites

- The interface must be disabled using a **shutdown** command before it can be taken out of service.

Restrictions

- The interface cannot be a member of a PortChannel.

- Taking interfaces out of service releases all the shared resources to ensure that they are available to other interfaces. This causes the configuration in the shared resources to revert to default when the interface is brought back into service. Also, an interface cannot come back into service unless the default shared resources for the port are available. The operation to free up shared resources from another port is disruptive.

Detailed Steps

To take an interface out of service, follow these steps:

	Command	Purpose
Step 1	switch# **config t** switch(config)#	Enters configuration mode.
Step 2	switch(config)# **interface fc 1/1** switch(config-if)#	Selects the interface and enters interface configuration submode.

	Command	Purpose
Step 3	`switch(config-if)# no channel-group`	Removes the interface from a PortChannel.
Step 4	`switch(config-if)# shutdown`	Disables the interface.

Step 5	`switch(config-if)# out-of-service`
	`Putting an interface into out-of-service will`
	`cause its shared resource configuration to`
	`revert to default`
	`Do you wish to continue (y/n)? [n] y`
		Takes the interface out of service.

Use the **show port-resources module** command to verify the out-of-service configuration for interfaces on a Generation 2 and Generation 3 switching module.

This example shows a 24-port 4-Gbps module:

```
switch# show port-resources module 9
Module 9
Available dedicated buffers are 5429

 Port-Group 1
  Total bandwidth is 12.8 Gbps
  Total shared bandwidth is 12.8 Gbps
  Allocated dedicated bandwidth is 0.0 Gbps
  --------------------------------------------------------------------
  Interfaces in the Port-Group        B2B Credit  Bandwidth  Rate Mode
                                        Buffers     (Gbps)
  --------------------------------------------------------------------
  fc9/1                                   16         4.0   shared
  fc9/2 (out-of-service)
  fc9/3                                   16         4.0   shared
  fc9/4                                   16         4.0   shared
  fc9/5                                   16         4.0   shared
  fc9/6                                   16         4.0   shared
...
```

Releasing Shared Resources in a Port Group

When you want to reconfigure the interfaces in a port group on a Generation 2 or Generation 3 module, you can return the port group to the default configuration to avoid problems with allocating shared resources.

Restrictions

- The interface cannot be a member of a PortChannel.

- Releasing shared resources disrupts traffic on the port. Traffic on other ports in the port group is not affected.

Detailed Steps

To release the shared resources for a port group, follow these steps:

	Command	Purpose
Step 1	switch# **config t** switch(config)#	Enters configuration mode.
Step 2	switch(config)# **interface fc 1/1** switch(config-if)#	Selects the interface and enters interface configuration submode. **Tip** You can use an interface range to release the resources for all interfaces in a port group.
Step 3	switch(config-if)# **no channel-group**	Removes the interface from a PortChannel.
Step 4	switch(config-if)# **shutdown**	Disables the interface.
Step 5	switch(config-if)# **out-of-service** Putting an interface into out-of-service will cause its shared resource configuration to revert to default Do you wish to continue(y/n)? [n] **y**	Takes the interface out of service.
Step 6	switch(config-if)# **no out-of-service**	Makes the interface available for service. Repeat Step 2 through Step 6 for all the interfaces in the port group.

Disabling ACL Adjacency Sharing for System Image Downgrade

Fibre Channel ACL adjacency sharing is enabled by default on the switches with an active Generation 2 switching module as of Cisco MDS SAN-OS Release 3.0(3), and with an active Generation 3 module as of MDS NX-OS Release 4.1(1). Fibre Channel ACL adjacency sharing improves the performance for zoning and inter-VSAN routing (IVR) network address translation (NAT). To prevent disruptions when downgrading the system image on your switch to a release prior to Cisco SAN-OS Release 3.0(3), enter the following command in EXEC mode:

switch# **system no acl-adjacency-sharing**

To reenable Fibre Channel ACL adjacency sharing on your switch, enter the following command in EXEC mode:

switch# **system acl-adjacency-sharing**

Verifying Fibre Channel Interfaces Configuration

To display Fibre Channel interface configuration information, perform one of the following tasks:

Command	Purpose
show module	Displays the module.
show module *slot* **recovery-steps**	Displays the slot for the module.
show port-resources module *slot*	Displays the port resources for the slot.

Command	Purpose
show interface fc *slot/port*	Displays the slot or port information.
show interface brief	Displays the interface.
show port index-allocation	Displays the port in the index allocation.
show port index-allocation startup	Displays the startup port in the index allocation.
show port-channel compatibility parameters	Displays the PortChannel compatibility parameters.
show module *slot* **bandwidth-fairness**	Displays the module slot bandwidth fairness information.

