

Chapter 5

Configuring Ethernet Interfaces

This chapter describes how to configure Ethernet interfaces on E-series routers.

Most of the procedures described here do not apply to the Fast Ethernet management port on the SRP module. You can, however, select and display statistics for that port by using commands described in this chapter. For information about managing the Fast Ethernet port on the SRP module, see *JUNOS System Basics Configuration Guide, Chapter 6, Managing Modules*.

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Ethernet Overview

Ethernet modules support the following Ethernet interfaces:

- Fast Ethernet
- Gigabit Ethernet
- 10-Gigabit Ethernet

This section describes features that are available with Ethernet interfaces.

Ethernet modules use the Address Resolution Protocol (ARP) to obtain MAC addresses for outgoing Ethernet frames. For more information about ARP, see *JUNOS IP, IPv6, and IGP Configuration Guide, Chapter 1, Configuring IP*.



NOTE: Read *Configuration Tasks for Ethernet* on page 183 before you begin to configure an Ethernet interface.

Features

Ethernet interfaces support the following features:

- Routing of IP packets.
- Quality of Service (QoS) classification.
- High-density Ethernet. (For information, see *High-Density Ethernet* on page 181.)
- Virtual LAN (VLAN) configurations. (For information, see *JUNOS Link Layer Configuration Guide, Chapter 5, Configuring VLAN and S-VLAN Subinterfaces*.)
- Stacked Virtual LAN (S-VLAN) configurations. (For information, see *JUNOS Link Layer Configuration Guide, Chapter 5, Configuring VLAN and S-VLAN Subinterfaces*.)
- IEEE 802.3ad link aggregation configurations. (For information, see *JUNOS Link Layer Configuration Guide, Chapter 6, Configuring 802.3ad Link Aggregation and Link Redundancy*.)
- Configurations with upper-layer protocols. (For information, see *JUNOS Link Layer Configuration Guide, Chapter 4, Configuring Upper-Layer Protocols over Static Ethernet Interfaces*.)
- Layer 2 Tunneling Protocol (L2TP). (For information, see *JUNOS Link Layer Configuration Guide, Chapter 4, Configuring Upper-Layer Protocols over Static Ethernet Interfaces*.)
- Multinetting. (For information, see *JUNOS Link Layer Configuration Guide, Chapter 4, Configuring Upper-Layer Protocols over Static Ethernet Interfaces*.)

Ethernet Interface Platform Considerations

You can configure Ethernet interfaces on the following E-series routers:

- E120 router
- E320 router
- ERX-1440 router
- ERX-1410 router
- ERX-710 router
- ERX-705 router
- ERX-310 router

This section describes the line modules and I/O modules that support Ethernet interfaces.

For detailed information about the modules that support Fast Ethernet and Gigabit Ethernet interfaces on the ERX-14xx models, ERX-7xx models, and the ERX-310 router:

- See *ERX Module Guide, Table 1, Module Combinations* for detailed specifications of these modules.
- See *ERX Module Guide, Appendix A, Module Protocol Support* for information about the protocols and applications that Ethernet modules support.

For detailed information about the modules that support Gigabit Ethernet and 10-Gigabit Ethernet interfaces on the E120 router and the E320 router:

- See *E120 and E320 Module Guide, Table 1, Modules and IOAs* for detailed specifications of these modules.
- See *E120 and E320 Module Guide, Appendix A, IOA Protocol Support* for information about the protocols and applications that Ethernet modules support.

Numbering Scheme

When configuring or managing an interface, you must know the numbering scheme for identifying an interface. The numbering scheme depends on the type of E-series router that you have.

ERX-7xx Models, ERX-14xx Models, and the ERX-310 Router

Use the *slot/port* [*.subinterface*] format to identify Ethernet interfaces and subinterfaces.

- *slot*—Number of the slot in which the line module resides in the chassis.

In ERX-7xx models, line module slots are numbered 2-6; slots 0 and 1 are reserved for SRP modules. In ERX-14xx models, line module slots are numbered 0-5 and 8-13; slots 6 and 7 are reserved for SRP modules. In an ERX-310 router, line module slots are numbered 1-2; slot 0 is reserved for the SRP module.

- *port*—Number of the port on the I/O module.

On the OC3-2 GE APS I/O module, you can configure only a Gigabit Ethernet interface in port 2; ports 0 and 1 are reserved for OC3/STM1 ATM interfaces.

- *subinterface*—Subinterface number of the protocol or VLAN subinterface.

For information about installing line modules and I/O modules in ERX routers, see *ERX Hardware Guide, Chapter 4, Installing Modules*.

E120 Router and E320 Router

Use the *slot/adapter/port* [*.subinterface*] format to identify Ethernet interfaces and subinterfaces.

- *slot*—Number of the slot in which the line module resides in the chassis.

In the E120 router, line module slots are numbered 0-5. In the E320 router, line module slots are numbered 0-5 and 11-16. For both routers, slots 6 and 7 are reserved for SRP modules; slots 8-10 are reserved for switch fabric modules (SFMs).

- *adapter*—Number of the bay in which the I/O adapter (IOA) resides.

This identifier applies to the E120 and E320 routers only. In the software, adapter 0 identifies the right IOA bay (E120 router) and the upper IOA bay (E320 router); adapter 1 identifies the left IOA bay (E120 router) and the lower IOA bay (E320 router).

- *port*—Number of the port on the IOA
- *subinterface*—Subinterface number of the protocol or VLAN subinterface

For information about installing line modules and IOAs in the E120 and E320 routers, see *E120 and E320 Hardware Guide, Chapter 4, Installing Modules*.

Interface Specifier

The configuration task examples in this chapter use the format for ERX-7xx models, ERX-14xx models, and the ERX-310 router to specify an Ethernet interface. (The format is described in *Numbering Scheme* on page 165.)

For example, the following command specifies a Fast Ethernet interface on port 0 of an I/O module in slot 4.

```
host1(config)#interface fastEthernet 4/0
```

When you configure a Gigabit Ethernet interface or a 10-Gigabit Ethernet interface on E120 or E320 routers, you must include the adapter identifier as part of the interface specifier. For example, the following command specifies a Gigabit Ethernet interface on port 0 of the IOA installed in the upper adapter bay of slot 3.

```
host1(config)#interface gigabitEthernet 3/0/0
```

For more information about interface types and specifiers on E-series models, see *Interface Types and Specifiers* in *JUNOS Command Reference Guide, About This Guide*.

Fast Ethernet I/O Modules

Fast Ethernet interfaces are supported on two I/O modules: the FE-8 I/O module and the FE-8 SFP I/O module.

FE-8 I/O Module

ERX-7xx models, ERX-14xx models, and the ERX-310 router all support the FE-8 I/O module.

An FE-8 I/O module accepts up to eight RJ-45 connectors.

FE-8 SFP I/O Module

ERX-7xx models, ERX-14xx models, and the ERX-310 router all support the FE-8 SFP I/O module.

The FE-8 SFP I/O module uses a range of small form-factor pluggable transceivers (SFPs) to support different optical modes and cabling distances. The I/O module supports up to eight LC-style fiber-optic connectors.

Unlike all other Fast Ethernet and Gigabit Ethernet I/O modules, the FE-8 SFP I/O module does not support automatic negotiation of the line speed and duplex mode by the router. For more information, see **duplex** on page 184 and **speed** on page 187.

Gigabit Ethernet I/O Modules and IOAs

Gigabit Ethernet interfaces are supported on the following modules:

- GE I/O module
- GE-2 SFP I/O module
- GE-8 I/O module
- OC3-2 GE APS I/O module
- ES2-S1 GE-4 IOA
- ES2-S1 GE-8 IOA
- ES2-S3 GE-20 IOA

GE I/O Module

ERX-7xx models, ERX-14xx models, and the ERX-310 router all support the GE I/O module.

