Configuring the Cisco ASR 1000 Series Fixed Ethernet Line Card

This chapter provides information about configuring the Cisco ASR 1000 Series Fixed Ethernet Line Cards 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 vi .

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 Cisco ASR 1000 Series Fixed Ethernet Line Cards and includes information about verifying the configuration, and includes the following topics:

Mandatory Configuration Tasks

This section lists the mandatory configuration steps to configure the Cisco ASR 1000 Series Fixed Ethernet Line Card. Some of the mandatory configuration commands implement default values that might be appropriate for your network. If the default value is correct for your network, you do not have to configure the command. These commands are indicated by (As Required) in the Purpose column.

To configure the Cisco ASR 1000 Series Fixed Ethernet Line Card, complete the following steps:

SUMMARY STEPS

1. **configure terminal**
2. Do one of the following:

    • **interface gigabitethernet** *slot* /*subslot* /*port*

3. **ip address** *ip-address mask* [**secondary**] | **dhcp** {**client-id interface-name**}{**hostname host-name**}}
4. **mtu** *bytes*
5. **standby** [**group-number**] **ip** {**ip-address** [**secondary**]}
6. **no shutdown**

DETAILED STEPS

	Command or Action	**Purpose**
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

Step 2	Do one of the following:
	
	• **interface gigabitethernet** *slot* /*subslot* /*port*
	
	Example:
	
	`Router(config)# `**`interface gigabitethernet `**`2`
	`/0`
	`/0`
	
	Example:
	
	`Router(config)# `**`interface tengigabitethernet`**
	` 1`
	`/0`
	`/20`
	
	Example:
		Configures the Gigabit Ethernet or the 10-GE interface. Here:
		
		• *slot* /*subslot* /*port* —Specifies the location of the interface. See the Specifying the Interface Address on an Ethernet Line Card, on page 3.
		• *subinterface-number*—(Optional) Specifies a secondary interface (subinterface) number.

Step 3	**ip address** *ip-address mask* [**secondary**]	**dhcp** {**client-id interface-name**}{**hostname host-name**}} **Example:** `Router(config-if)# ip address `**`10.20.30.40`** **`255.255.255.0`**	Sets a primary or secondary IP address for an interface that is using IPv4. Here: • *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

	Command or Action	Purpose
		to the hexadecimal MAC address of the named interface. • **hostname** *host-name*—Specifies the hostname for DHCP purposes. The *host-name* is the name of the host to be placed in the DHCP option 12 field.
Step 4	**mtu** *bytes* **Example:** Router(config-if)# **mtu** *1523*	(As required) Specifies the maximum packet size for an interface. Here: • *bytes*— Specifies the maximum number of bytes for a packet. The default is 1500 bytes; the range is 1500 to 9216 bytes.
Step 5	**standby** [**group-number**] **ip** {*ip-address* [**secondary**]} **Example:** Router(config-if)# standby 2 ip 10.20.30.40	(Required for HSRP configuration only) Creates (or enables) an HSRP group using its number and virtual IP address. Here: • (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 have 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 of 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 that corresponds to your Cisco IOS software release.
Step 6	**no shutdown** **Example:** Router(config-if)# **no shutdown**	Enables the interface.

Specifying the Interface Address on an Ethernet Line Card

To configure or monitor Ethernet Line Card interfaces, specify the physical location of the Ethernet Line Card, and interface in the CLI. The interface address format is slot/subslot/port. Here:

• slot—Specifies the chassis slot number in the Cisco ASR 1000 Series Aggregation Services Router on which the Ethernet Line Card is installed.

- subslot—Specifies the secondary slot number in the Cisco ASR 1000 Series Aggregation Services Router on which the Ethernet Line Card is installed. It is always specified as 0.
- port—Specifies the number of the individual interface port on an Ethernet Line Card.

The following example shows how to specify the first interface (0) on an Ethernet Line Card that is 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 Cisco ASR 1000 Series Fixed Ethernet Line Cards use a default MAC address for each port that is derived from the base address that is stored in the EEPROM on the backplane of the Cisco ASR 1000 Series Aggregation Services Routers.

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

Command	Purpose
mac-address *ieee-address* Router(config-if)# **mac-address** 000a.f330.2e40	Modifies the default MAC address of an interface to a user-defined address. Here: • *ieee-address*— Specifies the 48-bit 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 this command.

Verifying a MAC Address

To verify the MAC address of an interface, use the **show interfaces gigabitethernet command in the** privileged EXEC mode 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 Ethernet Line Card installed in slot 2 of a Cisco ASR 1000 Series Aggregation Services Router:

```
Router# show interfaces gigabitethernet 2/0/0
GigabitEthernet2/0/0 is administratively down, line protocol is down
  Hardware is BUILT-IN-2T+20X1GE, address is 000a.f330.2e40 (bia 000a.f330.2e40)
  MTU 1500 bytes, BW 1000000 Kbit/sec, DLY 10 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive not supported
  Full Duplex, 1000Mbps, link type is auto, media type is SX
  output flow-control is off, input flow-control is off
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input never, output 01:58:11, output hang never
  Last clearing of "show interfaces" counters never
  Input queue: 0/375/0/0 (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
   0 packets input, 0 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
   80 packets output, 7560 bytes, 0 underruns
   0 output errors, 0 collisions, 18 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
```

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.

