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 1
- Information About Configuring Ethernet, on page 5
- Link Layer Discovery Protocol (LLDP), on page 12
- Dense Wavelength Division Multiplexing Tunable Optics, on page 15
- How to Configure Interfaces in Breakout Mode, on page 27

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
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.

---

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>
<thead>
<tr>
<th>Parameter</th>
<th>Configuration File Entry</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTU</td>
<td><code>mtu</code></td>
<td>• 1514 bytes for normal frames</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 1518 bytes for 802.1Q tagged frames.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 1522 bytes for Q-in-Q frames.</td>
</tr>
<tr>
<td>MAC address</td>
<td><code>mac address</code></td>
<td>Hardware burned-in address (BIA)</td>
</tr>
</tbody>
</table>

---

**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 be configured or set to autonegotiate with the 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.

### Configuring Network Interface Speed

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

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

**Note**

Cisco recommends configuring network interface speed in autonegotiation mode.

### 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.

```bash
#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:

```bash
#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

<table>
<thead>
<tr>
<th>Wavelength (nm)</th>
<th>Tx Power (dBm)</th>
<th>Rx Power (dBm)</th>
<th>Laser Bias (mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>n/a</td>
<td>0.0</td>
<td>1.0000</td>
</tr>
<tr>
<td></td>
<td>1.0000</td>
<td>0.0</td>
<td>1.0000</td>
</tr>
</tbody>
</table>

DOM alarms:
No alarms

Alarm Thresholds

<table>
<thead>
<tr>
<th>Alarm</th>
<th>High</th>
<th>Warning</th>
<th>Low</th>
<th>Warning</th>
<th>Alarm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transceiver Temp (C):</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Transceiver Voltage (V):</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Laser Bias (mA):</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Transmit Power (mW):</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>Transmit Power (dBm):</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Receive Power (mW):</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>Receive Power (dBm):</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td></td>
</tr>
</tbody>
</table>

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

```bash
#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, 100Mbit/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:

```plaintext
#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:

```plaintext
#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

<table>
<thead>
<tr>
<th>Lane</th>
<th>Wavelength</th>
<th>Tx Power (dBm)</th>
<th>Rx Power (mW)</th>
<th>Laser Bias (mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0 n/a</td>
<td>0.0</td>
<td>1.0000</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

DOM alarms:
No alarms

Alarm Thresholds

<table>
<thead>
<tr>
<th>Alarm</th>
<th>High</th>
<th>High</th>
<th>Low</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transceiver Temp (C):</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Transceiver Voltage (V):</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Laser Bias (mA):</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Transmit Power (mW):</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
</tr>
<tr>
<td>Transmit Power (dBm):</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Receive Power (mW):</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
</tr>
<tr>
<td>Receive Power (dBm):</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
</tbody>
</table>

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
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 parameters (full-duplex and pause) except speed. The speed is forced to the configured value.

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

```
#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, 100Mbit/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 runs, 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

<table>
<thead>
<tr>
<th>Wavelength</th>
<th>Tx Power</th>
<th>Rx Power</th>
<th>Laser Bias</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lane (nm)</td>
<td>(dBm)</td>
<td>(mW)</td>
<td>(mW)</td>
</tr>
<tr>
<td>--</td>
<td>--------</td>
<td>--------</td>
<td>----------</td>
</tr>
<tr>
<td>0</td>
<td>n/a</td>
<td>0.000</td>
<td>0.000</td>
</tr>
</tbody>
</table>

DOM alarms:
No alarms

Alarm Thresholds
<table>
<thead>
<tr>
<th>Alarm</th>
<th>High</th>
<th>Warning</th>
<th>Low</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transceiver Temp (C):</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Transceiver Voltage (V):</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Laser Bias (mA):</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Transmit Power (mW):</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
</tr>
<tr>
<td>Receive Power (mW):</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
</tr>
<tr>
<td>Receive Power (dBm):</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
</tbody>
</table>

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.

  - **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 enabled 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).

