Configuring the Ethernet SPAs

This chapter provides information about configuring the Fast Ethernet and Gigabit Ethernet SPAs on the Cisco ASR 1000 Series Aggregation Services Routers. It includes the following sections:

For more information about the commands used in this chapter, refer to the related Cisco IOS software command reference and master index publications and the publication that corresponds to your Cisco IOS XE software release. For more information about accessing these publications, see the "Related Documentation" section on page xxxiii.

For information about managing your system images and configuration files, refer to the *Cisco ASR 1000 Series Aggregation Services Routers Software Configuration Guide*, the *Cisco IOS Configuration Fundamentals Configuration Guide*, and the *Cisco IOS Configuration Fundamentals Command Reference* publications that correspond to your Cisco IOS software release.

Configuration Tasks

This section describes how to configure the Gigabit Ethernet and Fast Ethernet SPAs and includes information about verifying the configuration.

This section includes the following topics:

Required Configuration Tasks

This section lists the required configuration steps to configure the Gigabit Ethernet SPAs. 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 Fast Ethernet or Gigabit Ethernet SPAs, complete the following steps:

	Command	Purpose
Step 1	Router# **configure terminal**	Enters global configuration mode.
Step 2	Router(config)# **interface gigabitethernet** *slot*/*subslot*/*port*[**.***subinterface-number*] or Router(config)# **interface tengigabitethernet** *slot*/*subslot*/*port*[**.***subinterface-number*] or Router(config)# **interface fastethernet** *slot*/*subslot*/*port*[**.***subinterface-number*]	Specifies the Gigabit Ethernet, Ten Gigabit Ethernet, or Fast Ethernet interface to configure, where: • *slot*/*subslot*/*port*—Specifies the location of the interface. See the "Specifying the Interface Address on a SPA" section on page 10-4. • **.***subinterface-number*—(Optional) Specifies a secondary interface (subinterface) number.

	Command	Purpose
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* 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.

	Command	Purpose
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: • (Optional) *group-number*—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. • (Optional on all but one interface if configuring HSRP) *ip-address*—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. • (Optional) **secondary**—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. 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 SPA

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

- *slot*—Specifies the chassis slot number in the Cisco ASR 1000 Series Aggregation Services Router where the SIP is installed.
- *subslot*—Specifies the slot of the SIP where the SPA is installed.
- *port*—Specifies the number of the individual interface port on a SPA.

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

```
Router(config)# interface GigabitEthernet 0/0/0
interface GigabitEthernet0/0/0
no ip address
shutdown
negotiation auto
no cdp enable
```

Modifying the MAC Address on an Interface

The Gigabit Ethernet SPAs 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 ASR 1000 Series Aggregation Services 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*).

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 000a.f330.2e40 for interface 1 on the SPA installed in subslot 0 of the SIP installed in slot 2 of the Cisco ASR 1000 Series Aggregation Services Router:

```
Router# show interfaces gigabitethernet 2/0/1
GigabitEthernet2/0/1 is up, line protocol is up
  Hardware is SPA-1X10GE-L-V2, address is 000a.f330.2e40 (bia 000a.f330.2e40)
  Internet address is 2.2.2.1/24
  MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive not supported
  Full-duplex, 1000Mb/s, link type is force-up, media type is SX
  output flow-control is on, input flow-control is on
(Additional output removed for readability)
```

Gathering MAC Address Accounting Statistics

The **ip accounting mac-address** [**input** | **output**] command can be entered to enable MAC Address Accounting on an interface. After enabling MAC Address Accounting, MAC address statistics can be displayed by entering the **show interfaces mac-accounting** command.

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 2/1/0 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 2/1/0
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 SPA 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 Gigabit Ethernet SPAs on the Cisco ASR 1000 Series Aggregation Services Router, the default MTU size is 1500 bytes. The maximum configurable MTU is 9216 bytes. The SPA automatically adds an additional 22 bytes to the configured MTU size to accommodate some of the additional overhead.

Note In the Cisco ASR 1000 Series Route Processor 1 (RP1), 2RU and 2RU-Fixed chassis, the MTU size for the Management Ethernet interface (interface gigabitethernet 0) is limited to 2370 bytes.

Interface MTU Configuration Guidelines

When configuring the interface MTU size on a Gigabit Ethernet SPA on a Cisco ASR 1000 Series Aggregation Services 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.

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 1 (the second port) on the Gigabit Ethernet SPA installed in the top subslot (0) of the SIP that is located in slot 2 of the Cisco ASR 1000 Series Aggregation Services Router:

```
Router# show interfaces gigabitethernet 2/0/1
GigabitEthernet2/0/1 is up, line protocol is up
  Hardware is SPA-1X10GE-L-V2, address is 000a.f330.2e40 (bia 000a.f330.2e40)
  Internet address is 2.2.2.1/24
  MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive not supported
```

QoS Classification

The physical level interface module (PLIM) is the hardware component in the data path between the media interface and the forwarding engine.

Use the following commands in interface configuration mode to configure QoS:

Command	Purpose
Router(config-if)# **plim qos input map ip** {**precedence-based** | **precedence** *precedence-value* **queue low-latency**}	Classifies incoming IP traffic according to the value of the IP precedence bits and places the traffic into the appropriate queue. • *precedence-value*—Specifies the value of the IP precedence bits (0 to 7). You can specify a range of values separated by a dash or a list of values. By default, the Gigabit Ethernet SPA classifies IP precedence range 6-7 as high priority. • **low-latency**—Specifies the high priority queue. Enter 0 for low priority. Use the **no** form of the command to remove the configured values.
Router(config-if)# **plim qos input map ipv6 all queue low-latency** | **0**	Classifies all IPv6 packets as high or low priority. • **low-latency**—Specifies high priority traffic. Enter 0 for low priority. The **no** form of this command disables all IPv6 classification By default, without using this command, the command is disabled.
Router(config-if)# **plim qos input map ipv6 tc** [*tc-value* | *tc-range*] **queue low-latency** | **0**	Classifies ingress IPv6 traffic based on the value of the traffic-class bits and places the traffic into the appropriate queue. • *tc-value* | *tc-range*—Specifies the value of the traffic class bits. You can specify a range of values separated by a dash or a list of values. • **low-latency**—Specifies the high priority queue. Enter 0 for the low priority queue. The **no** form of this command sets the classification according to default DSCP EF. By default, IPv6 traffic with a traffic-class value equal to ef uses the high-priority queue and all other traffic uses the low-priority queue. Only the most significant six bits of the traffic-class octet is used for the classification.
Router(config-if)# **plim qos input map mpls all queue low-latency** | **0**	Classifies all MPLS packets as high or low priority. • **low-latency**—Specifies high priority packets. Enter 0 for low priority packets. The **no** form of this command disables MPLS classification. By default, without using this command, the command is disabled.

Command	Purpose
Router(config-if)# **plim qos input map mpls exp** *exp-value* | *exp-range* **queue low-latency | 0**	Classifies incoming MPLS traffic according to the value of the **exp** bits and places the traffic into the appropriate queue. • *exp-value* | *exp-range*—Specifies which MPLS **exp** value or range to use. • **low-latency**—Specifies high priority MPLS traffic. Enter **0** for low priority. By default, without using this command, the Gigabit Ethernet SPA classifies MPLS EXP range 6-7 as high priority. The **no** form of this command sets the classification according to default **exp** range 6-7.
Router(config-if)# **plim qos input queue low-latency | 0 pause** [**enable | threshold** *percent*]	Enables Ethernet pause frame generation due to flow control status. • **low latency**—Specifies high priority queue. Enter **0** for a low priority queue. • **pause**—Sets up the queue threshold to send a pause frame, which is a percentage of queue limit for packet drop. • The default threshold is 90 percent. By default, without using the command, pause frame generation is enabled for **low latency** queue. The **no** form of this command disables pause generation for a queue.
Router(config-if)# **plim qos input** [**bandwidth** *value_in_Kbps* [**low-latency**]] [**weight** *weight*]	Specifies the whole port, regardless of priority, or specifies priority only (**low-latency**) to receive minimum bandwidth guarantee, what minimum bandwidth is demanded, and what weight value is assigned for the excess scheduling. The default mode (without using this command) is that minimum scheduling is *off* and only excess scheduling is in service, which uses default weight proportional to the interface bandwidth. The **no** form of this command sets the interface to the default minimum bandwidth and weight.

Port-Level or Physical-Level QoS Classification

Use the following commands for port or physical level classification:

Command	Purpose
Router(config-if)# **plim qos input map ip all queue low-latency | 0**	Allows user to specify all IPv4 packets as high or low priority. • **low latency**—Specifies high priority packets. Enter **0** for a low priority packets The **no** form of this command disables all IPv4 classification. By default, without using this command, the command is disabled.
Router(config-if)# **plim qos input map ip dscp-based**	Enables IP DSCP-based classification. By default, without using this command, the Gigabit Ethernet SPA enables IP precedence-based classification for the Cisco ASR 1000 Series Aggregation Services Routers.]The **no** form of this command totally disables the IP DSCP-based classification.
Router(config-if)# **plim qos input map ip dscp** *dscp-value* | *dscp-range* **queue low-latency | 0**	Allows the user to specify an IP DSCP value or range. • **low-latency**—Specifies high priority IP DSCP value. Enter **0** for low priority. By default, without this command, the Gigabit Ethernet SPA classifies DSCP cs6-cs7 as high priority. The **no** form of this command removes the IP DSCP value or range.

