



# Configuring EtherChannels

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## Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table at the end of this module.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to <https://cfnng.cisco.com/>. An account on Cisco.com is not required.

## Restrictions for EtherChannels

- All ports in an EtherChannel must be assigned to the same VLAN or they must be configured as trunk ports.
- When the ports in an EtherChannel are configured as trunk ports, all the ports must be configured with the same mode (either Inter-Switch Link [ISL] or IEEE 802.1Q).

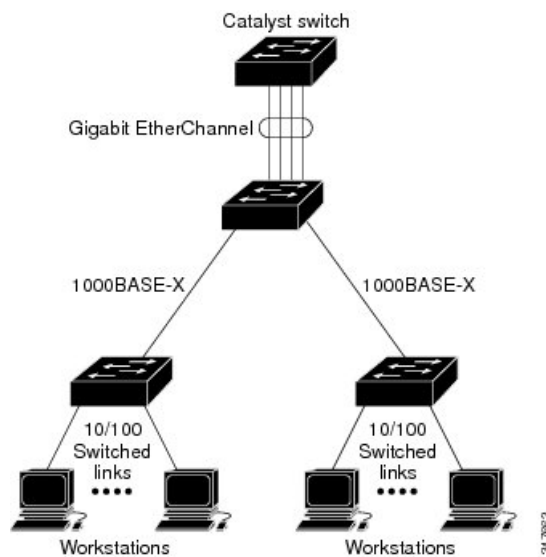
# Information About EtherChannels

## EtherChannel Overview

EtherChannel provides fault-tolerant high-speed links between switches, routers, and servers. You can use the EtherChannel to increase the bandwidth between the wiring closets and the data center, and you can deploy it anywhere in the network where bottlenecks are likely to occur. EtherChannel provides automatic recovery for the loss of a link by redistributing the load across the remaining links. If a link fails, EtherChannel redirects traffic from the failed link to the remaining links in the channel without intervention.

An EtherChannel consists of individual Ethernet links bundled into a single logical link.

**Figure 1: Typical EtherChannel Configuration**



The EtherChannel provides full-duplex bandwidth up to 8 Gb/s (Gigabit EtherChannel) or 40 Gb/s (10-Gigabit EtherChannel) between your switch and another switch or host. Note: Bandwidth up to 40 Gb/s (10-Gigabit EtherChannel) is supported with Cisco IOS Release 15.2(6)E and later releases.

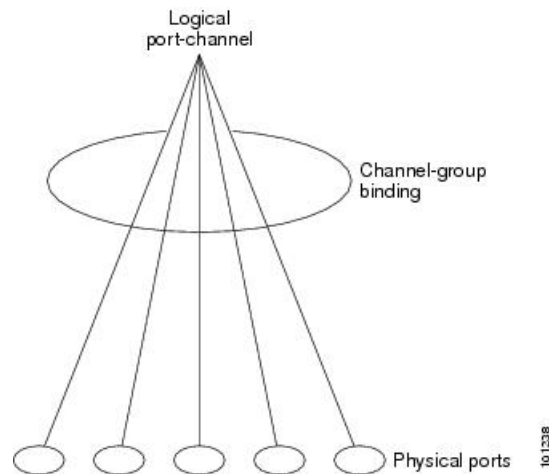
Each EtherChannel can consist of up to eight compatibly configured Ethernet ports.

## Channel Groups and Port-Channel Interfaces

An EtherChannel comprises a channel group and a port-channel interface. The channel group binds physical ports to the port-channel interface. Configuration changes applied to the port-channel interface apply to all the physical ports bound together in the channel group.

**Figure 2: Relationship of Physical Ports, Channel Group and Port-Channel Interface**

The **channel-group** command binds the physical port and the port-channel interface together. Each EtherChannel has a port-channel logical interface numbered from 1 to 6. This port-channel interface number corresponds to the one specified with the **channel-group** interface configuration command.



- With Layer 2 ports, use the **channel-group** interface configuration command to dynamically create the port-channel interface.

You also can use the **interface port-channel** *port-channel-number* global configuration command to manually create the port-channel interface, but then you must use the **channel-group** *channel-group-number* command to bind the logical interface to a physical port. The *channel-group-number* can be the same as the *port-channel-number*, or you can use a new number. If you use a new number, the **channel-group** command dynamically creates a new port channel.

#### Related Topics

[Creating Port-Channel Logical Interfaces](#)

[EtherChannel Configuration Guidelines](#), on page 8

[Default EtherChannel Configuration](#)

[Layer 2 EtherChannel Configuration Guidelines](#), on page 9

[Configuring the Physical Interfaces](#)

## Port Aggregation Protocol

The Port Aggregation Protocol (PAgP) is a Cisco-proprietary protocol that can be run only on Cisco switches and on those switches licensed by vendors to support PAgP. PAgP facilitates the automatic creation of EtherChannels by exchanging PAgP packets between Ethernet ports.

By using PAgP, the switch learns the identity of partners capable of supporting PAgP and the capabilities of each port. It then dynamically groups similarly configured ports (on a single switch) into a single logical link (channel or aggregate port). Similarly configured ports are grouped based on hardware, administrative, and port parameter constraints. For example, PAgP groups the ports with the same speed, duplex mode, native VLAN, VLAN range, and trunking status and type. After grouping the links into an EtherChannel, PAgP adds the group to the spanning tree as a single switch port.

## PAgP Modes

PAgP modes specify whether a port can send PAgP packets, which start PAgP negotiations, or only respond to PAgP packets received.

*Table 1: EtherChannel PAgP Modes*

Mode	Description
<b>auto</b>	Places a port into a passive negotiating state, in which the port responds to PAgP packets it receives but does not start PAgP packet negotiation. This setting minimizes the transmission of PAgP packets.
<b>desirable</b>	Places a port into an active negotiating state, in which the port starts negotiations with other ports by sending PAgP packets.

Switch ports exchange PAgP packets only with partner ports configured in the **auto** or **desirable** modes. Ports configured in the **on** mode do not exchange PAgP packets.

Both the **auto** and **desirable** modes enable ports to negotiate with partner ports to form an EtherChannel based on criteria such as port speed. and for Layer 2 EtherChannels, based on trunk state and VLAN numbers.

