

# Configuring IEEE 802.3ad Link Bundling

This document describes how the IEEE 802.3ad Link Bundling feature leverages the EtherChannel infrastructure within Cisco IOS XE software to manage the bundling of Ethernet links. The supported Ethernet link types for link bundling are Gigabit Ethernet and Ten Gigabit Ethernet.


- Prerequisites for Configuring IEEE 802.3ad Link Bundling, on page 1
- Restrictions for Configuring IEEE 802.3ad Link Bundling, on page 1
- Information About Configuring IEEE 802.3ad Link Bundling, on page 2
- How to Configure IEEE 802.3ad Link Bundling, on page 6
- Configuration Examples for IEEE 802.3ad Link Bundling, on page 20
- Additional References Configuring IEEE 802.3ad Link Bundling, on page 25
- Feature Information for Configuring IEEE 802.3ad Link Bundling, on page 25


## Prerequisites for Configuring IEEE 802.3ad Link Bundling

- Knowledge of how EtherChannels and Link Aggregation Control Protocol (LACP) function in a network
- Verification that both ends of the LACP link have the same baseline software version

## Restrictions for Configuring IEEE 802.3ad Link Bundling

- All links must operate at the same link speed and in full-duplex mode (LACP does not support half-duplex mode).
- All links must be configured as either EtherChannel links or LACP links.
- Only physical interfaces can form aggregations. Aggregations of VLAN interfaces are not possible nor is an aggregation of aggregations.
- If a router is connected to a switch, the bundle terminates on the switch.
- An EtherChannel will not form if one of the LAN ports is a Switched Port Analyzer (SPAN) destination port.
- All ports in an EtherChannel must use the same EtherChannel protocol.
- Maximum of four bundled ports per Ethernet port channel are supported.

- The maximum number of bundled ports per Ethernet port channel that can be supported varies by platform. Some platforms support maximum of 4 while other platforms support a maximum of 14.
- Maximum of 64 Ethernet port channels in a chassis are supported.
- Quality of service (QoS) is supported on individual bundled ports and not on Ethernet port channels.

# Information About Configuring IEEE 802.3ad Link Bundling

## Gigabit EtherChannel

Gigabit EtherChannel (GEC) is high-performance Ethernet technology that provides Gigabit per second (Gb/s) transmission rates. A Gigabit EtherChannel bundles individual Ethernet links (Gigabit Ethernet or Ten Gigabit Ethernet) into a single logical link that provides the aggregate bandwidth of up to physical links. All LAN ports in each EtherChannel must be the same speed and all must be configured as either Layer 2 or Layer 3 LAN ports. Inbound broadcast and multicast packets on one link in an EtherChannel are blocked from returning on any other link in the EtherChannel.

When a link within an EtherChannel fails, traffic previously carried over the failed link switches to the remaining links within that EtherChannel. Also when a failure occurs, a trap is sent that identifies the device, the EtherChannel, and the failed link.

## Port-Channel and LACP-Enabled Interfaces

Each EtherChannel has a numbered port-channel interface that must be manually created before interfaces can be added to the channel group. The configuration of a port-channel interface affects all LAN ports assigned to that port-channel interface.

To change the parameters of all ports in an EtherChannel, change the configuration of the port-channel interface; for example, if you want to configure Spanning Tree Protocol or configure a Layer 2 EtherChannel as a trunk. Any configuration or attribute changes you make to the port-channel interface are propagated to all interfaces within the same channel group as the port-channel; that is, configuration changes are propagated to the physical interfaces that are not part of the port-channel but are part of the channel group.

The configuration of a LAN port affects only that LAN port.

## IEEE 802.3ad Link Bundling

The IEEE 802.3ad Link Bundling feature provides a method for aggregating multiple Ethernet links into a single logical channel based on the IEEE 802.3ad standard. This feature helps improve the cost effectiveness of a device by increasing cumulative bandwidth without necessarily requiring hardware upgrades. In addition, IEEE 802.3ad Link Bundling provides a capability to dynamically provision, manage, and monitor various aggregated links and enables interoperability between various Cisco devices and devices of third-party vendors.

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. After LACP identifies correctly matched Ethernet links, it facilitates grouping the links into an EtherChannel. Then the EtherChannel is 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 compatible LACP modes, as in the following examples:

- A LAN port in active mode can form an EtherChannel 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 device running LACP. The system priority can be configured automatically or through the command-line interface (CLI). LACP uses the system priority with the device MAC address to form the system ID and also during negotiation with other systems.
- 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. 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 also uses the port priority with the port number to form the port identifier.
- LACP administrative key—LACP automatically configures an administrative key value 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 the following:
  - 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, it tries to configure the maximum number of compatible ports in an EtherChannel, up to the maximum allowed by the hardware. To use the hot standby feature in the event a channel port fails, both ends of the LACP bundle must support the **lacp max-bundle** command.

As a control protocol, LACP uses the Slow Protocol Multicast address of 01-80-C2-00-00-02 to transmit LACP protocol data units (PDUs). Aside from LACP, the Slow Protocol linktype is to be utilized by operations, administration, and maintenance (OAM) packets, too. Subsequently, a subtype field is defined per the IEEE 802.3ad standard [1] (Annex 43B, section 4) differentiating LACP PDUs from OAM PDUs.



**Note** LACP and Port Aggregation Control Protocol (PAgP) are not compatible. Ports configured for PAgP cannot form port channels on ports configured for LACP, and ports configured for LACP cannot form port channels on ports configured for PAgP.

