Configuring EtherChannels

This chapter describes how to configure EtherChannels on Layer 2 or Layer 3 LAN ports in Cisco IOS Release 12.2SX.

Note For complete syntax and usage information for the commands used in this chapter, see the Cisco IOS Master Command List, at this URL:

http://www.cisco.com/en/US/docs/ios/mcl/allreleasemcl/all_book.html

Tip For additional information about Cisco Catalyst 6500 Series Switches (including configuration examples and troubleshooting information), see the documents listed on this page:

http://www.cisco.com/en/US/products/hw/switches/ps708/tsd_products_support_series_home.html

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This chapter consists of these sections:

Understanding EtherChannels

These sections describe how EtherChannels work:

EtherChannel Feature Overview

An EtherChannel bundles individual Ethernet links into a single logical link that provides the aggregate bandwidth of up to eight physical links.

Cisco IOS Release 12.2SX supports a maximum of 256 EtherChannels in standalone mode and 512 EtherChannels in VVS mode. You can form an EtherChannel with up to eight compatibly configured LAN ports on any switching module. All LAN ports in each EtherChannel must be the same speed and must all be configured as either Layer 2 or Layer 3 LAN ports.

Note   The network device to which a switch is connected may impose its own limits on the number of ports in an EtherChannel.

If a segment within an EtherChannel fails, traffic previously carried over the failed link switches to the remaining segments within the EtherChannel. When a failure occurs, the EtherChannel feature sends a trap that identifies the switch, the EtherChannel, and the failed link. Inbound broadcast and multicast packets on one segment in an EtherChannel are blocked from returning on any other segment of the EtherChannel.

Understanding EtherChannel Configuration

These sections describe how EtherChannels are configured:

EtherChannel Configuration Overview

You can configure EtherChannels manually or you can use the Port Aggregation Control Protocol (PAgP) or the Link Aggregation Control Protocol (LACP) to form EtherChannels. The EtherChannel protocols allow ports with similar characteristics to form an EtherChannel through dynamic negotiation with connected network devices. PAgP is a Cisco-proprietary protocol and LACP is defined in IEEE 802.3ad.

PAgP and LACP do not interoperate with each other. Ports configured to use PAgP cannot form EtherChannels with ports configured to use LACP. Ports configured to use LACP cannot form EtherChannels with ports configured to use PAgP. Neither interoperates with ports configured manually.

Table 19-1 lists the user-configurable EtherChannel modes.

Table 19-2 lists the EtherChannel member port states.

Table 19-1   EtherChannel Modes

Mode	Description
on	Mode that forces the LAN port to channel unconditionally. In the **on** mode, a usable EtherChannel exists only when a LAN port group in the **on** mode is connected to another LAN port group in the **on** mode. Because ports configured in the **on** mode do not negotiate, there is no negotiation traffic between the ports. You cannot configure the **on** mode with an EtherChannel protocol. If one end uses the **on** mode, the other end must also.
auto	PAgP mode that places a LAN port into a passive negotiating state, in which the port responds to PAgP packets it receives but does not initiate PAgP negotiation. (Default)
desirable	PAgP mode that places a LAN port into an active negotiating state, in which the port initiates negotiations with other LAN ports by sending PAgP packets.
passive	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 negotiation. (Default)
active	LACP mode that places a port into an active negotiating state, in which the port initiates negotiations with other ports by sending LACP packets.

Table 19-2   EtherChannel Member Port States

Port States	Description
bundled	The port is part of an EtherChannel and can send and receive BPDUs and data traffic.
suspended	The port is not part of an EtherChannel. The port can receive BPDUs but cannot send them. Data traffic is blocked.
standalone	The port is not bundled in an EtherChannel. The port functions as a standalone data port. The port can send and receive BPDUs and data traffic.
	Note When one end of an EtherChannel has more members than the other, the unmatched ports enter the standalone state. 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. For LACP EtherChannels with Release 12.2(33)SXI3 and later releases, you can enter the **port-channel standalone-disable** interface configuration mode command to put ports into the suspended state instead of the standalone state. See the "Configuring LACP Port-Channel Standalone Disable" section on page 19-17.

