Software Configuration Guide for the Cisco 6-port GE SFP Service Module and Cisco 4-port GE SFP and 1-port 10 GE SFP Service Module

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Cisco 6-port GE SFP Service Module and Cisco 4-port GE SFP and 1-port 10 GE SFP Service Module

The Cisco 6-port GE SFP Service Module (SM-X-6x1GE) and Cisco 4-port GE SFP and 1-port 10 GE SFP Service Module (SM-X-4x1GE-1x10GE) are software-configurable high-speed connectivity routing port service modules for the Cisco ISR 4000 Series routers.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and 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 feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

About the SM-X-6X1G and SM-X-4X1G-1X10G Modules

The Cisco 6-port GE SFP Service Module (SM-X-6x1GE) and Cisco 4-port GE SFP and 1-port 10 GE SFP Service Module (SM-X-4x1GE-1x10GE) are software-configurable high-speed connectivity routing port service modules for the Cisco ISR 4000 Series routers. These service modules provide increased density of Ethernet interfaces on the Cisco ISR 4000 Series routers.

Requirements for the Cisco SM-X-6X1G and Cisco SM-X-4X1G-1X10G

Cisco IOS/IOS XE Requirements

The following table describes Cisco IOS/IOS XE requirements for operating the Cisco SM-X-6X1G and Cisco SM-X-4X1G-1X10G.

Table 1: Cisco IOS/IOS XE Requirements

Supported Platform	IOS/IOS XE release
• Cisco 4400 Series ISRs • Cisco 4300Series ISRs	• SM-X-6x1G — Cisco IOS XE release 3.11 or later • SM-X-4x1G-10xG — Cisco IOS XE release 3.13 or later

Memory Requirements

The following table describes the minimum platform memory recommended for operating the Cisco SM-X-6X1G and Cisco SM-X-4X1G-1X10G.

Table 2: Cisco SM-X-6X1G and Cisco SM-X-4X1G-1X10G Minimum Memory Requirements

Supported Platforms	Flash Memory
Cisco ISR 4400 series routers	8 Mb

Finding Support Information for Platforms and Cisco IOS Software Images

Restrictions

Observe the following restrictions when using the Cisco SM-X-4X1G-1X10G service module:

Working Modes

- Not all ports provided on the Cisco SM-X-4X1G-1X10G service module are operational at the same time. The SM-X-4X1G-1X10G service module can only work in either the 1X10GE mode or 4X1GE mode.
- To use the SM-X-4X1G-1X10G service module in the 1X10GE mode, you must first shut down the four GE ports. To use the SM-X-4X1G-1X10G service module in 4X1GE mode, you must first shut down the 10G port.

Observe the following restrictions when using the Cisco SM-X-6X1G and SM-X-4X1G-1X10G service modules:

IPv4/IPv6 Classification Rules

- The Cisco SM-X-6X1G and SM-X-4X1G-1X10G do not support different classification rules for IPv4 and IPv6. The same rules will apply to both.
- 802.1Q and IPv4/IPv6 classification cannot be enabled on a port at the same time.

VLAN COS Classification

- The Cisco SM-X-6X1G and SM-X-4X1G-1X10G support COS classification on the main interface. COS classification is not supported in the subinterface mode.

Per VLAN Statistics

- The Cisco SM-X-6X1G and SM-X-4X1G-1X10G support total packet/byte statistics only. The service modules do not support the statistics for policy drops, oversubscription drops, unicast, broadcast input, output packet number, or bytes per VLAN.

Configuring the Cisco SM-X-6X1G and Cisco SM-X-4X1G-1X10G

This section describes how to configure the Cisco SM-X-6X1G and Cisco SM-X-4X1G-1X10G and includes information about verifying the configuration.

This section includes the following:

Required Configuration Tasks

This section lists the required configuration steps to configure the Cisco SM-X-6X1G and Cisco SM-X-4X1G-1X10G. Some of the required configuration commands implement default values that might be appropriate for your network. If the default value is correct for your network, then you do not need to configure the command. These commands are indicated by "(As Required)" in the Purpose column.

To configure the Cisco SM-X-6X1G and Cisco SM-X-4X1G-1X10G, complete the following steps:

SUMMARY STEPS

1. Router# **configure terminal**
2. Do one of the following:
   - Router(config)# **interface GigabitEthernet***slot*/*subslot*/*port* [**.***subinterface-number*]
   - Router(config)# **interface TenGigabitEthernet** *slot*/*subslot*/*port* [**.***subinterface-number*]
3. Router(config-if)# **ip address** *ip-address mask* {**secondary**} | **dhcp** {**client-id** *interface-name*} {**hostname** *host-name*}]
4. Router(config-if)# **mtu** *bytes*
5. Router(config-if)# **standby** [*group-number*] **ip** [*ip-address* [**secondary**]]
6. Router(config-if)# **no shutdown**

DETAILED STEPS

	Command or Action	Purpose
Step 1	Router# **configure terminal**	Enters global configuration mode.
Step 2	Do one of the following:	Specifies the Gigabit Ethernet, or Ten Gigabit Ethernet interface to configure, where:

	Command or Action	Purpose
	• Router(config)# **interface GigabitEthernet***slot*/*subslot*/*port* [**.***subinterface-number*] • Router(config)# **interface TenGigabitEthernet** *slot*/*subslot*/*port* [**.***subinterface-number*]	• *slot*/*subslot*/*port*—Specifies the location of the interface. See the "Specifying the Interface Address on a SM" section. • **.***subinterface-number*—(Optional) Specifies a secondary interface (subinterface) number.
Step 3	Router(config-if)# **ip address** *ip-address mask* {**secondary**} | **dhcp** {**client-id** *interface-name*} {**hostname** *host-name*}]	Sets a primary or secondary IP address for an interface that is using IPv4, where: • *ip-address* —Specifies the IP address for the interface. • *mask* —Specifies the mask for the associated IP subnet. • **secondary**—(Optional) Specifies that the configured address is a secondary IP address. If this keyword is omitted, the configured address is the primary IP address. • **dhcp**—Specifies that IP addresses will be assigned dynamically using DHCP. • **client-id** *interface-name*—Specifies the client identifier. The *interface-name* sets the client identifier to the hexadecimal MAC address of the named interface. • **hostname** *host-name*—Specifies the hostname for the DHCP purposes. The *host-name* argument is the name of the host to be placed in the DHCP option 12 field.
Step 4	Router(config-if)# **mtu** *bytes*	(As Required) Specifies the maximum packet size for an interface, where: • *bytes*—Specifies the maximum number of bytes for a packet. The default is 1500 bytes; the range is 1500 to 9216.
Step 5	Router(config-if)# **standby** [*group-number*] **ip** [*ip-address* [**secondary**]]	(Required for HSRP Configuration Only) Creates (or enables) the HSRP group using its number and virtual IP address, where: • *group-number*—(Optional) Specifies the group number on the interface for which HSRP is being enabled. The range is 0 to 255; the default is 0. If there is only one HSRP group, you do not need to enter a group number. • *ip-address*—(Optional on all but one interface if configuring HSRP) Specifies the virtual IP address of the hot standby router interface. You must enter the virtual IP address for at least one of the interfaces; it can be learned on the other interfaces. • **secondary**—(Optional) Specifies the IP address is a secondary hot standby router interface. If neither router is designated as a secondary or standby router and no priorities are set, the primary IP addresses are compared and the higher IP address is the active router, with the next highest as the standby router.

	Command or Action	Purpose
		This command enables HSRP but does not configure it further. For additional information on configuring HSRP, refer to the HSRP section of the Cisco IP Configuration Guide publication that corresponds to your Cisco IOS software release.
Step 6	Router(config-if)# **no shutdown**	Enables the interface.

Specifying the Interface Address on a SM

SM interface ports begin numbering with "0" from left to right. Single-port SMs use only the port number 0. To configure or monitor SM interfaces, you need to specify the physical location of the SM, and interface in the CLI. The interface address format is slot/subslot/port, where:

- **slot—**Specifies the chassis slot number in the Cisco ISR 4400 series routers where the SIP is installed.
- **subslot—**Specifies the slot of the SIP where the SM is installed.
- **port—**Specifies the number of the individual interface port on a SM.

The following example shows how to specify the first interface (0) on a SM installed in the first subslot of a SIP (0) installed in chassis slot 1:

```
router(config)# interface GigabitEthernet 1/0/0

interface GigabitEthernet1/0/0
no ip address
shutdown
negotiation auto
no cdp enable
```

Modifying the MAC Address on an Interface

The Cisco SM-X-6X1G and Cisco SM-X-4X1G-1X10G use a default MAC address for each port that is derived from the base address that is stored in the electrically erasable programmable read-only memory (EEPROM) on the backplane of the Cisco ISR 4400 series routers.

To modify the default MAC address of an interface to some user-defined address, use the following command in interface configuration mode:

Command	Purpose
Router(config-if)# **mac-address** *ieee-address*	Modifies the default MAC address of an interface to some user-defined address, where: • *ieee-address*—Specifies the 48-bit Institute of Electrical and Electronics Engineers (IEEE) MAC address written as a dotted triple of four-digit hexadecimal numbers (*xxxx.yyyy.zzzz*). **Note** To return to the default MAC address on the interface, use the **no** form of the command.

Verifying a MAC Address

To verify the MAC address of an interface, use the **show interfaces gigabitethernet** privileged EXEC command and observe the value shown in the "address is" field.

The following example shows that the MAC address is a44c.119e.0884 (bia a44c.119e.0884) for interface 0 on the SM installed in subslot 0 of the SIP installed in slot 1 of the Cisco ISR 4451-X:

```
router# show interface gigabitEthernet 1/0/0

GigabitEthernet1/0/0 is up, line protocol is up
  Hardware is SM-X-4X1G-1X10G, address is a44c.119e.0884 (bia a44c.119e.0884)
  Internet address is 3.0.0.1/24
  MTU 1500 bytes, BW 100000 Kbit/sec, DLY 100 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive not supported
  Half Duplex, 100Mbps, link type is force-up, media type is RJ45
  output flow-control is on, input flow-control is on
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input never, output 00:00:55, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/375/0/0 (size/max/drops/flushes); Total output drops: 440722919
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
(Additional output removed for readability)
```

Configuring the Hot Standby Router Protocol

The Hot Standby Router Protocol (HSRP) provides high network availability because it routes IP traffic from hosts without relying on the availability of any single router. HSRP is used in a group of routers for selecting an active router and a standby router. (An *active router* is the router of choice for routing packets; a *standby router* is a router that takes over the routing duties when an active router fails, or when preset conditions are met).

