



Configuration of Fibre Channel Interfaces

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Configuration of Fibre Channel Interfaces

This chapter describes how to configure the Fibre Channel interfaces.

This chapter includes the following topics:

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 6.x or higher is required to support the Generation 4 modules.

[Table 1: Fibre Channel Modules and Fabric Switches, on page 2](#) identifies the Generation 2, Generation 3, and Generation 4 modules, as well as the Fabric switches.

Table 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.

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 2: Bandwidth and Port Groups for the Fibre Channel Modules and Fabric Switches, on page 3 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 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				

Part Number	Product Name/ Description	Number of Ports Per Port Group	Bandwidth Per Port Group (Gbps)	Maximum Bandwidth Per Port (Gbps)
DS-X9248-256K9	48-port 8-Gbps Advanced Fibre Channel switching module.	6	32.4 or 12.8	8 or 10 Gbps—depending on the configuration
DS-X9232-256K9	32-port 8-Gbps Advanced Fibre Channel switching module.	4	32.4 ³ or 12.8 ⁴	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 ⁵
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				
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

Part Number	Product Name/ Description	Number of Ports Per Port Group	Bandwidth Per Port Group (Gbps)	Maximum Bandwidth Per Port (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 [Footnote.](#)
- ⁴ [Footnote.](#)
- ⁵ 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:



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 3: Port Rate Mode Support on Generation 2, Generation 3, and Generation 4 Modules and Switches](#) shows the modules that support dedicated, shared, and the default rate modes.

Table 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	Auto, Shared

Part Number	Product Name/Description	Supports Dedicated Rate Mode	Supports Shared Rate Mode	Default Speed Mode and Rate Mode on All Ports
DS-X9232-256K9	32-port 8-Gbps Advanced Fibre Channel switching module	Yes	Yes ⁷	Auto, Shared
Generation 3 Modules				
DS-X9248-96K9	48-Port 8-Gbps Fibre Channel switching module	Yes	Yes	Auto, Shared
DS-X9224-96K9	24-Port 8-Gbps Fibre Channel switching module	Yes	Yes ⁹	Auto, Shared
DS-X9248-48K9	4/44-Port 8-Gbps Host-Optimized Fibre Channel switching module	Yes	Yes ¹⁰	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 ¹¹	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				
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 ¹²	Yes	No	Auto, Dedicated

Part Number	Product Name/Description	Supports Dedicated Rate Mode	Supports Shared Rate Mode	Default Speed Mode and Rate Mode on All Ports
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

⁶ Supports shared rate mode.

⁷ [Footnote.](#)

⁸ Shared rate mode is supported on Fx ports only and no ISLs.

⁹ [Footnote.](#)

¹⁰ [Footnote.](#)

¹¹ 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.

¹² 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 60-2).

[Table 4: Bandwidth Reserved for the Port Speeds on Generation 4 Switching Modules](#), on page 7 shows the bandwidth provided by the various port speed configurations on the 8-Gbps Advanced Fibre Channel switching modules.

Table 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	
Auto with 2-Gbps maximum	2 Gbps
2-Gbps	
1-Gbps	1 Gbps

Table 5: Bandwidth Reserved for the Port Speeds on Generation 3 Switching Modules , on page 8 shows the bandwidth provided by the various port speed configurations on the 8-Gbps Fibre Channel switching modules.

Table 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 6: Bandwidth Reserved for the Port Speeds on Generation 2 Switching Modules , on page 8 shows the amount of bandwidth reserved for a configured port speed on 4-Gbps switching modules.

Table 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 of 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 7: [Dedicated Rate Mode Bandwidth Reservation for Generation 4 Fibre Channel Modules](#), on page 9 shows the maximum possible dedicated rate mode configuration scenarios for the Generation 4 Fibre Channel modules.

Table 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 8: [Dedicated Rate Mode Bandwidth Reservation for Generation 3 Fibre Channel Modules](#), on page 9 shows the maximum possible dedicated rate mode configuration scenarios for the Generation 3 Fibre Channel modules.

