



Configuring Port Channels

This chapter contains the following sections:

- [Information About Port Channels, on page 1](#)
- [Understanding Port Channels, on page 2](#)
- [Compatibility Requirements, on page 3](#)
- [Load Balancing Using Port Channels, on page 4](#)
- [Resilient Hashing, on page 6](#)
- [Guidelines and Limitations for ECMP, on page 6](#)
- [Symmetric Hashing, on page 6](#)
- [Understanding LACP, on page 7](#)
- [Guidelines and Limitations, on page 10](#)
- [Configuring Port Channels, on page 11](#)
- [Verifying Port Channel Configuration, on page 22](#)
- [Triggering the Port Channel Membership Consistency Checker, on page 23](#)
- [Verifying the Load-Balancing Outgoing Port ID , on page 23](#)
- [Port Profiles, on page 24](#)
- [Configuring Port Profiles, on page 26](#)
- [Creating a Port Profile, on page 26](#)
- [Entering Port-Profile Configuration Mode and Modifying a Port Profile, on page 27](#)
- [Assigning a Port Profile to a Range of Interfaces, on page 27](#)
- [Enabling a Specific Port Profile, on page 28](#)
- [Inheriting a Port Profile, on page 29](#)
- [Removing a Port Profile from a Range of Interfaces, on page 30](#)
- [Removing an Inherited Port Profile, on page 30](#)

Information About Port Channels

A port channel bundles individual interfaces into a group to provide increased bandwidth and redundancy. Port channeling also load balances traffic across these physical interfaces. The port channel stays operational as long as at least one physical interface within the port channel is operational. If the min-links configuration is > 1 , the port channel will go down if the min-links condition is not met.

You create a port channel by bundling compatible interfaces. You can configure and run either static port channels or port channels running the Link Aggregation Control Protocol (LACP).

Any configuration changes that you apply to the port channel are applied to each member interface of that port channel. For example, if you configure Spanning Tree Protocol (STP) parameters on the port channel, Cisco NX-OS applies those parameters to each interface in the port channel.

You can use static port channels, with no associated protocol, for a simplified configuration. For more efficient use of the port channel, you can use LACP, which is defined in IEEE 802.3ad. When you use LACP, the link passes protocol packets.

Related Topics

[LACP Overview](#), on page 7

Understanding Port Channels

Using port channels, Cisco NX-OS provides wider bandwidth, redundancy, and load balancing across the channels.

You can collect ports into a static port channel or you can enable the Link Aggregation Control Protocol (LACP). Configuring port channels with LACP requires slightly different steps than configuring static port channels. For information on port channel configuration limits, see the *Verified Scalability* document for your platform. For more information about load balancing, see [Load Balancing Using Port Channels](#), on page 4.



Note Cisco NX-OS does not support Port Aggregation Protocol (PAgP) for port channels.

A port channel bundles individual links into a channel group to create a single logical link that provides the aggregate bandwidth of several physical links. If a member port within a port channel fails, traffic previously carried over the failed link switches to the remaining member ports within the port channel.

Each port can be in only one port channel. All the ports in a port channel must be compatible; they must use the same speed and operate in full-duplex mode. When you are running static port channels without LACP, the individual links are all in the on channel mode; you cannot change this mode without enabling LACP.



Note You cannot change the mode from ON to Active or from ON to Passive.

You can create a port channel directly by creating the port-channel interface, or you can create a channel group that acts to aggregate individual ports into a bundle. When you associate an interface with a channel group, Cisco NX-OS creates a matching port channel automatically if the port channel does not already exist. You can also create the port channel first. In this instance, Cisco NX-OS creates an empty channel group with the same channel number as the port channel and takes the default configuration.



Note A port channel is operationally up when at least one of the member ports is up and that port's status is channeling. The port channel is operationally down when all member ports are operationally down.

Compatibility Requirements

When you add an interface to a port channel group, Cisco NX-OS checks certain interface attributes to ensure that the interface is compatible with the channel group. Cisco NX-OS also checks a number of operational attributes for an interface before allowing that interface to participate in the port-channel aggregation.

The compatibility check includes the following operational attributes:

- Port mode
- Access VLAN
- Trunk native VLAN
- Allowed VLAN list
- Speed
- 802.3x flow control setting
- MTU
- Broadcast/Unicast/Multicast Storm Control setting
- Priority-Flow-Control
- Untagged CoS

Use the **show port-channel compatibility-parameters** command to see the full list of compatibility checks that Cisco NX-OS uses.

You can only add interfaces configured with the channel mode set to on to static port channels. You can also only add interfaces configured with the channel mode as active or passive to port channels that are running LACP. You can configure these attributes on an individual member port.

When the interface joins a port channel, the following individual parameters are replaced with the values on the port channel:

- Bandwidth
- MAC address
- Spanning Tree Protocol

The following interface parameters remain unaffected when the interface joins a port channel:

- Description
- CDP
- LACP port priority
- Debounce

After you enable forcing a port to be added to a channel group by entering the **channel-group force** command, the following two conditions occur:

- When an interface joins a port channel, the following parameters are removed and they are operationally replaced with the values on the port channel; however, this change will not be reflected in the running configuration for the interface:
 - QoS
 - Bandwidth
 - Delay
 - STP
 - Service policy
 - ACLs
- When an interface joins or leaves a port channel, the following parameters remain unaffected:
 - Beacon
 - Description
 - CDP
 - LACP port priority
 - Debounce
 - UDLD
 - Shutdown
 - SNMP traps

Load Balancing Using Port Channels

Cisco NX-OS load balances traffic across all operational interfaces in a port channel by reducing part of the binary pattern formed from the addresses in the frame to a numerical value that selects one of the links in the channel. Port channels provide load balancing by default.