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

Displaying Interface Capabilities

Before configuring a Generation 2 or Generation 3 interface, you can use the **show interface capabilities** command to display detailed information about the capabilities of the interface.

This example shows the capabilities of a Generation 2 Fibre Channel interface:

```
switch# show interface fc 9/1 capabilities
 Min Speed is 1 Gbps
 Max Speed is 4 Gbps
 FC-PH Version (high, low)                    (0,6)
 Receive data field size (max/min)            (2112/256) bytes
 Transmit data field size (max/min)           (2112/128)  bytes
 Classes of Service supported are             Class 2, Class 3, Class F
 Class 2 sequential delivery                  supported
 Class 3 sequential delivery                  supported
 Hold time (max/min)                          (100/1) micro sec
 BB state change notification                 supported
 Maximum BB state change notifications        14
 Rate Mode change                             supported

 Rate Mode Capabilities                       Shared       Dedicated
  Receive BB Credit modification supported      yes            yes
  FX mode Receive BB Credit (min/max/default)  (1/16/16)    (1/250/16)
  ISL mode Receive BB Credit (min/max/default)   --         (2/250/250)
  Performance buffer modification supported      no             no

 Out of Service capable                       yes
 Beacon mode configurable                     yes
```

This example shows the capabilities of an interface on the 48-port 8-Gbps Fibre Channel switching module:

```
switch# show interface fc 4/1 capabilities
 Min Speed is 1 Gbps
 Max Speed is 8 Gbps
 FC-PH Version (high, low)                    (0,6)
 Receive data field size (max/min)            (2112/256) bytes
 Transmit data field size (max/min)           (2112/128) bytes
 Classes of Service supported are             Class 2, Class 3, Class F
 Class 2 sequential delivery                  supported
 Class 3 sequential delivery                  supported
 Hold time (max/min)                          (100000/1) micro sec
```

```
BB state change notification                    supported
Maximum BB state change notifications           14
Rate Mode change                                supported

Rate Mode Capabilities                          Shared       Dedicated
 Receive BB Credit modification supported         yes           yes
 FX mode Receive BB Credit (min/max/default)    (1/32/32)    (1/500/32)
 ISL mode Receive BB Credit (min/max/default)      --       (2/500/250)
 Performance buffer modification supported         no            no

Out of Service capable                            yes
Beacon mode configurable                          yes
Extended B2B credit capable                       yes
```

Displaying SFP Diagnostic Information

You can use the **show interface transceiver** command to display small form-factor pluggable (SFP) diagnostic information for Generation 2 switching modules.

```
switch# show interface transceiver
...
fc12/12 sfp is present
    name is CISCO-FINISAR
    part number is FTRJ-8519-7D2CS1
    revision is A
    serial number is H11TVQB
    fc-transmitter type is short wave laser w/o OFC (SN)
    fc-transmitter supports intermediate distance link length
    media type is multi-mode, 62.5m (M6)
    Supported speed is 200 MBytes/sec
    Nominal bit rate is 2100 MBits/sec
    Link length supported for 50/125mm fiber is 300 m(s)
    Link length supported for 62.5/125mm fiber is 150 m(s)
    cisco extended id is unknown (0x0)

    no tx fault, rx loss, no sync exists, Diag mon type 104
    SFP Diagnostics Information
        Temperature     :  24.33 Celsius
        Voltage         :   3.33 Volt
        Current         :   0.04 mA        --
        Optical Tx Power :  N/A   dBm       --
        Optical Rx Power :  N/A   dBm       -
    Note: ++  high-alarm; +  high-warning; --  low-alarm; -  low-warning
...
```

Configuration Examples for Fibre Channel Interfaces

This section describes example configurations and includes the following sections:

Configuration Example for 48-Port 8-Gbps Module Interfaces

These steps describe how to configure the 48-port 8-Gbps module interfaces:

Step 1 Select the interfaces fc 4/1 through fc 4/2.

```
switch# config t
switch(config)# interface fc 4/1 - 2
```

Step 2 Configure the port speed, rate mode, and port mode on the interfaces.

```
switch(config-if)# switchport speed 8000
switch(config-if)# switchport rate-mode shared
switch(config-if)# switchport mode f
```

Step 3 Enable the interfaces and return to configuration mode.

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

Step 4 Select the interfaces fc 4/3 through fc 4/4.

```
switch# config t
switch(config)# interface fc 4/3 - 4
```

Step 5 Configure the port speed, rate mode, and port mode on the interfaces.

```
switch(config-if)# switchport speed auto max 4000
switch(config-if)# switchport rate-mode dedicated
switch(config-if)# switchport mode f
```

Step 6 Enable the interfaces and return to configuration mode.