Configuring the Encapsulation Type

By default, the interfaces on the Gigabit Ethernet SPAs support Advanced Research Projects Agency (ARPA) encapsulation. They do not support configuration of service access point or SNAP encapsulation for transmission of frames; however, the interfaces will properly receive frames that use service access point and SNAP encapsulation.

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

Configuring the Autonegotiation on an Interface

Fast Ethernet and 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 the Cisco ASR 1000 Series Aggregation Services Router, 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 10-Port Gigabit Ethernet SPA on the Cisco ASR1000-SIP10.
- Flow control is enabled by default.
- Flow control will be on if autonegotiation is disabled on both ends of the link.

Disabling Autonegotiation

Autonegotiation is automatically enabled and can be disabled on the Fast Ethernet and Gigabit Ethernet interfaces on the Cisco ASR1000-SIP10. 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 Fast Ethernet or Gigabit Ethernet SPA, 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 Fast Ethernet SPAs—100 Mbps for speed and full-duplex mode.
- For Gigabit Ethernet SPAs 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 Gigabit Ethernet SPAS 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 Fast Ethernet or Gigabit Ethernet SPA interfaces on the Cisco ASR1000-SIP10. No advertisement of flow control occurs.

Configuring Speed and Duplex

When autonegotiation is turned off on Fast Ethernet or the RJ-45 interface in the 2-Port Gigabit Ethernet SPA, you can manually specify the speed and duplex configuration.

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

Note On the Cisco ASR 1002-X Router, the copper SFP port's flow control is on, regardless of the duplex setting. In contrast, on the Cisco ASR 1002 Router, the copper SFP port's flow control is off when the duplex setting is Half.

To configure the speed for a Fast Ethernet or 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 2-Port Gigabit Ethernet SPA supports RJ-45 and fiber ports. Use the **media-type** configuration command to select either the RJ-45 or fiber media for a given port.

Command	Purpose
Router(config-if)# **media-type** {**10baset** | **100baset** | **rj45** | **gbic**}	Specifies the physical connection on an interface.

Enabling Autonegotiation

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

Command	Purpose
Router(config-if)# **negotiation auto**	Enables autonegotiation on a Fast Ethernet SPA interface on a Cisco ASR1000-SIP10 or a Gigabit Ethernet SPA interface on the Cisco ASR1000-SIP10. Advertisement of flow control occurs.

Configuring a Subinterface on a VLAN

Note You can configure no more than 8100 802.1Q VLAN subinterfaces per Ethernet SPA in software releases prior to Cisco IOS XE Release 2.5. Beginning in Cisco IOS XE Release 2.5, you can use the **hw-module subslot ethernet vlan unlimited** command to increase the system default and enable support for configuration of up to 4094 dot1q VLANs per port per SPA. The default is 8100 VLANs.

You can configure subinterfaces on the Fast Ethernet SPA interfaces and Gigabit Ethernet SPA interfaces on a VLAN using IEEE 802.1Q encapsulation. Cisco Discovery Protocol (CDP) is disabled by default on the 2-Port Gigabit Ethernet SPA interfaces and subinterfaces on the Cisco ASR1000-SIP10.

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

	Command	Purpose
Step 1	Router(config)# **hw-module subslot** *slot*/*subslot* **ethernet vlan unlimited**	(Optional) Enables configuration of up to 4094 dot1q VLANs per port per Ethernet SPA, where: • *slot*—Specifies the chassis slot number where the SIP is installed. • *subslot*—Specifies the slot of the SIP where the SPA is installed.
Step 2	Router(config)# **interface gigabitethernet** *slot*/*subslot*/*port*.*subinterface-number* or 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 SPA" section on page 10-4. • .*subinterface-number*—Specifies a secondary interface (subinterface) number.
Step 3	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 4	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**—(Optional) 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

Note When the **hw-module subslot ethernet vlan unlimited** command is configured, the default classification of CoS bits 6-7 as high priority is still supported. However, other user-defined CoS values for high and low priority classification using the **plim qos input map cos queue** command are not supported.

Addition of Warning Message when Enabling VLAN Scale Configuration

Effective from Cisco IOS XE Release 2.1.0S, a warning message is displayed when enabling VLAN Scale configuration.

Previous Behavior

When VLAN scale configuration is enabled using the **hw-module subslot slot/subslot ethernet vlan unlimited** command, the VLAN custom COS configurations are lost. However, an informational message was not displayed.

New Behavior

Effective from Cisco IOS XE Release 2.1.0S a warning message has been introduced when VLAN scale configuration is enabled using the **hw-module subslot slot/subslot ethernet vlan unlimited** command, suggesting that VLAN COS bits classification will be lost.

The following is a sample output of **hw-module subslot slot/subslot ethernet vlan unlimited** command displaying a warning message.

```
Router(config)# hw-module subslot 1/3 ethernet vlan unlimited
%VLAN input classification in subslot 1/3 will not be available.
```

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

Command	Purpose
Router(config-subif)# **plim qos input map cos enable**	Enables packet classification based on 802.1q VLAN COS bits. By default, this command is enabled on the Gigabit Ethernet SPA. The **no** form of this command totally disables the COS classification. The command is used in the dot1q subinterface configuration mode which can be either under the main physical interface or the Gigabit EtherChannel (GEC) link bundle.
Router(config-subif)# **plim qos input map cos** *cos-value* | *cos-range* **queue low-latency | 0**	Allows the user to specify which COS value or range for high priority (**low-latency**) or low priority (**0**). By default, without this command, COS value 6-7 is classified as high priority. Only the default behavior is supported when the **hw-module subslot ethernet vlan unlimited** command is configured. The **no** form of this command sets the classification according to the default value (COS priority value 6-7). This command is in the VLAN subinterface configuration mode under either the main physical interface or the GEC link bundle.

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 SPA 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:

GigabitEthernet4/1/0.1 (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* publications that correspond to your Cisco IOS software release.

Shutting Down and Restarting an Interface on a SPA

You can shut down and restart any of the interface ports on a SPA 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 Gigabit Ethernet SPAs. Gigabit Ethernet SPAs can be removed from a SIP at any time. SIPs populated with any type of SPAs can be removed from the router at any time.

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

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

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

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

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

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

Verifying the Interface Configuration

Besides using the **show running-configuration** command to display your Cisco ASR 1000 Series Aggregation Services Router configuration settings, you can use the **show interfaces gigabitethernet** command to get detailed information on a per-port basis for your Gigabit Ethernet SPAs.

Verifying Per-Port Interface Status

To find detailed interface information on a per-port basis for the Gigabit Ethernet SPAs, use the **show interfaces gigabitethernet** command.

The following example provides sample output for interface port 1 on the SPA located in the top subslot (0) of the SIP that is installed in slot 2 of the Cisco ASR 1000 Series Aggregation Services Router:

```
Router# show interfaces gigabitethernet 2/0/1
GigabitEthernet2/0/1 is up, line protocol is up
  Hardware is SPA-1X10GE-L-V2, address is 000a.f330.2e40 (bia 000a.f330.2e40)
  Internet address is 2.2.2.1/24
  MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive not supported
  Full-duplex, 1000Mb/s, link type is force-up, media type is SX
  output flow-control is on, input flow-control is on
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input 03:18:49, output 03:18:44, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  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
     1703 packets input, 638959 bytes, 0 no buffer
     Received 23 broadcasts (0 IP multicasts)
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
     0 watchdog, 1670 multicast, 0 pause input
     1715 packets output, 656528 bytes, 0 underruns
     0 output errors, 0 collisions, 4 interface resets
     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
```

Using show Commands to Check SFP Module and XFP Module Status

You can use various **show** commands to view information specific to SFP, XFP, CWDM, and DWDM optical transceiver modules.

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

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

Following are sample output of several **show** commands for SFP Modules and XFP Modules.

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

```
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-C6
Vendor Revision = A
Serial Number (SN) = FNS1037R8DH
Vendor Name = CISCO-FINISAR
Vendor OUI (IEEE company ID) = 00.90.65 (36965)
CLEI code = IPUIALJRAA
Cisco part number = 10-2143-01
Device State = Enabled.
Date code (yy/mm/dd) = 06/09/14
Connector type = LC.
Encoding = 8B10B
NRZ
Nominal bitrate = GE (1300 Mbits/s)
Minimum bit rate as % of nominal bit rate = not specified
Maximum bit rate as % of nominal bit rate = not specified
```

The following **show hw-module subslot** command sample output is for CWDM 1490:

```
Router# show hw-module subslot 2/0 transceiver 2 idprom
IDPROM for transceiver GigabitEthernet2/0/2:
Description = SFP optics (type 3)
Transceiver Type: = GE CWDM 1490 (28)
Product Indentifier (PID) = FWDM-16217D49CSC
Vendor Revision = C
Serial Number (SN) = FNS10500HA9
Vendor Name = CISCO-FINISAR
Vendor OUI (IEEE company ID) = 00.90.65 (36965)
CLEI code = CNTRVX0FAA
Cisco part number = 10-1884-01
Device State = Enabled.
Date code (yy/mm/dd) = 06/12/12
Connector type = LC.
Encoding = 8B10B
NRZ
Nominal bitrate = (2700 Mbits/s)
Minimum bit rate as % of nominal bit rate = not specified
Maximum bit rate as % of nominal bit rate = not specified
```