You can configure the switch to use one of the following methods (see the following table for more details) to load balance across the port channel:

- Destination MAC address
- Source MAC address
- Source and destination MAC address
- Destination IP address
- Source IP address
- Source and destination IP address
- Destination TCP/UDP port number
- Source TCP/UDP port number

- Source and destination TCP/UDP port number

Table 1: Port Channel Load-Balancing Criteria

Configuration	Layer 2 Criteria	Layer 3 Criteria	Layer 4 Criteria
Destination MAC	Destination MAC	Destination MAC	Destination MAC
Source MAC	Source MAC	Source MAC	Source MAC
Source and destination MAC	Source and destination MAC	Source and destination MAC	Source and destination MAC
Destination IP	Destination MAC	Destination MAC, destination IP	Destination MAC, destination IP
Source IP	Source MAC	Source MAC, source IP	Source MAC, source IP
Source and destination IP	Source and destination MAC	Source and destination MAC, source and destination IP	Source and destination MAC, source and destination IP
Destination TCP/UDP port	Destination MAC	Destination MAC, destination IP	Destination MAC, destination IP, destination port
Source TCP/UDP port	Source MAC	Source MAC, source IP	Source MAC, source IP, source port
Source and destination TCP/UDP port	Source and destination MAC	Source and destination MAC, source and destination IP	Source and destination MAC, source and destination IP, source and destination port

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

Regardless of the load-balancing algorithm configured, multicast traffic uses the following methods for load balancing with port channels:

- Multicast traffic with Layer 4 information - Source IP address, source port, destination IP address, destination port
- Multicast traffic without Layer 4 information - Source IP address, destination IP address
- Non-IP multicast traffic - Source MAC address, destination MAC address



Note The hardware multicast hw-hash command is not supported on Cisco Nexus 3000 Series switches. It is recommended not to configure this command on these switches. By default, Cisco Nexus 3000 Series switches hash multicast traffic.

Resilient Hashing

With the exponential increase in the number of both physical and logical links used in data centers, there is also the potential for an increase of possibility for link failures. In static hashing systems that are used for load balancing flows across members of port channels or Equal Cost Multipath (ECMP) groups, each flow is hashed to a link. If a link fails, all flows are rehashed across the remaining working links. This rehashing of flows to links results in some packets being delivered out of order even for those flows that were not hashed to the failed link.

This rehashing also occurs when a link is added to the port channel or Equal Cost Multipath (ECMP) group. All flows are rehashed across the new number of links, which results in some packets being delivered out of order. Resilient hashing supports only unicast traffic.

The resilient hashing system in Cisco Nexus 3600 platform switches maps flows to physical ports. In case a link fails, the flows assigned to the failed link are redistributed uniformly among the working links. The existing flows through the working links are not rehashed and their packets are not delivered out of order.

Resilient hashing is supported only by ECMP groups. When a link is added to the ECMP group, all the flows hashed to the existing links are rehashed to the new link.

Resilient hashing supports IPv4 and IPv6 unicast traffic, but it does not support IPv4 multicast traffic.

Guidelines and Limitations for ECMP

You might observe that load balancing with Layer 2/Layer 3 GW flows are not load balanced equally among all links when the switch comes up initially after reload. There are two CLIs to change the ECMP hash configuration in the hardware. The two CLI commands are mutually exclusive.

- Enter the **port-channel load-balance [src | src-dst | dst] mac** command for MAC-based only hash.
- For hash based on IP/Layer 4 ports, enter either the **ip load-share** or **port-channel load-balance** command.
- The **port-channel load-balance** command can overwrite the **ip load-share** command. It is better to enter the **port-channel load-balance** command which helps to set both the IP and MAC parameters.
- There are no options to force the hashing algorithm based on the IP/Layer 4 port. The default MAC configuration is always programmed as a part of the port channel configuration.

Symmetric Hashing

To be able to effectively monitor traffic on a port channel, it is essential that each interface connected to a port channel receives both forward and reverse traffic flows. Normally, there is no guarantee that the forward and reverse traffic flows will use the same physical interface. However, when you enable symmetric hashing on the port channel, bidirectional traffic is forced to use the same physical interface and each physical interface in the port channel is effectively mapped to a set of flows.

When symmetric hashing is enabled, the parameters used for hashing, such as the source and destination IP address, are normalized before they are entered into the hashing algorithm. This process ensures that when

the parameters are reversed (the source on the forward traffic becomes the destination on the reverse traffic), the hash output is the same. Therefore, the same interface is chosen.

Symmetric hashing is supported only on Cisco Nexus 3600 Series switches.

Only the following load-balancing algorithms support symmetric hashing:

- source-dest-ip-only
- source-dest-port-only
- source-dest-ip
- source-dest-port
- source-dest-ip-gre

Understanding LACP

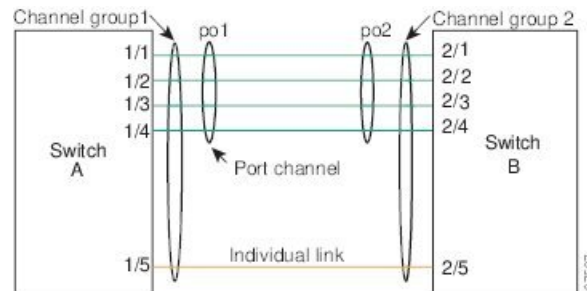
LACP Overview



Note You must enable the LACP feature before you can configure and use LACP functions.

The following figure shows how individual links can be combined into LACP port channels and channel groups as well as function as individual links.

Figure 1: Individual Links Combined into a Port Channel



With LACP, just like with static port channels, you can bundle up to 32 interfaces in a channel group.



Note When you delete the port channel, Cisco NX-OS automatically deletes the associated channel group. All member interfaces revert to their previous configuration.

