



# Configuring Fast EtherChannel and Gigabit EtherChannel

This chapter describes how to configure Fast EtherChannel and Gigabit EtherChannel port bundles on the Catalyst enterprise LAN switches. The configuration procedures in this chapter apply to Fast Ethernet and Gigabit Ethernet switch ports on switching modules and fixed-configuration switches, as well as to supervisor engine Fast Ethernet and Gigabit Ethernet uplink ports.



**Note**

For complete information on installing Catalyst 4500 series Fast Ethernet and Gigabit Ethernet modules, refer to the *Catalyst 4500 Series Installation Guide*.



**Note**

For complete syntax and usage information for the commands used in this chapter, refer to the *Catalyst 4500 Series, Catalyst 2948G, and Catalyst 2980G Switches Command Reference*.

This chapter consists of these sections:

- [Understanding How EtherChannel Works, page 6-1](#)
- [PAgP and LACP, page 6-2](#)
- [EtherChannel Configuration Guidelines and Restrictions, page 6-3](#)
- [Understanding the PAgP, page 6-5](#)
- [Configuring EtherChannel Using PAgP, page 6-6](#)
- [EtherChannel Configuration Examples, page 6-12](#)
- [Understanding the LACP, page 6-16](#)
- [Configuring EtherChannel Using LACP, page 6-18](#)

## Understanding How EtherChannel Works

These sections describe how EtherChannel works:

- [EtherChannel Overview, page 6-2](#)
- [Understanding Frame Distribution, page 6-2](#)
- [Hardware Support for EtherChannel, page 6-2](#)

## EtherChannel Overview

Fast EtherChannel and Gigabit EtherChannel port bundles let you group multiple Fast or Gigabit Ethernet ports into a single logical transmission path between a switch and a router, a host, or another switch. Depending on your hardware, you can form an EtherChannel with up to eight compatibly configured Fast or Gigabit Ethernet ports on the switch. In addition, on the Catalyst 4500 series switches, you can configure an EtherChannel using ports from multiple modules. All ports in an EtherChannel must be the same speed.

The switch distributes frames across the ports in an EtherChannel according to the source and destination MAC addresses. If a port within an EtherChannel fails, traffic previously carried over the failed port switches to the remaining ports within the EtherChannel. A trap is sent when a failure identifies the switch, the EtherChannel, and the failed link.

You can configure both Fast and Gigabit EtherChannel bundles as trunk links. After you have formed a channel, you can configure any port in the channel as a trunk. The configuration is applied to all ports in the channel. You can also configure identical trunk ports as an EtherChannel. For more information, see the [“EtherChannel Configuration Guidelines and Restrictions”](#) section on page 6-3 and [Chapter 11, “Configuring VLAN Trunks on Fast Ethernet and Gigabit Ethernet Ports.”](#)

## Understanding Frame Distribution

EtherChannel distributes frames across the links in a channel based on the low-order bits of the source and destination MAC addresses of each frame. The frame distribution method is not configurable.

## Hardware Support for EtherChannel

EtherChannel support is hardware dependent. You can enter the **show port capabilities** command to determine whether your hardware supports EtherChannel, and to confirm which ports you can bundle into a single EtherChannel.

An EtherChannel bundle can consist of any two to eight ports. Ports in an EtherChannel bundle do not have to be continuous, and they do not have to be on the same module.

Due to the port ID handling by the spanning tree feature, the maximum supported number of channels is 126 for a 6-slot chassis.

## PAgP and LACP

Port Aggregation Control Protocol (PAgP) and Link Aggregation Control Protocol (LACP) allow ports with similar characteristics to form a channel through dynamic negotiation with adjoining switches. PAgP is a Cisco-proprietary protocol that can be run only on Cisco switches and those switches released by licensed vendors. LACP, which is defined in IEEE 802.3ad, allows Cisco switches to manage Ethernet channeling with devices that conform to the 802.3ad specification.

**Note**

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MAC address notification settings are ignored on PAgP and LACP EtherChannel ports.

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To use PAgP, see the [“Understanding the PAgP”](#) section on page 6-5. To use LACP, see the [“Understanding the LACP”](#) section on page 6-16.

# EtherChannel Configuration Guidelines and Restrictions

If improperly configured, some EtherChannel ports are disabled automatically to avoid network loops and other problems. Follow the guidelines below to avoid configuration problems.

**Note**

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Except where noted, these guidelines apply to both PAgP and LACP.

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## Guidelines for Configuring a Port

This section lists the guidelines and restrictions for configuring a port for EtherChannel:

- Ensure that you have a maximum of eight compatibly configured ports per EtherChannel; the ports do not have to be contiguous or on the same module.
- Ensure that all ports in an EtherChannel use the same protocol; you cannot run two protocols on a module.
- PAgP and LACP are not compatible; both ends of a channel must use the same protocol.

**Note**

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Switches can be configured manually, with PAgP on one side and LACP on the other side in the **on** mode.

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- You can change the protocol at any time, but this change causes all existing EtherChannels to reset to the default channel mode for the new protocol.
- Configure all ports in an EtherChannel to operate at the same speed and duplex mode (full duplex only for LACP mode).
- Enable all ports in an EtherChannel. If you disable a port in an EtherChannel, it is treated as a link failure and its traffic is transferred to one of the remaining ports in the EtherChannel.
- You cannot assign a port to more than one channel group at the same time.
- Ports with different port path costs, set by the **set spantree portcost** command, can form an EtherChannel as long as they are otherwise compatibly configured. Setting different port path costs does not, by itself, make ports incompatible for the formation of an EtherChannel.
- PAgP and LACP manage channels differently. When all the ports in a channel get disabled, PAgP removes them from its internal channels list; the **show** commands do not display the channel. With LACP, when all the ports in a channel get disabled, LACP does not remove the channel; the **show** commands continue to display the channel even though all its ports are down. To determine if a channel is actively sending and receiving traffic with LACP, use the **show port** command to see if the link is up or down.
- LACP does not support half-duplex links. If a port is in active/passive mode and becomes half duplex, the port is suspended (and a syslog message is generated). The port is shown as “connected” using the **show port** command and as “not connected” using the **show spantree** command. This discrepancy exists because the port is physically connected but never joined spanning tree. To get the port to join spanning tree, either set the duplex to full or set the channel mode to off for that port.

