Configuring Layer 3 Interfaces

This chapter contains information about how to configure Layer 3 interfaces on the Cisco 7600 series routers.

Note

For complete syntax and usage information for the commands used in this chapter, see these publications:

- The Cisco 7600 Series Routers Command References at this URL:

This chapter consists of these sections:

- Layer 3 Interface Configuration Guidelines and Restrictions, page 22-1
- Configuring Subinterfaces on Layer 3 Interfaces, page 22-2
- Configuring IPv4 Routing and Addresses, page 22-3
- Configuring IPX Routing and Network Numbers, page 22-7
- Configuring AppleTalk Routing, Cable Ranges, and Zones, page 22-8
- Configuring Other Protocols on Layer 3 Interfaces, page 22-9

Layer 3 Interface Configuration Guidelines and Restrictions

When configuring Layer 3 interfaces, follow these guidelines and restrictions:

- We recommend that you configure no more than 2,000 Layer 3 VLAN interfaces.
- The `ip unnumbered` command is supported on Layer 3 VLAN interfaces.
- The `[no] ip dhcp route [connected | static ]` command is supported.
- To support VLAN interfaces, create and configure VLANs and assign VLAN membership to Layer 2 LAN ports. For more information, see Chapter 14, “Configuring VLANs” and Chapter 13, “Configuring VTP.”
- Cisco 7600 series routers do not support:
  - Integrated routing and bridging (IRB)
  - Concurrent routing and bridging (CRB)
  - Remote source-route bridging (RSRB)
• Use bridge groups on VLAN interfaces, sometimes called fall-back bridging, to bridge nonrouted protocols. Bridge groups on VLAN interfaces are supported in software on the MSFC.
• Cisco 7600 series routers do not support the IEEE bridging protocol for bridge groups. Configure bridge groups to use the VLAN-bridge or the DEC spanning-tree protocol.
• Do not configure an IP address on the physical interface if there is a subinterface configured with dot1q native encapsulation on the same physical interface.
• IPV6 support for TCP Adjust MSS is available on 7600 series routers from Release 15.4(01)S onwards.

Configuring Subinterfaces on Layer 3 Interfaces

When configuring Layer 3 subinterfaces, follow these guidelines and restrictions:
• The following features are supported on LAN port subinterfaces:
  – IPv4 unicast forwarding, including MPLS VPN
  – IPv4 multicast forwarding, including MPLS VPN
  – 6PE
  – EoMPLS
  – IPv4 unnumbered
  – Counters for subinterfaces in MIBS and with the `show vlans` command
  – iBGP and eBGP
  – OSPF
  – EIGRP
  – RIPv1/v2
  – RIPv2
  – ISIS
  – Static routing
  – Unidirectional link routing (UDLR)
  – IGMPv1, IGMPv2, IGMPv3
  – PIMv1, PIMv2
  – SSM IGMPv3lite and URD
  – Stub IP multicast routing
  – IGMP join
  – IGMP static group
  – Multicast routing monitor (MRM)
  – Multicast source discovery protocol (MSDP)
  – SSM
  – IPv4 Ping
  – IPv6 Ping
Always use the **native** keyword when the VLAN ID is the ID of the IEEE 802.1Q native VLAN. Do not configure encapsulation on the native VLAN of an IEEE 802.1Q trunk without the **native** keyword.

Because VLAN IDs are global to the router, you can use a VLAN internally, on a subinterface, or with a Layer 3 VLAN interface.

- You cannot configure an internal VLAN on a subinterface or a Layer 3 VLAN interface.
- You cannot configure a subinterface VLAN on a Layer 3 VLAN interface.
- You cannot configure a VLAN used with a Layer 3 VLAN interface on a subinterface.

**Note**

You cannot configure a VLAN used on one interface or subinterface on another interface or subinterface.

You can configure subinterfaces with any normal range or extended range VLAN ID in VTP transparent mode. Because VLAN IDs 1 to 1005 are global in the VTP domain and can be defined on other network devices in the VTP domain, you can use only extended range VLANs with subinterfaces in VTP client or server mode. In VTP client or server mode, normal range VLANs are excluded from subinterfaces.

**Note**

If you configure normal range VLANs on subinterfaces, you cannot change the VTP mode from transparent.