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

- A port in the **desirable** mode can form an EtherChannel with another port that is in the **desirable** or **auto** mode.
- A port in the **auto** mode can form an EtherChannel with another port in the **desirable** mode.

A port in the **auto** mode cannot form an EtherChannel with another port that is also in the **auto** mode because neither port starts PAgP negotiation.

### Related Topics

[Configuring Layer 2 EtherChannels](#), on page 12

[EtherChannel Configuration Guidelines](#), on page 8

[Default EtherChannel Configuration](#)

[Layer 2 EtherChannel Configuration Guidelines](#), on page 9

[Creating Port-Channel Logical Interfaces](#)

[Configuring the Physical Interfaces](#)

### Silent Mode

If your switch is connected to a partner that is PAgP-capable, you can configure the switch port for nonsilent operation by using the **non-silent** keyword. If you do not specify **non-silent** with the **auto** or **desirable** mode, silent mode is assumed.

Use the silent mode when the switch is connected to a device that is not PAgP-capable and seldom, if ever, sends packets. An example of a silent partner is a file server or a packet analyzer that is not generating traffic. In this case, running PAgP on a physical port connected to a silent partner prevents that switch port from ever becoming operational. However, the silent setting allows PAgP to operate, to attach the port to a channel group, and to use the port for transmission.

### Related Topics

[Configuring Layer 2 EtherChannels](#), on page 12

[EtherChannel Configuration Guidelines](#), on page 8  
[Default EtherChannel Configuration](#)  
[Layer 2 EtherChannel Configuration Guidelines](#), on page 9  
[Creating Port-Channel Logical Interfaces](#)  
[Configuring the Physical Interfaces](#)

## PAgP Learn Method and Priority

Network devices are classified as PAgP physical learners or aggregate-port learners. A device is a physical learner if it learns addresses by physical ports and directs transmissions based on that knowledge. A device is an aggregate-port learner if it learns addresses by aggregate (logical) ports. The learn method must be configured the same at both ends of the link.

When a device and its partner are both aggregate-port learners, they learn the address on the logical port-channel. The device sends packets to the source by using any of the ports in the EtherChannel. With aggregate-port learning, it is not important on which physical port the packet arrives.

PAgP cannot automatically detect when the partner device is a physical learner and when the local device is an aggregate-port learner. Therefore, you must manually set the learning method on the local device to learn addresses by physical ports. You also must set the load-distribution method to source-based distribution, so that any given source MAC address is always sent on the same physical port.

You also can configure a single port within the group for all transmissions and use other ports for hot-standby. The unused ports in the group can be swapped into operation in just a few seconds if the selected single port loses hardware-signal detection. You can configure which port is always selected for packet transmission by changing its priority with the **pagp port-priority** interface configuration command. The higher the priority, the more likely that the port will be selected.



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**Note** The switch supports address learning only on aggregate ports even though the **physical-port** keyword is provided in the CLI. The **pagp learn-method** command and the **pagp port-priority** command have no effect on the switch hardware, but they are required for PAgP interoperability with devices that only support address learning by physical ports, such as the Catalyst 1900 switch.

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### Related Topics

[Configuring the PAgP Learn Method and Priority](#), on page 14  
[EtherChannel Configuration Guidelines](#), on page 8  
[Default EtherChannel Configuration](#)  
[Monitoring EtherChannel, PAgP, and LACP Status](#), on page 23  
[Layer 2 EtherChannel Configuration Guidelines](#), on page 9

## PAgP Interaction with Virtual Switches and Dual-Active Detection

A virtual switch can be two or more core switches connected by virtual switch links (VSLs) that carry control and data traffic between them. One of the switches is in active mode. The others are in standby mode. For redundancy, remote switches are connected to the virtual switch by remote satellite links (RSLs).

If the VSL between two switches fails, one switch does not know the status of the other. Both switches could change to the active mode, causing a *dual-active situation* in the network with duplicate configurations (including duplicate IP addresses and bridge identifiers). The network might go down.

To prevent a dual-active situation, the core switches send PAgP protocol data units (PDUs) through the RSLs to the remote switches. The PAgP PDUs identify the active switch, and the remote switches forward the PDUs to core switches so that the core switches are in sync. If the active switch fails or resets, the standby switch takes over as the active switch. If the VSL goes down, one core switch knows the status of the other and does not change its state.

## PAgP Interaction with Other Features

The Dynamic Trunking Protocol (DTP) and the Cisco Discovery Protocol (CDP) send and receive packets over the physical ports in the EtherChannel. Trunk ports send and receive PAgP protocol data units (PDUs) on the lowest numbered VLAN.

In Layer 2 EtherChannels, the first port in the channel that comes up provides its MAC address to the EtherChannel. If this port is removed from the bundle, one of the remaining ports in the bundle provides its MAC address to the EtherChannel.

PAgP sends and receives PAgP PDUs only from ports that are up and have PAgP enabled for the auto or desirable mode.

## Link Aggregation Control Protocol

The LACP is defined in IEEE 802.3ad and enables Cisco switches to manage Ethernet channels between switches that conform to the IEEE 802.3ad protocol. LACP facilitates the automatic creation of EtherChannels by exchanging LACP packets between Ethernet ports.

By using LACP, the switch learns the identity of partners capable of supporting LACP and the capabilities of each port. It then dynamically groups similarly configured ports into a single logical link (channel or aggregate port). Similarly configured ports are grouped based on hardware, administrative, and port parameter constraints. For example, LACP groups the ports with the same speed, duplex mode, native VLAN, VLAN range, and trunking status and type. After grouping the links into an EtherChannel, LACP adds the group to the spanning tree as a single switch port.

The independent mode behavior of ports in a port channel is changed. With CSCtn96950, by default, standalone mode is enabled. When no response is received from an LACP peer, ports in the port channel are moved to suspended state.

## LACP Modes

LACP modes specify whether a port can send LACP packets or only receive LACP packets.

*Table 2: EtherChannel LACP Modes*

Mode	Description
<b>active</b>	Places a port into an active negotiating state in which the port starts negotiations with other ports by sending LACP packets.
<b>passive</b>	Places a port into a passive negotiating state in which the port responds to LACP packets that it receives, but does not start LACP packet negotiation. This setting minimizes the transmission of LACP packets.