With software release 7.3(1) and later releases, LACP behavior for half-duplex links has changed and affected ports are no longer suspended. Instead of suspending a port, LACP PDU transmission (if any) is suppressed. If the port is part of a channel, the port is detached from the channel but still functions as a nonchannel port. A syslog message is generated when this condition occurs. Normal LACP behavior is reenabled automatically when the link is set back to full duplex.

## Guidelines for Configuring VLANs and Trunks

This section lists the guidelines and restrictions for configuring VLAN and trunks for EtherChannel:

- Assign all ports in an EtherChannel to the same VLAN, or configure them as trunk ports.
- If you configure the EtherChannel as a trunk, configure the same trunk mode on all the ports in the EtherChannel. Configuring ports in an EtherChannel in different trunk modes can have unexpected results.
- An EtherChannel supports the same allowed range of VLANs on all the ports in a trunking EtherChannel. If the allowed range of VLANs is not the same for a port list, the ports do not form an EtherChannel even when set to the **auto** or **desirable** mode with the **set port channel** command.
- Do not configure the ports in an EtherChannel as dynamic VLAN ports. Doing so can adversely affect switch performance.
- Ports with different VLAN costs or VLAN configurations cannot form a channel.

## EtherChannel Interaction with other Features

This section lists the guidelines and restrictions for EtherChannel's interaction with other features:

- An EtherChannel will not form with ports that have different GARP VLAN Registration Protocol (GVRP), GARP Multicast Registration Protocol (GMRP), and quality of service (QoS) configurations.
- An EtherChannel will not form with ports where the port security feature is enabled. Do not enable the port security feature for ports in an EtherChannel.
- An EtherChannel will not form if one of the ports is a SPAN destination port.
- An EtherChannel will not form if protocol filtering is set differently on the ports.
- Cisco Discovery Protocol (CDP) runs on the physical port even after the port is added to a channel.
- VLAN Trunking Protocol (VTP) and Dual Ring Protocol (DRiP) run on the channel.
- During fast switchover to the standby supervisor engine, all channeling ports are cleared on its channeling configuration and state, and the links are pulled down temporarily to cause partner ports to reset. All ports are reset to the nonchanneling state.
- Ports with different dot1q port types cannot form a channel.
- Ports with different jumbo frame configurations cannot form a channel.
- Ports with different dynamic configurations cannot form a channel.
- If one port in an EtherChannel is used by IGMP multicast filtering, you must set the EtherChannel mode for both PAgP and LACP to **off**. No other mode may be used.



### Note

With software release 6.3(1) and later releases, a PAgP-configured EtherChannel is preserved even if it contains only one port (this does not apply to LACP-configured EtherChannels). In software releases prior to 6.3(1), traffic was disrupted when you removed a 1-port channel from spanning tree and then added it to spanning tree as an individual port.

# Understanding the PAgP

Use the information in the following sections if you are configuring EtherChannel using PAgP. If you are using LACP, see the “[Understanding the LACP](#)” section on page 6-16.

## PAgP Modes

The Port Aggregation Protocol (PAgP) facilitates the automatic creation of Fast EtherChannel and Gigabit EtherChannel links by exchanging packets between channel-capable ports. The protocol learns the capabilities of port groups dynamically and informs the neighboring ports.

After PAgP identifies correctly paired channel-capable links, it groups the ports into a channel. The channel is then added to the spanning tree as a single bridge port. A given outbound broadcast or multicast packet is transmitted out one port in the channel only, not out every port in the channel. In addition, outbound broadcast and multicast packets that are transmitted on one port in a channel are blocked from returning on any other port of the channel.

There are four user-configurable channel modes: **on**, **off**, **auto**, and **desirable**. PAgP packets are exchanged only between ports in **auto** and **desirable** mode. Ports that are configured in **on** or **off** mode do not exchange PAgP packets. The **auto** and **desirable** modes can be modified with the **silent** and **non-silent** keywords. [Table 6-1](#) describes each mode.

**Table 6-1 Channel Modes**

Mode	Description
<b>on</b>	Forces the port to channel without negotiation. PAgP packets are not exchanged. The port is channeling regardless of how the peer port is configured. If the peer port is in <b>on</b> mode, a channel is formed. In any other mode, the peer port is placed in the errdisable state due to a channel misconfiguration.
<b>off</b>	Prevents the port from channeling. PAgP packets are not exchanged. The port is not channeling regardless of how the peer port is configured. No channel is formed.
<b>auto</b>	Places a port into a passive negotiating state, in which the port responds to PAgP packets it receives but does not initiate PAgP packet negotiation. A channel is formed only with another port group in <b>desirable</b> mode. (Default)
<b>desirable</b>	Places a port into an active negotiating state, in which the port initiates negotiations with other ports by sending PAgP packets. A channel is formed with another port group in either <b>desirable</b> or <b>auto</b> mode.  Use the <b>silent</b> keyword when you are connecting to a “silent partner” (a device that is not generating BPDUs or other traffic). An example of a silent partner is a traffic generator that is not transmitting packets. Use this keyword with the <b>auto</b> or <b>desirable</b> mode. If you do not specify <b>silent</b> or <b>non-silent</b> , silent is assumed.  Use the <b>non-silent</b> keyword when you are connecting to a device that will transmit BPDUs or other traffic. Use this keyword with the <b>auto</b> or <b>desirable</b> mode.

Both the **auto** and **desirable** modes allow ports to negotiate with connected ports to determine if they can form a channel, based on criteria such as port speed, trunking state, native VLAN, and so on.

