IEEE 802.3ad Link Bundling

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The IEEE 802.3ad Link Bundling feature provides a method of aggregating multiple Ethernet links into a single logical channel. This feature helps improve the cost effectiveness of a device by increasing cumulative bandwidth without 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.

This document describes how the IEEE 802.3ad Link Bundling feature leverages the EtherChannel infrastructure within Cisco IOS software to manage the bundling of various links.

Finding Feature Information in This Module

Your Cisco IOS software release may not support all of the features documented in this module. To reach links to specific feature documentation in this module and to see a list of the releases in which each feature is supported, use the "Feature Information for IEEE 802.3ad Link Bundling" section on page 40.

Finding Support Information for Platforms and Cisco IOS and Catalyst OS Software Images

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

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Prerequisites for IEEE 802.3ad Link Bundling

- Knowledge of how EtherChannels and LACP function in a network

Restrictions for IEEE 802.3ad Link Bundling

- Number of links supported per bundle is bound by the platform.
- On the Cisco 10000 router, the number of links per bundle is 4.
- On the Cisco 10000 only 1-gigabit-per-second (Gbps) ports are supported for Gigabit EtherChannels (GECs).
- All links must operate at the same link speed and in full-duplex mode (Link Aggregation Control Protocol [LACP] does not support half-duplex mode).
- 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.

Information About IEEE 802.3ad Link Bundling

Before you set up IEEE 802.3ad Link Bundling, you should understand the following concepts:

Gigabit EtherChannel

Gigabit EtherChannel is high-performance Ethernet technology that provides Gbps transmission rates. A Gigabit EtherChannel bundles individual Gigabit Ethernet links into a single logical link that provides the aggregate bandwidth of up to eight 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, if not already created, is created automatically when the first physical interface is 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 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. In Cisco IOS Release 12.2(31)SB2 on the Cisco 10000 series router, only 4 ports per bundle can be aggregated and the peer must be configured to support LACP. 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. See the "lacp max-bundle" section on page 29 for additional details.

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.

Benefits of IEEE 802.3ad Link Bundling

IEEE 802.3ad Link Bundling offers the following benefits:

- Increased network capacity without changing physical connections or upgrading hardware
- Cost savings resulting from 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

How to Configure IEEE 802.3ad Link Bundling

Perform the following tasks to configure IEEE 802.3ad Link Bundling:

Enabling LACP

Perform this task to enable 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

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface port-channel** *channel-number* **Example:** `Router(config)# interface port-channel 10`	Identifies the interface port channel and places the command-line interface (CLI) in interface configuration mode.
Step 4	**channel-group** *channel-group-number* **mode** {**active** | **passive**} **Example:** `Router(config-if)# channel-group 25 mode active`	Configures the interface in a channel group and sets it as active. In active mode, the port will initiate negotiations with other ports by sending LACP packets.
Step 5	**end** **Example:** `Router(config-if)# end`	Returns CLI 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. **ip address** *ip_address mask*
5. **end**
6. **show running-config interface port-channel** *group_number*
7. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface port-channel** *channel-number* **Example:** `Router(config)# interface port-channel 10`	Identifies the interface port channel and places the CLI in interface configuration mode.
Step 4	**ip address** *ip_address mask* **Example:** `Router(config-if)# ip address 172.31.52.10 255.255.255.0`	Assigns an IP address and subnet mask to the EtherChannel.
Step 5	**end** **Example:** `Router(config-if)# end`	Returns the CLI to privileged EXEC mode.
Step 6	**show running-config interface port-channel** *group_number* **Example:** `Router# show running-config interface port-channel 10`	Displays the port channel configuration.
Step 7	**end** **Example:** `Router# end`	Ends the current configuration session.

Examples

This example shows how to verify the configuration:

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

Building configuration...
Current configuration:
!
interface Port-channel10
 ip address 172.31.52.10 255.255.255.0
 no ip directed-broadcast
end
```

Associating a Channel Group with a Port Channel

Perform this task to associate a channel group with a port channel.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface port-channel** *channel-number*
4. **interface** *type number*
5. **channel-group** *channel-group-number* **mode** {**active** | **passive**}
6. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface port-channel** *channel-number* **Example:** `Router(config)# interface port-channel 5`	Creates a port channel.
Step 4	**interface** *type number* Example: `Router(config)# interface gigabitethernet 7/0/0`	Configures a GigabitEthernet interface and places the CLI in interface configuration mode.

	Command or Action	Purpose
Step 5	**channel-group** *channel-group-number* **mode** {**active** | **passive**} Example: `Router(config-if)# channel-group 5 mode active`	Includes the interface as part of the port channel bundle.
Step 6	**end** **Example:** `Router(config-if)# end`	Returns the CLI to privileged EXEC mode.

Setting LACP System Priority

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

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **lacp system-priority** *priority*
4. **end**
5. **show lacp sys-id**
6. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**lacp system-priority** *priority* **Example:** `Router(config)# lacp system-priority 200`	Sets the system priority.
Step 4	**end** **Example:** `Router(config)# end`	Returns the CLI to privileged EXEC mode.

	Command or Action	Purpose
Step 5	**show lacp sys-id** **Example:** `Router# show lacp 200`	Displays the system ID, which is a combination of the system priority and the MAC address of the device.
Step 6	**end** **Example:** `Router# end`	Ends the current configuration session.

Examples

This example shows how to verify the LACP configuration:

```
Router# show lacp 200

200.abcd.abcd.abcd.
```

Adding and Removing Interfaces from a Bundle

Perform this task to add and remove an interface from a link bundle.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **channel-group** *channel-group-number* **mode** {**active** | **passive**}
5. **no channel-group** *channel-group-number* **mode** {**active** | **passive**}
6. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Router(config)# interface gigabitethernet 5/0/0`	Configures a GigabitEthernet interface.

	Command or Action	Purpose
Step 4	**channel-group** *channel-group-number* **mode** {**active** | **passive**} **Example:** `Router(config-if)# channel-group 5 mode active`	Adds a GigabitEthernet interface to a channel group and places the CLI in interface configuration mode.
Step 5	**no channel-group** *channel-group-number* **Example:** `Router(config-if)# no channel-group 5 mode active`	Removes the GigabitEthernet interface from channel group.
Step 6	**end** **Example:** `Router(config-if)# end`	Returns the CLI to privileged EXEC mode.

Monitoring LACP Status

Perform this task to monitor LACP activity in the network.

SUMMARY STEPS

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

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**show lacp** {*number* | **counters** | **internal** | **neighbor** | **sys-id**} Example: `Router# show lacp internal`	Displays internal device information.
Step 3	**end** **Example:** `Router# end`	Ends the current configuration session.

Troubleshooting Tips

Use the **debug lacp** command to display LACP configuration and activity details.

The following sample output from a **debug lacp all** command shows that a remote device is removing a link and also adding a link.

The following sample output shows a remote device removing a link:

