Etherchannel Configuration Guide

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Preface

This preface describes the conventions of this document and information on how to obtain other documentation. It also provides information on what's new in Cisco product documentation.

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Document Conventions

This document uses the following conventions:

Convention	Description
^ or Ctrl	Both the ^ symbol and Ctrl represent the Control (Ctrl) key on a keyboard. For example, the key combination **^D** or **Ctrl-D** means that you hold down the Control key while you press the D key. (Keys are indicated in capital letters but are not case sensitive.)
bold font	Commands and keywords and user-entered text appear in **bold** font.
Italic font	Document titles, new or emphasized terms, and arguments for which you supply values are in *italic* font.
`Courier` font	Terminal sessions and information the system displays appear in `courier` font.
`Bold Courier` font	**`Bold Courier`** font indicates text that the user must enter.
[x]	Elements in square brackets are optional.
...	An ellipsis (three consecutive nonbolded periods without spaces) after a syntax element indicates that the element can be repeated.
|	A vertical line, called a pipe, indicates a choice within a set of keywords or arguments.
[x | y]	Optional alternative keywords are grouped in brackets and separated by vertical bars.

Convention	Description
{x | y}	Required alternative keywords are grouped in braces and separated by vertical bars.
[x {y | z}]	Nested set of square brackets or braces indicate optional or required choices within optional or required elements. Braces and a vertical bar within square brackets indicate a required choice within an optional element.
string	A nonquoted set of characters. Do not use quotation marks around the string or the string will include the quotation marks.
< >	Nonprinting characters such as passwords are in angle brackets.
[ ]	Default responses to system prompts are in square brackets.
!, #	An exclamation point (!) or a pound sign (#) at the beginning of a line of code indicates a comment line.

Reader Alert Conventions

This document may use the following conventions for reader alerts:

Note Means *reader take note*. Notes contain helpful suggestions or references to material not covered in the manual.

Tip Means *the following information will help you solve a problem.*

Caution Means *reader be careful*. In this situation, you might do something that could result in equipment damage or loss of data.

Timesaver Means *the described action saves time.* You can save time by performing the action described in the paragraph.

Take note of the following general safety warnings:

Warning IMPORTANT SAFETY INSTRUCTIONS

Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Read the installation instructions before using, installing, or connecting the system to the power source. Use the statement number at the beginning of each warning statement to locate its translation in the translated safety warnings for this device.

SAVE THESE INSTRUCTIONS

Related Documentation

Note Before installing or upgrading the , refer to the release notes.

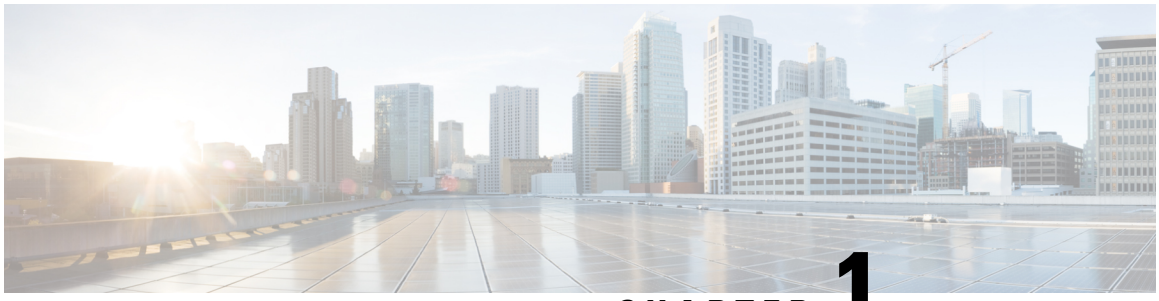
- Cisco Validated Designs documents, located at:

  http://www.cisco.com/go/designzone

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, using the Cisco Bug Search Tool (BST), submitting a service request, and gathering additional information, see What's New in Cisco Product Documentation.

You can also subscribe to the *What's New in Cisco Product Documentation* RSS feed, which delivers lists and content of new and revised Cisco technical documentation directly to your desktop, using any RSS reader application. This RSS feed is a free service.



CHAPTER 1

EtherChannel

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Auto-LAG

Auto-LAG feature:

- Automatically creates EtherChannels on ports connected to a switch.
- Uses the LACP (Link Aggregation Control Protocol) to create auto EtherChannels.
- Supports only one EtherChannel per unique partner device.
- Disabled globally by default, but is enabled on all port interfaces.
- Requires global enablement for Auto-LAG to operate. Ports must also meet specific conditions:
  - Ports with existing manual EtherChannels cannot participate in auto EtherChannel creation.
  - Disabling Auto-LAG on a port causes it to unbundle from any auto-created EtherChannel.
- Global disablement results in all existing auto-created EtherChannels being converted into manual EtherChannels.

When Auto-LAG is globally enabled, the following configurations are supported between actor and partner devices:

Table 1: 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

Limitations

- You cannot modify existing auto-created EtherChannel configurations. To make changes, convert the EtherChannel to manual using **port-channel <channel-number> persistent**

Additional Information

- Auto-LAG applies LACP protocol behavior for seamless provisioning.
- For more information, refer to the [Auto-LAG Configuration Guide].

Auto-LAG Configuration Guidelines

Follow these guidelines when configuring the auto-LAG feature:

- Auto-LAG is enabled on interfaces by default. If enabled globally on the switch, the user wants some ports not to participate in becoming an auto EtherChannel member. Disable the auto-LAG on those port
- 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.
  - By default, the port tries to create auto EtherChannel with the partner device.
- Auto-LAG is supported only on Layer 2 EtherChannel and is not supported on:
  - Layer 3 interfaces
  - Layer 3 EtherChannel.
- Auto-LAG is supported on cross-stack EtherChannel.