Ports can form an EtherChannel when they are in different channel modes as long as the modes are compatible, as follows:

- A port in **desirable** mode can form an EtherChannel successfully with another port that is in **desirable** or **auto** mode.
- A port in **auto** mode can form an EtherChannel with another port in **desirable** mode.
- A port in **auto** mode cannot form an EtherChannel with another port that is also in **auto** mode, because neither port will initiate negotiation.
- A port in **on** mode can form a channel only with a port in **on** mode, because ports in **on** mode do not exchange PAgP packets.
- A port in **off** mode will not form a channel with any port.

## Understanding Administrative Groups and EtherChannel IDs

Configuring an EtherChannel creates an administrative group, designated by an integer between 1 and 1024, inclusive, to which the EtherChannel belongs. You can assign an administrative group number manually or let the system software assign the next available administrative group number automatically.

Forming an EtherChannel without specifying an administrative group number creates a new automatically numbered administrative group consisting of the ports you configure as an EtherChannel. An administrative group can contain a maximum of eight ports.

You can define an EtherChannel administrative group without forming an EtherChannel. Only ports belonging to the same administrative group can form a single EtherChannel.

In addition to the administrative group number, each EtherChannel is automatically assigned a unique EtherChannel ID. Use the **show channel group** command to display the EtherChannel ID.

EtherChannel administrative group numbers are stored in NVRAM and remain the same after the switch is reset or power cycled. EtherChannel IDs are not saved in NVRAM. The ID can change if the EtherChannel is torn down and renegotiated, or if the switch is reset or power cycled.

## Configuring EtherChannel Using PAgP

These sections describe how to configure an EtherChannel bundle using PAgP:

- [Creating an EtherChannel, page 6-7](#)
- [Defining an EtherChannel Administrative Group, page 6-7](#)
- [Setting the EtherChannel Spanning Tree Port Cost, page 6-8](#)
- [Setting the EtherChannel Spanning Tree Port VLAN Cost, page 6-9](#)
- [Removing an EtherChannel Bundle, page 6-9](#)
- [Displaying EtherChannel Configuration Information, page 6-10](#)
- [Displaying EtherChannel Traffic Statistics, page 6-11](#)
- [Displaying EtherChannel PAgP Statistics, page 6-12](#)

**Note**

Before you configure the EtherChannel, see the [“EtherChannel Configuration Guidelines and Restrictions”](#) section on page 6-3.

## Creating an EtherChannel

You create an EtherChannel port bundle by specifying the ports in the channel and the channeling mode. When you create an EtherChannel, an administrative group number is assigned automatically if one is not already assigned to the specified ports. In addition, a channel ID is assigned.

The **silent** and **non-silent** keywords function only with the **auto** and **desirable** modes.

To create an EtherChannel port bundle, perform this task in privileged mode:

	Task	Command
Step 1	If you are unsure which ports you can configure as an EtherChannel, verify the EtherChannel capabilities for the module or switch you are configuring.	<b>show port capabilities</b> [ <i>mod_num</i> [/ <i>port_num</i> ]]
Step 2	Create an EtherChannel with the desired ports.	<b>set port channel</b> <i>port_list</i> [ <i>admin_group</i> ] <b>mode</b> { <b>on</b>   <b>off</b>   <b>desirable</b>   <b>auto</b> } [ <b>silent</b>   <b>non-silent</b> ]
Step 3	Verify the EtherChannel configuration.	<b>show port channel</b> [ <i>port_list</i> ]

This example shows how to create an EtherChannel bundle and verify the configuration:

```

Console> (enable) set port channel 3/5-6 on
Port(s) 3/5-6 are assigned to admin group 57.
Port(s) 3/5-6 channel mode set to on.
Console> (enable) show port channel
Port  Status      Channel          Admin Ch
      Mode                               Group Id
-----
 3/5  connected  on                57    835
 3/6  connected  on                57    835
-----

Port  Device-ID                               Port-ID          Platform
-----
 3/5  069003103(5500)                          3/5              WS-C4000
 3/6  069003103(5500)                          3/6              WS-C4000
-----
Console> (enable)

```

## Defining an EtherChannel Administrative Group

You can define EtherChannel administrative groups manually to identify groups of ports that are allowed to form an EtherChannel bundle. When you create an EtherChannel port bundle, an administrative group is defined automatically. Administrative group membership is limited by hardware restrictions.

The *admin\_group* can be any value between 1 and 1024, inclusive.



### Caution

Modifying the EtherChannel administrative group on connected ports causes the specified ports to be removed from and then added to spanning tree (that is, a spanning tree topology change occurs and the ports must enter listening and learning mode before returning to forwarding mode).

To define an EtherChannel administrative group, perform this task in privileged mode:

	Task	Command
Step 1	Define the administrative group by specifying the ports in the group.	<b>set port channel</b> <i>port_list</i> <i>admin_group</i>
Step 2	Verify the administrative group configuration.	<b>show channel group</b> [ <i>admin_group</i> ]

This example shows how to assign ports to an administrative group and verify the configuration:

```

Console> (enable) set port channel 3/5-6 50
Port(s) 3/5-6 are assigned to admin group 50.
Console> (enable) show channel group 50
Admin Port  Status      Channel      Channel
group       Mode           Mode         id
-----
    50  3/5  connected  auto silent          0
    50  3/6  connected  auto silent          0

Admin Port  Device-ID                               Port-ID           Platform
group
-----
    50  3/5
    50  3/6
Console> (enable)

```

## Setting the EtherChannel Spanning Tree Port Cost

To set the spanning tree port cost for an EtherChannel, perform this task in privileged mode:

	Task	Command
Step 1	Determine the EtherChannel ID of the EtherChannel for which you want to set the port cost.	<b>show channel group</b> <i>admin_group</i>
Step 2	Set the spanning tree port cost for an EtherChannel using the EtherChannel ID obtained in Step 1.	<b>set channel cost</b> { <i>channel_id</i>   <b>all</b> } <i>cost</i>