```
Router1# debug lacp all

Link Aggregation Control Protocol all debugging is on

Router1#

*Aug 20 17:21:51.685: LACP :lacp_bugpak: Receive LACP-PDU packet via Gi5/0/0
*Aug 20 17:21:51.685: LACP : packet size: 124
*Aug 20 17:21:51.685: LACP: pdu: subtype: 1, version: 1
*Aug 20 17:21:51.685: LACP: Act: tlv:1, tlv-len:20, key:0x1, p-pri:0x8000, p:0x14,
p-state:0x3C,
s-pri:0xFFFF, s-mac:0011.2026.7300
*Aug 20 17:21:51.685: LACP: Part: tlv:2, tlv-len:20, key:0x5, p-pri:0x8000, p:0x42,
p-state:0x3D,
s-pri:0x8000, s-mac:0014.a93d.4a00
*Aug 20 17:21:51.685: LACP: col-tlv:3, col-tlv-len:16, col-max-d:0x8000
*Aug 20 17:21:51.685: LACP: term-tlv:0 termr-tlv-len:0
*Aug 20 17:21:51.685: LACP: Gi5/0/0 LACP packet received, processing
*Aug 20 17:21:51.685:     lacp_rx Gi5: during state CURRENT, got event 5(recv_lacpdu)
*Aug 20 17:21:59.869: LACP: lacp_p(Gi5/0/0) timer stopped
*Aug 20 17:21:59.869: LACP: lacp_p(Gi5/0/0) expired
*Aug 20 17:21:59.869:     lacp_ptx Gi5: during state SLOW_PERIODIC, got event
3(pt_expired)
*Aug 20 17:21:59.869: @@@ lacp_ptx Gi5: SLOW_PERIODIC -> PERIODIC_TX
*Aug 20 17:21:59.869: LACP: Gi5/0/0 lacp_action_ptx_slow_periodic_exit entered
*Aug 20 17:21:59.869: LACP: lacp_p(Gi5/0/0) timer stopped
*Aug 20 17:22:00.869: LACP: lacp_t(Gi5/0/0) timer stopped
*Aug 20 17:22:00.869: LACP: lacp_t(Gi5/0/0) expired
*Aug 20 17:22:19.089: LACP :lacp_bugpak: Receive LACP-PDU packet via Gi5/0/0
*Aug 20 17:22:19.089: LACP : packet size: 124
*Aug 20 17:22:19.089: LACP: pdu: subtype: 1, version: 1
*Aug 20 17:22:19.089: LACP: Act: tlv:1, tlv-len:20, key:0x1, p-pri:0x8000, p:0x14,
p-state:0x4,
s-pri:0xFFFF, s-mac:0011.2026.7300
*Aug 20 17:22:19.089: LACP: Part: tlv:2, tlv-len:20, key:0x5, p-pri:0x8000, p:0x42,
p-state:0x34,
s-pri:0x8000, s-mac:0014.a93d.4a00
*Aug 20 17:22:19.089: LACP: col-tlv:3, col-tlv-len:16, col-max-d:0x8000
*Aug 20 17:22:19.089: LACP: term-tlv:0 termr-tlv-len:0
*Aug 20 17:22:19.089: LACP: Gi5/0/0 LACP packet received, processing
*Aug 20 17:22:19.089:     lacp_rx Gi5: during state CURRENT, got event 5(recv_lacpdu)
*Aug 20 17:22:19.989: LACP: lacp_t(Gi5/0/0) timer stopped
*Aug 20 17:22:19.989: LACP: lacp_t(Gi5/0/0) expired
*Aug 20 17:22:19.989: LACP: timer lacp_t(Gi5/0/0) started with interval 1000.
*Aug 20 17:22:19.989: LACP: lacp_send_lacpdu: (Gi5/0/0) About to send the 110 LACPDU
*Aug 20 17:22:19.989: LACP :lacp_bugpak: Send LACP-PDU packet via Gi5/0/0
*Aug 20 17:22:19.989: LACP : packet size: 124
*Aug 20 17:22:20.957: LACP: lacp_t(Gi5/0/0) timer stopped
*Aug 20 17:22:20.957: LACP: lacp_t(Gi5/0/0) expired
*Aug 20 17:22:21.205: %LINK-3-UPDOWN: Interface GigabitEthernet5/0/0, changed state to
down
*Aug 20 17:22:21.205: LACP: lacp_hw_off: Gi5/0/0 is going down

*Aug 20 17:22:21.205: LACP: if_down: Gi5/0/0
```

```
*Aug 20 17:22:21.205:     lacp_ptx Gi5: during state SLOW_PERIODIC, got event
0(no_periodic)
*Aug 20 17:22:22.089: %LINEPROTO-5-UPDOWN: Line protocol on Interface Port-channel5,
changed state to down
*Aug 20 17:22:22.153: %C10K_ALARM-6-INFO: CLEAR CRITICAL GigE 5/0/0 Physical Port Link
Down
*Aug 20 17:22:23.413: LACP: Gi5/0/0 oper-key: 0x0
*Aug 20 17:22:23.413: LACP: lacp_hw_on: Gi5/0/0 is coming up

*Aug 20 17:22:23.413:     lacp_ptx Gi5: during state NO_PERIODIC, got event 0(no_periodic)
*Aug 20 17:22:23.413: @@@ lacp_ptx Gi5: NO_PERIODIC -> NO_PERIODIC
*Aug 20 17:22:23.413: LACP: Gi5/0/0 lacp_action_ptx_no_periodic entered
*Aug 20 17:22:23.413: LACP: lacp_p(Gi5/0/0) timer stopped
*Aug 20 17:22:24.153: %LINK-3-UPDOWN: Interface GigabitEthernet5/0/0, changed state to up
*Aug 20 17:22:24.153: LACP: lacp_hw_on: Gi5/0/0 is coming up

*Aug 20 17:22:24.153:     lacp_ptx Gi5: during state FAST_PERIODIC, got event
0(no_periodic)
*Aug 20 17:22:24.153: @@@ lacp_ptx Gi5: FAST_PERIODIC -> NO_PERIODIC
*Aug 20 17:22:24.153: LACP: Gi5/0/0 lacp_action_ptx_fast_periodic_exit entered
*Aug 20 17:22:24.153: LACP: lacp_p(Gi5/0/0) timer stopped
*Aug 20 17:22:24.153: LACP:
*Aug 20 17:22:25.021: LACP: lacp_p(Gi5/0/0) timer stopped
*Aug 20 17:22:25.021: LACP: lacp_p(Gi5/0/0) expired
*Aug 20 17:22:25.021:     lacp_ptx Gi5: during state FAST_PERIODIC, got event
3(pt_expired)
*Aug 20 17:22:25.021: @@@ lacp_ptx Gi5: FAST_PERIODIC -> PERIODIC_TX
*Aug 20 17:22:25.021: LACP: Gi5/0/0 lacp_action_ptx_fast_periodic_exit entered
*Aug 20 17:22:25.021: LACP: lacp_p(Gi5/0/0) timer stopped
*Aug 20 17:22:25.917: LACP: lacp_p(Gi5/0/0) timer stopped
*Aug 20 17:22:25.917: LACP: lacp_p(Gi5/0/0) expired
*Aug 20 17:22:25.917:     lacp_ptx Gi5: during state FAST_PERIODIC, got event
3(pt_expired)
*Aug 20 17:22:25.917: @@@ lacp_ptx Gi5: FAST_PERIODIC -> PERIODIC_TX
*Aug 20 17:22:25.917: LACP: Gi5/0/0 lacp_action_ptx_fast_periodic_exit entered
*Aug 20 17:22:25.917: LACP: lacp_p(Gi5/0/0) timer stopped
Router1#
```

The following sample output shows a remote device adding a link:

```
Router1#

*Aug 20 17:23:54.005: LACP: lacp_t(Gi5/0/0) timer stopped
*Aug 20 17:23:54.005: LACP: lacp_t(Gi5/0/0) expired
*Aug 20 17:23:55.789: %C10K_ALARM-6-INFO: ASSERT CRITICAL GigE 5/0/0 Physical Port Link
Down
*Aug 20 17:23:56.497: %C10K_ALARM-6-INFO: CLEAR CRITICAL GigE 5/0/0 Physical Port Link
Down
*Aug 20 17:24:19.085: LACP: lacp_p(Gi5/0/0) timer stopped
*Aug 20 17:24:19.085: LACP: lacp_p(Gi5/0/0) expired
*Aug 20 17:24:19.085:     lacp_ptx Gi5: during state SLOW_PERIODIC, got event
3(pt_expired)
*Aug 20 17:24:19.085: @@@ lacp_ptx Gi5: SLOW_PERIODIC -> PERIODIC_TX
*Aug 20 17:24:19.085: LACP: Gi5/0/0 lacp_action_ptx_slow_periodic_exit entered
*Aug 20 17:24:19.085: LACP: lacp_p(Gi5/0/0) timer stopped
*Aug 20 17:24:19.957: LACP: lacp_t(Gi5/0/0) timer stopped
*Aug 20 17:24:19.957: LACP: lacp_t(Gi5/0/0) expired
*Aug 20 17:24:21.073: LACP :lacp_bugpak: Receive LACP-PDU packet via Gi5/0/0
*Aug 20 17:24:21.073: LACP : packet size: 124
*Aug 20 17:24:21.073: LACP: pdu: subtype: 1, version: 1
*Aug 20 17:24:21.073: LACP: Act: tlv:1, tlv-len:20, key:0x1, p-pri:0x8000, p:0x14,
p-state:0xC,
s-pri:0xFFFF, s-mac:0011.2026.7300
```

```
*Aug 20 17:24:21.073: LACP: Part: tlv:2, tlv-len:20, key:0x0, p-pri:0x8000, p:0x42,
p-state:0x75,
s-pri:0x8000, s-mac:0014.a93d.4a00
*Aug 20 17:24:21.073: LACP: col-tlv:3, col-tlv-len:16, col-max-d:0x8000
*Aug 20 17:24:21.073: LACP: term-tlv:0 termr-tlv-len:0
*Aug 20 17:24:21.073: LACP: Gi5/0/0 LACP packet received, processing
*Aug 20 17:24:21.073:     lacp_rx Gi5: during state DEFAULTED, got event 5(recv_lacpdu)
*Aug 20 17:24:21.929: LACP: lacp_t(Gi5/0/0) timer stopped
*Aug 20 17:24:21.929: LACP: lacp_t(Gi5/0/0) expired
*Aug 20 17:24:21.929: LACP: timer lacp_t(Gi5/0/0) started with interval 1000.
*Aug 20 17:24:21.929: LACP: lacp_send_lacpdu: (Gi5/0/0) About to send the 110 LACPDU
*Aug 20 17:24:21.929: LACP :lacp_bugpak: Send LACP-PDU packet via Gi5/0/0
*Aug 20 17:24:21.929: LACP : packet size: 124
*Aug 20 17:24:22.805: LACP: lacp_t(Gi5/0/0) timer stopped
*Aug 20 17:24:22.805: LACP: lacp_t(Gi5/0/0) expired
*Aug 20 17:24:23.025: LACP: lacp_w(Gi5/0/0) timer stopped
*Aug 20 17:24:23.025: LACP: lacp_w(Gi5/0/0) expired
*Aug 20 17:24:23.025:     lacp_mux Gi5: during state WAITING, got event 4(ready)
*Aug 20 17:24:23.025: @@@ lacp_mux Gi5: WAITING -> ATTACHED
*Aug 20 17:24:23.921: LACP: lacp_t(Gi5/0/0) timer stopped
*Aug 20 17:24:23.921: LACP: lacp_t(Gi5/0/0) expired
*Aug 20 17:24:26.025: %LINEPROTO-5-UPDOWN: Line protocol on Interface Port-channel5,
changed state to up
```

Configuration Examples for IEEE 802.3ad Link Bundling

This section contains the following configuration examples:

Associating a Channel Group with a Port Channel: Example

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

```
Router1# configure terminal

Enter configuration commands, one per line.  End with CNTL/Z.

Router1(config)# interface port 5
Router1(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

Router1(config-if)#
Router1(config-if)# interface gigabitethernet 7/0/0
Router1(config-if)# channel-group 5 mode active
Router1(config-if)#

*Aug 20 17:07:43.713: %LINK-3-UPDOWN: Interface GigabitEthernet7/0/0, changed state to
down
*Aug 20 17:07:44.713: %LINEPROTO-5-UPDOWN: Line protocol on Interface
GigabitEthernet7/0/0, changed state to down
*Aug 20 17:07:45.093: %C10K_ALARM-6-INFO: ASSERT CRITICAL GigE 7/0/0 Physical Port Link
Down
```

```
*Aug 20 17:07:45.093: %C10K_ALARM-6-INFO: CLEAR CRITICAL GigE 7/0/0 Physical Port Link
Down
*Aug 20 17:07:47.093: %LINK-3-UPDOWN: Interface GigabitEthernet7/0/0, changed state to up
*Aug 20 17:07:48.093: %LINEPROTO-5-UPDOWN: Line protocol on Interface
GigabitEthernet7/0/0, changed state to up
*Aug 20 17:07:48.957: GigabitEthernet7/0/0 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

Router1(config-if)# end
Router1#

*Aug 20 17:08:00.933: %SYS-5-CONFIG_I: Configured from console by console

Router1# 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
Gi7/0/0   SA      bndl      32768         0x5       0x5     0x43        0x3D

Router1# 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 : GigabitEthernet7/0/0 , 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
Router1#
```

Adding and Removing Interfaces from a Bundle: Example

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

```
Router1#
Router1# 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
Gi7/0/0   SA      bndl      32768         0x5       0x5     0x43        0x3D

Router1# configure terminal

Enter configuration commands, one per line.  End with CNTL/Z.

Router1(config)# interface gigabitethernet 5/0/0
Router1(config-if)# channel-group 5 mode active
Router1(config-if)#

*Aug 20 17:10:19.057: %LINK-3-UPDOWN: Interface GigabitEthernet5/0/0, changed state to
down
*Aug 20 17:10:19.469: %C10K_ALARM-6-INFO: ASSERT CRITICAL GigE 5/0/0 Physical Port Link
Down
*Aug 20 17:10:19.473: %C10K_ALARM-6-INFO: CLEAR CRITICAL GigE 5/0/0 Physical Port Link
Down
*Aug 20 17:10:21.473: %LINK-3-UPDOWN: Interface GigabitEthernet5/0/0, changed state to up
*Aug 20 17:10:21.473: GigabitEthernet7/0/0 taken out of port-channel5

*Aug 20 17:10:23.413: GigabitEthernet5/0/0 added as member-1 to port-channel5

*Aug 20 17:10:23.473: %LINK-3-UPDOWN: Interface Port-channel5, changed state to up

Router1(config-if)# end
Router1#

*Aug 20 17:10:27.653: %SYS-5-CONFIG_I: Configured from console by console

*Aug 20 17:11:40.717: GigabitEthernet7/0/0 added as member-2 to port-channel5

Router1# 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
Gi7/0/0   SA      bndl      32768         0x5       0x5     0x43        0x3D
Gi5/0/0   SA      bndl      32768         0x5       0x5     0x42        0x3D

Router1#
Router1# 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 : GigabitEthernet5/0/0 , Full-duplex, 1000Mb/s  <---- added to port
channel bundle
        Member 1 : GigabitEthernet7/0/0 , 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
Router1#
```

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

```
Router1#
Router1# configure terminal

Enter configuration commands, one per line.  End with CNTL/Z.

