

## Chapter 4

# Configuring Upper-Layer Protocols over Static Ethernet Interfaces

This chapter describes how to configure upper-layer protocols over static Ethernet interfaces on E-series routers.

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## Upper-Layer Protocols over Static Ethernet Overview

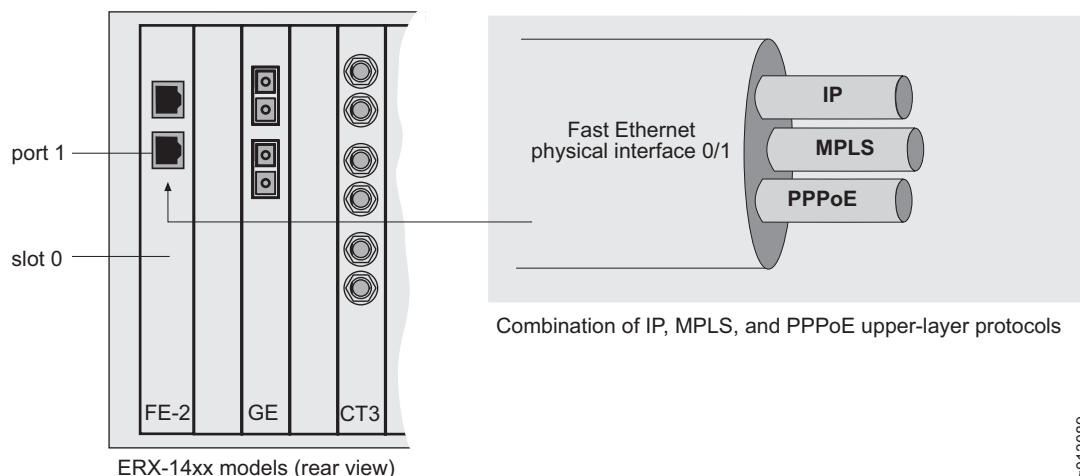
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You can configure one or more protocols over Ethernet with or without VLANs. This section focuses on non-VLAN configurations only. You can configure the following upper-layer protocols on Fast Ethernet, Gigabit Ethernet, and 10-Gigabit Ethernet interfaces:

- IP
- Point-to-Point Protocol over Ethernet (PPPoE)
- Multiprotocol Label Switching (MPLS)

The Ethernet configuration examples in this section use combinations of these protocols. Figure 8 on page 148 illustrates how different protocols can be multiplexed over a single physical link without the use of VLANs.

**Figure 8: Multiplexing Multiple Protocols over a Single Physical Link**



The following sections describe how to create the following common non-VLAN configurations, which you can configure on Fast Ethernet, Gigabit Ethernet, and 10-Gigabit Ethernet interfaces:

- IP over Ethernet
- PPPoE over Ethernet
- IP over Ethernet and MPLS over Ethernet
- IP over Ethernet, MPLS over Ethernet, and PPPoE over Ethernet



**NOTE:** You can also configure upper-layer protocols over dynamic interfaces. See *Chapter 15, Configuring Dynamic Interfaces* and *Chapter 16, Configuring Dynamic Interfaces Using Bulk Configuration*.

## Upper-Layer Protocols over Static Ethernet Platform Considerations

You can configure upper-layer protocols over Ethernet 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

### Module Requirements

For information about the modules supported on E-series routers:

- See the *ERX Module Guide* for modules supported on ERX-7xx models, ERX-14xx models, and the ERX-310 router.
- See the *E120 and E320 Module Guide* for modules supported on the E120 router and the E320 router.

### Interface Specifiers

The configuration task examples in this chapter use the format for ERX-7xx models, ERX-14xx models, and the ERX-310 router to specify a VLAN or S-VLAN subinterface.

For ERX-7xx models, ERX-14xx models, and ERX-310 routers, use the *slot/port[.subinterface]* format. For example, the following command specifies a VLAN subinterface configured on port 0 of an I/O module in slot 4.

```
host1(config)#interface fastEthernet 4/0.1
```

For E120 and E320 routers, use the *slot/adapter/port[.subinterface]* format, which includes an identifier for the bay in which the I/O adapter (IOA) resides. For example, the following command specifies a VLAN subinterface configured on port 0 of the IOA installed in the upper adapter bay of slot 3.

```
host1(config)#interface gigabitEthernet 3/0/0.1
```

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*.