This example shows how to set the EtherChannel port path cost for channel ID 768:

```

Console> (enable) show channel group 20
Admin Port  Status      Channel      Channel
group       Mode           Mode         id
-----
    20  1/1  notconnect  on           768
    20  1/2  connected   on           768

Admin Port  Device-ID                               Port-ID           Platform
group
-----
    20  1/1
    20  1/2  066510644 (cat26-lnf (NET25))  2/1              WS-C6009
Console> (enable)

```

```

Console> (enable) set channel cost 768 12
Port(s) 1/1,1/2 port path cost are updated to 31.
Channel 768 cost is set to 12.
Warning:channel cost may not be applicable if channel is broken.
Console> (enable)

```

## Setting the EtherChannel Spanning Tree Port VLAN Cost

The spanning tree port VLAN cost provides an alternate cost for some of the VLANs in a trunk channel. Setting the spanning tree port VLAN cost provides load balancing of VLAN traffic across multiple channels configured with trunking because some VLANs in the channel can have port VLAN cost, while the remaining VLANs in the channel have port cost.

To set the spanning tree port VLAN cost for an EtherChannel, perform this task in privileged mode:

	Task	Command
Step 1	Determine the EtherChannel ID of the EtherChannel for which you want to set the port VLAN cost.	<b>show channel group</b> <i>admin_group</i>
Step 2	Set the spanning tree port VLAN cost for an EtherChannel using the EtherChannel ID obtained in Step 1.	<b>set channel vlancost</b> { <i>channel_id</i>   <b>all</b> } <i>cost</i>

This example shows how to set the EtherChannel VLAN cost for channel ID 768:

```

Console> (enable) show channel group 20
Admin Port  Status      Channel  Channel
group                               Mode     id
-----
   20    1/1 notconnect on          768
   20    1/2 connected on          768

Admin Port  Device-ID                               Port-ID           Platform
group
-----
   20    1/1
   20    1/2 066510644 (cat26-1nf(NET25))    2/1              WS-C6009
Console> (enable)

Console> (enable) set channel vlancost 768 12
Channel 768 vlancost set to 12.
Console> (enable)

```

## Removing an EtherChannel Bundle

To return a Fast EtherChannel or Gigabit EtherChannel bundle to its default configuration, perform this task in privileged mode:

	Task	Command
Step 1	Return a channel to its default configuration (you must perform this task on both sides of the channel).	<b>set port channel</b> <i>port_list</i> <b>mode auto</b>
Step 2	Verify the configuration.	<b>show port channel</b> [ <i>mod_num</i> [/ <i>port_num</i> ]]

This example shows how to return a channel to its default configuration and how to verify the configuration:

```
Console> (enable) set port channel 3/5-6 mode auto
Port(s) 3/5-6 channel mode set to auto.
Console> (enable) show port channel
No ports channelling
Console> (enable)
```

## Displaying EtherChannel Configuration Information

To display EtherChannel configuration information, perform one of these tasks in privileged mode:

Task	Command
Display EtherChannel configuration information by port.	<b>show port channel</b> [ <i>mod_num</i> [/ <i>port_num</i> ]] <b>info</b> [ <b>spantree</b>   <b>trunk</b>   <b>protocol</b>   <b>gmrp</b>   <b>gvrp</b>   <b>qos</b> ]
Display EtherChannel configuration information by EtherChannel administrative group.	<b>show channel group</b> [ <i>admin_group</i> ] <b>info</b> [ <b>spantree</b>   <b>trunk</b>   <b>protocol</b>   <b>gmrp</b>   <b>gvrp</b>   <b>qos</b> ]
Display EtherChannel configuration information by EtherChannel ID.	<b>show channel</b> [ <i>channel_id</i> ] <b>info</b> [ <b>spantree</b>   <b>trunk</b>   <b>protocol</b>   <b>gmrp</b>   <b>gvrp</b>   <b>qos</b> ]

This example shows how to display EtherChannel configuration information by port:

```
Console> (enable) show port channel info
Switch Frame Distribution Method: mac both
```

```
Port  Status      Channel      Admin Channel  Speed Duplex Vlan
     mode
-----
3/5   connected   on           56      835 a-100 a-full  1
3/6   connected   on           56      835 a-100 a-full  1
-----
```

```
Port  ifIndex Oper-group Neighbor Oper-Distribution PortSecurity/
     Oper-group Method          Dynamic port
-----
3/5   377      1          mac both
3/6   377      1          mac both
-----
```

```
Port  Device-ID          Port-ID          Platform
-----
3/5   069003103 (5500)   3/5              WS-C4000
3/6   069003103 (5500)   3/6              WS-C4000
-----
```

```
Port  Trunk-status Trunk-type Trunk-vlans
-----
3/5   not-trunking negotiate  1-1005
3/6   not-trunking negotiate  1-1005
-----
```

```
Port  Portvlancost-vlans
-----
3/5
3/6
-----
```

```

Port  Port      Portfast Port  Port
      priority          vlanpri vlanpri-vlans
-----
3/5      32 disabled      0
3/6      32 disabled      0
-----

Port  IP      IPX      Group
-----
3/5  on      auto-on auto-on
3/6  on      auto-on auto-on
-----

Port  GMRP      GMRP      GMRP
      status  registration forwardAll
-----
3/5  enabled  normal    disabled
3/6  enabled  normal    disabled
-----

Port  GVRP      GVRP      GVRP
      status  registration applicant
-----
3/5  disabled  normal    normal
3/6  disabled  normal    normal
-----

Port  Qos-Tx Qos-Rx Qos-Trust  Qos-DefCos
-----
3/5  -      -      untrusted  0
3/6  -      -      untrusted  0
-----

Console> (enable)

```

## Displaying EtherChannel Traffic Statistics

To display EtherChannel traffic statistics, perform this task in privileged mode:

Task	Command
Display EtherChannel traffic statistics.	<b>show channel</b> [ <i>channel_id</i> ] <b>mac</b>