You can pair any of the following types of GE I/O modules with the GE/FE line module:

- The GE I/O SFP module uses a range of SFPs to support different optical modes and cabling distances. The I/O module accepts up to two pairs (Tx/Rx) of LC-style fiber-optic connectors that support different optical modes and cabling distances. Alternatively, the I/O module supports up to two pairs of copper SFPs.
- The GE I/O MULTI MODE module accepts up to two pairs (Tx/Rx) of SC-style fiber-optic connectors.
- The GE I/O SINGLE MODE module accepts up to two pairs (Tx/Rx) of SC-style fiber-optic connectors.

The GE I/O module has two ports: one port (port 0) is active (also known as *primary*), and the other port (port 0R) is redundant. If the active port fails, the redundant port automatically becomes active.

You can configure only port 0 for a Gigabit Ethernet interface; you cannot configure redundant port 0R. Cabling both ports provides a redundant path to the Gigabit Ethernet interface.

GE-2 SFP I/O Module

The ERX-1440 router and the ERX-310 router both support the GE-2 SFP I/O module. Other E-series routers do not support the GE-2 SFP I/O module. The GE-2 SFP I/O module was previously called the 2XGE APS I/O module.

The GE-2 SFP I/O module pairs with the GE-2 line module and the GE-HDE line module. You can install the GE-2 line module or the GE-HDE line module and its corresponding GE-2 SFP I/O module in slot 1 or slot 2 of an ERX-310 router or in any slot of an ERX-1440 router.

The GE-2 SFP I/O module can use either fiber-optic or copper SFPs. The I/O module accepts up to two pairs (Tx/Rx) of LC-style fiber-optic connectors that support different optical modes and cabling distances. Alternatively, the I/O module supports up to two pairs of copper SFPs.

Ports on GE-2 SFP I/O Module

The GE-2 SFP I/O module has four ports: two ports (port 0 and port 1) are active (also known as *primary*), and the other two ports (port 0R and port 1R) are redundant. If an active port fails, its corresponding redundant port automatically becomes active.

You can configure only port 0 and port 1 for a Gigabit Ethernet interface; you cannot configure redundant ports 0R and 1R. Cabling an active port and its corresponding redundant port (that is, port 0 and port 0R, or port 1 and port 1R) provides a redundant path to the Gigabit Ethernet interface.

Bandwidth and Line Rate Considerations

When the GE-2 line module or the GE-HDE line module is installed in the ERX-1440 router, it delivers full bandwidth of 2 GB per port only when installed in slot 2 or slot 4, and when the SRP-40G+ module is used in the router. When the module is installed in any other ERX-1440 slot, it delivers a maximum bandwidth of 2 GB per line module (1 GB maximum at the ingress and 1 GB maximum at the egress). Therefore, of the maximum 24 possible ports for the module in an ERX-1440 chassis (that is, two ports in each of 12 slots), full bandwidth is delivered only on a maximum of four ports (those in slots 2 and 4).

When the GE-2 line module or the GE-HDE line module is installed in either the ERX-1440 router or the ERX-310 router and both ports are active, line rate performance is achieved only with packets that are 174 bytes or larger. The module might not achieve line rate with packets that are smaller than 174 bytes.

GE-8 I/O Module

The ERX-1440 router and the ERX-310 router both support the GE-8 I/O module. Other E-series routers do not support the GE-8 I/O module.

The GE-8 I/O module pairs with the GE-HDE line module to provide Gigabit Ethernet operation through eight line interfaces.



NOTE: The GE-8 I/O module has a logical port, numbered port 8, that is reserved for the hardware multicast packet replication feature. For more information, see *JUNOS Multicast Routing Configuration Guide, Chapter 5, Configuring IPv4 Multicast* and *JUNOS Multicast Routing Configuration Guide, Chapter 10, Configuring IPv6 Multicast*.

You can install the GE-HDE line module and its corresponding GE-8 I/O module in slot 1 or slot 2 of an ERX-310 router or in any slot of an ERX-1440 router.

The GE-8 I/O module can use either fiber-optic or copper SFPs. The I/O module accepts up to eight pairs (Tx/Rx) of LC-style fiber-optic connectors that support different optical modes and cabling distances. Alternatively, the I/O module supports up to eight pairs of copper SFPs.

Bandwidth and Line Rate Considerations

When the GE-HDE line module is installed in the ERX-1440 router, it delivers full bandwidth of 4 GB per line module (2 GB at the ingress and 2 GB at the egress) only when installed in slot 2 or slot 4, and when the SRP-40G+ module is used in the router. When the module is installed in any other ERX-1440 slot, it delivers a maximum bandwidth of 2 GB per line module (1 GB maximum at the ingress and 1 GB maximum at the egress). Therefore, of the maximum 96 possible ports for the module in an ERX-1440 chassis (that is, eight ports in each of 12 slots), full bandwidth is delivered only on a maximum of 16 ports (those in slots 2 and 4).

When the GE-HDE line module is installed in either the ERX-1440 router or the ERX-310 router and all ports are active, line rate performance is achieved only with packets that are 174 bytes or larger. The module might not achieve line rate with packets that are smaller than 174 bytes.

Table 15 lists the average data rate on the GE-HDE line module and GE-8 I/O module combination when installed in an ERX-310 router or in slots 2 or 4 of an ERX-1440 router.

Table 15: Average Data Rate for ERX-310 Router or in Slots 2 or 4 of an ERX-1440 Router

Port Combination	Average Data Rate per GE-8 I/O Module (> 174 Byte Packets)	Average Data Rate per GE-HDE Line Module
Ports 1–8	250 Mbps per port	250 Mbps per port
Any four ports	500 Mbps per port	500 Mbps per port
Any two ports	1 Gbps per port	1 Gbps per port

Table 16 lists the average data rate on the GE-HDE line module and GE-8 I/O module combination when installed in all other slots on the ERX-1440.

Table 16: Average Data Rate When Installed in All Other Slots on an ERX-1440 Router

Port Combination	Average Data Rate per GE-8 I/O Module (> 174 Byte Packets)	Average Data Rate per GE-HDE Line Module
Ports 1–8	125 Mbps per port	125 Mbps per port
Any four ports	250 Mbps per port	250 Mbps per port
Any two ports	500 Mbps per port	500 Mbps per port

Managing High-Density Ethernet

The overall data rate for the GE-HDE line module is 2 Gbps; therefore, the I/O module becomes highly oversubscribed because of the wire rate of the line module. The data rate of the GE-8 I/O module is limited with larger frames, and the packet rate is limited with smaller frames.

Currently, flow control using MAC pause frames is disabled on the GE-8 I/O module. The I/O module does not transmit or receive pause frames.

For more information about high-density Ethernet, see *High-Density Ethernet* on page 181.

OC3-2 GE APS I/O Module

ERX-7xx models, ERX-14xx models, and the ERX-310 router all support the OC3-2 GE APS I/O module.

The OC3-2 GE APS I/O module pairs with the OC3/STM1 GE/FE line module to provide Gigabit Ethernet operation through one line interface and OC3 STM1 ATM operation through two line interfaces.

The OC3-2 GE APS I/O module uses a range of SFPs to support different optical modes and cabling distances, and accepts up to three LC-style fiber-optic or copper SFPs. You can configure only port 2 for Gigabit Ethernet interfaces; port 0 and port 1 are reserved for OC3/STM1 ATM interfaces.

For more information about configuring OC3/STM-1 ATM interfaces on this I/O module, see *OC3/STM1 GE/FE Line Module* on page 73.



NOTE: The OC3-2 GE APS I/O module does not support APS in the current release.

ES2-S1 GE-4 IOA

The E120 router and the E320 router support the ES2-S1 GE-4 IOA. Other E-series routers do not support the ES2-S1 GE-4 IOA.

The ES2-S1 GE-4 IOA pairs with the ES2 4G line module (LM). For more information about the ES2 4G LM, see *ES2 4G Line Module* on page 74.