## Benefits of IEEE 802.3ad Link Bundling

- Increased network capacity without changing physical connections or upgrading hardware
- Cost savings from the use of existing hardware and software for additional functions
- A standard solution that enables interoperability of network devices

- Port redundancy without user intervention when an operational port fails

# LACP Enhancements

The following LACP enhancements are supported:

- Four member links per LACP bundle.
- Cisco nonstop forwarding (NSF), and nonstop routing (NSR) on Gigabit EtherChannel bundles.
- Link failover time of 250 milliseconds or less and a maximum link failover time of 2 seconds; port channels remain in the LINK_UP state to eliminate reconvergence by the Spanning-Tree Protocol.
- Shutting down a port channel when the number of active links falls below the minimum threshold. In the port channel interface, a configurable option is provided to bring down the port channel interface when the number of active links falls below the minimum threshold. For the port-channel state to be symmetric on both sides of the channel, the peer must also be running LACP and have the same **lacp min-bundle** command setting.
- The IEEE Link Aggregation Group (LAG) MIB.

# LACP for Gigabit Interfaces

The LACP (802.3ad) for Gigabit Interfaces feature bundles individual Ethernet links (Gigabit Ethernet or Ten Gigabit Ethernet) into a single logical link that provides the aggregate bandwidth of up to four physical links.

All LAN ports on a port channel must be the same speed and must all be configured as either Layer 2 or Layer 3 LAN ports. If a segment within a port channel fails, traffic previously carried over the failed link switches to the remaining segments within the port channel. Inbound broadcast and multicast packets on one segment in a port channel are blocked from returning on any other segment of the port channel.



**Note** The network device may impose its own limits on the number of bundled ports per port channel.

## Features Supported on Gigabit EtherChannel Bundles

The table below lists the features that are supported on Gigabit EtherChannel (GEC) bundles.

*Table 1: Gigabit EtherChannel Bundle Features*

| Cisco IOS XE Release | Feature | Bundle Interface |
|---|---|---|
| 2.5 | Access control lists (ACLs) per bundle | Supported |
| | All Ethernet routing protocols | Supported |
| | Intelligent Service Gateway (ISG) IP sessions | Not Supported |
| | Interface statistics | Supported |
| | IP switching | Supported |
| | IPv4: unicast and multicast | Supported |
| | IPv6: unicast without load balancing across member links | Supported |
| | IPv6: multicast | |
| | Layer 2 Tunneling Protocol Version 3 (L2TPv3), IPinIP, Any Transport Over Multiprotocol Label Switching (MPLS) (AToM) tunnels | Supported |
| | Layer 2 Tunneling Protocol Version 2 (L2TPv2) | Not Supported |
| | MPLS (6PE) | Supported |
| | Multicast VPN | Not Supported |
| | VLANs | Supported |
| 2.6 | Virtual Private Network (VPN) Routing and Forwarding (VRF) | Supported |
| 3.4 | IPv6: unicast and multicast | Supported |
| 3.6 | Bidirectional Forwarding Detection (BFD) over GEC | Supported |
| 3.7 | Layer 2 Tunneling Protocol Version 2 (L2TPv2) | Supported |
| | PPPoX (PPPoEoE, PPPoEoQinQ, PPPoVLAN) | Supported |
| 3.7.6 | Policy-based routing (PBR) over GEC | Supported |
| 3.11 | GEC over L2TPv3 | Supported |

| Cisco IOS XE Release | Feature | Bundle Interface |
|---|---|---|
| 3.12 | MPLS TE (Traffic Engineering) over GEC | Supported |

## Guidelines for LACP for Gigabit Interfaces Configuration

Port channel interfaces that are configured improperly with LACP are disabled automatically to avoid network loops and other problems. To avoid configuration problems, observe these guidelines and restrictions:

- Every port added to a port channel must be configured identically. No individual differences in configuration are allowed.
- Bundled ports can be configured on different line cards in a chassis.
- Maximum transmission units (MTUs) must be configured on only port channel interfaces; MTUs are propagated to the bundled ports.
- QoS and committed access rate (CAR) are applied at the port level. Access control lists (ACLs) are applied on port channels.
- MAC configuration is allowed only on port channels.
- MPLS IP should be enabled on bundled ports using the **mpls ip** command.
- Unicast Reverse Path Forwarding (uRPF) should be applied on the port channel interface using the **ip verify unicast reverse-path** command in interface configuration mode.
- Cisco Discovery Protocol should be enabled on the port channel interface using the **cdp enable** command in interface configuration mode.
- All LAN ports in a port channel should be enabled. If you shut down a LAN port in a port channel, the shutdown is treated as a link failure and the traffic is transferred to one of the remaining ports in the port channel.
- Create a port channel interface using the **interface port-channel** command in global configuration mode.
- When an Ethernet interface has an IP address assigned, disable that IP address before adding the interface to the port channel. To disable an existing IP address, use the **no ip address** command in interface configuration mode.
- The **hold queue in** command is valid only on port channel interfaces. The **hold queue out** command is valid only on bundled ports.

# How to Configure IEEE 802.3ad Link Bundling

## Enabling LACP

### SUMMARY STEPS

1. **enable**
2. **configure terminal**

3. **interface port-channel** *channel-number*
4. **channel-group** *channel-group-number* **mode** {**active** | **passive**}
5. **end**

**DETAILED STEPS**

**Procedure**

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br>**Example:**<br>`Device> enable` | Enables privileged EXEC mode.<br>• Enter your password if prompted. |
| **Step 2** | **configure terminal**<br>**Example:**<br>`Device# configure terminal` | Enters global configuration mode. |
| **Step 3** | **interface port-channel** *channel-number*<br>**Example:**<br>`Device(config)# interface port-channel 10` | Identifies the interface port channel and enters interface configuration mode. |
| **Step 4** | **channel-group** *channel-group-number* **mode** {**active** \| **passive**}<br>**Example:**<br>`Device(config-if)# channel-group 25 mode active` | Configures the interface in a channel group and sets it as active.<br>In active mode, the port will initiate negotiations with other ports by sending LACP packets. |
| **Step 5** | **end**<br>**Example:**<br>`Device(config-if)# end` | Returns to privileged EXEC mode. |

# Configuring a Port Channel

You must manually create a port channel logical interface. Perform this task to configure a port channel.