The following **show hw-module subslot** command sample output is for an XFP module:

```
Router# show hw-module subslot 2/2 transceiver 0 idprom brief
IDPROM for transceiver TenGigabitEthernet2/2/0:
Description = XFP optics (type 6)
Transceiver Type: = OC192 + 10GBASE-L (97)
Product Indentifier (PID) = TRF5011AN-LF004
Vendor Revision = 05
Serial Number (SN) = ONT11061053
Vendor Name = CISCO-OPNEXT
Vendor OUI (IEEE company ID) = 00.0B.40 (2880)
CLEI code = WMOTBEVAAB
Cisco part number = 10-1989-02
Device State = Enabled.
Date code (yy/mm/dd) = 07/02/06
Connector type = LC.
Encoding = 64B/66B
SONET Scrambled
NRZ
Minimum bit rate = 9900 Mbits/s
Maximum bit rate = 10500 Mbits/s
```

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-C6
Vendor Revision = A
Serial Number (SN) = FNS1037R8DH
Vendor Name = CISCO-FINISAR
Vendor OUI (IEEE company ID) = 00.90.65 (36965)
CLEI code = IPUIALJRAA
Cisco part number = 10-2143-01
Device State = Enabled.
SFP IDPROM Page 0xA0:
000: 03 04 07 00 00 00 01 00 00 00
010: 00 01 0D 00 00 00 37 1B 00 00
020: 43 49 53 43 4F 2D 46 49 4E 49
030: 53 41 52 20 20 20 00 00 90 65
040: 46 54 52 4A 38 35 31 39 50 31
050: 42 4E 4C 2D 43 36 41 20 20 20
060: 03 52 00 74 00 1A 00 00 46 4E
070: 53 31 30 33 37 52 38 44 48 20
080: 20 20 20 20 30 36 30 39 31 34
090: 20 20 58 80 01
SFP IDPROM Page 0xA2:
000: 6D 00 E3 00 67 00 F3 00 98 58
010: 69 78 90 88 71 48 1D 4C 01 F4
020: 17 70 03 E8 25 19 02 F5 25 19
030: 04 A9 E3 EE 01 DF 8F C5 02 EC
040: 00 00 00 00 00 00 00 00 00 00
050: 00 00 00 00 00 00 00 00 00 00
060: 00 00 00 00 00 00 00 00 3E 5D
070: 01 79 C0 5B AC 86 01 00 00 00
080: 00 AA FF FD 01 00 00 00 01 00
090: 00 00 00 00 00 3A 1B 70 80 D8
100: 00 62 00 28 00 22 00 00 00 00
110: 82 F8 05 40 00 00 05 40 00 00
120: 00 00 00 00 00 00 00 01 49 50
130: 55 49 41 4C 4A 52 41 41 31 30
140: 2D 32 31 34 33 2D 30 31 56 30
150: 31 20 89 FB 55 00 00 00 00 78
```

```
160: 00 00 00 00 00 00 00 00 00 00
170: 00 00 00 00 00 00 00 00 00 00
180: 00 00 00 00 00 00 00 00 00 00
190: AA AA 53 46 50 2D 47 45 2D 53
200: 20 20 20 20 20 20 20 20 20 20
210: 20 20 00 00 00 00 00 00 00 00
220: 00 00 00 A2 00 00 00 00 00 00
230: 00 00 00 00 00 00 00 00 00 00
240: 00 00 00 00 00 00 00 00 00 40
250: 00 40 00 00 00 00
Router#
```

Configuring the Network Clock for the 2-Port Gigabit Synchronous Ethernet SPA on a Cisco ASR 1000 Series Router

The 2-Port Gigabit Synchronous Ethernet SPA supports time, phase, and frequency awareness through Ethernet networks. The 2-Port Gigabit Synchronous Ethernet SPA on the Cisco SIP-40 enables clock selection and translation between the various clock frequencies. If the 2-Port Gigabit Synchronous Ethernet SPA interoperates with devices that do not support synchronization, synchronization features can be disabled or partially enabled to maintain backward compatibility.

Note For additional details to understand how SyncE feature is implemented on Cisco ASR 1000 Series Aggregation Services Routers using 4 different configuration, see the chapter 'Synchronous Ethernet Support On Cisco ASR 1000 Series Aggregation Services Routers' in the *Cisco ASR 1000 Series Software Configuration Guide*.

The network clock can be configured in global configuration mode and interface configuration mode:

- Configuring the Network Clock in Global Configuration Mode, page 10-20
- Configuring the Network Clock in Interface Configuration Mode, page 10-24

Configuring the Network Clock in Global Configuration Mode

Use the following commands to configure the network clock in global configuration mode on the Cisco SIP-40:

Command	Purpose
Router(config)# **[no] network-clock synchronization automatic** *Example:* `Router(config)# network-clock synchronization automatic`	Enables G.781 based automatic clock selection process. G.781 is the ITU-T Recommendation that specifies the synchronization layer functions.
Router(config)# **[no] network-clock eec** {*1* | *2*} *Example:* `Router(config)# network-clock eec 1`	Configures the clocking system hardware with the desired parameters. These are the options: • For option 1, the default value is EEC-Option 1 (2048). • For option 2, the default value is EEC-Option 2 (1544).

Command	Purpose
Router(config)# **[no] network-clock synchronization ssm option** {*1*| *2* {*GEN1* | *GEN2*}} *Example:* `Router(config)# network-clock synchronization ssm option 2 GEN1`	Configures the router to work in a synchronized network mode, as described in G.781. The following are the options: • Option 1: Refers to synchronization networks designed for Europe (SDH/ E1 framings are compatible with this option). • Option 2: Refers to synchronization networks designed for the US (SONET/T1 framings are compatible with this option). The default option is 1. While choosing option 2, you must specify whether it is second-generation message (GEN2) or first-generation message (GEN1). **Note** Network clock configurations that are not common between options should be configured again.
Router(config)# **[no] network-clock synchronization mode QL-enabled** *Example:* `Router(config)# network-clock synchronization mode QL-enabled`	Configures the automatic selection process for quality-level QL-enabled mode. **Note** QL-enabled mode succeeds only if there are any synchronization interfaces that are capable of sending SSM.
Router(config)# **[no] esmc process** *Example:* `Router(config)# esmc process`	Enables or disables the ESMC process at the system level. **Note** This command fails if no SyncE-capable interface is installed on the platform.
Router(config)# **network-clock hold-off** {*0* | <*50-10000*>} **global** *Example:* `Router(config)# network-clock hold-off 75 global`	Configures general hold-off timer in milliseconds. The default value is 300 milliseconds. **Note** Displays a warning message for values below 300 ms and above 1800 ms.
Router(config)# **network-clock external** <*slot/card/port*> **hold-off** {*0* | <*50-10000*>} *Example:* `Router(config)# network-clock external 3/1/1 hold-off 300`	Overrides hold-off timer value for external interface. **Note** Displays a warning message for values above 1800 ms, as waiting longer causes the clock to go into the holdover mode.
Router(config)# **network-clock wait-to-restore** <*0-86400*> **global** *Example:* `Router(config)# network-clock external wait-to-restore 1000 global`	Sets the value for the wait-to-restore timer globally. The wait to restore time is configurable in the range of 0 to 86400 seconds. The default value is 300 seconds. **Caution** Ensure that you set the wait-to-restore values above 50 seconds to avoid a timing flap.

Command	Purpose

Router(config)# **[no] network-clock input-source** <*priority*> {**interface** <*interface_name*> <*slot/card/port*> | **top** <*slot/card/port/session*> | {**external** <*slot/card/port*> *[t1 {sf | efs | d4} | e1 [crc4| fas| cas [crc4] | 2m | 10m]}*}
 	
Example:
`Router(config)# network-clock input-source 23 top 2/0/1/3`
 	
Example for GPS interface:
`Router(config)# network-clock input-source 1 external 3/0/0 10m`
	Configures a clock source line interface, an external timing input interface, GPS interface, or a packet-based timing recovered clock as the input clock for the system and defines its priority. Priority is a number between 1 and 250.
	
	This command also configures the type of signal for an external timing input interface. These signals are:
	• T1 with Standard Frame format or Extended Standard Frame format.
	• E1 with or without CRC4
	• 2 MHz signal
	• Default for Europe or Option I is e1 crc4 if the signal type is not specified.
	• Default for North America or Option II is t1 esf if signal type is not specified.
	
	Note The **no** version of the command reverses the command configuration, implying that the priority has changed to undefined and the state machine is informed.

Router(config)# **[no] network-clock revertive** *Example:* `Router(config)# network-clock revertive`	Specifies whether or not the clock source is revertive. Clock sources with the same priority are always non-revertive. The default value is non-revertive. In non-revertive switching, a switch to an alternate reference is maintained even after the original reference recovers from the failure that caused the switch. In revertive switching, the clock switches back to the original reference after that reference recovers from the failure, independent of the condition of the alternate reference.
Router(config)# **network-clock quality-level** *{tx | rx}* <*value*> *{***interface** <*interface name*> <*slot/card/port*> | **external** <*slot/card/port*> | **controller** <*slot/card/port*>*}* *Example:* `Router(config)# network-clock quality-level rx QL-PRC external 4/0/0 e1 crc4`	Specifies the QL value for line or external timing input or output. The value is based on a global interworking Option. • If Option 1 is configured, the available values are QL-PRC, QL-SSU-A, QL-SSU-B, QL-SEC, and QL-DNU. • If Option 2 is configured with GEN 2, the available values are QL-PRS, QL-STU, QL-ST2, QL-TNC, QL-ST3, QL-SMC, QL-ST4 and QL-DUS. • If option 2 is configured with GEN1, the available values are QL-PRS, QL-STU, QL-ST2, QL-SMC, QL-ST4 and QL-DUS **Note** This command is not supported for synchronous ethernet interfaces.

Command	Purpose
Router(config)# **network-clock output-source line** <*priority*> *{***interface** <*interface_name*> | **controller** *{t1 | e1}* <*slot/card/port*>*}* *{***external** <*slot/card/port*> *[t1 {sf | efs | d4} | e1 [crc4| fas| cas [crc4] | 2m | 10m] }* *Example:* `Router(config)# network-clock output-source line 1 interface GigabitEthernet3/0/0`	Transmits the line clock sources to external timing output interfaces. **Note** A line can be configured to be the output source for only one external interface. This command provides the station clock output as per G.781. We recommend that you use the interface level command instead of global commands. Global command should preferably be used for interfaces that do not have an interface sub mode. For more information on configuring network clock in interface level mode, see Configuring the Network Clock in Interface Configuration Mode, page 10-24.
Router(config)# **network-clock output-source system** <*priority*> *{***external** <*slot/card/port*> *[t1 {sf | efs | d4} | e1 [crc4| fas| cas [crc4] | 2m | 10m] }* *Example:* `Router(config)# network-clock output-source system 55 external 3/0/1 t1 efs`	Allows transmitting the system clock to external timing output interfaces. This command provides station clock output as per G.781. We recommend that you use the interface level command instead of global commands. Global command should preferably be used for interfaces that do not have an interface sub mode. For more information on configuring network clock in interface level mode, see Configuring the Network Clock in Interface Configuration Mode, page 10-24.
Router(config)# **[no] network-clock synchronization participate** <slot number> *Example:* `Router(config)# [no] network-clock synchronization participate 2`	Enables or disables a slot from participating in network-clock algorithm. By default all slots are participating slots. **Note** A slot cannot be disabled from participation if it's primary source, secondary source, or system to external is valid.

Configuring the Network Clock in Interface Configuration Mode

Use the following commands in the interface configuration mode to configure the network clock and timers on the Cisco ASR 1000 Series Aggregation Services Router SIP-40.

Command	Purpose
Router(config-if)# **synchronous mode** *Example:* `Router(config-if)# synchronous mode`	Configures the ethernet interface to synchronous mode and this automatically enables the ESMC and Quality Level process on the interface. **Note** This command is applicable to Synchronous Ethernet capable interfaces. The default value is asynchronous mode.
Router(config-if)# **esmc mode** [*tx* | *rx* |<*cr*>] *Example:* `Router(config-if)# esmc mode tx`	Enables or disables ESMC process on the interface. **Note** If the interface is configured as line source but does not receive ESMC message from peer node on the interface, then the interface is removed from selectable clock source list. By default this is enabled for synchronous mode and disabled for asynchronous mode. **Note** This command is not supported for non-synchronous ethernet interfaces.
Router(config-if)# **network-clock source quality-level** <value> {tx | rx} *Example:* `Router(config-if)# network-clock source quality-level QL-PRC`	The command forces QL value to local clock selection process and it is considered by the clock selection process as a value from network. The value is based on global interworking Option. • If Option 1 is configured, the available values are QL-PRC, QL-SSU-A, QL-SSU-B, QL-SEC, and QL-DNU. • If Option 2 is configured with GEN 2, the available values are QL-PRS, QL-STU, QL-ST2, QL-TNC, QL-ST3, QL-SMC, QL-ST4 and QL-DUS. • If option 2 is configured with GEN1, the available values are QL-PRS, QL-STU, QL-ST2, QL-SMC, QL-ST4 and QL-DUS **Note** This command is applicable to Synchronous Ethernet capable interfaces.
Router(config-if)# **network-clock hold-off** *<0 | 50-10000>* *Example:* `Router(config-if)# network-clock hold-off 1000`	Configures hold-off timer for interface. The default value is 300 milliseconds. **Note** Displays a warning for values below 300 ms and above 1800 ms.

Command	Purpose
Router(config-if)# **[no] network-clock wait-to-restore** *<0-86400>* *Example:* `Router(config-if)# network-clock wait-to-restore 1000`	Configures the wait-to-restore timer on the SyncE interface. **Caution** Ensure that you set the wait-to-restore values above 50 seconds to avoid timing flap.
Router(config-if)# **[no] esmc mode ql-disabled** *Example:* `Router(config-if)# esmc mode ql-disabled`	Disables the quality level mode. The default mode for synchronous ethernet is ql-enabled. **Note** This command is not supported for non-synchronous ethernet interfaces.

Managing Synchronization

You can manage the synchronization using the following management commands:

Command	Purpose

Router# **network-clock set lockout** {**interface** *interface_name slot/card/port* | **external** *slot/card/port*}
Example:
`Router# network-clock set lockout interface GigabitEthernet 0/0/0`
`Router# network-clock clear lockout interface GigabitEthernet 0/0/0`
	Locks out a clock source. A clock source flagged as lock-out is not selected for SyncE.
	To clear the lock-out on a source, use **network-clock clear lockout** {**interface** *interface_name slot/card/port* | **external** *slot/card/port*} command.
	Note Lockout takes precedence over force switch and force switch overrides the manual switch.

Router# **network-clock switch force** {**interface** *interface_name slot/card/port* | **external** *slot/card/port* | **internal T0**} *Example:* `Router# network-clock switch force interface GigabitEthernet 0/0/0 external 0/2/0`	Forcefully selects a synchronization source irrespective of whether the source is available and is within the range.
Router# **network-clock switch manual** {**interface** *interface_name slot/card/port* | **external** *slot/card/port* | **internal T0**} *Example:* `Router# network-clock switch manual interface GigabitEthernet 0/0/0 T0`	Manually selects a synchronization source, provided the source is available and is within the range.
Router# **network-clock clear switch** *{t0* | **external** *<slot/card/port> [10m* | *2m]}* *Example:* `Router# network-clock clear switch t0`	Clears the forced switch and manual switch commands.

Sample Configuration

Example 10-1 Configuration for QL-Enabled Mode Clock Selection