You cannot disable LACP while any LACP configurations are present. The configuration could have an LACP configuration, like LACP min-links on a port channel, but with no members. In that case, you can disable LACP.

LACP ID Parameters

LACP uses the following parameters:

- LACP system priority—Each system that runs LACP has an LACP system priority value. You can accept the default value of 32768 for this parameter, or you can configure a value between 1 and 65535. LACP uses the system priority with the MAC address to form the system ID and also uses the system priority during negotiation with other devices. A higher system priority value means a lower priority.



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

- LACP port priority—Each port configured to use LACP has an LACP port priority. You can accept the default value of 32768 for the LACP port priority, or you can configure a value between 1 and 65535. LACP uses the port priority with the port number to form the port identifier. LACP uses the port priority to decide which ports should be put in standby mode when there is a limitation that prevents all compatible ports from aggregating and which ports should be put into active mode. A higher port priority value means a lower priority for LACP. You can configure the port priority so that specified ports have a lower priority for LACP and are most likely to be chosen as active links, rather than hot-standby links.
- LACP administrative key—LACP automatically configures an administrative key value equal to the channel-group number on each port configured to use LACP. The administrative key defines the ability of a port to aggregate with other ports. A port's ability to aggregate with other ports is determined by these factors:
 - Port physical characteristics, such as the data rate, the duplex capability, and the point-to-point or shared medium state
 - Configuration restrictions that you establish

Channel Modes

Individual interfaces in port channels are configured with channel modes. When you run static port channels, with no protocol, the channel mode is always set to on. After you enable LACP globally on the device, you enable LACP for each channel by setting the channel mode for each interface to active or passive. You can configure either channel mode for individual links in the LACP channel group.



Note You must enable LACP globally before you can configure an interface in either the active or passive channel mode.

The following table describes the channel modes.

Table 2: Channel Modes for Individual Links in a Port Channel

Channel Mode	Description
passive	LACP mode that places a port into a passive negotiating state, in which the port responds to LACP packets that it receives but does not initiate LACP negotiation.
active	LACP mode that places a port into an active negotiating state, in which the port initiates negotiations with other ports by sending LACP packets.
on	<p>All static port channels, that is, that are not running LACP, remain in this mode. If you attempt to change the channel mode to active or passive before enabling LACP, the device returns an error message.</p> <p>You enable LACP on each channel by configuring the interface in that channel for the channel mode as either active or passive. When an LACP attempts to negotiate with an interface in the on state, it does not receive any LACP packets and becomes an individual link with that interface; it does not join the LACP channel group.</p> <p>The no lacp suspend-individual configuration is supported by default on Cisco Nexus 3600 switches.</p>

Both the passive and active modes allow LACP to negotiate between ports to determine if they can form a port channel, based on criteria such as the port speed and the trunking state. The passive mode is useful when you do not know whether the remote system, or partner, supports LACP.

Ports can form an LACP port channel when they are in different LACP modes as long as the modes are compatible as in the following examples:

- A port in active mode can form a port channel successfully with another port that is in active mode.
- A port in active mode can form a port channel with another port in passive mode.
- A port in passive mode cannot form a port channel with another port that is also in passive mode because neither port will initiate negotiation.
- A port in on mode is not running LACP.

LACP Marker Responders

Using port channels, data traffic may be dynamically redistributed due to either a link failure or load balancing. LACP uses the Marker Protocol to ensure that frames are not duplicated or reordered because of this redistribution. Cisco NX-OS supports only Marker Responders.

LACP-Enabled and Static Port Channel Differences

The following table provides a brief summary of major differences between port channels with LACP enabled and static port channels. For information about the maximum configuration limits, see the *Verified Scalability* document for your device.

Table 3: Port Channels with LACP Enabled and Static Port Channels

Configurations	Port Channels with LACP Enabled	Static Port Channels
Protocol applied	Enable globally.	Not applicable.
Channel mode of links	Can be either: <ul style="list-style-type: none"> • Active • Passive 	Can only be On.

LACP Port Channel Minimum Links and MaxBundle

A port channel aggregates similar ports to provide increased bandwidth in a single manageable interface. The introduction of the minimum links and MaxBundle feature further refines LACP port-channel operation and provides increased bandwidth in one manageable interface.

The LACP port channel MinLinks feature does the following:

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

The LACP MaxBundle defines the maximum number of bundled ports allowed in a LACP port channel. The LACP MaxBundle feature does the following:

- Defines an upper limit on the number of bundled ports in an LACP port channel.
- Allows hot-standby ports with fewer bundled ports. (For example, in an LACP port channel with five ports, you can designate two of those ports as hot-standby ports.)



Note The minimum links and maxbundle feature works only with LACP port channels. However, the device allows you to configure this feature in non-LACP port channels, but the feature is not operational.

Guidelines and Limitations

Port channeling has the following configuration guidelines and limitations:

- On a Cisco Nexus 36180YC switch, the first 24 ports are part of the same quadrant. Ports in the same quadrant must have same speed (1/10G or 25G) on all ports. Having different speed on ports in a quadrant is not supported. If you set different speed in any of the ports in a quadrant, ports go into error disable state. Interfaces in same quadrant are:
 - 1–4
 - 5–8

- 9–12
- 13–16
- 17–20
- 21–24
- 25–28
- 29–32
- 33–36
- 37–40
- 41–44
- 45–48

Configuring Port Channels

Creating a Port Channel

You can create a port channel before creating a channel group. Cisco NX-OS automatically creates the associated channel group.



Note If you want LACP-based port channels, you need to enable LACP.



Note Channel member ports cannot be a source or destination SPAN port.

Procedure

	Command or Action	Purpose
Step 1	switch# configure terminal	Enters global configuration mode.
Step 2	switch(config)# interface port-channel <i>channel-number</i>	Specifies the port-channel interface to configure, and enters the interface configuration mode. The range is from 1 to 4096. Cisco NX-OS automatically creates the channel group if it does not already exist.
Step 3	switch(config)# no interface port-channel <i>channel-number</i>	Removes the port channel and deletes the associated channel group.

