



Configuring Interface Buffers

This chapter provides information about interfaces buffers, its features, and how to configure the interface buffers.

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Finding Feature Information

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

Information About Interface Buffers

Fibre Channel interfaces use buffer credits to ensure all packets are delivered to their destination.

Buffer-to-Buffer Credits

Buffer-to-buffer credits (BB_credits) are a flow-control mechanism to ensure that Fibre Channel switches do not run out of buffers, so that switches do not drop frames. Buffer-to-buffer credits are negotiated on a per-hop basis.

The receive buffer-to-buffer credit (fcrxbbcredit) value may be configured for each Fibre Channel interface. In most cases, you do not need to modify the default configuration.

The receive buffer-to-buffer credit values depend on the module type and the port mode, as follows:

- For 16-port switching modules and full rate ports, the default value is 16 for Fx mode and 255 for E or TE modes. The maximum value is 255 in all modes. This value can be changed as required.
- For 32-port switching modules and host-optimized ports, the default value is 12 for Fx, E, and TE modes. These values cannot be changed.
- For 4-Gbps, 8-Gbps, advanced 8-Gbps switching modules, see the “[Buffer Pools](#)” section.



Note Because Generation 1 modules do not support as many buffer-to-buffer credits as advanced 8-Gbps modules support, you cannot configure an ISL on E or TE ports between a Generation 1 module such as the 16-port 1-, 2-Gbps Fibre Channel Switching Module (DS-X9016) and a advanced 8-Gbps module such as the 48 port 8-Gbps Advanced Fibre Channel module (DS-X9248-256K9) or the 32-port 8-Gbps Advanced Fibre Channel module (DS-X9232-256k9).

Performance Buffers

Regardless of the configured receive buffer-to-buffer credit value, additional buffers, called performance buffers, improve switch port performance. Instead of relying on the built-in switch algorithm, you can manually configure the performance buffer value for specific applications (for example, forwarding frames over FCIP interfaces).



Note Performance buffers are not supported on the Cisco MDS 9148 Fabric Switch, Cisco MDS 9124 Fabric Switch, the Cisco Fabric Switch for HP c-Class BladeSystem, and the Cisco Fabric Switch for IBM BladeCenter.

For each physical Fibre Channel interface in any switch in the Cisco MDS 9000 Series, you can specify the amount of performance buffers allocated in addition to the configured receive buffer-to-buffer credit value.

The default performance buffer value is 0. If you use the **default** option, the built-in algorithm is used. If you do not specify this command, the **default** option is automatically used.

Buffer Pools

In the architecture of 4-Gbps, 8-Gbps, and 16-Gbps modules, receive buffers shared by a set of ports are called *buffer groups*. The receive buffer groups are organized into *global* and *local* buffer pools.

The receive buffers allocated from the global buffer pool to be shared by a port group are called a global receive buffer pool. Global receive buffer pools include the following buffer groups:

- Reserved internal buffers
- Allocated buffer-to-buffer credit buffers for each Fibre Channel interface (user configured or assigned by default)
- Common unallocated buffer pool for buffer-to-buffer credits, if any, to be used for additional buffer-to-buffer credits as needed
- Performance buffers (only used on 12-port 4-Gbps and 4-port 10-Gbps switching modules)



Note The 48-port and 24-port 8-Gbps modules have *dual global buffer pools*. Each buffer pool in the 48-port modules support 24 ports and in the 24-port modules each buffer pool supports 12 ports.

Figure 1: Receive Buffers for Fibre Channel Ports in a Global Buffer Pool, on page 4 shows the allocation of BB_credit buffers on line cards (24-port and 48-port 4-Gbps line cards).

Figure 1: Receive Buffers for Fibre Channel Ports in a Global Buffer Pool

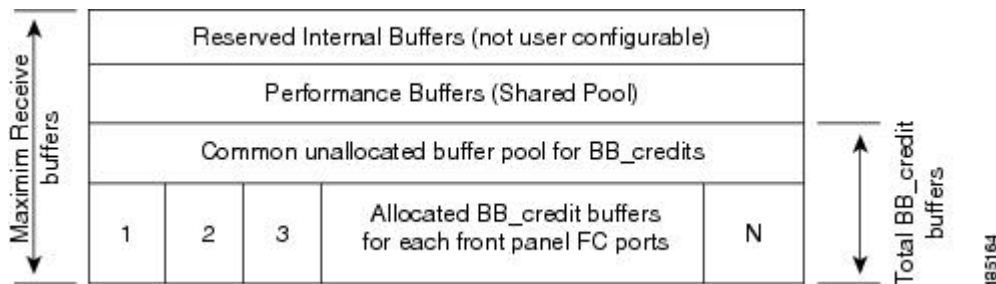


Figure 2: BB_Credit Buffer Allocation in 48-Port 8-Gbps Switching Modules, on page 5 shows the default BB_credit buffer allocation model for 48-port 8-Gbps switching modules. The minimum BB_credits required to bring up a port is two buffers.

Figure 2: BB_Credit Buffer Allocation in 48-Port 8-Gbps Switching Modules

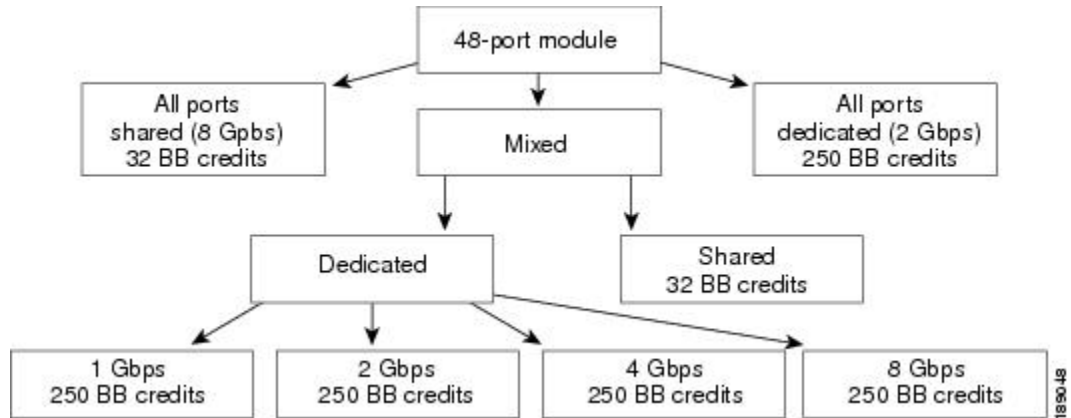


Figure 3: BB_Credit Buffer Allocation in 24-Port 8-Gbps Switching Modules, on page 5 shows the default BB_credit buffer allocation model for 24-port 8-Gbps switching modules. The minimum BB_credits required to bring up a port is two buffers.

Figure 3: BB_Credit Buffer Allocation in 24-Port 8-Gbps Switching Modules

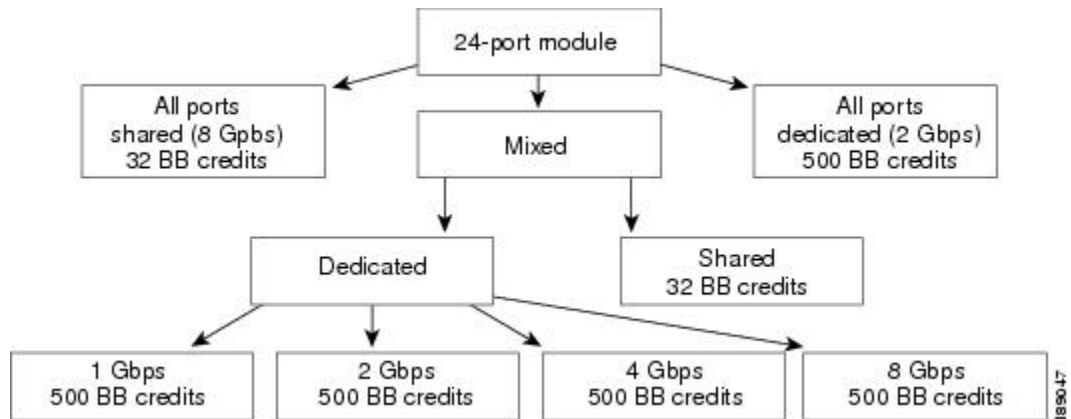


Figure 4: BB_Credit Buffer Allocation in 4/44-Port 8-Gbps Switching Modules, on page 6 shows the default BB_credit buffer allocation model for 4/44-port 8-Gbps host-optimized switching modules. The minimum BB_credits required to bring up a port is two buffers.

