



# 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



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**Tip** You can programmatically configure and manage the Ethernet interfaces using `openconfig-ethernet-if.yang` and `openconfig-interfaces.yang` OpenConfig data models. To get started with using data models, see the *Programmability Configuration Guide for Cisco NCS 5500 Series Routers*.

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These solutions are designed to interconnect the router with other systems in point-of-presence (POP)s, including core and edge routers and Layer 2 and Layer 3 switches.

## Restrictions for Configuring Ethernet Interfaces

- Router does not support configuration of the static mac address.
- As per design, traffic logs for incoming CRC error packets don't display packets per second (PPS) and other packet-specific information, as highlighted below.

```
Router# show interface tenGigE 0/0/0/10 | include packets
```

```
5 minute input rate 541242000 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
  0 packets input, 7718374402816 bytes, 0 total input drops
    Received 0 broadcast packets, 0 multicast packets
  2952 packets output, 389664 bytes, 0 total output drops
    Output 0 broadcast packets, 2952 multicast packets
```

- To save power consumption, the router shuts down the ethernet interfaces with no configuration other than **no shutdown** after a graceful line card or system reload. To avoid ethernet interfaces going down in such scenarios, you must provide a description and the **no shutdown** configuration under the interface. You can use the [description \(interface\)](#) to add a description to an interface.
- The router doesn't support connecting a 1Gig copper cable to a 25GbE or higher speed QSFP ports.

- For 1Gig fibre cable, the router doesn't support auto-negotiation for 25GbE or higher speed QSFP ports.
- [Configuring Gigabit Ethernet Interfaces](#), on page 2
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- [Link Layer Discovery Protocol \(LLDP\)](#), on page 13
- [Dense Wavelength Division Multiplexing Tunable Optics](#), on page 16
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## Configuring Gigabit Ethernet Interfaces

### Restrictions and Important Guidelines

- NC55-MPA-12T-S supports 1G optics in eight ports. The ports are 0 to 3 and 8 to 11.
- NC55-MPA-12T-S supports 10G optics in ports 4 to 7.

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 2000
```

(Optional) Sets the MTU value for the interface.

- The configurable range for MTU values is 1514 bytes to 9646 bytes.
- The default is 1514 bytes for normal frames and 1518 bytes for 802.1Q tagged frames.

**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 2000

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 1: 100-Gigabit Ethernet line card Default Configuration Values

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

## Network Interface Speed

1Gig interfaces connected through copper or fiber cable can have interface speed of either 100 Mbps or 1000 Mbps. This is applicable on 1Gig interface with a 1000Base-T module (GLC-TE). By default 1G interface has following capabilities:

- Speed—1000 Mbps for fiber cable and autonegotiate for copper cable
- Duplex—Full
- Pause—Receive Part (RX) and Transmit Part (TX)

The copper and fiber cables have same default values as mentioned above but autonegotiation is default for copper cable.

The speed can either configured or set to autonegotiate with remote end interface. When in autonegotiation mode, an interface is capable of negotiating the speed of 100 Mbps or 1000 Mbps depending on the speed at the remote end interface; and other parameters such as full duplex and pause are also autonegotiated.

Autonegotiation is an optional function of the Fast Ethernet standard that enables devices to automatically exchange information over a link about speed and duplex abilities. Autonegotiation is very useful for ports where devices with different capabilities are connected and disconnected on a regular basis.




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**Note** Autonegotiation is disabled by default, but it's mandatory on QSFP-100G-CUxM link. You must enable autonegotiation manually when you use 100GBASE-CR4 DAC cable.

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## Configuring Network Interface Speed

You can configure the network interface speed by using on of the following methods:

- Using the **speed** command
- Using the **negotiation auto** command
- Using both **speed** and **negotiation auto** command




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**Note** Cisco recommends configuring network interface speed in autonegotiation mode.

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## Using the speed command

When you configure the speed of the network interface (1G) using the **speed** command, the interface speed is forced to the configured speed by limiting the speed value of the auto negotiated parameter to the configured speed.

This sample configuration forces the Gig interface speed to 100Mbps.




---

**Note** The interface speed at remote end is also set to 100Mbps.

---

```
#configuration
(config)#interface GigabitEthernet 0/0/0/31
(config-if)#speed 100
(config-if)#commit
(config-if)#end
```

Use the **show controller GigE** and **show interface GigE** commands to verify if the speed is configured to 100Mbps and autonegotiation is disabled:

```
#show controllers GigabitEthernet 0/0/0/31
Operational data for interface GigabitEthernet0/0/0/31:
State:
  Administrative state: enabled
  Operational state: Up
  LED state: Green On
Phy:
  Media type: Four-pair Category 5 UTP PHY, full duplex
Optics:
  Vendor: CISCO
  Part number: SBCU-5740ARZ-CS1
  Serial number: AVC194525HW
  Wavelength: 0 nm
Digital Optical Monitoring:
  Transceiver Temp: 0.000 C
  Transceiver Voltage: 0.000 V

Alarms key: (H) Alarm high, (h) Warning high
            (L) Alarm low, (l) Warning low
            Wavelength    Tx Power      Rx Power      Laser Bias
            Lane  (nm)    (dBm)  (mW)    (dBm)  (mW)    (mA)
            ---  -
0         n/a      0.0    1.000    0.0    1.000    0.000

DOM alarms:
  No alarms

Alarm          Alarm      Warning    Warning    Alarm
Thresholds     High       High       Low         Low
-----
Transceiver Temp (C):      0.000    0.000    0.000    0.000
Transceiver Voltage (V):  0.000    0.000    0.000    0.000
Laser Bias (mA):          0.000    0.000    0.000    0.000
Transmit Power (mW):      1.000    1.000    1.000    1.000
```

## Using the negotiation auto command

```

        Transmit Power (dBm):      0.000      0.000      0.000      0.000
        Receive Power (mW):        1.000      1.000      1.000      1.000
        Receive Power (dBm):       0.000      0.000      0.000      0.000
Statistics:
    FEC:
        Corrected Codeword Count: 0
        Uncorrected Codeword Count: 0

MAC address information:
    Operational address: 0035.1a00.e67c
    Burnt-in address: 0035.1a00.e62c
Autonegotiation disabled.

