



Configuring EtherChannel

This chapter describes how to use the command-line interface (CLI) to configure EtherChannel on the Catalyst 6000 family switch Layer 2 or Layer 3 interfaces.



Note

For complete syntax and usage information for the commands used in this chapter, refer to the *Catalyst 6000 Family IOS Command Reference* publication.

This chapter consists of these sections:

- Understanding How EtherChannel Works, page 9-1
- EtherChannel Configuration Guidelines, page 9-3
- Configuring EtherChannel, page 9-4



Note

The commands in the following sections can be used on all Ethernet interfaces in Catalyst 6000 family switches, including the uplink ports on the supervisor engine and redundant supervisor engine, if present.

Understanding How EtherChannel Works

EtherChannel bundles individual Ethernet links into a single logical link that provides bandwidth up to 1600 Mbps (Fast EtherChannel full duplex) or 16 Gbps (Gigabit EtherChannel) between a Catalyst 6000 family switch and another switch or host.

A Catalyst 6000 family switch supports a maximum of 64 EtherChannels (256 with Release 12.1(2)E and earlier). You can form an EtherChannel with up to eight compatibly configured Ethernet interfaces on any module in a Catalyst 6000 family switch. All interfaces in each EtherChannel must be the same speed and must all be configured as either Layer 2 or Layer 3 interfaces.



Note

The network device to which a Catalyst 6000 family switch is connected may impose its own limits on the number of interfaces in an EtherChannel.

If a segment within an EtherChannel fails, traffic previously carried over the failed link switches to the remaining segments within the EtherChannel. A trap is sent upon a failure identifying the switch, the EtherChannel, and the failed link. Inbound broadcast and multicast packets on one segment in an EtherChannel are blocked from returning on any other segment of the EtherChannel.

Understanding Port-Channel Interfaces

Each EtherChannel has a port-channel interface, numbered from 1 to 64 (256 with Release 12.1(2)E and earlier). Configuration applied to the port-channel interface applies to all physical interfaces assigned to the port-channel interface.

After you configure an EtherChannel, configuration applied to the port-channel interface affects the EtherChannel and configuration applied to the physical interfaces affects only the interface where you apply the configuration. To change the parameters of all ports in an EtherChannel, apply configuration commands to the port-channel interface; for example, Spanning Tree Protocol commands or commands to configure a Layer 2 EtherChannel as a trunk.

Understanding the Port Aggregation Protocol

The Port Aggregation Protocol (PAgP) facilitates the automatic creation of EtherChannels by exchanging packets between Ethernet interfaces. PAgP packets are exchanged only between interfaces in **auto** and **desirable** modes. Interfaces configured in the **on** mode do not exchange PAgP packets.

The protocol learns the capabilities of interface groups dynamically and informs the other interfaces. Once PAgP identifies correctly matched Ethernet links, it facilitates grouping the links into an EtherChannel. The EtherChannel is then added to the spanning tree as a single bridge port.

EtherChannel includes three user-configurable modes: **on**, **auto**, and **desirable** (see Table 9-1). Only **auto** and **desirable** are PAgP modes.

Table 9-1 EtherChannel Modes

| Mode | Description |
|------------------|---|
| on | Forces the interface to channel without PAgP. With the on mode, a usable EtherChannel exists only when an interface group in on mode is connected to another interface group in on mode. |
| auto | PAgP mode that places an interface into a passive negotiating state, in which the interface responds to PAgP packets it receives but does not initiate PAgP packet negotiation. (Default) |
| desirable | PAgP mode that places an interface into an active negotiating state, in which the interface initiates negotiations with other interfaces by sending PAgP packets. |

Both the **auto** and **desirable** modes allow interfaces to negotiate with partner interfaces to determine if they can form an EtherChannel, based on criteria such as interface speed and, for Layer 2 EtherChannels, trunking state and VLAN numbers.

Interfaces can form an EtherChannel when they are in different PAgP modes as long as the modes are compatible. For example:

- An interface in **desirable** mode can form an EtherChannel successfully with another interface that is in **desirable** or **auto** mode.
- An interface in **auto** mode can form an EtherChannel with another interface in **desirable** mode.
- An interface in **auto** mode cannot form an EtherChannel with another interface that is also in **auto** mode, because neither interface will initiate negotiation.

Understanding Load Balancing

EtherChannel balances traffic load across the links in a channel by reducing part of the binary pattern formed from the addresses in the frame to a numerical value that selects one of the links in the channel.

EtherChannel load balancing can use either MAC addresses or IP addresses and either source or destination or both source and destination addresses. The selected mode applies to all EtherChannels configured on the switch.

Use the option that provides the greatest variety in your configuration. For example, if the traffic on a channel is going only to a single MAC address, using the destination MAC address always chooses the same link in the channel; using source addresses or IP addresses may result in better load balancing.

