



# Understanding and Configuring EtherChannel

This chapter describes how to use the command-line interface (CLI) to configure EtherChannel on the Catalyst 4006 switch with Supervisor Engine III Layer 2 or Layer 3 interfaces. It also provides guidelines, procedures, and configuration examples.

This chapter consists of the following sections:

- [EtherChannel Overview, page 11-1](#)
- [EtherChannel Configuration Guidelines and Restrictions, page 11-3](#)
- [Configuring EtherChannel, page 11-4](#)



**Note**

The commands in the following sections can be used on all Ethernet interfaces in Catalyst 4006 switch with Supervisor Engine III, including the uplink ports on the supervisor engine.



**Note**

For complete syntax and usage information for the commands used in this chapter, refer to the *Command Reference for the Catalyst 4006 Switch with Supervisor Engine III* and the publications at the following URL:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios121/121cgcr/index.htm>

## EtherChannel Overview

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 4006 switch with Supervisor Engine III and another switch or host.

A Catalyst 4006 switch with Supervisor Engine III supports a maximum of 64 EtherChannels. You can form an EtherChannel with up to eight compatibly configured Ethernet interfaces on any module and across modules in a Catalyst 4006 switch with Supervisor Engine III. 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 4006 switch with Supervisor Engine III 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. An SNMP 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.

The following sections describe how EtherChannel works:

- [Understanding Port-Channel Interfaces, page 11-2](#)
- [Understanding the Port Aggregation Protocol, page 11-2](#)
- [Understanding Load Balancing, page 11-3](#)

## Understanding Port-Channel Interfaces

Each EtherChannel has a numbered port-channel interface. A configuration applied to the port-channel interface affects all physical interfaces assigned to that interface.

After you configure an EtherChannel, the configuration that you apply to the port-channel interface affects the EtherChannel; the configuration that you apply 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 (such as STP commands, or commands to configure a Layer2 EtherChannel as a trunk) to the port-channel interface.

## Understanding the Port Aggregation Protocol

The Port Aggregation Protocol (PAgP) expedites 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. When PAgP identifies correctly matched Ethernet links, it groups 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 11-1](#)). Only **auto** and **desirable** are PAgP modes.

**Table 11-1 EtherChannel Modes**

Mode	Description
<b>on</b>	Mode that forces the interface to channel without PAgP. In the <b>on</b> mode, a usable EtherChannel exists only when an interface group in the <b>on</b> mode is connected to another interface group in the <b>on</b> mode.
<b>auto</b>	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 negotiation.
<b>desirable</b>	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 between two connected switches can form an EtherChannel when they are in different PAgP modes as long as the modes are compatible. This is shown in [Table 11-2](#).

**Table 11-2 Compatibility of EtherChannel Modes**

	<b>desirable</b>	<b>auto</b>	<b>on</b>
<b>desirable</b>	Yes	Yes	No
<b>auto</b>	Yes	No	No
<b>on</b>	No	No	Yes

## 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 MAC addresses, IP addresses, or Layer 4 port numbers; either source or destination or both source and destination.

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 might result in better load balancing.



### Note

Load balancing operates at the switch level rather than per-channel, applying globally for all channels on the switch.

For additional information on load balancing, see the [“Configuring EtherChannel Load Balancing” section on page 11-9](#).

## EtherChannel Configuration Guidelines and Restrictions

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

- All Ethernet interfaces on all modules 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.
- After you configure an EtherChannel, configuration that you apply to the port-channel interface affects the EtherChannel; configuration that you apply to the physical interfaces affects only the interface where you apply the configuration.

## Configuring EtherChannel

These sections describe how to configure EtherChannel:

- [Configuring Layer 3 EtherChannels, page 11-4](#)
- [Configuring Layer 2 EtherChannels, page 11-7](#)
- [Configuring EtherChannel Load Balancing, page 11-9](#)
- [Removing an Interface from an EtherChannel, page 11-10](#)
- [Removing an EtherChannel, page 11-11](#)



### Note

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Ensure that the interfaces are configured correctly (see the “[EtherChannel Configuration Guidelines and Restrictions](#)” section on page 11-3).

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## 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 11-4](#)
- [Configuring Physical Interfaces as a Layer 3 EtherChannel, page 11-5](#)

## Creating Port-Channel Logical Interfaces



### Note

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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.

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

	Task	Command
Step 1	Create the port-channel interface. <i>port_channel_number</i> can range from 1 to 64	Switch(config)# <b>interface port-channel</b> <i>port_channel_number</i>
Step 2	Assign an IP address and subnet mask to the EtherChannel.	Switch(config-if)# <b>ip address</b> <i>ip_address mask</i>
Step 3	Exit configuration mode.	Switch(config-if)# <b>end</b>
Step 4	Verify the configuration.	Switch# <b>show running-config interface</b> <b>port-channel</b> <i>port_channel_number</i>

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

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

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

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

Current configuration:
!
interface Port-channel1
 ip address 172.32.52.10 255.255.255.0
 no ip directed-broadcast
end