To configure a subinterface, perform this task:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>Router&gt; <strong>enable</strong> Enters privileged EXEC mode.</td>
</tr>
<tr>
<td>Step 2</td>
<td>Router# <strong>configure terminal</strong> Enters global configuration mode.</td>
</tr>
<tr>
<td>Step 3</td>
<td>Router(config)# <strong>interface</strong> {type slot/port/subinterface}</td>
</tr>
<tr>
<td></td>
<td>{type port-channel port-channel_number.subinterface}</td>
</tr>
<tr>
<td>Step 4</td>
<td>Router(config-subif)# <strong>encapsulation dot1q</strong> vlan_ID [native] Configures 802.1Q encapsulation for the subinterface.</td>
</tr>
<tr>
<td>Step 5</td>
<td>Router(config-if)# <strong>exit</strong> Returns to global configuration mode.</td>
</tr>
</tbody>
</table>

1. **type** = ethernet, fastethernet, gigabitethernet, tengigabitethernet, or ge-wan

**Configuring IPv4 Routing and Addresses**

For complete information and procedures, refer to these publications:

- *Cisco IOS IP and IP Routing Configuration Guide*, Release 12.2, at this URL:
  
When configuring IPv4 routing and addresses, follow these guidelines and restrictions:

- For information about the **maximum paths** command, refer to the *Cisco 7600 Series Router Cisco IOS Command Reference* publication.

- The Policy Feature Card (PFC) and any Distributed Feature Cards (DFCs) provide hardware support for policy-based routing (PBR) for route-map sequences that use the **match ip address**, **set ip next-hop**, and **ip default next-hop** PBR keywords.

When configuring PBR, follow these guidelines and restrictions:

- The PFC provides hardware support for PBR configured on a tunnel interface.

- The PFC does not provide hardware support for PBR configured with the **set ip next-hop** keywords if the next hop is a tunnel interface.

- If the MSFC address falls within the range of a PBR ACL, traffic addressed to the MSFC is policy routed in hardware instead of being forwarded to the MSFC. To prevent policy routing of traffic addressed to the MSFC, configure PBR ACLs to deny traffic addressed to the MSFC.

- Any options in Cisco IOS ACLs that provide filtering in a PBR route-map that would cause flows to be sent to the MSFC to be switched in software are ignored. For example, logging is not supported in ACEs in Cisco IOS ACLs that provide filtering in PBR route-maps.

- PBR traffic through switching module ports where PBR is configured is routed in software if the switching module resets. (CSCee92191)

- In Cisco IOS Release 15.2(1)S1 and later releases, for efficient use of hardware resources, enter the **platform ipv4 pbr optimize tcam** command in global configuration mode when configuring multiple PBR sequences (or a single PBR sequence with multiple ACLs) in which more than one PBR ACL contains DENY entries. Starting from Cisco IOS Release 15.2(4)S4, the same global CLI optimizes the use of masks in the ACL TCAM when PBR is applied on MPLS interfaces and VPN-CAM is enabled.

- PBR is not supported with next-hop as MPLS labeled interface. If MPLS is not label imposing, then PBR works fine on hardware. It is not supported on both hardware and software. PBR does not do label imposition. So you cannot use PBR to forward VPN traffic to a remote PE. This applies to both IP PBR and IPv6 PBR.

- When PBR is configured on an interface where MPLS is enabled, and if that interface receives MPLS packets, PBR will not work on those MPLS packets. This restriction applies to both IPv4 and IPv6 PBR.


To configure IPv4 routing and an IPv4 address on a Layer 3 interface, perform this task:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> Router(config)# ip routing</td>
<td>Enables IPv4 routing. (Required only if IPv4 routing is disabled.)</td>
</tr>
<tr>
<td><strong>Step 2</strong> Router(config)# router ip_routing_protocol</td>
<td>Specifies an IPv4 routing protocol.</td>
</tr>
<tr>
<td><strong>Step 3</strong> Router(config-router)# ip_routing_protocol_commands</td>
<td>Configures the IPv4 routing protocol.</td>
</tr>
<tr>
<td><strong>Step 4</strong> Router(config-router)# exit</td>
<td>Exists IPv4 routing protocol configuration mode.</td>
</tr>
</tbody>
</table>
### Configuring IPv4 Routing and Addresses

<table>
<thead>
<tr>
<th>Step</th>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>`Router(config)# interface {vlan vlan_ID}</td>
<td>{type slot/port}</td>
</tr>
<tr>
<td>6</td>
<td><code>Router(config-if)# ip address ip_address subnet_mask</code></td>
<td>Configures the IPv4 address and IPv4 subnet.</td>
</tr>
<tr>
<td>7</td>
<td><code>Router(config-if)# no shutdown</code></td>
<td>Enables the interface.</td>
</tr>
<tr>
<td>8</td>
<td><code>Router(config-if)# end</code></td>
<td>Exits configuration mode.</td>
</tr>
<tr>
<td>9</td>
<td>`Router# show interfaces [{vlan vlan_ID}</td>
<td>{type slot/port}</td>
</tr>
</tbody>
</table>