**SUMMARY STEPS**

1. **enable**
2. **configure terminal**
3. **interface port-channel** *channel-number*
4. **lacp max-bundle** *max-bundles*
5. **ip address** *ip-address mask*
6. **end**
7. **show running-config interface port-channel** *group-number*

## DETAILED STEPS

### Procedure

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br>**Example:**<br>`Device> enable` | Enables privileged EXEC mode.<br>• Enter your password if prompted. |
| **Step 2** | **configure terminal**<br>**Example:**<br>`Device# configure terminal` | Enters global configuration mode. |
| **Step 3** | **interface port-channel** *channel-number*<br>**Example:**<br>`Device(config)# interface port-channel 10` | Identifies the interface port channel and enters interface configuration mode. |
| **Step 4** | **lacp max-bundle** *max-bundles*<br>**Example:**<br>`Device(config-if)# lacp max-bundle 3` | Configures three active links on the port channel. The remaining links are in standby mode. Traffic is load-balanced among the active links. |
| **Step 5** | **ip address** *ip-address mask*<br>**Example:**<br>`Device(config-if)# ip address 172.31.52.10 255.255.255.0` | Assigns an IP address and subnet mask to the EtherChannel. |
| **Step 6** | **end**<br>**Example:**<br>`Device(config-if)# end` | Returns to privileged EXEC mode. |
| **Step 7** | **show running-config interface port-channel** *group-number*<br>**Example:**<br>`Device# show running-config interface port-channel 10` | Displays the port channel configuration. |

### Example

This example shows how to verify the configuration:

```
Device# show running-config interface port-channel 10

Building configuration...
Current configuration: : 110 bytes
!
interface Port-channel10
ip address 172.31.52.10 255.255.255.0
no negotiation auto
```

```
lacp max-bundle 3
end
```

# Configuring LACP (802.3ad) for Gigabit Interfaces

Perform this task to create a port channel with two bundled ports. You can configure a maximum of four bundled ports per port channel.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface port-channel** *number*
4. **ip address** *ip-address mask*
5. **interface** *type slot*/*subslot*/ *port*
6. **no ip address**
7. **channel-group** *channel-group-number* **mode** {**active** | **passive**}
8. **exit**
9. **interface** *type slot*/*subslot*/ *port*
10. **no ip address**
11. **channel-group** *channel-group-number* **mode** {**active** | **passive**}
12. **end**

### DETAILED STEPS

**Procedure**

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br>**Example:**<br>`Device> enable` | Enables privileged EXEC mode.<br>• Enter your password if prompted. |
| **Step 2** | **configure terminal**<br>**Example:**<br>`Device# configure terminal` | Enters global configuration mode. |
| **Step 3** | **interface port-channel** *number*<br>**Example:**<br>`Device(config)# interface port-channel 1` | Specifies the port channel interface and enters interface configuration mode.<br>• *number* —Valid range is from 1 to 64. |
| **Step 4** | **ip address** *ip-address mask*<br>**Example:**<br>`Device(config-if)# ip address 10.1.1.1 255.255.255.0` | Assigns an IP address and subnet mask to the port channel interface. |

| | Command or Action | Purpose |
|---|---|---|
| **Step 5** | **interface** *type slot/subslot/ port*<br>**Example:**<br>`Device(config-if)# interface gigabitethernet` | Specifies the port to bundle. |
| **Step 6** | **no ip address**<br>**Example:**<br>`Device(config-if)# no ip address` | Disables the IP address on the port channel interface. |
| **Step 7** | **channel-group** *channel-group-number* **mode** {**active** \| **passive**}<br>**Example:**<br>`Device(config-if)# channel-group 1 mode active` | Assigns the interface to a port channel group and sets the LACP mode.<br>• *channel-group-number* —Valid range is 1 to 64.<br>• **active** —Places a port into an active negotiating state, in which the port initiates negotiations with other ports by sending LACP packets.<br>• **passive** —Places a port into a passive negotiating state, in which the port responds to LACP packets it receives but does not initiate LACP negotiation. In this mode, the channel group attaches the interface to the bundle. |
| **Step 8** | **exit**<br>**Example:**<br>`Device(config-if)# exit` | Returns to global configuration mode. |
| **Step 9** | **interface** *type slot/subslot/ port*<br>**Example:**<br>`Device(config)# interface gigabitethernet` | Specifies the next port to bundle and places the CLI in interface configuration mode. |
| **Step 10** | **no ip address**<br>**Example:**<br>`Device(config-if)# no ip address` | Disables the IP address on the port channel interface. |
| **Step 11** | **channel-group** *channel-group-number* **mode** {**active** \| **passive**}<br>**Example:**<br>`Device(config-if)# channel-group 1 mode active` | Assigns the interface to the previously configured port channel group.<br>• *channel-group-number* —Valid range is 1 to 64.<br>• **active** —Places a port into an active negotiating state, in which the port initiates negotiations with other ports by sending LACP packets.<br>• **passive** —Places a port into a passive negotiating state, in which the port responds to LACP packets it receives but does not initiate LACP negotiation. In this mode, the channel-group attaches the interface to the bundle. |

| | Command or Action | Purpose |
|---|---|---|
| **Step 12** | **end**<br>**Example:**<br>`Device(config-if)# end` | Returns to privileged EXEC mode. |

**Example**

```
Device> enable
Device# configure terminal
Device(config)# interface port-channel 1
Device(config-if)# ip address 10.1.1.1 255.255.255.0
Device(config-if)#
Device(config-if)# no ip address
Device(config-if)# channel-group 1 mode active
Device(config-if)# exit
Device(config)#
Device(config-if)# no ip address
Device(config-if)# channel-group 1 mode active
Device(config-if)# end
```

# Setting LACP System Priority and Port Priority

Perform this task to set the LACP system priority and port priority. The system ID is the combination of the LACP system priority and the MAC address of a device. The port identifier is the combination of the port priority and port number.

## SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **lacp system-priority** *priority*
4. **interface** *slot*/*subslot*/ *port*
5. **lacp port-priority** *priority*
6. **end**
7. **show lacp sys-id**

## DETAILED STEPS

**Procedure**

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br>**Example:**<br>`Device> enable` | Enables privileged EXEC mode.<br>• Enter your password if prompted. |

| | Command or Action | Purpose |
|---|---|---|
| **Step 2** | **configure terminal**<br>**Example:**<br>`Device# configure terminal` | Enters global configuration mode. |
| **Step 3** | **lacp system-priority** *priority*<br>**Example:**<br>`Device(config)# lacp system-priority 200` | Sets the system priority. |
| **Step 4** | **interface** *slot*/*subslot*/ *port*<br>**Example:**<br>`Device(config)# interface gigabitethernet 0/1/1` | Specifies the bundled port on which to set the LACP port priority and enters interface configuration mode. |
| **Step 5** | **lacp port-priority** *priority*<br>**Example:**<br>`Device(config-if)# lacp port-priority 500` | Specifies the priority for the physical interface.<br>• *priority* —Valid range is from 1 to 65535. The higher the number, the lower the priority. |
| **Step 6** | **end**<br>**Example:**<br>`Device(config-if)# end` | Returns to privileged EXEC mode. |
| **Step 7** | **show lacp sys-id**<br>**Example:**<br>`Device# show lacp sys-id` | Displays the system ID (a combination of the system priority and the MAC address of the device). |

### Examples

```
Device> enable
Device# configure terminal
Device(config)# lacp system-priority 200
Device(config)# interface gigabitethernet 0/1/1
Device(config-if)# lacp port-priority 500
Device(config-if)# end
```

This example shows how to verify the LACP configuration:

```
Device# show lacp sys-id
200.abdc.abcd.abcd
```

# Adding and Removing Interfaces from a Link Bundle

### SUMMARY STEPS

1. **enable**
2. **configure terminal**

3. **interface** *type slot/subslot/port*
4. **channel-group** *channel-group-number* **mode** {**active** | **passive**}
5. **no channel-group** *channel-group-number* **mode** {**active** | **passive**}
6. **end**

**DETAILED STEPS**

**Procedure**

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br>**Example:**<br>`Device> enable` | Enables privileged EXEC mode.<br>• Enter your password if prompted. |
| **Step 2** | **configure terminal**<br>**Example:**<br>`Device# configure terminal` | Enters global configuration mode. |
| **Step 3** | **interface** *type slot/subslot/port*<br>**Example:**<br>`Device(config)# interface gigabitethernet` | Configures a Gigabit Ethernet interface. |
| **Step 4** | **channel-group** *channel-group-number* **mode** {**active** \| **passive**}<br>**Example:**<br>`Device(config-if)# channel-group 5 mode active` | Adds an interface to a channel group and enters interface configuration mode.<br>• In this instance, the interface from Step 3 is added. |
| **Step 5** | **no channel-group** *channel-group-number* **mode** {**active** \| **passive**}<br>**Example:**<br>`Device(config-if)# no channel-group 5 mode active` | Removes the Gigabit Ethernet interface from channel group. |
| **Step 6** | **end**<br>**Example:**<br>`Device(config-if)# end` | Returns to privileged EXEC mode. |

# Removing a Channel Group from a Port

Perform this task to remove a Gigabit Ethernet port channel group from a physical port.

**SUMMARY STEPS**

1. **enable**
2. **configure terminal**
3. **no interface port-channel** *number*

4. **end**

**DETAILED STEPS**

**Procedure**

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br>**Example:**<br>`Device> enable` | Enables privileged EXEC mode.<br>• Enter your password if prompted. |
| **Step 2** | **configure terminal**<br>**Example:**<br>`Device# configure terminal` | Enters global configuration mode. |
| **Step 3** | **no interface port-channel** *number*<br>**Example:**<br>`Device(config)# no interface port-channel 1` | Removes the specified port channel group from a physical port. |
| **Step 4** | **end**<br>**Example:**<br>`Device(config)# end` | Returns to privileged EXEC mode. |

**Example**

```
Device> enable
Device# configure terminal
Device(config)# no interface port-channel 1
Device(config)# end
```

# Setting a Minimum Threshold of Active Links

**SUMMARY STEPS**

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **lacp min-bundle** *min-bundle*
5. **end**

**DETAILED STEPS**

**Procedure**

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br>**Example:**<br>`Device> enable` | Enables privileged EXEC mode.<br>• Enter your password if prompted. |
| **Step 2** | **configure terminal**<br>**Example:**<br>`Device# configure terminal` | Enters global configuration mode. |
| **Step 3** | **interface** *type number*<br>**Example:**<br>`Device(config)# interface port-channel 1` | Creates a port-channel virtual interface and enters interface configuration mode. |
| **Step 4** | **lacp min-bundle** *min-bundle*<br>**Example:**<br>`Device(config-if)# lacp min-bundle 1` | Sets the minimum threshold of active links to 1.<br>**Note**<br>For Cisco ASR 1000 Series Aggregation Services Routers, the minimum number of member links per GEC interface is 1 and the maximum number is 14. |
| **Step 5** | **end**<br>**Example:**<br>`Device(config-if)# end` | Returns to privileged EXEC mode. |

# Monitoring LACP Status

**SUMMARY STEPS**

1. **enable**
2. **show lacp** {*number* | **counters** | **internal** | **neighbor** | **sys-id**}

**DETAILED STEPS**

**Procedure**

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br>**Example:**<br>`Device> enable` | Enables privileged EXEC mode.<br>• Enter your password if prompted. |

| | Command or Action | Purpose |
|---|---|---|
| **Step 2** | **show lacp** {*number* \| **counters** \| **internal** \| **neighbor** \| **sys-id**}<br>**Example:**<br>`Device# show lacp internal` | Displays internal device information. |

## Troubleshooting Tips

To verify and isolate a fault, start at the highest level maintenance domain and do the following:

1. Check the device error status.
2. When a error exists, perform a loopback test to confirm the error.
3. Run a traceroute to the destination to isolate the fault.
4. If the fault is identified, correct the fault.
5. If the fault is not identified, go to the next lower maintenance domain and repeat steps 1 through 4 at that maintenance domain level.
6. Repeat the first four steps, as needed, to identify and correct the fault.