Example

This example shows how to create a port channel:

```
switch# configure terminal
switch (config)# interface port-channel 1
```

Adding a Port to a Port Channel

You can add a port to a new channel group or to a channel group that already contains ports. Cisco NX-OS creates the port channel associated with this channel group if the port channel does not already exist.



Note If you want LACP-based port channels, you need to enable LACP.

Procedure

	Command or Action	Purpose
Step 1	switch# configure terminal	Enters global configuration mode.
Step 2	switch(config)# interface <i>type slot/port</i>	Specifies the interface that you want to add to a channel group and enters the interface configuration mode.
Step 3	(Optional) switch(config-if)# switchport mode trunk	Configures the interface as a trunk port.
Step 4	(Optional) switch(config-if)# switchport trunk { allowed vlan <i>vlan-id</i> native vlan <i>vlan-id</i> }	Configures necessary parameters for a trunk port.
Step 5	switch(config-if)# channel-group <i>channel-number</i>	Configures the port in a channel group and sets the mode. The channel-number range is from 1 to 4096. Cisco NX-OS creates the port channel associated with this channel group if the port channel does not already exist. This is called implicit port channel creation.
Step 6	(Optional) switch(config-if)# no channel-group	Removes the port from the channel group. The port reverts to its original configuration.

Example

This example shows how to add an Ethernet interface 1/4 to channel group 1:

```
switch# configure terminal
switch (config)# interface ethernet 1/4
switch (config-if)# switchport mode trunk
switch (config-if)# channel-group 1
```

Configuring Load Balancing Using Port Channels

You can configure the load-balancing algorithm for port channels that applies to the entire device.



Note If you want LACP-based port channels, you need to enable LACP.

Procedure

	Command or Action	Purpose
Step 1	switch# configure terminal	Enters global configuration mode.
Step 2	switch(config)# port-channel load-balance ethernet {[destination-ip destination-ip-gre destination-mac destination-port source-dest-ip source-dest-ip-gre source-dest-mac source-dest-port source-ip source-ip-gre source-mac source-port] symmetric crc-poly }	<p>Specifies the load-balancing algorithm and hash for the device. The range depends on the device. The default is source-dest-mac.</p> <p>Note The optional destination-ip-gre, source-dest-ip-gre and source-ip-gre keywords are used to include the NVGRE key in the hash computation. Inclusion of the NVGRE key is not enabled by default in the case of port channels. You must configure it explicitly by using these optional keywords.</p> <p>The optional symmetric keyword is used to enable or disable symmetric hashing. Symmetric hashing forces bi-directional traffic to use the same physical interface. Only the following load-balancing algorithms support symmetric hashing:</p> <ul style="list-style-type: none"> • source-dest-ip-only • source-dest-port-only • source-dest-ip • source-dest-port • source-dest-ip-gre
Step 3	(Optional) switch(config)# no port-channel load-balance ethernet	Restores the default load-balancing algorithm of source-dest-mac.
Step 4	(Optional) switch# show port-channel load-balance	Displays the port-channel load-balancing algorithm.

Example

This example shows how to configure source IP load balancing for port channels:

```
switch# configure terminal
switch (config)# port-channel load-balance ethernet source-ip
```

This example shows how to configure symmetric hashing for port channels:

```
switch# configure terminal
switch (config)# port-channel load-balance ethernet source-dest-ip-only symmetric
```

Enabling LACP

LACP is disabled by default; you must enable LACP before you begin LACP configuration. If you have any LACP port channels configured, LACP cannot be disabled.

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

Procedure

	Command or Action	Purpose
Step 1	switch# configure terminal	Enters global configuration mode.
Step 2	switch(config)# feature lacp	Enables LACP on the switch.
Step 3	(Optional) switch(config)# show feature	Displays enabled features.

Example

This example shows how to enable LACP:

```
switch# configure terminal
switch (config)# feature lacp
```

Configuring the Channel Mode for a Port

You can configure the channel mode for each individual link in the LACP port channel as active or passive. This channel configuration mode allows the link to operate with LACP.

When you configure port channels with no associated protocol, all interfaces on both sides of the link remain in the on channel mode.

Before you begin

Ensure that you have enabled the LACP feature.

Procedure

	Command or Action	Purpose
Step 1	switch# configure terminal	Enters global configuration mode.
Step 2	switch(config)# interface <i>type slot/port</i>	Specifies the interface to configure, and enters the interface configuration mode.
Step 3	switch(config-if)# channel-group <i>channel-number</i> [force] [mode { on active passive }]	<p>Specifies the port mode for the link in a port channel. After LACP is enabled, you configure each link or the entire channel as active or passive.</p> <p>force—Specifies that the LAN port be forcefully added to the channel group.</p> <p>mode—Specifies the port channel mode of the interface.</p> <p>active—Specifies that when you enable LACP, this command enables LACP on the specified interface. The interface is in an active negotiating state in which the port initiates negotiations with other ports by sending LACP packets.</p> <p>on—(Default mode) Specifies that all port channels that are not running LACP remain in this mode.</p> <p>passive—Enables LACP only if an LACP device is detected. The interface is in a passive negotiation state in which the port responds to LACP packets that it receives but does not initiate LACP negotiation.</p> <p>When you run port channels with no associated protocol, the channel mode is always on.</p>
Step 4	switch(config-if)# no channel-group <i>number</i> mode	Returns the port mode to on for the specified interface.