This example shows how to display EtherChannel traffic statistics information for EtherChannel ID 835:

```

Console> show channel 835 mac
Channel  Rcv-Unicast      Rcv-Multicast      Rcv-Broadcast
-----
835      0                  119200              0

Channel  Xmit-Unicast      Xmit-Multicast      Xmit-Broadcast
-----
835      0                  184171              0

Channel  Rcv-Octet      Xmit-Octet
-----
835      11283708       14942104

Channel  Dely-Exced MTU-Exced  In-Discard Lrn-Discrd In-Lost  Out-Lost

```

```
-----
835          0          0          0          0          0          0
Console> (enable)
```

## Displaying EtherChannel PAgP Statistics

To display EtherChannel PAgP statistics, perform one of these tasks in privileged mode:

Task	Command
Display EtherChannel PAgP statistics by port.	<b>show port channel</b> [ <i>mod_num</i> [/ <i>port_num</i> ]] <b>statistics</b>
Display EtherChannel PAgP statistics by EtherChannel administrative group.	<b>show channel group</b> [ <i>admin_group</i> ] <b>statistics</b>
Display EtherChannel PAgP statistics by EtherChannel ID.	<b>show channel</b> [ <i>admin_group</i> ] <b>statistics</b>

This example shows how to display EtherChannel PAgP statistics information by EtherChannel administrative group:

```
Console> show channel group 58 statistics
Port Admin  PAgP Pkts  PAgP Pkts PAgP Pkts PAgP Pkts PAgP Pkts PAgP Pkts
      Group  Transmitted Received InFlush  RetnFlush OutFlush InError
-----
3/5   58      194      81      0      0      0      0
3/6   58      204      85      0      0      0      0
Console> (enable)
```

## EtherChannel Configuration Examples

These sections contain Fast and Gigabit EtherChannel configuration examples:

- [Configuration Example of a Four-Port Fast EtherChannel, page 6-12](#)
- [Configuration Example of Two-Port Gigabit EtherChannel, page 6-14](#)



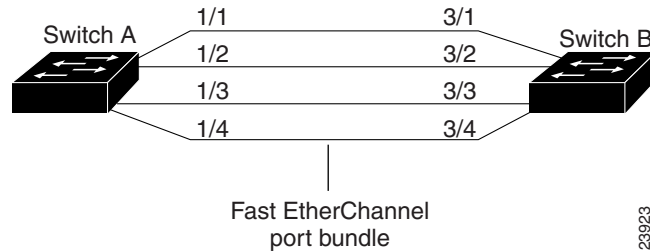
### Note

For examples of configuring VLAN trunks on EtherChannel port bundles, see the [“Example VLAN Trunk Configurations”](#) section on page 11-9.

## Configuration Example of a Four-Port Fast EtherChannel

This example shows how to configure a four-port Fast EtherChannel link between two switches. [Figure 6-1](#) shows two switches connected through four 100BASE-TX Fast Ethernet ports.

Figure 6-1 Example of a Fast EtherChannel Port Bundle



To configure a four-port EtherChannel link between two switches, follow these steps:

- Step 1** Make sure that all ports on Switch A and Switch B have the same port configuration, including VLAN membership, speed, and duplex.

```
Switch_A> (enable) set vlan 50 1/1-4
VLAN 50 modified.
VLAN 1 modified.
VLAN Mod/Ports
-----
50    1/1-4
      2/1-2
      3/1-3

Switch_A> (enable) set port speed 1/1-4 100
Ports 1/1-4 transmission speed set to 100Mbps.
Switch_A> (enable) set port duplex 1/1-4 full
Ports 1/1-4 set to full-duplex.
Switch_A> (enable)
```

```
Switch_B> (enable) set vlan 50 3/1-4
VLAN 50 modified.
VLAN 1 modified.
VLAN Mod/Ports
-----
50    3/1-4
```

```
Switch_B> (enable) set port speed 3/1-4 100
Ports 3/1-4 transmission speed set to 100Mbps.
Switch_B> (enable) set port duplex 3/1-4 full
Ports 3/1-4 set to full-duplex.
Switch_B> (enable)
```

- Step 2** Confirm the channeling status of the switches using the **show port channel** command.

```
Switch_A> (enable) show port channel
No ports channelling
Switch_A> (enable)
```

```
Switch_B> (enable) show port channel
No ports channelling
Switch_B> (enable)
```

- Step 3** Configure the ports on Switch A to negotiate a Fast EtherChannel bundle with the neighboring switch. This example assumes that the neighboring ports on Switch B are in EtherChannel **auto** mode. The system logging messages provide information about the formation of the EtherChannel bundle.

```
Switch_A> (enable) set port channel 1/1-4 desirable
Port(s) 1/1-4 channel mode set to desirable.
Switch_A> (enable) %PAGP-5-PORTFROMSTP:Port 1/1 left bridge port 1/1
```

```

%PAGP-5-PORTFROMSTP:Port 1/2 left bridge port 1/2
%PAGP-5-PORTFROMSTP:Port 1/3 left bridge port 1/3
%PAGP-5-PORTFROMSTP:Port 1/4 left bridge port 1/4
%PAGP-5-PORTFROMSTP:Port 1/2 left bridge port 1/2
%PAGP-5-PORTFROMSTP:Port 1/3 left bridge port 1/3
%PAGP-5-PORTFROMSTP:Port 1/4 left bridge port 1/4
%PAGP-5-PORTTOSTP:Port 1/1 joined bridge port 1/1-4
%PAGP-5-PORTTOSTP:Port 1/2 joined bridge port 1/1-4
%PAGP-5-PORTTOSTP:Port 1/3 joined bridge port 1/1-4
%PAGP-5-PORTTOSTP:Port 1/4 joined bridge port 1/1-4

Switch_B> (enable) %PAGP-5-PORTFROMSTP:Port 3/1 left bridge port 3/1
%PAGP-5-PORTFROMSTP:Port 3/2 left bridge port 3/2
%PAGP-5-PORTFROMSTP:Port 3/3 left bridge port 3/3
%PAGP-5-PORTFROMSTP:Port 3/4 left bridge port 3/4
%PAGP-5-PORTFROMSTP:Port 3/2 left bridge port 3/1-4
%PAGP-5-PORTFROMSTP:Port 3/3 left bridge port 3/1-4
%PAGP-5-PORTFROMSTP:Port 3/4 left bridge port 3/1-4
%PAGP-5-PORTTOSTP:Port 3/1 joined bridge port 3/1-4
%PAGP-5-PORTTOSTP:Port 3/2 joined bridge port 3/1-4
%PAGP-5-PORTTOSTP:Port 3/3 joined bridge port 3/1-4
%PAGP-5-PORTTOSTP:Port 3/4 joined bridge port 3/1-4