Understanding Manual EtherChannel Configuration

Manually configured EtherChannel ports do not exchange EtherChannel protocol packets. A manually configured EtherChannel forms only when you configure all ports in the EtherChannel compatibly.

Understanding PAgP EtherChannel Configuration

PAgP supports the automatic creation of EtherChannels by exchanging PAgP packets between LAN ports. PAgP packets are exchanged only between ports in **auto** and **desirable** modes.

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

Both the **auto** and **desirable** modes allow PAgP to negotiate between LAN ports to determine if they can form an EtherChannel, based on criteria such as port speed and trunking state. Layer 2 EtherChannels also use VLAN numbers.

LAN ports can form an EtherChannel when they are in different PAgP modes if the modes are compatible. For example:

- A LAN port in **desirable** mode can form an EtherChannel successfully with another LAN port that is in **desirable** mode.

- A LAN port in **desirable** mode can form an EtherChannel with another LAN port in **auto** mode.

- A LAN port in **auto** mode cannot form an EtherChannel with another LAN port that is also in **auto** mode, because neither port will initiate negotiation.

Understanding IEEE 802.3ad LACP EtherChannel Configuration

LACP supports the automatic creation of EtherChannels by exchanging LACP packets between LAN ports. LACP packets are exchanged only between ports in **passive** and **active** modes.

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

Both the **passive** and **active** modes allow LACP to negotiate between LAN ports to determine if they can form an EtherChannel, based on criteria such as port speed and trunking state. Layer 2 EtherChannels also use VLAN numbers.

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

- A LAN port in **active** mode can form an EtherChannel successfully with another LAN port that is in **active** mode.

- A LAN port in **active** mode can form an EtherChannel with another LAN port in **passive** mode.

- A LAN port in **passive** mode cannot form an EtherChannel with another LAN port that is also in **passive** mode, because neither port will initiate negotiation.

LACP uses the following parameters:

- LACP system priority—You must configure an LACP system priority on each switch running LACP. The system priority can be configured automatically or through the CLI (see the "Configuring the LACP System Priority and System ID" section on page 19-11). LACP uses the system priority with the switch MAC address to form the system ID and also during negotiation with other systems.

✎
Note The LACP system ID is the combination of the LACP system priority value and the MAC address of the switch.

- LACP port priority—You must configure an LACP port priority on each port configured to use LACP. The port priority can be configured automatically or through the CLI (see the "Configuring Channel Groups" section on page 19-9). LACP uses the port priority with the port number to form the port identifier. LACP uses the port priority to decide which ports should be put in standby mode when there is a hardware limitation that prevents all compatible ports from aggregating.

- LACP auto interleaved port priority—You can configure LACP auto interleaved port priority to create an effective distribution of bundled and hot standby ports across different slots that are part of the same port channel, either Distributed EtherChannel (DEC) or Multichassis EtherChannel (MEC). To configure auto interleaved port priority use the **lacp active-port distribution automatic**

command. The bundled port distribution can be configured through the CLI (see the "Configuring Channel Groups" section on page 19-9). Once the auto interleaved port priority feature is enabled, it automatically distributes bundled ports based on the position of when a port link comes up and is effective only if you configure it on the system that has the higher LACP system priority. You need to perform a shutdown and no shutdown on the interface port channel to enable the auto interleaved port priority feature on all ports.

- LACP administrative key—LACP automatically configures an administrative key value equal to the channel group identification number on each port configured to use LACP. The administrative key defines the ability of a port to aggregate with other ports. A port's ability to aggregate with other ports is determined by these factors:

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

On ports configured to use LACP, LACP tries to configure the maximum number of compatible ports in an EtherChannel, up to the maximum allowed by the hardware (eight ports). If LACP cannot aggregate all the ports that are compatible (for example, the remote system might have more restrictive hardware limitations), then all the ports that cannot be actively included in the channel are put in hot standby state and are used only if one of the channeled ports fails. You can configure an additional 8 standby ports (total of 16 ports associated with the EtherChannel).

