Overview of the Cisco ASR 1000 Series Fixed Ethernet Line Cards

This chapter provides an overview of the release history, and feature and MIB support for the Gigabit Ethernet and Cisco ASR 1000 Series Fixed Ethernet Line Cards on the Cisco ASR 1000 Series Aggregation Services Routers.

This chapter includes the following sections:

Supported Line Cards

This section lists and describes the line cards supported by the Cisco ASR 1000 Series Aggregation Services Routers.

ASR1000-2T+20X1GE

The Cisco ASR 1000 Series Fixed Ethernet Line Card ASR1000-2T+20X1GE is a fixed-port Ethernet line card for the Cisco ASR 1000 Series Aggregation Services Routers, that is capable of 40-Gbps full-duplex traffic forwarding using a fixed-port interface design. This line card has twenty 1-GE ports and two 10-GE ports.

This line card is supported on the Cisco ASR 1004, Cisco ASR 1006, ASR 1006-X, ASR 1009-X, and Cisco ASR 1013 Routers with RP2 and above + ESP40 and above combinations.

ASR1000-6TGE

The Cisco ASR 1000 Series Fixed Ethernet Line Card ASR1000-6TGE is a fixed-port Ethernet line card for the Cisco ASR 1000 Series Aggregation Services Routers. The line card is capable of 60-Gbps input traffic and 40-Gbps output traffic forwarding using a fixed-port interface design. This line card has six 10 GE ports.

The small form-factor pluggables (XFP modules) allow the line card to be configured for different optical requirements (single-mode fiber or multimode fiber), as available. There is one power LED, one line card status LED, and 6 port or link status LEDs.

This line card is supported on the Cisco ASR 1004, Cisco ASR 1006, ASR 1006-X, ASR 1009-X, and Cisco ASR 1013 Routers with RP2 and above + ESP40 and above combinations.

Release History

Release	Modification
Cisco IOS XE Release 3.10S	First release. Support for the Cisco ASR 1000 Series Fixed Ethernet Line Card ASR1000-2T+20X1GE was introduced on the Cisco ASR 1000 Series Aggregation Services Routers.
Cisco IOS XE Release 3.11S	Support for the VLAN Unlimited, Fast Re-route (FRR), Configurable Pause Frame Thresholds, and Per Port Weight for Low Priority Traffic features was introduced.
Cisco IOS XE Release 3.12S	Support for the Cisco ASR 1000 Series Fixed Ethernet Line Card ASR1000-6TGE was introduced on the Cisco ASR 1000 Series Aggregation Services Routers.
Cisco IOS XE Release 3.15	Added information pertaining to the support for the Cisco 1000BASET SFP Module (SFP-GLC-TE) on the ASR 1000 Series Routers.

Features Supported in Cisco IOS XE Release 3.12S

Table below lists of some of the significant hardware and software features supported by the Cisco ASR 1000 Series Fixed Ethernet Line Cards on the Cisco ASR 1000 Series Aggregation Services Routers using Cisco IOS XE Release 3.12S:

Table 1: Features Supported in Cisco IOS XE Release 3.12S

Feature Name	Description
Minimal Disruptive Restart (MDR) for ELCBase and ELCSPA	Effective from Cisco IOS XE Release 3.12S, the Cisco ASR 1000 Series Fixed Ethernet Line Card (ASR1000-2T+20X1GE) supports MDR for the ELCBase and ELCSPA packages. MDR support for ASR1000-2T+20X1GE is specifically available on the Cisco ASR 1006 Router and the Cisco ASR 1013 Router, both having RP 2. **Note** MDR is not supported on the Cisco ASR 1000 Series Fixed Ethernet Line Card ASR1000-6TGE in Cisco IOS XE Release 3.12S. For more information on MDR, see the http://www.cisco.com/c/en/us/td/docs/routers/asr1000/configuration/guide/chassis/asrswcfg.html Cisco ASR 1000 Series Aggregation Services Routers Software Configuration Guide .