Switch#
```

## Configuring Physical Interfaces as a Layer 3 EtherChannel

To configure physical interfaces as a Layer 3 EtherChannel, perform this task for each interface:

	Task	Command
Step 1	Select a physical interface to configure.	Switch(config)# <b>interface {fastethernet   gigabitethernet} slot/port</b>
Step 2	Make this a Layer 3 routed port.	Switch(config-if)# <b>no switchport</b>
Step 3	Ensure that there is no IP address assigned to the physical interface.	Switch(config-if)# <b>no ip address</b>
Step 4	Configure the interface in a port-channel and specify the PAgP mode.	Switch(config-if)# <b>channel-group</b> <i>port_channel_number</i> <b>mode {auto   desirable   on}</b>

Task	Command
Step 5	Exit configuration mode. Switch(config-if)# <b>end</b>
Step 6	Verify the configuration. Switch# <b>show running-config interface port-channel port_channel_number</b>  Switch# <b>show running-config interface {fastethernet   gigabitethernet} slot/port</b>  Switch# <b>show interfaces {fastethernet   gigabitethernet} slot/port etherchannel</b>  Switch# <b>show etherchannel 1 port-channel</b>

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

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

**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:

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

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

Switch# show interfaces fastethernet 5/4 etherchannel
Port state      = EC-Enbld Up In-Bndl Usr-Config
Channel group = 1          Mode = Desirable      Gchange = 0
Port-channel = Po1        GC   = 0x00010001   Pseudo-port-channel = 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     Interval Count  Priority Method  Ifindex

Partner's information:

Port      Partner          Partner          Partner          Partner Group
Name      Device ID       Port            Age  Flags  Cap.
```

```
Fa5/4      JAB031301          0050.0f10.230c  2/45      1s SAC      2D
```

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

```
Switch#
```

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

```
Switch# show etherchannel 1 port-channel
```

```

          Channel-group listing:
          -----
Group: 1
-----

          Port-channels in the group:
          -----
Port-channel: Po1
-----

Age of the Port-channel   = 01h:56m:20s
Logical slot/port        = 10/1           Number of ports = 2
GC                       = 0x00010001   HotStandBy port = null
Port state                = Port-channel L3-Ag Ag-Inuse

Ports in the Port-channel:

Index  Load  Port
-----
   1    00   Fa5/6
   0    00   Fa5/7

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

Switch#
```

## Configuring Layer 2 EtherChannels

To configure Layer 2 EtherChannels, configure the Ethernet interfaces with the **channel-group** command. This 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.

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

Task	Command
<b>Step 1</b> Select a physical interface to configure.	Switch(config)# <b>interface</b> { <b>fastethernet</b>   <b>gigabitethernet</b> } <i>slot/port</i>
<b>Step 2</b> Configure the interface in a port-channel and specify the PAgP mode.	Switch(config-if)# <b>channel-group</b> <i>port_channel_number</i> <b>mode</b> { <b>auto</b>   <b>desirable</b>   <b>on</b> }



```
Fa5/6    SC    U6/S7          30s    1    128    Any    56
```

Partner's information:

Port	Partner Name	Partner Device ID	Partner Port	Partner Age	Partner Flags	Partner Group Cap.
Fa5/6	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:

```
Switch# show etherchannel 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    00   Fa5/6
  0    00   Fa5/7

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

Switch#
```

## Configuring EtherChannel Load Balancing



**Note** Load balancing operates at the switch level rather than per-channel, applying globally for all channels on the switch.

To configure EtherChannel load balancing, perform this task:

	Task	Command
<b>Step 1</b>	Configure EtherChannel load balancing. Use the <b>no</b> keyword to return EtherChannel load balancing to the default configuration.	Switch(config)# <b>[no] port-channel load-balance {src-mac   dst-mac   src-dst-mac   src-ip   dst-ip   src-dst-ip   src-port   dst-port   src-dst-port}</b>
<b>Step 2</b>	Exit configuration mode.	Switch(config)# <b>end</b>
<b>Step 3</b>	Verify the configuration.	Switch# <b>show etherchannel load-balance</b>

The load-balancing keywords are:

- **src-mac**—Source MAC addresses
- **src-dst-mac**—Destination MAC addresses
- **src-dst-mac**—Source and destination MAC addresses
- **src-ip**—Source IP addresses
- **src-dst-ip**—Destination IP addresses
- **src-dst-ip**—Source and destination IP addresses (Default)
- **src-port**—Source Layer 4 port
- **src-dst-port**—Destination Layer 4 port
- **src-dst-port**—Source and destination Layer 4 port

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

```
Switch# configure terminal
Switch(config)# port-channel load-balance src-dst-ip
Switch(config)# end
Switch(config)#
```

This example shows how to verify the configuration:

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

## Removing an Interface from an EtherChannel

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

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

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

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



**Note** See the “[Configuring a Range of Interfaces](#)” section on page 4-4 for information about the **range** keyword.

## Removing an EtherChannel

If you remove an EtherChannel, the member ports are shutdown and removed from the Channel group. To remove an EtherChannel, perform this task:

	<b>Task</b>	<b>Command</b>
<b>Step 1</b>	Remove the port-channel interface.	Switch(config)# <b>no interface port-channel</b> <i>port_channel_number</i>
<b>Step 2</b>	Exit configuration mode.	Switch(config)# <b>end</b>
<b>Step 3</b>	Verify the configuration.	Switch# <b>show etherchannel summary</b>

This example shows how to remove port-channel 1:

```
Switch# configure terminal
Switch(config)# no interface port-channel 1
Switch(config)# end
```