HSRP is enabled on an interface by entering the **standby** [*group-number*]**ip** [*ip-address*[**secondary**]] command. The **standby** command is also used to configure various HSRP elements. This document does not discuss more complex HSRP configurations. For additional information on configuring HSRP, refer to the HSRP section of the Cisco IP Configuration Guide publication that corresponds to your Cisco IOS XE software release. In the following HSRP configuration, standby group 2 on Gigabit Ethernet port 2/0/0 is configured at a priority of 110 and is also configured to have a preemptive delay should a switchover to this port occur:

```
Router(config)# interface GigabitEthernet 2/0/0
Router(config-if)# standby 2 ip 120.12.1.200
Router(config-if)# standby 2 priority 110
Router(config-if)# standby 2 preempt
```

Verifying HSRP

To verify the HSRP information, use the show standby command in EXEC mode:

```
Router# show standby

Ethernet0 - Group 0
Local state is Active, priority 100, may preempt
Hellotime 3 holdtime 10
Next hello sent in 0:00:00
Hot standby IP address is 198.92.72.29 configured
Active router is local
Standby router is 198.92.72.21 expires in 0:00:07
Standby virtual mac address is 0000.0c07.ac00
Tracking interface states for 2 interfaces, 2 up:
```

```
UpSerial0
UpSerial1
```

Modifying the Interface MTU Size

The Cisco IOS software supports three different types of configurable maximum transmission unit (MTU) options at different levels of the protocol stack:

- Interface MTU—Checked by the SM on traffic coming in from the network. Different interface types support different interface MTU sizes and defaults. The interface MTU defines the maximum packet size allowable (in bytes) for an interface before drops occur. If the frame is smaller than the interface MTU size, but is not smaller than the minimum frame size for the interface type (such as 64 bytes for Ethernet), then the frame continues to process.
- IP MTU—Can be configured on an interface or subinterface. If an IP packet exceeds the IP MTU size, then the packet is fragmented.
- Tag or Multiprotocol Label Switching (MPLS) MTU—Can be configured on an interface or subinterface and allows up to six different labels, or tag headers, to be attached to a packet. The maximum number of labels is dependent on your Cisco IOS software release.

Different encapsulation methods and the number of MPLS MTU labels add additional overhead to a packet. For example, Subnetwork Access Protocol (SNAP) encapsulation adds an 8-byte header, dot1q encapsulation adds a 2-byte header, and each MPLS label adds a 4-byte header (*n* labels x 4 bytes).

For Cisco SM-X-6X1G and Cisco SM-X-4X1G-1X10G on the Cisco ISR 4400 series routers, the default MTU size is 1500 bytes. The maximum configurable MTU is 9216 bytes. The SM automatically adds an additional 22 bytes to the configured MTU size to accommodate some of the additional overhead.

Note In the Cisco ISR 4400 series routers, 2RU and 2RU-Fixed chassis, the MTU size for the Management Ethernet interface (interface gigabitethernet 0) is limited to 4470 bytes.

Interface MTU Configuration Guidelines

When configuring the interface MTU size on a Gigabit Ethernet SM on a Cisco ISR 4400 series router, consider the following guidelines:

- The default interface MTU size accommodates a 1500-byte packet, plus 22 additional bytes to cover the following additional overhead:
  - Layer 2 header—14 bytes
  - Dot1q header—4 bytes
  - CRC—4 bytes
- If you are using MPLS, be sure that the **mpls mtu** command is configured for a value less than or equal to the interface MTU.
- If you are using MPLS labels, then you should increase the default interface MTU size to accommodate the number of MPLS labels. Each MPLS label adds 4 bytes of overhead to a packet.

Interface MTU Configuration Task

To modify the MTU size on an interface, use the following command in interface configuration mode:

Command	Purpose
Router(config-if)# **mtu** *bytes*	Configures the maximum packet size for an interface, where: • *bytes*—Specifies the maximum number of bytes for a packet. The default is 1500 bytes and the maximum configurable MTU is 9216 bytes. **Note** To return to the default MTU size, use the **no** form of the command.

Verifying the MTU Size

To verify the MTU size for an interface, use the **show interfaces gigabitethernet** privileged EXEC command and observe the value shown in the "MTU" field.