Both the **active** and **passive LACP** modes enable ports to negotiate with partner ports to an EtherChannel based on criteria such as port speed, and for Layer 2 EtherChannels, based on trunk state and VLAN numbers.

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

- A port in the **active** mode can form an EtherChannel with another port that is in the **active** or **passive** mode.
- A port in the **passive** mode cannot form an EtherChannel with another port that is also in the **passive** mode because neither port starts LACP negotiation.

#### Related Topics

[Configuring Layer 2 EtherChannels](#) , on page 12

[EtherChannel Configuration Guidelines](#), on page 8

[Default EtherChannel Configuration](#)

[Layer 2 EtherChannel Configuration Guidelines](#), on page 9

## LACP Interaction with Other Features

The DTP and the CDP send and receive packets over the physical ports in the EtherChannel. Trunk ports send and receive LACP PDUs on the lowest numbered VLAN.

In Layer 2 EtherChannels, the first port in the channel that comes up provides its MAC address to the EtherChannel. If this port is removed from the bundle, one of the remaining ports in the bundle provides its MAC address to the EtherChannel.

LACP sends and receives LACP PDUs only from ports that are up and have LACP enabled for the active or passive mode.

## EtherChannel On Mode

EtherChannel **on** mode can be used to manually configure an EtherChannel. The **on** mode forces a port to join an EtherChannel without negotiations. The **on** mode can be useful if the remote device does not support PAGP or LACP. In the **on** mode, a usable EtherChannel exists only when the switches at both ends of the link are configured in the **on** mode.

Ports that are configured in the **on** mode in the same channel group must have compatible port characteristics, such as speed and duplex. Ports that are not compatible are suspended, even though they are configured in the **on** mode.



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**Caution** You should use care when using the **on** mode. This is a manual configuration, and ports on both ends of the EtherChannel must have the same configuration. If the group is misconfigured, packet loss or spanning-tree loops can occur.

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## Default EtherChannel Configuration

The default EtherChannel configuration is described in this table.

**Table 3: Default EtherChannel Configuration**

Feature	Default Setting
Channel groups	None assigned.
Port-channel logical interface	None defined.
PAgP mode	No default.
PAgP learn method	Aggregate-port learning on all ports.
PAgP priority	128 on all ports.
LACP mode	No default.
LACP learn method	Aggregate-port learning on all ports.
LACP port priority	32768 on all ports.
LACP system priority	32768.
LACP system ID	LACP system priority and the switch MAC address.

## EtherChannel Configuration Guidelines

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

- Configure a PAgP EtherChannel with up to eight Ethernet ports of the same type.
- Configure a LACP EtherChannel with up to 16 Ethernet ports of the same type. Up to eight ports can be active, and up to eight ports can be in standby mode.
- Configure all ports in an EtherChannel to operate at the same speeds and duplex modes.
- Enable all ports in an EtherChannel. A port in an EtherChannel that is disabled by using the **shutdown** interface configuration command is treated as a link failure, and its traffic is transferred to one of the remaining ports in the EtherChannel.
- When a group is first created, all ports follow the parameters set for the first port to be added to the group. If you change the configuration of one of these parameters, you must also make the changes to all ports in the group:
  - Allowed-VLAN list
  - Spanning-tree path cost for each VLAN
  - Spanning-tree port priority for each VLAN
  - Spanning-tree Port Fast setting



- Do not configure a port to be a member of more than one EtherChannel group.
- Do not configure an EtherChannel in both the PAgP and LACP modes. EtherChannel groups running PAgP and LACP can coexist on the same switch. Individual EtherChannel groups can run either PAgP or LACP, but they cannot interoperate.
- Do not configure a secure port as part of an EtherChannel or the reverse.
- Do not configure a port that is an active or a not-yet-active member of an EtherChannel as an IEEE 802.1x port. If you try to enable IEEE 802.1x on an EtherChannel port, an error message appears, and IEEE 802.1x is not enabled.
- If EtherChannels are configured on switch interfaces, remove the EtherChannel configuration from the interfaces before globally enabling IEEE 802.1x on a switch by using the **dot1x system-auth-control** global configuration command.
- Do not enable link-state tracking on individual interfaces that will be part of a downstream Etherchannel interface.

### Related Topics

- [Configuring Layer 2 EtherChannels](#) , on page 12
- [EtherChannel Overview](#)
- [EtherChannel Modes](#)
- [EtherChannel on Switches](#)
- [EtherChannel Link Failover](#)
- [LACP Modes](#), on page 6
- [PAgP Modes](#) , on page 4
- [Silent Mode](#), on page 4
- [Creating Port-Channel Logical Interfaces](#)
- [Channel Groups and Port-Channel Interfaces](#), on page 2
- [Configuring the Physical Interfaces](#)
- [Configuring EtherChannel Load-Balancing](#)
- [Load-Balancing and Forwarding Methods](#)
- [MAC Address Forwarding](#)
- [IP Address Forwarding](#)
- [Load-Balancing Advantages](#)
- [Configuring the PAgP Learn Method and Priority](#) , on page 14
- [PAgP Learn Method and Priority](#), on page 5
- [Configuring the LACP System Priority](#) , on page 16
- [Configuring the LACP Port Priority](#) , on page 17

## Layer 2 EtherChannel Configuration Guidelines

When configuring Layer 2 EtherChannels, follow these guidelines:

- Assign all ports in the EtherChannel to the same VLAN, or configure them as trunks. Ports with different native VLANs cannot form an EtherChannel.
- An EtherChannel supports the same allowed range of VLANs on all the ports in a trunking Layer 2 EtherChannel. If the allowed range of VLANs is not the same, the ports do not form an EtherChannel even when PAgP is set to the **auto** or **desirable** mode.

- Ports with different spanning-tree path costs can form an EtherChannel if they are otherwise compatibly configured. Setting different spanning-tree path costs does not, by itself, make ports incompatible for the formation of an EtherChannel.