Figure 4: BB_Credit Buffer Allocation in 4/44-Port 8-Gbps Switching Modules

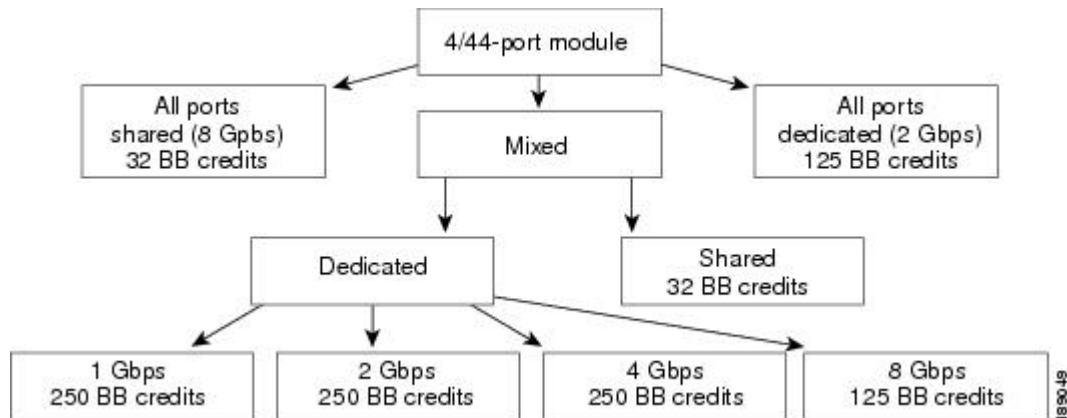
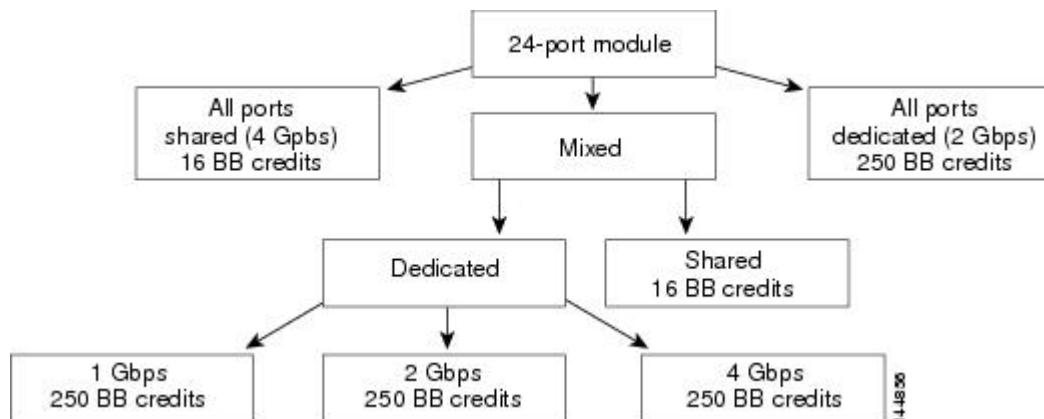


Figure 5: BB_Credit Buffer Allocation in 24-Port 4-Gbps Switching Modules, on page 6 shows the default BB_credit buffer allocation model for 24-port 4-Gbps switching modules. The minimum BB_credits required to bring up a port is two buffers.

Figure 5: BB_Credit Buffer Allocation in 24-Port 4-Gbps Switching Modules



Note The default BB_credit buffer allocation is the same for all port speeds.

Buffer-to-Buffer Credit Buffers for Switching Modules

This section describes how buffer credits are allocated to Cisco MDS 9000 Series Multilayer switches.

Configuring Buffer Credits on a 4-Gbps, 8-Gbps, or Advanced 8-Gbps Module

When you configure port mode to auto or E on a 4-Gbps module, one of the ports will not come up for the following configuration:

- Port Mode: auto or E for all of the ports
- Rate Mode: dedicated

- Buffer Credits: default value

When you configure port mode to auto or E on a 8-Gbps module, one or two of the ports will not come up for the following configuration:

- Port Mode: auto or E for the first half of the ports, the second half of the ports or for all of the ports
- Rate Mode: dedicated
- Buffer Credits: default value

When you configure port mode to auto or E for all ports in the global buffer pool, you need to reconfigure buffer credits on one or more of the ports. The total number of buffer credits configured for all the ports in the global buffer pool should be reduced by 64.

48-Port 16-Gbps Fibre Channel Module Buffer-to-Buffer Credit Buffers

Table 1: 48-Port 16-Gbps Switching Module Buffer-to-Buffer Credit Buffer Allocation, on page 7 lists the buffer-to-buffer credit buffer allocation for the 48-port 16-Gbps Fibre Channel switching module (DS-X9448-768K9).

Table 1: 48-Port 16-Gbps Switching Module Buffer-to-Buffer Credit Buffer Allocation

Buffer-to-Buffer Credit Buffer Allocation	Buffer-to-Buffer Credit Buffers Per Port	
	Dedicated Rate Mode 8-Gbps to 16-Gbps Speed	
	ISL	Fx Port
Default buffer-to-buffer credit buffers	500	32
Maximum buffer-to-buffer credit buffers	500	500
Extended Buffer-to-Buffer Credit Buffer Allocation	Extended Buffer-to-Buffer Credit Buffers Per Port	
	Dedicated Rate Mode 8-Gbps to 16-Gbps Speed	
	ISL	Fx Port
Maximum extended buffer-to-buffer credit buffers	2150	2150



Note The DS-X9448-768K9 module is a 16 Gbps line-rate module.

The following guidelines apply to buffer-to-buffer credit buffers on the 48-port 16-Gbps Fibre Channel switching modules:

- Buffer-to-buffer credit buffers for ISL connections can be configured from a minimum of 2 buffers to a maximum of 500 buffers.
- Buffer-to-buffer credit buffers for Fx port mode connections can be configured from a minimum of 1 buffers to a maximum of 500 buffers.
- If the user has installed an enterprise license, per port credits in a port group can be increased up to 2650 using extended buffer to buffer credits.
- If the user has installed an enterprise license, per port credits in a port group can be increased up to 4144 using extended buffer to buffer credits when ports are moved to out of service. However, the cli restricts the per port credits to be increased to only 4095.



Note In Cisco MDS 9700 Series Switches module, each port group comprises of 4 ports, and there are 12 port groups per ASIC. Port group buffers can be allocated to any combination of ports in that port group using extended buffer configuration. Refer to the **show port-resource module *module_number*** command for details about buffers supported by port-groups.

48-Port 8-Gbps Advanced Fibre Channel Module Buffer-to-Buffer Credit Buffers

[Table 2: 48-Port 8-Gbps Advanced Switching Module Buffer-to-Buffer Credit Buffer Allocation, on page 8](#) lists the buffer-to-buffer credit buffer allocation for the 48-port 8-Gbps Advanced Fibre Channel switching module.

Table 2: 48-Port 8-Gbps Advanced Switching Module Buffer-to-Buffer Credit Buffer Allocation

Buffer-to-Buffer Credit Buffer Allocation	Buffer-to-Buffer Credit Buffers Per Port		
	Dedicated Rate Mode 8-Gbps Speed		Shared Rate Mode 8-Gbps Speed
	ISL	Fx Port	Fx Port
Default buffer-to-buffer credit buffers	250 for 48 port 500 for 32 port	32	32
Maximum buffer-to-buffer credit buffers	500	500	32

The following guidelines apply to buffer-to-buffer credit buffers on 32/48-port Advanced 8-Gbps Fibre Channel switching modules:

- Buffer-to-buffer credit buffers for ISL connections can be configured from a minimum of 2 buffers to a maximum of 500 buffers for dedicated rate mode.
- Buffer-to-buffer credit buffers for Fx port mode connections can be configured. The minimum is 2 buffers and the maximum of 500 buffers for dedicated rate mode or 32 buffers for shared rate mode.
- Performance buffers are not supported on this module.

- The buffers should not be allocated automatically.