Example

This example shows how to set the LACP-enabled interface to active port-channel mode for Ethernet interface 1/4 in channel group 5:

```
switch# configure terminal
switch (config)# interface ethernet 1/4
switch(config-if)# channel-group 5 mode active
```

Configuring LACP Port Channel MinLinks

The MinLink feature works only with LACP port channels. The device allows you to configure this feature in non-LACP port channels, but the feature is not operational.



Important We recommend that you configure the LACP MinLink feature on both ends of your LACP port channel, that is, on both the switches. Configuring the **lACP min-links** command on only one end of the port channel might result in link flapping.

Procedure

	Command or Action	Purpose
Step 1	switch# configure terminal	Enters global configuration mode.
Step 2	switch(config)# interface port-channel number	Specifies the interface to configure.
Step 3	switch(config-if)# [no] lACP min-links number	Configures the number of minimum links. The default value for <i>number</i> is 1. The range is from 1 to 32. Use the no form of this command to disable this feature.
Step 4	(Optional) switch(config)# show running-config interface port-channel number	Displays the port channel configuration of the interface.

Example

This example shows how to configure the minimum number of links that must be up for the bundle as a whole to be labeled *up*:

```
switch#configure terminal
switch(config)#interface port-channel 3
switch(config-if)#lACP min-links 3
switch(config)#show running-config interface port-channel 3
```

Configuring the LACP Port-Channel MaxBundle

You can configure the LACP maxbundle feature. Although minimum links and maxbundles work only in LACP, you can enter the CLI commands for these features for non-LACP port channels, but these commands are nonoperational.



Note Use the **no lacp max-bundle** command to restore the default port-channel max-bundle configuration.

Command	Purpose
no lacp max-bundle Example: switch(config)# no lacp max-bundle	Restores the default port-channel max-bundle configuration.

Before you begin

Ensure that you are in the correct port-channel interface.

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters global configuration mode.
Step 2	interface port-channel <i>number</i> Example: switch(config)# interface port-channel 3 switch(config-if)#	Specifies an interface to configure.
Step 3	lacp max-bundle <i>number</i> Example: switch(config-if)# lacp max-bundle <number>	Configures the maximum number of active bundled LACP ports that are allowed in a port channel. The default value for the port-channel max-bundle is 32. The allowed range is from 1 to 32. Note Even if the default value is 16, the number of active members in a port channel is the minimum of the <i>pc_max_links_config</i> and <i>pc_max_active_members</i> that is allowed in the port channel.
Step 4	show running-config interface port-channel <number> Example: switch(config-if)# show running-config interface port-channel 3	(Optional) Displays the port-channel configuration for the interface.

Example

This example shows how to configure the maximum number of active bundled LACP ports:

```
switch# configure terminal
switch# interface port-channel 3
switch (config-if)# lacp max-bundle 3
switch (config-if)# show running-config interface port-channel 3
```

Configuring the LACP Fast Timer Rate

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

Before you begin

Ensure that you have enabled the LACP feature.

Procedure

	Command or Action	Purpose
Step 1	switch# configure terminal	Enters global configuration mode.
Step 2	switch(config)# interface <i>type slot/port</i>	Specifies the interface to configure and enters the interface configuration mode.
Step 3	switch(config-if)# lacp rate fast	Configures the fast rate (one second) at which LACP control packets are sent to an LACP-supported interface.

Example

This example shows how to configure the LACP fast rate on Ethernet interface 1/4:

```
switch# configure terminal
switch(config)# interface ethernet 1/4
switch(config-if)# lacp rate fast
```

This example shows how to restore the LACP default rate (30 seconds) on Ethernet interface 1/4.

```
switch# configure terminal
switch(config)# interface ethernet 1/4
switch(config-if)# no lacp rate fast
```

Configuring the LACP System Priority and System ID

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

Before you begin

Ensure that you have enabled the LACP feature.

Procedure

	Command or Action	Purpose
Step 1	switch# configure terminal	Enters global configuration mode.
Step 2	switch(config)# lACP system-priority <i>priority</i>	Configures the system priority for use with LACP. Valid values are 1 through 65535, and higher numbers have lower priority. The default value is 32768.
Step 3	(Optional) switch# show lACP system-identifier	Displays the LACP system identifier.

Example

This example shows how to set the LACP system priority to 2500:

```
switch# configure terminal
switch(config)# lACP system-priority 2500
```

Configuring the LACP Port Priority

You can configure each link in the LACP port channel for the port priority.

Before you begin

Ensure that you have enabled the LACP feature.

Procedure

	Command or Action	Purpose
Step 1	switch# configure terminal	Enters global configuration mode.
Step 2	switch(config)# interface <i>type slot/port</i>	Specifies the interface to configure, and enters the interface configuration mode.
Step 3	switch(config-if)# lACP port-priority <i>priority</i>	Configures the port priority for use with LACP. Valid values are 1 through 65535, and higher numbers have lower priority. The default value is 32768.

Example

This example shows how to set the LACP port priority for Ethernet interface 1/4 to 40000:

```
switch# configure terminal
switch (config)# interface ethernet 1/4
switch(config-if)# lacp port priority 40000
```

Disabling LACP Graceful Convergence

By default, LACP graceful convergence is enabled. In situations where you need to support LACP interoperability with devices where the graceful failover defaults may delay the time taken for a disabled port to be brought down or cause traffic from the peer to be lost, you can disable convergence. If the downstream access switch is not a Cisco Nexus device, disable the LACP graceful convergence option.



Note The port channel has to be in the administratively down state before the command can be run.

Before you begin

Enable LACP.

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters global configuration mode.
Step 2	interface port-channel <i>number</i> Example: switch(config)# interface port-channel 1 switch(config-if)#	Specifies the port channel interface to configure and enters the interface configuration mode.
Step 3	shutdown Example: switch(config-if) shutdown	Administratively shuts down the port channel.
Step 4	no lacp graceful-convergence Example: switch(config-if)# no lacp graceful-convergence	Disables LACP graceful convergence on the port channel.
Step 5	no shutdown Example: switch(config-if) no shutdown	Brings up the port channel administratively.
Step 6	copy running-config startup-config Example:	(Optional) Copies the running configuration to the startup configuration.