### Related Topics

- [Configuring Layer 2 EtherChannels](#) , on page 12
- [EtherChannel Overview](#)
- [EtherChannel Modes](#)
- [EtherChannel on Switches](#)
- [EtherChannel Link Failover](#)
- [LACP Modes](#), on page 6
- [PAgP Modes](#) , on page 4
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- [Creating Port-Channel Logical Interfaces](#)
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- [Configuring EtherChannel Load-Balancing](#)
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- [Configuring the PAgP Learn Method and Priority](#) , on page 14
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- [Configuring the LACP System Priority](#) , on page 16
- [Configuring the LACP Port Priority](#) , on page 17

## Auto-LAG

The auto-LAG feature provides the ability to auto create EtherChannels on ports connected to a switch. By default, auto-LAG is disabled globally and is enabled on all port interfaces. The auto-LAG applies to a switch only when it is enabled globally.

On enabling auto-LAG globally, the following scenarios are possible:

- All port interfaces participate in creation of auto EtherChannels provided the partner port interfaces have EtherChannel configured on them. For more information, see the "*The supported auto-LAG configurations between the actor and partner devices*" table below.
- Ports that are already part of manual EtherChannels cannot participate in creation of auto EtherChannels.
- When auto-LAG is disabled on a port interface that is already a part of an auto created EtherChannel, the port interface will unbundle from the auto EtherChannel.

The following table shows the supported auto-LAG configurations between the actor and partner devices:

**Table 4: The supported auto-LAG configurations between the actor and partner devices**

Actor/Partner	Active	Passive	Auto
Active	Yes	Yes	Yes

Passive	Yes	No	Yes
Auto	Yes	Yes	Yes

On disabling auto-LAG globally, all auto created Etherchannels become manual EtherChannels.

You cannot add any configurations in an existing auto created EtherChannel. To add, you should first convert it into a manual EtherChannel by executing the **port-channel**<channel-number>**persistent**.



**Note** Auto-LAG uses the LACP protocol to create auto EtherChannel. Only one EtherChannel can be automatically created with the unique partner devices.

#### Related Topics

- [Configuring Auto-LAG Globally](#), on page 20
- [Configuring Auto LAG: Examples](#), on page 25
- [Configuring Auto-LAG on a Port Interface](#), on page 21
- [Configuring Persistence with Auto-LAG](#), on page 22
- [Auto-LAG Configuration Guidelines](#), on page 11

## Auto-LAG Configuration Guidelines

Follow these guidelines when configuring the auto-LAG feature.

- When auto-LAG is enabled globally and on the port interface, and if you do not want the port interface to become a member of the auto EtherChannel, disable the auto-LAG on the port interface.
- A port interface will not bundle to an auto EtherChannel when it is already a member of a manual EtherChannel. To allow it to bundle with the auto EtherChannel, first unbundle the manual EtherChannel on the port interface.
- When auto-LAG is enabled and auto EtherChannel is created, you can create multiple EtherChannels manually with the same partner device. But by default, the port tries to create auto EtherChannel with the partner device.
- The auto-LAG is supported only on Layer 2 EtherChannel. It is not supported on Layer 3 interface and Layer 3 EtherChannel.

#### Related Topics

- [Configuring Auto-LAG Globally](#), on page 20
- [Configuring Auto LAG: Examples](#), on page 25
- [Configuring Auto-LAG on a Port Interface](#), on page 21
- [Configuring Persistence with Auto-LAG](#), on page 22
- [Auto-LAG](#), on page 10

# How to Configure EtherChannels

After you configure an EtherChannel, configuration changes applied to the port-channel interface apply to all the physical ports assigned to the port-channel interface, and configuration changes applied to the physical port affect only the port where you apply the configuration.

## Configuring Layer 2 EtherChannels

You configure Layer 2 EtherChannels by assigning ports to a channel group with the **channel-group** interface configuration command. This command automatically creates the port-channel logical interface.

### SUMMARY STEPS

1. **configure terminal**
2. **interface** *interface-id*
3. **switchport mode** {access | trunk}
4. **switchport access vlan** *vlan-id*
5. **channel-group** *channel-group-number* **mode** {auto [non-silent] | desirable [non-silent] | on } | { active | passive}
6. **end**

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b> <b>Example:</b> Switch# <b>configure terminal</b>	Enters global configuration mode.
<b>Step 2</b>	<b>interface</b> <i>interface-id</i> <b>Example:</b> Switch(config)# <b>interface</b> gigabitethernet0/1	Specifies a physical port, and enters interface configuration mode.  Valid interfaces are physical ports.  For a PAgP EtherChannel, you can configure up to eight ports of the same type and speed for the same group.  For a LACP EtherChannel, you can configure up to 16 Ethernet ports of the same type. Up to eight ports can be active, and up to eight ports can be in standby mode.
<b>Step 3</b>	<b>switchport mode</b> {access   trunk} <b>Example:</b> Switch(config-if)# <b>switchport mode</b> access	Assigns all ports as static-access ports in the same VLAN, or configure them as trunks.  If you configure the port as a static-access port, assign it to only one VLAN. The range is 1 to 4094.