Each port group on the 32/48-port Advanced 8-Gbps Fibre Channel switching module consists of four/six ports. The ports in shared rate mode in a port group can have a maximum bandwidth oversubscription of 1.5:1 considering that each port group has 32-Gbps bandwidth. In case of 32 Port version, each port group of 4 ports has sufficient bandwidth (32 Gbps) to handle the line rate traffic without any oversubscription.

The following example configurations are supported by the 48-port Advanced 8-Gbps Fibre Channel switching modules:

- Six ports with shared rate mode and 8-Gbps speed (1.5:1 oversubscription) (default).
- Two port with dedicated rate mode and 8-Gbps speed plus four ports with shared rate mode and 8-Gbps speed (2:1 oversubscription).
- Two ports with dedicated rate mode and 8-Gbps speed plus four ports with shared rate mode and 8-Gbps speed (2:1 oversubscription).
- One port with dedicated rate mode and 8-Gbps speed plus three ports with dedicated rate mode and 4-Gbps speed plus two ports with shared rate mode and 8-Gbps speed (1.33:1 oversubscription).
- Six ports with dedicated rate mode and 8-Gbps speed.

48-Port 8-Gbps Fibre Channel Module Buffer-to-Buffer Credit Buffers

[Table 3: 48-Port 8-Gbps Switching Module Buffer-to-Buffer Credit Buffer Allocation, on page 9](#) lists the buffer-to-buffer credit buffer allocation for the 48-port 8-Gbps Fibre Channel switching module.

Table 3: 48-Port 8-Gbps Switching Module Buffer-to-Buffer Credit Buffer Allocation

Buffer-to-Buffer Credit Buffer Allocation	Buffer-to-Buffer Credit Buffers Per Port		
	Dedicated Rate Mode 8-Gbps Speed		Shared Rate Mode 8-Gbps Speed
	ISL	Fx Port	Fx Port
Default buffer-to-buffer credit buffers	250	32	32
Maximum buffer-to-buffer credit buffers	500	500	32
Total Number of Buffer-to-Buffer Credit Buffers per Module			
Ports 1 through 24	6000		
Ports 25 through 48	6000		

The following guidelines apply to buffer-to-buffer credit buffers on 48-port 8-Gbps Fibre Channel switching modules:

- Buffer-to-buffer credit buffers allocated for ports 1 through 24 and 25 through 48 can be a maximum of 6000 each so that the load is distributed.
- Buffer-to-buffer credit buffers for ISL connections can be configured from a minimum of 2 buffers to a maximum of 500 buffers for dedicated rate mode.
- Buffer-to-buffer credit buffers for Fx port mode connections can be configured. The minimum is 2 buffers and the maximum of 500 buffers for dedicated rate mode or 32 buffers for shared rate mode.
- Performance buffers are not supported on this module.
- The buffers should not be allocated automatically.

Each port group on the 48-port 8-Gbps Fibre Channel switching module consists of six ports. The ports in shared rate mode in a port group can have a maximum bandwidth oversubscription of 10:1 considering that each port group has 12.8-Gbps bandwidth.

The following example configurations are supported by the 48-port 8-Gbps Fibre Channel switching modules:

- Six ports with shared rate mode and 8-Gbps speed (4:1 oversubscription) (default)
- One port with dedicated rate mode and 8-Gbps speed plus five ports with shared rate mode and 8-Gbps speed (10:1 oversubscription)
- Two ports with dedicated rate mode and 4-Gbps speed plus four ports with shared rate mode and 4-Gbps speed (4:1 oversubscription)
- One port with dedicated rate mode and 4-Gbps speed plus three ports with dedicated rate mode and 2-Gbps speed plus two ports with shared rate mode and 4-Gbps speed (4:1 oversubscription)
- Six ports with dedicated rate mode and 2-Gbps speed

24-Port 8-Gbps Fibre Channel Module Buffer-to-Buffer Credit Buffers

[Table 4: 24-Port 8-Gbps Switching Module Buffer-to-Buffer Credit Buffer Allocation, on page 10](#) lists the buffer-to-buffer credit buffer allocation for the 24-port 8-Gbps Fibre Channel switching module.

Table 4: 24-Port 8-Gbps Switching Module Buffer-to-Buffer Credit Buffer Allocation

Buffer-to-Buffer Credit Buffer Allocation	Buffer-to-Buffer Credit Buffers Per Port		
	Dedicated Rate Mode 8-Gbps Speed		Shared Rate Mode 8-Gbps Speed
	ISL	Fx Port	Fx Port
Default buffer-to-buffer credit buffers	500	32	32
Maximum buffer-to-buffer credit buffers	500 ¹	500 ²	32
Total Number of Buffer-to-Buffer Credit Buffers per Module			

Ports 1 through 12	6000
Ports 13 through 24	6000

¹ When connected to Generation 1 modules, reduce the maximum buffer-to-buffer credit allocation to 250.

² When connected to Generation 1 modules, reduce the maximum buffer-to-buffer credit allocation to 250.

The following guidelines apply to buffer-to-buffer credit buffers on 24-port 8-Gbps Fibre Channel switching modules:

- Buffer-to-buffer credit buffers allocated for ports 1 through 12 and 13 through 24 can be a maximum of 6000 each so that the load is distributed.
- Buffer-to-buffer credit buffers for ISL connections can be configured from a minimum of 2 buffers to a maximum of 500 buffers for dedicated rate mode.
- Buffer-to-buffer credit buffers for Fx port mode connections can be configured. The minimum is 2 buffers and the maximum of 500 buffers for dedicated rate mode or 32 buffers for shared rate mode.
- Performance buffers are not supported on this module.

Each port group on the 24-port 8-Gbps Fibre Channel switching module consists of three ports. The ports in shared rate mode in a port group can have a maximum bandwidth oversubscription of 10:1 considering that each port group has 12.8-Gbps bandwidth.

The following example configurations are supported by the 24-port 8-Gbps Fibre Channel switching modules:

- Three ports with shared rate mode and 8-Gbps speed (2:1 oversubscription) (default)
- One port with dedicated rate mode and 8-Gbps speed plus two ports with shared rate mode and 8-Gbps speed (4:1 oversubscription)
- One port with dedicated rate mode and 8-Gbps speed plus one port with dedicated rate mode and 4-Gbps speed plus one port with shared rate mode and 8-Gbps speed (10:1 oversubscription)
- Two ports with dedicated rate mode and 4-Gbps speed plus one port with shared rate mode and 8-Gbps speed (2:1 oversubscription)
- Three ports with dedicated rate mode and 4-Gbps speed

4/44-Port 8-Gbps Host-Optimized Fibre Channel Module Buffer-to-Buffer Credit Buffers

[Table 5: 4/44-Port 8-Gbps Switching Module Buffer-to-Buffer Credit Buffer Allocation, on page 12](#) lists the buffer-to-buffer credit buffer allocation for the 4/44-port 8-Gbps Fibre Channel switching module.

Table 5: 4/44-Port 8-Gbps Switching Module Buffer-to-Buffer Credit Buffer Allocation

Buffer-to-Buffer Credit Buffer Allocation	Buffer-to-Buffer Credit Buffers Per Port		
	Dedicated Rate Mode 8-Gbps Speed		Shared Rate Mode 8-Gbps Speed
	ISL	Fx Port	Fx Port
Default buffer-to-buffer credit buffers	125	32	32
Maximum buffer-to-buffer credit buffers	250	250	32
Total number of buffer-to-buffer credit buffers per module	6000		

The following guidelines apply to buffer-to-buffer credit buffers on 4/44-port 8-Gbps Fibre Channel switching modules:

- Buffer-to-buffer credit buffers for ISL connections can be configured from a minimum of 2 buffers to a maximum of 500 buffers for dedicated rate mode.
- Buffer-to-buffer credit buffers for Fx port mode connections can be configured. The minimum is 2 buffers and the maximum of 250 buffers for dedicated rate mode or 32 buffers for shared rate mode.
- Performance buffers are not supported on this module.

Each port group on the 24-port 8-Gbps Fibre Channel switching module consists of 12 ports. The ports in shared rate mode in a port group can have a maximum bandwidth oversubscription of 10:1 considering that each port group has 12.8-Gbps bandwidth.