```

**Step 4** After the EtherChannel bundle is negotiated, enter the **show port channel** command to verify the configuration.

```

Switch_A> (enable) show port channel
Port Status      Channel  Channel  Neighbor  Neighbor
      mode        status   device   device   port
-----
1/1  connected  desirable channel   WS-C4003  JAB023806 (Sw 3/1
1/2  connected  desirable channel   WS-C4003  JAB023806 (Sw 3/2
1/3  connected  desirable channel   WS-C4003  JAB023806 (Sw 3/3
1/4  connected  desirable channel   WS-C4003  JAB023806 (Sw 3/4
-----

Switch_A> (enable)

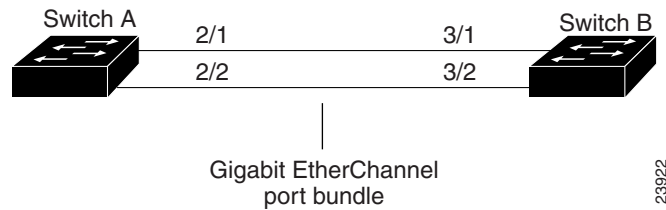
Switch_B> (enable) show port channel
Port Status      Channel  Channel  Neighbor  Neighbor
      mode        status   device   device   port
-----
3/1  connected  auto     channel   WS-C4012  009979082 (Sw 1/1
3/2  connected  auto     channel   WS-C4012  009979082 (Sw 1/2
3/3  connected  auto     channel   WS-C4012  009979082 (Sw 1/3
3/4  connected  auto     channel   WS-C4012  009979082 (Sw 1/4
-----

Switch_B> (enable)

```

## Configuration Example of Two-Port Gigabit EtherChannel

This example shows how to configure a two-port Gigabit EtherChannel link between two switches. [Figure 6-2](#) shows two switches connected through four 1000BASE-SX Gigabit Ethernet ports.

**Figure 6-2 Example of a Gigabit EtherChannel Port Bundle**

To configure a two-port Gigabit EtherChannel link between two switches, follow these steps:

- Step 1** Make sure that all ports on Switch A and Switch B have the same port configuration, such as VLAN membership.

```
Switch_A> (enable) set vlan 100 2/1-2
VLAN 100 modified.
VLAN 1 modified.
VLAN Mod/Ports
```

```
-----
100 2/1-2
```

```
Switch_A> (enable)
```

```
Switch_B> (enable) set vlan 100 3/1-2
VLAN 100 modified.
VLAN 1 modified.
VLAN Mod/Ports
```

```
-----
100 3/1-2
```

```
Switch_B> (enable)
```

- Step 2** Confirm the channeling status of the switches using the **show port channel** command.

```
Switch_A> (enable) show port channel
No ports channelling
Switch_A> (enable)
```

```
Switch_B> (enable) show port channel
No ports channelling
Switch_B> (enable)
```

- Step 3** In this example, configure EtherChannel as **on** for all ports. If you configure ports **on**, you must configure the ports on both ends of the EtherChannel bundle **on**. The switches will not negotiate an EtherChannel port bundle automatically in **on** mode. The system logging messages provide information about the formation of the EtherChannel bundle.

```
Switch_A> (enable) set port channel 2/1-2 on
Port(s) 2/1-2 channel mode set to on.
Switch_A> (enable) %PAGP-5-PORTFROMSTP:Port 2/1 left bridge port 2/1
%PAGP-5-PORTFROMSTP:Port 2/2 left bridge port 2/2
%PAGP-5-PORTTOSTP:Port 2/1 joined bridge port 2/1-2
%PAGP-5-PORTTOSTP:Port 2/2 joined bridge port 2/1-2
```

```
Switch_B> (enable) set port channel 3/1-2 on
Port(s) 3/1-2 channel mode set to on.
Switch_B> (enable) %PAGP-5-PORTFROMSTP:Port 3/1 left bridge port 3/1
%PAGP-5-PORTFROMSTP:Port 3/2 left bridge port 3/2
%PAGP-5-PORTTOSTP:Port 3/1 joined bridge port 3/1-2
%PAGP-5-PORTTOSTP:Port 3/2 joined bridge port 3/1-2
```

**Step 4** After the EtherChannel bundle is negotiated, enter the **show port channel** command to verify the configuration. If you configure only the ports on one side of the link **on**, the **show port channel** command will show that the ports are channeling, but no traffic will pass over the EtherChannel. Spanning tree loops can occur, and eventually the switch will disable the incorrectly configured EtherChannel.

```
Switch_A> (enable) show port channel
Port  Status      Channel  Channel  Neighbor  Neighbor
      mode        mode     status   device    device    port
-----
2/1   connected   on       channel  WS-C4003  JAB023806LN( 3/1
2/2   connected   on       channel  WS-C4003  JAB023806LN( 3/2
-----

Switch_A> (enable)

Switch_B> (enable) show port channel
Port  Status      Channel  Channel  Neighbor  Neighbor
      mode        mode     status   device    device    port
-----
3/1   connected   on       channel  WS-C4003  JAB023806JR( 2/1
3/2   connected   on       channel  WS-C4003  JAB023806JR( 2/2
-----

Switch_B> (enable)
```

## Understanding the LACP

Use the information in these sections if you are configuring EtherChannel using LACP. If you are using PAgP, see the “[Understanding the PAgP](#)” section on page 6-5.