Router1(config)# interface gigabitethernet 7/0/0
Router1(config-if)# no channel-group 5 mode active
Router1(config-if)#

*Aug 20 17:15:49.433: GigabitEthernet7/0/0 taken out of port-channel5

*Aug 20 17:15:49.557: %C10K_ALARM-6-INFO: ASSERT CRITICAL GigE 5/0/0 Physical Port Link
Down
*Aug 20 17:15:50.161: %C10K_ALARM-6-INFO: CLEAR CRITICAL GigE 5/0/0 Physical Port Link
Down
*Aug 20 17:15:51.433: %LINK-3-UPDOWN: Interface GigabitEthernet7/0/0, changed state to
down
*Aug 20 17:15:52.433: %LINEPROTO-5-UPDOWN: Line protocol on Interface
GigabitEthernet7/0/0, changed state to down

Router1(config-if)# end
Router1#

*Aug 20 17:15:58.209: %SYS-5-CONFIG_I: Configured from console by console
Router1#
*Aug 20 17:15:59.257: %C10K_ALARM-6-INFO: ASSERT CRITICAL GigE 7/0/0 Physical Port Link
Down
*Aug 20 17:15:59.257: %C10K_ALARM-6-INFO: CLEAR CRITICAL GigE 7/0/0 Physical Port Link
Down

Router1#

*Aug 20 17:16:01.257: %LINK-3-UPDOWN: Interface GigabitEthernet7/0/0, changed state to up
*Aug 20 17:16:02.257: %LINEPROTO-5-UPDOWN: Line protocol on Interface
GigabitEthernet7/0/0, changed state to up
```

```
Router1# 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
Gi5/0/0   SA      bndl      32768         0x5       0x5     0x42        0x3D
Router1#
```

Monitoring LACP Status: Example

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

```
Router1# 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
Gi5/0/0   SA      bndl      32768         0x5       0x5     0x42        0x3D

Router1# show lacp 5 counters

              LACPDUs         Marker      Marker Response    LACPDUs
Port        Sent   Recv     Sent   Recv     Sent   Recv      Pkts Err
---------------------------------------------------------------------
Channel group: 5
Gi5/0/0      21     18       0      0        0      0         0

Router1# 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
Gi5/0/0   SA      bndl      32768         0x5       0x5     0x42        0x3D

Router1# 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
Gi5/0/0   SP      32768     0011.2026.7300  11s     0x1      0x14      0x3C
```

```
Router1# show lacp counters

              LACPDUs         Marker      Marker Response    LACPDUs
Port        Sent   Recv     Sent   Recv     Sent   Recv      Pkts Err
--------------------------------------------------------------------
Channel group: 5
Gi5/0/0      23     20       0      0        0      0         0