	Command or Action	Purpose
	<code>switch(config)# copy running-config startup-config</code>	

Example

This example shows how to disable LACP graceful convergence on a port channel:

```
switch# configure terminal
switch (config)# interface port-channel 1
switch(config-if)# shutdown
switch(config-if)# no lacp graceful-convergence
switch(config-if)# no shutdown
```

Reenabling LACP Graceful Convergence

If the default LACP graceful convergence is once again required, you can reenabling convergence.

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: <code>switch# configure terminal</code> <code>switch(config)#</code>	Enters global configuration mode.
Step 2	interface port-channel <i>number</i> Example: <code>switch(config)# interface port-channel 1</code> <code>switch(config-if)#</code>	Specifies the port channel interface to configure and enters the interface configuration mode.
Step 3	shutdown Example: <code>switch(config-if) shutdown</code>	Administratively shuts down the port channel.
Step 4	lacp graceful-convergence Example: <code>switch(config-if)# lacp graceful-convergence</code>	Enables LACP graceful convergence on the port channel.
Step 5	no shutdown Example: <code>switch(config-if) no shutdown</code>	Brings the port channel administratively up.
Step 6	copy running-config startup-config Example:	(Optional) Copies the running configuration to the startup configuration.

	Command or Action	Purpose
	<code>switch(config)# copy running-config startup-config</code>	

Example

This example shows how to enable LACP graceful convergence on a port channel:

```
switch# configure terminal
switch (config)# interface port-channel 1
switch(config-if)# shutdown
switch(config-if)# lacp graceful-convergence
switch(config-if)# no shutdown
```

Verifying Port Channel Configuration

Use the following command to verify the port channel configuration information:

Command	Purpose
<code>show interface port channel</code> <i>channel-number</i>	Displays the status of a port channel interface.
<code>show feature</code>	Displays enabled features.
<code>show resource</code>	Displays the number of resources currently available in the system.
<code>show lacp {counters interface</code> <i>type slot/port</i> <code>neighbor port-channel system-identifier}</code>	Displays LACP information.
<code>show port-channel compatibility-parameters</code>	Displays the parameters that must be the same among the member ports in order to join a port channel.
<code>show port-channel database</code> [<code>interface port-channel</code> <i>channel-number</i>]	Displays the aggregation state for one or more port-channel interfaces.
<code>show port-channel summary</code>	Displays a summary for the port channel interfaces.
<code>show port-channel traffic</code>	Displays the traffic statistics for port channels.
<code>show port-channel usage</code>	Displays the range of used and unused channel numbers.
<code>show port-channel database</code>	Displays information on current running of the port channel feature.
<code>show port-channel load-balance</code>	Displays information about load-balancing using port channels.

Triggering the Port Channel Membership Consistency Checker

You can manually trigger the port channel membership consistency checker to compare the hardware and software configuration of all ports in a port channel and display the results. To manually trigger the port channel membership consistency checker and display the results, use the following command in any mode:

Procedure

	Command or Action	Purpose
Step 1	<code>switch# show consistency-checker membership port-channels</code>	Starts a port channel membership consistency check on the member ports of a port channel and displays its results.

Example

This example shows how to trigger a port channel membership consistency check and display its results:

```
switch# show consistency-checker membership port-channels
Checks: Trunk group and trunk membership table.
Consistency Check: PASSED
No Inconsistencies found for port-channel1111:
  Module:1, Unit:0
  ['Ethernet1/4', 'Ethernet1/5', 'Ethernet1/6']
No Inconsistencies found for port-channel2211:
  Module:1, Unit:0
  ['Ethernet1/7', 'Ethernet1/8', 'Ethernet1/9', 'Ethernet1/10']
No Inconsistencies found for port-channel3311:
  Module:1, Unit:0
  ['Ethernet1/11', 'Ethernet1/12', 'Ethernet1/13', 'Ethernet1/14']
No Inconsistencies found for port-channel4095:
  Module:1, Unit:0
  ['Ethernet1/33', 'Ethernet1/34', 'Ethernet1/35', 'Ethernet1/36', 'Ethernet1
/37', 'Ethernet1/38', 'Ethernet1/39', 'Ethernet1/40', 'Ethernet1/41', 'Ethernet1
/42', 'Ethernet1/43', 'Ethernet1/44', 'Ethernet1/45', 'Ethernet1/46', 'Ethernet1
/47', 'Ethernet1/48', 'Ethernet1/29', 'Ethernet1/30', 'Ethernet1/31', 'Ethernet1
/32']
```

Verifying the Load-Balancing Outgoing Port ID

Command Guidelines

The `show port-channel load-balance` command allows you to verify which ports a given frame is hashed to on a port channel. You need to specify the VLAN and the destination MAC in order to get accurate results.



Note Certain traffic flows are not subject to hashing such as when there is a single port in a port-channel.

The **show port-channel load-balance** command supports only unicast traffic hashing. Multicast traffic hashing is not supported.

To display the load-balancing outgoing port ID, perform one of the tasks:

Command	Purpose
switch# show port-channel load-balance forwarding-path interface port-channel <i>port-channel-id</i> vlan <i>vlan-id</i> dst-ip <i>dst-ip</i> src-ip <i>src-ip</i> dst-mac <i>dst-mac</i> src-mac <i>src-mac</i> l4-src-port <i>port-id</i> l4-dst-port <i>port-id</i> ether-type <i>ether-type</i> ip-proto <i>ip-proto</i>	Displays the outgoing port ID.