The ES2-S1 GE-4 IOA is offered in a half-height size that enables you to configure it in one of two IOA bays that are available for each slot. You can install the ES2-S1 GE-4 IOA in only one of the IOA bays per slot. For more information about installing IOAs, see the *E120 and E320 Hardware Guide*.

The ES2-S1 GE-4 IOA has four ports. The IOA can use either fiber-optic or copper SFPs. The IOA accepts up to four pairs (Tx/Rx) of LC-style fiber-optic connectors that support different optical modes and cabling distances. Alternatively, the IOA supports up to eight pairs of copper SFPs.

The ES2-S1 GE-4 IOA does not support port redundancy.

ES2-S1 GE-8 IOA

The E120 router and the E320 router support the ES2-S1 GE-8 IOA. Other E-series routers do not support the ES2-S1 GE-8 IOA.

The ES2-S1 GE-8 IOA is offered in a half-height size that enables you to configure it in either of the two IOA bays that are available for each slot. You can install the ES2-S1 GE-8 IOA in both IOA bays. For more information about installing IOAs, see the *E120 and E320 Hardware Guide*.

The ES2-S1 GE-8 IOA has eight ports. The IOA can use either fiber-optic or copper SFPs. The IOA accepts up to four pairs (Tx/Rx) of LC-style fiber-optic connectors that support different optical modes and cabling distances. Alternatively, the IOA supports up to eight pairs of copper SFPs.



NOTE: The ES2-S1 GE-8 IOA has a logical port, numbered port 8, that is reserved for the hardware multicast packet replication feature. For more information, see *JUNOS Multicast Routing Configuration Guide, Chapter 5, Configuring IPv4 Multicast* and *JUNOS Multicast Routing Configuration Guide, Chapter 10, Configuring IPv6 Multicast*.

The ES2-S1 GE-8 IOA pairs with either the ES2 4G line module (LM) and the ES2 10G LM to provide access services.

ES2 4G LM Combination

For more information about the ES2 4G LM, see *ES2 4G Line Module* on page 74.

When paired with the ES2 4G LM, you can combine the ES2-S1 GE-8 IOA in a slot with one of the following IOA types:

- ES2-S1 OC3-8 ATM IOA
- ES2-S1 OC12-2 ATM IOA
- ES2-S1 OC12-2 POS IOA

Bandwidth and Line Rate Considerations

Table 17 lists the average data rate on the ES2-S1 GE-8 IOA when installed in E120 and E320 routers with one ES2 4G LM installed.

Table 17: Average Data Rate for One ES2-S1 GE-8 IOA Installed with an ES2 4G LM

Port Combination	100 Gbps Configuration (E320 Router)		120 Gbps and 320 Gbps Configurations (E120 and E320 Routers)	
	Average Data Rate per GE-8 IOA (> 128 Byte Packets)	Average Data Rate per ES2 4G LM	Average Data Rate per GE-8 IOA (> 128 Byte Packets)	Average Data Rate per ES2 4G LM
All eight ports	412.5 Mbps per port	412.5 Mbps per port	475 Mbps per port	475 Mbps per port
Any four ports	825 Mbps per port	825 Mbps per port	950 Mbps per port	950 Mbps per port
Any two ports	1 Gbps per port	1 Gbps per port	1 Gbps per port	1 Gbps per port

Table 18 lists the average data rate on two ES2-S1 GE-8 IOAs when installed in E120 and E320 routers with one ES2 4G LM installed.

Table 18: Average Data Rate for Two ES2-S1 GE-8 IOAs Installed with an ES2 4G LM

Port Combination	100 Gbps Configuration (E320 Router)		120 Gbps and 320 Gbps Configurations (E120 and E320 Routers)	
	Average Data Rate per GE-8 IOA (> 128 Byte Packets)	Average Data Rate per ES2 4G LM	Average Data Rate per GE-8 IOA (> 128 Byte Packets)	Average Data Rate per ES2 4G LM
All sixteen ports	206.25 Mbps per port	206.25 Mbps per port	237.5 Mbps per port	237.5 Mbps per port
Any eight ports	412.5 Mbps per port	412.5 Mbps per port	475 Mbps per port	475 Mbps per port
Any four ports	825 Mbps per port	825 Mbps per port	950 Mbps per port	950 Mbps per port
Any two ports	1 Gbps per port	1 Gbps per port	1 Gbps per port	1 Gbps per port

Table 19 lists the average data rate when combining an ES2-S1 GE-8 IOA in one adapter bay with the ES2-S1 OC3-8 ATM IOA, or the ES2-S1 OC12-2 ATM IOA, or the ES2-S1 OC12-2 POS IOA in another adapter bay. Because the OC3/STM1 and OC12/STM4 IOAs use less than half of the full bandwidth of the ES2 4G LM, the router allocates these IOAs as much bandwidth as they can use. The ES2-S1 GE-8 IOA uses any remaining bandwidth.

Each OC12/STM4 port has a maximum theoretical bandwidth of 622 Mbps. Each OC3/STM1 port has a maximum theoretical bandwidth of 155 Mbps. Therefore, the OC12/STM4 IOAs have a maximum theoretical bandwidth of 1.244 Gbps and the OC3/STM1 IOA has an maximum theoretical bandwidth of 1.244 Gbps.

Table 19: Average Data Rate for ES2-S1 GE-8 IOA Combined with Other IOA Types in Same Slot

Average Data Rate per GE-8 IOA (> 128 Byte Packets)	Average Data Rate per OC12/STM4 IOA	100 Gbps Configuration (E320 Router)	120 Gbps and 320 Gbps Configurations (E120 and E320 Routers)
		Average Data Rate per ES2 4G LM	Average Data Rate per ES2 4G LM
257 Mbps per port (Ports 0–7)	622 Mbps per port (Ports 0 and 1)	GE-8 IOA—257 Mbps per port OC12/STM4—622 Mbps per port	GE-8 IOA—319.5 Mbps per port OC12/STM4—622 Mbps per port
334.75 Mbps per port (Ports 0–7)	622 Mbps (Port 1)	GE-8 IOA—334.75 Mbps per port OC12/STM4 IOA—622 Mbps for port 1	GE-8 IOA—397.25 Mbps per port OC12/STM4 IOA—622 Mbps for port 1
387.5 Mbps per port (Ports 0–7)	100 Mbps per port (Ports 0 and 1)	GE-8 IOA—387.5 Mbps per port OC12/STM4 IOA—100 Mbps per port	GE-8 IOA—450 Mbps per port OC12/STM4 IOA—100 Mbps per port

Managing High-Density Ethernet

With a 100 Gbps fabric configuration, the overall data rate for the ES2 4G LM with ES2-S1 GE-8 IOAs is 3.3 Gbps. With a 120 Gbps fabric configuration or a 320 Gbps fabric configuration, the overall data rate for the ES2 4G LM with ES2-S1 GE-8 IOAs is 3.8 Gbps. In both configurations, the line module becomes highly oversubscribed because of the IOA available wire rate. When paired with the ES2 4G LM, the data rate of the ES2-S1 GE-8 IOA is bandwidth limited with larger frames, and the packet rate is limited with smaller frames.



NOTE: The overall data rate of the ES2-S1 GE-8 IOA is 0.1 Gbps less than other IOAs that pair with the ES2 4G LM because of fair bandwidth allocation across the eight ports.

Currently, flow control using MAC pause frames is disabled on the ES2-S1 GE-8 IOA. The IOA does not transmit or receive pause frames.

For more information about high-density Ethernet on E-series routers, see *High-Density Ethernet* on page 181.

ES2 10G LM Combination

When paired with the ES2 10G LM, you can only combine the ES2-S1 GE-8 IOA in a slot with another ES2-S1 GE-8 IOA.

With a 100 Gbps fabric configuration, the E320 router can accommodate up to 2 combinations of ES2 10G LMs and ES2-S1 GE-8 IOAs. You must install a combination in either of the turbo slots (slot 2 or slot 4). The 100 Gbps allocates 10 Gbps of overall bandwidth to each of these slots.