	Command or Action	Purpose
Step 4	<p><b>switchport access vlan</b> <i>vlan-id</i></p> <p><b>Example:</b></p> <pre>Switch(config-if)# <b>switchport access vlan 22</b></pre>	<p>(Optional) If you configure the port as a static-access port, assign it to only one VLAN. The range is 1 to 4094.</p>
Step 5	<p><b>channel-group</b> <i>channel-group-number</i> <b>mode</b> {<b>auto</b> [<b>non-silent</b>]   <b>desirable</b> [<b>non-silent</b>]   <b>on</b> }   {<b>active</b>   <b>passive</b>}</p> <p><b>Example:</b></p> <pre>Switch(config-if)# <b>channel-group 5 mode auto</b></pre>	<p>Assigns the port to a channel group, and specifies the PAGP or the LACP mode.</p> <p>For <i>channel-group-number</i>, the range is 1 to 6.</p> <p>For <b>mode</b>, select one of these keywords:</p> <ul style="list-style-type: none"> <li>• <b>auto</b>—Enables PAGP only if a PAGP device is detected. It places the port into a passive negotiating state, in which the port responds to PAGP packets it receives but does not start PAGP packet negotiation..</li> <li>• <b>desirable</b>—Unconditionally enables PAGP. It places the port into an active negotiating state, in which the port starts negotiations with other ports by sending PAGP packets. .</li> <li>• <b>on</b>—Forces the port to channel without PAGP or LACP. In the <b>on</b> mode, an EtherChannel exists only when a port group in the <b>on</b> mode is connected to another port group in the <b>on</b> mode.</li> <li>• <b>non-silent</b>—(Optional) If your switch is connected to a partner that is PAGP-capable, configures the switch port for nonsilent operation when the port is in the <b>auto</b> or <b>desirable</b> mode. If you do not specify <b>non-silent</b>, silent is assumed. The silent setting is for connections to file servers or packet analyzers. This setting allows PAGP to operate, to attach the port to a channel group, and to use the port for transmission.</li> <li>• <b>active</b>—Enables LACP only if a LACP device is detected. It places the port into an active negotiating state in which the port starts negotiations with other ports by sending LACP packets.</li> <li>• <b>passive</b>—Enables LACP on the port and places it into a passive negotiating state in which the port responds to LACP packets that it receives, but does not start LACP packet negotiation.</li> </ul>
Step 6	<p><b>end</b></p> <p><b>Example:</b></p> <pre>Switch(config-if)# <b>end</b></pre>	<p>Returns to privileged EXEC mode.</p>

**Related Topics**

- [EtherChannel Overview](#)
- [EtherChannel Modes](#)
- [EtherChannel on Switches](#)
- [EtherChannel Link Failover](#)
- [LACP Modes](#), on page 6
- [PAgP Modes](#) , on page 4
- [Silent Mode](#), on page 4
- [EtherChannel Configuration Guidelines](#), on page 8
- [Default EtherChannel Configuration](#)
- [Layer 2 EtherChannel Configuration Guidelines](#), on page 9

## Configuring the PAgP Learn Method and Priority

This task is optional.

**SUMMARY STEPS**

1. **configure terminal**
2. **interface** *interface-id*
3. **pagp learn-method physical-port**
4. **pagp port-priority** *priority*
5. **end**

**DETAILED STEPS**

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b> <b>Example:</b> Switch# <b>configure terminal</b>	Enters global configuration mode.
<b>Step 2</b>	<b>interface</b> <i>interface-id</i> <b>Example:</b> Switch(config)# <b>interface gigabitethernet 0/2</b>	Specifies the port for transmission, and enters interface configuration mode.
<b>Step 3</b>	<b>pagp learn-method physical-port</b> <b>Example:</b> Switch(config-if)# <b>pagp learn-method physical port</b>	Selects the PAgP learning method.  By default, <b>aggregation-port learning</b> is selected, which means the switch sends packets to the source by using any of the ports in the EtherChannel. With aggregate-port learning, it is not important on which physical port the packet arrives.  Selects <b>physical-port</b> to connect with another switch that is a physical learner.

	Command or Action	Purpose
		The learning method must be configured the same at both ends of the link.
<b>Step 4</b>	<p><b>pagp port-priority</b> <i>priority</i></p> <p><b>Example:</b></p> <pre>Switch(config-if) # pagp port-priority 200</pre>	<p>Assigns a priority so that the selected port is chosen for packet transmission.</p> <p>For <i>priority</i>, the range is 0 to 255. The default is 128. The higher the priority, the more likely that the port will be used for PAgP transmission.</p>
<b>Step 5</b>	<p><b>end</b></p> <p><b>Example:</b></p> <pre>Switch(config-if) # end</pre>	Returns to privileged EXEC mode.

#### Related Topics

- [PAgP Learn Method and Priority](#), on page 5
- [EtherChannel Configuration Guidelines](#), on page 8
- [Default EtherChannel Configuration](#)
- [Monitoring EtherChannel, PAgP, and LACP Status](#), on page 23
- [Layer 2 EtherChannel Configuration Guidelines](#), on page 9

## Configuring LACP Hot-Standby Ports

When enabled, LACP tries to configure the maximum number of LACP-compatible ports in a channel, up to a maximum of 16 ports. Only eight LACP links can be active at one time. The software places any additional links in a hot-standby mode. If one of the active links becomes inactive, a link that is in the hot-standby mode becomes active in its place.

If you configure more than eight links for an EtherChannel group, the software automatically decides which of the hot-standby ports to make active based on the LACP priority. To every link between systems that operate LACP, the software assigns a unique priority made up of these elements (in priority order):

- LACP system priority
- System ID (the switch MAC address)
- LACP port priority
- Port number

In priority comparisons, numerically lower values have higher priority. The priority decides which ports should be put in standby mode when there is a hardware limitation that prevents all compatible ports from aggregating.

Determining which ports are active and which are hot standby is a two-step procedure. First the system with a numerically lower system priority and system ID is placed in charge of the decision. Next, that system decides which ports are active and which are hot standby, based on its values for port priority and port number. The port priority and port number values for the other system are not used.

You can change the default values of the LACP system priority and the LACP port priority to affect how the software selects active and standby links.

## Configuring the LACP System Priority

You can configure the system priority for all the EtherChannels that are enabled for LACP by using the **lACP system-priority** global configuration command. You cannot configure a system priority for each LACP-configured channel. By changing this value from the default, you can affect how the software selects active and standby links.

You can use the **show etherchannel summary** privileged EXEC command to see which ports are in the hot-standby mode (denoted with an H port-state flag).

Follow these steps to configure the LACP system priority. This procedure is optional.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **lACP system-priority *priority***
4. **end**

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b> <b>Example:</b> Switch> <b>enable</b>	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2</b>	<b>configure terminal</b> <b>Example:</b> Switch# <b>configure terminal</b>	Enters global configuration mode.
<b>Step 3</b>	<b>lACP system-priority <i>priority</i></b> <b>Example:</b> Switch(config)# <b>lACP system-priority 32000</b>	Configures the LACP system priority. The range is 1 to 65535. The default is 32768. The lower the value, the higher the system priority.
<b>Step 4</b>	<b>end</b> <b>Example:</b> Switch(config)# <b>end</b>	Returns to privileged EXEC mode.