EtherChannel Configuration Guidelines

If improperly configured, some EtherChannel interfaces are disabled automatically to avoid network loops and other problems. Follow these guidelines to avoid configuration problems:

- All Ethernet interfaces on all modules, including those on a standby supervisor engine, support EtherChannel (maximum of eight interfaces) with no requirement that interfaces be physically contiguous or on the same module.
- Configure all interfaces in an EtherChannel to operate at the same speed and duplex mode.
- Enable all interfaces in an EtherChannel. If you shut down an interface in an EtherChannel, it is treated as a link failure and its traffic is transferred to one of the remaining interfaces in the EtherChannel.
- An EtherChannel will not form if one of the interfaces is a Switched Port Analyzer (SPAN) destination port.
- For Layer 3 EtherChannels:
 - Assign Layer 3 addresses to the port-channel logical interface, not to the physical interfaces in the channel.
- For Layer 2 EtherChannels:
 - Assign all interfaces in the EtherChannel to the same VLAN, or configure them as trunks.
 - If you configure an EtherChannel from trunk interfaces, verify that the trunking mode is the same on all the trunks. Interfaces in an EtherChannel with different trunk modes can have unexpected results.
 - An EtherChannel supports the same allowed range of VLANs on all the interfaces in a trunking Layer 2 EtherChannel. If the allowed range of VLANs is not the same, the interfaces do not form an EtherChannel even when set to the **auto** or **desirable** mode.
 - Interfaces with different Spanning Tree Protocol (STP) port path costs can form an EtherChannel as long they are otherwise compatibly configured. Setting different STP port path costs does not, by itself, make interfaces incompatible for the formation of an EtherChannel.
 - An EtherChannel will not form if protocol filtering is set differently on the interfaces.

Configuring EtherChannel

These sections describe how to configure EtherChannel:

- Configuring Layer 3 EtherChannels, page 9-4
- Configuring Layer 2 EtherChannels, page 9-7
- Configuring EtherChannel Load Balancing, page 9-9
- Removing an Interface from an EtherChannel, page 9-10
- Removing an EtherChannel, page 9-10



Note

Make sure that the interfaces are configured correctly (see the “EtherChannel Configuration Guidelines” section on page 9-3).



Note

After you configure an EtherChannel, configuration applied to the port-channel interface affects the EtherChannel and configuration applied to the physical interfaces affects only the interface where you apply the configuration.

Configuring Layer 3 EtherChannels

To configure Layer 3 EtherChannels, create the port-channel logical interface and then put the Ethernet interfaces into the port-channel.

These sections describe Layer 3 EtherChannel configuration:

- Creating Port-Channel Logical Interfaces, page 9-4
- Configuring the Physical Interfaces, page 9-5

Creating Port-Channel Logical Interfaces



Note

To move an IP address from a physical interface to an EtherChannel, you must delete the IP address from the physical interface before configuring it on the port-channel interface.

To create a port-channel interface for a Layer 3 EtherChannel, perform this task:

| | Command | Purpose |
|--------|--|---|
| Step 1 | Router(config)# interface port-channel port_channel_number | Create the port-channel interface. The <i>group</i> number can be from 1 to 64 (256 with Release 12.1(2)E and earlier). |
| Step 2 | Router(config-if)# ip address ip_address mask | Assign an IP address and subnet mask to the EtherChannel. |
| Step 3 | Router(config-if)# exit | Exit the interface configuration mode. |

| | Command | Purpose |
|--------|---|------------------------------|
| Step 4 | Router(config)# exit | Exit the configuration mode. |
| Step 5 | Router# show running-config interface port-channel port_channel_number | Verify the configuration. |

This example shows how to create port-channel interface 1:

```
Router# configure terminal
Router(config)# interface port-channel 1
Router(config-if)# ip address 172.32.52.10 255.255.255.0
Router(config-if)# exit
Router(config)# exit
```

This example shows how to verify the configuration of port-channel interface 1:

```
Router# show running-config interface port-channel 1
Building configuration...

Current configuration:
!
interface Port-channell
 ip address 172.32.52.10 255.255.255.0
 no ip directed-broadcast
end

Router#
```

Configuring the Physical Interfaces

To put Ethernet interfaces into a Layer 3 EtherChannel, perform this task for each interface:

| | Command | Purpose |
|--------|--|--|
| Step 1 | Router(config)# interface {ethernet fastethernet gigabitethernet} slot/port | Select a physical interface to configure. |
| Step 2 | Router(config-if)# no ip address | Ensure that there is no IP address assigned to the physical interface. |
| Step 3 | Router(config-if)# channel-group group port_channel_number mode {auto desirable on} | Configure the interface in a port-channel and specify the PAgP mode. |
| Step 4 | Router(config-if)# exit | Exit the interface configuration mode. |
| Step 5 | Router(config)# exit | Exit the configuration mode. |
| Step 6 | Router# show running-config interface port-channel port_channel_number Router# show running-config interface {ethernet fastethernet gigabitethernet} slot/port Router# show interfaces {ethernet fastethernet gigabitethernet} slot/port etherchannel Router# show etherchnl 1 port-channel | Verify the configuration. |