With a 120 Gbps fabric configuration, the E120 router can accommodate up to 6 combinations of ES2 10G LMs and ES2-S1 GE-8 IOAs. You can install a combination in any of the line module slots, each of which are allocated 10 Gbps of overall bandwidth.

With a 320 Gbps fabric configuration, the E320 router can accommodate up to 12 combinations of ES2 10G LMs and ES2-S1 GE-8 IOAs. You can install a combination in any of the line module slots, each of which are allocated 10 Gbps of overall bandwidth.

Bandwidth and Line Rate Considerations

Each ES2-S1 GE-8 IOA is connected to the ES2 10G LM through a 5 Gbps bus. Therefore, the aggregate bandwidth of any IOA is limited to 5 Gbps.

Table 20 lists the average data rate on the ES2-S1 GE-8 IOA when installed in E120 and E320 routers with one ES2 10G LM installed.

Table 20: Average Data Rate for One ES2-S1 GE-8 IOA Installed with an ES2 10G LM

Port Combination	100 Gbps, 120 Gbps, or 320 Gbps Configuration
	Average Data Rate per GE-8 IOA (> 128 Byte Packets)
Any five ports	1 Gbps per port
All eight ports	625 Mbps per port

Table 21 lists the average data rate of two ES2-S1 GE-8 IOAs when installed in E120 and E320 routers with one ES2 10G LM installed.

Table 21: Average Data Rate for Two ES2-S1 GE-8 IOAs Installed with an ES2 10G LM

Port Combination	100 Gbps, 120 Gbps, or 320 Gbps Configuration
	Average Data Rate per GE-8 IOA (> 128 Byte Packets)
All sixteen ports	625 Mbps per port
Any five ports on each IOA	1 Gbps per port

Managing High-Density Ethernet

When installed in an E120 router or an E320 router with any SRP module combination, the overall data rate for the ES2 10G LM with one ES2-S1 GE-8 IOA is limited to 5 Gbps. The overall data rate for the ES2 10G LM with two ES2-S1 GE-8 IOAs is limited to 10 Gbps. In all configurations, the line module can become oversubscribed because of the IOA available wire rate (8 Gbps).

Currently, flow control using MAC pause frames is disabled on the ES2-S1 GE-8 IOA. The IOA does not transmit or receive pause frames.

For more information about high-density Ethernet on E-series routers, see *High-Density Ethernet* on page 181.

ES2-S3 GE-20 IOA

The E120 router and the E320 router support the ES2-S3 GE-20 IOA. Other E-series routers do not support the ES2-S3 GE-20 IOA.

The ES2-S3 GE-20 IOA pairs with the ES2 10G LM to provide Gigabit Ethernet operation through 20 line interfaces.

The ES2-S3 GE-20 IOA is offered in a full-height size that uses both adapter bays. The IOA is identified by the software as adapter bay 0. For more information about installing IOAs, see the *E120 and E320 Hardware Guide*.

The IOA can use either fiber-optic or copper SFPs. The IOA accepts up to four pairs (Tx/Rx) of LC-style fiber-optic connectors that support different optical modes and cabling distances.

The ES2-S3 GE-20 IOA does not support port redundancy.

ES2 10G LM Combination

With a 100 Gbps fabric configuration, the E320 router can accommodate up to 2 combinations of ES2 10G LMs and ES2-S3 GE-20 IOAs. You must install a combination in either of the turbo slots (slot 2 or slot 4). The 100 Gbps allocates 10 Gbps of overall bandwidth to each of these slots.

With a 120 Gbps fabric configuration, the E120 router can accommodate up to 6 combinations of ES2 10G LMs and ES2-S3 GE-20 IOAs. You can install a combination in any of the line module slots, each of which are allocated 10 Gbps of overall bandwidth.

With a 320 Gbps fabric configuration, the E320 router can accommodate up to 12 combinations of ES2 10G LMs and ES2-S3 GE-20 IOAs. You can install a combination in any of the line module slots, each of which are allocated 10 Gbps of overall bandwidth.

Bandwidth and Line Rate Considerations

Table 20 lists the average data rate on the ES2-S3 GE-20 IOA when installed in E120 and E320 routers with one ES2 10G LM installed.

Table 22: Average Data Rate for One ES2-S3 GE-20 IOA Installed with an ES2 10G LM

100 Gbps, 120 Gbps, or 320 Gbps Configuration	
Port Combination	Average Data Rate per GE-20 IOA (> 128 Byte Packets)
Any 10 ports	1 Gbps per port
All 20 ports	500 Mbps per port

Managing High-Density Ethernet

When installed in an E120 router or an E320 router with any SRP module combination, the overall data rate for the ES2 10G LM with one ES2-S3 GE-20 IOA is limited to 10 Gbps. The line module can become oversubscribed because of the IOA available wire rate (20 Gbps).

Currently, flow control using MAC pause frames is disabled on the ES2-S3 GE-20 IOA. The IOA does not transmit or receive pause frames.

For more information about high-density Ethernet on E-series routers, see *High-Density Ethernet* on page 181.

10-Gigabit Ethernet IOAs

10-Gigabit Ethernet interfaces are supported on the ES2-S1 10GE IOA and the ES2-S1 10GE PR IOA. For more information about 10-Gigabit Ethernet, see IEEE Standard 802.3ae.

ES2-S1 10GE IOA

The E120 router and the E320 router support the ES2-S1 10GE IOA. Other E-series routers do not support the ES2-S1 10GE IOA.

The ES2-S1 10GE IOA pairs with the ES2 4G LM to provide a 10-Gigabit Ethernet interface. For more information about the ES2 4G LM, see *ES2 4G Line Module* on page 74.

The ES2-S1 10GE IOA is offered in a full-height size that uses both adapter bays. The IOA is identified by the software as adapter bay 0. For more information about installing IOAs, see the *E120 and E320 Hardware Guide*.

The ES2-S1 10GE IOA has one port, uses a range of 10-gigabit small form-factor pluggable transceivers (XFPs) to support different optical modes and cabling distances, and accepts one LC-style fiber-optic connector.

Managing High-Density Ethernet

With a 100 Gbps fabric configuration, the overall data rate for the ES2 4G LM with the ES2-S1 10GE IOA is 3.4 Gbps for large packets. With a 120 Gbps or a 320 Gbps fabric configuration, the overall data rate for the ES2 4G LM with the ES2-S1 10GE IOA is 3.9 Gbps for large packets. In all configurations, the line module becomes highly oversubscribed because of the available wire rate on the IOA. When paired with the ES2 4G LM, the data rate of the ES2-S1 10GE IOA is bandwidth limited with larger frames, and the packet rate is limited with smaller frames.

Currently, flow control using MAC pause frames is disabled on the ES2-S1 10GE IOA. The IOA does not transmit or receive pause frames.

For more information about high-density Ethernet on E-series routers, see *High-Density Ethernet* on page 181.

ES2-S2 10GE PR IOA

The E120 router and the E320 router support the ES2-S2 10GE PR IOA. Other E-series routers do not support the ES2-S2 10GE PR IOA.

The ES2-S2 10GE PR IOA is offered in a full-height size that uses both adapter bays. The IOA is identified by the software as adapter bay 0. For more information about installing IOAs, see the *E120 and E320 Hardware Guide*.

The ES2-S2 10GE PR IOA has one port, uses a range of XFPs to support different optical modes and cabling distances, and accepts 10 LC-style fiber-optic connectors.

The single port on the ES2-S2 10GE PR IOA has a redundant port. If the active port fails, the redundant port automatically becomes active. You can configure only the active port for a 10-Gigabit Ethernet interface; you cannot configure the redundant port. Cabling both ports provides a redundant path to the 10-Gigabit Ethernet interface.

The ES2-S2 10GE PR IOA pairs with the ES2 10G Uplink LM to provide uplink services or the ES2 10G LM to provide access services.

