



Overview of the Cisco ASR 1000 Series Modular Ethernet Line Card

This chapter provides an introduction to modular interface processors (MIPs) and ethernet port adapters (EPAs). This chapter provides an overview of the release history, and feature and MIB support for the Cisco ASR 1000 Series Modular Ethernet Line Card (ASR1000-MIP100), 1-Port 100 Gigabit Ethernet EPA (EPA-1X100GE) and 2-port 40 Gigabit Ethernet EPA (EPA-CPAK-2x40GE) on the Cisco ASR 1000 Series Routers.

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Introduction to MIPs and EPAs

The ASR1000-MIP100 is a Modular Ethernet Line Card with a 100 Gbps connection to the backplane, for the ASR 1000 platform. However, it can have an interface bandwidth of up to 200 Gbps. The ASR1000-MIP100 provides higher I/O speeds, increased density, and interface flexibility to the ASR1000.

EPAs are small plug-in modules containing circuitry to provide optical or electrical network interfaces. The packet data between the EPA and MIP carrier card can support a 100Gbps full-duplex bandwidth. The data path supports operating at various pre-defined data rates and protocols.

Cisco ASR 1000 Series MIPs and EPAs use a carrier card and port adapter architecture that increases modularity, flexibility, and density across Cisco routers for network connectivity. This section describes the MIPs and EPAs, and provides some guidelines for their use.

Release History

| Release | Modification |
|------------------------------|---|
| Cisco IOS XE Release 16.2.1 | Added support for EPA-10X10GE |
| Cisco IOS XE Release 3.16.2S | Added support for EPA-CPAK-2X40GE |
| Cisco IOS XE Release 3.16.1S | <p>First release. Support for the following hardwares were introduced on the Cisco ASR 1000 Series Routers:</p> <ul style="list-style-type: none"> • Cisco ASR 1000 Series Modular Ethernet Line Card (ASR1000-MIP100) • 1-Port 100 Gigabit Ethernet EPA (EPA-1X100GE) • 10-Port 10 Gigabit Ethernet EPA (EPA-10X10GE) |

Modular Interface Processors

The following list describes some of the general characteristics of a MIP:

- A MIP is a carrier card that inserts into a Router slot like a line card. It provides no network connectivity on its own.
- A MIP has two subslots, which are used to house one or more EPAs. The EPA provides interface ports for network connectivity.
- During normal operation, the MIP should reside in the Router fully populated either with functional EPAs in all subslots, or with a blank filler plate (EPA-BLANK=) inserted in all empty subslots.
- MIPs support online insertion and removal (OIR) with EPAs inserted in their subslots. EPAs also support OIR and can be inserted or removed independently from the MIP.



Note

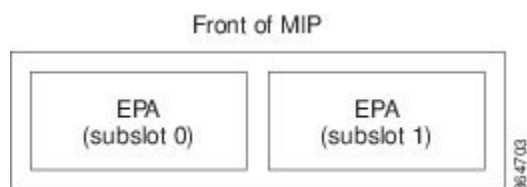
Fully populate all slots and subslots with blank filler plates or functional EPAs for maximum efficiency of the cooling system.

Ethernet Port Adapters

The following list describes some of the general characteristics of an EPA:

- An EPA is a modular type of port adapter that inserts into a subslot of a compatible MIP carrier card to provide network connectivity and increased interface port density. A MIP can hold one or more EPAs, depending on the MIP type.
- EPA inserts into one of the MIP-EPA bay, with vertically aligned EPA subslots as shown in [Figure 1: EPAs Inserted into the MIP Slots](#), on page 3.

Figure 1: EPAs Inserted into the MIP Slots



- Each EPA provides a certain number of connectors, or ports, that are the interfaces to one or more networks. These interfaces can be individually configured using the Cisco IOS command-line interface (CLI).
- Either a blank filler plate or a functional EPA should reside in every subslot of a MIP during normal operation to maintain cooling integrity.
- EPAs support online insertion and removal (OIR). They can be inserted or removed independently from the MIP. MIPs also support OIR with EPAs inserted in their subslots.

ASR1000-MIP100

The Cisco ASR 1000 Series Modular Ethernet Line Card (ASR1000-MIP100) is a modular-port ethernet line card for the Cisco ASR 1000 Series Routers, that is capable of 100 Gbps full-duplex traffic forwarded using a modular-port interface design. The ASR1000-MIP100 architecture is composed of a host carrier card, which accepts two EPAs. Each EPA can support either one 100 GE port or ten 10 GE ports. Overall, the ASR1000-MIP100 line card can support either two 100 GE ports, or twenty 10 GE ports, or one 100 GE port + ten 10 GE ports.

The ASR1000-MIP100 line card is supported on the Cisco ASR 1006-X Router, Cisco ASR 1009-X Router, and Cisco ASR 1013 Router with RP2 + ESP100, and RP2 + ESP200 combinations.