The following example shows an MTU size of 1500 bytes for interface port 2 on the Gigabit Ethernet SM installed in the top subslot (0) of the SIP that is located in slot 2 of the Cisco ISR 4451-X:

```
router# show interface gigabitEthernet 2/0/2
GigabitEthernet2/0/2 is up, line protocol is up
  Hardware is SM-X-4X1G-1X10G, address is a44c.119e.0884 (bia a44c.119e.0884)
  Internet address is 3.0.0.1/24
  MTU 1500 bytes, BW 100000 Kbit/sec, DLY 100 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive not supported
  Half Duplex, 100Mbps, link type is force-up, media type is RJ45
  output flow-control is on, input flow-control is on
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input never, output 00:00:55, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/375/0/0 (size/max/drops/flushes); Total output drops: 440722919
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     557663005 packets input, 33459780300 bytes, 0 no buffer
     Received 0 broadcasts (0 IP multicasts)
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
     0 watchdog, 0 multicast, 0 pause input
     451428325 packets output, 27800558158 bytes, 0 underruns
     0 output errors, 0 collisions, 7 interface resets
     0 unknown protocol drops
     0 babbles, 0 late collision, 0 deferred
     0 lost carrier, 0 no carrier, 0 pause output
     0 output buffer failures, 0 output buffers swapped out
```

Ingress QoS Classification for IPv4 and IPv6

The SM-X-6X1G and SM-X-4X1G-1X10G module support two priority queues per port on ingress. The high-priority queue is always processed before the low-priority queue.

Restrictions

- The SM-X-6X1G and SM-X-4X1G-1X10G supports IPv4/IPv6 classification rules on three of the external ports. 802.IQ based classification is supported on all ports.
- By default, ingress QoS classification is disabled.

- The SM-X-6X1G and SM-X-4X1G-1X10G modules do not support different classification rules for IPv4 and IPv6. The same rules apply to both.
- IPv4/IPv6-based classification and 802.1Q-based classification are mutually exclusive.

Note Ingress IPv4/IPv6 classification is supported on any three of the service module ports. If the following commands are entered in the fourth port, an error message appears.

Configuring Ingress QoS Classification for IPv4 and IPv6

Use the following commands in interface configuration mode to configure ingress QoS classification for IPv4 or IPv6:

Command	Purpose
Router(config-if)# **plim qos input map ipv4v6 qos-value-based**	Enables IPv4/IPv6 qos-based classification. The **no** form of this command disables all IPv4/IPv6 classification. By default, without using this command, qos-based classification is disabled on every interface.
Router(config-if)# **plim qos input map ipv6 qos-value** {*qos-value* | *qos-range* }{**queuestrict-priority** | **0**}	Allows you to specify which IPv4/IPv6 QoS value or range to choose for high priority (strict priority) or low priority (queue 0). • {*qos-value* | *qos-range*}—Specifies the value of QoS. You can specify a range of values separated by a dash or a list of values. • **queue**—Specifies the high priority queue (strict priority). Enter 0 for the low priority queue. The **no** form of this command removes the IPv4/IPv6 QoS value or range specified for high priority or low priority queue accordingly. **Note** By default, without using this command after enabling IPv4/IPv6 qos-based classification (entered 'plim qos input map ipv4v6 qos-value-based'), the interface classifies DSCP cs6, cs7 and ef as high priority.

Configuring the Encapsulation Type

By default, the interfaces on the Cisco SM-X-6X1G and Cisco SM-X-4X1G-1X10G support Advanced Research Projects Agency (ARPA) encapsulation. They do not support configuration of service access point or SNAP encapsulation for transmission of frames.

The only other encapsulation supported by the SM interfaces is IEEE 802.1Q encapsulation for virtual LANs (VLANs).

Configuring Autonegotiation on an Interface

The Gigabit Ethernet interfaces use a connection-setup algorithm called *autonegotiation.* Autonegotiation allows the local and remote devices to configure compatible settings for communication over the link. Using autonegotiation, each device advertises its transmission capabilities and then agrees upon the settings to be used for the link.

For the Gigabit Ethernet interfaces on Cisco ISR 4400 series routers, flow control is autonegotiated when autonegotiation is enabled. Autonegotiation is enabled by default.

The following guidelines should be followed regarding autonegotiation:

- If autonegotiation is disabled on one end of a link, it must be disabled on the other end of the link. If one end of a link has autonegotiation disabled while the other end of the link does not, the link will not come up properly on both ends.
- Autonegotiation is not supported on the 10GE ports in the SM-X-4X1G-1X10G module.
- Flow control is enabled by default.
- Flow control will be on if autonegotiation is disabled on both ends of the link.

Enabling Autonegotiation

To re-enable autonegotiation on a Gigabit Ethernet interface, use the following command in interface configuration mode:

Command	Purpose
Router(config-if)# **negotiation auto**	Enables autonegotiation on a Gigabit Ethernet SM interface on the Cisco ISR 4400 series routers. Advertisement of flow control occurs.

Disabling Autonegotiation

Autonegotiation is automatically enabled and can be disabled on the Gigabit Ethernet interfaces on the Cisco ISR 4400 series routers. During autonegotiation, advertisement for flow control, speed, and duplex occurs, depending on the media (fiber or copper) in use. If the interface is connected to a link that has autonegotiation disabled, autonegotiation should either be re-enabled on the other end of the link or disabled on the Gigabit Ethernet SM, if possible. Both ends of the link will not come up properly if only one end of the link has disabled autonegotiation.