ES2 10G Uplink LM Combination

With a 100 Gbps fabric configuration, the E320 router can accommodate up to 2 combinations of ES2 10G Uplink LMs and ES2-S2 10GE PR IOAs. You must install a combination in either of the turbo slots (slot 2 or slot 4). The 100 Gbps allocates 10 Gbps of overall bandwidth to each of these slots.

With a 120 Gbps fabric configuration, the E120 router can accommodate up to 6 combinations of ES2 10G Uplink LMs and ES2-S2 10GE PR IOAs. You can install a combination in any of the line module slots, each of which are allocated 10 Gbps of overall bandwidth.

With a 320 Gbps fabric configuration, the E320 router can accommodate up to 12 combinations of ES2 10G Uplink LMs and ES2-S2 10GE PR IOAs. You can install a combination in any of the line module slots, each of which are allocated 10 Gbps of overall bandwidth.

Uplink Operation

The ES2 10G Uplink LM and ES2-S2 10GE PR IOA combination provides an uplink connection from the core network to the edge rather than traditional broadband access services such as PPPoE, transparent bridging, and subscriber interfaces.

The combination can receive and transmit full duplex line rate of 10 GB (10 GB at the ingress and 10 GB at the egress). The IOA can also support 9.6 Kbps jumbo packets at both the ingress and egress.

Multicast

The ES2 10G Uplink LM can receive multicast traffic, including all multicast control protocols. The ES2 10G Uplink LM can also transmit multicast control protocol frames and multicast data frames to perform multicast egress elaboration.

L2TP

An E-series router can be configured as either an L2TP access concentrator (LAC) or an L2TP network server (LNS). The ES2 10G Uplink LM and ES2-S2 10GE PR IOA combination supports an E-series router configured as a LAC only for traffic to or from an LNS. The ES2 10G Uplink LM and ES2-S2 10GE PR IOA combination supports both sides of the L2TP LNS function (LAC facing and core facing).

Flow Control and Policy

The ES2 10G Uplink LM and ES2-S2 10GE PR IOA combination does not support quality of service (QoS) functionality that is available on other ASIC-based Ethernet modules.

Although the ES2 10G Uplink LM does not support scheduling and shaping for egress traffic, the LM does account for the traffic class of packets through the fabric so that high priority packets are scheduled for transmission to the line module before lower priority packets. Packets that arrive at the line module are processed and transmitted using a flow-through scheme.

Currently, flow control using MAC pause frames is disabled on the ES2-S2 10GE PR IOA. The IOA does not transmit or receive pause frames. Instead, the system prioritizes control traffic over non-control traffic (that is, data). For a list of types of control traffic, see *High-Density Ethernet* on page 181.

For information about configuring policies on the ES2 10G Uplink LM and ES2-S2 10GE PR IOA, see *JUNOS Policy Management Configuration Guide, Chapter 8, Policy Resources*.

ES2 10G LM Combination

With a 100 Gbps fabric configuration, the E320 router can accommodate up to 2 combinations of ES2 10G LMs and ES2-S2 10GE PR IOAs. You must install a combination in either of the turbo slots (slot 2 or slot 4). The 100 Gbps allocates 10 Gbps of overall bandwidth to each of these slots.

With a 120 Gbps fabric configuration, the E120 router can accommodate up to 6 combinations of ES2 10G LMs and ES2-S2 10GE PR IOAs. You can install a combination in any of the line module slots, each of which are allocated 10 Gbps of overall bandwidth.

With a 320 Gbps fabric configuration, the E320 router can accommodate up to 12 combinations of ES2 10G LMs and ES2-S2 10GE PR IOAs. You can install a combination in any of the line module slots, each of which are allocated 10 Gbps of overall bandwidth.

Access Operation

The ES2 10G LM and ES2-S2 10GE PR IOA combination provides traditional broadband access services such as PPPoE and subscriber interfaces. It also supports both sides of the L2TP LNS and LAC function.

The combination can receive and transmit full duplex line rate of 10 GB (10 GB at the ingress and 10 GB at the egress). The IOA can also support 9.6 Kbps jumbo packets at both the ingress and egress.

Multicast

The ES2 10G LM can receive multicast traffic, including all multicast control protocols. The ES2 10G LM can also transmit multicast control protocol frames and multicast data frames to perform multicast egress elaboration.

Flow Control and Policy

The ES2 10G LM and ES2-S2 10GE PR IOA combination supports QoS functionality that is available on other ASIC-based Ethernet modules.

Currently, flow control using MAC pause frames is disabled on the ES2-S2 10GE PR IOA. The IOA does not transmit or receive pause frames. Instead, the system prioritizes control traffic over non-control traffic (that is, data). For a list of types of control traffic, see *High-Density Ethernet* on page 181.

For information about configuring policies on the ES2 10G LM and ES2-S2 10GE PR IOA, see *JUNOS Policy Management Configuration Guide, Chapter 1, Managing Policies on the E-series Router*.

Ethernet References

For more information about Ethernet implementations, consult the following resources:

- IEEE 802.1q (Virtual LANs)
- IEEE 802.1w (Rapid Reconfiguration of Spanning Tree)
- IEEE 802.3 (Fast Ethernet and Gigabit Ethernet)
- IEEE 802.3u (Fast Ethernet only)
- IEEE 802.3z (Gigabit Ethernet only)
- IEEE 802.3ae (10-Gigabit Ethernet only)
- IEEE 802.3ad (Link Aggregation)
- RFC 826—An Ethernet Address Resolution Protocol (November 1982)

For more information about MIB support for Ethernet interfaces, consult the following resources:

- RFC 2863—The Interfaces Group MIB (June 2000)
- RFC 2668—Definitions of Managed Objects for IEEE 802.3 Medium Attachment Units (MAUs) (August 1999)
- RFC 2665—Definitions of Managed Objects for the Ethernet-like Interface Types (August 1998)

High-Density Ethernet

The following modules support high-density Ethernet:

- GE-HDE line module and GE-8 I/O module combination
- ES2 4G LM and ES2-S1 10GE IOA module combination
- ES2 4G LM and ES2-S1 GE-8 IOA module combination

In the current release, you cannot configure port parameters for high-density Ethernet. Instead, JUNOS contains a packet classifier that enables the module to *intelligently drop* certain packets when the module becomes oversubscribed. The packet classifier inspects each incoming packet to determine whether to classify it as control traffic. To enhance network stability, the packet classifier prioritizes control traffic over non-control traffic (that is, data). The packet classifier randomly drops non-control packets when the interface is oversubscribed.

When the I/O module or IOA is oversubscribed, the packet classifier prioritizes the following types of control traffic:

- PPP discovery or PPP session
- Address Resolution Protocol (ARP)
- 802.3ad (link aggregation)
- 802.3 Spanning Tree Protocol (STP)
- IPv4 and IPv6 DHCP server
- IPv4 and IPv6 DHCP host
- IPv6 Neighbor Discovery
- IPv4 virtual router alert
- IPv4 and IPv6 Internet Group Management Protocol (IGMP)
- IPv4 packets with a type of service (ToS) precedence value set to Internetwork Control (C0)
- IPv6 packets with a traffic class precedence value set to Internetwork Control (C0)

Managing Port Redundancy on Gigabit Ethernet I/O Modules

By default, the software manages port redundancy on GE I/O modules automatically. However, you can manage redundancy on GE I/O modules as follows:

- Specify the time that the router waits for a port on a GE I/O module to become active before the router switches to the redundant port.
- Force a GE I/O module to switch operation from one port to the other.
- Disable port redundancy by specifying operation on one port only.

If you manage port redundancy manually, the router retains the manual configuration after the module reboots.

You can monitor the port redundancy configuration with the **show interfaces gigabitEthernet** command.