The following example shows that the MAC accounting statistics for interface 1 on the Ethernet Line Card is installed in slot 1 of a Cisco ASR 1000 Series Aggregation Services Router:

```
Router# show interfaces TenGigabitEthernet1/0/0 mac-accounting
TenGigabitEthernet1/0/0
Input(494 free)
0000.0c5d.92f9(58 ): 1 packets, 106 bytes, last: 4038ms ago
0004.c059.c060(61 ): 0 packets, 0 bytes, last: 2493135ms ago
00b0.64bc.4860(64 ): 1 packets, 106 bytes, last: 20165ms ago
0090.f2c9.cc00(103): 12 packets, 720 bytes, last: 3117ms ago
Total: 14 packets, 932 bytes
Output (511 free)
0090.f2c9.cc00(103): 8 packets, 504 bytes, last: 4311ms ago
Total: 8 packets, 504 bytes
```

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).

Enable HSRP on an interface by entering the **standby** [*group-number*] **ip** [*ip-address* [**secondary**]] command. You can also use the **standby** command to configure various HSRP elements. This document does not discuss 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 with a priority of 110 and to have a preemptive delay for a switchover to 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 HSRP information, use the show standby command in EXEC mode:

```
Router# show standby
GigabitEthernet2/0/0 - Group 1
  State is Active
    2 state changes, last state change 00:00:33
    Track object 1 (unknown)
  Virtual IP address is 172.16.16.254
  Active virtual MAC address is 0000.0c07.ac01 (MAC In Use)
    Local virtual MAC address is 0000.0c07.ac01 (v1 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 2.416 secs
  Preemption enabled
  Active router is local
  Standby router is unknown
  Priority 105 (configured 105)
  Group name is "hsrp-Gi2/0/0-1" (default)
```

Modifying the Interface MTU Size

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 Ethernet Line Card on the 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), the frame continues to process.
- IP MTU—Can be configured on an interface or subinterface. If an IP packet exceeds the IP MTU size, 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 4-byte header, and each MPLS label adds a 4-byte header (*n* labels x 4 bytes).

For Cisco ASR 1000 Series Fixed Ethernet Line Cards on the Cisco ASR 1000 Series Aggregation Services Routers, the default MTU size is 1500 bytes. The maximum configurable MTU is 9216 bytes. The Ethernet Line Card automatically adds an additional 22 bytes to the configured MTU size to accommodate some of the additional overhead.

Note You cannot set the MTU option at the subinterface level.

Interface MTU Configuration Guidelines

When configuring the interface MTU size of a Cisco ASR 1000 Series Fixed Ethernet Line Card 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, 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 the interface configuration mode:

Command	Purpose
mtu *bytes* Router(config-if)# **mtu** *1523*	Configures the maximum packet size for an interface. Here: • *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 this command.

Verifying the MTU Size

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

The following example shows an MTU size of 9216 bytes for interface port 1 (the second port) on the Cisco ASR 1000 Series Fixed Ethernet Line Card installed in slot 2 of a 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 BUILT-IN-2T+20X1GE, address is 70ca.9b6a.1b50 (bia 70ca.9b6a.1b50)
Internet address is 1.2.1.1/24
MTU 9216 bytes, BW 1000000 Kbit/sec, DLY 10 usec,
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, loopback not set
Keepalive not supported
Full Duplex, 1000Mbps, link type is auto, media type is SX
output flow-control is off, input flow-control is off
ARP type: ARPA, ARP Timeout 04:00:00
Last input 02:20:41, output 00:03:36, output hang never
Last clearing of "show interfaces" counters never
Input queue: 0/375/0/0 (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
```