Speed and duplex configurations can be advertised using autonegotiation. However, the only values that are negotiated are:

- For Cisco SM-X-6X1G and Cisco SM-X-4X1G-1X10G using RJ-45 copper interfaces—1000 Mbps for speed and full-duplex mode. Link speed is not negotiated when using fiber interfaces.

From a user's perspective, these settings are not really negotiated, but rather are enabled using autonegotiation. The SFPs for Cisco SM-X-6X1G and Cisco SM-X-4X1G-1X10G support 1000Base-X, and the IEEE 1000Base-X standard for fiber does not support negotiation of link speed.

To disable autonegotiation, use the following command in interface configuration mode:

Command	Purpose
Router(config-if)# **no negotiation auto**	Disables autonegotiation on Gigabit Ethernet SM interfaces on Cisco ISR 4400 series routers. No advertisement of flow control occurs.

Configuring Speed and Duplex

Note When using the SFP-GE-T, you must configure both the speed and duplex modes.

To configure the speed for a Gigabit Ethernet interface, use the **speed** command in interface configuration mode. To return to the default setting, use the **no** form of this command:

Command	Purpose
Router(config-if)# **speed** {**10** | **100** | **1000**}	Configures the interface to transmit at 10 Mbps, 100 Mbps, or 1000 Mbps. (The **1000** keyword is only valid for Gigabit Ethernet.)

To configure duplex operation on an interface, use the **duplex** command in interface configuration mode. Use the **no** form of this command to return to the default value.

Command	Purpose
Router(config-if)# **duplex** {**full** | **half**}	Specifies full- or half-duplex operation.

Configuring the Media Type

The Gigabit Ethernet SMs support two media types: RJ-45 and SFP. Use the **media-type** configuration command to select either the RJ-45 or SFP for a given port.

Command	Purpose
Router(config-if)# **media-type** {**rj45** | **sfp**}	Specifies the physical connection on an interface. The auto-select feature uses the connector that is attached: • rj45—Uses RJ45 connector • sfp—Uses SFP connector

Configuring Auto-Media-Detection and Auto-Failover

The Cisco SM-X-6X1G and Cisco SM-X-4X1G-1X10G module supports the auto-detection and auto-failover feature from Cisco IOS XE release 3.16 onwards, You need to upgrade to Cisco IOS XE release 3.16 to configure this feature on the Cisco SM-X-6X1G and Cisco SM-X-4X1G-1X10G module. You can configure the media for failover redundancy when the network goes down.

Enabling Auto-Media-Detection

When the media-type is not configured, the auto-select feature is enabled by default. The auto-select feature automatically detects the media that is connected and links it up. If both the media are connected, the media that comes up first is linked.

Enabling Auto-Failover

The primary media is explicitly indicated as SFP or RJ-45. When the router receives an indication that the primary media is down, the secondary failover media is enabled. After the switchover, when the primary media is restored, the media does not switch back to the primary media.

To enable auto-detect or auto-failover, use the following commands beginning in global configuration mode:

SUMMARY STEPS

1. Router(config)# **interface gigabitethernet** *slot*/*subslot*/*port* [**.***subinterface-number*]
2. Router(config-subif)# **media-type rj45**
3. Router(config-if)# **imedia-type sfp**
4. Router(config-if)# **media-type auto-select/no media type**
5. Router(config-if)# **media-type rj45 auto-failover**
6. Router(config-if)# **media-type sfp auto-failover**

DETAILED STEPS

	Command or Action	Purpose
Step 1	Router(config)# **interface gigabitethernet** *slot*/*subslot*/*port* [**.***subinterface-number*]	Specifies the Gigabit Ethernet interface to configure, where: • *slot*/*subslot*/*port*—Specifies the location of the interface. See the "Specifying the Interface Address on a SM" section.. • *subinterface-number*—Specifies a secondary interface (subinterface) number.
Step 2	Router(config-subif)# **media-type rj45**	Defines RJ-45 as the exclusive media-type.
Step 3	Router(config-if)# **imedia-type sfp**	Defines SFP as the exclusive media-type.
Step 4	Router(config-if)# **media-type auto-select/no media type**	Enables auto-select by default and whichever media comes first is linked.
Step 5	Router(config-if)# **media-type rj45 auto-failover**	Specifies RJ-45 as the primary media-type and media failovers to SFP if the RJ-45 is down.
Step 6	Router(config-if)# **media-type sfp auto-failover**	Specifies SFP as the primary media-type and media failovers to RJ-45 if the SFP is down.

Configuring a Subinterface on a VLAN

You can configure subinterfaces on the Gigabit Ethernet SM interfaces on a VLAN using IEEE 802.1Q encapsulation. Cisco Discovery Protocol (CDP) is disabled by default on the Gigabit Ethernet SM interfaces and subinterfaces on the Cisco ISR 4400series routers.