Features Supported in Cisco IOS XE Release 3.11S

Table below lists of some of the significant hardware and software features supported by the Cisco ASR 1000 Series Fixed Ethernet Line Card ASR1000-2T+20X1GE on the Cisco ASR 1000 Series Aggregation Services Routers using Cisco IOS XE Release 3.11S:

Table 2: Features Supported in Cisco IOS XE Release 3.11S

Feature Name	Description
VLAN Unlimited	The hw-module subslot ethernet vlan unlimited configuration command increases the system default and enables support for configuration of up to 4094 dot1q VLANs per port.
Fast Re-route (FRR)	Although this feature can be configured on Cisco IOS XE Release 3.10S, the FRR switchover time can be more than 50 ms.
Configurable PLIM QoS	• Configurable PLIM classification is supported. • Configurable policing for the packets classified as high-priority traffic using the plim qos input policer bandwidth command is not supported. • Configurable weights for the packets classified as low using the plim qos input weight command are not supported.

Feature Name	Description
Configurable pause frame thresholds	Configuration of threshold percentages at which the pause frames should be generated using the plim qos input queue <*queue #*> pause <*percent* > command is not supported.

Features Supported in Cisco IOS XE Release 3.10S

The following is a list of some of the significant hardware and software features supported by the Cisco ASR 1000 Series Fixed Ethernet Line Card ASR1000-2T+20X1GE on the Cisco ASR 1000 Series Aggregation Services Routers using Cisco IOS XE Release 3.10S:

- Auto negotiation
- Auto MDI and MDIX detection. The SFP-GE-T module enables auto MDI and MDIX detection on the 1-GE ports on Cisco ASR 1000 Series Fixed Ethernet Line Card ASR1000-2T+20X1GE and also on the built-in GE ports for the Cisco ASR 1000 Series Aggregation Services Routers.
- Full-duplex operation
- 802.1Q VLAN termination
- Support for jumbo frames (9216 bytes)
- Support for CLI-controlled online insertion and removal (OIR) of the Cisco ASR 1000 Series Fixed Ethernet Line Card.
- 802.3x flow control
- The following maximum number of VLANs are supported on each line card:
  - Number of VLANs per port: 4096
  - Number of VLANs per line card: 32768.
- Up to 20480 Media Access Controller (MAC) Accounting Entries per Fixed Ethernet Line Card (Source MAC Accounting on the ingress and Destination MAC Accounting on the egress)
- Per-port byte and packet counters for policy drops, oversubscription drops, Cyclic Redundancy Check (CRC) error drops, packet sizes, unicast, multicast, and broadcast packets
- Per-VLAN byte and packet counters for policy drops, oversubscription drops, unicast, multicast, and broadcast packets
- Per-port packet counters for good packets and dropped packets
- Multiprotocol Label Switching (MPLS)
- Quality of Service (QoS)
- Hot Standby Router Protocol (HSRP)
- L1 clock frequency distribution—In this mode, the Cisco ASR 1000 Series Fixed Ethernet Line Card recovers the received clock, synchronizes it to a traceable source, and uses it to transmit data to the next node.

- In order to maintain a communication channel in synchronous network connections, Ethernet relies on a channel called Ethernet Synchronization Messaging Channel (ESMC) based on the IEEE 802.3 Organization-Specific Slow Protocol. ESMC relays the synchronization status message code that represents the quality level of the Ethernet Equipment Clock (EEC) in a physical layer.

Note The Ethernet hardware used for the Cisco ASR 1000 Series Fixed Ethernet Line Card can support a minimum Inter-Frame Gap (IFG) of 8 bytes for 1-GE ports, and 5 bytes for 10-GE ports.