Features Supported in Cisco IOS XE Release 3.16S

The following is a list of some of the significant hardware and software features supported by the Cisco ASR 1000 Series Modular Ethernet Line Card (ASR1000-MIP100) on the Cisco ASR 1000 Series Routers using Cisco IOS XE Release 3.16S:

- Full-duplex operation
- 802.1Q/803.1ad VLAN termination
- Q-in-Q
- Link aggregation (Port-channel)

- Support for jumbo frames (> 1500 bytes and <= 9216 bytes)
- Support for CLI-controlled online insertion and removal (OIR) of the Cisco ASR 1000 Series Modular 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/QinQ per port: 8192
 - Number of VLANs per line card: 32768
- Up to 20480 Media Access Controller (MAC) accounting entries per Modular 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)

| Feature Name | Description |
|-----------------------|---|
| VLAN Unlimited | The hw-module subslot x/y ethernet vlan unlimited configuration command increases the ethernet card default to system limit. This enables support for configuring higher than the default EPA/SPA limit. |
| Fast Re-route (FRR) | Although this feature can be configured on Cisco IOS XE Release 3.16S, the FRR switchover time can be more than 50 ms. |
| Configurable PLIM QoS | <ul style="list-style-type: none"> • 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 <code>plim qos input queue # pause percent</code> command is not supported. |

Cisco ASR1000-MIP100 and EPAs Hardware Compatibility Matrix

Table 1: ASR1000-MIP100 and EPAs Hardware Compatibility Matrix, on page 5 shows the hardware compatibility matrix of the Cisco ASR1000-MIP100 and EPAs on the Cisco ASR 1000 Series Routers:

Table 1: ASR1000-MIP100 and EPAs Hardware Compatibility Matrix

| Hardware | Support | Restrictions |
|--|---|---|
| Chassis Type | Cisco ASR 1006-X Router, Cisco ASR 1009-X Router, Cisco ASR 1013 Router | Cisco ASR 1013 Router: With ESP100 and ESP200, the MIP operates at 100 Gbps in slot 2 and slot 3. The MIP operates at 40 Gbps in slots 0, 1, 4, or 5. |
| Supported RP | RP2 and RP3 | 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 |
| Supported ESP | ESP-100G, ESP-200G | — |
| 1-Port 100 Gigabit Ethernet EPA (EPA-1X100GE) | Supported on Cisco ASR1000-MIP100 | — |
| 10-Port 10 Gigabit Ethernet EPA (EPA-10X10GE) | Supported on Cisco ASR1000-MIP100 | — |
| 2-Port 40 Gigabit Ethernet EPA (EPA-CPAK-2X40GE) | Supported on Cisco ASR1000-MIP100 | The EPA-CPAK-2x40GE is supported in IOS XE 3.16.2 and later 3.16.x releases. It is not supported in IOS XE 3.17.x releases. |

Modular Optics Compatibility

The 1-Port 100 Gigabit Ethernet EPA (EPA-1X100GE) uses a CPAK module to provide network connectivity, The EPA-CPAK-2x40GE uses a CPAK module and a 2x40 GE breakout cable to provide network connectivity.

The 10-Port 10 Gigabit Ethernet EPA (EPA-10X10GE) uses small form-factor pluggable (SFP+) optical transceivers to provide network connectivity.

Cisco qualifies the SFP+ and CPAK modules that can be used with EPAs as shown in the following table.

Table 2: Modular Optics Compatibility

| EPA | Qualified Optics Modules (Cisco Part Numbers) |
|-----------------|--|
| EPA-1X100GE | <ul style="list-style-type: none"> • CPAK-100G-SR10 • CPAK-100G-LR4 |
| EPA-10X10GE | <ul style="list-style-type: none"> • SFP-10G-SR • SFP-10G-SR-X • SFP-10G-LR • SFP-10G-LRM • SFP-10G-LR-X • SFP-10G-ER • SFP-10G-ZR • SFP-H10GB-ACU7MSFP-H10GB-ACU10M |
| EPA-CPAK-2x40GE | <ul style="list-style-type: none"> • CPAK-100G-SR10 • CAB-MPO24-2XMPO12 (breakout cable) |



Note

The EPA-CPAK-2x40GE is shipped with the CPAK-100G-SR10 and breakout cable. A spare breakout cable can be ordered using part number CAB-MPO24-2XMPO12. The EPA-CPAK-2x40GE (with the CPAK-100G-SR10 and breakout cable) supports the QSFP-40G-SR4 transceiver on the peer device.

Supported MIBs

The following MIBs are supported by the Cisco ASR 1000 Series Modular Ethernet Line Card on the Cisco ASR 1000 Series Routers:

- 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
- ENTITY-STATE-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

In the Cisco ASR 1013 Router, the MIP operates at 100 Gbps in slot 2 and slot 3, and operates at 40 Gbps in slots 0, 1, 4, or 5.

Modular Ethernet Line Card Architecture

This section provides an overview of the architecture of the Cisco ASR 1000 Series Modular 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 Modular Ethernet Line Card software and can be helpful to understand when performing troubleshooting tasks or interpreting some of the Modular Ethernet Line Card CLI and **show** command output.