Table 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	

Part Number	Product Name/ Description	Dedicated Bandwidth per Port	Maximum Allowed Ports That Can Come Up	Ports in Shared Mode
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 guaranteed for the shared ports. 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.

Bandwidth Reservation: 48-Port 96-Gbps Fibre Channel Module

RateMode Configuration Macro	Description
Dedicated 4 Gbps on the first port of each group and the remaining ports 8 Gbps shared	Allocates a rate mode of 4 Gbps on the first port of each group and the remaining ports share 8 Gbps depending on the operational speed of the ports.
Dedicated 8 Gbps on the first port of each group and the remaining ports 8 Gbps shared	Allocates a rate mode of 8 Gbps on the first port of each group and the remaining ports share 8 Gbps depending on the operational speed of the ports.
Shared 8 Gbps on all ports (initial and default settings)	Allocates a rate mode of 8 Gbps on all the available ports. This is the default setting.

Bandwidth Reservation: 48-Port 48-Gbps Fibre Channel Module

RateMode Configuration Macro	Description
Dedicated 2 Gbps on the first port of each group and the remaining ports 4 Gbps shared	Allocates a rate mode of 2 Gbps on the first port of each group and the remaining ports share 4 Gbps depending on the operational speed of the ports.
Dedicated 8 Gbps on the first port of each group and the remaining ports 4 Gbps shared	Allocates a rate mode of 8 Gbps on the first port of each group and the remaining ports share 4 Gbps depending on the operational speed of the ports.
Shared auto with maximum of 4 Gbps on all ports (initial and default settings)	Allocates a maximum rate mode of 4 Gbps on all the available ports. This is the default setting.

Bandwidth Reservation: 24-Port 48-Gbps Fibre Channel Module

RateMode Configuration Macro	Description
Dedicated 8 Gbps on the first port of each group and the remaining ports 8 Gbps shared	Allocates a rate mode of 8Gbps on the first port of each group and the remaining ports share 8 Gbps depending on the operational speed of the ports.
Shared Auto on all ports (initial and default settings)	Allocates a rate mode of 8 Gbps on all the available ports. This is the default setting.

Bandwidth Reservation: 48-Port 256-Gbps Advanced Fibre Channel Module

RateMode Configuration Macro	Description
Dedicated 8 Gbps on the first 4 ports in each 6-port port group and the remaining ports 8 Gbps shared	Allocates a rate mode of 8 Gbps on the first 4 ports in each 6-port port group and the remaining ports share 8 Gbps depending on the operational speed of the ports.
Dedicated 8 Gbps on the first port of each group and the remaining ports 8 Gbps shared	Allocates a rate mode of 8 Gbps on the first port of each group and the remaining ports share 8 Gbps depending on the operational speed of the ports.
Shared 8 Gbps on all ports	Allocates a rate mode of 8 Gbps on all the available ports. This is the default setting.
Dedicated 4 Gbps on all ports	Allocates a rate mode of 4 Gbps on all the available ports.
Dedicated 10 Gbps on following ports: <ul style="list-style-type: none"> • 4, 5, 6, 7, 8, 10 (ports 1,2, 3, 9, 11, 12 disabled) • 16, 17, 18, 19, 20, 22 (ports 13, 14, 15, 21, 23, 24 disabled) • 28, 29, 30, 31, 32, 34 (ports 25, 26, 27, 33, 35, 36 disabled) • 40, 41, 42, 43, 44, 46 (ports 37, 38, 39, 45, 47, 48 disabled) 	Allocates a rate mode of 10 Gbps on all the available ports.

Bandwidth Reservation: 32-Port 256-Gbps Advanced Fibre Channel Module

RateMode Configuration Macro	Description
Dedicated 8 Gbps on all ports—initial and default settings	Allocates a rate mode of 8 Gbps on all the available ports.
Shared 8 Gbps on all ports—initial and default settings	Allocates a rate mode of shared 8 Gbps on all the available ports.

