



Interface and Hardware Component Configuration Guide for Cisco NCS 5500 Series Routers, IOS XR Release 6.0.x

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Preface

The *Interface and Hardware Component Configuration Guide for Cisco NCS 5500 Series Routers* provides information and procedures related to router interface and hardware configuration.

The preface contains the following sections:

- [Changes to This Document, on page v](#)
- [Obtaining Documentation and Submitting a Service Request, on page v](#)

Changes to This Document

This table lists the technical changes made to this document since it was first released.

Table 1: Changes to This Document

Date	Summary
April 2016	Initial release of this document.
July 2016	Republished with documentation updates for Cisco IOS XR Release 6.0.2 features.

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly *What's New in Cisco Product Documentation*, which also lists all new and revised Cisco technical documentation, at: <http://www.cisco.com/c/en/us/td/docs/general/whatsnew/whatsnew.html>

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CHAPTER 1

Preconfiguring Physical Interfaces

This module describes the preconfiguration of physical interfaces.

Preconfiguration is supported for these types of interfaces and controllers:

- 100-Gigabit Ethernet
- Management Ethernet

Preconfiguration allows you to configure line cards before they are inserted into the router. When the cards are inserted, they are instantly configured. The preconfiguration information is created in a different system database tree, rather than with the regularly configured interfaces. That database tree is known as the *preconfiguration directory* on the route processor.

There may be some preconfiguration data that cannot be verified unless the line card is present, because the verifiers themselves run only on the line card. Such preconfiguration data is verified when the line card is inserted and the verifiers are initiated. A configuration is rejected if errors are found when the configuration is copied from the preconfiguration area to the active area.



Note One Gigabit Ethernet interface is not supported. Only physical interfaces can be preconfigured.



Note From Cisco IOS XR Release 6.3.2, a six-seconds delay is introduced in error propagation from the driver to DPA for the MACSec line card and Oldcastle platforms. As a result, the BER algorithm on these platforms knows the error with a delay of 6 seconds.

- [Physical Interface Preconfiguration Overview, on page 2](#)
- [Prerequisites for Preconfiguring Physical Interfaces, on page 2](#)
- [Benefits of Interface Preconfiguration, on page 2](#)
- [How to Preconfigure Physical Interfaces, on page 3](#)
- [Information About Preconfiguring Physical Interfaces, on page 4](#)

Physical Interface Preconfiguration Overview

Preconfiguration is the process of configuring interfaces before they are present in the system. Preconfigured interfaces are not verified or applied until the actual interface with the matching location (rack/slot/module) is inserted into the router. When the anticipated line card is inserted and the interfaces are created, the precreated configuration information is verified and, if successful, immediately applied to the running configuration of the router.



Note When you plug the anticipated line card in, make sure to verify any preconfiguration with the appropriate **show** commands.

Use the **show run** command to see interfaces that are in the preconfigured state.



Note We recommend filling out preconfiguration information in your site planning guide, so that you can compare that anticipated configuration with the actual preconfigured interfaces when that card is installed and the interfaces are up.



Tip Tip Use the **commit best-effort** command to save the preconfiguration to the running configuration file. The **commit best-effort** command merges the target configuration with the running configuration and commits only valid configuration (best effort). Some configuration might fail due to semantic errors, but the valid configuration still comes up.

Prerequisites for Preconfiguring Physical Interfaces

Before preconfiguring physical interfaces, ensure that this condition is met:

- Preconfiguration drivers and files are installed. Although it may be possible to preconfigure physical interfaces without a preconfiguration driver installed, the preconfiguration files are required to set the interface definition file on the router that supplies the strings for valid interface names.

Benefits of Interface Preconfiguration

Preconfigurations reduce downtime when you add new cards to the system. With preconfiguration, the new line card can be instantly configured and actively running during line card bootup.

Another advantage of performing a preconfiguration is that during a card replacement, when the line card is removed, you can still see the previous configuration and make modifications.

How to Preconfigure Physical Interfaces

This task describes only the most basic preconfiguration of an interface.

SUMMARY STEPS

1. **configure**
2. **interface preconfigure** *type interface-path-id*
3. Use one of the following commands:
 - **ipv4 address** *ip-address subnet-mask*
 - **ipv4 address** *ip-address /prefix*
4. Configure additional interface parameters, as described in this manual in the configuration chapter that applies to the type of interface that you are configuring.
5. **end** or **commit** best-effort
6. **show running-config**

DETAILED STEPS

Step 1 **configure**

Example:

```
RP/0/RP0/CPU0:router#configure
```

Enters global configuration mode.

Step 2 **interface preconfigure** *type interface-path-id*

Example:

```
RP/0/RP0/CPU0:router(config)# interface preconfigure HundredGigE 0/3/0/2
```

Enters interface preconfiguration mode for an interface, where *type* specifies the supported interface type that you want to configure and *interface-path-id* specifies the location where the interface will be located in *rack/slot/module/port* notation.

Step 3 Use one of the following commands:

- **ipv4 address** *ip-address subnet-mask*
- **ipv4 address** *ip-address /prefix*

Example:

```
RP/0/RP0/CPU0:router(config-if-pre)# ipv4 address 192.168.1.2/31
```

Assigns an IP address and mask to the interface.

Step 4 Configure additional interface parameters, as described in this manual in the configuration chapter that applies to the type of interface that you are configuring.

Step 5 **end** or **commit** best-effort

Example:

```
RP/0/RP0/CPU0:router(config-if-pre)# end
```

or

```
RP/0/RP0/CPU0:router(config-if-pre)# commit
```

Saves configuration changes.

- When you issue the **end** command, the system prompts you to commit changes: `Uncommitted changes found, commit them before exiting (yes/no/cancel)?`
- Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.
- Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes.
- Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes.
- Use the **commit best-effort** command to save the configuration changes to the running configuration file and remain within the configuration session. The **commit best-effort** command merges the target configuration with the running configuration and commits only valid changes (best effort). Some configuration changes might fail due to semantic errors.

Step 6 show running-config**Example:**

```
RP/0/RP0/CPU0:router# show running-config
```

(Optional) Displays the configuration information currently running on the router.

Example

This example shows how to preconfigure a basic Ethernet interface:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface preconfigure HundredGigE 0/3/0/24
RP/0/RP0/CPU0:router(config-if)# ipv4 address 192.168.1.2/31
RP/0/RP0/CPU0:router(config-if-pre)# commit
```

Information About Preconfiguring Physical Interfaces

To preconfigure interfaces, you must understand these concepts:

Use of the Interface Preconfigure Command

Interfaces that are not yet present in the system can be preconfigured with the **interface preconfigure** command in global configuration mode.

The **interface preconfigure** command places the router in interface configuration mode. Users should be able to add any possible interface commands. The verifiers registered for the preconfigured interfaces verify the configuration. The preconfiguration is complete when the user enters the **end** command, or any matching exit or global configuration mode command.



Note It is possible that some configurations cannot be verified until the line card is inserted.

Do not enter the **no shutdown** command for new preconfigured interfaces, because the no form of this command removes the existing configuration, and there is no existing configuration.

Users are expected to provide names during preconfiguration that will match the name of the interface that will be created. If the interface names do not match, the preconfiguration cannot be applied when the interface is created. The interface names must begin with the interface type that is supported by the router and for which drivers have been installed. However, the slot, port, subinterface number, and channel interface number information cannot be validated.



Note Specifying an interface name that already exists and is configured (or an abbreviated name like Hu0/3/0/0) is not permitted.



CHAPTER 2

Advanced Configuration and Modification of the Management Ethernet Interface

This module describes the configuration of Management Ethernet interfaces.

Before you can use Telnet to access the router through the LAN IP address, you must set up a Management Ethernet interface and enable Telnet servers.



Note Although the Management Ethernet interfaces on the system are present by default, the user must configure these interfaces to use them for accessing the router, using protocols and applications such as Simple Network Management Protocol (SNMP), HTTP, extensible markup language (XML), TFTP, Telnet, and command-line interface (CLI).

- [Prerequisites for Configuring Management Ethernet Interfaces, on page 7](#)
- [How to Perform Advanced Management Ethernet Interface Configuration, on page 8](#)
- [Information About Configuring Management Ethernet Interfaces, on page 14](#)

Prerequisites for Configuring Management Ethernet Interfaces

Before performing the Management Ethernet interface configuration procedures that are described in this chapter, be sure that the following tasks and conditions are met:

- You have performed the initial configuration of the Management Ethernet interface.
- You know how to apply the generalized interface name specification *rack/slot/module/port*.



Note For transparent switchover, both active and standby Management Ethernet interfaces are expected to be physically connected to the same LAN or switch.

How to Perform Advanced Management Ethernet Interface Configuration

This section contains the following procedures:

Configuring a Management Ethernet Interface

Perform this task to configure a Management Ethernet interface. This procedure provides the minimal configuration required for the Management Ethernet interface.

SUMMARY STEPS

1. **configure**
2. **interface MgmtEth** *interface-path-id*
3. **ipv4 address** *ip-address mask*
4. **mtu** *bytes*
5. **no shutdown**
6. **end** or **commit**
7. **show interfaces MgmtEth** *interface-path-id*

DETAILED STEPS

Step 1 **configure****Example:**

```
RP/0/RP0/CPU0:router# configure
```

Enters global configuration mode.

Step 2 **interface MgmtEth** *interface-path-id***Example:**

```
RP/0/RP0/CPU0:router(config)# interface MgmtEth 0/RP0/CPU0/0
```

Enters interface configuration mode and specifies the Ethernet interface name and notation *rack/slot/module/port*.

The example indicates port 0 on the RP card that is installed in slot 0.

Step 3 **ipv4 address** *ip-address mask***Example:**

```
RP/0/RP0/CPU0:router(config-if)# ipv4 address 1.76.18.150/16 (or)  
ipv4 address 1.76.18.150 255.255.0.0
```

Assigns an IP address and subnet mask to the interface.

- Replace *ip-address* with the primary IPv4 address for the interface.

- Replace *mask* with the mask for the associated IP subnet. The network mask can be specified in either of two ways:
- The network mask can be a four-part dotted decimal address. For example, 255.255.0.0 indicates that each bit equal to 1 means that the corresponding address bit belongs to the network address.
- The network mask can be indicated as a slash (/) and number. For example, /16 indicates that the first 16 bits of the mask are ones, and the corresponding bits of the address are network address.

Step 4 `mtu bytes`**Example:**