Example

This example shows how to display the load balancing outgoing port ID:

```
switch# show port-channel load-balance forwarding-path interface port-channel 10 vlan 1
dst-ip 1.225.225.225 src-ip 1.1.10.10 src-mac aa:bb:cc:dd:ee:ff
l4-src-port 0 l4-dst-port 1
Missing params will be substituted by 0's. Load-balance Algorithm on switch: source-dest-port
  crc8_hash:204 Outgoing port id: Ethernet 1/1 Param(s) used to calculate load balance:
dst-port: 0
src-port: 0
dst-ip: 1.225.225.225
src-ip: 1.1.10.10
dst-mac: 0000.0000.0000
src-mac: aabb.ccdd.eeff
```

Port Profiles

You can create a port profile that contains many interface commands and apply that port profile to a range of interfaces. Each port profile can be applied only to a specific type of interface; the choices are as follows:

- Ethernet
- VLAN network interface
- Port channel

When you choose Ethernet or port channel as the interface type, the port profile is in the default mode which is Layer 3. Enter the **switchport** command to change the port profile to Layer 2 mode.

You inherit the port profile when you attach the port profile to an interface or range of interfaces. When you attach, or inherit, a port profile to an interface or range of interfaces, the system applies all the commands in that port profile to the interfaces. Additionally, you can have one port profile inherit the settings from another port profile. Inheriting another port profile allows the initial port profile to assume all of the commands of the second, inherited, port profile that do not conflict with the initial port profile. Four levels of inheritance are supported. The same port profile can be inherited by any number of port profiles.

The system applies the commands inherited by the interface or range of interfaces according to the following guidelines:

- Commands that you enter under the interface mode take precedence over the port profile's commands if there is a conflict. However, the port profile retains that command in the port profile.
- The port profile's commands take precedence over the default commands on the interface, unless the port-profile command is explicitly overridden by the default command.

- When a range of interfaces inherits a second port profile, the commands of the initial port profile override the commands of the second port profile if there is a conflict.
- After you inherit a port profile onto an interface or range of interfaces, you can override individual configuration values by entering the new value at the interface configuration level. If you remove the individual configuration values at the interface configuration level, the interface uses the values in the port profile again.
- There are no default configurations associated with a port profile.

A subset of commands are available under the port-profile configuration mode, depending on which interface type you specify.

To apply the port-profile configurations to the interfaces, you must enable the specific port profile. You can configure and inherit a port profile onto a range of interfaces prior to enabling the port profile. You would then enable that port profile for the configurations to take effect on the specified interfaces.

If you inherit one or more port profiles onto an original port profile, only the last inherited port profile must be enabled; the system assumes that the underlying port profiles are enabled.

When you remove a port profile from a range of interfaces, the system undoes the configuration from the interfaces first and then removes the port-profile link itself. Also, when you remove a port profile, the system checks the interface configuration and either skips the port-profile commands that have been overridden by directly entered interface commands or returns the command to the default value.

If you want to delete a port profile that has been inherited by other port profiles, you must remove the inheritance before you can delete the port profile.

You can also choose a subset of interfaces from which to remove a port profile from among that group of interfaces that you originally applied the profile. For example, if you configured a port profile and configured ten interfaces to inherit that port profile, you can remove the port profile from just some of the specified ten interfaces. The port profile continues to operate on the remaining interfaces to which it is applied.

If you delete a specific configuration for a specified range of interfaces using the interface configuration mode, that configuration is also deleted from the port profile for that range of interfaces only. For example, if you have a channel group inside a port profile and you are in the interface configuration mode and you delete that port channel, the specified port channel is also deleted from the port profile as well.

Just as in the device, you can enter a configuration for an object in port profiles without that object being applied to interfaces yet. For example, you can configure a virtual routing and forward (VRF) instance without it being applied to the system. If you then delete that VRF and related configurations from the port profile, the system is unaffected.

After you inherit a port profile on an interface or range of interfaces and you delete a specific configuration value, that port-profile configuration is not operative on the specified interfaces.

If you attempt to apply a port profile to the wrong type of interface, the system returns an error.

When you attempt to enable, inherit, or modify a port profile, the system creates a checkpoint. If the port-profile configuration fails, the system rolls back to the prior configuration and returns an error. A port profile is never only partially applied.

Configuring Port Profiles

You can apply several configuration parameters to a range of interfaces simultaneously. All the interfaces in the range must be the same type. You can also inherit the configurations from one port profile into another port profile. The system supports four levels of inheritance.

Creating a Port Profile

You can create a port profile on the device. Each port profile must have a unique name across types and the network.



Note Port profile names can include only the following characters:

- a-z
- A-Z
- 0-9
- No special characters are allowed, except for the following:
 - .
 - -
 - _

Procedure

	Command or Action	Purpose
Step 1	<code>configure terminal</code>	Enters the global configuration mode.
Step 2	<code>port-profile [type {ethernet interface-vlan port-channel}] name</code>	Creates and names a port profile for the specified type of interface and enters the port-profile configuration mode.
Step 3	<code>exit</code>	Exits the port-profile configuration mode.
Step 4	(Optional) <code>show port-profile</code>	Displays the port-profile configuration.
Step 5	(Optional) <code>copy running-config startup-config</code>	Copies the running configuration to the startup configuration.

Example

This example shows how to create a port profile named test for ethernet interfaces:

```
switch# configure terminal
switch(config)# port-profile type ethernet test
switch(config-ppm)#
```

Entering Port-Profile Configuration Mode and Modifying a Port Profile

You can enter the port-profile configuration mode and modify a port profile. To modify the port profile, you must be in the port-profile configuration mode.

Procedure

	Command or Action	Purpose
Step 1	configure terminal	Enters the global configuration mode.
Step 2	port-profile [type { ethernet interface-vlan port-channel }] <i>name</i>	Enters the port-profile configuration mode for the specified port profile and allows you to add or remove configurations to the profile.
Step 3	exit	Exits the port-profile configuration mode.
Step 4	(Optional) show port-profile	Displays the port-profile configuration.
Step 5	(Optional) copy running-config startup-config	Copies the running configuration to the startup configuration.