Operational values:
Speed: 100Mbps          /*Gig interface speed is set to 100Mbps */
Duplex: Full Duplex
Flowcontrol: None
Loopback: None (or external)
MTU: 1514
MRU: 1514
Forward error correction: Disabled

#show interfaces GigabitEthernet 0/0/0/31
GigabitEthernet0/0/0/31 is up, line protocol is up
Interface state transitions: 7
Hardware is GigabitEthernet, address is 0035.1a00.e62c (bia 0035.1a00.e62c)
Internet address is Unknown
MTU 1514 bytes, BW 100000 Kbit (Max: 100000 Kbit)
    reliability 255/255, txload 0/255, rxload 0/255
Encapsulation ARPA,
Full-duplex, 100Mb/s, TFD, 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 00:00:30
Last input 00:00:00, output 00:00:00
Last clearing of "show interface" counters never
30 second input rate 1000 bits/sec, 1 packets/sec
30 second output rate 0 bits/sec, 1 packets/sec
90943 packets input, 11680016 bytes, 0 total input drops
0 drops for unrecognized upper-level protocol
Received 0 broadcast packets, 90943 multicast packets
    0 runts, 0 giants, 0 throttles, 0 parity
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
61279 packets output, 4347618 bytes, 0 total output drops
Output 0 broadcast packets, 8656 multicast packets
0 output errors, 0 underruns, 0 applique, 0 resets
0 output buffer failures, 0 output buffers swapped out
8 carrier transitions

```

In the above show output you will observe that the state of the GigabitEthernet0/0/0/31 is up, and line protocol is up. This is because the speed at both ends is 100Mbps.

## Using the negotiation auto command

When you configure the network interface speed using **negotiation auto** command, the speed is autonegotiated with the remote end interface. This command enhances the speed capability to 100M or 1G to be negotiated with the peer.

This sample configuration sets the interface speed to autonegotiate:






---

**Note** The interface speed at remote end is set to 100Mbps.

---




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**Note** Before Cisco IOS XR Software Release 7.3.2, the default setting for autonegotiation varied with different platforms under the NCS 5500 family. On NCS 540 and NCS 55A2, 100G autonegotiation was enabled by default.

From Cisco IOS XR Software Release 7.3.2 onwards, autonegotiation is not enabled by default. Use the **negotiation auto** command to enable autonegotiation.

---

```
#configuration
(config)#interface GigabitEthernet 0/0/0/31
(config-if)#negotiation auto
(config-if)#commit
(config-if)#end
```

Use the **show controller GigE** and **show interface GigE** commands to verify if the speed is autonegotiated:

```
#show interfaces GigabitEthernet 0/0/0/31
GigabitEthernet0/0/0/31 is up, line protocol is up
  Interface state transitions: 10
  Hardware is GigabitEthernet, address is 0035.1a00.e62c (bia 0035.1a00.e62c)
  Internet address is Unknown
  MTU 1514 bytes, BW 100000 Kbit (Max: 100000 Kbit)
    reliability 255/255, txload 0/255, rxload 0/255
  Encapsulation ARPA,
  Full-duplex, 100Mb/s, TFD, link type is autonegotiation
  output flow control is off, input flow control is off
  Carrier delay (up) is 10 msec
  loopback not set,
  Last link flapped 00:00:01
  Last input 00:00:00, output 00:00:00
  Last clearing of "show interface" counters never
  30 second input rate 1000 bits/sec, 1 packets/sec
  30 second output rate 0 bits/sec, 0 packets/sec
  91005 packets input, 11687850 bytes, 0 total input drops
    0 drops for unrecognized upper-level protocol
  Received 0 broadcast packets, 91005 multicast packets
    0 runts, 0 giants, 0 throttles, 0 parity
  0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
  61307 packets output, 4350024 bytes, 0 total output drops
  Output 0 broadcast packets, 8668 multicast packets
  0 output errors, 0 underruns, 0 applique, 0 resets
  0 output buffer failures, 0 output buffers swapped out
  15 carrier transitions
```

In the above show output you see that GigabitEthernet0/0/0/31 is up, and line protocol is up.

```
#show controllers GigabitEthernet 0/0/0/31
Operational data for interface GigabitEthernet0/0/0/31:

State:
  Administrative state: enabled
  Operational state: Up
  LED state: Green On

Phy:
  Media type: Four-pair Category 5 UTP PHY, full duplex
```

```

Optics:
  Vendor: CISCO
  Part number: SBCU-5740ARZ-CS1
  Serial number: AVC194525HW
  Wavelength: 0 nm
Digital Optical Monitoring:
  Transceiver Temp: 0.000 C
  Transceiver Voltage: 0.000 V

Alarms key: (H) Alarm high, (h) Warning high
            (L) Alarm low, (l) Warning low
      Wavelength  Tx Power      Rx Power      Laser Bias
Lane  (nm)      (dBm)    (mW)      (dBm)    (mW)      (mA)
---  ---      -
0    n/a      0.0    1.0000    0.0    1.0000    0.000

DOM alarms:
  No alarms

Alarm                               Alarm    Warning  Warning  Alarm
Thresholds                          High     High     Low     Low
-----
Transceiver Temp (C):                0.000    0.000    0.000    0.000
Transceiver Voltage (V):              0.000    0.000    0.000    0.000
Laser Bias (mA):                      0.000    0.000    0.000    0.000
Transmit Power (mW):                   1.000    1.000    1.000    1.000
Transmit Power (dBm):                  0.000    0.000    0.000    0.000
Receive Power (mW):                    1.000    1.000    1.000    1.000
Receive Power (dBm):                   0.000    0.000    0.000    0.000

Statistics:
  FEC:
    Corrected Codeword Count: 0
    Uncorrected Codeword Count: 0

MAC address information:
  Operational address: 0035.1a00.e67c
  Burnt-in address: 0035.1a00.e62c

Autonegotiation enabled:
  No restricted parameters

Operational values:
  Speed: 100Mbps
  Duplex: Full Duplex
  Flowcontrol: None
  Loopback: None (or external)
  MTU: 1514
  MRU: 1514
  Forward error correction: Disabled

```

## Using speed and negotiation auto command

When you configure the speed of the network interface (1G) using the **speed** and **negotiation auto** command, the interface autonegotiates all the paramets (full-duplex and pause) except speed. The speed is forced to the configured value.

This sample shows how to configures Gig interface speed to 100Mbps and autonegotiate other parameters:




---

**Note** The interface speed at remote end is set to 100Mbps.

---

```
#configuration
(config)#interface GigabitEthernet 0/0/0/31
(config-if)#negotiation auto
(config-if)#speed 100
(config-if)#end
```

Use the **show controller GigE** and **show interface GigE** command to verify if the link is up, speed is forced to 100Mbps and autonegotiation is enabled:

```
#show interfaces GigabitEthernet 0/0/0/31
GigabitEthernet0/0/0/31 is up, line protocol is up
Interface state transitions: 9
Hardware is GigabitEthernet, address is 0035.1a00.e62c (bia 0035.1a00.e62c)
Internet address is Unknown
MTU 1514 bytes, BW 100000 Kbit (Max: 100000 Kbit)
  reliability 255/255, txload 0/255, rxload 0/255
Encapsulation ARPA,
Full-duplex, 100Mb/s, TFD, link type is autonegotiation
output flow control is off, input flow control is off
Carrier delay (up) is 10 msec
loopback not set,
Last link flapped 00:00:03
Last input 00:00:00, output 00:00:00
Last clearing of "show interface" counters never
30 second input rate 0 bits/sec, 1 packets/sec
30 second output rate 0 bits/sec, 0 packets/sec
 90968 packets input, 11683189 bytes, 0 total input drops
 0 drops for unrecognized upper-level protocol
Received 0 broadcast packets, 90968 multicast packets
 0 runts, 0 giants, 0 throttles, 0 parity
 0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
61287 packets output, 4348541 bytes, 0 total output drops
Output 0 broadcast packets, 8664 multicast packets
 0 output errors, 0 underruns, 0 applique, 0 resets
 0 output buffer failures, 0 output buffers swapped out
12 carrier transitions
```

In the above show output you will observe that the GigabitEthernet0/0/0/31 is up, and line protocol is up This is because the speed at both ends is 100Mbps.

```
#show controllers GigabitEthernet 0/0/0/31
Operational data for interface GigabitEthernet0/0/0/31:

State:
  Administrative state: enabled
  Operational state: Up
  LED state: Green On

Phy:
  Media type: Four-pair Category 5 UTP PHY, full duplex
  Optics:
    Vendor: CISCO
    Part number: SBCU-5740ARZ-CS1
    Serial number: AVC194525HW
    Wavelength: 0 nm
  Digital Optical Monitoring:
    Transceiver Temp: 0.000 C
    Transceiver Voltage: 0.000 V

  Alarms key: (H) Alarm high, (h) Warning high
              (L) Alarm low, (l) Warning low
              Wavelength Tx Power Rx Power Laser Bias
```

```

Lane   (nm)   (dBm)   (mW)   (dBm)   (mW)   (mA)
--   ----   -
0     n/a     0.0    1.0000  0.0    1.0000  0.000

DOM alarms:
  No alarms

Alarm                               Alarm   Warning   Warning   Alarm
Thresholds                          High     High     Low     Low
-----
Transceiver Temp (C):                0.000   0.000   0.000   0.000
Transceiver Voltage (V):             0.000   0.000   0.000   0.000
Laser Bias (mA):                     0.000   0.000   0.000   0.000
Transmit Power (mW):                  1.000   1.000   1.000   1.000
Transmit Power (dBm):                 0.000   0.000   0.000   0.000
Receive Power (mW):                   1.000   1.000   1.000   1.000
Receive Power (dBm):                 0.000   0.000   0.000   0.000

Statistics:
  FEC:
    Corrected Codeword Count: 0
    Uncorrected Codeword Count: 0

MAC address information:
  Operational address: 0035.1a00.e67c
  Burnt-in address: 0035.1a00.e62c

Autonegotiation enabled:
  Speed restricted to: 100Mbps /* autonegotiation is enabled and speed is forced to
  100Mbps*/

Operational values:
  Speed: 100Mbps
  Duplex: Full Duplex
  Flowcontrol: None
  Loopback: None (or external)
  MTU: 1514
  MRU: 1514
  Forward error correction: Disabled

```

## 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.




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**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.



---

**Note** To enable hashing for L3 header only when the majority of traffic is fragmented, use the [hw-module profile load-balance algorithm L3-Only](#) command.

---

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).

Following are the supported MTU properties on devices containing NC55 first generation line cards, NCS 5501, NCS5501-SE cards:

- Each physical port can have a different MTU.
- Main interface of each bundle can have one MTU value.
- L3 sub-interface (bundle or physical) shares MTU profiles and can have a maximum of 3 unique configured MTUs per NPU.



---

**Note** L2 sub-interface MTU is not supported.

---

Following are the supported MTU profiles on devices containing NC55 second generation line cards. Each profile has a limit of 7 configured MTUs per NPU.

- Port MTU profile: This is shared by bundle main interfaces and physical main interfaces.
- RIF MTU profile: This is used by the L3 sub-interface (bundle or physical) on the device.



---

**Note** L2 sub-interface MTU is not supported.

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For more information about the architecture, refer to the [NCS 5500 and NCS 5700 Fixed Platform Architecture white paper](#).

## Link Layer Discovery Protocol (LLDP)

Cisco Discovery Protocol (CDP) is a device discovery protocol that runs over Layer 2. Layer 2 is also known as the data link layer that runs on all Cisco-manufactured devices, such as routers, bridges, access servers, and switches. CDP allows the network management applications to automatically discover and learn about other Cisco devices that connect to the network.

To support non-Cisco devices and to allow for interoperability between other devices, it also supports the IEEE 802.1AB LLDP. LLDP is also a neighbor discovery protocol that is used for network devices to advertise information about themselves to other devices on the network. This protocol runs over the data link layer, which allows two systems running different network layer protocols to learn about each other.

With LLDP, you can also access the information about a particular physical network connection. If you use a non-Cisco monitoring tool (via SNMP,) LLDP helps you identify the Object Identifiers (OIDs) that the system supports. The following are the supported OIDs:

- 1.0.8802.1.1.2.1.4.1.1.4
- 1.0.8802.1.1.2.1.4.1.1.5
- 1.0.8802.1.1.2.1.4.1.1.6
- 1.0.8802.1.1.2.1.4.1.1.7
- 1.0.8802.1.1.2.1.4.1.1.8
- 1.0.8802.1.1.2.1.4.1.1.9
- 1.0.8802.1.1.2.1.4.1.1.10
- 1.0.8802.1.1.2.1.4.1.1.11
- 1.0.8802.1.1.2.1.4.1.1.12

## Enabling LLDP Globally

To run LLDP on the router, you must enable it globally. When you enable LLDP globally, all interfaces that support LLDP are automatically enabled for both transmit and receive operations.

You can override this default operation at the interface to disable receive or transmit operations.

The following table describes the global attributes that you can configure:

Attribute	Default	Range	Description
Holdtime	120	0-65535	Specifies the holdtime (in sec) that are sent in packets
Reinit	2	2-5	Delay (in sec) for LLDP initialization on any interface
Timer	30	5-65534	Specifies the rate at which LLDP packets are sent (in sec)

To enable LLDP globally, complete the following steps:

1. `RP/0/RSP0/CPU0:router # configure`
2. `RP/0/RSP0/CPU0:router(config) #lldp`
3. `end` or `commit`

### Running configuration