Router1# show lacp sys-id

32768,0014.a93d.4a00
Router1#
```

Additional References

The following sections provide references related to the IEEE 802.3ad Link Bundling feature.

Related Documents

Related Topic	Document Title
Configuring EtherChannels	"Configuring EtherChannels" chapter of the *Catalyst 6500 Series Cisco IOS Software Configuration Guide,* Release 12.1E
LACP commands	*Cisco IOS Network Management Command Reference,* Release 12.4T

Standards

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

MIBs

MIB	MIBs Link
• CISCO-LAG-MIB • 802.3ad-MIB	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	—

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password. If you have a valid service contract but do not have a user ID or password, you can register on Cisco.com.	http://www.cisco.com/techsupport

Command Reference

This section documents only commands that are new or modified.

- **channel-group (interface)**
- **debug lacp**
- **lacp max-bundle**
- **lacp port-priority**
- **lacp system-priority**
- **show lacp**

channel-group (interface)

To assign and configure an EtherChannel interface to an EtherChannel group, use the **channel-group** command in interface configuration mode. To remove the channel-group configuration from the interface, use the **no** form of this command.

channel-group *channel-group-number* **mode** {**active** | **on** | **passive**}

no channel-group *channel-group-number*

Cisco 2600 Series, Cisco 3600 Series, and Cisco 3700 Series Routers

channel-group *channel-group-number* **mode on**

no channel-group *channel-group-number*

Cisco Catalyst Switches

channel-group *channel-group-number* **mode** {**active** | **on** | **auto** [**non-silent**] | **desirable** [**non-silent**] | **passive**}

no channel-group *channel-group-number*

Syntax Description

channel-group-number	Integer that identifies the channel-group. Valid values are from 1 to 256; the maximum number of integers that can be used is 64. For Fast EtherChannel groups, the number is an integer from 1 to 4. This number is the one previously assigned to the port-channel interface.
mode	Specifies the EtherChannel mode of the interface.
active	Enables Link Aggregation Control Protocol (LACP) unconditionally.
on	Enables EtherChannel only.
auto	Places a port into a passive negotiating state in which the port responds to Port Aggregation Protocol (PAgP) packets that it receives but does not initiate PAgP packet negotiation.
non-silent	(Optional) Used with the **auto** or **desirable** mode when traffic is expected from the other device.
desirable	Places a port into an active negotiating state in which the port initiates negotiations with other ports by sending PAgP packets.
passive	Enables LACP only when an LACP device is detected. This is the default state.

Command Default

No channel groups are assigned.

Command Modes

Interface configuration

Command History

Release	Modification
11.1CA	This command was introduced.
12.0(7)XE	Support for this command was implemented on Cisco Catalyst 6000 series switches.
12.1(3a)E3	The number of valid values for the *number* argument was changed; see the "Usage Guidelines" section for valid values.
12.2(2)XT	This command was implemented on the Cisco 2600 series, Cisco 3600 series, and Cisco 3700 series routers.
12.2(8)T	Support for this command was implemented on the Cisco 2600 series, the Cisco 3600 series, and the Cisco 3700 series routers and integrated into Cisco IOS Release 12.2(8)T.
12.2(14)SX	Support for this command was implemented on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was integrated into Cisco IOS Release 12.2(17d)SXB.
12.2(18)SXE	This command was changed to support advanced QinQ translation on QinQ link bundles using GE-WAN interfaces on an OSM-2+4GE-WAN+ OSM on Cisco 7600 series routers.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(31)SB2	This command was integrated into Cisco IOS Release 12.2(31)SB2.
12.2(33)SRB	Support for this command on the Cisco 7600 router was integrated into Cisco IOS Release 12.2(33)SRB.

Usage Guidelines

OSMs are not supported on Cisco 7600 series routers that are configured with a Supervisor Engine 32.

IP Address for the Physical Interface

You do not have to disable the IP address that is assigned to a physical interface that is part of a channel group, but Cisco highly recommends doing so.

Layer 2 and Layer 3 Port Channels

You can create both Layer 2 and Layer 3 port channels by entering the **interface port-channel** command or, when the channel-group gets its first physical interface assignment. The port channels are not created at run time, nor are they created dynamically.

You do not have to create a port-channel interface before assigning a physical interface to a channel group. A port-channel interface is automatically created when the channel group gets its first physical interface, if it is not already created.

Propagation of Configuration and Attribute Changes

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. (for example, configuration changes are also propagated to the physical interfaces that are not part of the port-channel, but are part of the channel group.)

The on Keyword

When you use the **on** keyword, a usable EtherChannel exists only when a port group in **on** mode is connected to another port group in the **on** mode.

Cisco 2600 Series, Cisco 3600 Series, and Cisco 3700 Series Routers

You do not have to create a port-channel interface before assigning a physical interface to a channel group. A port-channel interface is created automatically when the channel group gets its first physical interface, if it is not already created.

Cisco Catalyst Switches

The number of valid values for *number* depends on the software release. For software releases prior to Cisco IOS Release 12.1(3a)E3, valid values are from 1 to 256; for Cisco IOS Release 12.1(3a)E3, 12.1(3a)E4, and 12.1(4)E1, valid values are from 1 to 64. Cisco IOS Release 12.1 E and later releases support a maximum of 64 values ranging from 1 to 256.

The channel-group number is global and is shared between all the channeling protocols. If a specific channel number is used for the PAgP-enabled interfaces of a channel group, that same channel number cannot be used for configuring a channel that has LACP-enabled interfaces or vice versa.

Entering the **auto** or **desirable** keyword enables PAgP on the specified interface; the command will be rejected if it is issued on an LACP-enabled interface.

The **active** and **passive** keywords are valid on PAgP-disabled interfaces only.

You can change the mode for an interface only if it is the only interface that is designated to the specified channel group.

The **on** keyword forces the bundling of the interface on the channel without any negotiation.

You can manually configure a switch with PAgP on one side and LACP on the other side in the **on** mode.

With the **on** mode, a usable EtherChannel exists only when a port group in **on** mode is connected to another port group in **on** mode.

If you enter the **channel group** command on an interface that is added to a channel with a different protocol than the protocol you are entering, the command is rejected.

If the interface belongs to a channel, the **no** form of this command is rejected.

All ports in the same channel group must use the same protocol; you cannot run two protocols on one channel group.

PAgP and LACP are not compatible; both ends of a channel must use the same protocol.

You can change the protocol at any time, but this change causes all existing EtherChannels to reset to the default channel mode for the new protocol.

Configure all ports in an EtherChannel to operate at the same speed and duplex mode (full duplex only for LACP mode).

All ports in a channel must be on the same DFC-equipped module. You cannot configure any of the ports to be on other modules.

On systems that are configured with nonfabric-enabled modules and fabric-enabled modules, you can bundle ports across all modules, but those bundles cannot include a DFC-equipped module port.

You do not have to create a port-channel interface before assigning a physical interface to a channel group. A port-channel interface is created automatically when the channel group gets its first physical interface, if it is not already created.

You do not have to disable the IP address that is assigned to a physical interface that is part of a channel group, but it is highly recommended.

You can create both Layer 2 and Layer 3 port channels by entering the **interface port-channel** command or when the channel group gets its first physical interface assignment. The port channels are not created at runtime or dynamically.

Any configuration or attribute changes that you make to the port-channel interface are propagated to all interfaces within the same channel group as the port channel (for example, configuration changes are also propagated to the physical interfaces that are not part of the port channel but are part of the channel group).

When configuring Layer 2 EtherChannels, you cannot put Layer 2 LAN ports into manually created port-channel logical interfaces.

Only the **on** mode is supported when using this command with GE-WAN ports on the OSM-2+4GE-WAN+ OSM to create QinQ link bundles for advanced QinQ translation. Also, you cannot use the **channel-group** command on GE-WAN interfaces if MPLS is configured. You must remove all IP, MPLS, and other Layer 3 configuration commands before using the **channel-group** command with GE-WAN interfaces.

Note The GE-WAN interfaces on an OSM-2+4GE-WAN+ OSM behave slightly differently than other interfaces if you want to move the interface from one group to another. To move most other interfaces, you can enter the **channel-group** command again to delete the interface from the old group and move it to the new group. For GE-WAN ports, however, you must manually remove the interface from the group by entering the **no channel-group** command before assigning it to a new group.

Caution Do not enable Layer 3 addresses on the physical EtherChannel interfaces. Assigning bridge groups on the physical EtherChannel interfaces causes loops in your network.

For a complete list of guidelines, see the "Configuring EtherChannel" section of the *Cisco 7600 Series Router Cisco IOS Software Configuration Guide*.

Fast EtherChannel

Before you assign a Fast Ethernet interface to a Fast EtherChannel group, you must first create a port-channel interface. To create a port-channel interface, use the **interface port-channel** global configuration command.

If the Fast Ethernet interface has an IP address assigned, you must disable it before adding the Fast Ethernet interface to the Fast EtherChannel. To disable an existing IP address on the Fast Ethernet interface, use the **no ip address** command in interface configuration mode.

The Fast EtherChannel feature allows multiple Fast Ethernet point-to-point links to be bundled into one logical link to provide bidirectional bandwidth of up to 800 Mbps. Fast EtherChannel can be configured between Cisco 7500 series routers and Cisco 7000 series routers with the 7000 Series Route Switch Processor (RSP7000) and 7000 Series Chassis Interface (RSP7000CI) or between a Cisco 7500 series router or a Cisco 7000 series router with the RSP7000 and RSP700CI and a Cisco Catalyst 5000 switch.

A maximum of four Fast Ethernet interfaces can be added to a Fast EtherChannel group.

Caution The port-channel interface is the routed interface. Do not enable Layer 3 addresses on the physical Fast Ethernet interfaces. Do not assign bridge groups on the physical Fast Ethernet interfaces because it creates loops. Also, you must disable spanning tree.

To display information about the Fast EtherChannel, use the **show interfaces port-channel** EXEC command.

For more guidelines see the "Configuring EtherChannel" section of the *Cisco 7600 Series Router Cisco IOS Software Configuration Guide* and the "Configuring EtherChannel" section of the *Catalyst 6500 Series Switch Cisco IOS Software Configuration Guide*.

Examples

This example shows how to add EtherChannel interface 1/0 to the EtherChannel group that is specified by port-channel 1:

```
Router(config-if)# channel-group 1 mode on
Router(config-if)#
```

The following example shows how to add interface Fast Ethernet 1/0 to the Fast EtherChannel group specified by port-channel 1:

```
Router(config)# interface port-channel 1
Router(config-if)# exit
Router(config)# interface fastethernet 1/0
Router(config-if)# channel-group 1
```

Related Commands

Command	Description
interface	Creates a port-channel virtual interface and puts the CLI in interface configuration mode when the **port-channel** keyword is used.
ip address	Sets a primary or secondary IP address on an interface.
show etherchannel	Displays the EtherChannel information for a channel.
show interfaces port-channel	Displays traffic that is seen by a specific port channel.

debug lacp

To enable debugging for all Link Aggregation Control Protocol (LACP) debug messages, use the **debug lacp** command in privileged EXEC mode. To disable all LACP debug messages, use the **no** form of this command.

debug lacp [**all** | **event** | **fsm** | **misc** | **packet**]

no debug lacp

Syntax Description

all	(Optional) Displays all LACP debug information.
event	(Optional) Displays all debug information relevant to events that occur within LACP.
fsm	(Optional) Displays changes within the LACP finite state machine.
misc	(Optional) Displays various debug information that may be useful for monitoring the status of LACP.
packet	(Optional) Displays the receiving and transmitting LACP control packets.

Command Default

LACP debugging activity is disabled.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.1(13)EW	Support for this command was introduced on the Cisco Catalyst 4500 series switch.
12.2(31)SB2	This command was integrated into Cisco IOS Release 12.2(31)SB.
12.2(33)SRB	Support for this command on the Cisco 7600 router was integrated into Cisco IOS Release 12.2(33)SRB.

Usage Guidelines

This command is useful for troubleshooting problems with LACP.

Examples

The following sample output from the **debug lacp all** command shows a remote device removing a link:

```
Router# debug lacp all

Link Aggregation Control Protocol all debugging is on
Router1#
*Aug 20 17:21:51.685: LACP :lacp_bugpak: Receive LACP-PDU packet via Gi5/0/0
*Aug 20 17:21:51.685: LACP : packet size: 124
*Aug 20 17:21:51.685: LACP: pdu: subtype: 1, version: 1
*Aug 20 17:21:51.685: LACP: Act: tlv:1, tlv-len:20, key:0x1, p-pri:0x8000, p:0x14,
p-state:0x3C,
s-pri:0xFFFF, s-mac:0011.2026.7300
```

```
*Aug 20 17:21:51.685: LACP: Part: tlv:2, tlv-len:20, key:0x5, p-pri:0x8000, p:0x42,
p-state:0x3D,
s-pri:0x8000, s-mac:0014.a93d.4a00
*Aug 20 17:21:51.685: LACP: col-tlv:3, col-tlv-len:16, col-max-d:0x8000
*Aug 20 17:21:51.685: LACP: term-tlv:0 termr-tlv-len:0
*Aug 20 17:21:51.685: LACP: Gi5/0/0 LACP packet received, processing
*Aug 20 17:21:51.685:     lacp_rx Gi5: during state CURRENT, got event 5(recv_lacpdu)
*Aug 20 17:21:59.869: LACP: lacp_p(Gi5/0/0) timer stopped
*Aug 20 17:21:59.869: LACP: lacp_p(Gi5/0/0) expired
*Aug 20 17:21:59.869:     lacp_ptx Gi5: during state SLOW_PERIODIC, got event
3(pt_expired)
*Aug 20 17:21:59.869: @@@ lacp_ptx Gi5: SLOW_PERIODIC -> PERIODIC_TX
*Aug 20 17:21:59.869: LACP: Gi5/0/0 lacp_action_ptx_slow_periodic_exit entered
*Aug 20 17:21:59.869: LACP: lacp_p(Gi5/0/0) timer stopped
*Aug 20 17:22:00.869: LACP: lacp_t(Gi5/0/0) timer stopped
*Aug 20 17:22:00.869: LACP: lacp_t(Gi5/0/0) expired
*Aug 20 17:22:19.089: LACP :lacp_bugpak: Receive LACP-PDU packet via Gi5/0/0
*Aug 20 17:22:19.089: LACP : packet size: 124
*Aug 20 17:22:19.089: LACP: pdu: subtype: 1, version: 1
*Aug 20 17:22:19.089: LACP: Act: tlv:1, tlv-len:20, key:0x1, p-pri:0x8000, p:0x14,
p-state:0x4,
s-pri:0xFFFF, s-mac:0011.2026.7300
*Aug 20 17:22:19.089: LACP: Part: tlv:2, tlv-len:20, key:0x5, p-pri:0x8000, p:0x42,
p-state:0x34,
s-pri:0x8000, s-mac:0014.a93d.4a00
*Aug 20 17:22:19.089: LACP: col-tlv:3, col-tlv-len:16, col-max-d:0x8000
*Aug 20 17:22:19.089: LACP: term-tlv:0 termr-tlv-len:0
*Aug 20 17:22:19.089: LACP: Gi5/0/0 LACP packet received, processing
*Aug 20 17:22:19.089:     lacp_rx Gi5: during state CURRENT, got event 5(recv_lacpdu)
*Aug 20 17:22:19.989: LACP: lacp_t(Gi5/0/0) timer stopped
*Aug 20 17:22:19.989: LACP: lacp_t(Gi5/0/0) expired
*Aug 20 17:22:19.989: LACP: timer lacp_t(Gi5/0/0) started with interval 1000.
*Aug 20 17:22:19.989: LACP: lacp_send_lacpdu: (Gi5/0/0) About to send the 110 LACPDU
*Aug 20 17:22:19.989: LACP :lacp_bugpak: Send LACP-PDU packet via Gi5/0/0
*Aug 20 17:22:19.989: LACP : packet size: 124
*Aug 20 17:22:20.957: LACP: lacp_t(Gi5/0/0) timer stopped
*Aug 20 17:22:20.957: LACP: lacp_t(Gi5/0/0) expired
*Aug 20 17:22:21.205: %LINK-3-UPDOWN: Interface GigabitEthernet5/0/0, changed state to
down
*Aug 20 17:22:21.205: LACP: lacp_hw_off: Gi5/0/0 is going down

*Aug 20 17:22:21.205: LACP: if_down: Gi5/0/0
*Aug 20 17:22:21.205:     lacp_ptx Gi5: during state SLOW_PERIODIC, got event
0(no_periodic)
*Aug 20 17:22:22.089: %LINEPROTO-5-UPDOWN: Line protocol on Interface Port-channel5,
changed state to down
*Aug 20 17:22:22.153: %C10K_ALARM-6-INFO: CLEAR CRITICAL GigE 5/0/0 Physical Port Link
Down
*Aug 20 17:22:23.413: LACP: Gi5/0/0 oper-key: 0x0
*Aug 20 17:22:23.413: LACP: lacp_hw_on: Gi5/0/0 is coming up

*Aug 20 17:22:23.413:     lacp_ptx Gi5: during state NO_PERIODIC, got event 0(no_periodic)
*Aug 20 17:22:23.413: @@@ lacp_ptx Gi5: NO_PERIODIC -> NO_PERIODIC
*Aug 20 17:22:23.413: LACP: Gi5/0/0 lacp_action_ptx_no_periodic entered
*Aug 20 17:22:23.413: LACP: lacp_p(Gi5/0/0) timer stopped
*Aug 20 17:22:24.153: %LINK-3-UPDOWN: Interface GigabitEthernet5/0/0, changed state to up
*Aug 20 17:22:24.153: LACP: lacp_hw_on: Gi5/0/0 is coming up

*Aug 20 17:22:24.153:     lacp_ptx Gi5: during state FAST_PERIODIC, got event
0(no_periodic)
*Aug 20 17:22:24.153: @@@ lacp_ptx Gi5: FAST_PERIODIC -> NO_PERIODIC
*Aug 20 17:22:24.153: LACP: Gi5/0/0 lacp_action_ptx_fast_periodic_exit entered
*Aug 20 17:22:24.153: LACP: lacp_p(Gi5/0/0) timer stopped
*Aug 20 17:22:24.153: LACP:
```