Understanding LACP 1:1 Redundancy

With Release 12.2(33)SXH and later releases, the LACP 1:1 redundancy feature provides an EtherChannel configuration with one active link and fast switchover to a hot standby link.

To use LACP 1:1 redundancy, you configure an LACP EtherChannel with two ports (one active and one standby). If the active link goes down, the EtherChannel stays up and the system performs fast switchover to the hot standby link. When the failed link becomes operational again, the EtherChannel performs another fast switchover to revert to the original active link.

For the LACP 1:1 redundancy feature to work correctly, especially the fast switchover capability, the feature needs to be enabled at both ends of the link.

Understanding Port Channel Interfaces

Each EtherChannel has a numbered port channel interface. You can configure a maximum of 512 port-channel interfaces, numbered from 1 to 512 in VSS mode. In the stand-alone, the max number of port channel interfaces is 256, numbered from 1 to 256. The configuration that you apply to the port channel interface affects all LAN ports assigned to the port channel interface.

After you configure an EtherChannel, the configuration that you apply to the port channel interface affects the EtherChannel; the configuration that you apply to the LAN ports affects only the LAN port where you apply the configuration. To change the parameters of all ports in an EtherChannel, apply the configuration commands to the port channel interface, for example, Spanning Tree Protocol (STP) commands or commands to configure a Layer 2 EtherChannel as a trunk.

Understanding Load Balancing

An EtherChannel balances the traffic load across the links in an EtherChannel by reducing part of the binary information in the frame header to a numerical value that selects one of the links in the channel.

You can configure which header information will be used to derive the numerical value for link selection. The EtherChannel load balancing method can use MAC addresses, IP addresses, or Layer 4 port numbers, and you can configure whether the information will be from the source or destination or both source and destination addresses or ports. The selected mode applies to all EtherChannels configured on the switch. EtherChannel load balancing can also use MPLS Layer 2 information. If PFC3C/CXL hardware is installed, EtherChannel load balancing will additionally consider VLAN information by default.

Use the option that provides the balance criteria with the greatest variety in your configuration. For example, if the traffic on an EtherChannel is going only to a single MAC address and you use the destination MAC address as the basis of EtherChannel load balancing, the EtherChannel always chooses the same link in the EtherChannel; using source addresses or IP addresses might result in better load balancing.

EtherChannel Feature Configuration Guidelines and Restrictions

When EtherChannel interfaces are configured improperly, they are disabled automatically to avoid network loops and other problems. To avoid configuration problems, observe these guidelines and restrictions:

- The commands in this chapter can be used on all Layer 2 Ethernet ports, including the ports on the supervisor engine and a redundant supervisor engine.

- The WS-X6148-GE-TX and WS-X6148V-GE-TX switching modules do not support more than 1 Gbps of traffic per EtherChannel.

- When you add a member port that does not support ISL trunking to an EtherChannel, Cisco IOS software automatically adds a **switchport trunk encapsulation dot1q** command to the port-channel interface to prevent configuration of the EtherChannel as an ISL trunk. The **switchport trunk encapsulation dot1q** command is inactive when the EtherChannel is not a trunk.

- All Layer 2 Ethernet ports on all modules, including those on a redundant supervisor engine, support EtherChannels (maximum of eight LAN ports) with no requirement that the LAN ports be physically contiguous or on the same module.

- A Distributed EtherChannel (DEC) is an EtherChannel with member ports that are served by the PFC and one or more DFCs or by multiple DFCs. On switching modules with dual switch-fabric connections, a DEC can also be a single-module EtherChannel. Search the release notes for "Dual switch-fabric connections".

- Configure all LAN ports in an EtherChannel to use the same EtherChannel protocol; you cannot run two EtherChannel protocols in one EtherChannel.

- Configure all LAN ports in an EtherChannel to operate at the same speed and in the same duplex mode.

- LACP does not support half-duplex. Half-duplex ports in an LACP EtherChannel are put in the suspended state.

- Enable all LAN ports in an EtherChannel. If you shut down a LAN 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.

- An EtherChannel will not form if one of the LAN ports is a Switched Port Analyzer (SPAN) destination port.