```
RP/0/RP0/CPU0:router-5#show run lldp
Fri Dec 15 20:36:49.132 UTC
lldp
!
```

```
RP/0/RP0/CPU0:router#show lldp neighbors
Fri Dec 15 20:29:53.763 UTC
Capability codes:
  (R) Router, (B) Bridge, (T) Telephone, (C) DOCSIS Cable Device
  (W) WLAN Access Point, (P) Repeater, (S) Station, (O) Other

Device ID          Local Intf          Hold-time  Capability  Port ID
SW-NOSTG-I11-PUB.cis Mg0/RP0/CPU0/0    120       N/A         Fa0/28

Total entries displayed: 1

RP/0/RP0/CPU0:router#show lldp neighbors mgmtEth 0/RP0/CPU0/0
Fri Dec 15 20:30:54.736 UTC
Capability codes:
  (R) Router, (B) Bridge, (T) Telephone, (C) DOCSIS Cable Device
  (W) WLAN Access Point, (P) Repeater, (S) Station, (O) Other

Device ID          Local Intf          Hold-time  Capability  Port ID
SW-NOSTG-I11-PUB.cis Mg0/RP0/CPU0/0    120       N/A         Fa0/28

Total entries displayed: 1
```

## Enabling LLDP Per Interface

When you enable LLDP globally, all interfaces that support LLDP are automatically enabled for both transmit and receive operations. However, if you want to enable LLDP per interface, perform the following configuration steps:

1. RP/0/RSP0/CPU0:router(config)# int gigabitEthernet 0/2/0/0
2. RP/0/RSP0/CPU0:router(config-if)# no sh
3. RP/0/RSP0/CPU0:router(config-if)#commit
4. RP/0/RSP0/CPU0:router(config-if)#lldp ?
5. RP/0/RSP0/CPU0:router(config-if)#lldp enable
6. RP/0/RSP0/CPU0:router(config-if)#commit

### Running configuration

```
RP/0/RSP0/CPU0:router#sh running-config
Wed Jun 27 12:40:21.274 IST
Building configuration...
!! IOS XR Configuration 0.0.0
!! Last configuration change at Wed Jun 27 00:59:29 2018 by UNKNOWN
!
interface GigabitEthernet0/1/0/0
 shutdown
!
interface GigabitEthernet0/1/0/1
 shutdown
!
interface GigabitEthernet0/1/0/2
 shutdown
!
interface GigabitEthernet0/2/0/0
 Shutdown
!
interface GigabitEthernet0/2/0/1
```

```

shutdown
!
interface GigabitEthernet0/2/0/2
 shutdown
!
end

```

### Verification

Verifying the config

```
=====
```

```
RP/0/RSP0/CPU0:router#sh lldp interface <===== LLDP enabled only on GigEth0/2/0/0
Wed Jun 27 12:43:26.252 IST
```

```
GigabitEthernet0/2/0/0:
  Tx: enabled
  Rx: enabled
  Tx state: IDLE
  Rx state: WAIT FOR FRAME
RP/0/RSP0/CPU0:router#
```

```
RP/0/RSP0/CPU0:router# show lldp neighbors
Wed Jun 27 12:44:38.977 IST
```

Capability codes:

```

(R) Router, (B) Bridge, (T) Telephone, (C) DOCSIS Cable Device
(W) WLAN Access Point, (P) Repeater, (S) Station, (O) Other

```

```

Device ID      Local Intf      Hold-time  Capability  Port ID
ios            Gi0/2/0/0      120        R           Gi0/2/0/0    <===== LLDP
enabled only on GigEth0/2/0/0 and neighborhood seen for the same.

```

Total entries displayed: 1

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

## Dense Wavelength Division Multiplexing Tunable Optics

The Dense Wavelength-Division Multiplexing (DWDM) wavelengths of the DWDM-SFP10G-C module on the Cisco NCS 5500 Series Aggregation Services Routers is tunable. You can configure the DWDM ITU wavelengths by using the `itu channel` command in the interface configuration mode. The `itu channel` command ensures that the traffic continues to flow.

The following table contains the wavelength mapping information for the DWDM module:

Channel	Frequency (THz)	Wavelength (nm)
1	191.35	1566.723
2	191.40	1566.314
3	191.45	1565.905
4	191.50	1565.496
5	191.55	1565.087
6	191.60	1564.679
7	191.65	1564.271



Channel	Frequency (THz)	Wavelength (nm)
8	191.70	1563.863
9	191.75	1563.455
10	191.80	1563.047
11	191.85	1562.640
12	191.90	1562.233
13	191.95	1561.826
14	192.00	1561.419
15	192.05	1561.013
16	192.10	1560.606
17	192.15	1560.200
18	192.20	1559.794
19	192.25	1559.389
20	192.30	1558.983
21	192.35	1558.578
22	192.40	1558.173
23	192.45	1557.768
24	192.50	1557.363
25	192.55	1556.959
26	192.60	1556.555
27	192.65	1556.151
28	192.70	1555.747
29	192.75	1555.343
30	192.80	1554.940
31	192.85	1554.537
32	192.90	1554.134
33	192.95	1553.731
34	193.00	1553.329
35	193.05	1552.926

Channel	Frequency (THz)	Wavelength (nm)
36	193.10	1552.524
37	193.15	1552.122
38	193.20	1551.721
39	193.25	1551.319
40	193.30	1550.918
41	193.35	1550.517
42	193.40	1550.116
43	193.45	1549.715
44	193.50	1549.315
45	193.55	1548.915
46	193.60	1548.515
47	193.65	1548.115
48	193.70	1547.715
49	193.75	1547.316
50	193.80	1546.917
51	193.85	1546.518
52	193.90	1546.119
53	193.95	1545.720
54	194.00	1545.322
55	194.05	1544.924
56	194.10	1544.526
57	194.15	1544.128
58	194.20	1543.730
59	194.25	1543.333
60	194.30	1542.936
61	194.35	1542.539
62	194.40	1542.142
63	194.45	1541.746

Channel	Frequency (THz)	Wavelength (nm)
64	194.50	1541.349
65	194.55	1540.953
66	194.60	1540.557
67	194.65	1540.162
68	194.70	1539.766
69	194.75	1539.371
70	194.80	1538.976
71	194.85	1538.581
72	194.90	1538.186
73	194.95	1537.792
74	195.00	1537.397
75	195.05	1537.003
76	195.10	1536.609
77	195.15	1536.216
78	195.20	1535.822
79	195.25	1535.429
80	195.30	1535.036
81	195.35	1534.643
82	195.40	1534.250
83	195.45	1533.858
84	195.50	1533.465
85	195.55	1533.073
86	195.60	1532.681
87	195.65	1532.290
88	195.70	1531.898
89	195.75	1531.507
90	195.80	1531.116
91	195.85	1530.725

Channel	Frequency (THz)	Wavelength (nm)
92	195.90	1530.334
93	195.95	1529.944
94	196.00	1529.553
95	196.05	1529.163
96	196.10	1528.773



**Note** For more information on limitations of this feature and details about optical parameters, see [https://www.cisco.com/c/en/us/products/collateral/interfaces-modules/dwdm-transceiver-modules/data\\_sheet\\_c78-711186.html](https://www.cisco.com/c/en/us/products/collateral/interfaces-modules/dwdm-transceiver-modules/data_sheet_c78-711186.html).

## Configuring the DWDM Tunable Optics

Perform the following procedure to configure the DWDM Tunable Optics module:

1. Router# enable //Enables the privileged EXEC mode. If prompted, enter your password.
2. Router# configure terminal
3. Router(config)# interface tengigabitethernet 4/11 // Specifies the 10-Gigabit Ethernet interface to be configured. slot/port-Specifies the location of the interface.
4. Router(config-if)# itu channel 28 //Sets the ITU channel. *number* specifies the ITU channel number. The acceptable values are from 1-96.

### Verifying the ITU Configuration

The following example shows how to use the show controller optics command to check an ITU configuration:

```
RP/0/RP0/CPU0:ios#show controllers optics 0/0/0/16
Tue Sep  5 08:25:54.127 UTC

Controller State: Up

Transport Admin State: In Service

Laser State: Off

LED State: Off

Optics Status

    Optics Type:  SFP+ 10G DWDM Tunable
    DWDM carrier Info:  C BAND, MSA ITU Channel=49, Frequency=193.75THz,
    Wavelength=1547.316nm

    Alarm Status:
    -----
    Detected Alarms:
        LOW-RX0-PWR
```

LOS/LOL/Fault Status:

Laser Bias Current = 0.0 mA  
 Actual TX Power = 0.00 dBm  
 RX Power = 0.00 dBm

Performance Monitoring: Enable

THRESHOLD VALUES

-----

Parameter	High Alarm	Low Alarm	High Warning	Low Warning
Rx Power Threshold(dBm)	-2.9	-30.9	-7.0	-26.9
Tx Power Threshold(dBm)	5.9	-5.0	2.9	-1.0
LBC Threshold(mA)	75.00	25.00	70.00	30.00
Temp. Threshold(celsius)	75.00	-5.00	70.00	0.00
Voltage Threshold(volt)	3.63	2.97	3.46	3.13

Polarization parameters not supported by optics

Temperature = 38.00 Celsius  
 Voltage = 3.28 V

Transceiver Vendor Details

Form Factor : SFP+  
 Vendor Info

-----

Optics type : SFP+ 10G DWDM Tunable  
 Name : CISCO-OCLARO  
 OUI Number : 00.0b.40  
 Part Number : TRS7080FNCCA033  
 Rev Number : 0000  
 Serial Number : ONT2038009B  
 PID : DWDM-SFP10G-C  
 VID : V01

// DWDM Channel to Frequency/Wavelength Mapping  
 RP/0/RP0/CPU0:ios#show controllers optics 0/0/0/16 dwdm-carrier-map  
 Tue Sep 5 08:26:31.175 UTC  
 DWDM Carrier Band:: (null)  
 MSA ITU channel range supported: 1~96

DWDM Carrier Map table

ITU Ch Num	G.694.1 Ch Num	Frequency (THz)	Wavelength (nm)
1	-35	191.35	1566.723
2	-34	191.40	1566.314
3	-33	191.45	1565.905
4	-32	191.50	1565.496
5	-31	191.55	1565.087
6	-30	191.60	1564.679
7	-29	191.65	1564.271

8	-28	191.70	1563.863
9	-27	191.75	1563.455
10	-26	191.80	1563.047
11	-25	191.85	1562.640
12	-24	191.90	1562.233
13	-23	191.95	1561.826
14	-22	192.00	1561.419
15	-21	192.05	1561.013
16	-20	192.10	1560.606
17	-19	192.15	1560.200
18	-18	192.20	1559.794
19	-17	192.25	1559.389
20	-16	192.30	1558.983
21	-15	192.35	1558.578
22	-14	192.40	1558.173
23	-13	192.45	1557.768
24	-12	192.50	1557.363
25	-11	192.55	1556.959
26	-10	192.60	1556.555
27	-9	192.65	1556.151
28	-8	192.70	1555.747
29	-7	192.75	1555.343
30	-6	192.80	1554.940
31	-5	192.85	1554.537
32	-4	192.90	1554.134
33	-3	192.95	1553.731
34	-2	193.00	1553.329
35	-1	193.05	1552.926
36	0	193.10	1552.524
37	1	193.15	1552.122
38	2	193.20	1551.721
39	3	193.25	1551.319

40	4	193.30	1550.918
41	5	193.35	1550.517
42	6	193.40	1550.116
43	7	193.45	1549.715
44	8	193.50	1549.315
45	9	193.55	1548.915
46	10	193.60	1548.515
47	11	193.65	1548.115
48	12	193.70	1547.715
49	13	193.75	1547.316
50	14	193.80	1546.917
51	15	193.85	1546.518
52	16	193.90	1546.119
53	17	193.95	1545.720
54	18	194.00	1545.322
55	19	194.05	1544.924
56	20	194.10	1544.526
57	21	194.15	1544.128
58	22	194.20	1543.730
59	23	194.25	1543.333
60	24	194.30	1542.936
61	25	194.35	1542.539
62	26	194.40	1542.142
63	27	194.45	1541.746
64	28	194.50	1541.349
65	29	194.55	1540.953
66	30	194.60	1540.557
67	31	194.65	1540.162
68	32	194.70	1539.766
69	33	194.75	1539.371
70	34	194.80	1538.976
71	35	194.85	1538.581