```
network-clock synchronization automatic
network-clock synchronization mode QL-enabled
network-clock input-source 1 interface GigabitEthernet0/2/0
network-clock input-source 1 interface ATM6/0/0
!
interface GigabitEthernet0/2/1
 no ip address
 clock source line
 synchronous mode
end
!
interface ATM6/0/0
 no ip address
 atm framing sdh
 no atm enable-ilmi-trap
end
```

Example 10-2 Configuration for Line to External

```
network-clock synchronization automatic
network-clock synchronization mode QL-enabled
network-clock input-source 1 External 3/0/0
network-clock output-source line 1 interface GigabitEthernet3/0/0 External 3/0/0 e1 crc4

interface GigabitEthernet3/0/0
 no ip address
 no negotiation auto
 synchronous mode
```

Example 10-3 GPS Configuration

```
10MHz signal
network-clock input-source 1 External 3/0/0 10m

2M signal
network-clock input-source 1 External 3/0/0 10m
```

Verifying Synchronous Ethernet Configuration

Use the **show network-clocks synchronization** command to display the sample output as shown here:

```
Router#show network-clocks synchronization
Router# show network-clocks synchronization
Symbols:     En - Enable, Dis - Disable, Adis - Admin Disable
             NA - Not Applicable
             *  - Synchronization source selected
             #  - Synchronization source force selected
             &  - Synchronization source manually switched

Automatic selection process : Enable
Equipment Clock : 2048 (EEC-Option1)
Clock Mode : QL-Enable
ESMC : Enabled
SSM Option : 1
T0 : GigabitEthernet1/1/0
```

```
Hold-off (global) : 300 ms
Wait-to-restore (global) : 30 sec
Tsm Delay : 180 ms
Revertive : No

Nominated Interfaces

 Interface            SigType     Mode/QL      Prio  QL_IN  ESMC Tx  ESMC Rx
 Internal             NA          NA/Dis       251   QL-SEC    NA        NA
*Gi1/1/0              NA          Sync/En      1     QL-PRC    -         -
```

Use the **show network-clocks synchronization detail** command to display all the details of the network clock synchronization parameters at the global and interface levels, as shown here:

```
Router# show network-clocks synchronization detail
Symbols:     En - Enable, Dis - Disable, Adis - Admin Disable
             NA - Not Applicable
             *  - Synchronization source selected
             #  - Synchronization source force selected
             &  - Synchronization source manually switched

Automatic selection process : Enable
Equipment Clock : 2048 (EEC-Option1)
Clock Mode : QL-Enable
ESMC : Enabled
SSM Option : 1
T0 : GigabitEthernet1/1/0
Hold-off (global) : 300 ms
Wait-to-restore (global) : 30 sec
Tsm Delay : 180 ms
Revertive : No
Force Switch: FALSE
Manual Switch: FALSE
Number of synchronization sources: 2
sm(netsync NETCLK_QL_ENABLE), running yes, state 1A
Last transition recorded: (ql_mode_enable)-> 1A (begin)-> 1A (sf_change)-> 1A
(sf_change)-> 1A (ql_change)-> 1A (ql_change)-> 1A (ql_change)-> 1A (ql_change)-> 1A


Nominated Interfaces

 Interface            SigType     Mode/QL      Prio  QL_IN  ESMC Tx  ESMC Rx
 Internal             NA          NA/Dis       251   QL-SEC    NA        NA
*Gi1/1/0              NA          Sync/En      1     QL-PRC    -         -
 External 1/3/0       E1 CRC4     NA/En        2     QL-FAILED NA        NA

Interface:
-----------------------------------------------
Local Interface: Internal
Signal Type: NA
Mode: NA(Ql-enabled)
SSM Tx: DISABLED
SSM Rx: DISABLED
Priority: 251
QL Receive: QL-SEC
QL Receive Configured: -
QL Receive Overrided: -
QL Transmit: -
QL Transmit Configured: -
Hold-off: 0
Wait-to-restore: 30
Lock Out: FALSE
Signal Fail: FALSE
Alarms: FALSE
```