### Related Topics

[EtherChannel Configuration Guidelines](#), on page 8



[Default EtherChannel Configuration](#)

[Layer 2 EtherChannel Configuration Guidelines](#), on page 9

[Monitoring EtherChannel, PAgP, and LACP Status](#), on page 23

## Configuring the LACP Port Priority

By default, all ports use the same port priority. If the local system has a lower value for the system priority and the system ID than the remote system, you can affect which of the hot-standby links become active first by changing the port priority of LACP EtherChannel ports to a lower value than the default. The hot-standby ports that have lower port numbers become active in the channel first. You can use the **show etherchannel summary** privileged EXEC command to see which ports are in the hot-standby mode (denoted with an H port-state flag).



**Note** If LACP is not able to aggregate all the ports that are compatible (for example, the remote system might have more restrictive hardware limitations), all the ports that cannot be actively included in the EtherChannel are put in the hot-standby state and are used only if one of the channeled ports fails.

Follow these steps to configure the LACP port priority. This procedure is optional.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *interface-id*
4. **lACP port-priority** *priority*
5. **end**

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>enable</b> <b>Example:</b> Switch> <b>enable</b>	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
Step 2	<b>configure terminal</b> <b>Example:</b> Switch# <b>configure terminal</b>	Enters global configuration mode.
Step 3	<b>interface</b> <i>interface-id</i> <b>Example:</b> Switch(config)# <b>interface gigabitethernet 0/2</b>	Specifies the port to be configured, and enters interface configuration mode.

	Command or Action	Purpose
<b>Step 4</b>	<b>lacp port-priority</b> <i>priority</i> <b>Example:</b> Switch(config-if)# <b>lacp port-priority</b> 32000	Configures the LACP port priority.  The range is 1 to 65535. The default is 32768. The lower the value, the more likely that the port will be used for LACP transmission.
<b>Step 5</b>	<b>end</b> <b>Example:</b> Switch(config-if)# <b>end</b>	Returns to privileged EXEC mode.

### Related Topics

- [EtherChannel Configuration Guidelines](#), on page 8
- [Default EtherChannel Configuration](#)
- [Layer 2 EtherChannel Configuration Guidelines](#), on page 9
- [Monitoring EtherChannel, PAgP, and LACP Status](#), on page 23

## Configuring the LACP Port Channel Min-Links Feature

You can specify the minimum number of active ports that must be in the link-up state and bundled in an EtherChannel for the port channel interface to transition to the link-up state. Using EtherChannel min-links, you can prevent low-bandwidth LACP EtherChannels from becoming active. Port channel min-links also cause LACP EtherChannels to become inactive if they have too few active member ports to supply the required minimum bandwidth.

To configure the minimum number of links that are required for a port channel. Perform the following tasks.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface port-channel** *channel-number*
4. **port-channel min-links** *min-links-number*
5. **end**

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b> <b>Example:</b> Switch> <b>enable</b>	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>

	Command or Action	Purpose
Step 2	<b>configure terminal</b> <b>Example:</b> <pre>Switch# configure terminal</pre>	Enters global configuration mode.
Step 3	<b>interface port-channel <i>channel-number</i></b> <b>Example:</b> <pre>Switch(config)# interface port-channel 2</pre>	Enters interface configuration mode for a port-channel. For <i>channel-number</i> , the range is 1 to 6.
Step 4	<b>port-channel min-links <i>min-links-number</i></b> <b>Example:</b> <pre>Switch(config-if)# port-channel min-links 3</pre>	Specifies the minimum number of member ports that must be in the link-up state and bundled in the EtherChannel for the port channel interface to transition to the link-up state. For <i>min-links-number</i> , the range is 2 to 8.
Step 5	<b>end</b> <b>Example:</b> <pre>Switch(config)# end</pre>	Returns to privileged EXEC mode.

#### Related Topics

[Configuring LACP Port Channel Min-Links: Examples](#), on page 26

## Configuring LACP Fast Rate Timer

You can change the LACP timer rate to modify the duration of the LACP timeout. Use the **lacp rate** command to set the rate at which LACP control packets are received by an LACP-supported interface. You can change the timeout rate from the default rate (30 seconds) to the fast rate (1 second). This command is supported only on LACP-enabled interfaces.

#### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface { fastethernet | gigabitethernet | tengigabitethernet } slot/port**
4. **lacp rate { normal | fast }**
5. **end**
6. **show lacp internal**

#### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>enable</b>	Enables privileged EXEC mode.

	Command or Action	Purpose
	<b>Example:</b>  Switch> <b>enable</b>	<ul style="list-style-type: none"> <li>Enter your password if prompted.</li> </ul>
<b>Step 2</b>	<b>configure terminal</b>  <b>Example:</b>  Switch# <b>configure terminal</b>	Enters global configuration mode.
<b>Step 3</b>	<b>interface {fastethernet   gigabitethernet   tengigabitethernet} slot/port</b>  <b>Example:</b>  Switch(config)# <b>interface gigabitEthernet 2/1</b>	Configures an interface and enters interface configuration mode.
<b>Step 4</b>	<b>lacp rate {normal   fast}</b>  <b>Example:</b>  Switch(config-if)# <b>lacp rate fast</b>	Configures the rate at which LACP control packets are received by an LACP-supported interface. <ul style="list-style-type: none"> <li>To reset the timeout rate to its default, use the <b>no lacp rate</b> command.</li> </ul>
<b>Step 5</b>	<b>end</b>  <b>Example:</b>  Switch(config)# <b>end</b>	Returns to privileged EXEC mode.
<b>Step 6</b>	<b>show lacp internal</b>  <b>Example:</b>  Switch# <b>show lacp internal</b> Switch# <b>show lacp counters</b>	Verifies your configuration.

### Related Topics

[Example: Configuring LACP Fast Rate Timer](#), on page 27

## Configuring Auto-LAG Globally

### SUMMARY STEPS

- enable**
- configure terminal**
- [no] port-channel auto**
- end**
- show etherchannel auto**

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>enable</b> <b>Example:</b> Switch> <b>enable</b>	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
Step 2	<b>configure terminal</b> <b>Example:</b> Switch# <b>configure terminal</b>	Enters global configuration mode.
Step 3	<b>[no] port-channel auto</b> <b>Example:</b> Switch(config)# <b>port-channel auto</b>	Enables the auto-LAG feature on a switch globally. Use the no form of this command to disable the auto-LAG feature on the switch globally.  <b>Note</b> By default, the auto-LAG feature is enabled on the port.
Step 4	<b>end</b> <b>Example:</b> Switch(config)# <b>end</b>	Returns to privileged EXEC mode.
Step 5	<b>show etherchannel auto</b> <b>Example:</b> Switch# <b>show etherchannel auto</b>	Displays that EtherChannel is created automatically.