```

-----
 72   36           194.90           1538.186
-----
 73   37           194.95           1537.792
-----
 74   38           195.00           1537.397
-----
 75   39           195.05           1537.003
-----
 76   40           195.10           1536.609
-----
 77   41           195.15           1536.216
-----
 78   42           195.20           1535.822
-----
 79   43           195.25           1535.429
-----
 80   44           195.30           1535.036
-----
 81   45           195.35           1534.643
-----
 82   46           195.40           1534.250
-----
 83   47           195.45           1533.858
-----
 84   48           195.50           1533.465
-----
 85   49           195.55           1533.073
-----
 86   50           195.60           1532.681
-----
 87   51           195.65           1532.290
-----
 88   52           195.70           1531.898
-----
 89   53           195.75           1531.507
-----
 90   54           195.80           1531.116
-----
 91   55           195.85           1530.725
-----
 92   56           195.90           1530.334
-----
 93   57           195.95           1529.944
-----
 94   58           196.00           1529.553
-----
 95   59           196.05           1529.163
-----
 96   60           196.10           1528.773

```

```
// Change Frequency
```

```

RP/0/RP0/CPU0:ios#conf t
Tue Sep  5 08:34:14.312 UTC
RP/0/RP0/CPU0:ios(config)#controller optics 0/0/0/16
RP/0/RP0/CPU0:ios(config-Optics)#shutdown
RP/0/RP0/CPU0:ios(config-Optics)#dwdm-carrier 50GHZ-grid frequency 19335
RP/0/RP0/CPU0:ios(config-Optics)#commit
Tue Sep  5 08:34:39.943 UTC
RP/0/RP0/CPU0:ios(config-Optics)#end
RP/0/RP0/CPU0:ios#show controllers optics 0/0/0/16
Tue Sep  5 08:34:42.824 UTC

```



Controller State: Administratively Down

Transport Admin State: Out Of Service

Laser State: Off

LED State: Off

Optics Status

Optics Type: SFP+ 10G DWDM Tunable  
 DWDM carrier Info: C BAND, MSA ITU Channel=41, Frequency=193.35THz,  
 Wavelength=1550.517nm

Alarm Status:

-----

Detected Alarms:

LOW-RX0-PWR

LOS/LOL/Fault Status:

Laser Bias Current = 0.0 mA

Actual TX Power = 0.00 dBm

RX Power = 0.00 dBm

Performance Monitoring: Enable

THRESHOLD VALUES

-----

Parameter	High Alarm	Low Alarm	High Warning	Low Warning
Rx Power Threshold(dBm)	-2.9	-30.9	-7.0	-26.9
Tx Power Threshold(dBm)	5.9	-5.0	2.9	-1.0
LBC Threshold(mA)	75.00	25.00	70.00	30.00
Temp. Threshold(celsius)	75.00	-5.00	70.00	0.00
Voltage Threshold(volt)	3.63	2.97	3.46	3.13

Polarization parameters not supported by optics

Temperature = 39.00 Celsius

Voltage = 3.28 V

Transceiver Vendor Details

Form Factor : SFP+

Vendor Info

-----

Optics type : SFP+ 10G DWDM Tunable  
 Name : CISCO-OCLARO  
 OUI Number : 00.0b.40  
 Part Number : TRS7080FNCCA033  
 Rev Number : 0000  
 Serial Number : ONT2038009B  
 PID : DWDM-SFP10G-C  
 VID : V01

// Change Wavelength

```
RP/0/RP0/CPU0:ios#conf t
Tue Sep  5 11:27:21.614 UTC
RP/0/RP0/CPU0:ios(config)#controller optics 0/0/0/16
RP/0/RP0/CPU0:ios(config-Optics)#shutdown
RP/0/RP0/CPU0:ios(config-Optics)#dwdm-carrier 50GHz-grid wavelength 1539766
```

```

RP/0/RP0/CPU0:ios(config-Optics)#commit
Tue Sep  5 11:28:14.547 UTC
RP/0/RP0/CPU0:ios(config-Optics)#end
RP/0/RP0/CPU0:ios#show controllers optics 0/0/0/16
Tue Sep  5 11:28:30.934 UTC

Controller State: Administratively Down

Transport Admin State: Out Of Service

Laser State: Off

LED State: Off

Optics Status

Optics Type: SFP+ 10G DWDM Tunable
DWDM carrier Info: C BAND, MSA ITU Channel=68, Frequency=194.70THz,
Wavelength=1539.766nm

Alarm Status:
-----
Detected Alarms:
          LOW-RX0-PWR

LOS/LOL/Fault Status:

Laser Bias Current = 0.0 mA
Actual TX Power = 0.00 dBm
RX Power = 0.00 dBm

Performance Monitoring: Enable

THRESHOLD VALUES
-----

```

Parameter	High Alarm	Low Alarm	High Warning	Low Warning
Rx Power Threshold(dBm)	-2.9	-30.9	-7.0	-26.9
Tx Power Threshold(dBm)	5.9	-5.0	2.9	-1.0
LBC Threshold(mA)	75.00	25.00	70.00	30.00
Temp. Threshold(celsius)	75.00	-5.00	70.00	0.00
Voltage Threshold(volt)	3.63	2.97	3.46	3.13

```

Polarization parameters not supported by optics

Temperature = 38.00 Celsius
Voltage = 3.28 V

Transceiver Vendor Details

Form Factor : SFP+
Vendor Info
-----
Optics type   : SFP+ 10G DWDM Tunable
Name         : CISCO-OCLARO
OUI Number   : 00.0b.40
Part Number  : TRS7080FNCCA033
Rev Number   : 0000
Serial Number : ONT2038009E
PID         : DWDM-SFP10G-C
VID         : V01

// Change Channel
RP/0/RP0/CPU0:ios#conf t

```

```
Tue Sep 5 08:29:03.648 UTC
RP/0/RP0/CPU0:ios(config)#controller optics 0/0/0/16
RP/0/RP0/CPU0:ios(config-Optics)#shutdown
RP/0/RP0/CPU0:ios(config-Optics)#dwdm-carrier 50GHz-grid ?
  frequency  Configure Frequency and Map to ITU Channel
  itu-ch     Configure the ITU 50GHz Grid ITU Channel
  wavelength Configure Wavelength and Map to ITU Channel
RP/0/RP0/CPU0:ios(config-Optics)#dwdm-carrier 50GHz-grid itu-ch 84
RP/0/RP0/CPU0:ios(config-Optics)#commit
```

```
RP/0/RP0/CPU0:ios#show controllers optics 0/0/0/16
Tue Sep 5 08:29:54.851 UTC
```

Controller State: Administratively Down

Transport Admin State: Out Of Service

Laser State: Off

LED State: Off

Optics Status