Hardware Compatibility Matrix

Table 3: Hardware Compatibility Matrix, on page 5 shows the hardware compatibility matrix of the Cisco ASR 1000 Series Fixed Ethernet Line Card:

Table 3: Hardware Compatibility Matrix

Hardware	Support	Restrictions
Chassis Type	Supported on the Cisco ASR 1004, Cisco ASR 1006, Cisco ASR 1006-X, Cisco ASR 1009-X, and Cisco ASR 1013 Routers with RP2 and above + ESP40 and above combinations.	—
RP2 with ESP-40G, ESP-100G, ESP-200G	Supported	The combination of ESP-40G with the Ethernet Line Card in slot 4 or slot 5 of a Cisco ASR1013 is not supported. **Note** ESP-100G and ESP-200G are not supported on Cisco ASR1004 **Note** RP2 requires the minimum ROMMON version to be 15.2(01)r. For more information about ROMMON, see http://www.cisco.com/en/US/products/ps9343/prod_maintenance_guides_list.html
RP1, ESP-10G, ESP-20G	Not Supported	—
SFP-GE-T	Supported	Only 1-Gigabit Mode is supported in Cisco IOS XE Release 3.10S. 10 Mbps or 100 Mbps is supported from Cisco IOS XE Release 3.11S onwards.
SFP-GLC-TE	Supported	—
GLC-GE-100FX	Not Supported	Not supported in Cisco IOS XE Release 3.11S.

Note For the complete list of supported SFP modules, see the Cisco ASR 1000 Series Fixed Ethernet Line Card Hardware Installation Guide .

Synchronous Ethernet

Synchronous Ethernet (SyncE) is a procedure in which a physical layer interface is used to pass timing from node to node in the same way that timing is passed in SONET or Synchronous Digital Hierarchy (SDH). SyncE, defined by ITU-T standards, such as G.8261, G.8262, G.8264, and G.781, leverages the physical (PHY) layer of Ethernet to transmit frequency to remote sites. SyncE over Ethernet provides a cost-effective alternative to the networks. For SyncE to work, each network element must, along with the synchronization path, support SyncE.

You can implement SyncE on the Cisco ASR 1000 Series Fixed Ethernet Line Card, with the following configuration:

Clock Recovery from SyncE—The system clock is recovered from the SyncE clocking source (Gigabit interface and 10-Gigabit interface only). The router uses this clock as the Tx clock for other SyncE interfaces, ATM, or Circuit Emulation over Packet (CEoP) interfaces.

Synchronization Status Message and ESMC

Network clocking uses these mechanisms to exchange the quality level of the clock between the network elements:

- Synchronization Status Message
- Ethernet Synchronization Messaging Channel (ESMC)

Synchronization Status Message

Network elements use synchronization status messages to inform the neighboring elements about the quality level of the clock. Non-Ethernet interfaces, such as optical interfaces and SONET/T1/E1 Fixed Ethernet Line Card framers, use synchronization status messages. The key benefits of the synchronization status messages are:

- Prevents timing loops.
- Provides quick recovery when a part of the network fails.
- Ensures that a node derives timing from the most reliable clock source.

Ethernet Synchronization Messaging Channel

In order to maintain a logical communication channel in synchronous network connections, Ethernet relies on a channel called ESMC based on IEEE 802.3 organization-specific slow protocol standards. ESMC relays

the synchronization status messages code that represents the quality level of the Ethernet Equipment Clock (EEC) in a physical layer.

The ESMC packets are received only for those ports configured as clock sources, and transmitted on all the SyncE interfaces in the system. These packets are then processed by the clock selection algorithm on a route processor. and are used to select the best clock. The Tx frame is generated based on the quality level value of the selected clock source, and sent to all the enabled SyncE ports.

Clock Selection Algorithm

The clock selection algorithm selects the best available synchronization source from the nominated sources. The algorithm has a nonrevertive behavior among clock sources with the same quality level value, and always selects the signal with the best quality level value. For clock option 1, the default is revertive, and for clock option 2, the default is nonrevertive.

The clock selection process works in the quality level-enabled and quality level-disabled modes. When multiple selection processes are present in a network element, all the processes work in the same mode.

Quality Level-Enabled Mode

In the quality level-enabled mode, the following parameters contribute to the selection process:

- Quality level
- Signal fail via quality level-FAILED
- Priority
- External commands.

Note If no external commands are active, the algorithm selects the reference (for clock selection) with the highest quality level that does not experience a signal fail condition. If multiple inputs have the same highest quality level, the input with the highest priority is selected. For multiple inputs having the same highest priority and quality level, the existing reference is maintained (if it belongs to this group). Otherwise, an arbitrary reference from this group is selected.