RateMode Configuration Macro	Description
Dedicated 10 Gbps on following ports: <ul style="list-style-type: none"> • 2, 3, 4, 5, 6, 8 (ports 1 and 7 disabled) • 10, 11, 12, 13, 14, 16 (ports 9 and 15 disabled) • 18, 19, 20, 21, 22, 24 (ports 17 and 23 disabled) • 26, 27, 28, 29, 30, 32 (ports 25 and 31 disabled) 	Allocates a rate mode of 10Gbps on the following ports.

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 9: Bandwidth Allocation for Oversubscribed Interfaces, on page 13](#) describes the bandwidth allocation for oversubscribed interfaces configured in shared mode on the 4-Gbps and 8-Gbps modules.

Table 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

Switching Module	Configured Speed	Reserved Bandwidth (Gbps)		Maximum Bandwidth (Gbps)
		Ratios enabled	Ratios disabled	
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
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 Buffers	Bandwidth (Gbps)	Rate Mode
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 Buffers	Bandwidth (Gbps)	Rate Mode
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 Buffers	Bandwidth (Gbps)	Rate Mode
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 Buffers	Bandwidth (Gbps)	Rate Mode
fc5/29	32	8.0	shared
fc5/30	32	8.0	shared
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 Buffers	Bandwidth (Gbps)	Rate Mode
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 6.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 10: Port Index Requirements for Generation 1 Modules](#), on page 21 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 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.