```
595 packets input, 45373 bytes, 0 no buffer
Received 3 broadcasts (0 IP multicasts)
0 runts, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
0 watchdog, 569 multicast, 0 pause input
593 packets output, 47591 bytes, 0 underruns
0 output errors, 0 collisions, 2 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
```

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 the interface configuration mode to configure QoS:

Command	Purpose
`plim qos input map ip {precedence-based	precedence `*`precedence-value`*` queue {`**`strict-priority	0`**`}}`    `Router(config-if)# plim qos input map ip precedence-based`     `Router(config-if)# plim qos input map ip precedence 5 queue strict-priority`	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 Cisco ASR 1000 Series Fixed Ethernet Line Card classifies IP precedence range 6-7 as high priority. • **strict-priority**—Specifies the high-priority queue. Enter 0 for low priority. Use the **no** form of this command to remove the configured values.
`plim qos input map ipv6 all queue {`**`strict-priority`**`	`**`0`**`}`    `Router(config-if)# plim qos input map ipv6 all queue` **`strict-priority`**	Classifies all the IPv6 packets as high priority or low priority. • **strict-priority**—Specifies high-priority traffic. Enter 0 for low-priority. The **no** form of this command disables all IPv6 classification. By default, this command is disabled.

Command	Purpose
`plim qos input map ipv6 tc {`*tc-value* | *tc-range*`} queue {`**strict-priority** | **0}**`` `Router(config-if)# plim qos input map ipv6 tc` *ef queue 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. • **strict-priority**—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.
`plim qos input map mpls all queue {`**strict-priority** | **0}**`` `Router(config-if)# plim qos input map mpls all queue` **strict-priority**	Classifies all MPLS packets as high priority or low priority. • **strict-priority**—Specifies high-priority packets. Enter 0 for low-priority packets. The **no** form of this command disables MPLS classification. By default, this command is disabled.
`plim qos input map mpls exp {`*exp-value* | *exp-range}* `queue {`**strict-priority** | **0}**`` `Router(config-if)# plim qos input map mpls exp 5` *queue strict-priority*	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. • **strict-priority**—Specifies high-priority MPLS traffic. Enter **0** for low-priority. By default, the Cisco ASR 1000 Series Fixed Ethernet Line Card 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.
`plim qos input queue {`**strict-priority** | **0}** `pause enable | threshold percent]` `Router(config-if)# plim qos input queue` **strict-priority pause enable**	Enables Ethernet pause frame generation due to flow control status. • **strict-priority**—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. • threshold—Specifies the amount of traffic required to generate the pause frame. The default threshold is 100 percent. This feature is supported from Cisco IOS XE Release 3.11S onwards. By default, pause frame generation is enabled for a **strict-priority** queue. The **no** form of this command disables pause generation for a queue.

Command	Purpose
`plim qos input map ip all queue {`**`strict-priority`**`	`**`0`**`}`  `Router(config-if)# plim qos input map ip all queue `**`0`**	Allows user to specify all IPv4 packets as high priority or low priority. • **strict-priority**—Specifies high-priority packets. Enter **0** for a low-priority packets The **no** form of this command disables all IPv4 classification. By default, this command is disabled.

`plim qos input map ip dscp-based`
 	
`Router(config-if)# plim qos input map ip dscp-based`
	Enables IP DSCP-based classification.
	
	By default, the Cisco ASR 1000 Series Fixed Ethernet Line Card 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.

`plim qos input map ip dscp {`*`dscp-value`*`	`*`dscp-range`*`} `**`queue`** **`{strict-priority`**`	`**`0}`**  `Router(config-if)# plim qos input map ip dscp `*`af11 queue`* *`strict-priority`*	Allows the user to specify an IP DSCP value or range. • **strict-priority**—Specifies high-priority IP DSCP value. Enter **0** for low-priority. By default, the Cisco ASR 1000 Series Fixed Ethernet Line Card classifies DSCP EF as high priority. The **no** form of this command removes the IP DSCP value or range.

`plim qos input [bandwidth value_in_Kbps [strict-priority]] [weight weight]`
 	
`Router(config-if)# plim qos input [bandwidth value_in_Kbps [strict-priority]] [weight weight]`
	Specifies the port regardless of priority, or specifies priority only (strict-priority) to receive the guaranteed minimum bandwidth, demanded minimum bandwidth, and assigned weight value for excess scheduling.
	
	The default mode (without using this command) is that the minimum scheduling is off, and only excess scheduling, which uses default weight proportional to the interface bandwidth, is in service.
	
	The **no** form of this command sets the interface to the default minimum bandwidth and weight.
	
	This feature is supported from Cisco IOS XE Release 3.11S onwards.

Configuring the Encapsulation Type

By default, the interfaces on the Cisco ASR 1000 Series Fixed Ethernet Line Cards 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 Ethernet Line Card interfaces is IEEE 802.1Q encapsulation for virtual LANs (VLANs).

Configuring Autonegotiation on an Interface

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.
- Flow control is enabled by default.
- Flow control will be on if autonegotiation is disabled on both ends of the link.

Note For configuring any ASR1000 platform, ensure that auto negotiation is configured identically on both sides of the link. For example, if auto negotiation is disabled on one side of the link, the other end of the link must also have auto negotiation disabled. If the auto negotiation configuration does not match on both sides of the link, it may lead to connection failure.

Disabling Autonegotiation

Autonegotiation is automatically enabled and can be disabled on the Gigabit Ethernet interfaces on the Cisco ASR 1000 Series Fixed Ethernet Line Card. 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 Cisco ASR 1000 Series Fixed Ethernet Line Card, 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 ASR 1000 Series Fixed Ethernet Line Cards—100 Mbps for speed and full-duplex mode.
- For Cisco ASR 1000 Series Fixed Ethernet Line Cards 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 ASR 1000 Series Fixed Ethernet Line Cards support 1000Base-X, but the IEEE 1000Base-X standard for fiber does not support negotiation of link speed.

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

Command	Purpose
`no negotiation auto` Router(config-if)# **no negotiation auto**	Disables autonegotiation on Cisco ASR 1000 Series Fixed Ethernet Line Card interfaces. No advertisement of flow control occurs.

Configuring Speed and Duplex

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

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

Note Before configuring speed and duplex, disable autonegotiation on the interface. The **speed** and **duplex** commands are not available on the 10-GE interfaces.

Command	Purpose
speed {**10** | **100** | **1000**} Router(config-if)# **speed 100**	Configures the interface to transmit at 10 Mbps, 100 Mbps, or 1000 Mbps.

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

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

Enabling Autonegotiation

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

Command	Purpose
negotiation auto Router(config-if)# **negotiation auto**	Enables autonegotiation on a Cisco ASR 1000 Series Fixed Ethernet Line Card interface. Advertisement of flow control occurs.

Configuring a Subinterface on a VLAN

You can configure subinterfaces on the Cisco ASR 1000 Series Fixed Ethernet Line Card interfaces on a VLAN using IEEE 802.1Q encapsulation. Cisco Discovery Protocol is disabled by default on the Cisco ASR 1000 Series Fixed Ethernet Line Card interfaces and subinterfaces.

To configure an Ethernet Line Card subinterface on a VLAN, use the following commands in the global configuration mode:

SUMMARY STEPS

1. **hw-module subslot** slot/subslot **ethernet vlan unlimited**
2. Do one of the following:

   • **interface gigabitethernet** *slot* /*subslot* /*port* [**.**subinterface-number]

3. **encapsulation dot1q** *vlan-id*
4. **ip address** *ip-address mask* [**secondary]**}

DETAILED STEPS

	Command or Action	**Purpose**
Step 1	**hw-module subslot** slot/subslot **ethernet vlan unlimited** **Example:** Router(config)# hw-module subslot slot/subslot ethernet vlan unlimited	(Optional) Enables configuration of up to 4094 dot1q VLANs per port per Cisco ASR 1000 Fixed Ethernet Line Card. Here: • *slot* —Specifies the slot number of the chassis in which the Ethernet Line Card is installed. • *subslot* —Specifies the slot number of the Ethernet Line Card in which the Ethernet Line Card is installed. This feature is supported from Cisco IOS XE Release 3.11S onwards.
Step 2	Do one of the following: • **interface gigabitethernet** *slot* /*subslot* /*port* [**.**subinterface-number] **Example:** Router(config)# **interface gigabitethernet** *2* /*0* /*0.20* **Example:** **Example:** **Example:** Router(config)# **interface tengigabitethernet** *1* /*0* /*20.43* **Example:**	Specifies the Gigabit Ethernet interface to configure. Here: • *slot* /*subslot* /*port* —Specifies the location of the interface. See the Specifying the Interface Address on an Ethernet Line Card, on page 3. • *subinterface-number*—Specifies a secondary interface (subinterface) number.
Step 3	**encapsulation dot1q** *vlan-id* **Example:** Router(config-subif)# **encapsulation dot1q** *25*	Defines the encapsulation format as IEEE 802.1Q (dot1q), where *vlan-id* is the number of the VLAN. The valid value range is 1–4094.

	Command or Action	Purpose
Step 4	**ip address** *ip-address mask* [**secondary**]} **Example:** Router(config-subif)# ip address **10.20.30.40 255.255.255.0** **Example:**	Sets a primary or secondary IP address for an interface. Here: • *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

This section describes how to configure the COS based classification rules at VLAN sub-interface level and L3 classification rules at main-interface level.

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

When the VLAN scale configuration is enabled using the **hw-module subslot** *slot/subslot* **ethernet vlan unlimited** command, the VLAN COS bits classification will be lost.

The following is a sample output of the **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 the subinterface configuration mode:

Command	Purpose
plim qos input map cos enable 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 Cisco ASR 1000 Series Fixed Ethernet Line Card. 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 link bundle.

Command	Purpose