```
Optics Type: SFP+ 10G DWDM Tunable
DWDm carrier Info: C BAND, MSA ITU Channel=84, Frequency=195.50THz,
Wavelength=1533.465nm
```

Alarm Status:

```
-----
Detected Alarms:
    LOW-RX0-PWR
```

LOS/LOL/Fault Status:

```
Laser Bias Current = 0.0 mA
Actual TX Power = 0.00 dBm
RX Power = 0.00 dBm
```

Performance Monitoring: Enable

THRESHOLD VALUES

```
-----
```

Parameter	High Alarm	Low Alarm	High Warning	Low Warning
Rx Power Threshold(dBm)	-2.9	-30.9	-7.0	-26.9
Tx Power Threshold(dBm)	5.9	-5.0	2.9	-1.0
LBC Threshold(mA)	75.00	25.00	70.00	30.00
Temp. Threshold(celsius)	75.00	-5.00	70.00	0.00
Voltage Threshold(volt)	3.63	2.97	3.46	3.13

```
-----
```

Polarization parameters not supported by optics

```
Temperature = 38.00 Celsius
Voltage = 3.28 V
```

Transceiver Vendor Details

```
Form Factor : SFP+
Vendor Info
-----
Optics type   : SFP+ 10G DWDM Tunable
Name         : CISCO-OCLARO
```

```

OUI Number      : 00.0b.40
Part Number     : TRS7080FNCCA033
Rev Number      : 0000
Serial Number   : ONT2038009B
PID             : DWDM-SFP10G-C
VID             : V01

```

## Priority Flow Control (PFC)

Priority flow control (PFC; IEEE 802.1Qbb), which is also referred to as Class-based Flow Control (CBFC) or Per Priority Pause (PPP), is a mechanism that prevents frame loss that is due to congestion. PFC is similar to 802.3x Flow Control (pause frames) or link-level flow control (LLFC). However, PFC functions on a per class-of-service (CoS) basis.

During congestion, PFC sends a pause frame that indicates which CoS value needs to be paused. A PFC pause frame contains a 2-octet timer value for each CoS that indicates the length of time that the traffic needs to be paused. The unit of time for the timer is specified in pause quanta. A quanta is the time that is required for transmitting 512 bits at the speed of the port. The range is from 0 to 65535.




---

**Note** The router sends out the required amount of pause frames or pause-threshold (x-off) messages to achieve lossless queues. It also sends out resume-threshold (x-on) messages.

---

PFC asks the peer to stop sending frames of a particular CoS value by sending a pause frame to a well-known multicast address. This pause frame is a one-hop frame that is not forwarded when received by the peer. When the congestion is mitigated, the router stops sending the PFC frames to the upstream node.




---

**Note**

- PFC Rx traffic processing is enabled only if `hw-module profile priority-flow-control` command is enabled on the line card.
- `CISCO-PFC-EXT-MIB` is supported.

---

The PFC feature is only supported on the following line card or fixed chassis PIDs of the NCS5500 Series:

- NC55-36X100G
- NC55-18H18F
- NC55-24X100G-SE
- NC55-36X100G-S
- NC55-24H12F-SE
- NC55-36X100G-A-SE
- NCS-55A1-36H-SE-S
- NCS-55A1-36H-S
- NCS-55A1-24H
- NCS-55A1-48Q6H

## Restrictions for PFC

PFC has the following restrictions:

- PFC for transmit is not supported for internal traffic (recycle / loopback) and non-unicast traffic (broadcast / multicast).
- PFC for receive impacts all traffic meant to go out of the port. This may cause unintended drops to both unicast and non-unicast traffic because non-unicast traffic may consume buffer descriptors, thus starving unicast traffic. Hence, PFC is incompatible with sustained high rate non-unicast traffic in the system.
- PFC configuration will enable or disable both PFC transmit and receive functionalities. There is no support to enable only transmit or receive functions.
- PFC is only supported in the non-HQoS profile. For more details on this QoS prerequisite and configuration examples, please refer to *Modular QoS Configuration Guide for Cisco NCS 5500 Series Routers*.
- Link level flow control and PFC are not supported on the same interface simultaneously.
- PFC is only qualified on 40G and 100G physical interface types. PFC is not supported on breakout ports for these interface types and is not qualified on other interface types.
- Being an Ethernet feature, PFC has to be individually configured on the member interfaces of a bundle instead of the bundle interface. The user is expected to either enable or disable PFC on all members of the bundle, as a mix isn't supported.

## Configuring Priority Flow Control

Use the following steps to configure Priority Flow Control:

### Configuration:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(configure)#interface HundredGigE0/0/0/0
RP/0/RP0/CPU0:router(config)# priority-flow-control mode on
```

### Running configuration:

```
*Interface Level*
interface HundredGigE0/0/0/0
priority-flow-control mode on
```

### Verification:

Sample output for `show controllers hundredGigE 0/0/0/0 priority-flow-control` command is:

```
RP/0/RP1/CPU0:router#show controllers hundredGigE 0/0/0/0 priority-flow-control
Mon Oct 12 12:20:53.520 UTC
```

Priority flow control information for interface HundredGigE0/0/0/0:

```
Priority Flow Control:
Total Rx PFC Frames: 0
Total Tx PFC Frames: 1764273
Rx Data Frames Dropped: 0
CoS  Status  Rx Frames  Tx Frames
---  -
0   off      0          0
1   off      0          0
2   off      0          0
3   on       0          882032
```

```

4 on          0      882241
5 off         0          0
6 off         0          0
7 off         0          0

```

Priority flow control watchdog configuration:

(D) : Default value

U : Unconfigured

```

-----
Configuration Item           Global  Interface Effective
-----
PFC watchdog state           :      U      U  Enabled(D)
Poll interval                 :      U      U    100(D)
Shutdown multiplier           :      U      U      1(D)
Auto-restore multiplier       :      U      U    10(D)

```

Priority flow control watchdog statistics:

SAR: Auto restore and shutdown

```

-----
Traffic Class      :      0      1      2      3      4      5      6
7
-----
Watchdog Events    :      0      0      0      0      0      0      0
0
Shutdown Events   :      0      0      0      0      0      0      0
0
Auto Restore Events :      0      0      0      0      0      0      0
0
SAR Events         :      0      0      0      0      0      0      0
0
SAR Instantaneous Events :      0      0      0      0      0      0      0
0
Total Dropped Packets :      0      0      0      0      0      0      0
0
Dropped Packets   :      0      0      0      0      0      0      0
0

```

Priority flow control watchdog state machine state:

D - Disabled

M - Monitoring

S - Waiting For Shutdown

R - Waiting to Restore

```

-----
PFC Watchdog       : Enabled
Watchdog SM state : Traffic Class
                   7 6 5 4 3 2 1 0
                   - - - D D - - -

```

RP/0/RP1/CPU0:router#

Sample output for `show controllers hundredGigE 0/0/0/0 priority-flow-control statistics` command is:

```
RP/0/RP1/CPU0:router#show controllers hundredGigE 0/0/0/0 priority-flow-control statistics
```

Mon Oct 12 12:22:39.362 UTC

Priority flow control information for interface HundredGigE0/0/0/0:

```

Priority Flow Control:
  Total Rx PFC Frames: 0
  Total Tx PFC Frames: 1764273
  Rx Data Frames Dropped: 0

```

CoS	Status	Rx Frames	Tx Frames
0	off	0	0
1	off	0	0
2	off	0	0
3	on	0	882032
4	on	0	882241
5	off	0	0
6	off	0	0
7	off	0	0

Sample output for `clear controller hundredGigE 0/0/0/0 priority-flow-control statistics [traffic-class <0-7>]` is:

```
RP/0/RP1/CPU0:router#clear controller hundredGigE 0/0/0/0 priority-flow-control statistics
traffic-class 3
Mon Oct 12 12:22:48.778 UTC
RP/0/RP1/CPU0:router#show controllers hundredGigE 0/0/0/0 priority-flow-control statistics
Mon Oct 12 12:22:51.097 UTC
```

Priority flow control information for interface HundredGigE0/0/0/0:

```
Priority Flow Control:
Total Rx PFC Frames: 0
Total Tx PFC Frames: 882241
Rx Data Frames Dropped: 0
CoS  Status  Rx Frames  Tx Frames
---  -
0    off      0          0
1    off      0          0
2    off      0          0
3    on       0          0
4    on      0          882241
5    off      0          0
6    off      0          0
7    off      0          0
RP/0/RP1/CPU0:router#
```

## How to Configure Interfaces in Breakout Mode

### Information About Breakout

The router supports transmission of traffic in the breakout mode. The breakout mode enables a 40GbE, 100GbE, or 400GbE port to be split into multiple GbE ports.

Breakout Mode options:

- 4x10GbE
- 4x25GbE
- 2x50GbE
- 8x50GbE
- 4x100GbE
- 3x100GbE

- 2x100GbE
- 1x100GbE



**Note** • The supported breakout mode is dependent on the port and optic transceiver.

## Configure Breakout in a Port

This example shows how to configuring a 4x10GbE breakout in a port:

```
RP/0/RP0/CPU0:Router# configure
RP/0/RP0/CPU0:Router(config)# controller optics 0/1/0/28
RP/0/RP0/CPU0:Router(config-Optics)# breakout 4x10
RP/0/RP0/CPU0:Router(config-Optics)# commit
RP/0/RP0/CPU0:Router(config-Optics)# end
RP/0/RP0/CPU0:Router#
```

## Remove the Breakout Configuration

Removing the breakout configuration:

```
RP/0/RP0/CPU0:Router# configure
RP/0/RP0/CPU0:Router(config)# controller optics 0/1/0/28
RP/0/RP0/CPU0:Router(config-Optics)# no breakout 4x10
RP/0/RP0/CPU0:Router(config-Optics)# commit
RP/0/RP0/CPU0:Router(config-Optics)# end
```

## Verify a Breakout Configuration

Verifying a breakout configuration:

```
RP/0/RP0/CPU0:Router# show running-config controller optics 0/1/0/28
controller Optics0/1/0/28
breakout 4x10
!

RP/0/RP0/CPU0:Router# show int br location 0/1/CPU0 | i Te0/1/0/28
Te0/1/0/27/0      up      up      ARPA 10000 10000000
Te0/1/0/27/1      up      up      ARPA 10000 10000000
Te0/1/0/27/2      up      up      ARPA 10000 10000000
Te0/1/0/27/3      up      up      ARPA 10000 10000000
Te0/1/0/28/0      up      up      ARPA 10000 10000000
Te0/1/0/28/1      up      up      ARPA 10000 10000000
Te0/1/0/28/2      up      up      ARPA 10000 10000000
Te0/1/0/28/3      up      up      ARPA 10000 10000000
```



# How to Configure Interfaces in Breakout Mode

## Information About Breakout

The router supports transmission of traffic in the breakout mode. The breakout mode enables a 40GbE, 100GbE, or 400GbE port to be split into multiple GbE ports.

Breakout Mode options:

- 4x10GbE
- 4x25GbE
- 2x50GbE
- 8x50GbE
- 4x100GbE
- 3x100GbE
- 2x100GbE
- 1x100GbE



---

**Note**

- The supported breakout mode is dependent on the port and optic transceiver.
- 

## Configure Breakout in a Port

This example shows how to configuring a 4x10GbE breakout in a port:

```
RP/0/RP0/CPU0:Router# configure
RP/0/RP0/CPU0:Router(config)# controller optics 0/1/0/28
RP/0/RP0/CPU0:Router(config-Optics)# breakout 4x10
RP/0/RP0/CPU0:Router(config-Optics)# commit
RP/0/RP0/CPU0:Router(config-Optics)# end
RP/0/RP0/CPU0:Router#
```

## Remove the Breakout Configuration

Removing the breakout configuration:

```
RP/0/RP0/CPU0:Router# configure
RP/0/RP0/CPU0:Router(config)# controller optics 0/1/0/28
RP/0/RP0/CPU0:Router(config-Optics)# no breakout 4x10
RP/0/RP0/CPU0:Router(config-Optics)# commit
RP/0/RP0/CPU0:Router(config-Optics)# end
```

## Verify a Breakout Configuration

Verifying a breakout configuration:

```
RP/0/RP0/CPU0:Router# show running-config controller optics 0/1/0/28
controller Optics0/1/0/28
breakout 4x10
!
```

```
RP/0/RP0/CPU0:Router# show int br location 0/1/CPU0 | i Te0/1/0/28
Te0/1/0/27/0      up      up      ARPA 10000 10000000
Te0/1/0/27/1      up      up      ARPA 10000 10000000
Te0/1/0/27/2      up      up      ARPA 10000 10000000
Te0/1/0/27/3      up      up      ARPA 10000 10000000
Te0/1/0/28/0      up      up      ARPA 10000 10000000
Te0/1/0/28/1      up      up      ARPA 10000 10000000
Te0/1/0/28/2      up      up      ARPA 10000 10000000
Te0/1/0/28/3      up      up      ARPA 10000 10000000
```