- For Layer 3 EtherChannels, assign Layer 3 addresses to the port channel logical interface, not to the LAN ports in the channel.

- Layer 3 EtherChannels of all types and single-module non-DEC EtherChannels offer the highest throughput.

- CSCti23324 is resolved in Release 12.2(33)SXJ1 and later releases. In releases where CSCti23324 is not resolved, Layer 2 DECs have lower throughput because Layer 2 DEC traffic uses packet recirculation. If possible, configure nondistributed Layer 2 EtherChannels or Layer 3 DECs.

- When the switch is in bus mode (also called flow-through mode), Layer 2 multi-module EtherChannels have lower throughput because Layer 2 multi-module EtherChannel traffic uses packet recirculation. If possible, configure single-module EtherChannels or upgrade the installed hardware so that the switch does not operate in bus mode.

- For Layer 2 EtherChannels:
  - Assign all LAN ports in the EtherChannel to the same VLAN or configure them as trunks.
  - If you configure an EtherChannel from trunking LAN ports, verify that the trunking mode is the same on all the trunks. LAN ports in an EtherChannel with different trunk modes can operate unpredictably.
  - An EtherChannel supports the same allowed range of VLANs on all the LAN ports in a trunking Layer 2 EtherChannel. If the allowed range of VLANs is not the same, the LAN ports do not form an EtherChannel.
  - LAN ports with different STP port path costs can form an EtherChannel as long they are compatibly configured with each other. If you set different STP port path costs, the LAN ports are not incompatible for the formation of an EtherChannel.
  - An EtherChannel will not form if protocol filtering is set differently on the LAN ports.
  - Configure static MAC addresses on the EtherChannel only and not on physical member ports of the EtherChannel.

- After you configure an EtherChannel, the configuration that you apply to the port channel interface affects the EtherChannel. The configuration that you apply to the LAN ports affects only the LAN port where you apply the configuration.

- When QoS is enabled, enter the **no mls qos channel-consistency** port-channel interface command to support EtherChannels that have ports with different queue structures, for example, ports with and without strict-priority queues.

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Caution   Serious traffic problems can result from mixing manual mode with PAgP or LACP modes, or with a port with no EtherChannel configured. For example, if a port configured in **on** mode is connected to another port configured in **desirable** mode, or to a port not configured for EtherChannel, a bridge loop is created and a broadcast storm can occur. If one end uses the **on** mode, the other end must also.

Serious traffic problems can result if an EtherChannel forms from ports that pass data through the switch in significantly different ways. For example, ports on modules with and without DFCs, or when enabled

with the **no mls qos channel-consistency** port-channel interface command, ports that have significantly different QoS port parameters (buffers sizes and queue types). Be prepared to disable such EtherChannels.

Configuring EtherChannels

These sections describe how to configure EtherChannels:

Note Make sure that the LAN ports are configured correctly (see the "EtherChannel Feature Configuration Guidelines and Restrictions" section on page 19-6).

Configuring Port Channel Logical Interfaces for Layer 3 EtherChannels

Note
- When configuring Layer 2 EtherChannels, you cannot put Layer 2 LAN ports into manually created port channel logical interfaces. If you are configuring a Layer 2 EtherChannel, do not perform the procedures in this section (see the "Configuring Channel Groups" section on page 19-9).

- When configuring Layer 3 EtherChannels, you must manually create the port channel logical interface as described in this section, and then put the Layer 3 LAN ports into the channel group (see the "Configuring Channel Groups" section on page 19-9).

- To move an IP address from a Layer 3 LAN port to an EtherChannel, you must delete the IP address from the Layer 3 LAN port before configuring it on the port channel logical interface.

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

	Command	Purpose
Step 1	Router(config)# **interface port-channel** *group_number*	Creates the port channel interface.
Step 2	Router(config-if)# **ip address** *ip_address mask*	Assigns an IP address and subnet mask to the EtherChannel.
Step 3	Router(config-if)# **end**	Exits configuration mode.
Step 4	Router# **show running-config interface port-channel** *group_number*	Verifies the configuration.

