Configuring Layer 3 Interfaces

This chapter contains information about how to configure Layer 3 interfaces on the Catalyst 6500 series switches.

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

- The *Cisco IOS Master Command List*, Release 12.2SX at this URL:

  http://www.cisco.com/en/US/docs/ios/mcl/allreleasemcl/all_book.html

- The Release 12.2 publications at this URL:

  http://www.cisco.com/en/US/products/sw/iosswrel/ps1835/products_installation_and_configuration_guides_list.html

This chapter consists of these sections:

Tip For additional information about Cisco Catalyst 6500 Series Switches (including configuration examples and troubleshooting information), see the documents listed on this page:

http://www.cisco.com/en/US/products/hw/switches/ps708/tsd_products_support_series_home.html

Participate in the Technical Documentation Ideas forum

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.

- Release 12.2(18)SXE and later releases supports the **ip unnumbered** command on Layer 3 VLAN interfaces.

- Release 12.2(18)SXE and later releases supports the [**no**] **ip dhcp route** [**connected** | **static**] command.

- 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."

- Catalyst 6500 series switches 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.

- Catalyst 6500 series switches do not support the IEEE bridging protocol for bridge groups. Configure bridge groups to use the VLAN-bridge or the DEC spanning-tree protocol.

Configuring Subinterfaces on Layer 3 Interfaces

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

- With a PFC3, Release 12.2(18)SXE and later releases support these features 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

- These restrictions apply to releases earlier than Release 12.2(18)SXE:
  - Configure subinterfaces only to support MPLS.
  - Do not configure ISL encapsulation.

- 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 switch, 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:

	Command	Purpose
Step 1	Router> **enable**	Enters privileged EXEC mode.
Step 2	Router# **configure terminal**	Enters global configuration mode.
Step 3	Router(config)# **interface** {{*type*[1] *slot/port.subinterface*} | {**port-channel** *port_channel_number.subinterface*}}	Selects an interface and enters subinterface configuration mode.

	Command	Purpose
Step 4	`Router(config-subif)# encapsulation dot1q vlan_ID [native]`	Configures 802.1Q encapsulation for the subinterface.
Step 5	`Router(config-if)# exit`	Returns to global configuration mode.

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:

  http://www.cisco.com/en/US/docs/ios/12_2/ip/configuration/guide/fipr_c.html

- *Cisco IOS IP and IP Routing Command Reference*, Release 12.2, at these URLs:

  http://www.cisco.com/en/US/docs/ios/12_2/ipaddr/command/reference/fipras_r.html

  http://www.cisco.com/en/US/docs/ios/12_2/iproute/command/reference/fiprrp_r.html

When configuring IPv4 routing and addresses, follow these guidelines and restrictions:

- For information about the **maximum paths** command, refer to the *Cisco IOS Master Command List*, Release 12.2SX 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)

  - Any **permit** route-map sequence with no **set** statement will cause matching traffic to be processed by the MSFC.

  - In Cisco IOS Release 12.2(33)SXF16 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. In earlier releases, we recommend avoiding this type of configuration. (CSCsr45495)

  - In Cisco IOS Release 12.2(33)SXH4 and later releases, the BOOTP/DHCP traffic will be dropped unless explicitly permitted. In Cisco IOS Release 12.2(18)SXF, BOOTP/DHCP packets are not subjected to a PBR configured in the ingress interfaces and the BOOTP/DHCP packets are forwarded to the BOOTP/DHCP server, although they are not explicitly permitted.

To configure PBR, refer to the *Cisco IOS Quality of Service Solutions Configuration Guide*, Release 12.2, "Classification," "Configuring Policy-Based Routing," at this URL:

http://www.cisco.com/en/US/docs/ios/12_2/qos/configuration/guide/qcfpbr_ps1835_TSD_Products_Configuration_Guide_Chapter.html