To configure a SM interface on a VLAN, use the following commands beginning in global configuration mode:

SUMMARY STEPS

1. Do one of the following:
   - Router(config)# **interface gigabitethernet** *slot*/*subslot*/*port* [**.***subinterface-number*]
   - Router(config)# **interface tengigabitethernet** *slot*/*subslot*/*port* [**.***subinterface-number*]
2. Router(config-subif)# **encapsulation dot1q** *vlan-id*
3. Router(config-if)# **ip address** *ip-address mask* [**secondary**]

DETAILED STEPS

	Command or Action	Purpose
Step 1	Do one of the following: • Router(config)# **interface gigabitethernet** *slot*/*subslot*/*port* [**.***subinterface-number*] • Router(config)# **interface tengigabitethernet** *slot*/*subslot*/*port* [**.***subinterface-number*]	Specifies the Gigabit Ethernet interface to configure, where: • *slot*/*subslot*/*port*—Specifies the location of the interface. See the "Specifying the Interface Address on a SM" section.. • **.***subinterface-number*—Specifies a secondary interface (subinterface) number.
Step 2	Router(config-subif)# **encapsulation dot1q** *vlan-id*	Defines the encapsulation format as IEEE 802.1Q ("dot1q"), where *vlan-id* is the number of the VLAN (1–4094).
Step 3	Router(config-if)# **ip address** *ip-address mask* [**secondary**]	Sets a primary or secondary IP address for an interface, where: • *ip-address*—Specifies the IP address for the interface. • *mask*—Specifies the mask for the associated IP subnet. • **secondary**—Specifies that the configured address is a secondary IP address. If this keyword is omitted, the configured address is the primary IP address.

VLAN Classification

To specify VLAN classification, use the following commands in physical router configuration mode:

Command	Purpose
Router (config) # **plim qos input map cos enable**	Enables packet classification based on 802.1q VLAN COS bits. The **no** form of this command totally disables the COS classification. **Note** By default, without using this command, COS classification is disabled on every interface.
Router (config) # **plim qos input map cos** *cos-value* | *cos-range* **queue** {**strict-priority**|**0**}	Allows the user to specify a specific COS value or range for high priority or low priority (**0**). By default, without this command, COS value 6-7 is classified as high priority after COS classification is enabled. The **no** form of this command removes cos value or range specified for high priority or low priority queue accordingly. **Note** This command will apply to all vlans configured on this main interface
Router (config) # **plim qos input weight** *weight*	Specifies the weight value for excess scheduling on low priority traffic. The no form of this command sets the scheduling parameters to the deafult values. **Note** The default value is 8.
Router (config) # **plim qos input policer bandwidth** *kbps* **strict-priority**	Sets the maximum bandwidth for high priority traffic from that interface.

Verifying Subinterface Configuration on a VLAN

To verify the configuration of a subinterface and its status on the VLAN, use the **show vlans** privileged EXEC command.

The following example shows the status of subinterface number 1 on port 0 on the SM in VLAN number 200:

```
Router# show vlans

VLAN ID:200 (IEEE 802.1Q Encapsulation)
Protocols Configured:         Received:       Transmitted:
          IP                  0                  2
VLAN trunk interfaces for VLAN ID 200:
GigabitEthernet1/0/0.1 (200)
      IP:12.200.21.21
      Total 0 packets, 0 bytes input
      Total 2 packets, 120 bytes output
```

Saving the Configuration

To save your running configuration to nonvolatile random-access memory (NVRAM), use the following command in privileged EXEC configuration mode:

Command	Purpose
Router# **copy running-config startup-config**	Writes the new configuration to NVRAM.

For information about managing your system image and configuration files, refer to the *Cisco IOS Configuration Fundamentals Configuration Guide* and *Cisco IOS Configuration Fundamentals Command Reference* that correspond to your Cisco IOS software release.

Shutting Down and Restarting an Interface on a SM

You can shut down and restart any of the interface ports on a SM independently of each other. Shutting down an interface stops traffic and enters the interface into an "administratively down" state.

There are no restrictions for online insertion and removal (OIR) on Cisco SM-X-6X1G and Cisco SM-X-4X1G-1X10G. Cisco SM-X-6X1G and Cisco SM-X-4X1G-1X10G can be removed from a SIP at any time. SIPs populated with any type of SMs can be removed from the router at any time.

If you are preparing for an OIR of a SM, it is not necessary to independently shut down each of the interfaces prior to deactivation of the SM. The **hw-module subslot stop** command automatically stops traffic on the interfaces and deactivates them along with the SM in preparation for OIR.

In similar fashion, you do not need to independently restart any interfaces on a SM after OIR of a SM or SIP.

To shut down an interface on a SM, use the following command in interface configuration mode:

Command	Purpose
Router(config-if)# **shutdown**	Disables an interface.

To restart an interface on a SM, use the following command in interface configuration mode:

Command	Purpose
Router(config-if)# **no shutdown**	Restarts a disabled interface.

Configuring Ethernet Flow Control

To configure Ethernet flow control per queue per port, use the following commands in the interface configuration mode:

Command	Purpose
Router(config-if)# **plim qos input queue** {**strict-priority** | **0**} **pause enable**	Enables Ethernet flow control pause frame generation on a queue. By default pause is enabled on both the high priority and low priority queues. **Note** When you enable ingress classification rules, it is recommended that you disable pause on the low priority queue.

Command	Purpose
Router(config-if)# plim qos input queue {**strict-priority** | **0**} **pause threshold** *value*	Sets the threshold for pause frame generation. The default value is 90. **Note** The minimum threshold value accepted by the SM-X-6X1G and SM-X-4X1G-1X10G is 20. If threshold is set to a number less than 20, the module will use 20. The configurable minimum threshold is 20 percent.