NOTE: The router manages failover in the same way for the GE I/O Modules and the GE-2 SFP I/O module.

link failover force

- Use to force a GE I/O module to switch operation from one port to the other.
- Select an interface on the GE I/O module before you issue this command.
- Example


```
host1(config)#interface gigabitEthernet 5/0
host1(config-if)#link failover force
```
- There is no **no** version.

link failover timeout

- Use to specify the time that the router waits for a port on a GE I/O module to become active before the router switches to the redundant port.
- Select an interface on the GE I/O module before you issue this command.
- Specify a time in the range 100–10,000 ms.
- Example


```
host1(config)#interface gigabitEthernet 5/0
host1(config-if)#link failover timeout 1000
```
- Use the **no** version to restore the default situation in which the router sets this time automatically.

link selection

- Use to disable redundancy on a GE I/O module by allowing operation on the specified port only.
- Select an interface on the GE I/O module before you issue this command.

- Example


```
host1(config)#interface gigabitEthernet 5/0
host1(config-if)#link selection secondary
```
- Use the **no** version to restore the default situation in which port redundancy is enabled.

Configuration Tasks for Ethernet

This section describes the options for configuring Ethernet interfaces.

You configure an Ethernet interface based on the requirements for your router configuration and the protocols you plan to route on the interface. Because you can configure an interface in different ways, Ethernet configuration tasks are divided into three primary areas. These areas are further described in separate sections in this chapter.

- Configuring the physical interface—You must perform basic configuration steps for all interfaces. This task begins with selecting an Ethernet interface and setting parameters such as line speed and MTU.
- Configuring VLANs and stacked VLANs (S-VLANs)—After you configure the physical interface, you must decide whether to configure the Ethernet interface with or without VLANs or S-VLANs. VLANs and S-VLANs enable you to multiplex multiple IP interfaces and PPPoE interfaces over a single physical Ethernet port. If you are not configuring with VLANs or S-VLANs, proceed to *JUNOS Link Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces*.
- Configuring upper-layer protocols—You must determine which upper-layer protocols, such as MPLS, to configure on the interface. This section focuses on non-VLAN configurations. You can configure some upper-layer protocols, such as PPPoE, with or without VLANs. For more information, see *JUNOS Link Layer Configuration Guide, Chapter 4, Configuring Upper-Layer Protocols over Static Ethernet Interfaces*.

Configuring the Physical Interface

This section describes how to complete the basic configuration for a Fast Ethernet, Gigabit Ethernet, or 10-Gigabit Ethernet interface. CLI examples are provided with the individual command descriptions.

To configure an Ethernet interface:

1. Select an Ethernet interface.
2. (Optional) Specify the line speed and duplex mode.
3. (Optional) Specify the MTU.

4. (Optional) Set the time interval at which the router records bit and packet rates.
5. (Optional) Associate a name with the interface.
6. (Optional) Validate MAC addresses on a per interface basis.

duplex

- Use to specify the duplex mode.
- This command also works on the Fast Ethernet port on the SRP module on all E-series routers. For more information, see the *Managing the Ethernet Port on the SRP Module* in *JUNOS System Basics Configuration Guide, Chapter 6, Managing Modules*.



NOTE: If you set either the line speed or duplex mode to automatically negotiate by using the **automatically negotiate** keyword, the router negotiates both parameters. You can specify different values to prevent the router from negotiating these parameters.

Automatic negotiation is not supported for the FE-8 SFP I/O module. For this I/O module, full duplex mode is the default.

- Example
host1(config-if)#**duplex full**
- Use the **no** version to revert to the default, either automatically negotiate or full duplex (FE-8 SFP I/O module only)

ethernet description

- Use to associate a text description of up to 64 characters with an Ethernet interface.
- This command does not work for the Fast Ethernet port on the SRP module.
- The description is displayed in the output for **show configuration**, **show interfaces fastEthernet**, **show interfaces gigabitEthernet**, and **show interfaces tenGigabitEthernet** commands.
- Example
host1(config-if)#**ethernet description abcd1234**
- Use the **no** version to remove the description from the interface.

interface fastEthernet

- Use to select a Fast Ethernet interface on a line module.
- You can also use it to select a Fast Ethernet management port on an SRP I/O module (ERX-7xx models, ERX-14xx models, and the ERX-310 router) or an SRP IOA (E120 and E320 routers). For information about managing the Fast Ethernet port on the SRP module, see *JUNOS System Basics Configuration Guide, Chapter 6, Managing Modules*.

- Use the *slot/port [.subinterface]* format for Fast Ethernet interfaces on ERX-7xx models, ERX-14xx models, and the ERX-310 router. Use the *slot/adaptor/port* format for the SRP IOA on the E120 or E320 routers; the port on the SRP IOA is always identified by 0.
- Example 1—Selects a Fast Ethernet interface on ERX-7xx models, ERX-14xx models, or the ERX-310 router

```
host1(config)#interface fastEthernet 1/0
```
- Example 2—Selects the Fast Ethernet management port on an E320 router

```
host1(config)#interface fastEthernet 6/0/0
```
- Use the **no** version to remove IP from an interface or subinterface. You must issue the **no** version from the highest level down; you cannot remove an interface or subinterface if the one above it still exists.

interface gigabitEthernet

- Use to select a Gigabit Ethernet interface.



NOTE: On the GE I/O module, you can configure only the primary port, 0. The router automatically uses the redundant port, 0R, if the primary port fails.

On the GE-2 SFP I/O module, you can configure only the primary ports, 0 and 1. The router automatically uses the corresponding redundant port, 0R or 1R, if the primary port fails.

On the OC3-2 GE APS I/O module, you can configure only port 2. Ports 0 and 1 are reserved for OC3/STM1 ATM interfaces. This I/O module does not support redundant ports in the current release.

On the ES2-S1 GE-4 IOA, you can configure all four ports.

On the ES2-S1 GE-8 IOA, you can configure all eight ports.

- Use the *slot/port [.subinterface]* format for Gigabit Ethernet interfaces on ERX-7xx models, ERX-14xx models, or the ERX-310 router; use the *slot/adaptor/port* format for Gigabit Ethernet interfaces on the E120 and E320 routers.
- Example 1—Selects a Gigabit Ethernet interface on ERX-7xx models, ERX-14xx models, and the ERX-310 router

```
host1(config)#interface gigabitEthernet 1/0
host1(config)#interface gigabitEthernet 2/1
```
- Example 2—Selects a Gigabit Ethernet interface on the E320 router

```
host1(config)#interface gigabitEthernet 4/0/1
```
- Use the **no** version to remove IP from an interface. You must issue the **no** version from the highest level down; you cannot remove an interface or subinterface if the one above it still exists.

interface tenGigabitEthernet

- Use to select a 10-Gigabit Ethernet interface on the E120 router or the E320 router.



NOTE: On the ES2-S2 10GE PR IOA, you can configure only the primary port, 0. The router automatically uses the redundant port, 0R, if the primary port fails.

- Use the *slot/adaptor/port* format.
- Example—Selects a 10-Gigabit Ethernet interface on the ES2-S1 10GE IOA
`host1(config)#interface tenGigabitEthernet 4/0/1`
- Use the **no** version to remove IP from an interface. You must issue the **no** version from the highest level down; you cannot remove an interface or subinterface if the one above it still exists.

ip mac-validate

- Use to enable or disable MAC address validation on a per interface basis.
- Use the **strict** keyword to prevent transmission of IP packets that do not reside in the validation table.
- Use the **loose** keyword to enable IP packets to pass through even though the packets do not have entries in the validation table. Only packets that have matching IP-MAC pair entries in the table are validated.
- The default behavior is not to perform MAC address validation.
- Example
`host1(config)#interface gigabitEthernet 2/0`
`host1(config-if)#ip address 4.4.4.2 255.255.255.0`
`host1(config-if)#ip mac-validate strict`
`host1(config-if)#exit`
- Use the **no** version to disable the command.