# Displaying Gigabit EtherChannel Information

To display Gigabit Ethernet port channel information, use the **show interfaces port-channel** command in user EXEC mode or privileged EXEC mode. The following example shows information about port channels configured on ports 0/2 and 0/3. The default MTU is set to 1500 bytes.

```
Device# show interfaces port-channel 1
Port-channel1 is up, line protocol is up
Hardware is GEChannel, address is 0013.19b3.7748 (bia 0000.0000.0000)
MTU 1500 bytes, BW 2000000 Kbit, DLY 10 usec,
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, loopback not set
Keepalive set (10 sec)
ARP type: ARPA, ARP Timeout 04:00:00
No. of active members in this channel: 2
Member 0 : GigabitEthernet , Full-duplex, 1000Mb/s Member 1 : GigabitEthernet , Full-duplex,
 1000Mb/s
Last input 00:00:05, output never, output hang never
Last clearing of "show interface" counters 00:04:40
Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
Interface Port-channel1 queueing strategy: PXF First-In-First-Out
Output queue 0/8192, 0 drops; input queue 0/75, 0 drops
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
0 packets input, 0 bytes, 0 no buffer
Received 0 broadcasts (0 IP multicasts)
0 runts, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
0 watchdog, 0 multicast, 0 pause input
3 packets output, 180 bytes, 0 underruns
0 output errors, 0 collisions, 0 interface resets
0 babbles, 0 late collision, 0 deferred
```

```
0 lost carrier, 0 no carrier, 0 PAUSE output
0 output buffer failures, 0 output buffers swapped out
```

The table below describes the significant fields shown in the display.

***Table 2: show interfaces port-channel Field Descriptions***

| Field | Description |
|---|---|
| Port-channel1 is up, line protocol is up | Indicates the bundle interface is currently active and can transmit and receive or it has been taken down by an administrator. |
| Hardware is | Hardware type (Gigabit EtherChannel). |
| address is | Address being used by the interface. |
| MTU | Maximum transmission unit of the interface. |
| BW | Bandwidth of the interface, in kilobits per second. |
| DLY | Delay of the interface, in microseconds. |
| reliability | Reliability of the interface as a fraction of 255 (255/255 is 100 percent reliability), calculated as an exponential average over 5 minutes. |
| tx load rxload | Transmit and receive load on the interface as a fraction of 255 (255/255 is completely saturated), calculated as an exponential average over 5 minutes. The calculation uses the value from the **bandwidth** interface configuration command. |
| Encapsulation | Encapsulation type assigned to the interface. |
| loopback | Indicates if loopbacks are set. |
| keepalive | Indicates if keepalives are set. |
| ARP type | Address Resolution Protocol (ARP) type on the interface. |
| ARP Timeout | Number of hours, minutes, and seconds an ARP cache entry stays in the cache. |
| No. of active members in this channel | Number of bundled ports (members) currently active and part of the port channel group. |
| Member <*no.*> Gigabit Ethernet: <*no.* /*no.* /*no.* > | Number of the bundled port and associated Gigabit Ethernet port channel interface. |
| Last input | Number of hours, minutes, and seconds since the last packet was successfully received by an interface and processed locally on the Device. Useful for knowing when a dead interface failed. This counter is updated only when packets are process-switched, not when packets are fast-switched. |
| output | Number of hours, minutes, and seconds since the last packet was successfully transmitted by an interface. This counter is updated only when packets are process-switched, not when packets are fast-switched. |

| Field | Description |
|---|---|
| output hang | Number of hours, minutes, and seconds since the interface was last reset because of a transmission that took too long. When the number of hours in any of the "last" fields exceeds 24 hours, the number of days and hours is printed. If that field overflows, asterisks are printed. |
| last clearing | Time at which the counters that measure cumulative statistics (such as number of bytes transmitted and received) shown in this report were last reset to zero. Variables that might affect routing (for example, load and reliability) are not cleared when the counters are cleared.<br>*** indicates that the elapsed time is too long to be displayed.<br>0:00:00 indicates that the counters were cleared more than 231 ms and less than 232 ms ago. |
| Input queue | Number of packets in the input queue and the maximum size of the queue. |
| Queueing strategy | First-in, first-out queueing strategy (other queueing strategies you might see are priority-list, custom-list, and weighted fair). |
| Output queue | Number of packets in the output queue and the maximum size of the queue. |
| 5 minute input rate 5 minute output rate | Average number of bits and packets received or transmitted per second in the last 5 minutes. |
| packets input | Total number of error-free packets received by the system. |
| bytes (input) | Total number of bytes, including data and MAC encapsulation, in the error-free packets received by the system. |
| no buffer | Number of received packets discarded because there was no buffer space in the main system. Broadcast storms on Ethernet lines and bursts of noise on serial lines are often responsible for no input buffer events. |
| broadcasts | Total number of broadcast or multicast packets received by the interface. |
| runts | Number of packets that are discarded because they are smaller than the minimum packet size for the medium. |
| giants | Number of packets that are discarded because they exceed the maximum packet size for the medium. |
| input errors | Total number of no buffer, runts, giants, cyclic redundancy checks (CRCs), frame, overrun, ignored, and terminated counts. Other input-related errors can also increment the count, so that this sum might not balance with the other counts. |
| CRC | CRC generated by the originating LAN station or far-end device does not match the checksum calculated from the data received. On a LAN, this usually indicates noise or transmission problems on the LAN interface or the LAN bus. A high number of CRCs is usually the result of collisions or a station transmitting bad data. On a serial link, CRCs usually indicate noise, gain hits or other transmission problems on the data link. |