### Upper-Layer Protocols over Static Ethernet References

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For more information about upper-layer protocol implementations over Ethernet, consult the following resources:

- RFC 894—A Standard for the Transmission of IP Datagrams over Ethernet Networks (April 1984)
- RFC 1042—A Standard for the Transmission of IP Datagrams over IEEE 802 Networks (February 1988)
- RFC 1112—Host Extensions for IP Multicasting (August 1989)
- RFC 2516—Method for Transmitting PPP over Ethernet (PPPoE) (February 1998)

## Configuring IP over a Static Ethernet Interface

To configure IP over an Ethernet interface:

1. Specify a Fast Ethernet, Gigabit Ethernet, or 10-Gigabit Ethernet port.

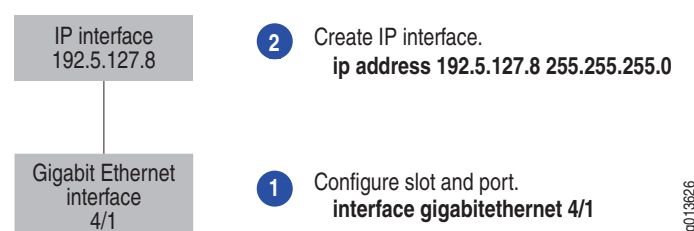
```
host1(config)#interface fastEthernet 4/1
```

2. Create an IP interface.

```
host1(config-if)#ip address 192.5.127.8 255.255.255.0
```

Figure 9 illustrates this configuration.

**Figure 9: Example of IP over Ethernet Stacking Configuration Steps**



## Configuring PPPoE over a Static Ethernet Interface

To configure PPPoE over an Ethernet interface:

1. Specify a Fast Ethernet, Gigabit Ethernet, or 10-Gigabit Ethernet port.

```
host1(config)#interface fastEthernet 4/1
```

2. Specify PPPoE as the encapsulation method on the interface.

```
host1(config-if)#pppoe
```

3. Create a PPPoE subinterface.

```
host1(config-if)#pppoe subinterface fastEthernet 4/1.1
```

4. Specify PPP as the encapsulation method on the interface.

```
host1(config-if)#encapsulation ppp
```

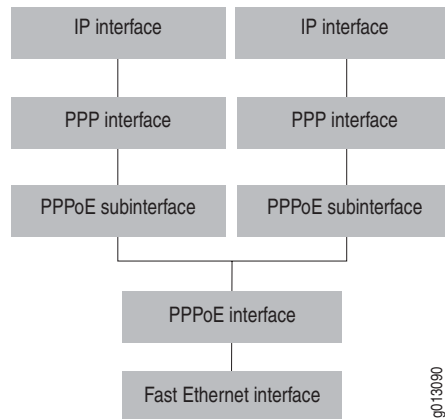
5. Assign an IP address and mask.

```
host1(config-if)#ip address 164.10.6.51 255.255.255.0
```

6. (Optional) Configure additional PPPoE subinterfaces by completing Steps 3 through 5 using unique numbering.

Figure 10 illustrates this configuration.

**Figure 10: Example of PPPoE Stacking Configuration Steps**



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## Configuring IP and MPLS over a Static Ethernet Interface

To configure both IP and MPLS over an Ethernet interface:

1. Specify a Fast Ethernet, Gigabit Ethernet, or 10-Gigabit Ethernet port.

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

2. Create an IP interface.

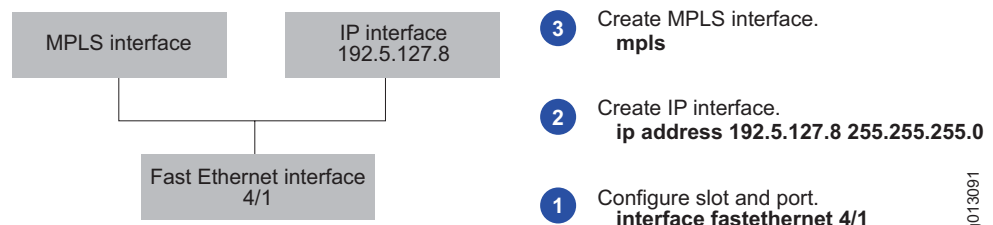
```
host1(config-if)#ip address 192.5.127.8 255.255.255.0
```

3. Create an MPLS interface.

```
host1(config-if)#mpls
```

Figure 11 illustrates this configuration.