Quality Level-Disabled Mode

In quality level-disabled mode, the following parameters contribute to the selection process:

- Signal failure
- Priority
- External commands

Note If no external commands are active, the algorithm selects the reference (for clock selection) with the highest priority that does not experience a signal fail condition. For multiple inputs having the same highest priority, the existing reference is maintained (if it belongs to this group). Otherwise, an arbitrary reference from this group is selected

Ingress Over Subscription on the ASR1000-6TGE Line Card

The Cisco ASR 1000 Fixed Ethernet Line Card ASR1000-6TGE has two ESI links connected to the backplane. Each of these ESI links is capable of a 23-Gbps bidirectional throughput for a total of 46 Gbps. (The 46-Gbps throughput includes the additional ESI headers added to the traffic before sending the traffic to the forwarding processor.) This limits the total traffic-carrying capacity of the line card, even though there are six 10-GE interfaces available, resulting in oversubscribed traffic to the line card. This oversubscription architecture of the ASR1000-6TGE line card is useful for providing connectivity to end users by using the additional two ports that are provided.

Supported MIBs

The following MIBs are supported by the Cisco ASR 1000 Fixed Ethernet Line Cards on the router:

- ENTITY-MIB
- CISCO-ENTITY-SENSOR-MIB
- ENTITY-SENSOR-MIB
- CISCO-ENTITY-FRU-CONTROL-MIB
- CISCO-ENTITY-ALARM-MIB
- IF-MIB
- CISCO-IF-EXTENSION-MIB
- ETHERLIKE-MIB
- CISCO-ETHERLIKE-EXT-MIB
- CISCO-ENTITY-PERFORMANCE-MIB
- CISCO-CLASS-BASED-QOS-MIB
- ENTITY-STATE-MIB
- CISCO-ENTITY-VENDORTYPE-OID-MIB

To locate and download MIBs for select platforms, Cisco IOS releases, and feature sets, use the Cisco MIB Locator found at the following URL:

http://tools.cisco.com/ITDIT/MIBS/servlet/index

If the Cisco MIB Locator does not support the MIB information that you need, you can also obtain a list of supported MIBs and download them from the Cisco MIBs page at the following URL:

http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml

To access the Cisco MIB Locator, you must have an account on Cisco.com. If you have forgotten or lost your account information, send a blank e-mail to cco-locksmith@cisco.com. An automatic check will verify that your e-mail address is registered with Cisco.com. If the check is successful, account details with a new random password will be e-mailed to you. Qualified users can establish an account on Cisco.com by following the directions found at this URL:

https://tools.cisco.com/RPF/register/register.do

Restrictions

- When an ESP40 module is used with a Cisco ASR 1013 Router, the Fixed Ethernet Line Cards are not supported in slot 4 and slot 5 of the Cisco ASR 1013 Router.
- Synchronous Ethernet is not supported on SFP-GE-T on the ASR1000-2T+20X1GE Line Card.

Fixed Ethernet Line Card Architecture

This section provides an overview of the architecture of the Cisco ASR 1000 Series Fixed Ethernet Line Card and describes the path of a packet in the ingress and egress directions. Some of these areas of architecture are referenced in the Fixed Ethernet Line Card software and can be helpful to understand when performing troubleshooting tasks or interpreting some of the Fixed Ethernet Line Card CLI and **show** command output.

Every incoming and outgoing packet on the Cisco ASR 1000 Series Fixed Ethernet Line Card goes through the PHY SFP optics, the MAC, and a Layer 2 Filtering or Accounting Network Processor.

The Path of an Ingress Packet

The following steps describe the path of an ingress packet through the Cisco ASR 1000 Series Fixed Ethernet Line Card:

1. For a 1-GE port on the Cisco ASR 1000 Series Fixed Ethernet Line Card, the SFP optics receive incoming frames on a per-port basis from one of the optical fiber interface connectors.
2. For 10-GE port on the Cisco ASR 1000 Series Fixed Ethernet Line Card, the XFP PHY device processes the frame and sends it over a Media Independent Interface (MII) to the MAC device.
3. The MAC device receives the frame, strips the CRCs, and sends the packet to the Network Processor.
4. The Network Processor takes the packet from the MAC devices and classifies the Ethernet information. Content-addressable memory (CAM) lookups based on Ethertype, port, VLAN, and destination MAC address information determine whether a packet is dropped or forwarded to the Quantum Flow Processor (QFP).