| Field | Description |
|---|---|
| frame | Number of packets received incorrectly having a CRC error and a noninteger number of octets. On a serial line, this is usually the result of noise or other transmission problems. |
| overrun | Number of times the serial receiver hardware was unable to pass received data to a hardware buffer because the input rate exceeded the receiver's capacity for handling the data. |
| ignored | Number of received packets ignored by the interface because the interface hardware ran low on internal buffers. These buffers are different than the system buffers mentioned previously in the buffer description. Broadcast storms and bursts of noise can cause the ignored count to be incremented. |
| watchdog | Number of times the watchdog receive timer expired. |
| multicast | Number of multicast packets received. |
| packets output | Total number of messages transmitted by the system. |
| bytes (output) | Total number of bytes, including data and MAC encapsulation, transmitted by the system. |
| underruns | Number of times that the far-end transmitter has been running faster than the near-end Device's receiver can handle. |
| output errors | Sum of all errors that prevented the final transmission of datagrams out of the interface being examined. Note that this might not balance with the sum of the enumerated output errors, as some datagrams can have more than one error, and others can have errors that do not fall into any of the specifically tabulated categories. |
| collisions | Number of messages retransmitted because of an Ethernet collision. A packet that collides is counted only once in output packets. |
| interface resets | Number of times an interface has been completely reset. This can happen if packets queued for transmission were not sent within a certain interval. If the system notices that the carrier detect line of an interface is up but the line protocol is down, the system periodically resets the interface in an effort to restart that interface. Interface resets can also occur when an unrecoverable interface processor error occurred, or when an interface is looped back or shut down. |
| babbles | The transmit jabber timer expired. |
| late collision | Number of late collisions. Late collision happens when a collision occurs after transmitting the preamble. The most common cause of late collisions is that your Ethernet cable segments are too long for the speed at which you are transmitting. |
| deferred | Indicates that the chip had to defer while ready to transmit a frame because the carrier was asserted. |
| lost carrier | Number of times the carrier was lost during transmission. |

| Field | Description |
|---|---|
| no carrier | Number of times the carrier was not present during the transmission. |
| PAUSE output | Not supported. |
| output buffer failures | Number of times that a packet was not output from the output hold queue because of a shortage of shared memory. |
| output buffers swapped out | Number of packets stored in main memory when the output queue is full; swapping buffers to main memory prevents packets from being dropped when output is congested. The number is high when traffic is bursty. |

# Configuration Examples for IEEE 802.3ad Link Bundling

## Example: Configuring LACP for Gigabit Interfaces

The following example shows how to configure Gigabit Ethernet ports into port channel 1 with LACP parameters.

```
Device> enable
Device# configure terminal
Device(config)# lacp system-priority 65535
Device(config)# interface port-channel 1
Device(config-if)# lacp max-bundle 1
Device(config-if)# ip address 10.1.1.1 255.255.255.0
Device(config-if)# exit
Device(config)#
Device(config-if)# no ip address
Device(config-if)# lacp port-priority 100
Device(config-if)# channel-group 1 mode passive
Device(config-if)# exit
Device(config)#
Device(config-if)# no ip address
Device(config-if)# lacp port-priority 200
Device(config-if)# channel-group 1 mode passive
Device(config-if)# end
```

## Example Associating a Channel Group with a Port Channel

This example shows how to configure channel group number 5 and include it in the channel group.

```
Device1# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Device1(config)# interface port 5
Device1(config-if)#
*Aug 20 17:06:14.417: %LINEPROTO-5-UPDOWN: Line protocol on Interface Port-channel5, changed
 state to down
*Aug 20 17:06:25.413: %LINK-3-UPDOWN: Interface Port-channel5, changed state to down
Device1(config-if)#
Device1(config-if)#
Device1(config-if)# channel-group 5 mode active
Device1(config-if)#
*Aug 20 17:07:43.713: %LINK-3-UPDOWN: Interface GigabitEthernet, changed state to down
*Aug 20 17:07:44.713: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet,
```

```
changed state to down
*Aug 20 17:07:45.093: %C10K_ALARM-6-INFO: ASSERT CRITICAL GigE  Physical Port Link Down
*Aug 20 17:07:45.093: %C10K_ALARM-6-INFO: CLEAR CRITICAL GigE  Physical Port Link Down
*Aug 20 17:07:47.093: %LINK-3-UPDOWN: Interface GigabitEthernet, changed state to up
*Aug 20 17:07:48.093: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet,
changed state to up
*Aug 20 17:07:48.957: GigabitEthernet added as member-1 to port-channel5

*Aug 20 17:07:51.957: %LINEPROTO-5-UPDOWN: Line protocol on Interface Port-channel5, changed
 state to up
Device1(config-if)# end
Device1#
*Aug 20 17:08:00.933: %SYS-5-CONFIG_I: Configured from console by console
Device1# show etherchannel summary
Flags:  D - down        P/bndl - bundled in port-channel
        I - stand-alone s/susp - 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


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

Group  Port-channel  Protocol    Ports
------+-------------+-----------+-----------------------------------------------
1       Po1(RU)         LACP     Te0/3/0(bndl) Te0/3/1(hot-sby)

RU - L3 port-channel UP State
SU - L2 port-channel UP state
P/bndl -  Bundled
S/susp  - Suspended

Device1# show running-config int po1
Building configuration...

Current configuration : 87 bytes
!
interface Port-channel1
 no ip address
 lacp fast-switchover
 lacp max-bundle 1
end

Device1# 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 5
                            LACP port     Admin     Oper    Port        Port
Port      Flags   State     Priority      Key       Key     Number      State
   SA      bndl      32768         0x5       0x5     0x43        0x3D
Device1# show interface port 5
Port-channel5 is up, line protocol is up
  Hardware is GEChannel, address is 0014.a93d.4aa8 (bia 0000.0000.0000)
  MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
```

```
  ARP type: ARPA, ARP Timeout 04:00:00
    No. of active members in this channel: 1
        Member 0 : GigabitEthernet , Full-duplex, 1000Mb/s
  Last input 00:00:05, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Interface Port-channel5 queueing strategy: PXF First-In-First-Out
  Output queue 0/8192, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     0 packets input, 0 bytes, 0 no buffer
     Received 0 broadcasts (0 IP multicasts)
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
     0 watchdog, 0 multicast, 0 pause input
     9 packets output, 924 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 babbles, 0 late collision, 0 deferred
     0 lost carrier, 0 no carrier, 0 PAUSE output
     0 output buffer failures, 0 output buffers swapped out
```