```
Slot Disabled: FALSE

Local Interface: Gi1/1/0
Signal Type: NA
Mode: Synchronous(Ql-enabled)
ESMC Tx: ENABLED
ESMC Rx: ENABLED
Priority: 1
QL Receive: QL-PRC
QL Receive Configured: -
QL Receive Overrided: -
QL Transmit: QL-DNU
QL Transmit Configured: -
Hold-off: 300
Wait-to-restore: 30
Lock Out: FALSE
Signal Fail: FALSE
Alarms: FALSE
Slot Disabled: FALSE
```

Use the **show interface accounting** command to display packets accounting statistics, as shown here:

```
Router#show interfaces GigabitEthernet 0/2/0 accounting
GigabitEthernet0/2/0
                Protocol    Pkts In   Chars In   Pkts Out  Chars Out
                 DEC MOP         14       1134         14       1806
                     ARP          0          0          2        224
                     CDP        145      55970        145      63049
                    ESMC       3246     194760       7099     823484
```

Use the **show esmc** command to display the sample output, as shown here:

```
Router#show esmc
SYNCE-2RU#show esmc
Interface: GigabitEthernet0/2/0
  Administative configurations:
    Mode: Synchronous
    ESMC TX: Enable
    ESMC RX: Enable
    QL TX: -
    QL RX: -
  Operational status:
    Port status: UP
    QL Receive: QL-DNU
    QL Transmit: QL-SEC
    QL rx overrided: QL-DNU
    ESMC Information rate: 1 packet/second
    ESMC Expiry: 5 second

Interface: GigabitEthernet0/2/1
  Administative configurations:
    Mode: Synchronous
    ESMC TX: Enable
    ESMC RX: Enable
    QL TX: -
    QL RX: -
  Operational status:
    Port status: UP
    QL Receive: QL-DNU
    QL Transmit: QL-SEC
    QL rx overrided: QL-DNU
    ESMC Information rate: 1 packet/second
    ESMC Expiry: 5 second
```

```
Interface: GigabitEthernet0/3/0
  Administative configurations:
    Mode: Synchronous
    ESMC TX: Enable
    ESMC RX: Enable
    QL TX: -
    QL RX: -
  Operational status:
    Port status: UP
    QL Receive: QL-DNU
    QL Transmit: QL-SEC
    QL rx overrided: QL-DNU
    ESMC Information rate: 1 packet/second
    ESMC Expiry: 5 second

Interface: GigabitEthernet0/3/1
  Administative configurations:
    Mode: Synchronous
    ESMC TX: Enable
    ESMC RX: Enable
    QL TX: -
    QL RX: -
  Operational status:
    Port status: DOWN
    QL Receive: QL-DNU
    QL Transmit: -
    QL rx overrided: QL-DNU
    ESMC Information rate: 1 packet/second
    ESMC Expiry: 5 second
```

Use the **show esmc detail** command to display all the details of the ESMC parameters at the global and interface levels, as shown here:

```
Router#show esmc detail
Interface: GigabitEthernet0/2/0
  Administative configurations:
    Mode: Synchronous
    ESMC TX: Enable
    ESMC RX: Enable
    QL TX: -
    QL RX: -
  Operational status:
    Port status: UP
    QL Receive: QL-DNU
    QL Transmit: QL-SEC
    QL rx overrided: QL-DNU
    ESMC Information rate: 1 packet/second
    ESMC Expiry: 5 second
    ESMC Tx Timer: Running
    ESMC Rx Timer: Running
    ESMC Tx interval count: 1
    ESMC INFO pkts in: 0
    ESMC INFO pkts out: 629451
    ESMC EVENT pkts in: 0
    ESMC EVENT pkts out: 0

Interface: GigabitEthernet0/2/1
  Administative configurations:
    Mode: Synchronous
    ESMC TX: Enable
    ESMC RX: Enable
    QL TX: -
    QL RX: -
  Operational status:
```

```
    Port status: UP
    QL Receive: QL-DNU
    QL Transmit: QL-SEC
    QL rx overrided: QL-DNU
    ESMC Information rate: 1 packet/second
    ESMC Expiry: 5 second
    ESMC Tx Timer: Running
    ESMC Rx Timer: Running
    ESMC Tx interval count: 1
    ESMC INFO pkts in: 0
    ESMC INFO pkts out: 629451
    ESMC EVENT pkts in: 0
    ESMC EVENT pkts out: 0

Interface: GigabitEthernet0/3/0
  Administative configurations:
    Mode: Synchronous
    ESMC TX: Enable
    ESMC RX: Enable
    QL TX: -
    QL RX: -
  Operational status:
    Port status: UP
    QL Receive: QL-DNU
    QL Transmit: QL-SEC
    QL rx overrided: QL-DNU
    ESMC Information rate: 1 packet/second
    ESMC Expiry: 5 second
    ESMC Tx Timer: Running
    ESMC Rx Timer: Running
    ESMC Tx interval count: 1
    ESMC INFO pkts in: 0
    ESMC INFO pkts out: 624901
    ESMC EVENT pkts in: 0
    ESMC EVENT pkts out: 0

Interface: GigabitEthernet0/3/1
  Administative configurations:
    Mode: Synchronous
    ESMC TX: Enable
    ESMC RX: Enable
    QL TX: -
    QL RX: -
  Operational status:
    Port status: DOWN
    QL Receive: QL-DNU
    QL Transmit: -
    QL rx overrided: QL-DNU
    ESMC Information rate: 1 packet/second
    ESMC Expiry: 5 second
    ESMC Tx Timer: Running
    ESMC Rx Timer: Running
    ESMC Tx interval count: 0
    ESMC INFO pkts in: 0
    ESMC INFO pkts out: 0
    ESMC EVENT pkts in: 0
    ESMC EVENT pkts out: 0
```

Troubleshooting the Synchronous Ethernet Configuration

The following debug commands are available for troubleshooting the synchronous Ethernet configuration on the Cisco ASR 1000 Series Router:

Table 10-1 Debug Commands for Troubleshooting

Debug Command	Purpose
debug platform network-clock	Debugs issues related to the network clock such as alarms, OOR, active-standby sources not selected correctly, and so on.
debug esmc error **debug esmc event** **debug esmc packet** [**interface** *<interface name>*] **debug esmc packet rx** [**interface** *<interface name>*] **debug esmc packet tx** [**interface** *<interface name>*]	Verifies whether the ESMC packets are transmitted and received with the correct quality-level values.

Troubleshooting Scenarios

Note Before you troubleshoot, ensure that all the network clock synchronization configurations are complete.

Table 10-2 provides the troubleshooting scenarios encountered while configuring the synchronous ethernet.

Table 10-2 Troubleshooting scenarios

Problem	Solution
Clock is not getting selected	• Verify that there are no alarms on the interfaces. Use the **show network-clock synchronization detail** command to check this. • Ensure that the nonrevertive configurations are in place. • Reproduce the issue and collate the logs using the **debug network-clock errors**, **debug network-clock event**, and **debug network-clock sm** commands. Contact the Cisco technical support if the issue persists.

Table 10-2 Troubleshooting scenarios (continued)

Problem	Solution
Incorrect QL values	• Ensure that there is no framing mismatch with the SSM option. • Reproduce the issue using the **debug network-clock errors**, **debug network-clock event**, and **debug platform ssm** commands. Also, enable the **debug hw-module subslot** command.
Alarms are not getting triggered	• Reproduce the issue using the **debug platform network-clock** command enabled in the route processor. Alternatively, enable the **debug network-clock event** and **debug network-clock errors** commands.

Change in show running-config command output for SPA-4X1FE-TX-V2 SPA

This behavioral change refers to the change in **show running-config interface Fast Ethernet slot/subslot/port** command output for a 4-Port Fast Ethernet SPA. The configuration details impacting the change is removal of the speed as 100 from being displayed in **show running-config** command output when negotiation is configured as auto.

Tip If negotiations is configured as auto then speed cannot be configured. Disable auto-negotiation using the **no negotiation auto** command from interface-configuration mode. The default value of speed is 100 Mbps. If speed is configured to a value other than default value then auto-negotiation cannot be configured. Execute the **no speed** command to return to default value of speed which allows auto negotiation to be configured.

Release Number for Behavioral Change

From Cisco IOS XE Release 3.1.0s onwards, the speed as 100 (which is the default speed) will not be displayed in **show running-config interface Fast Ethernet slot/subslot/port** command output for a 4-Port Fast Ethernet SPA.

Note For Gigabit Ethernet SPAs, the speed as 100 is not displayed in the **show running-config interface gigabit ethernet slot/subslot/port** command output. The behavior of SPA-4X1FE-TX-V2 SPA also needs to be in synchronization with Gigabit Ethernet SPAs.

Old-Behavior

Prior to Cisco IOS XE Release 3.1.0s, the **show running-config interface Fast Ethernet slot/subslot/port** command output, displayed both speed as 100 (which is the default speed) when negotiation is configured as auto for SPA-4X1FE-TX-V2 SPA. As speed 100 is the default configuration it should not be displayed in the command output for SPA-4X1FE-TX-V2 SPA.

The command output prior to Cisco IOS XE Release 3.1.0s displays the speed as 100 as indicated in the following example:

```
show running-config Fast Ethernet 0/3/0
Building configuration...