This example shows how to put Fast Ethernet interfaces 5/4 and 5/5 into port-channel 1 with PAgP mode **desirable**:

```
Router# configure terminal
Router(config)# interface range fastethernet 5/4 -5
Router(config-if)# no ip address
Router(config-if)# channel-group group 1 mode desirable
Router(config-if)# exit
```

**Note**

See the “Configuring a Range of Interfaces” section on page 4-4 for information about the **range** keyword.

This example shows how to verify the configuration of Fast Ethernet interface 5/4:

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

Current configuration:
!
interface FastEthernet5/4
 no ip address
 no ip directed-broadcast
 channel-group group 1 mode auto
end

Router# show interfaces fastethernet 5/4 etherchannel
Port state      = EC-Enbld Up In-Bndl Usr-Config
Channel group = 1          Mode = Desirable      Gcchange = 0
Port-channel   = Po1      GC   = 0x00010001    Psudo-agport = Po1
Port indx      = 0          Load = 0x55

Flags:  S - Device is sending Slow hello.  C - Device is in Consistent state.
        A - Device is in Auto mode.        P - Device learns on physical port.
Timers: H - Hello timer is running.        Q - Quit timer is running.
        S - Switching timer is running.    I - Interface timer is running.

Local information:

Port      Flags State   Timers   Hello   Partner  PAgP   Learning  Group
Fa5/4     SC    U6/S7   30s     30s     1        128    Any       55

Partner's information:

Port      Partner      Partner      Partner      Partner Group
Fa5/4     Name         Device ID    Port         Age  Flags  Cap.
          JAB031301   0050.0f10.230c  2/45        1s  SAC   2D

Age of the port in the current state: 00h:54m:52s

Router#
```

This example shows how to verify the configuration of port-channel interface 1 after the interfaces have been configured:

```
Router# show etherchnl 1 port-channel
Port-channels in the group:
-----
Port-channel: Po1
-----

Age of the Port-channel   = 01h:56m:20s
Logical slot/port        = 10/1          Number of ports in agport = 2
GC                        = 0x00010001    HotStandBy port = null
```

```

Passive port list    = Fa5/4 Fa5/5
Port state          = Port-channel L3-Ag Ag-Inuse

Ports in the Port-channel:

Index  Load  Port
-----
0      55    Fa5/4
1      AA    Fa5/5

Time since last port bundled:    01h:55m:44s    Fa5/5

Router#

```

Configuring Layer 2 EtherChannels

To configure Layer 2 EtherChannels, configure the Ethernet interfaces with the **channel-group** command, which creates the port-channel logical interface.



Note

IOS creates port-channel interfaces for Layer 2 EtherChannels when you configure Layer 2 Ethernet interfaces with the **channel-group** command. You cannot put Layer 2 Ethernet interfaces into manually created port-channel interfaces.



Note

Layer 2 interfaces must be connected and functioning for IOS to create port-channel interfaces for Layer 2 EtherChannels.

To configure Layer 2 Ethernet interfaces as a Layer 2 EtherChannel, perform this task for each interface:

| | Command | Purpose |
|--------|--|--|
| Step 1 | Router(config)# interface { ethernet fastethernet gigabitethernet } <i>slot/port</i> | Select a physical interface to configure. |
| Step 2 | Router(config-if)# channel-group group <i>port_channel_number</i> mode { auto desirable on } | Configure the interface in a port-channel and specify the PAgP mode. |
| Step 3 | Router(config-if)# exit | Exit the interface configuration mode. |
| Step 4 | Router(config)# exit | Exit the configuration mode. |
| Step 5 | Router# show running-config interface { ethernet fastethernet gigabitethernet } <i>slot/port</i> Router# show interface { ethernet fastethernet gigabitethernet } <i>slot/port etherchannel</i> | Verify the configuration. |

This example shows how to put Fast Ethernet interfaces 5/6 and 5/7 into port-channel 2 with PAgP mode **desirable**:

```

Router# configure terminal
Router(config)# interface range fastethernet 5/6 -7
Router(config-if)# channel-group group 2 mode desirable
Router(config-if)# exit

```



Note

See the “Configuring a Range of Interfaces” section on page 4-4 for information about the **range** keyword.

This example shows how to verify the configuration of port-channel interface 2:

```
Router# show running-config interface port-channel 2
Building configuration...