```
RP/0/RP0/CPU0:router(config-if# mtu 1488
```

(Optional) Sets the maximum transmission unit (MTU) byte value for the interface. The default is 1514.

- The default is 1514 bytes.
- The range for the Management Ethernet interface Interface **mtu** values is 64 to 1514 bytes.

Step 5 `no shutdown`**Example:**

```
RP/0/RP0/CPU0:router(config-if)# no shutdown
```

Removes the shutdown configuration, which removes the forced administrative down on the interface, enabling it to move to an up or down state.

Step 6 `end` or `commit`**Example:**

```
RP/0/RP0/CPU0:router(config-if)# end
```

or

```
RP/0/RP0/CPU0:router(config-if)# commit
```

Saves configuration changes.

- When you issue the **end** command, the system prompts you to commit changes:

```
Uncommitted changes found, commit them before exiting(yes/no/cancel)?  
[cancel]:
```

- Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.
- Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes.
- Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes.
- Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.

Step 7 show interfaces MgmtEth *interface-path-id***Example:**

```
RP/0/RP0/CPU0:router# show interfaces MgmtEth 0/RP0/CPU0/0
```

(Optional) Displays statistics for interfaces on the router.

Example

This example displays advanced configuration and verification of the Management Ethernet interface on the RP:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface MgmtEth 0/RP0/CPU0/0
RP/0/RP0/CPU0:router(config)# ipv4 address 1.76.18.150/16
RP/0/RP0/CPU0:router(config-if)# no shutdown
RP/0/RP0/CPU0:router(config-if)# commit
RP/0/RP0/CPU0:router:Mar 26 01:09:28.685 :ifmgr[190]:%LINK-3-UPDOWN :Interface
MgmtEth0/RP0/CPU0/0, changed state to Up
RP/0/RP0/CPU0:router(config-if)# end

RP/0/RP0/CPU0:router# show interfaces MgmtEth 0/RP0/CPU0/0

MgmtEth0/RP0/CPU0/0 is up, line protocol is up
  Interface state transitions: 3
  Hardware is Management Ethernet, address is 1005.cad8.4354 (bia 1005.cad8.4354)
  Internet address is 1.76.18.150/16
  MTU 1488 bytes, BW 1000000 Kbit (Max: 1000000 Kbit)
    reliability 255/255, txload 0/255, rxload 0/255
  Encapsulation ARPA,
  Full-duplex, 1000Mb/s, 1000BASE-T, link type is autonegotiation
  loopback not set,
  Last link flapped 00:00:59
  ARP type ARPA, ARP timeout 04:00:00
  Last input 00:00:00, output 00:00:02
  Last clearing of "show interface" counters never
  5 minute input rate 4000 bits/sec, 3 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
    21826 packets input, 4987886 bytes, 0 total input drops
    0 drops for unrecognized upper-level protocol
    Received 12450 broadcast packets, 8800 multicast packets
      0 runts, 0 giants, 0 throttles, 0 parity
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
  1192 packets output, 217483 bytes, 0 total output drops
  Output 0 broadcast packets, 0 multicast packets
  0 output errors, 0 underruns, 0 applique, 0 resets
  0 output buffer failures, 0 output buffers swapped out
  3 carrier transitions

RP/0/RP0/CPU0:router# show running-config interface MgmtEth 0/RP0/CPU0/0

interface MgmtEth0/RP0/CPU0/0
  mtu 1488
  ipv4 address 1.76.18.150/16
  ipv6 address 2002::14c:125a/64
```



```
ipv6 enable
!
```

The following example displays VRF configuration and verification of the Management Ethernet interface on the RP with source address:

```
RP/0/RP0/CPU0:router# show run interface MgmtEth 0/RP0/CPU0/0
interface MgmtEth0/RP0/CPU0/0
 vrf httpupload
 ipv4 address 10.8.67.20 255.255.0.0
 ipv6 address 2001:10:8:67::20/48
!
```

```
RP/0/RP0/CPU0:router# show run http
Wed Jan 30 14:58:53.458 UTC
http client vrf httpupload
http client source-interface ipv4 MgmtEth0/RP0/CPU0/0
```

```
RP/0/RP0/CPU0:router# show run vrf
Wed Jan 30 14:59:00.014 UTC
vrf httpupload
!
```

IPv6 Stateless Address Auto Configuration on Management Interface

Perform this task to enable IPv6 stateless auto configuration on Management interface.

SUMMARY STEPS

1. **configure**
2. **interface MgmtEth** *interface-path-id*
3. **ipv6 address autoconfig**
4. **show ipv6 interfaces** *interface-path-id*

DETAILED STEPS

Step 1 **configure**

Example:

```
RP/0/RP0/CPU0:router# configure
Enters global configuration mode.
```

Step 2 **interface MgmtEth** *interface-path-id*

Example:

```
RP/0/RP0/CPU0:router(config)# interface MgmtEth 0/RP0/CPU0/0
Enters interface configuration mode and specifies the Ethernet interface name and notation rack/slot/module/port.
The example indicates port 0 on the RP card that is installed in slot 0.
```

Step 3 **ipv6 address autoconfig**

Example:

```
RP/0/RP0/CPU0:router(config-if)# ipv6 address autoconfig
```

Enable IPv6 stateless address auto configuration on the management port.

Step 4 **show ipv6 interfaces** *interface-path-id***Example:**

```
RP/0/RP0/CPU0:router# show ipv6 interfaces gigabitEthernet 0/2/0/0
```

(Optional) Displays statistics for interfaces on the router.

Example

This example displays :

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface MgmtEth 0/RP0/CPU0/0
RP/0/RP0/CPU0:router(config)# ipv6 address autoconfig
RP/0/RP0/CPU0:router# show ipv6 interfaces gigabitEthernet 0/2/0/0

Fri Nov 4 16:48:14.372 IST
GigabitEthernet0/2/0/0 is Up, ipv6 protocol is Up, Vrfid is default (0x60000000)
  IPv6 is enabled, link-local address is fe80::d1:1eff:fe2b:baf
  Global unicast address(es):
    5::d1:1eff:fe2b:baf [AUTO CONFIGURED], subnet is 5::/64 <<<<<< auto configured address

  Joined group address(es): ff02::1:ff2b:baf ff02::2 ff02::1
  MTU is 1514 (1500 is available to IPv6)
  ICMP redirects are disabled
  ICMP unreachable are enabled
  ND DAD is enabled, number of DAD attempts 1
  ND reachable time is 0 milliseconds
  ND cache entry limit is 1000000000
  ND advertised retransmit interval is 0 milliseconds
  Hosts use stateless autoconfig for addresses.
  Outgoing access list is not set
  Inbound common access list is not set, access list is not set
  Table Id is 0xe0800000
  Complete protocol adjacency: 0
  Complete glean adjacency: 0
  Incomplete protocol adjacency: 0
  Incomplete glean adjacency: 0
  Dropped protocol request: 0
  Dropped glean request: 0
```

Modifying the MAC Address for a Management Ethernet Interface

Perform this task to configure the MAC layer address of the Management Ethernet interfaces for the RPs.

SUMMARY STEPS**1. configure**

2. **interface MgmtEth** *interface-path-id*
3. **mac-address** *address*
4. **end** or **commit**

DETAILED STEPS

Step 1 **configure**

Example:

```
RP/0/RP0/CPU0:router# configure
```

Enters global configuration mode.

Step 2 **interface MgmtEth** *interface-path-id*

Example:

```
RP/0/RP0/CPU0:router(config)# interface MgmtEth 0/RP0/CPU0/0
```

Enters interface configuration mode and specifies the Management Ethernet interface name and instance.

Step 3 **mac-address** *address*

Example:

```
RP/0/RP0/CPU0:router(config-if)# mac-address 0001.2468.ABCD
```

Configures the MAC layer address of the Management Ethernet interface.

Note • To return the device to its default MAC address, use the **no mac-address** address command.

Step 4 **end** or **commit**

Example:

```
RP/0/RP0/CPU0:router(config-if)# end
```

or

```
RP/0/RP0/CPU0:router(config-if)# commit
```

Saves configuration changes.

- When you issue the **end** command, the system prompts you to commit changes:

```
Uncommitted changes found, commit them before exiting(yes/no/cancel)?  
[cancel]:
```

- Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.
- Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes.

- Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes.
 - Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.
-

Verifying Management Ethernet Interface Configuration

Perform this task to verify configuration modifications on the Management Ethernet interfaces.

SUMMARY STEPS

1. **show interfaces MgmtEth *interface-path-id***
2. **show running-config interface MgmtEth *interface-path-id***

DETAILED STEPS

Step 1 **show interfaces MgmtEth *interface-path-id***

Example:

```
RP/0/RP0/CPU0:router# show interfaces MgmtEth 0/RP0/CPU0/0
```

Displays the Management Ethernet interface configuration.

Step 2 **show running-config interface MgmtEth *interface-path-id***

Example:

```
RP/0/RP0/CPU0:router# show running-config interface MgmtEth 0/RP0/CPU0/0
```

Displays the running configuration.

Information About Configuring Management Ethernet Interfaces

To configure Management Ethernet interfaces, you must understand the following concept:



CHAPTER 3

Configuring Ethernet Interfaces

This module describes the configuration of Ethernet interfaces.

The following distributed ethernet architecture delivers network scalability and performance, while enabling service providers to offer high-density, high-bandwidth networking solutions.

- 10-Gigabit
- 40-Gigabit
- 100-Gigabit

These solutions are designed to interconnect the router with other systems in POPs, including core and edge routers and Layer 2 and Layer 3 switches.

Restrictions

Router does not support configuration of the static mac address.

- [Configuring Gigabit Ethernet Interfaces, on page 15](#)
- [Information About Configuring Ethernet, on page 19](#)

Configuring Gigabit Ethernet Interfaces

Use this procedure to create a basic Ethernet interface configuration.

SUMMARY STEPS

1. **show version**
2. **show interfaces** [**GigE TenGigE HundredGigE**] *interface-path-id*
3. **configure**
4. **interface** [**GigE TenGigE HundredGigE**] *interface-path-id*
5. **ipv4 address** *ip-address mask*
6. **mtu** *bytes*
7. **no shutdown**
8. **end** or **commit**
9. **show interfaces** [**GigE TenGigE HundredGigE**] *interface-path-id*

DETAILED STEPS

Step 1 **show version**

Example:

```
RP/0/RP0/CPU0:router# show version
```

(Optional) Displays the current software version, and can also be used to confirm that the router recognizes the line card.

Step 2 **show interfaces [GigE TenGigE HundredGigE] interface-path-id**

Example:

```
RP/0/RP0/CPU0:router# show interface HundredGigE 0/1/0/1
```

(Optional) Displays the configured interface and checks the status of each interface port.

Step 3 **configure**

Example:

```
RP/0/RP0/CPU0:router# configure terminal
```

Enters global configuration mode.

Step 4 **interface [GigE TenGigE HundredGigE] interface-path-id**

Example:

```
RP/0/RP0/CPU0:router(config)# interface HundredGigE 0/1/0/1
```

Enters interface configuration mode and specifies the Ethernet interface name and notation *rack/slot/module/port*. Possible interface types for this procedure are:

- GigE
- 10GigE
- 100GigE

Note • The example indicates a 100-Gigabit Ethernet interface in the line card in slot 1.

Step 5 **ipv4 address ip-address mask**

Example:

```
RP/0/RP0/CPU0:router(config-if)# ipv4 address 172.18.189.38 255.255.255.224
```

Assigns an IP address and subnet mask to the interface.

- Replace *ip-address* with the primary IPv4 address for the interface.
- Replace *mask* with the mask for the associated IP subnet. The network mask can be specified in either of two ways:
 - The network mask can be a four-part dotted decimal address. For example, 255.0.0.0 indicates that each bit equal to 1 means that the corresponding address bit belongs to the network address.

- The network mask can be indicated as a slash (/) and number. For example, /8 indicates that the first 8 bits of the mask are ones, and the corresponding bits of the address are network address.

Step 6 *mtu bytes***Example:**

```
RP/0/RP0/CPU0:router(config-if)# mtu 1448
```

(Optional) Sets the MTU value for the interface.

- The default is 1514 bytes for normal frames and 1518 bytes for 802.1Q tagged frames.
- The range for 100-Gigabit Ethernet mtu values is 64 bytes to 65535 bytes.

Step 7 *no shutdown***Example:**

```
RP/0/RP0/CPU0:router(config-if)# no shutdown
```

Removes the shutdown configuration, which forces an interface administratively down.

Step 8 *end or commit***Example:**

```
RP/0/RP0/CPU0:router(config-if)# end
```

or

```
RP/0/RP0/CPU0:router(config-if)# commit
```

Saves configuration changes.

- When you issue the **end** command, the system prompts you to commit changes:

```
Uncommitted changes found, commit them before exiting(yes/no/cancel)?  
[cancel]:
```

- Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.
- Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes.
- Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes.
- Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.

Step 9 *show interfaces [GigE TenGigE HundredGigE] interface-path-id***Example:**

```
RP/0/RP0/CPU0:router# show interfaces HundredGigE 0/1/0/1
```

(Optional) Displays statistics for interfaces on the router.

Example

This example shows how to configure an interface for a 100-Gigabit Ethernet line card:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface HundredGigE 0/1/0/1
RP/0/RP0/CPU0:router(config-if)# ipv4 address 172.18.189.38 255.255.255.224

RP/0/RP0/CPU0:router(config-if)# mtu 1448

RP/0/RP0/CPU0:router(config-if)# no shutdown
RP/0/RP0/CPU0:router(config-if)# end
Uncommitted changes found, commit them? [yes]: yes
```

```
RP/0/RP0/CPU0:router# show interfaces HundredGigE 0/5/0/24
HundredGigE0/5/0/24 is up, line protocol is up
  Interface state transitions: 1
  Hardware is HundredGigE, address is 6219.8864.e330 (bia 6219.8864.e330)
  Internet address is 3.24.1.1/24
  MTU 9216 bytes, BW 100000000 Kbit (Max: 100000000 Kbit)
    reliability 255/255, txload 3/255, rxload 3/255
  Encapsulation ARPA,
  Full-duplex, 100000Mb/s, link type is force-up
  output flow control is off, input flow control is off
  Carrier delay (up) is 10 msec
  loopback not set,
  Last link flapped 10:05:07
  ARP type ARPA, ARP timeout 04:00:00
  Last input 00:08:56, output 00:00:00
  Last clearing of "show interface" counters never
  5 minute input rate 1258567000 bits/sec, 1484160 packets/sec
  5 minute output rate 1258584000 bits/sec, 1484160 packets/sec
    228290765840 packets input, 27293508436038 bytes, 0 total input drops
    0 drops for unrecognized upper-level protocol
    Received 15 broadcast packets, 45 multicast packets
      0 runts, 0 giants, 0 throttles, 0 parity
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
  212467849449 packets output, 25733664696650 bytes, 0 total output drops
  Output 23 broadcast packets, 15732 multicast packets
  39 output errors, 0 underruns, 0 applique, 0 resets
  0 output buffer failures, 0 output buffers swapped out
  0 carrier transitions
```

```
RP/0/RP0/CPU0:router# show running-config interface HundredGigE 0/5/0/24

interface HundredGigE 0/5/0/24
  mtu 9216
  service-policy input linerate
  service-policy output elinerate
  ipv4 address 3.24.1.1 255.255.255.0
  ipv6 address 3:24:1::1/64
  flow ipv4 monitor perfv4 sampler fsm ingress
!
```


Information About Configuring Ethernet

This section provides the following information sections:

Default Configuration Values for 100-Gigabit Ethernet

This table describes the default interface configuration parameters that are present when an interface is enabled on a 100-Gigabit Ethernet line card.



Note You must use the **shutdown** command to bring an interface administratively down. The interface default is **no shutdown**. When a line card is first inserted into the router, if there is no established preconfiguration for it, the configuration manager adds a shutdown item to its configuration. This shutdown can be removed only by entering the **no shutdown** command.

Table 2: 100-Gigabit Ethernet Line Card Default Configuration Values

Parameter	Configuration File Entry	Default Value
MTU	mtu	<ul style="list-style-type: none"> • 1514 bytes for normal frames • 1518 bytes for 802.1Q tagged frames. • 1522 bytes for Q-in-Q frames.
MAC address	mac address	Hardware burned-in address (BIA)

Ethernet MTU

The Ethernet maximum transmission unit (MTU) is the size of the largest frame, minus the 4-byte frame check sequence (FCS), that can be transmitted on the Ethernet network. Every physical network along the destination of a packet can have a different MTU.

Cisco IOS XR software supports two types of frame forwarding processes:

- Fragmentation for IPV4 packets—In this process, IPV4 packets are fragmented as necessary to fit within the MTU of the next-hop physical network.



Note IPv6 does not support fragmentation.

- MTU discovery process determines largest packet size—This process is available for all IPV6 devices, and for originating IPV4 devices. In this process, the originating IP device determines the size of the largest IPV6 or IPV4 packet that can be sent without being fragmented. The largest packet is equal to the smallest MTU of any network between the IP source and the IP destination devices. If a packet is larger

than the smallest MTU of all the networks in its path, that packet will be fragmented as necessary. This process ensures that the originating device does not send an IP packet that is too large.

Jumbo frame support is automatically enable for frames that exceed the standard frame size. The default value is 1514 for standard frames and 1518 for 802.1Q tagged frames. These numbers exclude the 4-byte frame check sequence (FCS).



CHAPTER 4

Configuring Link Bundling

The Link Bundling feature allows you to group multiple point-to-point links together into one logical link and provide higher bidirectional bandwidth, redundancy, and load balancing between two routers. A virtual interface is assigned to the bundled link. The component links can be dynamically added and deleted from the virtual interface.

The virtual interface is treated as a single interface on which one can configure an IP address and other software features used by the link bundle. Packets sent to the link bundle are forwarded to one of the links in the bundle.

A link bundle is simply a group of ports that are bundled together and act as a single link. The advantages of link bundles are as follows:

- Multiple links can span several line cards to form a single interface. Thus, the failure of a single link does not cause a loss of connectivity.
- Bundled interfaces increase bandwidth availability, because traffic is forwarded over all available members of the bundle. Therefore, traffic can flow on the available links if one of the links within a bundle fails. Bandwidth can be added without interrupting packet flow.

All the individual links within a single bundle must be of the same type and the same speed.

Cisco IOS XR software supports the following method of forming bundles of Ethernet interfaces:

- IEEE 802.3ad—Standard technology that employs a Link Aggregation Control Protocol (LACP) to ensure that all the member links in a bundle are compatible. Links that are incompatible or have failed are automatically removed from a bundle.
- [Limitations and Compatible Characteristics of Ethernet Link Bundles, on page 22](#)
- [Configuring Ethernet Link Bundles, on page 23](#)
- [Configuring EFP Load Balancing on an Ethernet Link Bundle, on page 27](#)
- [VLANs on an Ethernet Link Bundle, on page 29](#)
- [Configuring VLAN over Bundles, on page 30](#)
- [LACP Short Period Time Intervals, on page 34](#)
- [Configuring the Default LACP Short Period Time Interval, on page 35](#)
- [Configuring Custom LACP Short Period Time Intervals, on page 37](#)
- [Configuring VPWS Cross-Connects in MC-LAG, on page 42](#)
- [Configuring VPLS in MC-LAG, on page 45](#)
- [Information About Configuring Link Bundling, on page 47](#)

Limitations and Compatible Characteristics of Ethernet Link Bundles

This list describes the properties and limitations of ethernet link bundles:

- The router supports mixed speed bundles. Mixed speed bundles allow member links of different bandwidth to be configured as active members in a single bundle. The ratio of the bandwidth for bundle members must not exceed 10. Also, the total weight of the bundle must not exceed 64. For example, 100Gbps link and 10Gbps links can be active members in a bundle and load-balancing on member links is based on bandwidth weightage.
- The weight of each bundle member is the ratio of its bandwidth to the lowest bandwidth member. Total weight of the bundle is the sum of weights or relative bandwidth of each bundle member. Since the weight for a bundle member is greater than or equal to 1 and less than or equal to 10, the total member of links in a bundle is less than 64 in mixed bundle case.
- Any type of Ethernet interfaces can be bundled, with or without the use of LACP (Link Aggregation Control Protocol).
- A single router can support a maximum of 63 bundle interfaces. Link bundles of only physical interfaces are supported.
- Physical layer and link layer configuration are performed on individual member links of a bundle.
- Configuration of network layer protocols and higher layer applications is performed on the bundle itself.
- IPv4 and IPv6 addressing is supported on ethernet link bundles.
- A bundle can be administratively enabled or disabled.
- Each individual link within a bundle can be administratively enabled or disabled.
- Ethernet link bundles are created in the same way as Ethernet channels, where the user enters the same configuration on both end systems.
- The MAC address that is set on the bundle becomes the MAC address of the links within that bundle.
- Load balancing (the distribution of data between member links) is done by flow instead of by packet. Data is distributed to a link in proportion to the bandwidth of the link in relation to its bundle.
- QoS is supported and is applied proportionally on each bundle member.
- All links within a single bundle must terminate on the same two systems.
- Bundled interfaces are point-to-point.
- A link must be in the up state before it can be in distributing state in a bundle.
- Only physical links can be bundle members.
- Multicast traffic is load balanced over the members of a bundle. For a given flow, internal processes select the member link and all traffic for that flow is sent over that member.