**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
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:

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

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
```
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:
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:

<table>
<thead>
<tr>
<th>Channel</th>
<th>Frequency (THz)</th>
<th>Wavelength (nm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>191.35</td>
<td>1566.723</td>
</tr>
<tr>
<td>2</td>
<td>191.40</td>
<td>1566.314</td>
</tr>
<tr>
<td>3</td>
<td>191.45</td>
<td>1565.905</td>
</tr>
<tr>
<td>4</td>
<td>191.50</td>
<td>1565.496</td>
</tr>
<tr>
<td>5</td>
<td>191.55</td>
<td>1565.087</td>
</tr>
<tr>
<td>6</td>
<td>191.60</td>
<td>1564.679</td>
</tr>
<tr>
<td>7</td>
<td>191.65</td>
<td>1564.271</td>
</tr>
<tr>
<td>8</td>
<td>191.70</td>
<td>1563.863</td>
</tr>
<tr>
<td>9</td>
<td>191.75</td>
<td>1563.455</td>
</tr>
<tr>
<td>10</td>
<td>191.80</td>
<td>1563.047</td>
</tr>
<tr>
<td>11</td>
<td>191.85</td>
<td>1562.640</td>
</tr>
<tr>
<td>12</td>
<td>191.90</td>
<td>1562.233</td>
</tr>
<tr>
<td>13</td>
<td>191.95</td>
<td>1561.826</td>
</tr>
<tr>
<td>14</td>
<td>192.00</td>
<td>1561.419</td>
</tr>
<tr>
<td>Channel</td>
<td>Frequency (THz)</td>
<td>Wavelength (nm)</td>
</tr>
<tr>
<td>---------</td>
<td>----------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>15</td>
<td>192.05</td>
<td>1561.013</td>
</tr>
<tr>
<td>16</td>
<td>192.10</td>
<td>1560.606</td>
</tr>
<tr>
<td>17</td>
<td>192.15</td>
<td>1560.200</td>
</tr>
<tr>
<td>18</td>
<td>192.20</td>
<td>1559.794</td>
</tr>
<tr>
<td>19</td>
<td>192.25</td>
<td>1559.389</td>
</tr>
<tr>
<td>20</td>
<td>192.30</td>
<td>1558.983</td>
</tr>
<tr>
<td>21</td>
<td>192.35</td>
<td>1558.578</td>
</tr>
<tr>
<td>22</td>
<td>192.40</td>
<td>1558.173</td>
</tr>
<tr>
<td>23</td>
<td>192.45</td>
<td>1557.768</td>
</tr>
<tr>
<td>24</td>
<td>192.50</td>
<td>1557.363</td>
</tr>
<tr>
<td>25</td>
<td>192.55</td>
<td>1556.959</td>
</tr>
<tr>
<td>26</td>
<td>192.60</td>
<td>1556.555</td>
</tr>
<tr>
<td>27</td>
<td>192.65</td>
<td>1556.151</td>
</tr>
<tr>
<td>28</td>
<td>192.70</td>
<td>1555.747</td>
</tr>
<tr>
<td>29</td>
<td>192.75</td>
<td>1555.343</td>
</tr>
<tr>
<td>30</td>