Current configuration : 81 bytes
!
interface FastEthernet0/3/0
 no ip address
 speed 10
negotiation auto
end
```

New Behavior

From Cisco IOS XE Release 3.1.0s onwards, the speed 100 (which is the default speed) is not displayed in **show running-config interface Fast Ethernet slot/subslot/port** command output, if negotiation is configured as auto.

The new command output without the speed as 100 is displayed as follows:

```
show running-config Fast Ethernet 0/3/0
Building configuration...

Current configuration : 68 bytes
!
interface FastEthernet0/3/0
 no ip address
 negotiation auto
end
```

Configuring LAN/WAN-PHY Controllers

The LAN/WAN-PHY controllers are configured in the physical layer control element of the Cisco IOS XE software. By default, the 1-Port 10-Gigabit Ethernet LAN/WAN PHY SPA initializes in the WAN-PHY mode. Use the **hw-module subslot** *slot/subslot* **enable lan** command to configure the LAN-PHY mode.

Configuration of the LAN/WAN-PHY controllers is described in the following tasks.

Configuring 1-Port 10-Gigabit Ethernet LAN/WAN PHY SPA

This section lists the basic mandatory configuration steps that should be performed to configure the 1-Port 10-Gigabit Ethernet LAN/WAN PHY SPA which is essential for the traffic to pass through the SPA. The 1-Port 10-Gigabit Ethernet LAN/WAN PHY SPA operates in either the LAN mode or the WAN mode. By default, when the SPA is first inserted into the SIP, it operates in the WAN mode.

Note If the operation mode is changed from LAN to WAN or from WAN to LAN, an informational message "%SPA(SPA-1X10GE-WL-V2): SPA reloaded to configure operation (LAN or WAN) mode" is displayed. Depending on the mode to which it is changed, the respective operation mode (LAN or WAN) is displayed in the message.

Mandatory Initial Configuration Steps

To perform the initial configuration of the 1-Port 10-Gigabit Ethernet LAN/WAN PHY SPA and to allow the traffic to pass through the SPA, complete these steps:

SUMMARY STEPS

1. **configure terminal**
2. **interface tengigabitethernet** *slot/subslot/port.subinterface-number*
3. **ip address** *ip-address mask* [**secondary**]
4. **mtu bytes**
5. **standby ip** *ip-address* **secondary**
6. **no shutdown**
7. **exit**
8. **exit**
9. **show running-config interface tengigabitethernet** *slot/subslot/port*

DETAILED STEPS

	Command or Action	Purpose
Step 1	`Router# configure terminal`	Enters the global configuration mode.
Step 2	`interface tengigabitethernet` *`slot/subslot/port.subinterface-number`* **Example:** `Router(config)# interface tengigabitethernet 0/1/0`	Specific the 10-GB Ethernet interface to be configured, where: • *slot/subslot/port*—Indicates the location of the interface. • *subinterface-number*—(Optional) Indicates a secondary subinterface number. Enters the interface configuration (config-if) mode after executing the **interface tengigabitethernet** *slot/subslot/port* command.

	Command or Action	Purpose
Step 3	**ip address** *ip-address mask* **[secondary]** **Example:** `Router(config-if)# ip address 1.1.1.1 255.0.0.0`	For IPv4: Sets a primary or secondary IP address for an interface that is using IPv4, where: • *ip-address*—Indicates the IP address for the interface. • *mask*—Indicates the subnet mask for the associated IP subnet. • *secondary*—(Optional) Indicates the configured address is a secondary IP address. If this keyword is omitted, the configured address is the primary address.
Step 4	**mtu** *bytes* **Example:** `Router(config-if)# mtu 9216`	(Optional) Specifies the maximum packet size for an interface, where: • bytes—Indicates the maximum number of bytes for a packet. The default is 1500 bytes. The valid range is 1500 to 9216 bytes.
Step 5	**standby ip** *ip-address* **secondary** **Example:** `Router(config-if)# standby ip 1.1.1.2 standby`	(Required only for HSRP configuration) Creates (or enables) the HSRP group using its virtual IP address, where: • (Optional) *group-number*—Indicates the group number on the interface for which HSRP is being enabled. The range is 0 to 255, and the default is 0. If there is only one HSRP group, you do not have to enter a group number. • (Optional for all but one interface if configuring HSRP) *ip-address*—Indicates the virtual IP address of the hot standby router interface. Enter the virtual IP address for at least one of the interfaces. • (Optional) **secondary**—Specifies the IP address in the 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. 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* that corresponds to your Cisco IOS software release.
Step 6	**no shutdown** **Example:** `Router(config-if)# no shutdown`	Enables the interface.

	Command or Action	Purpose
Step 7	**exit** **Example:** `Router(config-if)# exit`	Exits interface-configuration (config-if) mode and enters configuration mode.
Step 8	**exit** **Example:** `Router(config)# exit`	Exits global-configuration (config) mode and enters privilege-exec mode.

Step 9	**show running-config interface Tengigabitethernet** *slot/subslot/port*
	
	Example:
	`Router# show running-config interface TenGigabitethernet 0/1/0`
	
	`Building configuration...`
	
	`Current configuration : 115 bytes`
	`!`
	`interface TenGigabitEthernet0/1/0`
	` mtu 9216`
	` ip address 10.1.1.1 255.0.0.0`
	` standby 0 ip 10.1.1.2 secondary`
	`end`
		Displays the interface configuration details for the WAN PHY SPA installed at 0/1/0.

Configuring the LAN-PHY Mode

This section describes how to configure the LAN-PHY mode on the 1-Port 10GE LAN/WAN-PHY Shared Port Adapter (SPA-1X10GE-WL-V2).

SUMMARY STEPS

1. **show controllers wanphy** *interface-path-id*
2. **configure terminal**
3. **hw-module subslot 0/1 enable LAN**
4. **exit**
5. **show controllers wanphy** *interface-path-id*

DETAILED STEPS

	Command or Action	Purpose

Step 1	**show controllers wanphy** *0/1/0*
	
	Example:
	`Router# show controllers wanphy 0/1/0`
	`TenGigabitEthernet0/1/0`
	`Mode of Operation: WAN Mode`
	`SECTION`
	`  LOF = 0          LOS   = 0`
	`BIP(B1) = 0`
	`LINE`
	`  AIS = 0             RDI    = 0          FEBE`
	`= 0          BIP(B2) = 0`
	`PATH`
	`  AIS = 0             RDI    = 0          FEBE`
	`= 0          BIP(B3) = 0`
	`  LOP = 0             NEWPTR = 0          PSE`
	`= 0          NSE     = 0`
	`WIS ALARMS`
	`  SER    = 0          FELCDP = 0`
	`FEAISP = 0`
	`  WLOS   = 0          PLCD   = 0`
	`  LFEBIP = 0          PBEC   = 0`
	
	`Active Alarms[All defects]: SWLOF LAIS PAIS SER`
	`Active Alarms[Highest Alarms]: SWLOF`
	`Alarm reporting enabled for: SF SWLOF B1-TCA`
	`B2-TCA PLOP WLOS`
	
	`  Rx(K1/K2): 00/00  Tx(K1/K2): 00/00`
	`  S1S0 = 00, C2 = 0x1A`
	`PATH TRACE BUFFER: UNSTABLE`
	`  Remote J1 Byte :`
	
	`BER thresholds:  SD = 10e-6  SF = 10e-3`
	`TCA thresholds:  B1 = 10e-6  B2 = 10e-6  B3 =`
	`10e-6`
		Displays the configuration mode of the LAN/WAN-PHY controller. By default, prior to configuration of the LAN-PHY mode, the controller operates in the WAN-PHY mode.

Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters the global configuration mode.

Step 3	**hw-module subslot** *slot/subslot* **enable LAN**
	
	Example:
	`Router(config)# hw-module subslot 0/1 enable`
	`LAN`
		Configures the LAN PHY mode for the 1-Port 10-Gigabit Ethernet LAN/WAN PHY SPA.
		
		Note Whenever mode is changed from WAN mode to LAN mode

	Command or Action	Purpose
Step 4	**exit** **Example:** `Router(config)# exit`	Exits global-configuration (config) mode and enters privilege-exec mode.

Step 5	**show controllers wanphy 0/1/0**
	
	Example:
	`Router# show controllers wanphy 0/1/0`
	`TenGigabitEthernet0/1/0`
	`Mode of Operation: LAN Mode`
		Displays the configuration mode for the LAN/WAN-PHY controller. The example shows the mode of operation as LAN mode for the 1-Port 10-Gigabit Ethernet LAN/WAN PHY SPA.

Configuring the WAN-PHY Mode

This section describes how to configure the WAN-PHY mode on the 1-Port 10GE LAN/WAN-PHY Shared Port Adapter (SPA-1X10GE-WL-V2). By default, the 1-Port 10-Gigabit Ethernet LAN/WAN PHY SPA operates in the WAN-PHY mode.

SUMMARY STEPS

1. **show controllers wanphy** *interface-path-id*
2. **configure terminal**
3. **hw-module subslot 0/1 enable WAN**
4. **exit**
5. **show controllers wanphy** *interface-path-id*

DETAILED STEPS

	Command or Action	Purpose

Step 1	**show controllers wanphy 0/1/0**
	
	Example:
	`Router# show controllers wanphy 0/1/0`
	`TenGigabitEthernet0/1/0`
	`Mode of Operation: LAN Mode`
		Displays the configuration mode of the LAN/WAN-PHY controller. The example indicates that the SPA is running in the LAN-PHY mode.

Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters the global configuration mode.

Command or Action	Purpose

Step 3 **hw-module subslot** *slot/subslot* **enable WAN**
 	
Example:
`Router(config)# hw-module subslot 0/1 enable WAN`
`*Jan 7 03:49:25.778: %ASR1000_OIR-6-SYNCSPA: SPA (SPA-1X10GE-WL-V2) reloading to come up in WAN mode`
`*Jan 7 03:49:25.978: %SONET-4-ALARM: TenGigabitEthernet0/1/0: SLOF cleared`
`*Jan 7 03:49:25.979: %ASR1000_OIR-6-SOFT_RELOADSPA: SPA(SPA-1X10GE-WL-V2) reloaded on subslot 0/1`
`*Jan 7 03:49:25.980: %SPA_OIR-6-OFFLINECARD: SPA (SPA-1X10GE-WL-V2) offline in subslot 0/1`
`*Jan 7 03:49:34.117: %SONET-4-ALARM: TenGigabitEthernet0/1/0: WLOS declared`
`*Jan 7 03:49:34.278: %SPA_OIR-6-ONLINECARD: SPA (SPA-1X10GE-WL-V2) online in subslot 0/1`
`*Jan 7 03:49:34.826: %SONET-4-ALARM: TenGigabitEthernet0/1/0: WLOS cleared`
`*Jan 7 03:49:34.826: %SONET-4-ALARM: TenGigabitEthernet0/1/0: SLOF declared`
`*Jan 7 03:49:36.105: %LINK-3-UPDOWN: Interface TenGigabitEthernet0/1/0, changed state to down`
`*Jan 7 03:49:36.294: %LINK-3-UPDOWN: SIP0/1: Interface TenGigabitEthernet0/1/0, changed state to down`
	Configures WAN-PHY mode for the 1-Port 10-Gigabit Ethernet LAN/WAN PHY SPA.
	
	Tip When operation-mode is changed from LAN to WAN, alarm messages are displayed in the **hw-module subslot** *slot/subslot* **enable WAN** command output. But, if the operation mode is changed from WAN to LAN, a soft-reload of SPA occurs but alarms are not displayed.

	Command or Action	Purpose
Step 4	**exit** **Example:** `Router(config)# exit`	Exits global-configuration (config) mode and enters privilege-exec mode.

Step 5	**show controllers wanphy** *0/1/0*
	
	Example:
	`Router# show controllers wanphy 0/1/0`
	`TenGigabitEthernet0/1/0`
	`Mode of Operation: WAN Mode`
	`SECTION`
	`  LOF = 0  LOS  = 0`
	`BIP(B1) = 0`
	`LINE`
	`  AIS = 0  RDI  = 0  FEBE`
	`= 0  BIP(B2) = 0`
	`PATH`
	`  AIS = 0  RDI  = 0  FEBE`
	`= 0  BIP(B3) = 0`
	`  LOP = 0  NEWPTR = 0  PSE`
	`= 0  NSE  = 0`
	`WIS ALARMS`
	`  SER  = 0  FELCDP = 0`
	`FEAISP = 0`
	`  WLOS  = 0  PLCD  = 0`
	`  LFEBIP = 0  PBEC  = 0`
	
	`Active Alarms[All defects]: SWLOF LAIS PAIS SER`
	`Active Alarms[Highest Alarms]: SWLOF`
	`Alarm reporting enabled for: SF SWLOF B1-TCA`
	`B2-TCA PLOP WLOS`
	
	`  Rx(K1/K2): 00/00  Tx(K1/K2): 00/00`
	`  S1S0 = 00, C2 = 0x1A`
	`PATH TRACE BUFFER: UNSTABLE`
	`  Remote J1 Byte :`
	
	`BER thresholds:  SD = 10e-6  SF = 10e-3`
	`TCA thresholds:  B1 = 10e-6  B2 = 10e-6  B3 =`
	`10e-6`
		Displays the configuration mode of the LAN-PHY or WAN-PHY controller. In this example, the mode of operation has changed to the WAN mode for the 1-Port 10-Gigabit Ethernet LAN/WAN PHY SPA.

Configuring the Flag for Path Trace