The following example configurations are supported by the 4/44-port 8-Gbps Fibre Channel switching modules:

- Twelve ports with shared rate mode and 4-Gbps speed (5:1 oversubscription) (default)
- One port with dedicated rate mode and 8-Gbps speed plus eleven ports with shared rate mode and 4-Gbps speed (10:1 oversubscription)
- One port with dedicated rate mode and 4-Gbps speed plus three ports with dedicated rate mode and 3-Gbps speed plus eight ports with shared rate mode and 4-Gbps speed (2:1 oversubscription)
- Twelve ports with dedicated rate mode and 1-Gbps speed

48-Port 4-Gbps Fibre Channel Module Buffer-to-Buffer Credit Buffers

Table 6: 48-Port 4-Gbps Switching Module Buffer-to-Buffer Credit Buffer Allocation, on page 13 lists the buffer-to-buffer credit buffer allocation for 48-port 4-Gbps Fibre Channel switching modules.

Table 6: 48-Port 4-Gbps Switching Module Buffer-to-Buffer Credit Buffer Allocation

Buffer-to-Buffer Credit Buffer Allocation	Buffer-to-Buffer Credit Buffers Per Port		
	Dedicated Rate Mode 4-Gbps Speed		Shared Rate Mode 4-Gbps Speed
	ISL ³	Fx Port	Fx Port
Default buffer-to-buffer credit buffers	125	16	16
Maximum buffer-to-buffer credit buffers	250	250	16
Total number of buffer-to-buffer credit buffers per module	6000		

³ ISL = E port or TE port.

The following considerations apply to buffer-to-buffer credit buffers on 48-port 4-Gbps Fibre Channel switching modules:

- Buffer-to-buffer credit buffers for ISL connections can be configured from a minimum of 2 buffers to a maximum of 250 buffers for dedicated rate mode or 16 buffers for shared rate mode.
- Buffer-to-buffer credit buffers for Fx port mode connections can be configured. The minimum is 2 buffers and the maximum of 250 buffers for dedicated rate mode or 16 buffers for shared rate mode.
- Performance buffers are not supported on this module.

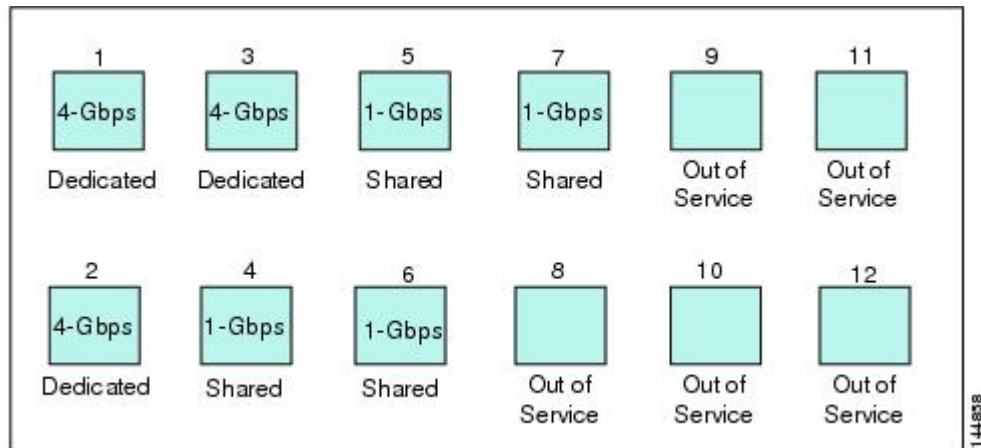
Each port group on the 48-port 4-Gbps Fibre Channel switching module consists of 12 ports. The ports in shared rate mode have bandwidth oversubscription of 2:1 by default. However, some configurations of the shared ports in a port group can have maximum bandwidth oversubscription of 4:1 (considering that each port group has 12.8-Gbps bandwidth).

The following example configurations are supported by the 48-port 4-Gbps Fibre Channel switching modules:

- Twelve ports with shared rate mode and 4-Gbps speed (4:1 oversubscription) (default)
- One port with dedicated rate mode and 4-Gbps speed plus 11 ports with shared rate mode and 4-Gbps speed (5:1 oversubscription)
- One port with dedicated rate mode and 4-Gbps speed plus 11 ports with shared rate mode and 2-Gbps speed (2.5:1 oversubscription)
- Two ports with dedicated rate mode and 2-Gbps speed plus 10 ports with shared rate mode and 4-Gbps speed (5:1 oversubscription)
- Two ports with dedicated rate mode and 2-Gbps speed plus 10 ports with shared rate mode and 2-Gbps speed (2.5:1 oversubscription)

- Twelve ports with dedicated rate mode and 1-Gbps speed
- Three ports with dedicated rate mode and 4-Gbps speed plus four ports with shared rate mode and 1-Gbps speed plus five ports put out-of-service (see [Figure 6: Example Speed and Rate Configuration on a 48-Port 4-Gbps Switching Module](#), on page 14)

Figure 6: Example Speed and Rate Configuration on a 48-Port 4-Gbps Switching Module

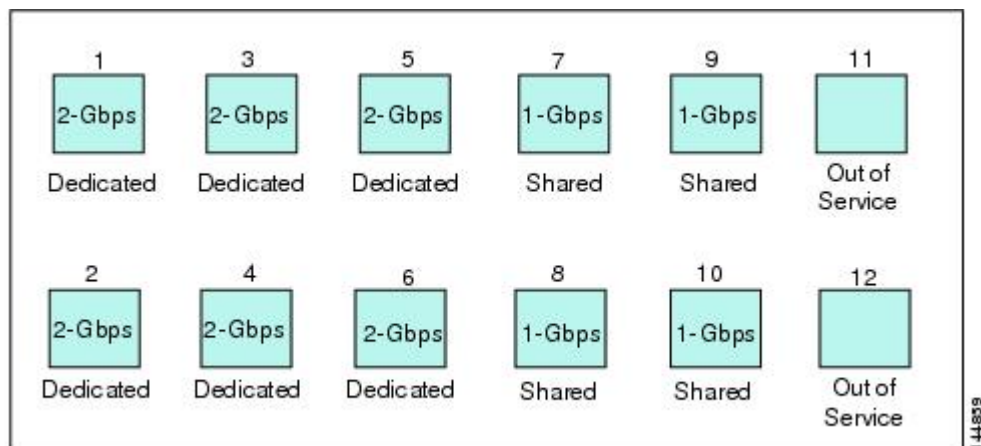


- Six ports with dedicated rate mode and 2-Gbps speed plus four ports with shared rate mode and 1-Gbps speed plus two ports put out-of-service (see [Figure 7: Example Speed and Rate Configuration on a 48-Port 4-Gbps Switching Module](#), on page 14)



Note For detailed configuration steps of this example, see “[Configuration Example for 48-Port 8-Gbps Module Interfaces](#)” section.

Figure 7: Example Speed and Rate Configuration on a 48-Port 4-Gbps Switching Module



24-Port 4-Gbps Fibre Channel Module Buffer-to-Buffer Credit Buffers

Table 7: 24-Port 4-Gbps Switching Module Buffer-to-Buffer Credit Buffer Allocation, on page 15 lists the buffer-to-buffer credit buffer allocation for 24-port 4-Gbps Fibre Channel switching modules.

Table 7: 24-Port 4-Gbps Switching Module Buffer-to-Buffer Credit Buffer Allocation

Buffer-to-Buffer Credit Buffer Allocation	Buffer-to-Buffer Credit Buffers Per Port		
	Dedicated Rate Mode 4-Gbps Speed		Shared Rate Mode 4-Gbps Speed
	ISL ⁴	Fx Port	Fx Port
Default buffer-to-buffer credit buffers	250	16	16
Maximum buffer-to-buffer credit buffers	250	250	16
Total number of buffer-to-buffer credits buffers per module	6000		

⁴ ISL = E port or TE port.

The following considerations apply to buffer-to-buffer credit buffers on 24-port 4-Gbps Fibre Channel switching modules:

- Buffer-to-buffer credit buffers for ISL connections can be configured from a minimum of 2 buffers to a maximum of 250 buffers for dedicated rate mode or 16 buffers for shared rate mode.
- Buffer-to-buffer credit buffers for Fx port mode connections can be configured. The minimum is 2 buffers and the maximum of 250 buffers for dedicated rate mode or 16 buffers for shared rate mode.
- Performance buffers are not supported on this module.

Each port group on the 24-port 4-Gbps Fibre Channel switching module consists of six ports. The ports in shared rate mode have a bandwidth oversubscription of 2:1 by default. However, some configurations of the shared ports in a port group can have a maximum bandwidth oversubscription of 4:1 (considering that each port group has 12.8-Gbps bandwidth).