The Path of an Egress Packet

The following steps describe the path of an egress packet through the Cisco ASR 1000 Series Fixed Ethernet Line Card:

1. The packet is sent to the Network Processor from QFP. The packets are received with Layer 2 and Layer 3 headers in addition to the packet data.
2. The Network Processor uses port number, destination MAC address, destination address type, and VLAN ID to perform CAM lookups. The Network Processor forwards the packet to the MAC device.
3. For the Cisco ASR 1000 Series Fixed Ethernet Line Card, the MAC device forwards the packets to the PHY laser-optic interface, which transmits the packet.

Displaying the ASR 1000 Series Fixed Ethernet Line Card Hardware Type

To verify the Fixed Ethernet Line Card hardware type that is installed in your router, use the **show platform** command.

Table 4: Fixed Ethernet Line Card Hardware Descriptions in show interfaces Command Output, on page 10 shows the hardware description that appears in the **show interfaces** command output for each Cisco ASR 1000 Series Fixed Ethernet Line Card that is supported on the router.

Table 4: Fixed Ethernet Line Card Hardware Descriptions in show interfaces Command Output

Fixed Ethernet Line Card	Description in the show interfaces Command
20-port GE and 2-port 10-GE Fixed Ethernet Line Card	Hardware is BUILT-IN-2T+20X1GE
Six 10 GE Fixed Ethernet Line Card	Hardware is BUILT-IN-6X10GE

The following is a sample output of the **show interfaces tengigabitethernet** command on a Cisco ASR 1000 Series Aggregation Services Router with a Cisco ASR 1000 Series Fixed Ethernet Line Card ASR1000-2T+20X1GE installed in slot 1:

```
Router# show interfaces tengigabitEthernet 1/0/20
TenGigabitEthernet1/0/20 is up, line protocol is up
Hardware is BUILT-IN-2T+20X1GE, address is 70ca.9b6a.1b54 (bia 70ca.9b6a.1b54)
Internet address is 21.1.1.1/24
MTU 9216 bytes, BW 10000000 Kbit/sec, DLY 10 usec,
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, loopback not set
Keepalive not supported
Full Duplex, 10000Mbps, link type is force-up, media type is 10GBase-LR
output flow-control is unsupported, input flow-control is unsupported
ARP type: ARPA, ARP Timeout 04:00:00
Last input never, output 00:03:22, 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
574 packets output, 46477 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
```

The following is a sample output of the **show interfaces tengigabitethernet** command on a Cisco ASR 1000 Series Aggregation Services Router with a Cisco ASR 1000 Series Fixed Ethernet Line Card ASR1000-6TGE installed in slot 1:

```
Router# show interfaces tengigabitEthernet 1/0/0
```

```
TenGigabitEthernet1/0/0 is up, line protocol is up
Hardware is BUILT-IN-6TGE, address is ecc8.8275.ee40 (bia ecc8.8275.ee40)
MTU 1500 bytes, BW 10000000 Kbit/sec, DLY 10 usec,
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, loopback not set
Keepalive not supported
Full Duplex, 10000Mbps, link type is force-up, media type is 10GBase-SR/SW
output flow-control is on, input flow-control is on
ARP type: ARPA, ARP Timeout 04:00:00
Last input never, output 00:07:20, 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
0 packets output, 0 bytes, 0 underruns
0 output errors, 0 collisions, 3 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
```

The following is a sample output of the **show interfaces gigabitethernet** command on a Cisco ASR 1000 Series Aggregation Services Router with a Cisco ASR 1000 Series Fixed Ethernet Line Card installed in slot 1:

```
Router# show interfaces gigabitEthernet 1/0/16
GigabitEthernet1/0/16 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
```