# Example Adding and Removing Interfaces from a Bundle

The following example shows how to add an interface to a bundle:

```
Device1# 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 5
                            LACP port     Admin     Oper    Port        Port
Port      Flags   State     Priority      Key       Key     Number      State
   SA      bndl      32768         0x5       0x5     0x43        0x3D
Device1# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Device1(config)#
Device1(config-if)# channel-group 5 mode active
Device1(config-if)#
*Aug 20 17:10:19.057: %LINK-3-UPDOWN: Interface GigabitEthernet, changed state to down
*Aug 20 17:10:19.469: %C10K_ALARM-6-INFO: ASSERT CRITICAL GigE  Physical Port Link Down
*Aug 20 17:10:19.473: %C10K_ALARM-6-INFO: CLEAR CRITICAL GigE  Physical Port Link Down
*Aug 20 17:10:21.473: %LINK-3-UPDOWN: Interface GigabitEthernet, changed state to up
*Aug 20 17:10:21.473: GigabitEthernet taken out of port-channel5
*Aug 20 17:10:23.413: GigabitEthernet added as member-1 to port-channel5

*Aug 20 17:10:23.473: %LINK-3-UPDOWN: Interface Port-channel5, changed state to up
Device1(config-if)# end
Device1#
*Aug 20 17:10:27.653: %SYS-5-CONFIG_I: Configured from console by console
*Aug 20 17:11:40.717: GigabitEthernet added as member-2 to port-channel5

Device1# 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 5
                            LACP port     Admin     Oper    Port        Port
Port      Flags   State     Priority      Key       Key     Number      State
   SA      bndl      32768         0x5       0x5     0x43        0x3D
   SA      bndl      32768         0x5       0x5     0x42        0x3D
Device1#
Device1# show interface port 5
Port-channel5 is up, line protocol is up
```

```
  Hardware is GEChannel, address is 0014.a93d.4aa8 (bia 0000.0000.0000)
  MTU 1500 bytes, BW 2000000 Kbit, DLY 10 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  ARP type: ARPA, ARP Timeout 04:00:00
    No. of active members in this channel: 2
        Member 0 : GigabitEthernet , Full-duplex, 1000Mb/s  <---- added to port channel
bundle
        Member 1 : GigabitEthernet , Full-duplex, 1000Mb/s
  Last input 00:00:00, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/150/0/0 (size/max/drops/flushes); Total output drops: 0
  Interface Port-channel5 queueing strategy: PXF First-In-First-Out
  Output queue 0/8192, 0 drops; input queue 0/150, 0 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     0 packets input, 0 bytes, 0 no buffer
     Received 0 broadcasts (0 IP multicasts)
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
     0 watchdog, 0 multicast, 0 pause input
     104 packets output, 8544 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 babbles, 0 late collision, 0 deferred
     0 lost carrier, 0 no carrier, 0 PAUSE output
     0 output buffer failures, 0 output buffers swapped out
```

The following example shows how to remove an interface from a bundle:

```
Device1# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Device1(config)#
Device1(config-if)# no channel-group 5 mode active
Device1(config-if)#
*Aug 20 17:15:49.433: GigabitEthernet taken out of port-channel5
*Aug 20 17:15:49.557: %C10K_ALARM-6-INFO: ASSERT CRITICAL GigE  Physical Port Link Down
*Aug 20 17:15:50.161: %C10K_ALARM-6-INFO: CLEAR CRITICAL GigE  Physical Port Link Down
*Aug 20 17:15:51.433: %LINK-3-UPDOWN: Interface GigabitEthernet, changed state to down
*Aug 20 17:15:52.433: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet,
changed state to down
Device1(config-if)# end
Device1#
*Aug 20 17:15:58.209: %SYS-5-CONFIG_I: Configured from console by console
Device1#
*Aug 20 17:15:59.257: %C10K_ALARM-6-INFO: ASSERT CRITICAL GigE  Physical Port Link Down
*Aug 20 17:15:59.257: %C10K_ALARM-6-INFO: CLEAR CRITICAL GigE  Physical Port Link Down
Device1#
*Aug 20 17:16:01.257: %LINK-3-UPDOWN: Interface GigabitEthernet, changed state to up
*Aug 20 17:16:02.257: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet,
changed state to up
Device1# 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 5
                            LACP port     Admin     Oper    Port        Port
Port      Flags   State     Priority      Key       Key     Number      State
   SA      bndl      32768         0x5       0x5     0x42        0x3D
```