### LACP Modes

You may manually turn on channeling by setting the port channel mode to **on**, and you may turn channeling off by setting the port channel mode to **off**.

If you want LACP to handle channeling, use the **active** and **passive** channel modes. To start automatic EtherChannel configuration with LACP, you need to configure at least one end of the link to **active** mode to initiate channeling, because ports in **passive** mode passively respond to initiation and never initiate the sending of LACP packets.

[Table 6-2](#) describes the EtherChannel modes that use LACP.

**Table 6-2 EtherChannel Modes That Use LACP**

Mode	Description
<b>on</b>	Mode that forces the port to channel without LACP. With the <b>on</b> mode, a usable EtherChannel exists only when a port group in <b>on</b> mode is connected to another port group in <b>on</b> mode.
<b>off</b>	Mode that prevents the port from channeling.

**Table 6-2 EtherChannel Modes That Use LACP (continued)**

Mode	Description
<b>passive</b> (Default)	LACP mode that places a port into a passive negotiating state in which the port responds to LACP packets it receives but does not initiate LACP packet negotiation.
<b>active</b>	LACP mode that places a port into an active negotiating state, in which the port initiates negotiations with other ports by sending LACP packets.

## LACP Parameters

LACP uses the following parameters:

- System priority

Each switch running LACP must have a system priority. You can specify the system priority automatically or through the CLI (see the [“Specifying the System Priority” section on page 6-19](#)). The switch uses the MAC address and the system priority to form the system ID and is also used during negotiation with other systems.

- Port priority

Each port in the switch must have a port priority. You can specify the port priority automatically or through the CLI (see the [“Specifying the Port Priority” section on page 6-19](#)). The port priority and the port number form the port identifier. The switch uses the port priority to decide which ports to put in standby mode when a hardware limitation prevents all compatible ports from aggregating.

- Administrative key

Each port in the switch must have an administrative key value. You can specify the administrative key value automatically or through the CLI (see the [“Specifying an Administrative Key Value” section on page 6-19](#)). The administrative key defines the ability of a port to aggregate with other ports. The following factors determine a port’s ability to aggregate with other ports:

- Port physical characteristics, such as data rate, duplex capability, and point-to-point or shared medium
- Configuration constraints that you establish

When enabled, LACP always tries to configure the maximum number of compatible ports in a channel, up to the maximum allowed by the hardware (eight ports). If LACP is not able to aggregate all the ports that are compatible (for example, the remote system might have more restrictive hardware limitations), then the system places all the ports that cannot be actively included in the channel in hot standby state and uses them only if one of the channeled ports fails.

You can configure different channels with ports that have been assigned the same administrative key. For example, if you assign eight ports to the same administrative key, you may configure four ports in a channel using LACP **active** mode and the remaining four ports in a manually configured channel using the **on** mode. An administrative key is meaningful only in the context of the switch that allocates it; there is no global significance to administrative key values.

## Configuring EtherChannel Using LACP

These sections describe how to configure EtherChannel using LACP:

- [Specifying the EtherChannel Protocol, page 6-18](#)
- [Specifying the System Priority, page 6-19](#)
- [Specifying the Port Priority, page 6-19](#)
- [Specifying an Administrative Key Value, page 6-19](#)
- [Changing the Channel Mode, page 6-20](#)
- [Specifying the Channel Path Cost, page 6-21](#)
- [Specifying the Channel VLAN Cost, page 6-21](#)
- [Clearing LACP Statistics, page 6-21](#)
- [Displaying EtherChannel Traffic Utilization, page 6-21](#)
- [Disabling an EtherChannel, page 6-22](#)
- [Displaying Spanning Tree-Related Information for EtherChannels, page 6-22](#)



**Note** Before you configure the EtherChannel, see the “[EtherChannel Configuration Guidelines and Restrictions](#)” section on page 6-3.

## Specifying the EtherChannel Protocol



**Note** The default protocol is PAgP.



**Note** You can specify only one protocol, PAgP or LACP, per module.

To specify the EtherChannel protocol, perform this task in privileged mode:

Task	Command
Specify the EtherChannel protocol.	<code>set channelprotocol [pagp   lacp] mod</code>

This example shows how to specify the LACP protocol for modules 2 and 3:

```
Console> (enable) set channelprotocol lacp 2,3
Mod 2 is set to LACP protocol.
Mod 3 is set to LACP protocol.
Console> (enable)
```

Use the `show channelprotocol` command to display the protocols for all modules.

## Specifying the System Priority



### Note

Although the **set lACP-channel system-priority** command is a global option, it applies only to modules on which LACP is enabled; it is ignored on modules running PAgP.

The system priority value must be a number in the range of 1–65,535, where higher numbers represent lower priority. The default priority is 32,768.

To specify the system priority, perform this task in privileged mode:

Task	Command
Specify the system priority.	<b>set lACP-channel system-priority</b> <i>value</i>

This example shows how to specify the system priority as 20,000:

```
Console> (enable) set lACP-channel system-priority 20000
LACP system priority is set to 20000
Console> (enable)
```

Use the **show lACP-channel sys-id** command to display the LACP system ID and system priority.

## Specifying the Port Priority

The port priority value must be a number in the range of 1–255, where higher numbers represent lower priority. The default priority is 128.

To specify the port priority, perform this task in privileged mode:

Task	Command
Specify the port priority.	<b>set port lACP-channel</b> <i>mod/ports</i> <b>port-priority</b> <i>value</i>

This example shows how to specify the port priority as 10 for ports 1/1 to 1/4 and 2/6 to 2/8:

```
Console> (enable) set port lACP-channel 1/1-4,2/6-8 port-priority 10
Port(s) 1/1-4,2/6-8 port-priority set to 10.
Console> (enable)
```

Use the **show lACP-channel group admin\_key info** command to display the port priority.