Configuring Ethernet Link Bundles

This section describes how to configure an Ethernet link bundle.



Note In order for an Ethernet bundle to be active, you must perform the same configuration on both connection endpoints of the bundle.

SUMMARY STEPS

1. **configure**
2. **interface Bundle-Ether** *bundle-id*
3. **ipv4 address** *ipv4-address mask*
4. **bundle minimum-active bandwidth** *kbps*
5. **bundle minimum-active links** *links*
6. **bundle maximum-active links** *links* [**hot-standby**]
7. **exit**
8. **interface HundredGigE** *interface-path-id*
9. **bundle id** *bundle-id* [**mode** {**active** | **on** | **passive**}]
10. **bundle port-priority** *priority*
11. **no shutdown**
12. **exit**
13. **bundle id** *bundle-id* [**mode** {**active** | **passive** | **on**}] **no shutdown exit**
14. **end** or **commit**
15. **exit**
16. **exit**
17. Perform Step 1 through Step 15 on the remote end of the connection.
18. **show bundle Bundle-Ether** *bundle-id*
19. **show lacp Bundle-Ether** *bundle-id*

DETAILED STEPS

Step 1 **configure**

Example:

```
RP/0/RP0/CPU0:router# configure
Enters global configuration mode.
```

Step 2 **interface Bundle-Ether** *bundle-id*

Example:

```
RP/0/RP0/CPU0:router(config)# interface Bundle-Ether 3
Creates a new Ethernet link bundle with the specified bundle-id. The range is 1 to 65535.
```

This **interface Bundle-Ether** command enters you into the interface configuration submode, where you can enter interface specific configuration commands are entered. Use the **exit** command to exit from the interface configuration submode back to the normal global configuration mode.

Step 3 **ipv4 address** *ipv4-address mask*

Example:

```
RP/0/RP0/CPU0:router(config-if)# ipv4 address 10.1.2.3 255.0.0.0
```

Assigns an IP address and subnet mask to the virtual interface using the **ipv4 address** configuration subcommand.

Note • Only a Layer 3 bundle interface requires an IP address.

Step 4 **bundle minimum-active bandwidth** *kbps*

Example:

```
RP/0/RP0/CPU0:router(config-if)# bundle minimum-active bandwidth 580000
```

(Optional) Sets the minimum amount of bandwidth required before a user can bring up a bundle.

Step 5 **bundle minimum-active links** *links*

Example:

```
RP/0/RP0/CPU0:router(config-if)# bundle minimum-active links 2
```

(Optional) Sets the number of active links required before you can bring up a specific bundle.

Step 6 **bundle maximum-active links** *links [hot-standby]*

Example:

```
RP/0/RP0/CPU0:router(config-if)# bundle maximum-active links 1 hot-standby
```

(Optional) Implements 1:1 link protection for the bundle, which causes the highest-priority link in the bundle to become active and the second-highest-priority link to become the standby. Also, specifies that a switchover between active and standby LACP-enabled links is implemented per a proprietary optimization.

Note • The priority of the active and standby links is based on the value of the **bundle port-priority** command.

Step 7 **exit**

Example:

```
RP/0/RP0/CPU0:router(config-if)# exit
```

Exits interface configuration submode for the Ethernet link bundle.

Step 8 **interface HundredGigE** *interface-path-id*

Example:

```
RP/0/RP0/CPU0:router(config)# interface HundredGigE 0/1/0/1
```

Enters interface configuration mode for the specified interface.

Enter the **HundredGigE** keyword to specify the interface type. Replace the *interface-path-id* argument with the node-id in the *rack/slot/module* format.

Step 9 **bundle id** *bundle-id* [**mode** {**active** | **on** | **passive**}]

Example:

```
RP/0/RP0/CPU0:router(config-if)# bundle-id 3
```

Adds the link to the specified bundle.

To enable active or passive LACP on the bundle, include the optional **mode active** or **mode passive** keywords in the command string.

To add the link to the bundle without LACP support, include the optional **mode on** keywords with the command string.

Note • If you do not specify the **mode** keyword, the default mode is **on** (LACP is not run over the port).

Step 10 **bundle port-priority** *priority*

Example:

```
RP/0/RP0/CPU0:router(config-if)# bundle port-priority 1
```

(Optional) If you set the **bundle maximum-active links** command to 1, you must also set the priority of the active link to the highest priority (lowest value) and the standby link to the second-highest priority (next lowest value). For example, you can set the priority of the active link to 1 and the standby link to 2.

Step 11 **no shutdown**

Example:

```
RP/0/RP0/CPU0:router(config-if)# no shutdown
```

(Optional) If a link is in the down state, bring it up. The **no shutdown** command returns the link to an up or down state depending on the configuration and state of the link.

Step 12 **exit**

Example:

```
RP/0/RP0/CPU0:router(config-if)# exit
```

Exits interface configuration submode for the Ethernet interface.

Step 13 **bundle id** *bundle-id* [**mode** {**active** | **passive** | **on**}] **no shutdown exit**

Example:

```
RP/0/RP0/CPU0:router(config)# interface TenGigE 0/1/0/1
```

```
RP/0/RP0/CPU0:router(config-if)# bundle id 3
```

```
RP/0/RP0/CPU0:router(config-if)# bundle port-priority 2
```

```
RP/0/RP0/CPU0:router(config-if)# no shutdown
```

```
RP/0/RP0/CPU0:router(config-if)# exit
```

```
RP/0/RP0/CPU0:router(config)# interface TenGigE 0/1/0/1
RP/0/RP0/CPU0:router(config-if)# bundle id 3
RP/0/RP0/CPU0:router(config-if)# no shutdown
RP/0/RP0/CPU0:router(config-if)# exit
```

(Optional) Repeat Step 8 through Step 11 to add more links to the bundle.

Step 14 **end** or **commit**

Example:

```
RP/0/RP0/CPU0:router(config-if)# end
or
RP/0/RP0/CPU0:router(config-if)# commit
```

Saves configuration changes.

- When you issue the **end** command, the system prompts you to commit changes:

```
Uncommitted changes found, commit them before exiting(yes/no/cancel)?
[cancel]:
```

- Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.
- Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes.
- Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes.
- Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.

Step 15 **exit**

Example:

```
RP/0/RP0/CPU0:router(config-if)# exit
```

Exits interface configuration mode.

Step 16 **exit**

Example:

```
RP/0/RP0/CPU0:router(config)# exit
```

Exits global configuration mode.

Step 17 Perform Step 1 through Step 15 on the remote end of the connection.

Brings up the other end of the link bundle.

Step 18 **show bundle Bundle-Ether *bundle-id***

Example:

```
RP/0/RP0/CPU0:router# show bundle Bundle-Ether 3
```

(Optional) Shows information about the specified Ethernet link bundle.

Step 19 **show lacp Bundle-Ether *bundle-id*****Example:**

```
RP/0/RP0/CPU0:router# show lacp Bundle-Ether 3
```

(Optional) Shows detailed information about LACP ports and their peers.

Configuring EFP Load Balancing on an Ethernet Link Bundle

This section describes how to configure Ethernet flow point (EFP) Load Balancing on an Ethernet link bundle.

By default, Ethernet flow point (EFP) load balancing is enabled. However, the user can choose to configure all egressing traffic on the fixed members of a bundle to flow through the same physical member link. This configuration is available only on an Ethernet Bundle subinterface with Layer 2 transport (**l2transport**) enabled.



Note If the active members of the bundle change, the traffic for the bundle may get mapped to a different physical link that has a hash value that matches the configured value.

SUMMARY STEPS

1. **configure**
2. **hw-module load-balance bundle l2-service l3-params**
3. **interface Bundle-Ether *bundle-id* l2transport**
4. **bundle load-balance hash *hash-value* [auto]**
5. **end** or **commit**

DETAILED STEPS

Step 1 **configure****Example:**

```
RP/0/RP0/CPU0:router# configure
```

Enters global configuration mode.

Step 2 **hw-module load-balance bundle l2-service l3-params****Example:**

```
RP/0/RP0/CPU0:router(config)# hw-module load-balance bundle l2-service l3-params
```

(Optional) Enables Layer 3 load balancing on Layer 2 link bundles.

Step 3 **interface Bundle-Ether *bundle-id* l2transport**

Example:

```
RP/0/RP0/CPU0:router#(config)# interface Bundle-Ether 3 l2transport
```

Creates a new Ethernet link bundle with the specified *bundle-id* and with Layer 2 transport enabled.

The range is 1 to 65535.

Step 4 **bundle load-balance hash *hash-value* [auto]**

Example:

```
RP/0/RP0/CPU0:router(config-subif)# bundle load-balancing hash 1
```

or

```
RP/0/RP0/CPU0:router(config-subif)# bundle load-balancing hash auto
```

Configures all egressing traffic on the fixed members of a bundle to flow through the same physical member link.

- *hash-value*—Numeric value that specifies the physical member link through which all egressing traffic in this bundle will flow. The values are 1 through 8.
- **auto**—The physical member link through which all egressing traffic on this bundle will flow is automatically chosen.

Step 5 **end or commit**

Example:

```
RP/0/RP0/CPU0:router(config-if)# end
```

or

```
RP/0/RP0/CPU0:router(config-if)# commit
```

Saves configuration changes.