The *group_number* can be 1 through 256, up to a maximum of 256 port-channel interfaces in standalone mode. In VSS-mode the group number can be through 1 through 512, up to a maximum of 512 port channel-interfaces. This example shows how to create port channel interface 1:

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

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

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

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

Configuring Channel Groups

Note
- When configuring Layer 3 EtherChannels, you must manually create the port channel logical interface first (see the "Configuring Port Channel Logical Interfaces for Layer 3 EtherChannels" section on page 19-8), and then put the Layer 3 LAN ports into the channel group as described in this section.

- When configuring Layer 2 EtherChannels, configure the LAN ports with the **channel-group** command as described in this section, which automatically creates the port channel logical interface. You cannot put Layer 2 LAN ports into a manually created port channel interface.

- For Cisco IOS to create port channel interfaces for Layer 2 EtherChannels, the Layer 2 LAN ports must be connected and functioning.

To configure channel groups, perform this task for each LAN port:

	Command	Purpose
Step 1	Router(config)# **interface** *type*[1] *slot/port*	Selects a LAN port to configure.
Step 2	Router(config-if)# **no ip address**	Ensures that there is no IP address assigned to the LAN port.
Step 3	Router(config-if)# **channel-protocol** (**lacp** | **pagp**}	(Optional) On the selected LAN port, restricts the **channel-group** command to the EtherChannel protocol configured with the **channel-protocol** command.
Step 4	Router(config-if)# **channel-group** *group_number* **mode** {**active** | **auto** | **desirable** | **on** | **passive**}	Configures the LAN port in a port channel and specifies the mode (see Table 19-1 on page 19-3). PAgP supports only the auto and desirable modes. LACP supports only the active and passive modes.
Step 5	Router(config-if)# **lacp port-priority** *priority_value*	(Optional for LACP) Valid values are 1 through 65535. Higher numbers have lower priority. The default is 32768.

Command	Purpose
Step 6	`Router(config-if)# ` **`do show interface port-channel`** `group_number`	(Optional) Displays the interface configuration information of the specified port channel. Note: The output of this command shows that the newly created port channel interface will be in shutdown state.
Step 7	`Router(config-if)# ` **`no shutdown`**	Brings the port channel and its members up and all the configuration changes that you apply to the port channel is applied to every member interface of that port channel.
Step 8	`Router(config-if)# ` **`end`**	Exits configuration mode.
Step 9	`Router# ` **`show running-config interface`** `type`[1] `slot/port` `Router# ` **`show interfaces`** `type`[1] `slot/port` **`etherchannel`**	Verifies the configuration.

1.   *type* = **fastethernet**, **gigabitethernet**, or **tengigabitethernet**

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

```
Router# configure terminal
Router(config)# interface range fastethernet 5/6 -7
Router(config-if)# channel-group 2 mode desirable
Router(config-if)# shutdown
Router(config-if)# no shutdown
Router(config-if)# end
```

Note   See the "Configuring a Range of Interfaces" section on page 8-4 for information about the **range** keyword.

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

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

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

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

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

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

```
Router# show interfaces fastethernet 5/6 etherchannel
Port state     = Down Not-in-Bndl
Channel group = 12          Mode = Desirable-Sl    Gcchange = 0
Port-channel  = null        GC   = 0x00000000        Pseudo port-channel = Po1
2
Port index    = 0           Load = 0x00        Protocol =   PAgP

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

Local information:
                               Hello    Partner  PAgP     Learning  Group
Port        Flags State   Timers Interval Count    Priority  Method Ifindex
Fa5/2       d     U1/S1          1s       0        128       Any      0

Age of the port in the current state: 04d:18h:57m:19s
```

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

```
Router# show etherchannel 12 port-channel
              Port-channels in the group:
              ---------------------

Port-channel: Po12
------------

Age of the Port-channel   = 04d:18h:58m:50s
Logical slot/port   = 14/1          Number of ports = 0
GC                  = 0x00000000     HotStandBy port = null
Port state          = Port-channel Ag-Not-Inuse
Protocol            =   PAgP

Router#
```

Configuring the LACP System Priority and System ID

The LACP system ID is the combination of the LACP system priority value and the MAC address of the switch.