The following example configurations are supported by the 24-port 4-Gbps Fibre Channel switching modules:

- Six ports with shared rate mode and 4-Gbps speed (2:1 oversubscription) (default)
- Two ports with dedicated rate mode and 4-Gbps speed plus four ports with shared rate mode and 4-Gbps speed (with 4:1 oversubscription)
- One port with dedicated rate mode and 4-Gbps speed plus three ports with dedicated rate mode and 2-Gbps speed plus two ports with shared rate mode and 4-Gbps speed (4:1 oversubscription)
- Six ports with dedicated rate mode and 2-Gbps speed

- Three ports with dedicated rate mode and 4-Gbps speed plus three ports with shared rate mode and 1-Gbps speed (see [Figure 8: Example Speed and Rate Configuration on a 24-Port 4-Gbps Switching Module](#), on page 16)

Figure 8: Example Speed and Rate Configuration on a 24-Port 4-Gbps Switching Module



Note For detailed configuration steps of this example, see the “[Configuration Example for 24-Port 8-Gbps Module Interfaces](#)” section.

Example Speed and Rate Configuration on a 24-Port 4-Gbps Switching Module

18-Port Fibre Channel/4-Port Gigabit Ethernet Multiservice Module Buffer-to-Buffer Credit Buffers

[Table 8: 18-Port 4-Gbps Multiservice Module Buffer-to-Buffer Credit Buffer Allocation](#), on page 16 lists the buffer-to-buffer credit buffer allocation for 18-port 4-Gbps multiservice modules.

Table 8: 18-Port 4-Gbps Multiservice Module Buffer-to-Buffer Credit Buffer Allocation

Buffer-to-Buffer Credit Buffer Allocation	Buffer-to-Buffer Credit Buffers Per Port			
	Dedicated Rate Mode 4-Gbps Speed		Shared Rate Mode 4-Gbps Speed	
	ISL ⁵	Fx Port	ISL ⁶	Fx Port
Default buffer-to-buffer credit buffers	250	16	16	16
Maximum buffer-to-buffer credit buffers	250	250	16	16
Total number of buffer-to-buffer credit buffers per module		4509		

⁵ ISL = E port or TE port.

⁶ ISL = E port or TE port.

The following considerations apply to buffer-to-buffer credit buffers on 18-port 4-Gbps Fibre Channel switching modules:

- Buffer-to-buffer credit buffers for ISL connections can be configured from a minimum of 2 buffers to a maximum of 250 buffers for dedicated rate mode or 16 buffers for shared rate mode.

- Buffer-to-buffer credit buffers for Fx port mode connections can be configured. The minimum is 2 buffers and the maximum of 250 buffers for dedicated rate mode or 16 buffers for shared rate mode.
- Performance buffers are not supported on this module.

12-Port 4-Gbps Switching Module Buffer-to-Buffer Credit Buffers

Table 9: 12-Port 4-Gbps Switching Module Buffer-to-Buffer Credit Buffer Allocation, on page 17 lists the buffer-to-buffer credit buffer allocation for 12-port 4-Gbps switching modules.

Table 9: 12-Port 4-Gbps Switching Module Buffer-to-Buffer Credit Buffer Allocation

Buffer-to-Buffer Credit Buffer Allocation	Buffer-to-Buffer Credit Buffers Per Port	
	Dedicated Rate Mode 4-Gbps Speed	
	ISL ⁷	Fx Port
Default buffer-to-buffer credit buffers	500	32
Maximum buffer-to-buffer credit buffers	500	500

⁷ ISL = E port or TE port.

The following considerations apply to buffer-to-buffer credit buffers on 12-port 4-Gbps switching modules:

- Buffer-to-buffer credit buffers for ISL connections can be configured from a minimum of 2 buffers to a maximum of 250 buffers.
- Buffer-to-buffer credit buffers for Fx port mode connections can be configured from a minimum of 2 buffers to a maximum of 250 buffers.
- By default, 512 performance buffers are preallocated and are shared by all the ports. These buffers are configurable and the buffers are assigned to the port based on the availability of the buffers in the shared pool.
- There are 2488 extra buffers available as extended buffer-to-buffer credit buffers after allocating all the default buffer-to-buffer credit buffers for all the ports in ISL mode (5488 - (250 * 12)).



Note

- Extended buffer-to-buffer credits are allocated across all ports on the switch. That is, they are not allocated by port group.
- By default, the ports in the 12-port 4-Gbps switching modules come up in 4-Gbps dedicated rate mode but can be configured as 1-Gbps and 2-Gbps dedicated rate mode. Shared mode is not supported.

4-Port 10-Gbps Switching Module Buffer-to-Buffer Credit Buffers

Table 10: 4-Port 10-Gbps Switching Module Buffer-to-Buffer Credit Buffer Allocation, on page 18 lists the buffer-to-buffer credit buffer allocation for 4-port 10-Gbps switching modules.

Table 10: 4-Port 10-Gbps Switching Module Buffer-to-Buffer Credit Buffer Allocation

Buffer-to-Buffer Credit Buffer Allocation	Buffer-to-Buffer Credit Buffers Per Port	
	Dedicated Rate Mode 10-Gbps Speed	
	ISL ⁸	Fx Port ⁹
Default buffer-to-buffer credit buffers	250	16
Maximum buffer-to-buffer credit buffers	750	16
Maximum buffer-to-buffer credit buffers on one of the ports with Enterprise license	4095	
Total number of buffer-to-buffer credit buffers per module	5488	
Default Performance buffers	145	12
Total number of performance buffers per module	512 (shared)	

⁸ ISL = E port or TE port.

⁹ Ports on the 4-port 10-Gbps cannot operate in FL port mode.



Note The ports in the 4-port 10-Gbps switching module only support 10-Gbps dedicated rate mode. FL port mode and shared rate mode are not supported.

The following considerations apply to buffer-to-buffer credit buffers on 4-port 10-Gbps switching modules:

- Buffer-to-buffer credit buffers for ISL connections can be configured from a minimum of 2 buffers to a maximum of 750 buffers.
- Buffer-to-buffer credit buffers for Fx port mode connections can be configured from a minimum of 2 buffers to a maximum of 750 buffers.

- By default, 512 performance buffers are preallocated and are shared by all the ports. These buffers are configurable and the buffers are assigned to the port based on the availability of the buffers in the shared pool.
- There are 2488 extra buffers available as extended buffer-to-buffer credits after allocating all the default buffer-to-buffer credit buffers for all the ports in ISL mode (5488 - (750 * 4)).



Note Extended buffer-to-buffer credits are allocated across all ports on the switch. That is, they are not allocated by port group.

Buffer-to-Buffer Credit Buffers for Fabric Switches

This section describes how buffer credits are allocated to Cisco MDS 9000 Fabric switches.

Cisco MDS 9396S Fabric Switch Buffer-to-Buffer Credit Buffers

[Table 11: 96-Port 16-Gbps Switch Buffer-to-Buffer Credit Buffer Allocation, on page 19](#) lists the buffer-to-buffer credit buffer allocation for the 96-port 16-Gbps Fibre Channel switch.

Table 11: 96-Port 16-Gbps Switch Buffer-to-Buffer Credit Buffer Allocation

Buffer-to-Buffer Credit Buffer Allocation	Buffer-to-Buffer Credit Buffers Per Port	
	Dedicated Rate Mode 16-Gbps Speed	
	ISL	Fx Port
Default buffer-to-buffer credit buffers	500	32
Maximum buffer-to-buffer credit buffers	500	500



Note Cisco MDS 9396S is a 16 Gbps line-rate switch.

The following guidelines apply to buffer-to-buffer credit buffers on the 96-port 16-Gbps Fibre Channel switch:

- Buffer-to-buffer credit buffers for ISL connections can be configured from a minimum of 2 buffers to a maximum of 500 buffers.
- Buffer-to-buffer credit buffers for Fx port mode connections can be configured from a minimum of 2 buffers to a maximum of 500 buffers.
- Per port credits can be increased up to 4095 using extended buffer to buffer credits if the user has installed an enterprise license.



Note In MDS 9396S Fabric switch, total buffer available are 99600 for 24 port groups. One port group comprises of 4 ports, and there are 2 port groups per ASIC. Each port-group consists of total 4150 buffers. These buffers can be allocated to any combination of port(s) using extended buffer configuration. Please refer **show port-resource module *module_number*** command for details about buffers supported by port-groups.