When a module does not power up because of a resource limitation, you can see the reason by viewing the module information in the Information pane.

```
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 |
 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 Generation 1, 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 11: PortChannel Configuration and Addition Results](#), on page 24 describes the results of adding a member to a PortChannel for various configurations.

Table 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 ¹³
	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
				Force	Pass or fail
	Auto max 2000	Auto	Generation 2 or Generation 3	Normal	Fail
				Force	Pass or fail
Auto max 4000	Auto	Generation 1 or Generation 2			
Auto max 4000	Auto	Generation 3			

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	

¹³ If resources are not available.

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

Default Settings

Table 12: Default Generation 2 Interface Parameters , on page 26 lists the default settings for Generation 2 interface parameters.

Table 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 ¹⁴	auto	auto	auto ¹⁵
Rate mode	shared	shared	dedicated	dedicated
Port mode	Fx	Fx	auto ¹⁶	auto ¹⁷
BB_credit buffers	16	16	250	250
Performance buffers	–	–	145 ¹⁸	1455

¹⁴ Auto speed mode on the 4-Gbps switching modules enables autosensing and negotiates to a maximum speed of 4 Gbps.

¹⁵ The 4-port 10-Gbps switching module only supports 10-Gbps traffic.

¹⁶ 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.

¹⁷ 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.

¹⁸ Performance buffers are shared among all ports on the module.

Table 13: Default Generation 3 Interface Parameters, on page 26 lists the default settings for Generation 3 interface parameters.

Table 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 ¹⁹	auto	auto	auto_max_4G ²⁰
Rate mode	shared	shared	shared
Port mode	Fx	Fx	Fx
BB_credit buffers	32	32	32

¹⁹ Auto speed mode on the 8-Gbps switching modules enables autosensing and negotiates to a maximum speed of 8 Gbps.

²⁰ Auto_max_4G speed mode on the 4/44-port 8-Gbps switching module negotiates to a maximum speed of 4 Gbps.

Table 14: Default Generation 4 Interface Parameters , on page 27 lists the default settings for Generation 4 interface parameters.

Table 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 ²¹	auto
Rate mode	shared	shared
Port mode	Fx	Fx
BB_credit buffers	32	32

²¹ Auto speed mode on the 8-Gbps switching modules enables autosensing and negotiates to a maximum speed of 8 Gbps.

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:

Procedure

- Step 1** Take unused interfaces out of service to release resources for other interfaces, if necessary.
See the [Taking Interfaces Out of Service, on page 35](#).
- 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 [Dynamic Bandwidth Management, on page 10](#).
- Step 3** Configure the rate mode (dedicated or shared).
See the [Configuring Rate Mode, on page 31](#).
- Step 4** Configure the port mode.
See the Configuring Interface Modes section.
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 and the Configuring Extended BB_credits section.
-

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:

Procedure

- Step 1** Take unused interfaces out of service to release resources for other interfaces, if necessary.
See the [Taking Interfaces Out of Service, on page 35](#).
- Step 2** Configure the BB_credits and extended BB_credits, as necessary.
See the *Configuring Buffer-to-Buffer Credits* section, and the *Extended BB_credits on Generation 1 Switching Modules* section.
- Step 3** Configure the port mode.
See the *Configuring Interface Modes* section.
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, on page 31](#).
- 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 [Dynamic Bandwidth Management, on page 10](#).

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:

Procedure

- 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 [Dynamic Bandwidth Management, on page 10](#).
- Step 2** Configure the port mode.
See the *Configuring Interface Modes* section.
- Step 3** Configure the BB_credits, performance buffers, and extended BB_credits, as necessary.
See the *Configuring Buffer-to-Buffer Credits* section, and the *Configuring Extended BB_credits* section.
-

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:

Procedure

- Step 1** Configure the port mode.
See the *Configuring Interface Modes* section.

- Step 2** Configure the BB_credits, performance buffers, and extended BB_credits, as necessary.
See the *Configuring Buffer-to-Buffer Credits* section, and the *Configuring Extended BB_credits* section.

Reserving Bandwidth Quickly for the 8-Gbps Module Interfaces

Detailed Steps

To quickly reserve bandwidth for all the ports in the port groups on the Generation 3 Fibre Channel modules using the Device Manager, follow these steps:

Procedure

- Step 1** In the Device Manager window, right-click the 8-Gbps Fibre Channel module.

Figure 1: Device Manager - 8 Gbps Module - Pop-Up Menu

- Step 2** From the popup menu, select **Bandwidth Reservation Config...**

- Step 3** In the Bandwidth Reservation Configuration dialog box that is displayed, choose a bandwidth reservation scheme. ([Figure 2: RateMode Configuration Dialog Box, on page 30](#)).