To configure the LACP system priority and system ID, perform this task:

	Command	Purpose
Step 1	Router(config)# **lacp system-priority** *priority_value*	(Optional for LACP) Valid values are 1 through 65535. Higher numbers have lower priority. The default is 32768.
Step 2	Router(config)# **end**	Exits configuration mode.
Step 3	Router# **show lacp sys-id**	Verifies the configuration.

This example shows how to configure the LACP system priority:

```
Router# configure terminal
Router(config)# lacp system-priority 23456
Router(config)# end
Router(config)#
```

This example shows how to verify the configuration:

```
Router# show lacp sys-id
23456,0050.3e8d.6400
Router#
```

The system priority is displayed first, followed by the MAC address of the switch.

Configuring EtherChannel Load Balancing

To configure EtherChannel load balancing, perform this task:

	Command	Purpose
Step 1	Router(config)# **port-channel per-module load-balance**	(Optional) Enables the ability to specify the load-balancing method on a per-module basis.
Step 2	Router(config)# **port-channel load-balance** {**src-mac** | **dst-mac** | **src-dst-mac** | **src-ip** | **dst-ip** | **src-dst-ip** | **src-port** | **dst-port** | **src-dst-port**} [**module** *slot*]	Configures the EtherChannel load-balancing method. The method is globally applied to all port channels. Optionally, you can configure the load-balancing method for a specific module. The default method is src-dst-ip.
	Router(config)# **no port-channel load-balance**	Reverts to default EtherChannel load balancing.
Step 3	Router(config)# **end**	Exits configuration mode.
Step 4	Router# **show etherchannel load-balance**	Verifies the configuration.

The load-balancing method keywords indicate the following information:

- **dst-ip**—Destination IP addresses
- **dst-mac**—Destination MAC addresses
- **dst-port**—Destination Layer 4 port
- **mpls**—Load balancing for MPLS packets
- **src-dst-ip**—(Default) Source and destination IP addresses
- **src-dst-mac**—Source and destination MAC addresses
- **src-dst-port**—Source and destination Layer 4 port
- **src-ip**—Source IP addresses
- **src-mac**—Source MAC addresses
- **src-port**—Source Layer 4 port

The optional **module** keyword allows you to specify the load-balancing method for a specific module. This capability is supported only on DFC-equipped switching modules. You must enable per-module load balancing globally before configuring the feature on a module.

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

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

This example shows how to verify the configuration:

```
Router# show etherchannel load-balance
```

```
        EtherChannel Load-Balancing Configuration:
                src-dst-ip enhanced
                mpls label-ip

        EtherChannel Load-Balancing Addresses Used Per-Protocol:
        Non-IP: Source XOR Destination MAC address
          IPv4: Source XOR Destination IP address
          IPv6: Source XOR Destination IP address
          MPLS: Label or IP

        Router#
```

> **Note**   In this example, the **enhanced** keyword indicates that PFC3C/CXL hardware is installed and, as a result, VLAN information will also be included in the load-balancing method.

Configuring EtherChannel Hash-Distribution Algorithm

Releases earlier than 12.2(33)SXH support a load-distribution algorithm called the fixed algorithm. When you add a port to the EtherChannel or delete a port from the EtherChannel, the switch updates the port ASIC for each port in the EtherChannel, which causes a short outage on each port.

Release 12.2(33)SXH and later releases support an additional algorithm called the adaptive algorithm. The adaptive algorithm does not need to update the port ASIC for existing member ports.

The fixed algorithm is the default algorithm. You can configure a global value for the adaptive algorithm. You can also specify the algorithm for individual port channels.

When you change the algorithm, the change is applied at the next member link event (link down, link up, addition, deletion, no shutdown, and shutdown). When you enter the command to change the algorithm, the command console issues a warning that the command does not take effect until the next member link event.

> **Note**   Some external devices require the fixed algorithm. For example, the service control engine (SCE) requires incoming and outgoing packets to use the same port.