<td>192.80</td>
<td>1554.940</td>
</tr>
<tr>
<td>31</td>
<td>192.85</td>
<td>1554.537</td>
</tr>
<tr>
<td>32</td>
<td>192.90</td>
<td>1554.134</td>
</tr>
<tr>
<td>33</td>
<td>192.95</td>
<td>1553.731</td>
</tr>
<tr>
<td>34</td>
<td>193.00</td>
<td>1553.329</td>
</tr>
<tr>
<td>35</td>
<td>193.05</td>
<td>1552.926</td>
</tr>
<tr>
<td>36</td>
<td>193.10</td>
<td>1552.524</td>
</tr>
<tr>
<td>37</td>
<td>193.15</td>
<td>1552.122</td>
</tr>
<tr>
<td>38</td>
<td>193.20</td>
<td>1551.721</td>
</tr>
<tr>
<td>39</td>
<td>193.25</td>
<td>1551.319</td>
</tr>
<tr>
<td>40</td>
<td>193.30</td>
<td>1550.918</td>
</tr>
<tr>
<td>41</td>
<td>193.35</td>
<td>1550.517</td>
</tr>
<tr>
<td>42</td>
<td>193.40</td>
<td>1550.116</td>
</tr>
<tr>
<td>Channel</td>
<td>Frequency (THz)</td>
<td>Wavelength (nm)</td>
</tr>
<tr>
<td>---------</td>
<td>----------------</td>
<td>----------------</td>
</tr>
<tr>
<td>43</td>
<td>193.45</td>
<td>1549.715</td>
</tr>
<tr>
<td>44</td>
<td>193.50</td>
<td>1549.315</td>
</tr>
<tr>
<td>45</td>
<td>193.55</td>
<td>1548.915</td>
</tr>
<tr>
<td>46</td>
<td>193.60</td>
<td>1548.515</td>
</tr>
<tr>
<td>47</td>
<td>193.65</td>
<td>1548.115</td>
</tr>
<tr>
<td>48</td>
<td>193.70</td>
<td>1547.715</td>
</tr>
<tr>
<td>49</td>
<td>193.75</td>
<td>1547.316</td>
</tr>
<tr>
<td>50</td>
<td>193.80</td>
<td>1546.917</td>
</tr>
<tr>
<td>51</td>
<td>193.85</td>
<td>1546.518</td>
</tr>
<tr>
<td>52</td>
<td>193.90</td>
<td>1546.119</td>
</tr>
<tr>
<td>53</td>
<td>193.95</td>
<td>1545.720</td>
</tr>
<tr>
<td>54</td>
<td>194.00</td>
<td>1545.322</td>
</tr>
<tr>
<td>55</td>
<td>194.05</td>
<td>1544.924</td>
</tr>
<tr>
<td>56</td>
<td>194.10</td>
<td>1544.526</td>
</tr>
<tr>
<td>57</td>
<td>194.15</td>
<td>1544.128</td>
</tr>
<tr>
<td>58</td>
<td>194.20</td>
<td>1543.730</td>
</tr>
<tr>
<td>59</td>
<td>194.25</td>
<td>1543.333</td>
</tr>
<tr>
<td>60</td>
<td>194.30</td>
<td>1542.936</td>
</tr>
<tr>
<td>61</td>
<td>194.35</td>
<td>1542.539</td>
</tr>
<tr>
<td>62</td>
<td>194.40</td>
<td>1542.142</td>
</tr>
<tr>
<td>63</td>
<td>194.45</td>
<td>1541.746</td>
</tr>
<tr>
<td>64</td>
<td>194.50</td>
<td>1541.349</td>
</tr>
<tr>
<td>65</td>
<td>194.55</td>
<td>1540.953</td>
</tr>
<tr>
<td>66</td>
<td>194.60</td>
<td>1540.557</td>
</tr>
<tr>
<td>67</td>