NOTE: For additional information about MAC address validation, see the **arp validate** command description in *JUNOS IP, IPv6, and IGP Configuration Guide, Chapter 1, Configuring IP*.

load-interval

- Use to set the time interval at which the router calculates bit and packet rate counters.
- This command does not work for the Fast Ethernet port on the SRP module.
- Specify a multiple of 30 seconds, in the range 30–300 seconds.
- The default value is 300 seconds.
- Example
`host1(config-if)#load-interval 90`
- Use the **no** version to restore the default time interval, 300 seconds.

mtu

- Use to specify the MTU for an interface.
- Specify a value in the range 64–9188 bytes. The range for FE-8 I/O modules is 64–9042 bytes.
- This command does not work for the Fast Ethernet port on the SRP module.
- Example
host1(config-if)#**mtu 9000**
- Use the **no** version to specify the default, 1518.

speed

- Use to specify the line speed.
- This command also works on the Fast Ethernet port on the SRP module on all E-series routers. For more information, see *Managing the Ethernet Port on the SRP Module* in *JUNOS System Basics Configuration Guide, Chapter 6, Managing Modules*.



NOTE: If you set either the line speed or duplex mode to automatically negotiate by using the **automatically negotiate** keyword, the router negotiates both parameters. You can specify different values to prevent the router from negotiating these parameters.

Automatic negotiation is not supported for the FE-8 SFP I/O module. For this I/O module, the default speed is 100 Mbps.

- Example
host1(config-if)#**speed 10**
- Use the **no** version to revert to the default, either automatically negotiate or 100 Mbps (FE-8 SFP I/O module only).

Disabling Ethernet Interfaces

Use the **shutdown** command to disable an Ethernet interface.

shutdown

- Use to disable an Ethernet interface.
- Example
host1(config-if)#**shutdown**
- Use the **no** version to restart a disabled Ethernet interface.

Monitoring Ethernet Interfaces

This section explains how to use the **show** commands to display the physical characteristics and the configured settings for Ethernet interfaces.



NOTE: The E120 router and E320 router output for **monitor** and **show** commands is identical to output from other E-series routers, except that the E120 and E320 router output also includes information about the adapter identifier in the interface specifier (*slot/adapter/port*).

Setting Statistics Baselines

The router stores statistics in counters that reset only when you reboot. However, you can establish a baseline for Ethernet statistics by setting a group of reference counters to zero.

baseline interface fastEthernet | gigabitEthernet | tenGigabitEthernet

- Use to establish a baseline for Fast Ethernet, Gigabit Ethernet, or 10-Gigabit Ethernet statistics on a line module or an SRP module.
- Use the **delta** keyword with the **show interfaces fastEthernet**, the **show interfaces gigabitEthernet**, or the **show interfaces tenGigabitEthernet** command to display baselined statistics.

Using Ethernet show Commands

Use the **show** commands described in this section to display information about your Ethernet configuration and to monitor Ethernet interfaces.

show interfaces fastEthernet

- Use to display the status of Fast Ethernet interfaces.
- You can specify the following keywords:
 - **delta**—Specifies that baselined statistics are to be shown
 - **brief**—Displays the operational status of all configured interfaces
- Field descriptions
 - FastEthernet *interfaceSpecifier*—Status of the hardware on this interface
 - up—Hardware is operational
 - down—Hardware is not operational
 - Administrative status—Operational state that you configured for this interface
 - up—Interface is enabled
 - down—Interface is disabled
 - Hardware—Type of MAC device on this interface
 - Address—MAC address of the processor on this interface

- MAU—Type of medium attachment unit (MAU) on the physical port:
 - 10BASE-T (10 Mbps)
 - 100BASE-TX (100 Mbps)
 - 100BASE-FX-MM (100 Mbps) with the distance appearing after the type
 - 100BASE-LX-SM (100 Mbps)
 - SFP (Empty)—SFPs that are empty
 - SFP (Non-compliant Juniper Part)—SFPs that are installed in the FE-8 I/O module and do not have a Juniper Networks part number programmed
- MTU—Size of the MTU for this interface
 - Operational—Size of the largest packet processed
 - Administrative—Setting for MTU size that you specified
- Duplex Mode—Duplex option for this interface
 - Operational—Duplex option currently used
 - Administrative—Setting for duplex that you specified
- Speed—Line speed for this interface
 - Operational—Current rate at which packets are processed
 - Administrative—Setting for line speed
 - 5 minute input rate—Data rates based on traffic received in the last 5 minutes
 - 5 minute output rate—Data rates based on traffic sent in the last 5 minutes
- In—Analysis of inbound traffic on this interface
 - Bytes—Number of bytes received in error-free packets
 - Unicast—Number of unicast packets received
 - Multicast—Number of multicast packets received
 - Broadcast—Number of broadcast packets received
 - Errors—Total number of errors in all received packets; some packets might contain more than one error
 - Discards—Total number of discarded incoming packets
 - Mac Errors—Number of incoming packets discarded because of MAC sublayer failures
 - Alignment—Number of incomplete octets received
 - CRC—Number of packets discarded because the checksum the router computed from the data does not match the checksum generated by the originating devices
 - Too Longs—Number of packets discarded because the size exceeded the MTU
 - Symbol Errors—Number of symbols received that the router did not correctly decode

- Out—Analysis of outbound traffic on this interface
 - Bytes—Number of bytes sent
 - Unicast—Number of unicast packets sent
 - Multicast—Number of multicast packets sent
 - Broadcast—Number of broadcast packets sent
 - Errors—Total number of errors in all transmitted packets; some packets might contain more than one error
 - Discards—Total number of discarded outgoing packets
 - Mac Errors—Number of outgoing packets discarded because of MAC sublayer failures
 - Deferred—Number of packets that the router delayed sending because the line was busy. In half duplex mode, a high number of deferrals means the link is very busy with traffic from other stations. In full duplex mode, when the link is always available for transmission, this number is zero.
 - No Carrier—Number of packets sent when carrier sense was unavailable
- Collisions—Analysis of the collisions that occurred
 - Single—Number of packets sent after one collision
 - Multiple—Number of packets sent after multiple collisions
 - Late—Number of packets aborted during sending because of collisions after 64 bytes
 - Excessive—Number of packets not sent because of too many collisions
- ARP Statistics—Analysis of ARP traffic on this interface; In fields are for traffic received on the interface and Out fields are for traffic sent on the interface
 - ARP requests—Number of ARP requests
 - ARP responses—Number of ARP responses
 - Errors—Total number of errors in all ARP packets
 - Discards—Total number of discarded ARP packets
- queue—Hardware packet queue associated with the specified traffic class and interface
 - Queue length—Length of the queue, in bytes
 - Forwarded packets, bytes—Number of packets and bytes that were forwarded on this queue
 - Dropped committed packets, bytes—Number of committed packets and bytes that were dropped
 - Dropped conformed packets, bytes—Number of conformed packets and bytes that were dropped
 - Dropped exceeded packets, bytes—Number of exceeded packets and bytes that were dropped

- Example—Displays the status of a Fast Ethernet interface

```

host1:vr2#show interfaces fastEthernet 2/0
FastEthernet2/0 is Up, Administrative status is Up
  Hardware is Intel 21440, address is 0090.1a10.0552
  MAU is 10BASE-T
  MTU: Operational 1518, Administrative 1518
  Duplex Mode: Operational Full Duplex, Administrative Auto Negotiate
  Speed: Operational 100 Mbps, Administrative Auto Negotiate

5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec

In: Bytes 39256, Unicast 612
  Multicast 0, Broadcast 0
  Errors 0, Discards 0, Mac Errors 0, Alignment 0
  CRC 0, Too Longs 0, Symbol Errors 0
Out: Bytes 4579036, Unicast 610
  Multicast 0, Broadcast 70932
  Errors 0, Discards 0, Mac Errors 0, Deferred 0, No Carrier 3
  Collisions: Single 0, Multiple 0, Late 0, Excessive 0
ARP Statistics:
  In: ARP requests 0, ARP responses 0
    Errors 0, Discards 0
  Out: ARP requests 0, ARP responses 0
    Errors 0, Discards 0
Administrative qos-shaping-mode: none
Operational qos-shaping-mode: none

queue 0: traffic class control, bound to FastEthernet2/0
  Queue length 0 bytes
  Forwarded packets 1, bytes 46
  Dropped committed packets 0, bytes 0
  Dropped conformed packets 0, bytes 0
  Dropped exceeded packets 0, bytes 0