## Specifying an Administrative Key Value



### Note

When the system or module configuration information stored in NVRAM is cleared, the administrative keys are assigned new values automatically. For modules, each group of four consecutive ports, beginning at the 1st, 5th, 9th and so on, are assigned a unique administrative key. Across the module, ports must have unique administrative keys. After NVRAM is cleared, the channel mode of the ports is set to “passive.”

You can specify an administrative key value to a set of ports. If you do not specify an administrative key value, the system automatically selects a value. In both cases, the value can range from 1–1024.

If you choose a value for the administrative key, and this value has already been used in the system, then the system moves all the ports originally associated with the previously assigned administrative key value to another automatically assigned value, and it assigns the modules and ports you specified in the command to the administrative key value that you specified.

The maximum number of ports to which an administrative key can be assigned is eight.

The default mode for all ports being assigned the administrative key is passive; however, if the channel was previously assigned a particular mode (see the [“Changing the Channel Mode”](#) section on page 6-20), assigning the administrative key will not affect it—that is, the channel mode that you specified previously is maintained.

To specify the administrative key value, perform this task in privileged mode:

Task	Command
Specify the administrative key value.	<b>set port lacp-channel</b> <i>mod/ports</i> [ <i>admin_key</i> ]

This example assigns ports 4/1 to 4/4 the same administrative key, allowing the system to pick its value:

```
Console> (enable) set port lacp-channel 4/1-4
Port(s) 4/1-4 are assigned to admin key 96.
Console> (enable)
```

This example shows how to assign ports 4/4 to 4/6 the administrative key 96 (you specify the 96). In this example, the administrative key was previously assigned to another group of ports by the system (see the previous example), so those ports will be moved to another administrative key:

```
Console> (enable) set port lacp-channel 4/4-6 96
Port(s) 4/1-3 are moved to admin key 97.
Port(s) 4/4-6 are assigned to admin key 96.
Console> (enable)
```

This example shows the system response when more than eight ports are assigned the same administrative key value:

```
Console> (enable) set port lacp-port channel 2/1-2,4/1-8 123
No more than 8 ports can be assigned to an admin key.
Console> (enable)
```

Use the **show lacp-channel group** command to display administrative key values for ports.

## Changing the Channel Mode

You can change the channel mode for a set of ports that were previously assigned the same administrative key (see the [“Specifying an Administrative Key Value”](#) section on page 6-19).

To change the channel mode, perform this task in privileged mode:

Task	Command
Change the channel mode.	<b>set port lacp-channel</b> <i>mod/ports</i> <b>mode</b> [on   off   active   passive]

This example shows how to change the channel mode for ports 4/1 and 4/6, setting it to **on**. The administrative key for ports 4/1 and 4/6 is unchanged.

```
Console> (enable) set port lacp-channel 4/1,4/6 mode on
Port(s) 4/1,4/6 channel mode set to on.
Console> (enable)
```

Use the **show lacp-channel group admin\_key** command to display the channel mode for ports.

## Specifying the Channel Path Cost

You can specify the channel path cost by using a global command that configures both LACP and PAgP. For more information, see the [“Setting the EtherChannel Spanning Tree Port Cost”](#) section on page 6-8.

## Specifying the Channel VLAN Cost

You can specify the channel VLAN cost with a global command that configures both LACP and PAgP. See the [“Setting the EtherChannel Spanning Tree Port VLAN Cost”](#) section on page 6-9 for information.

## Clearing LACP Statistics

To clear LACP statistics, perform this task in privileged mode:

Task	Command
Clear LACP statistics.	<b>clear lacp-channel statistics</b>

This example shows how to clear LACP statistics:

```
Console> (enable) clear lacp-channel statistics
LACP channel counters are cleared.
Console> (enable)
```

## Displaying EtherChannel Traffic Utilization

To display the traffic utilization on the EtherChannel ports, perform this task:

Task	Command
Display traffic utilization.	<b>show lacp-channel traffic</b>

This example shows how to display traffic utilization on EtherChannel ports:

```
Console> (enable) show lacp-channel traffic
ChanId Port  Rx-Ucst Tx-Ucst  Rx-Mcst Tx-Mcst  Rx-Bcst Tx-Bcst
-----
   808  2/16   0.00%  0.00%   50.00%  75.75%   0.00%  0.00%
   808  2/17   0.00%  0.00%   50.00%  25.25%   0.00%  0.00%
   816  2/31   0.00%  0.00%   25.25%  50.50%   0.00%  0.00%
   816  2/32   0.00%  0.00%   75.75%  50.50%   0.00%  0.00%
Console> (enable)
```

## Disabling an EtherChannel

To disable an EtherChannel, perform this task for ports 2/2 to 2/8:

Task	Command
Disable an EtherChannel.	<b>set port lacp-channel <i>mod/port</i> mode off</b>

This example shows how to disable an EtherChannel:

```
Console> (enable) set port lacp-channel 2/2-8 mode off
Port(s) 2/2-8 channel mode set to off.
Console> (enable)
```

## Displaying Spanning Tree-Related Information for EtherChannels

You can display the channel ID and the truncated port list for all ports that are channeling. Ports that are not channeling are identified by their port number.

To display spanning tree-related information for EtherChannels, perform this task:

Task	Command
Display spanning-tree related information for EtherChannels.	<b>show spantree <i>mod/port</i></b>

These examples show how to display spanning tree-related information for EtherChannels:

```
Console> show spantree 4/6
Port          Vlan  Port-State    Cost  Priority  Portfast  Channel_id
-----
4/6           1     not-connected  4     32     disabled  0
Console>
```

```
Console> show spantree 4/7-8
Port          Vlan  Port-State    Cost  Priority  Portfast  Channel_id
-----
4/7-8        1     blocking      3     32     disabled  770
Console>
```