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

Step 7 Select the interfaces fc 4/5 through fc 4/6.

```
switch# config t
switch(config)# interface fc 4/5 - 6
```

Step 8 Configure the port speed, rate mode, and port mode on the interfaces.

```
switch(config-if)# switchport speed auto max 4000
switch(config-if)# switchport rate-mode shared
switch(config-if)# switchport mode f
```

Step 9 Enable the interfaces and return to configuration mode.

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

Configuration Example for 24-Port 8-Gbps Module Interfaces

These steps describe how to configure the 24-port 8-Gbps module interfaces:

Step 1   Select interfaces fc 3/1.

```
switch# config t
switch(config)# interface fc 3/1
```

Step 2   Configure the port speed, rate mode, and port mode on the interfaces.

```
switch(config-if)# switchport speed 8000
switch(config-if)# switchport rate-mode dedicated
switch(config-if)# switchport mode f
```

Step 3   Enable the interfaces and return to configuration mode.

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

Step 4   Select the interfaces fc 3/2 through fc 3/3.

```
switch# config t
switch(config)# interface fc 3/2 - 3
```

Step 5   Configure the port speed, rate mode, and port mode on the interfaces.

```
switch(config-if)# switchport speed 8000
switch(config-if)# switchport rate-mode shared
switch(config-if)# switchport mode f
```

Step 6   Enable the interfaces and return to configuration mode.

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

Configuration Example for 4/44-Port 8-Gbps Module Interfaces

These steps describe how to configure the 4/44-port 8-Gbps module interfaces:

Step 1   Select interfaces fc 4/11 through fc 4/12.

```
switch# config t
switch(config)# interface fc 4/11 - 12
```

Step 2   Disable the interfaces and take them out of service.

```
switch(config-if)# shutdown
switch(config-if)# out-of-service
```

Step 3   Return to configuration mode.

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

Step 4   Select the interfaces fc 4/1.

```
switch# config t
switch(config)# interface fc 4/1
```

Step 5   Configure the port speed, rate mode, and port mode on the interfaces.

```
switch(config-if)# switchport speed 8000
```

```
switch(config-if)# switchport rate-mode shared
switch(config-if)# switchport mode f
```

Step 6   Enable the interfaces and return to configuration mode.

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

Step 7   Select the interfaces fc 4/2 through fc 4/10.

```
switch# config t
switch(config)# interface fc 4/2 - 10
```

Step 8   Configure the port speed, rate mode, and port mode on the interfaces.

```
switch(config-if)# switchport speed auto max 4000
switch(config-if)# switchport rate-mode shared
switch(config-if)# switchport mode f
```

Step 9   Enable the interfaces and return to configuration mode.

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

Configuration Example for 48-Port 4-Gbps Module Interfaces

These steps describe how to configure the example shown in :

Step 1   Select interfaces fc 4/11 through fc 4/12.

```
switch# config t
switch(config)# interface fc 4/11 - 12
```

Step 2   Disable the interfaces and take them out of service.

```
switch(config-if)# shutdown
switch(config-if)# out-of-service
```

Step 3   Return to configuration mode.

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

Step 4   Select the interfaces fc 4/1 through fc 4/6.

```
switch# config t
switch(config)# interface fc 4/1 - 6
```

Step 5   Configure the port speed, rate mode, and port mode on the interfaces.

```
switch(config-if)# switchport speed auto max 2000
switch(config-if)# switchport rate-mode dedicated
switch(config-if)# switchport mode e
```

Step 6   Enable the interfaces and return to configuration mode.

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

Step 7   Select the interfaces fc 4/7 through fc 4/10.

```
switch# config t
switch(config)# interface fc 4/7 - 10
```

Step 8   Configure the port speed, rate mode, and port mode on the interfaces.

```
switch(config-if)# switchport speed 1000
switch(config-if)# switchport rate-mode shared
switch(config-if)# switchport mode f
```

Step 9   Enable the interfaces and return to configuration mode.

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

Configuration Example for 24-Port 4-Gbps Module Interfaces

These steps describe how to configure the example shown in :

Step 1   Select interfaces fc 3/1 through fc 3/3.

```
switch# config t
switch(config)# interface fc 3/1 - 3
```

Step 2   Configure the port speed, rate mode, and port mode on the interfaces.

```
switch(config-if)# switchport speed 4000
switch(config-if)# switchport rate-mode dedicated
switch(config-if)# switchport mode e
```

Step 3   Enable the interfaces and return to configuration mode.

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

Step 4   Select the interfaces fc 3/4 through fc 3/6.

```
switch# config t
switch(config)# interface fc 3/4 - 6
```

Step 5   Configure the port speed, rate mode, and port mode on the interfaces.

```
switch(config-if)# switchport speed 1000
switch(config-if)# switchport rate-mode shared
switch(config-if)# switchport mode f
```

Step 6   Enable the interfaces and return to configuration mode.

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

Send documentation comments to mdsfeedback-doc@cisco.com