- When you issue the **end** command, the system prompts you to commit changes: `Uncommitted changes found, commit them before exiting (yes/no/cancel)?`
- Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.
- Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes.
- Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes.
- Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.

Example

This example shows how to configure all egress traffic on the fixed members of a bundle to flow through the same physical member link automatically.

```
RP/0/RP0/CPU0:router# configuration terminal
RP/0/RP0/CPU0:router(config)# interface bundle-ether 1.1 l2transport
RP/0/RP0/CPU0:router(config-subif)#bundle load-balancing hash auto
RP/0/RP0/CPU0:router(config-subif)#
```

This example shows how to configure all egress traffic on the fixed members of a bundle to flow through a specified physical member link.

```
RP/0/RP0/CPU0:router# configuration terminal
RP/0/RP0/CPU0:router(config)# interface bundle-ether 1.1 l2transport
RP/0/RP0/CPU0:router(config-subif)#bundle load-balancing hash 1
RP/0/RP0/CPU0:router(config-subif)#
```

VLANs on an Ethernet Link Bundle

802.1Q VLAN subinterfaces can be configured on 802.3ad Ethernet link bundles. Keep the following information in mind when adding VLANs on an Ethernet link bundle:

- There is no separate limit defined for Layer 3 sub-interfaces on a bundle. However, an overall system limit of 4000 is applicable for NCS5001 and NCS5002, while a limit of 2000 is applicable for NCS5011.



Note The memory requirement for bundle VLANs is slightly higher than standard physical interfaces.

To create a VLAN subinterface on a bundle, include the VLAN subinterface instance with the **interface Bundle-Ether** command, as follows:

```
interface Bundle-Ether interface-bundle-id.subinterface
```

After you create a VLAN on an Ethernet link bundle, all VLAN subinterface configuration is supported on that link bundle.

VLAN subinterfaces can support multiple Layer 2 frame types and services, such as Ethernet Flow Points - EFPs) and Layer 3 services.

Layer 2 EFPs are configured as follows:

```
interface bundle-ether instance.subinterface l2transport. encapsulation dot1q xxxxx
```

Layer 3 VLAN subinterfaces are configured as follows:

```
interface bundle-ether instance.subinterface, encapsulation dot1q xxxxx
```



Note The difference between the Layer 2 and Layer 3 interfaces is the **l2transport** keyword. Both types of interfaces use **dot1q encapsulation**.

Configuring VLAN over Bundles

This section describes how to configure a VLAN bundle. The creation of a VLAN bundle involves three main tasks:

SUMMARY STEPS

1. Create an Ethernet bundle.
2. Create VLAN subinterfaces and assign them to the Ethernet bundle.
3. Assign Ethernet links to the Ethernet bundle.

DETAILED STEPS

-
- | | |
|---------------|---|
| Step 1 | Create an Ethernet bundle. |
| Step 2 | Create VLAN subinterfaces and assign them to the Ethernet bundle. |
| Step 3 | Assign Ethernet links to the Ethernet bundle. |
-

These tasks are describe in detail in the procedure that follows.



Note In order for a VLAN bundle to be active, you must perform the same configuration on both ends of the bundle connection.

SUMMARY STEPS

1. **configure**
2. **interface Bundle-Ether** *bundle-id*
3. **ipv4 address** *ipv4-address mask*
4. **bundle minimum-active bandwidth** *kbps*
5. **bundle minimum-active links** *links*
6. **bundle maximum-active links** *links* [**hot-standby**]
7. **exit**
8. **interface Bundle-Ether** *bundle-id.vlan-id*
9. **encapsulation dot1qvlan-id**
10. **ipv4 address** *ipv4-address mask*
11. **no shutdown**
12. **exit**
13. Repeat Step 9 through Step 12 to add more VLANs to the bundle you created in Step 2.

14. **end** or **commit**
15. **exit**
16. **exit**
17. **configure**
18. **interface** {**TenGigE** | **FortyGigE** | **HundredGigE**} *interface-path-id*

DETAILED STEPS

Step 1 **configure**

Example:

```
RP/0/RP0/CPU0:router# configure
```

Enters global configuration mode.

Step 2 **interface Bundle-Ether** *bundle-id*

Example:

```
RP/0/RP0/CPU0:router#(config)# interface Bundle-Ether 3
```

Creates and names a new Ethernet link bundle.

This **interface Bundle-Ether** command enters you into the interface configuration submenu, where you can enter interface-specific configuration commands. Use the **exit** command to exit from the interface configuration submenu back to the normal global configuration mode.

Step 3 **ipv4 address** *ipv4-address mask*

Example:

```
RP/0/RP0/CPU0:router(config-if)# ipv4 address 10.1.2.3 255.0.0.0
```

Assigns an IP address and subnet mask to the virtual interface using the **ipv4 address** configuration subcommand.

Step 4 **bundle minimum-active bandwidth** *kbps*

Example:

```
RP/0/RP0/CPU0:router(config-if)# bundle minimum-active bandwidth 580000
```

(Optional) Sets the minimum amount of bandwidth required before a user can bring up a bundle.

Step 5 **bundle minimum-active links** *links*

Example:

```
RP/0/RP0/CPU0:router(config-if)# bundle minimum-active links 2
```

(Optional) Sets the number of active links required before you can bring up a specific bundle.

Step 6 **bundle maximum-active links** *links* [**hot-standby**]

Example:

```
RP/0/RP0/CPU0:router(config-if)# bundle maximum-active links 1 hot-standby
```

(Optional) Implements 1:1 link protection for the bundle, which causes the highest-priority link in the bundle to become active and the second-highest-priority link to become the standby. Also, specifies that a switchover between active and standby LACP-enabled links is implemented per a proprietary optimization.

Note The priority of the active and standby links is based on the value of the **bundle port-priority** command.

Step 7 **exit**

Example:

```
RP/0/RP0/CPU0:router(config-if)# exit
```

Exits the interface configuration submode.

Step 8 **interface Bundle-Ether** *bundle-id.vlan-id*

Example:

```
RP/0/RP0/CPU0:router#(config)# interface Bundle-Ether 3.1
```

Creates a new VLAN, and assigns the VLAN to the Ethernet bundle you created in Step 2.

Replace the *bundle-id* argument with the *bundle-id* you created in Step 2.

Replace the *vlan-id* with a subinterface identifier.

Range is from 1 to 4094 inclusive (0 and 4095 are reserved).

Note When you include the *.vlan-id* argument with the **interface Bundle-Ether** *bundle-id* command, you enter subinterface configuration mode.

Step 9 **encapsulation dot1q***vlan-id*

Example:

```
RP/0/RP0/CPU0:router(config-subif)# encapsulation dot1q 100
```

Sets the Layer 2 encapsulation of an interface.

Step 10 **ipv4 address** *ipv4-address mask*

Example:

```
RP/0/RP0/CPU0:router#(config-subif)# ipv4 address 10.1.2.3/24
```

Assigns an IP address and subnet mask to the subinterface.

Step 11 **no shutdown**

Example:

```
RP/0/RP0/CPU0:router#(config-subif)# no shutdown
```

(Optional) If a link is in the down state, bring it up. The **no shutdown** command returns the link to an up or down state depending on the configuration and state of the link.

Step 12 **exit**

Example:

```
RP/0/RP0/CPU0:router(config-subif)# exit
```

Exits subinterface configuration mode for the VLAN subinterface.

- Step 13** Repeat Step 9 through Step 12 to add more VLANs to the bundle you created in Step 2.
(Optional) Adds more subinterfaces to the bundle.

Step 14 **end** or **commit**

Example:

```
RP/0/RP0/CPU0:router(config-subif)# end
```

or

```
RP/0/RP0/CPU0:router(config-subif)# commit
```

Saves configuration changes.

- When you issue the **end** command, the system prompts you to commit changes:

```
Uncommitted changes found, commit them before
exiting(yes/no/cancel)?
[cancel]:
```

- Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.

- Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes.

- Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes.

- Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.

Step 15 **exit**

Example:

```
RP/0/RP0/CPU0:router(config-subif)# end
```

Exits interface configuration mode.

Step 16 **exit**

Example:

```
RP/0/RP0/CPU0:router(config)# exit
```

Exits global configuration mode.

Step 17 **configure**

Example:

```
RP/0/RP0/CPU0:router # configure
```

Enters global configuration mode.

Step 18 `interface {TenGigE | FortyGigE | HundredGigE} interface-path-id`

Example:

```
RP/0/RP0/CPU0:router(config)# interface TenGigE 1/0/0/0
```

Enters interface configuration mode for the Ethernet interface you want to add to the Bundle.

Enter the **GigabitEthernet** or **TenGigE** keyword to specify the interface type. Replace the *interface-path-id* argument with the node-id in the rack/slot/module format.

Note A VLAN bundle is not active until you add an Ethernet interface on both ends of the link bundle.

LACP Short Period Time Intervals

As packets are exchanged across member links of a bundled interface, some member links may slow down or time-out and fail. LACP packets are exchanged periodically across these links to verify the stability and reliability of the links over which they pass. The configuration of short period time intervals, in which LACP packets are sent, enables faster detection and recovery from link failures.

Short period time intervals are configured as follows:

- In milliseconds
- In increments of 100 milliseconds
- In the range 100 to 1000 milliseconds
- The default is 1000 milliseconds (1 second)
- Up to 64 member links
- Up to 1280 packets per second (pps)

After 6 missed packets, the link is detached from the bundle.

When the short period time interval is *not* configured, LACP packets are transmitted over a member link every 30 seconds by default.

When the short period time interval is configured, LACP packets are transmitted over a member link once every 1000 milliseconds (1 second) by default. Optionally, both the transmit and receive intervals can be configured to less than 1000 milliseconds, independently or together, in increments of 100 milliseconds (100, 200, 300, and so on).

When you configure a custom LACP short period *transmit* interval at one end of a link, you must configure the same time period for the *receive* interval at the other end of the link.



Note You must always configure the *transmit* interval at both ends of the connection before you configure the *receive* interval at either end of the connection. Failure to configure the *transmit* interval at both ends first results in route flapping (a route going up and down continuously). When you remove a custom LACP short period, you must do it in reverse order. You must remove the *receive* intervals first and then the *transmit* intervals.

Configuring the Default LACP Short Period Time Interval

This section describes how to configure the default short period time interval for sending and receiving LACP packets on a Gigabit Ethernet interface. This procedure also enables the LACP short period.