1. `type` = ethernet, fastethernet, gigabitethernet, tengigabitethernet, or ge-wan

This example shows how to enable IPv4 Routing Information Protocol (RIP) routing:

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# ip routing
Router(config)# router rip
Router(config-router)# network 10.0.0.0
Router(config-router)# end
```

This example shows how to configure an IPv4 address on Fast Ethernet port 5/4:

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# interface fastethernet 5/4
Router(config-if)# ip address 172.20.52.106 255.255.255.248
Router(config-if)# no shutdown
Router(config-if)# end
```

This example uses the `show interfaces` command to display the interface IPv4 address configuration and status of Fast Ethernet port 5/4:

```
Router# show interfaces fastethernet 5/4
FastEthernet5/4 is up, line protocol is up
   Hardware is Cat6K 100Mb Ethernet, address is 0050.f0ac.3058 (bia 0050.f0ac.3058)
   Internet address is 172.20.52.106/29
   MTU 1500 bytes, BW 100000 Kbit, DLY 100 usec,
   reliability 255/255, txload 1/255, rxload 1/255
   Encapsulation ARPA, loopback not set
   Keepalive set (10 sec)
   Full-duplex, 100Mb/s
   ARP type: ARPA, ARP Timeout 04:00:00
   Last input 00:00:00, output never, output hang never
   Last clearing of "show interface" counters never
   Queueing strategy: fifo
   Output queue 0/40, 0 drops; input queue 0/75, 0 drops
   5 minute input rate 0 bits/sec, 0 packets/sec
   5 minute output rate 0 bits/sec, 0 packets/sec
   7 packets input, 871 bytes, 0 no buffer
   Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
```
This example uses the `show ip interface` command to display the detailed configuration and status of Fast Ethernet port 5/4:

```
Router# show ip interface fastethernet 5/4
FastEthernet5/4 is up, line protocol is up
   Internet address is 172.20.52.106/29
   Broadcast address is 255.255.255.255
   Address determined by setup command
   MTU is 1500 bytes
   Helper address is not set
   Directed broadcast forwarding is disabled
   Multicast reserved groups joined: 224.0.0.10
   Outgoing access list is not set
   Inbound access list is not set
   Proxy ARP is enabled
   Security level is default
   Split horizon is enabled
   ICMP redirects are always sent
   ICMP unreachables are always sent
   ICMP mask replies are never sent
   IP fast switching is enabled
   IP fast switching on the same interface is disabled
   IP Flow switching is disabled
   IP Fast switching turbo vector
   IP Normal CEF switching turbo vector
   IP multicast fast switching is enabled
   IP multicast distributed fast switching is disabled
   Router Discovery is disabled
   IP output packet accounting is disabled
   IP access violation accounting is disabled
   TCP/IP header compression is disabled
   RTP/IP header compression is disabled
   Probe proxy name replies are disabled
   Policy routing is disabled
   Network address translation is disabled
   WCCP Redirect outbound is disabled
   WCCP Redirect exclude is disabled
   BGP Policy Mapping is disabled
   IP multicast multilayer switching is disabled
   IP mls switching is enabled
```

This example uses the `show running-config` command to display the interface IPv4 address configuration of Fast Ethernet port 5/4:

```
Router# show running-config interfaces fastethernet 5/4
Building configuration...

Current configuration:
!
interface FastEthernet5/4
description "Router port"
ip address 172.20.52.106 255.255.255.248
no ip directed-broadcast
```
Configuring IPX Routing and Network Numbers

Note

The MSFC supports Internetwork Packet Exchange (IPX) with fast switching.

For complete information and procedures, refer to these publications:


To configure routing for IPX and to configure IPX on a Layer 3 interface, perform this task:

This example shows how to enable IPX routing and assign an IPX network address to interface VLAN 100:

Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# ipx routing
Router(config)# ipx router rip
Router(config-rip-router)# network all
Router(config-rip-router)# interface vlan 100
Router(config-if)# ipx network 100 encapsulation snap
Router(config-if)# no shutdown