Verifying the Interface Configuration

Besides using the **show running-configuration** command to display your Cisco ISR 4400 series router configuration settings, you can use the **show interfaces gigabitethernet** command to get detailed information on a per-port basis for your Cisco SM-X-6X1G and Cisco SM-X-4X1G-1X10G.

Verifying Per-Port Interface Status

To find detailed interface information on a per-port basis for the Cisco SM-X-6X1G and Cisco SM-X-4X1G-1X10G, use the**show interfaces gigabitethernet** command.

The following example provides sample output for interface port 0 on the SM located in the top subslot (0) of the SIP that is installed in slot 2 of the Cisco ISR 4451-X:

```
router# show interface gigabitEthernet 2/0/0

GigabitEthernet2/0/0 is up, line protocol is up
  Hardware is SM-X-4X1G-1X10G, address is a44c.119e.0884 (bia a44c.119e.0884)
  Internet address is 3.0.0.1/24
  MTU 1500 bytes, BW 100000 Kbit/sec, DLY 100 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive not supported
  Half Duplex, 100Mbps, link type is force-up, media type is RJ45
  output flow-control is on, input flow-control is on
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input never, output 00:00:55, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/375/0/0 (size/max/drops/flushes); Total output drops: 440722919
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     557663005 packets input, 33459780300 bytes, 0 no buffer
     Received 0 broadcasts (0 IP multicasts)
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
     0 watchdog, 0 multicast, 0 pause input
     451428325 packets output, 27800558158 bytes, 0 underruns
     0 output errors, 0 collisions, 7 interface resets
     0 unknown protocol drops
     0 babbles, 0 late collision, 0 deferred
     0 lost carrier, 0 no carrier, 0 pause output
     0 output buffer failures, 0 output buffers swapped out
```

Verifying Configuration and Classification Counters on an Interface

Use the following show commands to verify the configuration and classification counters on an interface:

Command	Purpose
Router(config)# **show platform hardware interface** *interface-name***plim qos input map**	Displays the ingress QoS classification rule for a given interface.
Router(config)# **show platform hardware subslot** *slot*/*sublsot***module interface** *interface-name***input qos counters**	Displays the input classification counters applied from ingress classification rule of a given interface. This command shows input packet numbers and bytes that have been classified to high priority or low priority queues.
Router(config)# **show platform hardware interface** *interface-name***plim qos input bandwidth**	Displays the configured bandwidth of the high-priority traffic and excess scheduling of low priority traffic of a given interface.

Using show Commands to Check SFP Module Status

You can use various **show** commands to view information specific to SFP and SFP+ optical transceiver modules.

To check or verify the status of an SFP Module or SFP+ Module, use the following **show** commands:

- **show hw-module subslot** *slot*/*subslot* **transceiver port idprom**
- **show hw-module subslot** *slot*/*subslot* **transceiver port idprom detail**
- **show hw-module subslot** *slot*/*subslot* **transceiver port idprom brief**
- **show hw-module subslot** *slot*/*subslot* **transceiver port idprom dump**

Following are sample output of several **show** commands for SFP and SFP+ modules.

The following show hw-module subslot command sample output is for SFP-GE-SX:

```
Router# show hw-module subslot 2/0 transceiver 0 idprom
IDPROM for transceiver GigabitEthernet2/0/0:Description = SFP optics (type 3)Transceiver
Type: = GE SX (19)Product Indentifier (PID) = FTRJ8519P1BNL-C6Vendor Revision = ASerial
Number (SN) = FNS1037R8DHVendor Name = CISCO-FINISARVendor OUI (IEEE company ID) = 00.90.65
 (36965)CLEI code = IPUIALJRAACisco part number = 10-2143-01Device State = Enabled.Date
code (yy/mm/dd) = 06/09/14Connector type = LC.Encoding = 8B10BNRZNominal bitrate = GE (1300
 Mbits/s)Minimum bit rate as % of nominal bit rate = not specifiedMaximum bit rate as % of
 nominal bit rate = not specified
```