SUMMARY STEPS

1. **configure**
2. **interface HundredGigE***interface-path*
3. **bundle id** *number* **mode active**
4. **lacp period short**
5. **end** or **commit**

DETAILED STEPS

Step 1 **configure**

Example:

```
RP/0/RP0/CPU0:router# configure
```

Enters global configuration mode.

Step 2 **interface HundredGigE***interface-path*

Example:

```
RP/0/RP0/CPU0:router(config)# interface HundredGigE 0/1/0/1
```

Creates a Gigabit Ethernet interface and enters interface configuration mode.

Step 3 **bundle id** *number* **mode active**

Example:

```
RP/0/RP0/CPU0:router(config-if)# bundle id 1 mode active
```

Specifies the bundle interface and puts the member interface in active mode.

Step 4 **lacp period short**

Example:

```
RP/0/RP0/CPU0:router(config-if)# lacp period short
```

Configures a short period time interval for the sending and receiving of LACP packets, using the default time period of 1000 milliseconds or 1 second.

Step 5 **end** or **commit**

Example:

```
RP/0/RP0/CPU0:router(config-if)# end
```

or

```
RP/0/RP0/CPU0:router(config-if)# commit
```

Saves configuration changes.

- When you issue the **end** command, the system prompts you to commit changes:

```
Uncommitted changes found, commit them before
exiting(yes/no/cancel)?
[cancel]:
```

- Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.

- Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes.

- Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes.

- Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.

Example

This example shows how to configure the LACP short period time interval to the default time of 1000 milliseconds (1 second):

```
config
interface HundredGigE 0/1/0/1
  bundle id 1 mode active
  lacp period short
  commit
```

The following example shows how to configure custom LACP short period transmit and receive intervals to *less than* the default of 1000 milliseconds (1 second):

```
config
interface HundredGigE 0/1/0/1
  bundle id 1 mode active
  lacp period short
  commit
```

```
config
```

```
interface HundredGigE 0/1/0/1
  lacp period short transmit 100
  commit

config
interface HundredGigE 0/1/0/1
  lacp period short receive 100
  commit
```

Configuring Custom LACP Short Period Time Intervals

This section describes how to configure custom short period time intervals (less than 1000 milliseconds) for sending and receiving LACP packets on a Gigabit Ethernet interface.



Note You must always configure the *transmit* interval at both ends of the connection before you configure the *receive* interval at either end of the connection. Failure to configure the *transmit* interval at both ends first results in route flapping (a route going up and down continuously). When you remove a custom LACP short period, you must do it in reverse order. You must remove the *receive* intervals first and then the *transmit* intervals.

SUMMARY STEPS

1. **configure**
2. **interface Bundle-Ether** *bundle-id*
3. **ipv4 address** *ipv4-address mask*
4. **bundle minimum-active bandwidth** *kbps*
5. **bundle minimum-active links** *links*
6. **bundle maximum-active links** *links*
7. **exit**
8. **interface Bundle-Ether** *bundle-id.vlan-id*
9. **dot1q vlan** *vlan-id*
10. **ipv4 address** *ipv4-address mask*
11. **no shutdown**
12. **exit**
13. Repeat Step 7 through Step 12 to add more VLANs to the bundle you created in Step 2.
14. **end** or **commit**
15. **exit**
16. **exit**
17. **show ethernet trunk bundle-ether** *instance*
18. **configure**
19. **interface {HundredGigE }** *interface-path-id*
20. **bundle id** *bundle-id* [**mode** {**active** | **on** | **passive**}]
21. **no shutdown**
22. Repeat Step 19 through Step 21 to add more Ethernet interfaces to the VLAN bundle.
23. **end** or **commit**

24. Perform Step 1 through Step 23 on the remote end of the VLAN bundle connection.
25. **show bundle Bundle-Ether** *bundle-id* [reasons]
26. **show ethernet trunk bundle-ether** *instance*

DETAILED STEPS

Step 1 **configure**

Example:

```
RP/0/RP0/CPU0:router# configure
```

Enters global configuration mode.

Step 2 **interface Bundle-Ether** *bundle-id*

Example:

```
RP/0/RP0/CPU0:router(config)# interface Bundle-Ether 3
```

Creates and names a new Ethernet link bundle.

This **interface Bundle-Ether** command enters you into the interface configuration submode, where you can enter interface-specific configuration commands. Use the **exit** command to exit from the interface configuration submode back to the normal global configuration mode.

Step 3 **ipv4 address** *ipv4-address mask*

Example:

```
RP/0/RP0/CPU0:router(config-if)# ipv4 address 10.1.2.3 255.0.0.0
```

Assigns an IP address and subnet mask to the virtual interface using the **ipv4 address** configuration subcommand.

Step 4 **bundle minimum-active bandwidth** *kbps*

Example:

```
RP/0/RP0/CPU0:router(config-if)# bundle minimum-active bandwidth 580000
```

(Optional) Sets the minimum amount of bandwidth required before a user can bring up a bundle.

Step 5 **bundle minimum-active links** *links*

Example:

```
RP/0/RP0/CPU0:router(config-if)# bundle minimum-active links 2
```

(Optional) Sets the number of active links required before you can bring up a specific bundle.

Step 6 **bundle maximum-active links** *links*

Example:

```
RP/0/RP0/CPU0:router(config-if)# bundle maximum-active links 1
```

(Optional) Designates one active link and one link in standby mode that can take over immediately for a bundle if the active link fails (1:1 protection).

- Note**
- The default number of active links allowed in a single bundle is 8.
 - If the **bundle maximum-active** command is issued, then only the highest-priority link within the bundle is active. The priority is based on the value from the **bundle port-priority** command, where a lower value is a higher priority. Therefore, we recommend that you configure a higher priority on the link that you want to be the active link.

Step 7 **exit****Example:**

```
RP/0/RP0/CPU0:router(config-if)# exit
```

Exits the interface configuration submode.

Step 8 **interface Bundle-Ether** *bundle-id.vlan-id***Example:**

```
RP/0/RP0/CPU0:router#(config)# interface Bundle-Ether 3.1
```

Creates a new VLAN, and assigns the VLAN to the Ethernet bundle you created in Step 2.

Replace the *bundle-id* argument with the *bundle-id* you created in Step 2.

Replace the *vlan-id* with a subinterface identifier. Range is from 1 to 4093 inclusive (0, 4094, and 4095 are reserved).

- Note**
- When you include the *vlan-id* argument with the **interface Bundle-Ether** *bundle-id* command, you enter subinterface configuration mode.

Step 9 **dot1q vlan** *vlan-id***Example:**

```
RP/0/RP0/CPU0:router(config-subif)# dot1q vlan 10
```

Assigns a VLAN to the subinterface.

Replace the *vlan-id* argument with a subinterface identifier. Range is from 1 to 4093 inclusive (0, 4094, and 4095 are reserved).

Step 10 **ipv4 address** *ipv4-address mask***Example:**

```
RP/0/RP0/CPU0:router(config-subif)# ipv4 address 10.1.2.3/24
```

Assigns an IP address and subnet mask to the subinterface.

Step 11 **no shutdown****Example:**

```
RP/0/RP0/CPU0:router(config-subif)# no shutdown
```

(Optional) If a link is in the down state, bring it up. The **no shutdown** command returns the link to an up or down state depending on the configuration and state of the link.

Step 12 **exit****Example:**

```
RP/0/RP0/CPU0:router(config-subif)# exit
```

Exits subinterface configuration mode for the VLAN subinterface.

Step 13 Repeat Step 7 through Step 12 to add more VLANs to the bundle you created in Step 2.

(Optional) Adds more subinterfaces to the bundle.

Step 14 **end** or **commit****Example:**

```
RP/0/RP0/CPU0:router(config-subif)# end
```

or

```
RP/0/RP0/CPU0:router(config-subif)# commit
```

Saves configuration changes.

- When you issue the **end** command, the system prompts you to commit changes: `Uncommitted changes found, commit them before exiting (yes/no/cancel)?`
- Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.
- Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes.
- Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes.
- Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.

Step 15 **exit****Example:**

```
RP/0/RP0/CPU0:router(config-subif)# exit
```

Exits interface configuration mode.

Step 16 **exit****Example:**

```
RP/0/RP0/CPU0:router(config)# exit
```

Exits global configuration mode.

Step 17 **show ethernet trunk bundle-ether** *instance***Example:**

```
RP/0/RP0/CPU0:router# show ethernet trunk bundle-ether 5
```

(Optional) Displays the interface configuration.

The Ethernet bundle instance range is from 1 through 65535.

Step 18 **configure**

Example:

```
RP/0/RP0/CPU0:router # configure
```

Enters global configuration mode.

Step 19 **interface {HundredGigE } interface-path-id**

Example:

```
RP/0/RP0/CPU0:router(config)# interface HundredGigE 0/1/0/1
```

Enters the interface configuration mode for the Ethernet interface you want to add to the Bundle.

Enter the **HundredGigE** keyword to specify the interface type. Replace the *interface-path-id* argument with the node-id in the rack/slot/module format.

Note • A VLAN bundle is not active until you add an Ethernet interface on both ends of the link bundle.

Step 20 **bundle id bundle-id [mode {active | on | passive}]**

Example:

```
RP/0/RP0/CPU0:router(config-if)# bundle-id 3
```

Adds an Ethernet interface to the bundle you configured in Step 2 through Step 13.

To enable active or passive LACP on the bundle, include the optional **mode active** or **mode passive** keywords in the command string.

To add the interface to the bundle without LACP support, include the optional **mode on** keywords with the command string.

Note • If you do not specify the **mode** keyword, the default mode is **on** (LACP is not run over the port).

Step 21 **no shutdown**

Example:

```
RP/0/RP0/CPU0:router(config-if)# no shutdown
```

(Optional) If a link is in the down state, bring it up. The **no shutdown** command returns the link to an up or down state depending on the configuration and state of the link.

Step 22 Repeat Step 19 through Step 21 to add more Ethernet interfaces to the VLAN bundle.

—

Step 23 **end** or **commit**

Example:

```
RP/0/RP0/CPU0:router(config-subif)# end
```

or

```
RP/0/RP0/CPU0:router(config-subif)# commit
```

Saves configuration changes.