Figure 2: RateMode Configuration Dialog Box

[Table 15: RateMode Configuration Schemes, on page 30](#) describes the default RateMode configuration schemes available in the Bandwidth Reservation Configuration dialog box for the 8-Gbps modules.

Table 15: RateMode Configuration Schemes

Module	Available RateMode Config Macros
DS-X9248-96K9 48-Port 8-Gbps Fibre Channel module	<ul style="list-style-type: none"> Dedicated 4 Gbps on the first port of each group and the remaining ports 8 Gbps shared Dedicated 8 Gbps on the first port of each group and the remaining ports 8 Gbps shared Shared 8 Gbps on all ports (initial and default settings)
DS-X9224-96K9 24-Port 8-Gbps Fibre Channel module	<ul style="list-style-type: none"> Dedicated 8 Gbps on the first port of each group and the remaining ports 8G shared Shared Auto²² on all ports (initial and default settings)
DS-X9248-48K9 4/44-Port 8-Gbps Host-Optimized Fibre Channel module	<ul style="list-style-type: none"> Dedicated 2 Gbps on the first port of each group and the remaining ports 4 Gbps shared Dedicated 8 Gbps on the first port of each group and the remaining ports 4 Gbps shared Shared Auto with Maximum of 4 Gbps on all ports (initial and default settings)

²² Auto is 8 Gbps.

- Step 4** Click **Apply**.
-

Configuring Port Speed

To configure dedicated bandwidth on an interface using DCNM-SAN, follow these steps:

Procedure

- Step 1** From the Fabric pane, select a switch or select a group of switches (SAN, fabric, VSAN) from the Logical Domains pane.
- Step 2** Expand **Switches**, expand **FC Interfaces** and select **Physical** from the Physical Attributes pane.
You see the **Physical > General** tab in the Interfaces pane.
- Step 3** Scroll until you see the row containing the switch and port you want to configure.
- Step 4** Select auto, 1Gb, 4Gb, or autoMax2G from the Speed Admin column.

Note The Generation 3, 8-Gbps Fibre Channel switching modules support the following speed configurations: 1G, 2G, 4G, 8G, autoMax2G, autoMax4G and the auto speed configuration configures autosensing for the interface with 8 Gbps of bandwidth reserved.

The auto parameter enables autosensing on the interface. The autoMax2G parameter enables autosensing on the interface with a maximum speed of 2 Gbps.

Note If you change the port bandwidth reservation parameters on a 48-port or 24-port 4-Gbps, or any 8-Gbps Fibre Channel switching module, the change affects only the changed port. No other ports in the port group are affected.

- Step 5** Click the **Apply Changes** icon.
-

Configuring Rate Mode

To configure the rate mode (dedicated or shared) on an interface on a 4-Gbps or 8-Gbps Fibre Channel switching module using DCNM-SAN, follow these steps:

Procedure

- Step 1** Select a switch from the Fabric pane, or select a group of switches (SAN, fabric, VSAN) from the Logical Domains pane.
- Step 2** Expand **Switches > FC Interfaces** and then select **Physical** from the Physical Attributes pane.
You see the **Physical > General** tab in the Interfaces pane.
- Step 3** Scroll until you see the row containing the switch and port you want to configure.
- Step 4** Select **dedicated** or **shared** from the Rate Mode column.
- Step 5** Click the **Apply Changes** icon.
-

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.

Configuring Local Switching Using DCNM-SAN

To enable or disable local switching module using DCNM-SAN, follow these steps:

Procedure

- Step 1** Choose **Switches > Hardware**.
 - Step 2** Click the **Module Config** tab. You see the Module Config dialog box.
 - Step 3** Select a module and from the LocalSwitchingMode drop-down list, select **enabled** or **disabled**. This step either enables or disables the local switching for the selected module.
 - Step 4** Click **Apply** to save the changes.
-

Configuring Local Switching Using Device Manager

To enable or disable local switching using Device Manager, follow these steps:

Procedure

- Step 1** Right-click a module and select **Configure**.
You see the Module dialog box. Click the **Config** tab.
 - Step 2** Click the **enabled** or **disabled** radio button to enable or disable local switching in the selected module.
 - Step 3** Click **Apply** to save the changes.
-

Disabling Restrictions on Oversubscription Ratios Using DCNM-SAN

To disable restrictions on oversubscription ratios on multiple 48-port or 24-port 4-Gbps, or any 8-Gbps Fibre Channel switching modules using DCNM-SAN, follow these steps:

Procedure

- Step 1** Choose **Switches > Hardware**.
- Step 2** Click the **Module Config** tab. You see the Module Config dialog box.

- Step 3** From the RateModeOversubscriptionLimit drop-down list, select **disabled** for each module for which you want to disable restrictions on oversubscription ratios.
- Step 4** Click **Apply** to save the changes.
-

Disabling Restrictions on Oversubscription Ratios Using Device Manager

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

Procedure

- Step 1** Right-click a module and select **Configure**.
You see the Module dialog box.
- Step 2** Click the disabled radio button to disable restrictions on oversubscription ratios.
- Step 3** Click **Apply** to save the changes.
-

Enabling Restrictions on Oversubscription Ratios Using DCNM-SAN