Cisco MDS 9250i and Cisco MDS 9148S Fabric Switch Buffer-to-Buffer Credit Buffers

Table 12: 40/48-Port 16-Gbps Switch Buffer-to-Buffer Credit Buffer Allocation, on page 20 lists the buffer-to-buffer credit buffer allocation for 40/48-port 16-Gbps Cisco MDS 9250i and 9148S Fabric switches.

Table 12: 40/48-Port 16-Gbps Switch Buffer-to-Buffer Credit Buffer Allocation

Buffer-to-Buffer Credit Buffer Allocation	Buffer-to-Buffer Credit Buffers Per Port	
	Dedicated Rate Mode 16-Gbps Speed	
	ISL	Fx Port
Default buffer-to-buffer credit buffers	64	64
Maximum buffer-to-buffer credit buffers	253	253



Note Cisco MDS 9148S and Cisco MDS 9250i are 16 Gbps line-rate switches.

The following guidelines apply to buffer-to-buffer credit buffers on the 40/48-port 9250i/9148S Fabric switches:

- Buffer-to-buffer credit buffers can be configured from a minimum of 1 buffer to a maximum of 64 buffers per port when the ports are in F or FL mode.
- Buffer-to-buffer credit buffers can be configured from a minimum of 2 buffers to a maximum of 64 buffers per port when the ports are in E or TE mode.
- Buffer-to-buffer credit buffers for F or FL port can be configured for a single port in a port group from a minimum of 1 buffer to a maximum of 253 buffers when all other ports in a port group are moved to out of service.
- Buffer-to-buffer credit buffers for E or TE port can be configured for a single port in a port group from a minimum of 2 buffer to a maximum of 253 buffers when all other ports in a port group are moved to out of service.



Note The ports that are moved to out-of-service need not be licensed.

Cisco MDS 9148 Fabric Switch Buffer-to-Buffer Credit Buffers

Table 13: 48-Port 8-Gbps Fabric Switch Buffer-to-Buffer Credit Buffer Allocation, on page 21 lists the buffer-to-buffer credit buffer allocation for 48-port 8-Gbps Fabric switches.

Table 13: 48-Port 8-Gbps Fabric Switch Buffer-to-Buffer Credit Buffer Allocation

Buffer-to-Buffer Credit Buffer Allocation	Buffer-to-Buffer Credit Buffers Per Port	Buffer-to-Buffer Credit Buffers Per Port	
		ISL ¹⁰	Fx Port
Default buffer-to-buffer credit buffers	128	32	32
Maximum configurable buffer-to-buffer credit buffers on 8-Gbps mode	128	125	125

¹⁰ ISL = E port or TE port.

The following considerations apply to buffer-to-buffer credit buffers on 48-port 8-Gbps Fabric switches:

- Buffer-to-buffer credit buffers can be configured from a minimum of 1 buffer to a maximum of 32 buffers per port when the ports are in F or FL mode.
- Buffer-to-buffer credit buffers can be configured from a minimum of 2 buffers to a maximum of 32 buffers per port when the ports are in E or TE mode.
- Buffer-to-buffer credit buffers for F or FL port can be configured for a single port in a port group from a minimum of 1 buffer to a maximum of 125 buffers when all other ports in a port group are moved to out of service.
- Buffer-to-buffer credit buffers for E or TE port can be configured for a single port in a port group from a minimum of 2 buffer to a maximum of 125 buffers when all other ports in a port group are moved to out of service.



Note The ports that are moved to out-of-service need not be licensed.

Cisco MDS 9134 Fabric Switch Buffer-to-Buffer Credit Buffers

Table 14: MDS 9134 Fabric Switch Buffer-to-Buffer Credit Buffer Allocation, on page 21 lists the buffer-to-buffer credit buffer allocation for MDS 9134 Fabric Switches.

Table 14: MDS 9134 Fabric Switch Buffer-to-Buffer Credit Buffer Allocation

Buffer-to-Buffer Credit Buffer Allocation	Buffer-to-Buffer Credit Buffers Per Port	Buffer-to-Buffer Credit Buffers Per Port	
		ISL ¹¹	Fx Port

Maximum user-configurable buffer-to-buffer credit buffers	64	61	61
Minimum user-configurable buffer-to-buffer credit buffers	NA	2	1
Default buffer-to-buffer credit buffers on 10-Gbps mode	64	64	64
Default buffer-to-buffer credit buffers on 4-Gbps mode	64	16	16

¹¹ ISL = E port or TE port.



Note Cisco MDS 9134 is a 10/4 Gbps line-rate switch.

The following guidelines apply to buffer-to-buffer credit buffers on the Cisco MDS 9134 Fabric switch:

- Buffer-to-buffer credit buffers can be configured from a minimum of 1 buffer to a maximum of 61 buffers per port when the ports are in F or FL mode.
- Buffer-to-buffer credit buffers can be configured from a minimum of 2 buffers to a maximum of 61 buffers per port when the ports are in E or TE mode.
- Buffer-to-buffer credit buffers for F or FL port can be configured for a single port in a port group from a minimum of 1 buffer to a maximum of 61 buffers when all other ports in a port group are moved to out of service.
- Buffer-to-buffer credit buffers for E or TE port can be configured for a single port in a port group from a minimum of 2 buffer to a maximum of 61 buffers when all other ports in a port group are moved to out of service.



Note The ports that are moved to out-of-service need not be licensed.

Cisco MDS 9124 Fabric Switch Buffer-to-Buffer Credit Buffers

Table 15: MDS 9124 Fabric Switch Buffer-to-Buffer Credit Buffer Allocation Defaults, on page 22 lists the buffer-to-buffer credit buffer allocation for MDS 9124 Fabric Switches.

Table 15: MDS 9124 Fabric Switch Buffer-to-Buffer Credit Buffer Allocation Defaults

Buffer-to-Buffer Credit Buffer Allocation	Buffer-to-Buffer Credit Buffers Per Port	Buffer-to-Buffer Credit Buffers Per Port	
		ISL ¹²	Fx Port

Maximum user-configurable buffer-to-buffer credit buffers	64	61	61
Minimum user-configurable buffer-to-buffer credit buffers	NA	2	1
Default buffer-to-buffer credit buffers	64	16	16

¹² ISL = E port or TE port.

Cisco MDS 9222i Multiservice Modular Switch Buffer-to-Buffer Credit Buffers

Table 16: 18-Port 4-Gbps Fabric Switch Buffer-to-Buffer Credit Buffer Allocation Defaults, on page 23 lists the buffer-to-buffer credit buffer allocation for 18-port 4-Gbps Multiservice Modular switches.

Table 16: 18-Port 4-Gbps Fabric Switch Buffer-to-Buffer Credit Buffer Allocation Defaults

Buffer-to-Buffer Credit Buffer Allocation	Buffer-to-Buffer Credit Buffers Per Port	Buffer-to-Buffer Credit Buffers Per Port	
		ISL ¹³	Fx Port
User-configurable buffer-to-buffer credit buffers	4509	250	16

¹³ ISL = E port or TE port.

Extended Buffer-to-Buffer Credits

To facilitate buffer-to-buffer credits for long-haul links, the extended buffer-to-buffer credits feature allows you to configure the receive buffers above the maximum value on all 4-Gbps, 8-Gbps, advanced 8-Gbps, 16-Gbps, and 32-Gbps switching modules. When necessary, you can reduce the buffers on one port and assign them to another port, exceeding the default maximum. The minimum extended buffer-to-buffer credits per port is 256 and the maximum is 4095.



Note Extended buffer-to-buffer credits are not supported on the Cisco MDS 9148 Fabric Switch, Cisco MDS 9134 Fabric Switch, Cisco MDS 9124 Fabric Switch, the Cisco Fabric Switch for HP c-Class BladeSystem, and the Cisco Fabric Switch for IBM BladeCenter.

In general, you can configure any port in a port group to dedicated rate mode. To do this, you must first release the buffers from the other ports before configuring larger extended buffer-to-buffer credits for a port.



Note The ENTERPRISE_PKG license is required to use extended buffer-to-buffer credits on 4-Gbps, 8-Gbps, advanced 8-Gbps, 16-Gbps, and 32-Gbps switching modules. Also, extended buffer-to-buffer credits are not supported by ports in shared rate mode.