<td>194.65</td>
<td>1540.162</td>
</tr>
<tr>
<td>68</td>
<td>194.70</td>
<td>1539.766</td>
</tr>
<tr>
<td>69</td>
<td>194.75</td>
<td>1539.371</td>
</tr>
<tr>
<td>70</td>
<td>194.80</td>
<td>1538.976</td>
</tr>
<tr>
<td>Channel</td>
<td>Frequency (THz)</td>
<td>Wavelength (nm)</td>
</tr>
<tr>
<td>---------</td>
<td>----------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>71</td>
<td>194.85</td>
<td>1538.581</td>
</tr>
<tr>
<td>72</td>
<td>194.90</td>
<td>1538.186</td>
</tr>
<tr>
<td>73</td>
<td>194.95</td>
<td>1537.792</td>
</tr>
<tr>
<td>74</td>
<td>195.00</td>
<td>1537.397</td>
</tr>
<tr>
<td>75</td>
<td>195.05</td>
<td>1537.003</td>
</tr>
<tr>
<td>76</td>
<td>195.10</td>
<td>1536.609</td>
</tr>
<tr>
<td>77</td>
<td>195.15</td>
<td>1536.216</td>
</tr>
<tr>
<td>78</td>
<td>195.20</td>
<td>1535.822</td>
</tr>
<tr>
<td>79</td>
<td>195.25</td>
<td>1535.429</td>
</tr>
<tr>
<td>80</td>
<td>195.30</td>
<td>1535.036</td>
</tr>
<tr>
<td>81</td>
<td>195.35</td>
<td>1534.643</td>
</tr>
<tr>
<td>82</td>
<td>195.40</td>
<td>1534.250</td>
</tr>
<tr>
<td>83</td>
<td>195.45</td>
<td>1533.858</td>
</tr>
<tr>
<td>84</td>
<td>195.50</td>
<td>1533.465</td>
</tr>
<tr>
<td>85</td>
<td>195.55</td>
<td>1533.073</td>
</tr>
<tr>
<td>86</td>
<td>195.60</td>
<td>1532.681</td>
</tr>
<tr>
<td>87</td>
<td>195.65</td>
<td>1532.290</td>
</tr>
<tr>
<td>88</td>
<td>195.70</td>
<td>1531.898</td>
</tr>
<tr>
<td>89</td>
<td>195.75</td>
<td>1531.507</td>
</tr>
<tr>
<td>90</td>
<td>195.80</td>
<td>1531.116</td>
</tr>
<tr>
<td>91</td>
<td>195.85</td>
<td>1530.725</td>
</tr>
<tr>
<td>92</td>
<td>195.90</td>
<td>1530.334</td>
</tr>
<tr>
<td>93</td>
<td>195.95</td>
<td>1529.944</td>
</tr>
<tr>
<td>94</td>
<td>196.00</td>
<td>1529.553</td>
</tr>
<tr>
<td>95</td>
<td>196.05</td>
<td>1529.163</td>
</tr>
<tr>
<td>96</td>
<td>196.10</td>
<td>1528.773</td>
</tr>
</tbody>
</table>
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. 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
Laser Bias Current = 0.0 mA
Actual TX Power = 0.00 dBm
RX Power = 0.00 dBm
Performance Monitoring: Enable
THRESHOLD VALUES
---------------------
<table>
<thead>
<tr>
<th>Parameter</th>
<th>High Alarm</th>
<th>Low Alarm</th>
<th>High Warning</th>
<th>Low Warning</th>
</tr>
</thead>
</table>
```