```

show interfaces gigabitEthernet

show interfaces tenGigabitEthernet

- Use to display the status of Gigabit Ethernet interfaces and 10-Gigabit Ethernet interfaces.
- You can specify the following keywords:
 - **delta**—Specifies that baselined statistics are to be shown
 - **brief**—Displays the operational status of all configured interfaces
- Field descriptions
 - GigabitEthernet or tenGigabitEthernet *interfaceSpecifier*—Status of the hardware on this interface
 - up—Hardware is operational
 - down—Hardware is not operational
 - Administrative status—Operational state that you configured for this interface
 - up—Interface is enabled
 - down—Interface is disabled

- Hardware—Type of MAC device on this interface
- Address—MAC address of the processor on this interface
- MAU—Type of medium attachment unit (MAU) on the primary and secondary physical ports:
 - SFP—1000BASE-LH, 1000BASE-SX, 1000BASE-ZX; for SFPs that are empty, SFP (Empty) appears in this field; for SFPs that are installed in the OC3-2 GE APS I/O module and do not have a Juniper Networks part number programmed, SFP (GE Compliant) appears in this field
 - XFP—10GBASE-SR (10 Gbps), 10GBASE-LR (10 Gbps), 10GBASE-ER (10 Gbps); for XFPs that are empty, XFP (Empty) appears in this field
- MTU—Size of the MTU for this interface
 - Operational—Size of the largest packet processed
 - Administrative—Setting for MTU size that you specified
- Duplex Mode—Duplex option for this interface
 - Operational—Duplex option currently used
 - Administrative—Setting for duplex that you specified
- Speed—Line speed for this interface
 - Operational—Current rate at which packets are processed
 - Administrative—Setting for line speed that you specified
- Link —Link information for this interface
 - Operational Link Selected—Port that the I/O module is currently using: primary or secondary
 - Administrative link selected—Port that the I/O module is configured to use:
 - primary—Only primary port is configured to operate
 - secondary—Only redundant port is configured to operate
 - automatically—Software controls port redundancy automatically
- Primary link selected x times—Number of times that the I/O has used the primary port since the module was last rebooted
- Secondary link selected x times—Number of times that the I/O has used the secondary port since the module was last rebooted
- Primary/Secondary link signal detected, Primary/Secondary link signal not detected—Specifies the port (primary or secondary) on which the router detects a signal (not displayed on GE I/O modules that do not support SFPs)
- 5 minute input rate—Data rates based on the traffic received in the last 5 minutes
- 5 minute output rate—Data rates based on the traffic sent in the last 5 minutes

- In—Analysis of inbound traffic on this interface
 - Bytes—Number of bytes received in error-free packets
 - Unicast—Number of unicast packets received
 - Multicast—Number of multicast packets received
 - Broadcast—Number of broadcast packets received
 - Errors—Total number of errors in all received packets; some packets might contain more than one error
 - Discards—Total number of discarded incoming packets
 - Mac Errors—Number of incoming packets discarded because of MAC sublayer failures
 - Alignment—Number of incomplete octets received
 - CRC—Number of packets discarded because the checksum that the router computed from the data does not match the checksum generated by the originating devices
 - Too Longs—Number of packets discarded because the size exceeded the MTU
 - Symbol Errors—Number of symbols received that the router did not correctly decode
- Out—Analysis of outbound traffic on this interface
 - Bytes—Number of bytes sent
 - Unicast—Number of unicast packets sent
 - Multicast—Number of multicast packets sent
 - Broadcast—Number of broadcast packets sent
 - Errors—Total number of errors in all transmitted packets; note that some packets might contain more than one error
 - Discards—Total number of discarded outgoing packets
 - Mac Errors—Number of outgoing packets discarded because of MAC sublayer failures
 - Deferred—Number of packets that the router delayed sending because the line was busy. In half duplex mode, a high number of deferrals means the link is very busy with traffic from other stations. In full duplex mode, when the link is always available for transmission, this number is zero.
 - No Carrier—Number of packets sent when carrier sense was unavailable
- Collisions—Analysis of the collisions that occurred
 - Single—Number of packets sent after one collision
 - Multiple—Number of packets sent after multiple collisions
 - Late—Number of packets aborted during sending because of collisions after 64 bytes
 - Excessive—Number of packets not sent because of too many collisions

- ARP Statistics—Analysis of ARP traffic on this interface; In fields are for traffic received on the interface and Out fields are for traffic sent on the interface
 - ARP requests—Number of ARP requests
 - ARP responses—Number of ARP responses
 - Errors—Total number of errors in all ARP packets
 - Discards—Total number of discarded ARP packets
- queue—Hardware packet queue associated with the specified traffic class and interface
 - Queue length—Length of the queue, in bytes
 - Forwarded packets, bytes—Number of packets and bytes that were forwarded on this queue
 - Dropped committed packets, bytes—Number of committed packets and bytes that were dropped
 - Dropped conformed packets, bytes—Number of conformed packets and bytes that were dropped
 - Dropped exceeded packets, bytes—Number of exceeded packets and bytes that were dropped
- Example—Displays the status of a Gigabit Ethernet interface

```

host1:vr2#show interfaces gigabitEthernet 10/2
ERX-40-20-43#show int gigabitEthernet 10/2
GigabitEthernet10/2 is Down, Administrative status is Up
  Hardware is SEEQ 8101, address is 0090.1a01.0cc8
  Primary MAU is 1000BASE-SX, secondary MAU is SFP (Empty)
  MTU: Operational 1518, Administrative 1518
  Duplex Mode: Operational Full Duplex, Administrative Auto Negotiate
  Speed: Operational 1000 Mbps, Administrative Auto Negotiate
  Link: Operational Secondary Link Selected,
        Administrative Link Selected Automatically
  Link Failover Timeout: Operational 652 ms, Administrative default
  Primary link selected 6302 times, Secondary link selected 6302 times
  Primary link signal detected, Secondary link signal detected

5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec

In: Bytes 0, Unicast 0
   Multicast 0, Broadcast 0
   Errors 0, Discards 0, Mac Errors 0, Alignment 0
   CRC 0, Too Longs 0, Symbol Errors 0
Out: Bytes 0, Unicast 0
   Multicast 0, Broadcast 0
   Errors 0, Discards 0, Mac Errors 0, Deferred 0, No Carrier 0
   Collisions: Single 0, Multiple 0, Late 0, Excessive 0
ARP Statistics:
In: ARP requests 0, ARP responses 0
   Errors 0, Discards 0
Out: ARP requests 0, ARP responses 0
   Errors 0, Discards 0
Administrative qos-shaping-mode: none
Operational qos-shaping-mode: none

```



```

queue 0: traffic class control, bound to GigabitEthernet10/2
  Queue length 0 bytes
  Forwarded packets 0, bytes 0
  Dropped committed packets 0, bytes 0
  Dropped conformed packets 0, bytes 0
  Dropped exceeded packets 0, bytes 0

```

show ip mac-validate interface

- Use to display the status of the MAC address validation on the physical interface.
- Field descriptions
 - FastEthernet *interfaceSpecifier*—On the ERX-14xx models, ERX-7xx models, and ERX-310 router, the Fast Ethernet or Gigabit Ethernet interface *slot/port*; on the E120 and E320 routers, the Gigabit Ethernet or 10-Gigabit Ethernet interface *slot/adaptor/port*
 - Keyword assigned to interface—Options: Strict or Loose
 - Address—IP address of the entry
 - Hardware Addr—Physical (MAC) address of the entry
- Example

```

host1:boston#show ip mac-validate interface fastEthernet 11/0
FastEthernet11/0: Strict

```

Address	Hardware Addr
3.3.3.3	0090.1a30.3365
4.4.4.4	0090.1a30.3368