**Figure 11: Example of IP and MPLS Stacking Configuration Steps**



- 3 Create MPLS interface.  
**mpls**
- 2 Create IP interface.  
**ip address 192.5.127.8 255.255.255.0**
- 1 Configure slot and port.  
**interface fastethernet 4/1**

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## Configuring IP, MPLS, and PPPoE over Ethernet

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To configure IP, MPLS, and PPPoE over an Ethernet interface:

1. Specify a Fast Ethernet, Gigabit Ethernet, or 10-Gigabit Ethernet port.

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

2. Create an IP interface.

```
host1(config-if)#ip address 192.5.127.8 255.255.255.0
```

3. Create an MPLS interface.

```
host1(config-if)#mpls
```

4. Create a PPPoE interface by specifying PPPoE as the encapsulation method on the interface.

```
host1(config-if)#pppoe
```

5. Create a PPPoE subinterface.

```
host1(config-if)#pppoe subinterface fastEthernet 4/1.1
```

6. Specify PPP as the encapsulation method on the interface.

```
host1(config-if)#encapsulation ppp
```

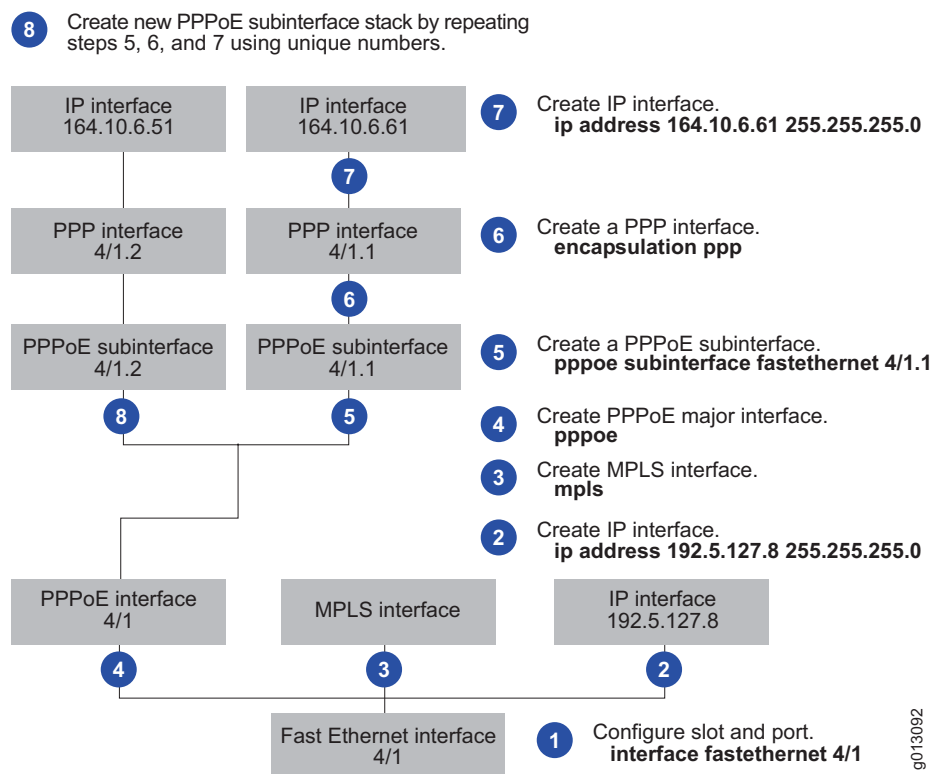
7. Assign an IP address and mask.

```
host1(config-if)#ip address 192.6.129.5 255.255.255.0
```

8. (Optional) Configure additional PPPoE subinterfaces by completing Steps 5 through 7 using unique numbering.

Figure 12 illustrates this configuration.

**Figure 12: Example of IP, MPLS, and PPPoE Stacking Configuration Steps**



### ***mpls***

- Use to enable, disable, or delete MPLS on an interface. MPLS is disabled by default.
- Example  
host1(config)#**mpls**
- Use the **no** version to halt MPLS on the interface and delete the MPLS interface configuration.

## **L2TP and Ethernet**

Most Ethernet interfaces support L2TP. To use L2TP, you must first create a PPP interface. See *JUNOS Broadband Access Configuration Guide, Chapter 11, L2TP Overview* for information about configuring L2TP.

## Multinetting and Ethernet

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Ethernet interfaces, except for bridged Ethernet interfaces, support multinetting; that is, adding more than one IP address to an IP interface. If you want to add multiple IP addresses to a single IP interface, use the **ip address** command with the **secondary** keyword, which is described in *JUNOS IP, IPv6, and IGP Configuration Guide, Chapter 1, Configuring IP*.

## Monitoring Upper-Level Protocols over Ethernet

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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*).

You can use various **show** commands to monitor upper-layer protocols. For more information, see:

- *Chapter 10, Configuring Point-to-Point Protocol over Ethernet*
- *JUNOS IP, IPv6, and IGP Configuration Guide, Chapter 1, Configuring IP*
- *JUNOS BGP and MPLS Configuration Guide, Chapter 2, Configuring MPLS*

### **show interfaces fastEthernet**

- Use to display the status of Fast Ethernet interfaces, VLAN subinterfaces, or S-VLAN subinterfaces.
- 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, 10-Gigabit Ethernet interfaces, VLAN subinterfaces, or S-VLAN subinterfaces.
- 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
- 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
```