> **Note**   If you change the load-balancing method, EtherChannel ports on DFC-equipped switching modules or on an active supervisor engine in a dual supervisor engine configuration will flap.

Configuring the Hash-Distribution Algorithm Globally

To configure the load-sharing algorithm globally, perform this task:

	Command	Purpose
Step 1	Router(config)# **port-channel hash-distribution** {**adaptive** | **fixed**}	Sets the hash distribution algorithm to adaptive or fixed.
Step 2	Router(config)# **end**	Exits configuration mode.

This example shows how to globally set the hash distribution to adaptive:

```
Router(config)# port-channel hash-distribution adaptive
```

Configuring the Hash-Distribution Algorithm for a Port Channel

To configure the hash-distribution algorithm for a specific port channel, perform this task:

	Command	Purpose
Step 1	`Router(config)# interface port-channel channel-num`	Enters interface configuration mode for the port channel.
Step 2	`Router(config-if)# port-channel port hash-distribution {adaptive	fixed}`	Sets the hash distribution algorithm for this interface
Step 3	`Router(config-if)# end`	Exits interface configuration mode.

This example shows how to set the hash distribution algorithm to adaptive on port channel 10:

```
Router (config)# interface port-channel 10
Router (config-if)# port-channel port hash-distribution adaptive
```

Configuring the EtherChannel Min-Links Feature

The EtherChannel min-links feature is supported on LACP EtherChannels. This feature allows you to configure 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. You can use the EtherChannel min-links feature to prevent low-bandwidth LACP EtherChannels from becoming active. This feature also causes LACP EtherChannels to become inactive if they have too few active member ports to supply your required minimum bandwidth. In addition, when LACP max-bundle values are specified in conjunction with min-links, the configuration is verified and an error message is returned if the min-links value is not compatible with (equal to or less than) the max-bundle value.

To configure the EtherChannel min-links feature, perform this task:

	Command	Purpose
Step 1	`Router(config)# interface port-channel group_number`	Selects an LACP port channel interface.
Step 2	`Router(config-if)# port-channel min-links number`	Configures 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.
Step 3	`Router(config-if)# end`	Exits configuration mode.
Step 4	`Router# show running-config interface port-channel group_number` `Router# show interfaces type`[1] `slot/port etherchannel`	Verifies the configuration.

1.   *type* = **fastethernet**, **gigabitethernet**, or **tengigabitethernet**

✎

Note   Although the EtherChannel min-links feature works correctly when configured only on one end of an EtherChannel, for best results, configure the same number of minimum links on both ends of the EtherChannel.

This example shows how to configure port channel interface 1 to be inactive if fewer than two member ports are active in the EtherChannel:

```
Router# configure terminal
Router(config)# interface port-channel 1
Router(config-if)# port-channel min-links 2
Router(config-if)# end
```

Configuring LACP 1:1 Redundancy

For the LACP 1:1 redundancy feature, the LACP EtherChannel must contain exactly two links, of which only one is active. The link with the lower port priority number (and therefore a higher priority) will be the active link, and the other link will be in a hot standby state. The LACP max-bundle must be set to 1.

To configure the LACP 1:1 redundancy feature, perform this task:

	Command	Purpose
Step 1	Router(config)# **interface port-channel** *group_number*	Selects an LACP port channel interface.
Step 1	Router(config-if)# **lacp fast-switchover**	Enables the fast switchover feature for this EtherChannel.
Step 2	Router(config-if)# **lacp max-bundle 1**	Sets the maximum number of active member ports to be one.
Step 3	Router(config-if)# **end**	Exits configuration mode.
Step 4	Router# **show running-config interface port-channel** *group_number* Router# **show interfaces** *type*[1] *slot/port* **etherchannel**	Verifies the configuration.

1. *type* = **fastethernet**, **gigabitethernet**, or **tengigabitethernet**

Note   For the LACP 1:1 redundancy feature to work correctly, especially the fast switchover capability, the feature needs to be enabled at both ends of the EtherChannel.