All ports on the 4-Gbps, 8-Gbps, 16-Gbps, and 32-Gbps switching modules support extended buffer-to-buffer credits. There are no limitations for how many extended buffer-to-buffer credits you can assign to a port (except for the maximum and minimum limits). If necessary, you can take interfaces out of service to make more extended buffer-to-buffer credits available to other ports.

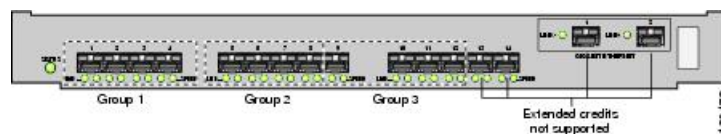
Extended Buffer-to-Buffer Credits on Generation 1 Switching Modules

The buffer-to-buffer credits feature allows you to configure up to 255 receive buffers on Generation 1 switching modules. To facilitate buffer-to-buffer credits for long haul links, you can configure up to 3,500 receive buffer-to-buffer credits on a Fibre Channel port on a Generation 1 switching module.

To use this feature on Generation 1 switching modules, you must meet the following requirements:

- Obtain the ENTERPRISE_PKG license. See the [Cisco MDS 9000 Series Licensing Guide](#).
- Configure this feature in any port of the full-rate 4-port group in either the Cisco MDS 9216i Switch or in the MPS-14/2 module (see [Figure 9: Port Group Support for the Extended BB_Credits Feature, on page 24](#)).

Figure 9: Port Group Support for the Extended BB_Credits Feature



The port groups that support extended credit configurations are as follows:

- Any one port in ports 1 to 4 (identified as Group 1).
- Any one port in ports 5 to 8 (identified as Group 2).
- Any one port in ports 9 to 12 (identified as Group 3).



Note The last two Fibre Channel ports (port 13 and port 14) and the two Gigabit Ethernet ports do not support the extended buffer-to-buffer credits feature.

- Any one port in ports 1 to 4 (identified as Group 1). Explicitly enable this feature in the required Cisco MDS switch.
- Disable the remaining three ports in the 4-port group if you need to assign more than 2,400 buffer-to-buffer credits to the first port in the port group.
 - If you assign less than 2,400 extended buffer-to-buffer credits to any one port in a port group, the remaining three ports in that port group can retain up to 255 buffer-to-buffer credits based on the port mode.



Note The receive buffer-to-buffer credit value for the remaining three ports depends on the port mode. The default value is 16 for the Fx mode and 255 for E or TE modes. The maximum value is 255 in all modes. This value can be changed as required without exceeding the maximum value of 255 buffer-to-buffer credits.

- If you assign more than 2,400 (up to a maximum of 3,500) extended buffer-to-buffer credits to the port in a port group, you must disable the other three ports.

- If you change the buffer-to-buffer credit value the port is disabled, and then reenabled.

Disable (explicitly) this feature if you need to nondisruptively downgrade to Cisco SAN-OS Release 1.3 or earlier. When you disable this feature, the existing extended buffer-to-buffer credit configuration is completely erased.



Note The extended buffer-to-buffer credit configuration takes precedence over the receive buffer-to-buffer credit and performance buffer configurations.

Extended Buffer-to-Buffer Credits on 4-Gbps and 8-Gbps Switching Modules

To use this feature on 4-Gbps or 8-Gbps switching modules, you must meet the following requirements:

- Display the interface configuration in the Information pane.
- Obtain the Enterprise package (ENTERPRISE_PKG) license (see the Cisco MDS 9000 Series Licensing Guide).
- Configure this feature in any port on a 4-Gbps switch module. See the “[Extended Buffer-to-Buffer Credits](#)” section for more information on extended buffer-to-buffer credits on 2-Gbps switching modules.



Note Extended buffer-to-buffer credits are not supported on the Cisco MDS 9124 Fabric Switch, Cisco MDS 9134 Fabric Switch, the Cisco Fabric Switch for HP c-Class BladeSystem, and the Cisco Fabric Switch for IBM BladeCenter.

Buffer-to-Buffer Credit Recovery

Although Fibre Channel standards require low bit and frame error rates, there is a likelihood of errors occurring. When these errors affect certain Fibre Channel primitives, credit loss might occur. When credits are lost, performance degradation might occur. When all credits are lost, transmission of frames in that direction stops. The Fibre Channel standards introduces a feature for two attached ports to detect and correct such scenarios nondisruptively. This feature is called *buffer-to-buffer credit recovery*.

A credit can be lost in either of these scenarios:

- An error corrupts the start-of-frame (SoF) delimiter of a frame. The receiving port fails to recognize the frame and subsequently does not send a corresponding receiver ready (R_RDY) primitive to the sender. The sending port does not replenish the credit to the receiving port.
- An error corrupts an R_RDY primitive. The receiving port fails to recognize the R_RDY and does not replenish the corresponding credit to the sending port.

The Buffer-to-Buffer Credit Recovery feature can help recover from the two specified scenarios. It is a per-hop feature and is negotiated between two directly attached peer ports when the link comes up, by exchanging parameters. Buffer-to-buffer credit recovery is enabled when a receiver acknowledges a nonzero buffer-to-buffer state change number (BB_SC_N).

Buffer-to-buffer credit recovery functions as follows:

1. The local port and peer port agree to send checkpoint primitives to each other for frames and R_RDYs, starting from the time the link comes up.
2. If a port detects frame loss, it sends the corresponding number of R_RDYs to replenish the lost credits at the peer port.
3. If a port detects R_RDY loss, the port internally replenishes the lost credits to the interface buffer pool.

Buffer-to-buffer credit recovery implementation is as follows:

1. Buffer-to-buffer state change SOF (BB_SCs) primitives are transmitted every $2^{\text{BB_SC_N}}$ number of frames sent. This enables an attached port to determine if any frames are lost. If frames loss is detected, the receiver of the BB_SCs transmits the appropriate number of R_RDYs to compensate for the lost frames.
2. Buffer-to-buffer state change R_RDY (BB_SCr) primitives are transmitted every $2^{\text{BB_SC_N}}$ number of R_RDY primitives sent. This enables an attached port to determine if any R_RDY primitives are lost. If R_RDY primitive loss is detected, the receiver of the BB_SCr increments the number of transmit credits by the appropriate number to compensate for the lost R_RDYs.

The Buffer-to-Buffer Credit Recovery feature can be used on any nonarbitrated loop link. This feature is most useful on unreliable links, such as Metropolitan Area Networks (MANs) or WANs, but can also help on shorter, high-loss links, such as a link with a faulty fiber connection.



Note

The Buffer-to-Buffer Credit Recovery feature is not compatible with the distance extension (DE) feature, also known as buffer-to-buffer credit spoofing. If you use intermediate optical equipment, such as dense wavelength-division multiplexing (DWDM) or Fibre Channel bridges that use DE on Inter-Switch Links (ISLs) between switches, then buffer-to-buffer credit recovery on both sides of an ISL must be disabled.

For 4 and 8 Gbps modules, the BB_SC_N on ISLs (E or TE ports) is enabled by default. This can fail the ISLs if used with optical equipment using distance extension (DE), also known as buffer-to-buffer credit spoofing.

On a 4-Gbps module, one port will not come up for the following configuration for all ports:

- Port Mode: auto or E for all the ports
- Rate Mode: dedicated
- Buffer Credits: default value

On an 8-Gbps module, one or two ports will not come up for the following configuration for the first half of the ports, the second half of the ports, or all ports:

- Port Mode: auto or E for the first half of the ports, the second half of the ports, or for all of the ports
- Rate Mode: dedicated
- Buffer Credits: default value

Receive Data Field Size

You can configure the receive data field size for Fibre Channel interfaces. The default data field size is 2112 bytes, which supports frame lengths up to 2148 byte, the maximum size of Fibre Channel frames.

Configuring Interface Buffers

Configuring Buffer-to-Buffer Credits



Note When you configure port mode to auto or E, and rate mode to dedicated for all the ports in the global buffer pool, you must reconfigure buffer credits on one or more ports (other than the default mode).

To configure a single pool of buffer-to-buffer credits for a Fibre Channel interface, perform these steps. The interface must be in R_RDY flow-control mode.

Before you begin

Enable the Receiver Ready (R_RDY) mode on ISLs before configuring the shared buffer-to-buffer credit pool. For more information, see [Disabling Extended Receiver Ready](#).