Link Aggregation Control Protocol

A Link Aggregation Control Protocol (LACP) is a network protocol defined under the IEEE 802.3ad standard that:

- Facilitates the automatic creation of EtherChannels by exchanging LACP packets between Ethernet ports,

- Enables devices to dynamically group similarly configured ports into a single logical link (channel or aggregate port), and
- Ensures compatibility between networking devices that support the IEEE 802.3ad protocol.

LACP identifies ports capable of supporting LACP and their capabilities. Ports are dynamically grouped into an EtherChannel based on hardware, administrative, and port parameter constraints such as:

- Speed,
- Duplex mode,
- Native VLAN, and
- Trunking status and type.

Once grouped, LACP adds the EtherChannel to the spanning tree protocol as a single device port. In default standalone mode, ports that do not receive a response from an LACP peer are moved to a suspended state. This ensures compatibility and stability in connected devices.

Link Aggregation Control Protocol Modes

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

Table 2: EtherChannel LACP Modes

Mode	Description
active	Places a port into an active negotiating state in which the port starts negotiations with other ports by sending LACP packets.
passive	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.

Link Aggregation Control Protocol Standalone Mode on Ethernet Channel

When one end of an EtherChannel has more members than the other, the unmatched ports enter the standalone state. The standalone mode is also called the independent mode. In the standalone mode the port is not bundled in an EtherChannel. The port functions as a standalone data port and it can send and receive BPDUs and data traffic.

In a topology that is not protected from Layer 2 loops by the spanning tree protocol (STP), a port in the standalone state can cause significant network errors. You can enter the **port-channel standalone-disable** command in the interface configuration mode to put ports into the suspended state instead of the standalone state.

The standalone mode is particularly relevant when a port (A) in a Layer 2 LACP EtherChannel is connected to an unresponsive port (B) on the peer. When LACP standalone is disabled on the EtherChannel, all traffic arriving on A is blocked (the default behavior on a switch). In some scenarios, you might want to allow management traffic on such ports. You can do this by enabling LACP standalone (or independent) mode. To enable the standalone mode on a Layer 2 LACP Etherchannel, use the **no port-channel standalone disable** command in the interface configuration mode. To disable the Standalone mode and revert to the default use the **port-channel standalone disable** command in the interface configuration mode.

Note LACP standalone mode is disabled by default.

Starting with the Cisco IOS XE Dublin 17.10.1 release, you can configure the LACP standalone mode on a Layer 3 EtherChannel. To configure the standalone mode use the **no port-channel standalone disable** command in the interface configuration mode. To disable the Standalone mode and revert to the default use the **port-channel standalone disable** command in the interface configuration mode.

Link Aggregation Control Protocol and Link Redundancy

LACP port-channel operation, bandwidth availability, and link redundancy can be further refined with the LACP port-channel min-links and the LACP max-bundle features.

The LACP port-channel min-links feature:

- Configures the minimum number of ports that must be linked up and bundled in the LACP port channel.
- Prevents a low-bandwidth LACP port channel from becoming active.
- Causes an LACP port channel to become inactive if there are too few active members ports to supply the required minimum bandwidth.

The LACP max-bundle feature:

- Defines an upper limit on the number of bundled ports in an LACP port channel.
- Allows hot-standby ports with fewer bundled ports. For example, in an LACP port channel with five ports, you can specify a max-bundle of three, and the two remaining ports are designated as hot-standby ports.

Link Aggregation Control Protocol Interaction with Other Features

The Link Aggregation Control Protocol (LACP) is a network protocol that:

- combines multiple physical ports into a single logical channel for redundancy,
- operates at the data link layer to enable fast convergence and failover, and
- synchronizes state information across member ports in active or passive mode.

Note Layer 2 port channel the default load balancing is source MAC and destination MAC

Layer 3 port channel the default load balancing is source IP and destination IP.

DTP and 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, the next active port provides its MAC address.

In Layer 3 EtherChannels, the MAC address is allocated by the active device when the EtherChannel interface is created using the **interface port-channel** global configuration command.

Link Aggregation Control Protocol with 1:1 Redundancy

The LACP 1:1 Redundancy feature supports an EtherChannel configuration with one active link, and fast switchover to a hot-standby link. The link that is connected to the port with the lower port priority number (and therefore, of a higher priority) will be the active link, and the other link will be in a hot-standby state. If the active link goes down, LACP performs a fast switchover to the hot-standby link to keep the EtherChannel up. When the failed link becomes operational again, LACP performs another fast switchover to revert to the original active link.

To allow the higher priority port to stabilize when it becomes active again after a higher-priority to lower-priority switchover, the LACP 1:1 Hot Standby Dampening feature configures a timer that delays switchover back to the higher priority port after higher priority port becomes active.

Port Aggregation Protocol

The Port Aggregation Protocol (PAgP) is a Cisco-proprietary protocol that can be run only on Cisco devices and on those devices that are 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 or switch stack 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 device in the stack) 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 device port.

Port Aggregation Protocol Modes

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

Table 3: EtherChannel PAgP Modes

Mode	Description
auto	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.
desirable	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 that are configured in the **auto** or **desirable** modes. Ports that are 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:

Table 4: PAgP Mode Compatibility and Interaction

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

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 that is 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.