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

	Command	Purpose
Step 1	Router(config)# **ip routing**	Enables IPv4 routing. (Required only if IPv4 routing is disabled.)
Step 2	Router(config)# **router** *ip_routing_protocol*	Specifies an IPv4 routing protocol.
Step 3	Router(config-router)# *ip_routing_protocol_commands*	Configures the IPv4 routing protocol.
Step 4	Router(config-router)# **exit**	Exists IPv4 routing protocol configuration mode.
Step 5	Router(config)# **interface** {**vlan** *vlan_ID*} | {*type*[1] *slot/port*} | {**port-channel** *port_channel_number*}	Selects an interface to configure.
Step 6	Router(config-if)# **ip address** *ip_address* *subnet_mask*	Configures the IPv4 address and IPv4 subnet.
Step 7	Router(config-if)# **no shutdown**	Enables the interface.
Step 8	Router(config-if)# **end**	Exits configuration mode.
Step 9	Router# **show interfaces** [{**vlan** *vlan_ID*} | {*type*[1] *slot/port*} | {**port-channel** *port_channel_number*}] Router# **show ip interfaces** [{**vlan** *vlan_ID*} | {*type*[1] *slot/port*} | {**port-channel** *port_channel_number*}] Router# **show running-config interfaces** [{**vlan** *vlan_ID*} | {*type*[1] *slot/port*} | {**port-channel** *port_channel_number*}]	Verifies the configuration.

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
Router#
```

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
Router#
```

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 00:00:01, 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
         0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
         0 input packets with dribble condition detected
         8 packets output, 1658 bytes, 0 underruns
         0 output errors, 0 collisions, 4 interface resets
         0 babbles, 0 late collision, 0 deferred
         0 lost carrier, 0 no carrier
         0 output buffer failures, 0 output buffers swapped out
Router#
```

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 CEF switching is enabled
  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
Router#
```

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 IPX with fast switching.

For complete information and procedures, refer to these publications:

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

  http://www.cisco.com/en/US/docs/ios/12_2/atipx/configuration/guide/fatipx_c.html

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

  http://www.cisco.com/en/US/docs/ios/12_2/atipx/command/reference/fatipx_r.html

To configure routing for Internetwork Packet Exchange (IPX) and configure IPX on a Layer 3 interface, perform this task:

	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*[1] *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*[1] *slot/port*} | {**port-channel** *port_channel_number*}] Router# **show ipx interfaces** [{**vlan** *vlan_ID*} | {*type*[1] *slot/port*} | {**port-channel** *port_channel_number*}] Router# **show running-config interfaces** [{**vlan** *vlan_ID*} | {*type*[1] *slot/port*} | {**port-channel** *port_channel_number*}]	Verifies the configuration.

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

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-ipx-router)# network all
Router(config-ipx-router)# interface vlan 100
Router(config-if)# ipx network 100 encapsulation snap
Router(config-if)# no shutdown
Router(config-if)# end
Router# copy running-config startup-config
```

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:

   http://www.cisco.com/en/US/docs/ios/12_2/atipx/configuration/guide/fatipx_c.html

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

   http://www.cisco.com/en/US/docs/ios/12_2/atipx/command/reference/fatipx_r.html

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

	Command	Purpose
Step 1	Router(config)# **appletalk routing**	Enables AppleTalk routing.
Step 2	Router(config)# **interface** {**vlan** *vlan_ID*} | {*type*[1] *slot/port*} | {**port-channel** *port_channel_number*}	Selects an interface to configure.
Step 3	Router(config-if)# **appletalk cable-range** *cable_range*	Assigns a cable range to the interface.
Step 4	Router(config-if)# **appletalk zone** *zone_name*	Assigns a zone name to the interface.
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*[1] *slot/port*} | {**port-channel** *port_channel_number*}] Router# **show appletalk interfaces** [{**vlan** *vlan_ID*} | {*type*[1] *slot/port*} | {**port-channel** *port_channel_number*}] Router# **show running-config interfaces** [{**vlan** *vlan_ID*} | {*type*[1] *slot/port*} | {**port-channel** *port_channel_number*}]	Verifies the configuration.

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:

    http://www.cisco.com/en/US/docs/ios/12_2/apollo/configuration/guide/fapolo_c.html

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

    http://www.cisco.com/en/US/docs/ios/12_2/apollo/command/reference/fapolo_r.html

Tip   For additional information about Cisco Catalyst 6500 Series Switches (including configuration examples and troubleshooting information), see the documents listed on this page:

http://www.cisco.com/en/US/products/hw/switches/ps708/tsd_products_support_series_home.html

Participate in the Technical Documentation Ideas forum