- When you issue the **end** command, the system prompts you to commit changes: `Uncommitted changes found, commit them before exiting (yes/no/cancel)?`
- Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.
- Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes.
- Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes.
- Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.

Step 24 Perform Step 1 through Step 23 on the remote end of the VLAN bundle connection.

Brings up the other end of the link bundle.

Step 25 **show bundle Bundle-Ether** *bundle-id* [**reasons**]

Example:

```
RP/0/RP0/CPU0:router# show bundle Bundle-Ether 3 reasons
```

(Optional) Shows information about the specified Ethernet link bundle.

The **show bundle Bundle-Ether** command displays information about the specified bundle. If your bundle has been configured properly and is carrying traffic, the State field in the **show bundle Bundle-Ether** command output will show the number “4,” which means the specified VLAN bundle port is “distributing.”

Step 26 **show ethernet trunk bundle-ether** *instance*

Example:

```
RP/0/RP0/CPU0:router# show ethernet trunk bundle-ether 5
```

(Optional) Displays the interface configuration.

The Ethernet bundle instance range is from 1 through 65535.

Configuring VPWS Cross-Connects in MC-LAG

Perform this task to configure VPWS cross-connects in MC-LAG.

SUMMARY STEPS

1. **configure**
2. **l2vpn**

3. **pw-status**
4. **xconnect group** *group-name*
5. **p2p** *xconnect-name*
6. **interface** *type interface-path-id*
7. **neighbor** *A.B.C.D pw-id pseudowire-id*
8. **pw-class** {*class-name*}
9. **backup neighbor** *A.B.C.D pw-id pseudowire-id*
10. **pw-class** {*class-name*}
11. **end** or **commit**

DETAILED STEPS

Step 1 **configure**

Example:

```
RP/0/RSP0/CPU0:router# configure
```

Enters global configuration mode.

Step 2 **l2vpn**

Example:

```
RP/0/RSP0/CPU0:router(config)# l2vpn
```

Enters L2VPN configuration mode.

Step 3 **pw-status**

Example:

```
RP/0/RSP0/CPU0:router(config-l2vpn)# pw-status
```

Enables pseudowire status.

- Note**
- When the attachment circuit changes redundancy state to Active, Active pw-status is sent over the primary and backup pseudowires.
 - When the attachment circuit changes redundancy state to Standby, Standby pw-status is sent over the primary and backup pseudowires.

Step 4 **xconnect group** *group-name*

Example:

```
RP/0/RSP0/CPU0:router(config-l2vpn)# xconnect group grp_1
```

Enters the name of the cross-connect group.

Step 5 **p2p** *xconnect-name*

Example:

```
RP/0/RSP0/CPU0:router(config-l2vpn-xc)# p2p p1
```

Enters a name for the point-to-point cross-connect.

Step 6 `interface type interface-path-id`

Example:

```
RP/0/RSP0/CPU0:router(config-l2vpn-xc-p2p)# interface Bundle-Ether 1.1
```

Specifies the interface type ID.

Step 7 `neighbor A.B.C.D pw-id pseudowire-id`

Example:

```
RP/0/RSP0/CPU0:router(config-l2vpn-xc-p2p)# neighbor 10.2.2.2 pw-id 2000
```

Configures the pseudowire segment for the cross-connect.

Optionally, you can disable the control word or set the transport-type to Ethernet or VLAN.

Step 8 `pw-class {class-name}`

Example:

```
RP/0/RSP0/CPU0:router(config-l2vpn-xc-p2p-pw)# pw-class c1
```

Configures the pseudowire class template name to use for the pseudowire.

Step 9 `backup neighbor A.B.C.D pw-id pseudowire-id`

Example:

```
RP/0/RSP0/CPU0:router(config-l2vpn-xc-p2p-pw)# backup neighbor 10.2.2.2 pw-id 2000
```

Adds a backup pseudowire.

Step 10 `pw-class {class-name}`

Example:

```
RP/0/RSP0/CPU0:router(config-l2vpn-xc-p2p-pw-backup)# pw-class c2
```

Configures the pseudowire class template name to use for the backup pseudowire.

Step 11 `end` or `commit`

Example:

```
RP/0/RSP0/CPU0:router(config-l2vpn-xc-p2p-pw-backup)# end
```

or

```
RP/0/RSP0/CPU0:router(config-l2vpn-xc-p2p-pw-backup)# commit
```

Saves configuration changes.

- When you issue the **end** command, the system prompts you to commit changes:

```
Uncommitted changes found, commit them before
exiting (yes/no/cancel)?
[cancel]:
```

- Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.
- Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes.
- Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes.
- Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.

Configuring VPLS in MC-LAG

Perform this task to configure VPLS in MC-LAG.

SUMMARY STEPS

1. **configure**
2. **l2vpn**
3. **pw-status**
4. **bridge group** *bridge-group-name*
5. **bridge-domain** *bridge-domain-name*
6. **interface** *type interface-path-id*
7. **vfi** *{vfi-name}*
8. **neighbor** *A.B.C.D pw-id pseudowire-id*
9. **pw-class** *{class-name}*
10. **end** or **commit**

DETAILED STEPS

Step 1 **configure**

Example:

```
RP/0/RSP0/CPU0:router# configure
```

Enters global configuration mode.

Step 2 **l2vpn**

Example:

```
RP/0/RSP0/CPU0:router(config)# l2vpn
```

Enters L2VPN configuration mode.

Step 3 **pw-status**

Example:

```
RP/0/RSP0/CPU0:router(config-l2vpn)# pw-status
```

(Optional) Enables pseudowire status.

All the pseudowires in the VFI are always active, independent of the attachment circuit redundancy state.

Step 4 **bridge group** *bridge-group-name***Example:**

```
RP/0/RSP0/CPU0:router(config-l2vpn)# bridge group cisco
RP/0/RSP0/CPU0:router(config-l2vpn-bg)#
```

Creates a bridge group so that it can contain bridge domains and then assigns network interfaces to the bridge domain.

Step 5 **bridge-domain** *bridge-domain-name***Example:**

```
RP/0/RSP0/CPU0:router(config-l2vpn-bg)# bridge-domain abc
RP/0/RSP0/CPU0:router(config-l2vpn-bg-bd)#
```

Establishes a bridge domain and enters L2VPN bridge group bridge domain configuration mode.

Step 6 **interface type** *interface-path-id***Example:**

```
RP/0/RSP0/CPU0:router(config-l2vpn-bg-bd)# interface Bundle-Ether 1.1
```

Specifies the interface type ID.

Step 7 **vfi** *{vfi-name}***Example:**

```
RP/0/RSP0/CPU0:router(config-l2vpn-bg-bd-ac)# vfi vfi-east
```

Enters virtual forwarding instance (VFI) configuration mode.

Step 8 **neighbor** *A.B.C.D* **pw-id** *pseudowire-id***Example:**

```
RP/0/RSP0/CPU0:router(config-l2vpn-bg-bd-vfi)# neighbor 10.2.2.2 pw-id 2000
```

Configures the pseudowire segment for the cross-connect.

Optionally, you can disable the control word or set the transport-type to Ethernet or VLAN.

Step 9 **pw-class** *{class-name}***Example:**

```
RP/0/RSP0/CPU0:router(config-l2vpn-bg-bd-vfi-pw)# pw-class canada
```

Configures the pseudowire class template name to use for the pseudowire.

Step 10 **end** or **commit**

Example:

```
RP/0/RSP0/CPU0:router(config-l2vpn-bg-bd-vfi-pw)# end
```

or

```
RP/0/RSP0/CPU0:router(config-l2vpn-bg-bd-vfi-pw)# commit
```

Saves configuration changes.

- When you issue the **end** command, the system prompts you to commit changes:

```
Uncommitted changes found, commit them before  
exiting(yes/no/cancel)?  
[cancel]:
```

- Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.
 - Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes.
 - Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes.
- Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.

Information About Configuring Link Bundling

To configure link bundling, you must understand the following concepts:

IEEE 802.3ad Standard

The IEEE 802.3ad standard typically defines a method of forming Ethernet link bundles.

For each link configured as bundle member, the following information is exchanged between the systems that host each end of the link bundle:

- A globally unique local system identifier
- An identifier (operational key) for the bundle of which the link is a member
- An identifier (port ID) for the link
- The current aggregation status of the link

This information is used to form the link aggregation group identifier (LAG ID). Links that share a common LAG ID can be aggregated. Individual links have unique LAG IDs.

The system identifier distinguishes one router from another, and its uniqueness is guaranteed through the use of a MAC address from the system. The bundle and link identifiers have significance only to the router

assigning them, which must guarantee that no two links have the same identifier, and that no two bundles have the same identifier.

The information from the peer system is combined with the information from the local system to determine the compatibility of the links configured to be members of a bundle.

The MAC address of the first link attached to a bundle becomes the MAC address of the bundle itself. The bundle uses this MAC address until that link (the first link attached to the bundle) is detached from the bundle, or until the user configures a different MAC address. The bundle MAC address is used by all member links when passing bundle traffic. Any unicast or multicast addresses set on the bundle are also set on all the member links.



Note We recommend that you avoid modifying the MAC address, because changes in the MAC address can affect packet forwarding.

Link Bundle Configuration Overview

The following steps provide a general overview of the link bundle configuration. Keep in mind that a link must be cleared of all previous network layer configuration before it can be added to a bundle:

1. In global configuration mode, create a link bundle. To create an Ethernet link bundle, enter the **interface Bundle-Ether** command.
2. Assign an IP address and subnet mask to the virtual interface using the **ipv4 address** command.
3. Add interfaces to the bundle you created in Step 1 with the **bundle id** command in the interface configuration submode.

You can add up to 32 links to a single bundle.

4. You can optionally implement 1:1 link protection for the bundle by setting the **bundle maximum-active links** command to 1. Performing this configuration causes the highest-priority link in the bundle to become active and the second-highest-priority link to become the standby. (The link priority is based on the value of the **bundle port-priority** command.) If the active link fails, the standby link immediately becomes the active link.



Note A link is configured as a member of a bundle from the interface configuration submode for that link.

Link Switchover

By default, a maximum of 64 links in a bundle can actively carry traffic. If one member link in a bundle fails, traffic is redirected to the remaining operational member links.

You can optionally implement 1:1 link protection for a bundle by setting the **bundle maximum-active links** command to 1. By doing so, you designate one active link and one or more dedicated standby links. If the active link fails, a switchover occurs and a standby link immediately becomes active, thereby ensuring uninterrupted traffic.