The following show hw-module subslot command sample output is for SFP-GE-SX:

```
Router# show hw-module subslot 2/0 transceiver 0 idprom dump
IDPROM for transceiver GigabitEthernet2/0/0:Description = SFP optics (type 3)Transceiver
Type: = GE SX (19)Product Indentifier (PID) = FTRJ8519P1BNL-C6Vendor Revision = ASerial
Number (SN) = FNS1037R8DHVendor Name = CISCO-FINISARVendor OUI (IEEE company ID) = 00.90.65
 (36965)CLEI code = IPUIALJRAACisco part number = 10-2143-01Device State = Enabled.
SFP IDPROM Page 0xA0:000: 03 04 07 00 00 00 01 00 00 00010: 00 01 0D 00 00 00 37 1B 00
00020: 43 49 53 43 4F 2D 46 49 4E 49030: 53 41 52 20 20 20 00 00 90 65040: 46 54 52 4A 38
35 31 39 50 31050: 42 4E 4C 2D 43 36 41 20 20 20060: 03 52 00 74 00 1A 00 00 46 4E070: 53
31 30 33 37 52 38 44 48 20080: 20 20 20 20 30 36 30 39 31 34090: 20 20 58 80 01
SFP IDPROM Page 0xA2:000: 6D 00 E3 00 67 00 F3 00 98 58010: 69 78 90 88 71 48 1D 4C 01
F4020: 17 70 03 E8 25 19 02 F5 25 19030: 04 A9 E3 EE 01 DF 8F C5 02 EC040: 00 00 00 00 00
00 00 00 00 00050: 00 00 00 00 00 00 00 00 00 00060: 00 00 00 00 00 00 00 00 3E 5D070: 01
79 C0 5B AC 86 01 00 00 00080: 00 AA FF FD 01 00 00 00 01 00090: 00 00 00 00 00 3A 1B 70
80 D8100: 00 62 00 28 00 22 00 00 00 00110: 82 F8 05 40 00 00 05 40 00 00120: 00 00 00 00
```

```
00 00 00 01 49 50130: 55 49 41 4C 4A 52 41 41 31 30140: 2D 32 31 34 33 2D 30 31 56 30150:
31 20 89 FB 55 00 00 00 00 78160: 00 00 00 00 00 00 00 00 00 00 00170: 00 00 00 00 00 00 00
00 00 00180: 00 00 00 00 00 00 00 00 00 00190: AA AA 53 46 50 2D 47 45 2D 53200: 20 20 20
20 20 20 20 20 20 20210: 20 20 00 00 00 00 00 00 00 00 00220: 00 00 00 A2 00 00 00 00 00 00230:
 00 00 00 00 00 00 00 00 00 00240: 00 00 00 00 00 00 00 00 00 00 40250: 00 40 00 00 00 00Router#
```

Configuration Examples

This section includes the following configuration examples:

Basic Interface Configuration

The following example shows how to enter the global configuration mode to specify the interface that you want to configure, configure an IP address for the interface, and save the configuration. This example configures interface port 0 on the SM that is located in subslot 0 of the SIP that is installed in slot 2 of the Cisco ISR 4451-X:

```
! Enter global configuration mode.
!
Router# configure terminal
! Enter configuration commands, one per line. End with CNTL/Z.
!
! Specify the interface address.
!
Router(config)# interface gigabitethernet 2/0/0
!
! Configure an IP address.
!
Router(config-if)# ip address 192.168.50.1 255.255.255.0
!
! Start the interface.
!
Router(config-if)# no shut
!
! Save the configuration to NVRAM.
!
Router(config-if)# exit
Router# copy running-config startup-config
```

MAC Address Configuration

The following example shows how to change the default MAC address on the interface to 1111.2222.3333:

```
! Enter global configuration mode.
!
Router# configure terminal
! Enter configuration commands, one per line. End with CNTL/Z.
!

! Specify the interface address
!
Router(config)# interface gigabitethernet 2/0/0
!
! Modify the MAC address.
!
Router(config-if)# mac-address 1111.2222.3333
```

MTU Configuration

The following example shows how to set the MTU interface to 9216 bytes.

Note The SM automatically adds an additional 22 bytes to the configured MTU interface size.

```
! Enter global configuration mode.
!
Router# configure terminal
! Enter configuration commands, one per line. End with CNTL/Z.
!

! Specify the interface address
!
Router(config)# interface gigabitethernet 2/0/0
!
! Configure the interface MTU.
!
Router(config-if)# mtu 9216
```

VLAN Configuration

The following example shows how to create the subinterface number 268 on SM interface port 2 (the third port), and configure the subinterface on the VLAN with the ID number 268, using IEEE 802.1Q encapsulation:

```
! Enter global configuration mode.
!
Router# configure terminal
! Enter configuration commands, one per line. End with CNTL/Z.
!

! Specify the interface address
!
Router(config)# interface gigabitethernet 2/0/1.268
!
! Configure dot1q encapsulation and specify the VLAN ID.
!
Router(config-subif)# encapsulation dot1q 268
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
Information on connecting the service module	Connecting the Cisco 6-port GE SFP Service Modules and Cisco 4-port 10 GE SFP Service Modules to the Network
Regulatory Compliance and Safety Information	Cisco Network Modules and Interface Cards Regulatory Compliance and Safety Information
Overview of Cisco Network Modules and Service Modules for Cisco Access Routers	Overview of Cisco Network Modules and Service Modules for Cisco Access Routers
Installing Cisco Network Modules and Service Modules in Cisco Access Routers	Installing Cisco Network Modules and Service Modules in Cisco Access Routers
Documentation Roadmap for the Cisco ISR 4400Series Routers	Documentation Roadmap for the Cisco ISR 4400 Series Routers

Related Topic	Document Title
Hardware Installation Guide for the Cisco ISR 4400 Series Routers	Hardware Installation Guide for the Cisco ISR 4400 Routers Integrated Services Router
Software Configuration Guide for the Cisco ISR 4400 Series Routers	Software Configuration Guide for the Cisco ISR 4400Series Routers

MIBs

MIB	MIBs Link
RFC1407–MIB	To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html