## Related Topics

- [Auto-LAG](#), on page 10
- [Auto-LAG Configuration Guidelines](#), on page 11
- [Configuring Auto LAG: Examples](#), on page 25
- [Configuring Auto-LAG on a Port Interface](#), on page 21
- [Configuring Persistence with Auto-LAG](#), on page 22

## Configuring Auto-LAG on a Port Interface

## SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *interface-id*
4. **[no] channel-group auto**
5. **end**
6. **show etherchannel auto**

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b> <b>Example:</b> Switch> <b>enable</b>	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2</b>	<b>configure terminal</b> <b>Example:</b> Switch# <b>configure terminal</b>	Enters global configuration mode.
<b>Step 3</b>	<b>interface <i>interface-id</i></b> <b>Example:</b> Switch(config)# <b>interface gigabitethernet 0/1</b>	Specifies the port interface to be enabled for auto-LAG, and enters interface configuration mode.
<b>Step 4</b>	<b>[no] channel-group auto</b> <b>Example:</b> Switch(config-if)# <b>channel-group auto</b>	(Optional) Enables auto-LAG feature on individual port interface. Use the no form of this command to disable the auto-LAG feature on individual port interface.  <b>Note</b> By default, the auto-LAG feature is enabled on the port.
<b>Step 5</b>	<b>end</b> <b>Example:</b> Switch(config-if)# <b>end</b>	Returns to privileged EXEC mode.
<b>Step 6</b>	<b>show etherchannel auto</b> <b>Example:</b> Switch# <b>show etherchannel auto</b>	Displays that EtherChannel is created automatically.

**What to do next****Related Topics**

[Configuring Auto-LAG Globally](#), on page 20

[Auto-LAG](#), on page 10

[Auto-LAG Configuration Guidelines](#), on page 11

[Configuring Persistence with Auto-LAG](#), on page 22

[Configuring Auto LAG: Examples](#), on page 25

## Configuring Persistence with Auto-LAG

You use the persistence command to convert the auto created EtherChannel into a manual one and allow you to add configuration on the existing EtherChannel.

## SUMMARY STEPS

1. `enable`
2. `port-channel channel-number persistent`
3. `show etherchannel summary`

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>enable</b> <b>Example:</b> Switch> <code>enable</code>	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
Step 2	<b>port-channel channel-number persistent</b> <b>Example:</b> Switch# <code>port-channel 1 persistent</code>	Converts the auto created EtherChannel into a manual one and allows you to add configuration on the EtherChannel.
Step 3	<b>show etherchannel summary</b> <b>Example:</b> Switch# <code>show etherchannel summary</code>	Displays the EtherChannel information.

## Related Topics

- [Configuring Auto-LAG Globally](#), on page 20
- [Auto-LAG](#), on page 10
- [Auto-LAG Configuration Guidelines](#), on page 11
- [Configuring Auto-LAG on a Port Interface](#), on page 21
- [Configuring Auto LAG: Examples](#), on page 25

## Monitoring EtherChannel, PAgP, and LACP Status

You can display EtherChannel, PAgP, and LACP status using the commands listed in this table.

*Table 5: Commands for Monitoring EtherChannel, PAgP, and LACP Status*

Command	Description
<b>clear lacp</b> { <i>channel-group-number</i> <b>counters</b>   <b>counters</b> }	Clears LACP channel-group information and traffic counters.
<b>clear pagp</b> { <i>channel-group-number</i> <b>counters</b>   <b>counters</b> }	Clears PAgP channel-group information and traffic counters.

Command	Description
<b>show etherchannel</b> [ <i>channel-group-number</i> { <b>detail</b>   <b>load-balance</b>   <b>port</b>   <b>port-channel</b>   <b>protocol</b>   <b>summary</b> } ] [ <b>detail</b>   <b>load-balance</b>   <b>port</b>   <b>port-channel</b>   <b>protocol</b>   <b>auto</b>   <b>summary</b> ]	Displays EtherChannel information in a brief, detailed, and one-line summary form. Also displays the load-balance or frame-distribution scheme, port, port-channel, protocol, and Auto-LAG information.
<b>show pagp</b> [ <i>channel-group-number</i> ] { <b>counters</b>   <b>internal</b>   <b>neighbor</b> }	Displays PAgP information such as traffic information, the internal PAgP configuration, and neighbor information.
<b>show pagp</b> [ <i>channel-group-number</i> ] <b>dual-active</b>	Displays the dual-active detection status.
<b>show lacp</b> [ <i>channel-group-number</i> ] { <b>counters</b>   <b>internal</b>   <b>neighbor</b>   <b>sys-id</b> }	Displays LACP information such as traffic information, the internal LACP configuration, and neighbor information.
<b>show running-config</b>	Verifies your configuration entries.
<b>show etherchannel load-balance</b>	Displays the load balance or frame distribution scheme among ports in the port channel.