```
*Aug 20 17:22:25.021: LACP: lacp_p(Gi5/0/0) timer stopped
*Aug 20 17:22:25.021: LACP: lacp_p(Gi5/0/0) expired
*Aug 20 17:22:25.021:     lacp_ptx Gi5: during state FAST_PERIODIC, got event
3(pt_expired)
*Aug 20 17:22:25.021: @@@ lacp_ptx Gi5: FAST_PERIODIC -> PERIODIC_TX
*Aug 20 17:22:25.021: LACP: Gi5/0/0 lacp_action_ptx_fast_periodic_exit entered
*Aug 20 17:22:25.021: LACP: lacp_p(Gi5/0/0) timer stopped
*Aug 20 17:22:25.917: LACP: lacp_p(Gi5/0/0) timer stopped
*Aug 20 17:22:25.917: LACP: lacp_p(Gi5/0/0) expired
*Aug 20 17:22:25.917:     lacp_ptx Gi5: during state FAST_PERIODIC, got event
3(pt_expired)
*Aug 20 17:22:25.917: @@@ lacp_ptx Gi5: FAST_PERIODIC -> PERIODIC_TX
*Aug 20 17:22:25.917: LACP: Gi5/0/0 lacp_action_ptx_fast_periodic_exit entered
*Aug 20 17:22:25.917: LACP: lacp_p(Gi5/0/0) timer stopped
Router1#
```

lacp max-bundle

To define the maximum number of bundled Link Aggregation Control Protocol (LACP) ports allowed in a port channel, use the **lacp max-bundle** command in interface configuration mode. To return to the default settings, use the **no** form of this command.

lacp max-bundle *max-bundles*

no lacp max-bundle

Syntax Description

max-bundles	Maximum number of bundled ports allowed in the port channel. Valid values are from 1 to 8. **Note** On the Cisco 10000 series router, the valid values are from 1 to 4.

Defaults

The default settings are as follows:

- Maximum of 8 bundled ports per port channel.
- Maximum of 8 bundled ports and 8 hot-standby ports per port channel if the port channels on both sides of the LACP bundle are configured in the same way.
- On the Cisco 10000 series router, maximum of 4 bundled ports per port channel.

Command Modes

Interface configuration

Command History

Release	Modification
12.2(18)SXD	Support for this command was introduced on the Supervisor Engine 720.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(31)SB2	Support for this command was implemented on the Cisco 10000 series router and integrated into Cisco IOS Release 12.2(31)SB2.
12.2(33)SRB	Support for this command on the Cisco 7600 router was integrated into Cisco IOS Release 12.2(33)SRB.

Usage Guidelines

Cisco 10000 Series Router

This command requires a Performance Routing Engine 2 (PRE2) or PRE3.

Examples

This example shows how to set 3 ports to bundle in a port channel:

```
Router(config-if)# lacp max-bundle 3
Router(config-if)#
```

Related Commands

Command	Description
interface port-channel	Creates a port-channel virtual interface and puts the CLI in interface configuration mode.
ip address	Sets a primary or secondary IP address on an interface.
show etherchannel	Displays the EtherChannel information for a channel.
show interfaces port-channel	Displays traffic that is seen by a specific port channel.

lacp port-priority

To set the priority for a physical interface, use the **lacp port-priority** command in interface configuration mode. To return to the default setting, use the **no** form of this command.

lacp port-priority *priority*

no lacp port-priority

Syntax Description

priority	Integer from 1 to 65535 that indicates the priority for the physical interface. The default is 32768.

Command Default

The default port priority is set.

Command Modes

Interface configuration

Command History

Release	Modification
12.1(13)EW	This command was introduced on the Cisco Catalyst 4500 series switches.
12.2(14)SX	Support for this command on the Supervisor Engine 720 was integrated into Cisco IOS Release12.2(14)SX.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was integrated into Cisco IOS Release12.2(17d) SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(31)SB2	This command was integrated into Cisco IOS Release 12.2(31)SB2.
12.2(33)SRB	Support for this command on the Cisco 7600 router was integrated into Cisco IOS Release 12.2(33)SRB.

Usage Guidelines

You must assign a port priority to each port on a device running Link Aggregation Control Protocol (LACP). You can specify the port priority by using the **lacp port-priority** command at the command-line interface (CLI) or use the default port priority (32768) that is carried as part of the LACP protocol data unit (PDU) exchanged with the partner. Port priority is used to decide which ports should be put in standby mode when a hardware limitation prevents all compatible ports from aggregating. Priority is supported only on port channels with LACP-enabled physical interfaces.

Note A high priority number means a low priority.

Port priority together with port number forms a port identifier.

Examples

This example shows how to set a priority of 23700 for an interface:

```
Router(config-if)# lacp port-priority 23700
Router(config-if)#
```

Related Commands

Command	Description
channel-group	Assigns and configures an EtherChannel interface to an EtherChannel group.
debug lacp	Enables debugging of LACP activities.
lacp system-priority	Sets the priority of the system.
show lacp	Displays information about LACP activities.

lacp system-priority

To set the priority for a system, use the **lacp system-priority** command in global configuration mode or in interface configuration mode. To return to the default setting, use the **no** form of this command.

lacp system-priority *priority*

no lacp system-priority

Syntax Description

priority	Integer from 1 to 65535 that indicates the priority for the system. The default is 32768.

Command Default

The default system priority is set.

Command Modes

Global configuration

Interface configuration

Command History

Release	Modification
12.1(13)EW	This command was introduced on the Cisco Catalyst 4500 series switches.
12.2(14)SX	Support for this command on the Supervisor Engine 720 was integrated into Cisco IOS Release12.2(14)SX.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was integrated into Cisco IOS Release12.2(17d) SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(31)SB2	This command was integrated into Cisco IOS Release 12.2(31)SB2.
12.2(33)SRB	Support for this command on the Cisco 7600 router was integrated into Cisco IOS Release 12.2(33)SRB.

Usage Guidelines

You must assign a system priority to each device running Link Aggregation Control Protocol (LACP). You can specify the system priority by using the **lacp system-priority** command at the command-line interface (CLI) or use the default system priority (32768) that is carried as part of the LACP protocol data unit (PDU) exchanged with the partner. System priority is used with the MAC address of the device to form the system ID and also is used during negotiation with other systems. Priority is supported only on port channels with LACP-enabled physical interfaces.

Note A high priority number means a low priority.

The **lacp system-priority** command can also be issued in interface configuration mode. After you enter the command, the system returns to global configuration mode.

Examples

The following example shows how to set a system priority of 25500 for a device:

```
Router(config)# lacp system-priority 25500
```

Related Commands

Command	Description
channel-group	Assigns and configures an EtherChannel interface to an EtherChannel group.
debug lacp	Enables debugging of LACP activities.
lacp port-priority	Sets the priority of a port.
show lacp	Displays information about LACP activities.

show lacp

To display Link Aggregation Control Protocol (LACP) information, use the **show lacp** command in user EXEC or privileged EXEC mode.

show lacp [*channel-group-number*] | {**counters** | **internal** [**detail**] | **neighbor** [**detail**]} | [**sys-id**]

Syntax Description

channel-group-number	(Optional) Number of the channel group; valid values are from 1 to 282.
counters	Displays information about the LACP traffic statistics.
detail	(Optional) Detailed internal information.
internal	Displays LACP internal information.
neighbors	Displays information about the LACP neighbor.
sys-id	Displays the LACP system identification. It is a combination of the port priority and the MAC address of the device

Defaults

This command has no default settings.

Command Modes

User EXEC
Privileged EXEC

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Cisco IOS Release 12.2(17d)SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(31)SB2	This command was integrated into Cisco IOS Release 12.2(31)SB2.
12.2(33)SRB	Support for this command on the Cisco 7600 router was integrated into Cisco IOS Release 12.2(33)SRB.

Usage Guidelines

Use the **show lacp** command to troubleshoot problems related to LACP in a network.

If you do not specify a *channel-group*, all channel groups are displayed.

The *channel-group* values from 257 to 282 are supported on the CSM and the FWSM only.

You can enter the optional *channel-group* to specify a channel group for all keywords, except the **sys-id** keyword.

Examples

show lacp sys-id Example

This example shows how to display the LACP system identification using the **show lacp sys-id** command:

```
Router> show lacp sys-id

8000,AC-12-34-56-78-90
```

The system identification is made up of the system priority and the system MAC address. The first 2 bytes are the system priority, and the last 6 bytes are the globally administered individual MAC address that is associated to the system.

LACP Statistics for a Specific Channel Group Examples

This example shows how to display the LACP statistics for a specific channel group:

```
Router# show lacp 1 counters

              LACPDUs         Marker       LACPDUs
Port        Sent   Recv     Sent   Recv     Pkts Err
---------------------------------------------------
Channel group: 1
  Fa4/1     8      15       0      0         3    0
  Fa4/2     14     18       0      0         3    0
  Fa4/3     14     18       0      0         0
  Fa4/4     13     18       0      0         0
```

The output displays the following information:

- The LACPDUs Sent and Recv columns display the LACPDUs that are sent and received on each specific interface.
- The LACPDUs Pkts and Err columns display the marker-protocol packets.

The following example shows output from a **show lacp** *number* **counters** command:

```
Router1# show lacp 5 counters

              LACPDUs         Marker      Marker Response    LACPDUs
Port        Sent   Recv     Sent   Recv     Sent   Recv      Pkts Err
---------------------------------------------------------------------
Channel group: 5
Gi5/0/0     21     18       0      0        0      0         0
```

Table 1 describes the significant fields shown in the sample output of the **show lacp** *number* **counters** command.

Table 1 show lacp number counters Field Descriptions

Field	Description
LACPDUs Sent Recv	Number of LACP PDUs sent and received.
Marker Sent Recv	Attempts to avoid data loss when a member link is removed from an LACP bundle.
Marker Response Sent Recv	Cisco IOS response to the Marker protocol.
LACPDUs Pkts Err	Number of LACP PDU packets transmitted and the number of packet errors.

The following example shows output from a **show lacp** *number* **internal** command:

```
Router1# 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
Gi5/0/0   SA      bndl      32768         0x5       0x5     0x42        0x3D
```

Table 2 describes the significant fields shown in the sample output of the **show lacp** *number* **internal** command.

Table 2 show lacp number internal Field Descriptions

Field	Description
Flags	Meanings of each flag value, which indicates a device activity.
Port	Port on which link bundling is configured.
Flags	Indicators of device activity.
State	Activity state of the port. States can be any of the following: • Bndl—Port is attached to an aggregator and bundled with other ports. • Susp—Port is in suspended state, so it is not attached to any aggregator. • Indep—Port is in independent state (not bundled but able to switch data traffic). This condition differs from the previous state because in this case LACP is not running on the partner port. • Hot-sby—Port is in hot standby state. • Down—Port is down.
LACP port Priority	Priority assigned to the port.
Admin Key	Defines the ability of a port to aggregate with other ports.
Oper Key	Operational key that determines the aggregation capability of the link.
Port Number	Number of the port.
Port State	Activity state of the port.

Internal Information About a Spcific Channel Group Example

This example shows how to display internal information for the interfaces that belong to a specific channel:

```
Router# show lacp 1 internal

Flags:  S - Device sends PDUs at slow rate. F - Device sends PDUs at fast rate.
        A - Device is in Active mode.       P - Device is in Passive mode.

Channel group 1
                              LACPDUs     LACP Port    Admin   Oper    Port     Port
```

```
Port      Flags    State    Interval    Priority     Key      Key      Number   State
Fa4/1     saC      bndl     30s         32768        100      100      0xc1     0x75
Fa4/2     saC      bndl     30s         32768        100      100      0xc2     0x75
Fa4/3     saC      bndl     30s         32768        100      100      0xc3     0x75
Fa4/4     saC      bndl     30s         32768        100      100      0xc4     0x75
Router#
```

Table 1 describes the fields that are shown in the example.

Table 3 show lacp internal Command Output Fields

Field	Description
State	State of the specific port at the current moment is displayed; allowed values are as follows: • *bndl*—Port is attached to an aggregator and bundled with other ports. • *susp*—Port is in a suspended state; it is not attached to any aggregator. • *indep*—Port is in an independent state (not bundled but able to switch data traffic. In this case, LACP is not running on the partner port). • *hot-sby*—Port is in a hot-standby state. • *down*—Port is down.
LACPDUs Interval	Interval setting.
LACP Port Priority	Port-priority setting.
Admin Key	Administrative key.
Oper Key	Operator key.
Port Number	Port number.
Port State	State variables for the port that are encoded as individual bits within a single octet with the following meaning [1]: • **bit0**: *LACP_Activity* • **bit1**: *LACP_Timeout* • **bit2**: *Aggregation* • **bit3**: *Synchronization* • **bit4**: *Collecting* • **bit5**: *Distributing* • **bit6**: *Defaulted* • **bit7**: *Expired*

Information About LACP Neighbors for a Specific Port Example

This example shows how to display the information about the LACP neighbors for a specific port channel:

```
Router# show lacp 1 neighbors

Flags:  S - Device sends PDUs at slow rate. F - Device sends PDUs at fast rate.
        A - Device is in Active mode.       P - Device is in Passive mode.

Channel group 1 neighbors
          Partner                Partner
```

```
Port      System ID               Port Number     Age     Flags
Fa4/1     8000,00b0.c23e.d84e     0x81            29s     P
Fa4/2     8000,00b0.c23e.d84e     0x82            0s      P
Fa4/3     8000,00b0.c23e.d84e     0x83            0s      P
Fa4/4     8000,00b0.c23e.d84e     0x84            0s      P

          Port          Admin     Oper      Port
          Priority      Key       Key       State
Fa4/1     32768         200       200       0x81
Fa4/2     32768         200       200       0x81
Fa4/3     32768         200       200       0x81
Fa4/4     32768         200       200       0x81
Router#
```

If no PDUs have been received, the default administrative information is displayed in braces.

Related Commands

Command	Description
clear lacp counters	Clears the statistics for all interfaces belonging to a specific channel group.
lacp port-priority	Sets the priority for the physical interfaces.
lacp system-priority	Sets the priority of the system.

Feature Information for IEEE 802.3ad Link Bundling

Table 4 lists the release history for this feature.

Not all commands may be available in your Cisco IOS software release. For release information about a specific command, see the command reference documentation.

Use Cisco Feature Navigator to find information about platform support and software image support. Cisco Feature Navigator enables you to determine which Cisco IOS and Catalyst OS software images support a specific software release, feature set, or platform. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn. An account on Cisco.com is not required.

Note Table 4 lists only the Cisco IOS software release that introduced support for a given feature in a given Cisco IOS software release train. Unless noted otherwise, subsequent releases of that Cisco IOS software release train also support that feature.

Table 4 Feature Information for IEEE 802.3ad Link Bundling

Feature Name	Releases	Feature Information
IEEE 802.3ad Link Bundling	12.2(31)SB2 12.2(33)SRB	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. 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. In 12.2(31)SB2, this feature was implemented on the Cisco 10000 series router. In 12.2(33)SRB, this feature was implemented on the Cisco 7600 router.