# Example Monitoring LACP Status

The following example shows LACP activity that you can monitor by using the **show lacp** command.

```
Device1# 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 5
                            LACP port     Admin     Oper    Port        Port
Port      Flags   State     Priority      Key       Key     Number      State
   SA      bndl      32768         0x5       0x5     0x42        0x3D
Device1# show lacp 5 counters
             LACPDUs         Marker      Marker Response    LACPDUs
Port       Sent   Recv     Sent   Recv     Sent   Recv      Pkts Err
---------------------------------------------------------------------
Channel group: 5
     21     18       0      0        0      0         0
Device1# show lacp 5 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 5
                            LACP port     Admin     Oper    Port        Port
Port      Flags   State     Priority      Key       Key     Number      State
   SA      bndl      32768         0x5       0x5     0x42        0x3D
Device1# show lacp 5 neighbor
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 5 neighbors
Partner's information:
          Partner Partner   LACP Partner  Partner   Partner  Partner     Partner
Port      Flags   State     Port Priority Admin Key Oper Key Port Number Port State
   SP      32768     0011.2026.7300  11s    0x1     0x14     0x3C
Device1# show lacp counters
             LACPDUs         Marker      Marker Response    LACPDUs
Port       Sent   Recv     Sent   Recv     Sent   Recv      Pkts Err
---------------------------------------------------------------------
Channel group: 5
     23     20       0      0        0      0         0
Device1# show lacp sys-id
32768,0014.a93d.4a00
```

# Example: Displaying Port-Channel Interface Information

The following example shows how to display the configuration of port-channel interface 1.

```
Device# show interface port-channel 1
Port-channel1 is up, line protocol is up
Hardware is GEChannel, address is 0013.19b3.7748 (bia 0000.0000.0000)
MTU 1500 bytes, BW 2000000 Kbit, DLY 10 usec,
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, loopback not set
Keepalive set (10 sec)
ARP type: ARPA, ARP Timeout 04:00:00
No. of active members in this channel: 2
Member 0 : GigabitEthernet , Full-duplex, 1000Mb/s Member 1 : GigabitEthernet , Full-duplex,
 1000Mb/s
Last input 00:00:05, output never, output hang never
Last clearing of "show interface" counters 00:04:40
Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
Interface Port-channel1 queueing strategy: PXF First-In-First-Out
Output queue 0/8192, 0 drops; input queue 0/75, 0 drops
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
0 packets input, 0 bytes, 0 no buffer
```

```
Received 0 broadcasts (0 IP multicasts)
0 runts, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
0 watchdog, 0 multicast, 0 pause input
3 packets output, 180 bytes, 0 underruns
0 output errors, 0 collisions, 0 interface resets
0 babbles, 0 late collision, 0 deferred
0 lost carrier, 0 no carrier, 0 PAUSE output
0 output buffer failures, 0 output buffers swapped out
```

# Additional References Configuring IEEE 802.3ad Link Bundling

### Related Documents

| Related Topic | Document Title |
|---|---|
| Configuring EtherChannels | "Configuring Layer 3 and Layer 2 EtherChannel" chapter of the *Catalyst 6500 Release 12.2SXF Software Configuration Guide* |
| LACP commands | Cisco IOS Carrier Ethernet Command Reference |
| LACP commands: complete command syntax, command mode, command history, defaults, usage guidelines, and examples | Cisco IOS Network Management Command Reference |

### Standards

| Standard | Title |
|---|---|
| IEEE 802.3ad-2000 | *IEEE 802.3ad-2000 Link Aggregation* |

### Technical Assistance

| Description | Link |
|---|---|
| The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password. | http://www.cisco.com/cisco/web/support/index.html |

# Feature Information for Configuring IEEE 802.3ad Link Bundling

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

*Table 3: Feature Information for Configuring IEEE 802.3ad Link Bundling*

| Feature Name | Releases | Feature Information |
|---|---|---|
| EtherChannel Min-Links | Cisco IOS XE Release 2.5<br>Cisco IOS XE Release 3.8S | The EtherChannel Min-Links feature allows a port channel to be shut down when the number of active links falls below the minimum threshold. Using the **lacp min-bundle** command, you can configure the minimum threshold.<br>In Cisco IOS XE Release 3.8S, support was added for the Cisco ASR 903 Router.<br>The following commands were introduced or modified: **lacp min-bundle**. |
| IEEE 802.3ad Faster Link Switchover Time | Cisco IOS XE Release 2.5 | The IEEE 802.3ad Faster Link Switchover Time feature provides a link failover time of 250 milliseconds or less and a maximum link failover time of 2 seconds. Also, port channels remain in the LINK_UP state to eliminate reconvergence by the Spanning-Tree Protocol.<br>The following commands were introduced or modified: **lacp fast-switchover**. |
| IEEE 802.3ad Link Aggregation (LACP) | Cisco IOS XE Release 2.4 | The IEEE 802.3ad Link Aggregation feature provides a method for aggregating multiple Ethernet links into a single logical channel based on the IEEE 802.3ad standard. In addition, this feature provides a capability to dynamically provision, manage, and monitor various aggregated links and enables interoperability between various Cisco devices and devices of third-party vendors.<br>In Cisco IOS XE Release 2.4, this feature was implemented on the Cisco ASR1000 Series Router.<br>The following commands were introduced or modified: **channel-group (interface)**, **debug lacp**, **lacp max-bundle**, **lacp port-priority**, **lacp system-priority**, **show lacp**. |
| Link Aggregation Control Protocol (LACP) (802.3ad) for Gigabit Interfaces | Cisco IOS XE Release 2.5 | The LACP (802.3ad) for Gigabit Interfaces feature bundles individual Gigabit Ethernet links into a single logical link that provides the aggregate bandwidth of up to four physical links.<br>The following commands were introduced or modified: **lacp max-bundle**. |
| SSO - LACP | Cisco IOS XE Release 2.5 | The SSO - LACP feature supports stateful switchover (SSO), in service software upgrade (ISSU), Cisco nonstop forwarding (NSF), and nonstop routing (NSR) on Gigabit EtherChannel bundles.<br>This feature uses no new or modified commands. |

| Feature Name | Releases | Feature Information |
|---|---|---|
| Support for 14 Member-links per GEC Bundle | Cisco IOS XE Denali 16.3.1 | The Support for 14 Member-links per GEC Bundle feature extends the number of supported member links from 4 to 14 on Cisco ASR 1000 Series Aggregation Services Routers.<br>This feature uses no new or modified commands. |