Every incoming and outgoing packet on the Cisco ASR 1000 Series Modular Ethernet Line Card goes through the PHY SFP+ and CPAK optics module, 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 Modular Ethernet Line Card:

- 1 For a 100 GE port on the Cisco ASR 1000 Series Modular Ethernet Line Card, the CPAK optics receive incoming frames on a per-port basis from one of the optical fiber interface connectors.
- 2 The MAC device receives the frame, strips the CRCs, and sends the packet to the Network Processor.

- 3 The Network Processor takes the packet from the MAC devices, and qualifies the packet according to ethernet information by performing content-addressable memory (CAM) lookups based on Ethertype, port, VLAN and MAC address information, and determines whether a packet has to be dropped or forwarded to the QFP.

The Path of an Egress Packet

The following steps describe the path of an egress packet through the Cisco ASR 1000 Series Modular 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 Modular Ethernet Line Card, the MAC device forwards the packets to the PHY laser-optic interface after adding CRCs, and the PHY transmits the packet.

Displaying the Cisco ASR 1000 Series Modular Ethernet Line Card Hardware Type

To verify the Cisco ASR 1000 Series Modular Ethernet Line Card hardware type that is installed in your Cisco ASR 1000 Series Routers, use the **show platform** command.

The following is a sample output of the **show platform** command for the Cisco ASR 1000 Series Modular Ethernet Line Card that is installed in Cisco ASR 1013 Router.

```
Router# show platform
Chassis type: ASR1013
```

| Slot | Type | State | Insert time (ago) |
|------|-------------------|------------|-------------------|
| 0 | ASR1000-SIP10 | ok | 1d00h |
| 1 | ASR1000-SIP40 | ok | 1d00h |
| 1/0 | SPA-10X1GE-V2 | ok | 1d00h |
| 1/1 | SPA-1X10GE-WL-V2 | ok | 1d00h |
| 1/3 | SPA-1X10GE-L-V2 | ok | 1d00h |
| 2 | ASR1000-MIP100 | ok | 1d00h |
| 2/0 | EPA-1X100GE | ok | 00:02:03 |
| 2/1 | EPA-CPAK-2X40GE | ok | 09:00:23 |
| 3 | ASR1000-6TGE | ok | 1d00h |
| 3/0 | BUILT-IN-6TGE | ok | 1d00h |
| R1 | ASR1000-RP2 | ok, active | 1d00h |
| F1 | ASR1000-ESP100 | ok, active | 1d00h |
| P0 | ASR1013/06-PWR-AC | ok | 1d00h |
| P1 | ASR1013/06-PWR-AC | ok 1d00h | |
| P2 | ASR1013-PWR-AC | ok | 1d00h |
| P3 | ASR1013/06-PWR-AC | ok | 1d00h |

| Slot | CPLD Version | Firmware Version |
|------|--------------|------------------|
| 0 | 09111601 | 15.2(1r)S |
| 1 | 00200800 | 15.2(1r)S |
| 2 | 15043000 | 15.5(3r)S |
| 3 | 14011701 | 15.4(2r)S |
| R1 | 14111801 | 15.2(1r)S |
| F1 | 12071700 | 15.2(4r)S1 |

Table 3: Modular Ethernet Line Card Hardware Descriptions in show interfaces Command Output, on page 9 shows the hardware description that appears in the **show interfaces** command output for each Cisco ASR 1000 Series Modular Ethernet Line Card that is supported on the Cisco ASR 1000 Series Routers.

Table 3: Modular Ethernet Line Card Hardware Descriptions in show interfaces Command Output

| Modular Ethernet Line Card and EPA | Description in the show interfaces Command |
|------------------------------------|--|
| ASR1000-MIP100 and EPA-1X100GE | Hardware is EPA-1X100GE |
| ASR1000-MIP100 and EPA-10X10GE | Hardware is EPA-10X10GE |
| ASR1000-MIP100 and EPA-CPAK-2X40GE | Hardware is EPA-CPAK-2X40GE |

The following is a sample output of the **show interfaces HundredGigE** command on a Cisco ASR 1000 Series Aggregation Services Router with the Cisco ASR 1000 Series Modular Ethernet Line Card installed in slot 2 and the EPA-1X100GE in subslot 0:

```
Router# show interfaces HundredGigE 2/0/0
HundredGigE1/0/0 is up, line protocol is up
  Hardware is EPA-1X100GE, address is 0000.c001.0002 (bia 0c06.2a08.0060)
  MTU 7500 bytes, BW 100000000 Kbit/sec, DLY 10 usec,
    reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation 802.1Q Virtual LAN, Vlan ID 1., loopback not set
.
.
.
```

The following is a sample output of the **show interfaces FortyGigabitEthernet** command on a Cisco ASR 1000 Series Aggregation Services Router with the MIP installed in slot 2 and the EPA-CPAK-2x40GE in subslot 1:

```
Router# show interfaces FortyGigabitEthernet 2/1/0
FortyGigabitEthernet2/1/0 is administratively up, line protocol is up
Hardware is EPA-CPAK-2X40GE, address is 6c41.6ada.a7a0 (bia 6c41.6ada.a7a0)
MTU 1500 bytes, BW 40000000 Kbit/sec, DLY 10 usec,
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, loopback not set
.
.
.
```