Example

This example shows how to enter the port-profile configuration mode for the specified port profile and bring all the interfaces administratively up:

```
switch# configure terminal
switch(config)# port-profile type ethernet test
switch(config-ppm)# no shutdown
switch(config-ppm)#
```

Assigning a Port Profile to a Range of Interfaces

You can assign a port profile to an interface or to a range of interfaces. All the interfaces must be the same type.

Procedure

	Command or Action	Purpose
Step 1	configure terminal	Enters the global configuration mode.

	Command or Action	Purpose
Step 2	interface [<i>ethernet slot/port</i> interface-vlan <i>vlan-id</i> port-channel <i>number</i>]	Selects the range of interfaces.
Step 3	inherit port-profile <i>name</i>	Assigns the specified port profile to the selected interfaces.
Step 4	exit	Exits the port-profile configuration mode.
Step 5	(Optional) show port-profile	Displays the port-profile configuration.
Step 6	(Optional) copy running-config startup-config	Copies the running configuration to the startup configuration.

Example

This example shows how to assign the port profile named adam to Ethernet interfaces 7/3 to 7/5, 10/2, and 11/20 to 11/25:

```
switch# configure terminal
switch(config)# interface ethernet7/3-5, ethernet10/2, ethernet11/20-25
switch(config-if)# inherit port-profile adam
switch(config-if)#
```

Enabling a Specific Port Profile

To apply the port-profile configurations to the interfaces, you must enable the specific port profile. You can configure and inherit a port profile onto a range of interfaces before you enable that port profile. You would then enable that port profile for the configurations to take effect on the specified interfaces.

If you inherit one or more port profiles onto an original port profile, only the last inherited port profile must be enabled; the system assumes that the underlying port profiles are enabled.

You must be in the port-profile configuration mode to enable or disable port profiles.

Procedure

	Command or Action	Purpose
Step 1	configure terminal	Enters the global configuration mode.
Step 2	port-profile [<i>type {ethernet interface-vlan port-channel}</i>] <i>name</i>	Creates and names a port profile for the specified type of interface and enters the port-profile configuration mode.
Step 3	state enabled	Enables that port profile.
Step 4	exit	Exits the port-profile configuration mode.
Step 5	(Optional) show port-profile	Displays the port-profile configuration.

	Command or Action	Purpose
Step 6	(Optional) <code>copy running-config startup-config</code>	Copies the running configuration to the startup configuration.

Example

This example shows how to enter the port-profile configuration mode and enable the port profile:

```
switch# configure terminal
switch(config)# port-profile type ethernet test
switch(config-ppm)# state enabled
switch(config-ppm)#
```

Inheriting a Port Profile

You can inherit a port profile onto an existing port profile. The system supports four levels of inheritance.

Procedure

	Command or Action	Purpose
Step 1	<code>configure terminal</code>	Enters the global configuration mode.
Step 2	<code>port-profile name</code>	Enters the port-profile configuration mode for the specified port profile.
Step 3	<code>inherit port-profile name</code>	Inherits another port profile onto the existing one. The original port profile assumes all the configurations of the inherited port profile.
Step 4	<code>exit</code>	Exits the port-profile configuration mode.
Step 5	(Optional) <code>show port-profile</code>	Displays the port-profile configuration.
Step 6	(Optional) <code>copy running-config startup-config</code>	Copies the running configuration to the startup configuration.

Example

This example shows how to inherit the port profile named adam onto the port profile named test:

```
switch# configure terminal
switch(config)# port-profile test
switch(config-ppm)# inherit port-profile adam
switch(config-ppm)#
```

Removing a Port Profile from a Range of Interfaces

You can remove a port profile from some or all of the interfaces to which you have applied the profile. You do this configuration in the interfaces configuration mode.

Procedure

	Command or Action	Purpose
Step 1	<code>configure terminal</code>	Enters the global configuration mode.
Step 2	<code>interface [ethernet slot/port interface-vlan vlan-id port-channel number]</code>	Selects the range of interfaces.
Step 3	<code>no inherit port-profile name</code>	Un-assigns the specified port profile to the selected interfaces.
Step 4	<code>exit</code>	Exits the port-profile configuration mode.
Step 5	(Optional) <code>show port-profile</code>	Displays the port-profile configuration.
Step 6	(Optional) <code>copy running-config startup-config</code>	Copies the running configuration to the startup configuration.

Example

This example shows how to unassign the port profile named adam to Ethernet interfaces 7/3 to 7/5, 10/2, and 11/20 to 11/25:

```
switch# configure terminal
switch(config)# interface ethernet 7/3-5, 10/2, 11/20-25
switch(config-if)# no inherit port-profile adam
switch(config-if)#
```

Removing an Inherited Port Profile

You can remove an inherited port profile. You do this configuration in the port-profile mode.

Procedure

	Command or Action	Purpose
Step 1	<code>configure terminal</code>	Enters the global configuration mode.
Step 2	<code>port-profile name</code>	Enters the port-profile configuration mode for the specified port profile.
Step 3	<code>no inherit port-profile name</code>	Removes an inherited port profile from this port profile.

	Command or Action	Purpose
Step 4	exit	Exits the port-profile configuration mode.
Step 5	(Optional) show port-profile	Displays the port-profile configuration.
Step 6	(Optional) copy running-config startup-config	Copies the running configuration to the startup configuration.

Example

This example shows how to remove the inherited port profile named adam from the port profile named test:

```
switch# configure terminal
switch(config)# port-profile test
switch(config-ppm)# no inherit port-profile adam
switch(config-ppm)#
```