```plim qos input map cos {cos-value | cos-range} queue {strict-priority | 0}```
 	
```Router(config-subif)# plim qos input map cos 3 queue strict-priority```
	Allows a user to specify a COS value or a COS range.
	
	By default, without this command, COS bits value 6 and 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 and 7).
	
	This command is in the VLAN subinterface configuration mode under either the main physical interface or the Gigabit EtherChannel link bundle.

Classifying Inner and Outer VLAN COS Values

To enable packet classification based on VLAN COS values for Inner and Outer VLAN of a 802.1Q subinterface or qinq subinterface, execute the following set of commands from the qinq subinterface configuration mode:

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface gigabitEthernet 0/0/0.1**
4. **plim qos input map cos inner-based**
5. **plim qos input map cos inner** {*cos-value* | *cos-range}* **queue {strict-priority | 0}**
6. **plim qos input map cos outer-based**
7. **plim qos input map cos outer** {*cos-value* | *cos-range}* **queue {strict-priority | 0}**

DETAILED STEPS

	Command or Action	**Purpose**
Step 1	**enable** **Example:** ```Router> enable```	Enables privileged EXEC mode. Enter your password when prompted.
Step 2	**configure terminal** **Example:** ```Router# configure terminal```	Enters global configuration mode.
Step 3	**interface gigabitEthernet 0/0/0.1** **Example:** ```Router(config)# interface gigabitEthernet 0/0/0.1```	Enters subinterface mode for Gigabit Ethernet 0/0/0.1.
Step 4	**plim qos input map cos inner-based** **Example:**	Enables and allows configuration for inner VLAN COS values.

	Command or Action	Purpose
	`Router(config-subif)# plim qos input map cos inner-based`	**Note** The VLAN COS values can be enabled by default by executing the **plim qos input map enable** command.
Step 5	**plim qos input map cos inner** {*cos-value* | *cos-range}* **queue {strict-priority | 0}** **Example:** `Router(config-subif)# plim qos input map cos inner 5 queue strict-priority`	Configures the COS values or the COS range of the inner VLAN of a qinq subinterface to high priority.
Step 6	**plim qos input map cos outer-based** **Example:** `Router(config-subif)# plim qos input map cos outer-based`	Enables configuration for outer VLAN COS values. **Note** The VLAN COS values can be enabled by default by executing the **plim qos input map enable** command.
Step 7	**plim qos input map cos outer** {*cos-value* | *cos-range}* **queue {strict-priority | 0}** **Example:** `Router(config-subif)# plim qos input map cos outer 4 queue strict-priority`	Configures the COS values or range for outer VLAN of a qinq subinterface to high priority.

Verifying a Subinterface Configuration on a VLAN

To verify the configuration of a subinterface and its status on the VLAN, use the show interfaces gigabitethernet 0/0/0.1 privileged EXEC command.

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