To enable restrictions on over subscription ratios on multiple 48-port or 24-port 4-Gbps, or any 8-Gbps Fibre Channel switching modules using DCNM-SAN, follow these steps:

Procedure

- Step 1** Choose **Switches > Hardware**.
- Step 2** Click the **Module Config** tab. You see the Module Config dialog box.
- Step 3** From the RateMode Oversubscription Limit drop-down list, select enabled for each module for which you want to enable restrictions on oversubscription ratios.
- Step 4** Click **Apply** to save the changes.
-

Enabling Restrictions on Oversubscription Ratios Using Device Manager

To enable restrictions on over subscription ratios on a single 48-port or 24-port 4-Gbps, or any 8-Gbps Fibre Channel switching module using Device Manager, follow these steps:

Procedure

- Step 1** Right-click a module and select **Configure**.
You see the Module dialog box.
- Step 2** Click the **enabled** radio button to enable restrictions on oversubscription ratios.

Step 3 Click **Apply** to save the changes.

Enabling Bandwidth Fairness Using DCNM-SAN

To enable bandwidth fairness on multiple 48-port or 24-port 4-Gbps, or any 8-Gbps Fibre Channel switching modules using DCNM-SAN, follow these steps:

Procedure

Step 1 Choose **Switches > Hardware**.

Step 2 Click the **Module Config** tab. You see the Module Config dialog box.

Step 3 From the BandwidthFairness Admin drop-down list, select enable for each module for which you want to enable bandwidth fairness.

Step 4 Click **Apply** to save the changes.

Enabling Bandwidth Fairness Using Device Manager

To enable bandwidth fairness on a single 48-port or 24-port 4-Gbps Fibre Channel switching module using Device Manager, follow these steps:

Procedure

Step 1 Right-click a module and select **Configure**.

You see the Module dialog box.

Step 2 Click the **enable** radio button to enable bandwidth fairness.

Step 3 Click **Apply** to save the changes.

Disabling Bandwidth Fairness Using DCNM-SAN

To disable bandwidth fairness on multiple 48-port or 24-port 4-Gbps, or 8-Gbps Fibre Channel switching modules using DCNM-SAN, follow these steps:

Procedure

Step 1 Choose **Switches > Hardware**.

Step 2 Click the **Module Config** tab. You see the Module Config dialog box.

Step 3 From the BandwidthFairness Admin drop-down list, select **disable** for each module for which you want to disable bandwidth fairness.

Step 4 Click **Apply** to save the changes.

Disabling Bandwidth Fairness Using Device Manager

To disable bandwidth fairness on a single 48-port or 24-port 4-Gbps, or 8-Gbps Fibre Channel switching module using Device Manager, follow these steps:

Procedure

- Step 1** Right-click a module and select **Configure**.
You see the Module dialog box.
 - Step 2** Click the **disable** radio button to disable bandwidth fairness.
 - Step 3** Click **Apply** to save the changes.
-

Taking Interfaces Out of Service

To take an interface out of service using DCNM-SAN, follow these steps:

Procedure

- Step 1** Select a switch from the Fabric pane, or select a group of switches (SAN, fabric, VSAN) from the Logical Domains pane.
 - Step 2** Expand **Switches**, and expand **FC Interfaces > Physical** in the Physical Attributes pane.
 - Step 3** Click **General** tab. You see the **General** tab information in the Information pane.
 - Step 4** Scroll down until you see the row containing the switch and port you want to configure.
 - Step 5** Scroll right (if necessary) until you see the **Status Service** column.
 - Step 6** Select **in** or **out** from the Status Service column.
 - Step 7** Click the **Apply Changes** icon.
-

Releasing Shared Resources in a Port Group

To release the shared resources for a port group using DCNM-SAN, follow these steps:

Procedure

- Step 1** Select a switch from the Fabric pane, or select a group of switches (SAN, fabric, VSAN) from the Logical Domains pane.
- Step 2** Expand **Switches**, and expand **FC Interfaces > Physical** in the Physical Attributes pane.
- Step 3** Click **General** tab. You see the **General** tab information in the Information pane.
- Step 4** Scroll down until you see the row containing the switch and port you want to configure.
- Step 5** Scroll right (if necessary) until you see the **Status Service** column.
- Step 6** Select the status **out** from the **Status Service** column.

- Step 7** Click the **Apply Changes** icon.
- Step 8** Select the status **in** from the **Status Service** column.
- Step 9** Click the **Apply Changes** icon.

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.
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 Diagnostics for Multiple Ports

To view diagnostic information for multiple ports using Device Manager, follow these steps:

Procedure

- Step 1** Choose **Interface > FC All** and click the **Diagnostics** tab or hold down the **Control** key, and then click each port for which you want to view diagnostic information.
- Step 2** Right-click the selected ports, and then select **Configure**.
You see the FC Interfaces dialog box.
- Step 3** Click **Refresh** to view the latest diagnostic information.
- To view diagnostic information for a single port using Device Manager, follow these steps:
- Right-click a port, and then select **Configure**.
You see the port licensing options for the selected port.

b) Click **Refresh** to view the latest information.