If the active and standby links are running LACP, you can choose between an IEEE standard-based switchover (the default) or a faster proprietary optimized switchover. If the active and standby links are not running LACP, the proprietary optimized switchover option is used.

Regardless of the type of switchover you are using, you can disable the wait-while timer, which expedites the state negotiations of the standby link and causes a faster switchover from a failed active link to the standby link.

To do so, you can use the **lacp fast-switchover** command.

Failure Cases

MC-LAG provides redundancy, switching traffic to the unaffected POA while presenting an unchanged bundle interface to the DHD, for these failure events:

- Link failure: A port or link between the DHD and one of the POAs fails.
- Device failure: Meltdown or reload of one of the POAs, with total loss of connectivity (to the DHD, the core and the other POA).
- Core isolation: A POA loses its connectivity to the core network, and therefore is of no value, being unable to forward traffic to or from the DHD.

A loss of connectivity between the POAs leads both devices to assume that the other has experienced device failure, causing them to attempt to take on the Active role. This is known as a split brain scenario and can happen in either of the following cases:

- All other connectivity remains; only the link between POAs is lost.
- One POA is isolated from the core network (i.e. a core isolation scenario where the connection between the two POAs was over the core network).

MC-LAG by itself does not provide a means to avoid this situation; resiliency in the connection between the POAs is a requirement. The DHD is given the responsibility of mitigating the problem by setting a limit on the number of links, within the bundle, that can be active. As such only the links connected to one of the POAs can be active at any one point of time.



CHAPTER 5

Configuring Virtual Loopback and Null Interfaces

This module describes the configuration of loopback and null interfaces. Loopback and null interfaces are considered virtual interfaces.

A virtual interface represents a logical packet switching entity within the router. Virtual interfaces have a global scope and do not have an associated location. Virtual interfaces have instead a globally unique numerical ID after their names. Examples are Loopback 0, Loopback 1, and Loopback 99999. The ID is unique per virtual interface type to make the entire name string unique such that you can have both Loopback 0 and Null 0.

Loopback and null interfaces have their control plane presence on the active route switch processor (RSP). The configuration and control plane are mirrored onto the standby RSP and, in the event of a failover, the virtual interfaces move to the ex-standby, which then becomes the newly active RSP.

- [Information About Configuring Virtual Interfaces, on page 51](#)

Information About Configuring Virtual Interfaces

To configure virtual interfaces, you must understand the following concepts:

Virtual Loopback Interface Overview

A virtual loopback interface is a virtual interface with a single endpoint that is always up. Any packet transmitted over a virtual loopback interface is immediately received by the same interface. Loopback interfaces emulate a physical interface.

In Cisco IOS XR Software, virtual loopback interfaces perform these functions:

- Loopback interfaces can act as a termination address for routing protocol sessions. This allows routing protocol sessions to stay up even if the outbound interface is down.
- You can ping the loopback interface to verify that the router IP stack is working properly.

In applications where other routers or access servers attempt to reach a virtual loopback interface, you must configure a routing protocol to distribute the subnet assigned to the loopback address.

Packets routed to the loopback interface are rerouted back to the router or access server and processed locally. IP packets routed out to the loopback interface but not destined to the loopback interface are dropped. Under these two conditions, the loopback interface can behave like a null interface.

Prerequisites for Configuring Virtual Interfaces

You must be in a user group associated with a task group that includes the proper task IDs. The command reference guides include the task IDs required for each command. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

Configuring Virtual Loopback Interfaces

This task explains how to configure a basic loopback interface.

Restrictions

The IP address of a loopback interface must be unique across all routers on the network. It must not be used by another interface on the router, and it must not be used by an interface on any other router on the network.

SUMMARY STEPS

1. **configure**
2. **interface loopback** *instance*
3. **ipv4 address** *ip-address*
4. **end** or **commit**
5. **show interface***type instance*

DETAILED STEPS

Step 1 **configure**

Example:

```
RP/0/RP0/CPU0:router# configure
```

Enters global configuration mode.

Step 2 **interface loopback** *instance*

Example:

```
RP/0/RP0/CPU0:router#(config)# interface Loopback 3
```

Enters interface configuration mode and names the new loopback interface.

Step 3 **ipv4 address** *ip-address*

Example:

```
RP/0/RP0/CPU0:router(config-if)# ipv4 address 100.100.100.69 255.255.255.255
```

Assigns an IP address and subnet mask to the virtual loopback interface using the **ipv4 address** configuration command.

Step 4 **end** or **commit**

Example:

```
RP/0/RP0/CPU0:router(config-if)# end
```

or

```
RP/0/RP0/CPU0:router(config-if)# commit
```

Saves configuration changes.

- When you issue the **end** command, the system prompts you to commit changes:

```
Uncommitted changes found, commit them before exiting(yes/no/cancel)?
[cancel]:
```

- Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.
- Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes.
- Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes.
- Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.

Step 5 `show interface` *type instance*

Example:

```
RP/0/RP0/CPU0:router# show interfaces Loopback0
```

(Optional) Displays the configuration of the loopback interface.

Example

This example shows how to configure a loopback interface:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface Loopback0
RP/0/RP0/CPU0:router(config-if)# ipv4 address 100.100.100.69 255.255.255.255
RP/0/RP0/CPU0:router(config-if)# ipv6 address 100::69/128
RP/0/RP0/CPU0:router(config-if)# end
Uncommitted changes found, commit them? [yes]: yes
RP/0/RP0/CPU0:router# show interfaces Loopback0
```

```
Loopback0 is up, line protocol is up
Interface state transitions: 1
Hardware is Loopback interface(s)
Internet address is 100.100.100.69/32
MTU 1500 bytes, BW 0 Kbit
    reliability Unknown, txload Unknown, rxload Unknown
Encapsulation Loopback, loopback not set,
Last link flapped 01:57:47
Last input Unknown, output Unknown
Last clearing of "show interface" counters Unknown
Input/output data rate is disabled.
```

Null Interface Overview

A null interface functions similarly to the null devices available on most operating systems. This interface is always up and can never forward or receive traffic; encapsulation always fails. The null interface provides an alternative method of filtering traffic. You can avoid the overhead involved with using access lists by directing undesired network traffic to the null interface.

The only interface configuration command that you can specify for the null interface is the **ipv4 unreachable** command. With the **ipv4 unreachable** command, if the software receives a non-broadcast packet destined for itself that uses a protocol it does not recognize, it sends an Internet Control Message Protocol (ICMP) protocol unreachable message to the source. If the software receives a datagram that it cannot deliver to its ultimate destination because it knows of no route to the destination address, it replies to the originator of that datagram with an ICMP host unreachable message. By default **ipv4 unreachable** command is enabled. If we do not want ICMP to send protocol unreachable, then we need to configure using the **ipv4 icmp unreachable disable** command.

The Null 0 interface is created by default during boot process and cannot be removed. The **ipv4 unreachable** command can be configured for this interface, but most configuration is unnecessary because this interface just discards all the packets sent to it.

The Null 0 interface can be displayed with the **show interfaces null0** command.

Configuring Null Interfaces

This task explains how to configure a basic null interface.

SUMMARY STEPS

1. **configure**
2. **interface null 0**
3. **end** or **commit**
4. **show interfaces null 0**

DETAILED STEPS

Step 1 **configure****Example:**

```
RP/0/RP0/CPU0:router# configure
```

Enters global configuration mode.

Step 2 **interface null 0****Example:**

```
RP/0/RP0/CPU0:router(config)# interface null 0
```

Enters the null 0 interface configuration mode.

Step 3 **end** or **commit****Example:**

```
RP/0/RP0/CPU0:router(config-null0)# end
```

or

```
RP/0/RP0/CPU0:router(config-null0)# commit
```

Saves configuration changes.

- When you issue the **end** command, the system prompts you to commit changes:

```
Uncommitted changes found, commit them before
exiting(yes/no/cancel)?
[cancel]:
```

- Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.
- Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes.
- Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes.
- Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.

Step 4 show interfaces null 0

Example:

```
RP/0/RP0/CPU0:router# show interfaces null 0
```

Verifies the configuration of the null interface.

Example

This example shows how to configure a null interface:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface Null 0
RP/0/RP0/CPU0:router(config-null0)# ipv4 icmp unreachable disable
RP/0/RP0/CPU0:router(config-null0)# end
Uncommitted changes found, commit them? [yes]: yes
RP/0/RP0/CPU0:router# show interfaces Null 0
```

```
Null0 is up, line protocol is up
Interface state transitions: 1
Hardware is Null interface
Internet address is Unknown
MTU 1500 bytes, BW 0 Kbit
reliability 255/255, txload Unknown, rxload Unknown
Encapsulation Null, loopback not set,
Last link flapped 4d20h
Last input never, output never
Last clearing of "show interface" counters 05:42:04
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 total input drops
0 drops for unrecognized upper-level protocol
Received 0 broadcast packets, 0 multicast packets
0 packets output, 0 bytes, 0 total output drops
Output 0 broadcast packets, 0 multicast packets

```

Configuring Virtual IPv4 Interfaces

This task explains how to configure an IPv4 virtual interface.

SUMMARY STEPS

1. **configure**
2. **ipv4 virtual address** *ipv4-*
3. **end** or **commit**

DETAILED STEPS

Step 1 **configure**

Example:

```
RP/0/RP0/CPU0:router# configure
```

Enters global configuration mode.

Step 2 **ipv4 virtual address** *ipv4-*

Example:

```
RP/0/RP0/CPU0:router(config)# ipv4 virtual address 10.3.32.154/8
```

Defines an IPv4 virtual address for the management Ethernet interface.

Step 3 **end** or **commit**

Example:

```
RP/0/RP0/CPU0:router(config-null0)# end
```

or

```
RP/0/RP0/CPU0:router(config-null0)# commit
```

Saves configuration changes.

- When you issue the **end** command, the system prompts you to commit changes:

```

Uncommitted changes found, commit them before
exiting(yes/no/cancel)?
[cancel]:

```

- Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.

- Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes.
 - Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes.
 - Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.
-

Example

This is an example for configuring a virtual IPv4 interface:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipv4 virtual address 10.3.32.154/8
RP/0/RP0/CPU0:router(config-null0)# commit
```