```
Router# show interfaces gigabitethernet 0/0/0.1
GigabitEthernet0/0/0.1 is up, line protocol is up
  Hardware is BUILT-IN-2T+20X1GE, address is badb.adbb.7a00 (bia badb.adbb.7a00)
  Internet address is 192.168.0.1/24
  MTU 1500 bytes, BW 1000000 Kbit/sec, DLY 10 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation 802.1Q Virtual LAN, Vlan ID  2.
  ARP type: ARPA, ARP Timeout 04:00:00
  Keepalive not supported
  Last clearing of "show interfaces" counters never
Router#
```

Saving a Configuration

To save your running configuration to NVRAM, use the following command in privileged EXEC configuration mode:

Command	Purpose
`copy running-config startup-config` `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 an Ethernet Line Card

You can shut down and restart any of the interface ports on a Cisco ASR 1000 Series Fixed Ethernet Line Card independent of each other. Shutting down an interface stops traffic and moves the interface into an administratively down state.

There are no restrictions for online insertion and removal (OIR) on the Cisco ASR 1000 Series Fixed Ethernet Line Cards.

If you are preparing for an OIR of an Ethernet line card, it is not necessary to independently shut down each of the interfaces prior to the deactivation of the Ethernet Line Card. The **hw-module slot <1> stop** command automatically stops traffic on the interfaces and deactivates them along with the Ethernet Line Card in preparation for OIR.

To shut down an interface on an Ethernet Line Card, use the following command in the interface configuration mode:

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

To restart an interface on an Ethernet Line Card, use the following command in interface configuration mode:

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

Modifying the Minimum Frame Size on a Gigabit Ethernet Interface

You can modify the minimum frame size of data that is transmitted on a Gigabit Ethernet interface from 64 bytes to 68 bytes, including the VLAN tag encapsulation.

Restrictions

The following are the restrictions for modifying the minimum frame size on a Gigabit Ethernet interface:

- This modification is specific to the interface level, and configuration changes are applied to all packet sizes that are less than 64 bytes.
- This type of modification is supported only on the ASR1000-2T+20X1GE and ASR1000-6TGE Cisco ASR 1000 Series Fixed Ethernet Line Cards.

Modifying the Minimum Frame Size to 68 Bytes

To configure the minimum frame size to 68 bytes, use the following command in privileged EXEC configuration mode:

Command	Purpose
`plim min-frame-length` *<68byte>* `Router(config-if)# `**`plim min-frame-length 68byte`**	Configures the minimum frame size to 68 bytes.

To disable the minimum frame size configuration, use the following command in privileged EXEC configuration mode:

Command	Purpose
`no plim min-frame-length` *<68byte>* `Router(config-if)# `**`no plim min-frame-length 68byte`**	Disables the 68-byte minimum frame size configuration.

Examples

The following example shows how to modify the minimum frame size from 64 bytes to 68 bytes:

```
Router(config-if)# plim min-frame-length ?
64 byte - Default:64 byte
Router(config-if)# plim min-frame-length 68byte
Router(config-if)# plim min-frame-length ?
68 byte - Default:64 byte
Router(config-if)# no plim min-frame-length 68byte
Router(config-if)# plim min-frame-length ?
64 byte - Default:64 byte
```

Verifying an 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 | tengigabitethernet**

command to get detailed information on a per-port basis for your Cisco ASR 1000 Series Fixed Ethernet Line Cards.

Verifying Per-Port Interface Status

To find detailed interface information on a per-port basis for the Cisco ASR 1000 Series Fixed Ethernet Line Cards, use the **show interfaces gigabitethernet** command.

The following example provides a sample output for interface port 1 on the Ethernet Line Card that is installed in slot 2 of a 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 BUILT-IN-2T+20X1GE, address is 70ca.9b6a.1b50 (bia 70ca.9b6a.1b50)
Internet address is 1.2.1.1/24
MTU 9216 bytes, BW 1000000 Kbit/sec, DLY 10 usec,
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, loopback not set
Keepalive not supported
Full Duplex, 1000Mbps, link type is auto, media type is SX
output flow-control is off, input flow-control is off
ARP type: ARPA, ARP Timeout 04:00:00
Last input 02:20:41, output 00:03:36, output hang never
Last clearing of "show interfaces" counters never
Input queue: 0/375/0/0 (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
595 packets input, 45373 bytes, 0 no buffer
Received 3 broadcasts (0 IP multicasts)
0 runts, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
0 watchdog, 569 multicast, 0 pause input
593 packets output, 47591 bytes, 0 underruns
0 output errors, 0 collisions, 2 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
```

Using show Commands to Check SFP Module and XFP Module Status

You can use various **show** commands to view information specific to Small Form-Factor Pluggable (SFP), 10-G Small Form Factor (XFP), Coarse Wavelength Division Multiplex (CWDM), and Dense Wavelength Division Multiplex (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**

The following is a list of 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-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 CWDM 1490:

```
Router# show hw-module subslot 2/0 transceiver 2 idpromIDPROM for transceiver
GigabitEthernet2/0/2:Description = SFP optics (type 3)Transceiver Type: = GE CWDM 1490
(28)Product Identifier (PID) = FWDM-16217D49CSCVendor Revision = CSerial Number (SN) =
FNS10500HA9Vendor Name = CISCO-FINISARVendor OUI (IEEE company ID) = 00.90.65 (36965)CLEI
code = CNTRVX0FAACisco part number = 10-1884-01Device State = Enabled.Date code (yy/mm/dd)
 = 06/12/12Connector type = LC.Encoding = 8B10BNRZNominal bitrate = (2700 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 an XFP module:

```
Router# show
 hw-module subslot 4/0 transceiver 21 id briefIDPROM for transceiver TenGigabitEthernet4/0/21:

  Description                         = XFP optics (type 6)
  Transceiver Type:                   = OC192 + 10GBASE-L (173)
  Product Identifier (PID)            = XFP-10GLR-OC192SR
  Vendor Revision                     = 02
  Serial Number (SN)                  = ONT1233101Y
  Vendor Name                         = CISCO-OPNEXT
  Vendor OUI (IEEE company ID)        = 00.0B.40 (2880)
  CLEI code                           = WMOTBEVAAB
  Cisco part number                   = 10-1989-02
  Device State                        = Disabled.
  Date code (yy/mm/dd)                = 08/08/13
  Connector type                      = LC.
  Encoding                            = 64B/66B
                                        SONET Scrambled
                                        NRZ
  Minimum bit rate                    = 9900 Mbits/s
  Maximum bit rate                    = 11100 Mbits/s
Router#
```

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

```
Router# show hw-module subslot 4/0 transceiver 21 id dumpIDPROM for transceiver
TenGigabitEthernet4/0/21:
  Description                         = XFP optics (type 6)
  Transceiver Type:                   = OC192 + 10GBASE-L (173)
  Product Identifier (PID)            = XFP-10GLR-OC192SR
  Vendor Revision                     = 02
  Serial Number (SN)                  = ONT1233101Y
  Vendor Name                         = CISCO-OPNEXT
  Vendor OUI (IEEE company ID)        = 00.0B.40 (2880)
  CLEI code                           = WMOTBEVAAB
  Cisco part number                   = 10-1989-02
  Device State                        = Disabled.
```

Configuring the Cisco ASR 1000 Series Fixed Ethernet Line Card

Configuring Synchronous Ethernet for a Cisco ASR 1000 Series Fixed Ethernet Line Card on a Cisco ASR 1000 Series Aggregation Services Router