Step 1 Enter configuration mode:

```
switch# configure terminal
```

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

```
switch(config)# interface fc slot/port
```

Step 3 Set the buffer-to-buffer credits as a single pool on an interface:

```
switch(config-if)# switchport fcrxbbcredit credits mode {E | Fx}
```

(Optional) Reset the buffer-to-buffer credits on the interface to the default value:

```
switch(config-if)# switchport fcrxbbcredit default
```

Configuring Performance Buffers

To configure performance buffers for a Fibre Channel interface, perform these steps:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

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

```
switch(config)# interface fcslot/port
```

Step 3 Set the number of performance buffers on an interface:

```
switch(config-if)# switchport fcrxbbcredit performance-buffers perf_bufs
```

(Optional) Reset the number of performance buffers on an interface to the default value:

```
switch(config-if)# switchport fcrxbbcredit performance-buffers default
```

Configuring Extended Buffer-to-Buffer Credits



Note You cannot configure regular buffer-to-buffer credits after configuring the extended buffer-to-buffer credits.

To configure a single pool of extended buffer-to-buffer credits for a Fibre Channel interface, perform these steps. The interface must be in R_RDY flow-control mode.

Before you begin

Enable the Receiver Ready (R_RDY) mode on ISLs before configuring the shared buffer-to-buffer credit pool. For more information, see [Disabling Extended Receiver Ready](#).

- Step 1** Enter configuration mode:
- ```
switch# configure terminal
```
- Step 2** Enable the extended Buffer-to-Buffer Credits feature:
- ```
switch(config)# fcrxbbcredit extended enable
```
- Step 3** Select a Fibre Channel interface and enter interface configuration submode:
- ```
switch(config)# interface fc slot/port
```
- Step 4** Set the extended buffer-to-buffer credits as a single pool on an interface:
- ```
switch(config-if)# switchport fcrxbbcredit extended extend_bufs mode {E | Fx}
```
- Step 5** (Optional) Reset the extended buffer-to-buffer credits on the interface to the default value:
- ```
switch(config-if)# switchport fcrxbbcredit extended default
```
- 

## Configuring Buffer-to-Buffer Credit Recovery

Buffer-to-buffer credit recovery is enabled by default on all Fibre Channel ports.

To disable the buffer-to-buffer credit recovery on a port, perform these steps:

---

- Step 1** Enter configuration mode:
- ```
switch# configure terminal
```
- Step 2** Select the interface and enter interface configuration submode:

```
switch(config)# interface fc slot/port
```

Step 3 Disable buffer-to-buffer credit recovery on the interface:

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

Step 4 (Optional) To enable buffer-to-buffer credit recovery on an interface if it was disabled:

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

Configuring Receive Data Field Size

To configure the receive data field size, perform these steps:

Step 1 Enter configuration mode:

```
switch# configure terminal
```

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

```
switch(config)# interface fc slot/port
```

Step 3 Set the data field size for the selected interface:

```
switch(config-if)# switchport fcrxbufsize bytes
```

Step 4 (Optional) Reset the receive data field size on the interface to the default value:

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

Configuration Examples for Interface Buffers

This example shows how to enable buffer-to-buffer credit recovery on an interface if it is disabled:

```
switch# configure terminal
switch(config)# interface fc 1/1
switch(config-if)# switchport fcbbbscn
```

This example shows how to configure default credits on an interface:

```
switch# configure terminal
switch(config)# interface fc 1/1
switch(config-if)# switchport fcrxbbcredit default
```

This example shows how to configure 50 receive buffer credits on an interface:

```
switch# configure terminal
switch(config)# interface fc 1/1
switch(config-if)# switchport fcrxbbcredit 50
```

This example shows how to configure 4095 extended buffer credits to an interface:

```
switch# configure terminal
switch(config)# fcrxbbcredit extended enable
switch(config)# interface fc 1/1
switch(config-if)# switchport fcrxbbcredit extended 4095
```

This examples shows how to assign 45 performance buffers to a selected interface:

```
switch# configure terminal
switch(config)# interface fc 1/1
switch(config-if)# switchport fcrxbbcredit performance-buffers 45
```

This example shows how to set the received frame data field size for an interface to 2000 bytes:

```
switch# configure terminal
switch(config)# interface fc 1/1
switch(config-if)# switchport fcrxbufsize 2000
```

This example shows how to assign buffer-to-buffer credits per virtual link on an ISL:

```
switch# configure terminal
switch(config)# interface fc 1/1
switch(config-if)# switchport vl-credit v10 12 v11 10 v12 29 v13 349
```

This example shows how to assign extended buffer-to-buffer credits per virtual link on an ISL:

```
switch# configure terminal
switch(config)# fcrxbbcredit extended enable
switch(config)# interface fc 1/1
```

```
switch(config-if)# switchport vl-credit extended v10 20 v11 25 v12 40 v13 349
```


Verifying Interface Buffer Configuration

This example shows which of the interfaces on a specified module are in R_RDY flow-control mode:

```
switch# show flow-control r_rdy module 3
fc3/17
fc3/18
```

This example shows how to verify the buffer-to-buffer credit information for all interfaces:

```
sswitch# show interface bbcredit
fc2/1 is down (SFP not present)
.
.
.
fc2/17 is trunking
Transmit B2B Credit is 255
Receive B2B Credit is 12
Receive B2B Credit performance buffers is 375
12 receive B2B credit remaining
255 transmit B2B credit remaining
fc2/21 is down (Link failure or not-connected)
.
.
.
fc2/31 is up
Transmit B2B Credit is 0
Receive B2B Credit is 12
Receive B2B Credit performance buffers is 48
12 receive B2B credit remaining
0 transmit B2B credit remaining
```

This example shows how to verify buffer-to-buffer credit information for a specific Fibre Channel interface:

```
switch# show interface fc2/31 bbcredit
fc2/31 is up
Transmit B2B Credit is 0
Receive B2B Credit is 12
Receive B2B Credit performance buffers is 48
12 receive B2B credit remaining
0 transmit B2B credit remaining
```

This example shows how to verify the type of buffers and data field size a port supports:

```
switch# show interface fc1/1 capabilities
fc1/1
Min Speed is 2 Gbps
Max Speed is 16 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 not supported

Rate Mode Capabilities Dedicated
Receive BB Credit modification supported yes
FX mode Receive BB Credit (min/max/default) (1/500/32)
ISL mode Receive BB Credit (min/max/default) (2/500/500)
Performance buffer modification supported yes
FX mode Performance buffers (min/max/default) (1/0/0)
ISL mode Performance buffers (min/max/default) (1/0/0)

Out of Service capable yes
Beacon mode configurable yes
Extended B2B credit capable yes
On demand port activation license supported no

```

This example shows how to verify the operational receive data field size for a port:

```

switch# show interface fc 4/1
fc4/1 is down (SFP not present)
Hardware is Fibre Channel
Port WWN is 20:c1:8c:60:4f:c9:53:00
Admin port mode is auto, trunk mode is on
snmp link state traps are enabled
Port vsan is 1
Receive data field Size is 2112
Beacon is turned off
Logical type is Unknown(0)
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
4 frames input,304 bytes
0 discards,0 errors
0 invalid CRC/FCS,0 unknown class
0 too long,0 too short
4 frames output,304 bytes
0 discards,0 errors
0 input OLS,0 LRR,0 NOS,0 loop inits
0 output OLS,0 LRR, 0 NOS, 0 loop inits
Last clearing of "show interface" counters : never

```

Troubleshooting Interface Buffer Credits

Use the **show logging onboard interrupt-stats** command to view the number of times a port sent extra R_RDYs or incremented transmit buffer to buffer credits to restore credit counts:

```
switch# show logging onboard interrupt-stats
...
-----
INTERRUPT COUNTS INFORMATION FOR DEVICE: FCMAC
-----
Interface|                               |      |      |      Time Stamp
Range    |      Interrupt Counter Name    | Count |      |MM/DD/YY HH:MM:SS
-----|-----|-----|-----|-----
fc1/1    |IP_FCMAC_INTR_ERR_BB_SCR_INCREMENT| 1     |      |01/01/17 20:00:00
fc1/1    |IP_FCMAC_INTR_ERR_BB_SCS_RESEND  | 1     |      |01/01/17 10:00:00
...

```