Current configuration:
!
interface Port-channel2
  no ip address
  switchport
  switchport access vlan 10
  switchport mode access
end

Router#
```

This example shows how to verify the configuration of Fast Ethernet interface 5/6:

```
Router# show running-config interface fastethernet 5/6
Building configuration...

Current configuration:
!
interface FastEthernet5/6
  no ip address
  switchport
  switchport access vlan 10
  switchport mode access
  channel-group group 2 mode desirable
end

Router# show interfaces fastethernet 5/6 etherchannel
Port state      = EC-Enbld Up In-Bndl Usr-Config
Channel group = 2          Mode = Desirable      Gcchange = 0
Port-channel = Po2          GC = 0x00020001
Port indx      = 1          Load = 0x55

Flags: S - Device is sending Slow hello.  C - Device is in Consistent state.
      A - Device is in Auto mode.          P - Device learns on physical port.
Timers: H - Hello timer is running.        Q - Quit timer is running.
      S - Switching timer is running.      I - Interface timer is running.

Local information:

Port      Flags State      Timers  Hello  Partner  PAgP  Learning  Group
Fa5/6    SC   U6/S7          30s    1      128     Any     56

Partner's information:

Port      Partner      Partner      Partner      Partner Group
Fa5/6    Name        Device ID    Port        Age  Flags  Cap.
        JAB031301   0050.0f10.230c  2/47      18s SAC   2F

Age of the port in the current state: 00h:10m:57s
```

This example shows how to verify the configuration of port-channel interface 2 after the interfaces have been configured:

```
Router# show etherchnl 2 port-channel
      Port-channels in the group:
      -----

Port-channel: Po2
-----

Age of the Port-channel   = 00h:23m:33s
Logical slot/port        = 10/2           Number of ports in agport = 2
GC                       = 0x00020001    HotStandBy port = null
Port state               = Port-channel Ag-Inuse

Ports in the Port-channel:

Index   Load   Port
-----
   1     55    Fa5/6
   0     AA    Fa5/7

Time since last port bundled:   00h:23m:33s   Fa5/6

Router#
```

Configuring EtherChannel Load Balancing

To configure EtherChannel load balancing, perform this task:

| | Command | Purpose |
|--------|---|--|
| Step 1 | Router(config)# [no] port-channel load-balance {src-mac dst-mac src-dst-mac src-ip dst-ip src-dst-ip} | Configure EtherChannel load balancing. Use the no port-channel load-balance command to return EtherChannel load balancing to the default configuration. |
| Step 2 | Router# show etherchannel load-balance | Verify the configuration. |

The load-balancing keywords are:

- **dst-ip**—Destination IP addresses
- **dst-mac**—Destination MAC addresses
- **src-dst-ip**—Source and destination IP addresses
- **src-dst-mac**—Source and destination MAC addresses
- **src-ip**—Source IP addresses
- **src-mac**—Source MAC addresses

This example shows how to configure EtherChannel to use source and destination IP addresses:

```
Router# configure terminal
Router(config)# port-channel load-balance src-dst-ip
Router(config)# exit
Router(config)#
```

This example shows how to verify the configuration:

```
Router# show etherchannel load-balance
Source XOR Destination IP address
Router#
```

Removing an Interface from an EtherChannel

To remove an Ethernet interface from an EtherChannel, perform this task:

| | Command | Purpose |
|--------|--|---|
| Step 1 | Router(config)# interface { ethernet fastethernet gigabitethernet } <i>slot/port</i> | Select a physical interface to configure. |
| Step 2 | Router(config-if)# no channel-group | Remove the interface from the port-channel interface. |
| Step 3 | Router(config-if)# exit | Exit the interface configuration mode. |
| Step 4 | Router(config)# exit | Exit the configuration mode. |
| Step 5 | Router# show running-config interface { ethernet fastethernet gigabitethernet } <i>slot/port</i> Router# show interface { ethernet fastethernet gigabitethernet } <i>slot/port etherchannel</i> | Verify the configuration. |

This example shows how to remove Fast Ethernet interface 5/4 from port-channel 1:

```
Router# configure terminal
Router(config)# interface range fastethernet 5/4 -5
Router(config-if)# no channel-group group 1
Router(config-if)# exit
```

Removing an EtherChannel

To remove an EtherChannel, perform this task:

| | Command | Purpose |
|--------|---|------------------------------------|
| Step 1 | Router(config)# no interface port-channel <i>port_channel_number</i> | Remove the port-channel interface. |
| Step 2 | Router(config)# exit | Exit the configuration mode. |
| Step 3 | Router# show etherchnl summary | Verify the configuration. |

This example shows how to remove port channel 1:

```
Router# configure terminal
Router(config)# no interface port-channel 1
Router(config)# exit
```