The 1-Port 10GE LAN/WAN-PHY Shared Port Adapter can operate in either the WAN mode or the LAN mode. To check end-to-end connectivity, J1 flag byte values can be configured on the local SPA. The configured J1 byte values are displayed at the remote end in the **show controllers wanphy** *interface-path-id* command output.

SUMMARY STEPS

1. **configure terminal**
2. **controller wanphy** *interface-path-id*
3. **wanphy flag j1 tansmit** *string*

4. **exit**
5. **exit**
6. **show controllers wanphy** *interface-path-id*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters the global configuration mode.
Step 2	**controller wanphy** *interface-path-id* **Example:** `Router(config)# controller wanphy 2/1/0`	Enters the controller mode of the WAN-PHY SPA. In this example, it enters slot 1 of SIP 2.
Step 3	**wanphy flag j1 transmit** *string* **Example:** `Router(config-controller)# wanphy flag j1 transmit passing_string_from_localend`	Passes the string of J1 bytes specified to the remote end of WAN-PHY SPA. In this example, the string value passing_string_from_localend is transmitted to the remotely connected WAN-PHY SPA.
Step 4	**exit** **Example:** `Router(config-controller)# exit`	Exits Controller-configuration (config) mode and enters global configuration mode.

	Command or Action	Purpose
Step 5	**exit** **Example:** `Router(config)# exit`	Exits global-configuration (config) mode and enters privilege-exec mode.

Step 6	**show controller wanphy** *<interface-path-id>*
	
	Example:
	`Router# show controller wanphy 2/2/0`
	`TenGigabitEthernet0/2/0`
	`Mode of Operation: WAN Mode`
	`SECTION`
	`  LOF = 0  LOS  = 0 BIP(B1) = 0`
	`LINE`
	`  AIS = 0  RDI  = 0  FEBE = 0  BIP(B2) = 0`
	`PATH`
	`  AIS = 0  RDI  = 0  FEBE = 0  BIP(B3) = 0`
	`  LOP = 0  NEWPTR = 0  PSE = 0  NSE  = 0`
	`WIS ALARMS`
	`  SER  = 0  FELCDP = 0`
	`FEAISP = 0`
	`  WLOS  = 0  PLCD  = 0`
	`  LFEBIP = 0  PBEC  = 0`
	
	`Active Alarms[All defects]: None`
	`Active Alarms[Highest Alarms]: None`
	`Alarm reporting enabled for: SF SWLOF B1-TCA B2-TCA PLOP WLOS`
	
	`  Rx(K1/K2): 00/00  Tx(K1/K2): 00/00`
	`  S1S0 = 00, C2 = 0x1A`
	`PATH TRACE BUFFER: STABLE`
	`  Remote J1 Byte : passing_string_from_localend`
	
	`BER thresholds:  SD = 10e-6  SF = 10e-3`
	`TCA thresholds:  B1 = 10e-6  B2 = 10e-6  B3 = 10e-6`
		This command must be executed on the remotely connected SPA. The command output displays the string of J1 byte values transmitted from the other end of the WAN-PHY SPA to check the path.
		
		In this example, the last line Remote J1 Byte, of the **show controller wanphy** *2/2/0* command output indicates that the string value passing_string_from_localend has been sent from the other end of the WAN-PHY SPA.

Configuring Alarm Reporting

The purpose of the WIS is to allow an Ethernet data streams that can be mapped directly to the STS-192c stream or VC-4-64c streams at the physical level without requiring MAC or higher-layer processing. The WIS adds path, line, and section overheads to generate the WIS frame. By default, line-level, section-level, and path-level alarms, which can be configured and used to selectively report and manage the alarms internally, are generated.

This section describes how to configure specific line-level, section-level, and path-level alarm reporting:

SUMMARY STEPS

1. **configure terminal**
2. **controller wanphy** *interface-path-id*

3. **wanphy report-alarm default**
4. **wanphy report-alarm line**
5. **wanphy report-alarm path**
6. **wanphy report-alarm section**
7. **wanphy report-alarm wis**
8. **exit**
9. **exit**
10. **show controllers wanphy** *interface-path-id*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters the global configuration mode.
Step 2	**controller wanphy** *interface-path-id* **Example:** `Router(config)# controller wanphy 2/2/0`	Enters the controller mode of the WAN-PHY SPA installed in slot 2 of SIP 2.
Step 3	**wanphy report-alarm default** **Example:** `Router(config-controller)# wanphy report-alarm default`	Sets the default alarm reporting values to SF, SWLOF, B1-TCA, B2-TCA, PLOP, and WLOS.
Step 4	**wanphy report-alarm line** **Example:** `Router(config-controller)# wanphy report-alarm line`	Configures selective reports (LAIS, LRDI, SF, SD) for line-level alarms.
Step 5	**wanphy report-alarm path** **Example:** `Router(config-controller)# wanphy report-alarm path`	Configures selective reports for path-level (PAIS, PLOP, PPLM) alarms.
Step 6	**wanphy report-alarm section** **Example:** `Router(config-controller)# wanphy report-alarm section`	Configures selective reports for section-level (SLOF,SLOS, SER, SWLOF) alarms.
Step 7	**wanphy report-alarm wis** **Example:** `Router(config-controller)# wanphy report-alarm wis`	Configures selective reports for WIS-level (WSER) alarms.

	Command or Action	Purpose
Step 8	**exit** **Example:** `Router(config-controller)# exit`	Exits from the controller configuration mode and enters the global configuration mode.
Step 9	**exit** **Example:** `Router(config)# exit`	Exits from the global configuration mode and enters the Privileged EXEC mode.

Step 10	**show controllers wanphy** *<interface-path-id>*
	
	`Router# show controllers wanphy 2/2/0`
	`TenGigabitEthernet2/1/0`
	`Mode of Operation: WAN Mode`
	`SECTION`
	`  LOF = 0  LOS  = 0`
	`BIP(B1) = 30`
	`LINE`
	`  AIS = 0  RDI  = 0  FEBE`
	`= 0  BIP(B2) = 6215`
	`PATH`
	`  AIS = 0  RDI  = 0  FEBE`
	`= 0  BIP(B3) = 8`
	`  LOP = 0  NEWPTR = 0  PSE`
	`= 0  NSE  = 0`
	`WIS ALARMS`
	`  SER  = 0  FELCDP = 0`
	`FEAISP = 0`
	`  WLOS  = 0  PLCD  = 0`
	`  LFEBIP = 1304  PBEC  = 8`
	
	`Active Alarms[All defects]: None`
	`Active Alarms[Highest Alarms]: None`
	`Alarm reporting enabled for: SF SD SWLOF B1-TCA`
	`LAIS LRDI B2-TCA PAIS PLOP PPLM SER FELCDP`
	`FEAISP WLOS PLCD`
	
	`  Rx(K1/K2): 00/00  Tx(K1/K2): 00/00`
	`  S1S0 = 00, C2 = 0x1A`
	`PATH TRACE BUFFER: STABLE`
	`  Remote J1 Byte :`
	
	`BER thresholds:  SD = 10e-6  SF = 10e-3`
	`TCA thresholds:  B1 = 10e-6  B2 = 10e-6  B3 =`
	`10e-6`
		The command output displays the default alarms and the configured alarms.
		
		The alarms that can be configured specifically for line, section, path, and WIS are:
		
		• Section-level alarms: SLOF
		• Line-level alarms: LAIS, LRDI
		• Physical-level alarms: PAIS, PLOP, PPLM
		• WIS-level alarms: WLOS, SER, PLCD, FEAISP, FELCDP

Configuring WAN-PHY Signal Failure and Signal Degrade Bit Error Rates

This section describes how to configure WAN-PHY Signal Failure (SF) and Signal Degrade (SD) Bit Error Rate (BER) reporting and thresholds.

A Signal Failure (SF) alarm is declared if the line bit error (B2) rate exceeds a user-provisioned threshold range (over the range of 10e-3 to 10e-9).

A Signal Degrade (SD) alarm is declared if the line bit error (B2) rate exceeds a user-provisioned threshold range (over the range of 10e-3 to 10e-9). If the B2 errors cross the SD threshold, a warning of link quality degradation is triggered. The WAN-PHY alarms are required for some users who are upgrading their Layer 2 core network from a SONET ring to a 10-Gigabit Ethernet ring.

Prerequisites

This section describes the prerequisites for configuring the BER threshold values on a 1-Port 10-Gigabit Ethernet LAN/WAN PHY SPA:

- The controller must be in the WAN-PHY mode prior to configuring the SF and SD BER reporting and thresholds.
- The WAN-PHY mode is supported only on the 1-Port 10-Gigabit Ethernet LAN/WAN PHY SPA (SPA-1X10GE-WL-V2).

Configuring the BER and TCA Threshold Values

This section describes how to configure the BER and Threshold Cross Alarms (TCA) threshold values.

SUMMARY STEPS

1. **configure terminal**
2. **controller wanphy** *interface-path-id*
3. **wanphy threshold b1-tca** *bit-error-rate*
4. **wanphy threshold b2-tca** *bit-error-rate*
5. **wanphy threshold sd-ber** *bit-error-rate*
6. **wanphy threshold sf-ber** *bit-error-rate*
7. **exit**
8. **exit**
9. **show controllers wanphy** *interface-path-id*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters the global configuration mode.
Step 2	**controller wanphy** *interface-path-id* **Example:** `Router(config)# controller wanphy 2/2/0`	Enters the controller mode of the WAN-PHY SPA installed in slot 2 of SIP 2 in this example.

	Command or Action	Purpose
Step 3	**wanphy threshold b1-tca** *bit-error-rate* **Example:** `Router(config-controller)# wanphy threshold b1-tca 4`	Sets the B1-tca threshold-crossing alarm value. The default threshold value for B1-tca is 10e-6. The valid range for the B1-tca threshold value is 4 to 9. In this example, the B1-tca threshold value is set to 4.
Step 4	**wanphy threshold b2-tca** *<bit-error-rate>* **Example:** `Router(config-controller)# wanphy threshold b2-tca 5`	Sets the B2-tca threshold-crossing alarm value. The default threshold value for B2-tca is 10e-6. The valid range for the B2-tca threshold value is 3 to 9 (10 to minus n). In this example, the B2-tca threshold value is set to 5.
Step 5	**wanphy threshold sd-ber** *<bit-error-rate>* **Example:** `Router(config-controller)# wanphy threshold sd-ber 8`	Sets the SD BER threshold-crossing alarm value. The default SD BER threshold value is 10e-6. The value range for SD BER threshold value is 3 to 9 (10 to minus n). In this example, the SD BER threshold value is set to 8.
Step 6	**wanphy threshold sf-ber** *<bit-error-rate>* **Example:** `Router(config-controller)# wanphy threshold sf-ber 9`	Sets the SF BER threshold-crossing alarm value. The default SF BER threshold value is 10e-3. The value range for the SF BER threshold value is 3 to 9 (10 to minus n). In this example, the SF BER threshold value is set to 9.
Step 7	**exit** **Example:** `Router(config-controller)# exit`	Exits from the Controller mode and enters the Global configuration mode.

	Command or Action	Purpose
Step 8	**exit** **Example:** `Router(config)# exit`	Exits from the global configuration mode and enters the Privileged EXEC mode.

Step 9	**show controllers wan** *<interface-path-id>*
	
	Example:
	`Router# show controller wan 2/2/0`
	
	`TenGigabitEthernet2/2/0`
	`Mode of Operation: WAN Mode`
	`SECTION`
	`  LOF = 0  LOS  = 0`
	`BIP(B1) = 13`
	`LINE`
	`  AIS = 0  RDI  = 1  FEBE`
	`= 0  BIP(B2) = 3827`
	`PATH`
	`  AIS = 0  RDI  = 0  FEBE`
	`= 28231  BIP(B3) = 5`
	`  LOP = 0  NEWPTR = 0  PSE`
	`= 0  NSE  = 0`
	`WIS ALARMS`
	`  SER  = 0  FELCDP = 0`
	`FEAISP = 1`
	`  WLOS  = 0  PLCD  = 0`
	`  LFEBIP = 7197878  PBEC  = 5`
	
	`Active Alarms[All defects]: None`
	`Active Alarms[Highest Alarms]: None`
	`Alarm reporting enabled for: SF SD SWLOF B1-TCA`
	`LAIS LRDI B2-TCA PAIS PLOP PPLM SER FELCDP`
	`FEAISP WLOS PLCD`
	
	`  Rx(K1/K2): 00/00  Tx(K1/K2): 00/00`
	`  S1S0 = 00, C2 = 0x1A`
	`PATH TRACE BUFFER: STABLE`
	`  Remote J1 Byte : an4ru-`
	
	`BER thresholds:  SD = 10e-8 SF = 10e-9`
	`TCA thresholds:  B1 = 10e-4  B2 = 10e-5 B3 =`
	`10e-6`
		The command output displays the SF, SD, BER threshold values and B1-tca and B2-tca threshold values in the last line of the command output in the example.
		
		In this example, the command output shows that B1 value is 4, B2 value is 5, SD value is 8, and SF value is 9.

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 1 on the SPA that is located in subslot 0 of the SIP that is installed in slot 0 of the Cisco ASR 1000 Series Aggregation Services Router:

```
! 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 0/0/1
!
! 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 0/0/1
!
! Modify the MAC address.
!
Router(config-if)# mac-address 1111.2222.3333
```

MAC Address Accounting Configuration

The following example shows how to enable MAC Address Accounting:

```
! Enter global configuration mode.
!
Router# configure terminal
! Enter configuration commands, one per line. End with CNTL/Z.
!
! Enable MAC address accounting
Router(config)# ip accounting mac-address {input | output}
Router(config-if)# ip accounting ?
access-violations Account for IP packets violating access lists on this interface
mac-address Account for MAC addresses seen on this interface
output-packets Account for IP packets output on this interface
precedence Count packets by IP precedence on this interface
<cr>
Router(config-if)# ip accounting mac-address ?
input Source MAC address on received packets
output Destination MAC address on transmitted packets
Router(config-if)# ip accounting mac-address input ?
<cr>
! Specify MAC address accounting for traffic entering the interface.
!
Router(config-if)# ip accounting mac-address input
! Specify MAC address accounting for traffic leaving the interface.
!
Router(config-if)# ip accounting mac-address output
Router(config-if)# end
! Verify the MAC Address on the interface.
!
Router# show interfaces GigabitEthernet 4/0/2 mac-accounting
GigabitEthernet4/0/2
Input (511 free)
000f.f7b0.5200(26): 124174 packets, 7450440 bytes, last: 1884ms ago
Total: 124174 packets, 7450440 bytes
Output (511 free)
000f.f7b0.5200(26): 135157 packets, 8109420 bytes, last: 1884ms ago
Total: 135157 packets, 8109420 bytes
```

MTU Configuration

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

Note The SPA automatically adds an additional 38 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 0/0/1
!
! Configure the interface MTU.
!
Router(config-if)# mtu 9216
```

VLAN Configuration

The following example shows how to create the subinterface number 268 on SPA 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
```