This example shows how to configure an LACP EtherChannel with 1:1 redundancy. Because Fast Ethernet port 5/6 is configured with a higher port priority number (and therefore a lower priority) than the default of 32768, it will be the standby port.

```
Router# configure terminal
Router(config)# lacp system-priority 33000
Router(config)# interface range fastethernet 5/6 -7
Router(config-if)# channel-protocol lacp
Router(config-if)# channel-group 1 mode active
Router(config)# interface fastethernet 5/6
Router(config-if)# lacp port-priority 33000
Router(config)# interface port-channel 1
Router(config-if)# lacp fast-switchover
Router(config-if)# lacp max-bundle 1
Router(config-if)# end
```

🔍

Tip   For additional information about Cisco Catalyst 6500 Series Switches (including configuration examples and troubleshooting information), see the documents listed on this page:

http://www.cisco.com/en/US/products/hw/switches/ps708/tsd_products_support_series_home.html

Configuring Auto Interleaved Port Priority For LACP Port Channels

To configure auto interleaved port priority for LACP on a port channel, perform this task on the port channel interface:

	Command	**Purpose**
Step 1	`Router(config)# interface port-channel channel-group`	Selects a port channel interface to configure.
Step 2	`Router(config-if)# lacp active-port distribution automatic`	Configures the port channel to use interleaved port priority. ✎ **Note** You need to perform a shutdown and no shutdown for interleaved port priority to be enabled.
Step 3	`Router(config-if)# shutdown`	Disables the interface.
Step 4	`Router(config-if)# no shutdown`	Enables the interface.
Step 5	`Router(config-if)# end`	Exits configuration mode.
Step 6	`Router# show etherchannel channel-group port-channel` `Router# show etherchannel channel-group summary`	Verifies the configuration.

This example shows how to configure auto interleaved port priority on a port channel:

```
Router(config)# interface port-channel23
Router(config-if)# lacp active-port distribution automatic
Please shut/no shut the port-channel for configuration to take effect immediately.
Router(config-if)# shutdown
Router(config-if)# no shutdown

Router(config-if)# end
```

This example shows how to verify the configuration of port channel interface 23:

```
Router# show running interfaces port-channel23
Building configuration...

Current configuration : 81 bytes
!
interface Port-channel23
 no switchport
 no ip address
 lacp max-bundle 4
 lacp active-port distribution automatic
end
```

This example shows how to verify the configuration of EtherChannel 23:

```
Router# show etherchannel 23 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
        d - default port

        w - waiting to be aggregated
Number of channel-groups in use: 9
Number of aggregators:          9

Group  Port-channel  Protocol    Ports
------+-------------+-----------+------------------------------------
23     Po23(RU)      LACP        Gi1/1/21(P)   Gi1/1/22(P)   Gi1/1/23(H)
                                 Gi1/1/24(H)   Gi2/1/17(P)   Gi2/1/18(P)
                                 Gi2/1/19(H)   Gi2/1/20(H)

Last applied Hash Distribution Algorithm: Fixed
```

Note   The above example shows that the four bundled ports are distributed 2 per chassis and slot.

Configuring LACP Port-Channel Standalone Disable

To disable the standalone EtherChannel member port state on a port channel (see Table 19-2 on page 19-3), perform this task on the port channel interface:

	Command	Purpose
Step 1	Router(config)# **interface port-channel** *channel-group*	Selects a port channel interface to configure.
Step 2	Router(config-if)# **port-channel standalone-disable**	Disables the standalone mode on the port-channel interface.
Step 3	Router(config-if)# **end**	Exits configuration mode.
Step 4	Router# **show etherchannel** *channel-group* **port-channel** Router# **show etherchannel** *channel-group* **detail**	Verifies the configuration.

This example shows how to disable the standalone EtherChannel member port state on port channel 42:

```
Router(config)# interface port-channel channel-group
Router(config-if)# port-channel standalone-disable
```

This example shows how to verify the configuration:

```
Router# show etherchannel 42 port-channel | include Standalone
Standalone Disable  = enabled
Router# show etherchannel 42 detail | include Standalone
Standalone Disable  = enabled
```

Configuring EtherChannels