```
        XFP IDPROM Page 0x0:
            000:        06 00 5A 00 F6 00 55 00 FB 00
            010:        00 00 00 00 00 00 00 00 FD E8
            020:        13 88 EA 60 17 70 3D E8 04 EA
            030:        27 10 07 CB 31 2D 00 B5 2B D4
            040:        01 20 89 EE 77 E2 87 5A 7A 75
            050:        00 00 00 00 00 00 00 00 00 00
            060:        00 00 00 00 00 00 00 00 00 00
            070:        00 00 00 00 00 00 00 00 00 00
            080:        05 00 05 00 C3 00 00 00 00 00
            090:        00 00 00 00 00 00 22 00 00 00
            100:        00 62 00 00 07 E1 7F 22 00 00
            110:        E8 C0 00 00 00 00 00 00 00 00
            120:        00 00 00 00 00 00 00 01
        XFP IDPROM Page 0x1:
            128:        06 58 07 40 40 00 00 40 00 00
            138:        00 B0 63 6F 0A 00 00 00 00 40
            148:        43 49 53 43 4F 2D 4F 50 4E 45
            158:        58 54 20 20 20 20 E0 00 0B 40
            168:        54 52 46 35 30 31 32 41 4E 2D
            178:        4C 41 30 30 30 20 30 32 66 58
            188:        0F A0 46 DA 7D 96 06 00 4F 4E
            198:        54 31 32 33 33 31 30 31 59 20
            208:        20 20 20 20 30 38 30 38 31 33
            218:        20 20 08 40 70 8A 00 00 11 B2
            228:        F3 42 3A A7 5A 7A 09 60 23 94
            238:        B5 22 68 BD 42 00 00 00 00 00
            248:        00 00 00 00 CC 4E 65 D5
        XFP IDPROM Page 0x2:
            128:        57 4D 4F 54 42 45 56 41 41 42
            138:        31 30 2D 31 39 38 39 2D 30 32
            148:        56 30 32 20 01 00 00 00 00 00
            158:        00 00 00 B9 00 00 00 00 00 00
            168:        00 00 58 AF 60 61 70 8F 92 D5
            178:        00 00 1F 00 69 8A 14 84 00 D8
            188:        00 00 AA AA 58 46 50 2D 31 30
            198:        47 4C 52 2D 4F 43 31 39 32 53
            208:        52 20 20 20 00 00 00 00 00 00
            218:        00 00 00 00 00 C1 32 35 35 34
            228:        36 36 35 30 00
    Router#
```

Configuring Synchronous Ethernet for a Cisco ASR 1000 Series Fixed Ethernet Line Card on a Cisco ASR 1000 Series Aggregation Services Router

The Cisco ASR 1000 Series Fixed Ethernet Line Card supports time, phase, and frequency awareness through Ethernet networks. The Cisco ASR 1000 Series Fixed Ethernet Line Card enables clock selection and translation between the various clock frequencies. If the Cisco ASR 1000 Series Fixed Ethernet Line Card 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 four different configuration, see the chapter "Synchronous Ethernet Support On Cisco ASR 1000 Series Aggregation Services Routers" in the Cisco ASR 1000 Series Aggregation Services Routers Software Configuration Guide .

The Synchronous Ethernet can be configured in global configuration mode and interface configuration mode:

Configuring Synchronous Ethernet in Global Configuration Mode

Use the following commands to configure Synchronous Ethernet in global configuration mode on a Cisco ASR 1000 Series Fixed Ethernet Line Card:

Command	Purpose
network-clock synchronization automatic 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. The **no** form of this command disables the G.781-based automatic clock selection process.
network-clock eec {1 | 2} 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). The **no** form of this command reverses the command configuration.
network-clock synchronization ssm option {1| 2 {GEN1 | GEN2}} 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 U.S. (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. The **no** form of this command reverses the command configuration.
network-clock synchronization mode QL-enabled Router(config)# **network-clock synchronization mode QL-enabled**	Configures the automatic selection process for quality level-enabled mode. **Note** Quality level-enabled mode succeeds only if there are synchronization interfaces that are capable of sending SSM. The **no** form of this command disables the automatic selection process for quality level-enabled mode.
esmc process Router(config)# **esmc process**	Enables the ESMC process at the system level. **Note** This command fails if no SyncE-capable interface is installed on the platform. The **no** form of this command disables the ESMC process at the system level.

Command	Purpose
`network-clock hold-off {0	<50-10000>} global`  `Router(config)# network-clock hold-off 75 global`	Configures general hold-off timer in milliseconds (ms). The default value is 300 ms. **Note** Displays a warning message for values below 300 ms and above 1800 ms.

`network-clock wait-to-restore <0-86400> global`
 	
`Router(config)# network-clock` **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.

`network-clock input-source <priority> {interface interface_name slot/card/port}`
 	
`Router(config)# network-clock input-source 23 interface gigabitethernet 2/0/0`
	Priority is a number between 1 and 250.
	
	Note The no version of this command reverses the command configuration, implying that the priority has changed to undefined, and the state machine is informed.

`network-clock revertive` `Router(config)#` **network-clock revertive**	Specifies whether or not the clock source is revertive. Clock sources with the same priority are always nonrevertive. The default value is nonrevertive. In nonrevertive 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. The no form of this command changes the clock to nonrevertive mode.

`network-clock synchronization participate slot number`
 	
`Router(config)#` **network-clock synchronization participate** `2`
	Enables or disables a slot from participating in network-clock algorithm.
	
	By default, all the slots are participating slots.
	
	Note A slot cannot be disabled from participation if it's primary source or secondary source is valid.
	
	The **no** form of this command disables the slot from participating in network-clock algorithm.

Configuring Synchronous Ethernet in Interface Configuration Mode

Use the following commands in interface configuration mode to configure Synchronous Ethernet and timers on a Cisco ASR 1000 Series Aggregation Services Router.

Command	Purpose
synchronous mode Router(config-if)# **synchronous mode**	Configures the Ethernet interface to synchronous mode, and this automatically enables the ESMC and quality-level processes on the interface. **Note** This command is applicable to Synchronous Ethernet-capable interfaces. The default value is asynchronous mode.
**esmc mode [tx	rx]** Router(config-if)# **esmc mode tx**	Enables or disables the ESMC process on the interface. **Note** If the interface is configured as line source but does not receive the ESMC message from the peer node on the interface, the interface is removed from the selectable clock source list. By default, this is enabled for the synchronous mode and disabled for the asynchronous mode. **Note** This command is not supported on nonsynchronous Ethernet interfaces.
**network-clock source quality-level value {tx	rx}** Router(config-if)# **network-clock source quality-level** QL-PRC tx	The command forces the quality-level value to the local clock selection process and is considered by the clock selection process as a value from network. The value is based on the 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.
network-clock hold-off 0	50-10000 Router(config-if)# **network-clock hold-off** 1000	Configures the hold-off timer for the interface. The default value is 300 ms. **Note** Displays a warning for values below 300 ms and above 1800 ms.
network-clock wait-to-restore 0-86400 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.

Command	Purpose

`esmc mode ql-disabled`
 	
`Router(config-if)# esmc mode ql-disabled`
	Disables the quality-level mode. The default mode for synchronous Ethernet is quality level-enabled.
	
	Note This command is not supported on nonsynchronous Ethernet interfaces.
	
	The **no** form of this command enables the quality-level mode.

Managing Synchronization

You can manage synchronization using the following management commands:

Command	Purpose

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

`network-clock switch force {interface interface_name slot/card/port | `**`T0`**`}`
 	
`Router(config)# network-clock switch force interface `**`GigabitEthernet`**` 0/0/0`
	Forcefully selects a synchronization source irrespective of whether the source is available and is within the range.

`network-clock switch manual {interface interface_name slot/card/port | `**`T0`**`}`
 	
`Router(config)# network-clock switch manual interface GigabitEthernet 0/0/0`
	Manually selects a synchronization source, provided the source is available and is within the range.

`network-clock clear switch {T0}`
 	
`Router(config)# network-clock clear switch T0`
	Clears the forced switch and manual switch commands.

Examples

The following example shows how to configure quality level-enabled mode clock selection:

```
network-clock synchronization automatic
network-clock synchronization mode QL-enabled
network-clock input-source 1 interface GigabitEthernet2/0/0
!
```

```
interface GigabitEthernet2/0/0
 no ip address
 clock source line
 synchronous mode
end
!
```

Verifying a 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 : GigabitEthernet1/0/0
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
*Gi1/0/0           NA          Sync/En      1     QL-PRC   -         -
```

Use the show network-clocks synchronization detail command to display all the details of the Synchronous Ethernet 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 : GigabitEthernet1/0/0
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
*Gi1/0/0           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: Gi1/0/0
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 interfaces accounting command to display packet accounting statistics, as shown here:

```
Router# show interfaces GigabitEthernet 2/0/0 accounting
GigabitEthernet2/0/0
              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: GigabitEthernet2/0/0
  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: GigabitEthernet2/0/0
  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: GigabitEthernet3/0/0
  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: GigabitEthernet3/0/1
  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: GigabitEthernet2/0/0
  Administrative 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: GigabitEthernet2/0/1
  Administrative 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: GigabitEthernet3/0/0
  Administrative 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: GigabitEthernet3/0/1
  Administrative 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 Synchronous Ethernet Configuration

The following debug commands are available for troubleshooting the Synchronous Ethernet configuration on a Cisco ASR 1000 Series Aggregation Services Router:

Table 1: debug Commands for Troubleshooting

debug Command	Purpose

`debug platform network-clock`
 	
`Router# debug platform network-clock`
	Debugs issues related to the Synchronous Ethernet, such as alarms, Clock Out-of-Range (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>]`
 	
`Router# debug esmc event`
	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 Synchronous Ethernet synchronization configurations are complete.

provides the troubleshooting scenarios encountered while configuring the Synchronous Ethernet:

Table 2: Troubleshooting Scenarios Encountered While Configuring the Synchronous Ethernet

Problem	Solution
Clock is not getting selected	The following solutions may help you to troubleshoot this issue: • 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.
Incorrect quality-level values	The following solutions may help you to troubleshoot this issue: • Ensure that there is no framing mismatch with the SSM option. • Verify the output of the show esmc detail and the show network -clock synchronization detail commands. • 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.

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 shows how to configure interface port 1 on the Ethernet Line Card that is located in subslot 0 of the Ethernet Line Card that is installed in slot 0 of a 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:

```
! 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 Ethernet Line Card 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
```