Command | Purpose
--- | ---
Step 1 Router(config)# ipx routing | Enables IPX routing.
Step 2 Router(config)# router ipx_routing_protocol | Specifies an IP routing protocol. This step might include other commands, such as specifying the networks to route with the network command.
Step 3 Router(config)# interface \{vlan vlan_ID\} | \{type slot/port\} | \{port-channel port_channel_number\} | Selects an interface to configure.
Step 4 Router(config-if)# ipx network \{network | unnumbered\} encapsulation encapsulation_type | Configures the IPX network number. This enables IPX routing on the interface. When you enable IPX routing on the interface, you can also specify an encapsulation type.
Step 5 Router(config-if)# no shutdown | Enables the interface.
Step 6 Router(config-if)# end | Exits configuration mode.
Step 7 Router# show interfaces \{vlan vlan_ID\} | \{type slot/port\} | \{port-channel port_channel_number\} | Router# show ipx interfaces \{vlan vlan_ID\} | \{type slot/port\} | \{port-channel port_channel_number\} | Router# show running-config interfaces \{vlan vlan_ID\} | \{type slot/port\} | \{port-channel port_channel_number\} | Verifies the configuration.

1. type = ethernet, fastethernet, gigabitethernet, or tengigabitethernet, or ge-wan
Configuring AppleTalk Routing, Cable Ranges, and Zones

For complete information and procedures, refer to these publications:

- *Cisco IOS AppleTalk and Novell IPX Configuration Guide*, Release 12.2, at this URL:

- *Cisco IOS AppleTalk and Novell IPX Command Reference*, Release 12.2, at this URL:

To configure routing for AppleTalk, perform this task beginning in global configuration mode:

This example shows how to enable AppleTalk routing and assign an AppleTalk cable-range and zone name to interface VLAN 100:

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# appletalk routing
Router(config)# interface vlan 100
Router(config-if)# appletalk cable-range 100-100
Router(config-if)# appletalk zone Engineering
Router(config-if)# no shutdown
Router(config-if)# end
Router# copy running-config startup-config
```

<table>
<thead>
<tr>
<th>Command</th>
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</tr>
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<tbody>
<tr>
<td>Step 1</td>
<td>Router(config)# appletalk routing</td>
</tr>
<tr>
<td>Step 2</td>
<td>Router(config)# interface {vlan vlan_ID}</td>
</tr>
<tr>
<td></td>
<td>{type' slot/port}</td>
</tr>
<tr>
<td></td>
<td>{port-channel port_channel_number}</td>
</tr>
<tr>
<td>Step 3</td>
<td>Router(config-if)# appletalk cable-range cable_range</td>
</tr>
<tr>
<td>Step 4</td>
<td>Router(config-if)# appletalk zone zone_name</td>
</tr>
<tr>
<td>Step 5</td>
<td>Router(config-if)# no shutdown</td>
</tr>
<tr>
<td>Step 6</td>
<td>Router(config-if)# end</td>
</tr>
<tr>
<td>Step 7</td>
<td>Router# show interfaces [{vlan vlan_ID}</td>
</tr>
<tr>
<td></td>
<td>{type' slot/port}</td>
</tr>
<tr>
<td></td>
<td>{port-channel port_channel_number}]</td>
</tr>
<tr>
<td></td>
<td>Router# show appletalk interfaces [{vlan vlan_ID}</td>
</tr>
<tr>
<td></td>
<td>{type' slot/port}</td>
</tr>
<tr>
<td></td>
<td>{port-channel port_channel_number}]</td>
</tr>
<tr>
<td></td>
<td>Router# show running-config interfaces [{vlan vlan_ID}</td>
</tr>
<tr>
<td></td>
<td>{type' slot/port}</td>
</tr>
<tr>
<td></td>
<td>{port-channel port_channel_number}]</td>
</tr>
</tbody>
</table>

1. type = ethernet, fastethernet, gigabitethernet, or tengigabitethernet, or ge-wan

This example shows how to enable AppleTalk routing and assign an AppleTalk cable-range and zone name to interface VLAN 100:

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# appletalk routing
Router(config)# interface vlan 100
Router(config-if)# appletalk cable-range 100-100
Router(config-if)# appletalk zone Engineering
Router(config-if)# no shutdown
Router(config-if)# end
Router# copy running-config startup-config
```
Configuring Other Protocols on Layer 3 Interfaces

Refer to these publications for information about configuring other protocols on Layer 3 interfaces:

- *Cisco IOS Apollo Domain, VINES, DECnet, ISO CLNS, and XNS Configuration Guide*, Release 12.2, at this URL:

- *Cisco IOS Apollo Domain, VINES, DECnet, ISO CLNS, and XNS Command Reference*, Release 12.2, at this URL:
Configuring Other Protocols on Layer 3 Interfaces