**Related Topics**

[Configuring the PAgP Learn Method and Priority](#) , on page 14

[PAgP Learn Method and Priority](#), on page 5

[Configuring the LACP System Priority](#) , on page 16

[Configuring the LACP Port Priority](#) , on page 17

# Configuration Examples for Configuring EtherChannels

## Configuring Layer 2 EtherChannels: Examples

This example shows how to configure an EtherChannel on a single switch. It assigns two ports as static-access ports in VLAN 10 to channel 5 with the PAgP mode **desirable**:

```
Switch# configure terminal
Switch(config)# interface range gigabitethernet0/1 -2
Switch(config-if-range)# switchport mode access
Switch(config-if-range)# switchport access vlan 10
Switch(config-if-range)# channel-group 5 mode desirable non-silent
Switch(config-if-range)# end
```

This example shows how to configure an EtherChannel on a single switch. It assigns two ports as static-access ports in VLAN 10 to channel 5 with the LACP mode **active**:

```
Switch# configure terminal
Switch(config)# interface range gigabitethernet0/1 -2
Switch(config-if-range)# switchport mode access
```



```
Switch(config-if-range)# switchport access vlan 10
Switch(config-if-range)# channel-group 5 mode active
Switch(config-if-range)# end
```

PoE or LACP negotiation errors may occur if you configure two ports from switch to the access point (AP). This scenario can be avoided if the port channel configuration is on the switch side. For more details, see the following example:

```
interface Port-channel1
  switchport access vlan 20
  switchport mode access
  switchport nonegotiate
  no port-channel standalone-disable <--this one
  spanning-tree portfast
```




---

**Note** If the port reports LACP errors on port flap, you should include the following command as well: **no errdisable detect cause pagp-flap**

---

## Configuring Auto LAG: Examples

This example shows how to configure Auto-LAG on a switch

```
switch> enable
switch# configure terminal
switch (config)# port-channel auto
switch (config-if)# end
switch# show etherchannel auto
```

The following example shows the summary of EtherChannel that was created automatically.

```
switch# show etherchannel auto
Flags:  D - down          P - bundled in port-channel
        I - stand-alone  s - suspended
        H - Hot-standby (LACP only)
        R - Layer3       S - Layer2
        U - in use       f - failed to allocate aggregator
        M - not in use, minimum links not met
        u - unsuitable for bundling
        w - waiting to be aggregated
        d - default port
        A - formed by Auto LAG
```

```
Number of channel-groups in use: 1
Number of aggregators:          1
```

```
Group  Port-channel  Protocol  Ports
-----+-----+-----+-----
1      Po1(SUA)         LACP      Gi1/0/45(P) Gi2/0/21(P) Gi3/0/21(P)
```

The following example shows the summary of auto EtherChannel after executing the **port-channel 1 persistent** command.

```
switch# port-channel 1 persistent

switch# show etherchannel summary
Switch# show etherchannel summary
Flags:  D - down          P - bundled in port-channel
        I - stand-alone  s - suspended
```

```

H - Hot-standby (LACP only)
R - Layer3      S - Layer2
U - in use      f - failed to allocate aggregator
M - not in use, minimum links not met
u - unsuitable for bundling
w - waiting to be aggregated
d - default port
A - formed by Auto LAG

```

```

Number of channel-groups in use: 1
Number of aggregators:          1

```

Group	Port-channel	Protocol	Ports
1	Po1(SU)	LACP	Gi1/0/45(P) Gi2/0/21(P) Gi3/0/21(P)

### Related Topics

[Configuring Auto-LAG Globally](#), on page 20

[Auto-LAG](#), on page 10

[Auto-LAG Configuration Guidelines](#), on page 11

[Configuring Persistence with Auto-LAG](#), on page 22

[Configuring Auto-LAG on a Port Interface](#), on page 21

## Configuring LACP Port Channel Min-Links: Examples

This example shows how to configure LACP port-channel min-links:

```

switch > enable
switch# configure terminal
switch(config)# interface port-channel 5
switch(config-if)# port-channel min-links 3
switch# show etherchannel 25 summary
switch# end

```

When the minimum links requirement is not met in standalone switches, the port-channel is flagged and assigned SM/SN or RM/RN state.

```

switch# show etherchannel 5 summary

Flags: D - down P - bundled in port-channel
I - stand-alone s - suspended
H - Hot-standby (LACP only)
R - Layer3 S - Layer2
U - in use N- not in use, no aggregation
f - failed to allocate aggregator
M - not in use, no aggregation due to minimum links not met
m- not in use, port not aggregated due to minimum links not met
u - unsuitable for bundling
w - waiting to be aggregated
d - default port
Number of channel-groups in use: 6
Number of aggregators: 6

Group  Port-channel  Protocol  Ports
-----+-----+-----+-----
6      Po25(RM)      LACP      Gi1/3/1(D) Gi1/3/2(D) Gi2/2/25(D) Gi2/2/26(W)

```

### Related Topics

[Configuring the LACP Port Channel Min-Links Feature](#), on page 18

## Example: Configuring LACP Fast Rate Timer

This example shows you how to configure the LACP rate:

```
switch> enable
switch# configure terminal
switch(config)# interface gigabitEthernet 2/1
switch(config-if)# lacp rate fast
switch(config-if)# exit
switch(config)# end
switch# show lacp internal
switch# show lacp counters
```

The following is sample output from the **show lacp internal** command:

```
switch# show lacp internal
Flags: S - Device is requesting Slow LACPDUs
F - Device is requesting Fast LACPDUs
A - Device is in Active mode P - Device is in Passive mode
Channel group 6
LACP port Admin Oper Port Port
Port Flags State Priority Key Key Number State
Tel/49 FA bndl 32768 0x19 0x19 0x32 0x3F
Tel/50 FA bndl 32768 0x19 0x19 0x33 0x3F
Tel/51 FA bndl 32768 0x19 0x19 0x34 0x3F
Tel/52 FA bndl 32768 0x19 0x19 0x35 0x3F
```

The following is sample output from the **show lacp counters** command:

```
switch# show lacp counters

LACPDUs Marker Marker Response LACPDUs
Port Sent Recv Sent Recv Sent Recv Pkts Err
-----
Channel group: 6
Tel/1/27 2 2 0 0 0 0 0
Te2/1/25 2 2 0 0 0 0 0
```

### Related Topics

[Configuring LACP Fast Rate Timer](#), on page 19

## Additional References for EtherChannels

### Related Documents

Related Topic	Document Title
Layer 2 command reference	

**Standards and RFCs**

Standard/RFC	Title
None	—

**MIBs**

MIB	MIBs Link
All the supported MIBs for this release.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: <a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a>

**Technical Assistance**

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	<a href="http://www.cisco.com/support">http://www.cisco.com/support</a>

## Feature Information for EtherChannels

Release	Modification
Cisco IOS Release 15.2(5)E	This feature was introduced.
Cisco IOS 15.2(3)E2, Cisco IOS XE 3.7.2E	Auto-LAG feature was introduced.