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

Configuring the DWDM Tunable Optics

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

DWDM Carrier Map table

<table>
<thead>
<tr>
<th>ITU Ch Num</th>
<th>G.694.1 Ch Num</th>
<th>Frequency (THz)</th>
<th>Wavelength (nm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 -35</td>
<td>191.35</td>
<td>1566.723</td>
<td></td>
</tr>
<tr>
<td>2 -34</td>
<td>191.40</td>
<td>1566.314</td>
<td></td>
</tr>
<tr>
<td>3 -33</td>
<td>191.45</td>
<td>1565.905</td>
<td></td>
</tr>
<tr>
<td>4 -32</td>
<td>191.50</td>
<td>1565.496</td>
<td></td>
</tr>
<tr>
<td>5 -31</td>
<td>191.55</td>
<td>1565.087</td>
<td></td>
</tr>
<tr>
<td>6 -30</td>
<td>191.60</td>
<td>1564.679</td>
<td></td>
</tr>
<tr>
<td>7 -29</td>
<td>191.65</td>
<td>1564.271</td>
<td></td>
</tr>
<tr>
<td>8 -28</td>
<td>191.70</td>
<td>1563.863</td>
<td></td>
</tr>
<tr>
<td>9 -27</td>
<td>191.75</td>
<td>1563.455</td>
<td></td>
</tr>
<tr>
<td>10 -26</td>
<td>191.80</td>
<td>1563.047</td>
<td></td>
</tr>
<tr>
<td>11 -25</td>
<td>191.85</td>
<td>1562.640</td>
<td></td>
</tr>
<tr>
<td>12 -24</td>
<td>191.90</td>
<td>1562.233</td>
<td></td>
</tr>
<tr>
<td>13 -23</td>
<td>191.95</td>
<td>1561.826</td>
<td></td>
</tr>
<tr>
<td>14 -22</td>
<td>192.00</td>
<td>1561.419</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>15</td>
<td>-21</td>
<td>192.05</td>
<td>1561.013</td>
</tr>
<tr>
<td>16</td>
<td>-20</td>
<td>192.10</td>
<td>1560.606</td>
</tr>
<tr>
<td>17</td>
<td>-19</td>
<td>192.15</td>
<td>1560.200</td>
</tr>
<tr>
<td>18</td>
<td>-18</td>
<td>192.20</td>
<td>1559.794</td>
</tr>
<tr>
<td>19</td>
<td>-17</td>
<td>192.25</td>
<td>1559.389</td>
</tr>
<tr>
<td>20</td>
<td>-16</td>
<td>192.30</td>
<td>1558.983</td>
</tr>
<tr>
<td>21</td>
<td>-15</td>
<td>192.35</td>
<td>1558.578</td>
</tr>
<tr>
<td>22</td>
<td>-14</td>
<td>192.40</td>
<td>1558.173</td>
</tr>
<tr>
<td>23</td>
<td>-13</td>
<td>192.45</td>
<td>1557.768</td>
</tr>
<tr>
<td>24</td>
<td>-12</td>
<td>192.50</td>
<td>1557.363</td>
</tr>
<tr>
<td>25</td>
<td>-11</td>
<td>192.55</td>
<td>1556.959</td>
</tr>
<tr>
<td>26</td>
<td>-10</td>
<td>192.60</td>
<td>1556.555</td>
</tr>
<tr>
<td>27</td>
<td>-9</td>
<td>192.65</td>
<td>1556.151</td>
</tr>
<tr>
<td>28</td>
<td>-8</td>
<td>192.70</td>
<td>1555.747</td>
</tr>
<tr>
<td>29</td>
<td>-7</td>
<td>192.75</td>
<td>1555.343</td>
</tr>
<tr>
<td>30</td>
<td>-6</td>
<td>192.80</td>
<td>1554.940</td>
</tr>
<tr>
<td>31</td>
<td>-5</td>
<td>192.85</td>
<td>1554.537</td>
</tr>
<tr>
<td>32</td>
<td>-4</td>
<td>192.90</td>
<td>1554.134</td>
</tr>
<tr>
<td>33</td>
<td>-3</td>
<td>192.95</td>
<td>1553.731</td>
</tr>
<tr>
<td>34</td>
<td>-2</td>
<td>193.00</td>
<td>1553.329</td>
</tr>
<tr>
<td>35</td>
<td>-1</td>
<td>193.05</td>
<td>1552.926</td>
</tr>
<tr>
<td>36</td>
<td>0</td>
<td>193.10</td>
<td>1552.524</td>
</tr>
<tr>
<td>37</td>
<td>1</td>
<td>193.15</td>
<td>1552.122</td>
</tr>
<tr>
<td>38</td>
<td>2</td>
<td>193.20</td>
<td>1551.721</td>
</tr>
<tr>
<td>39</td>
<td>3</td>
<td>193.25</td>
<td>1551.319</td>
</tr>
<tr>
<td>40</td>
<td>4</td>
<td>193.30</td>
<td>1550.918</td>
</tr>
<tr>
<td>41</td>
<td>5</td>
<td>193.35</td>
<td>1550.517</td>
</tr>
<tr>
<td>42</td>
<td>6</td>
<td>193.40</td>
<td>1550.116</td>
</tr>
<tr>
<td>43</td>
<td>7</td>
<td>193.45</td>
<td>1549.715</td>
</tr>
<tr>
<td>44</td>
<td>8</td>
<td>193.50</td>
<td>1549.315</td>
</tr>
<tr>
<td>45</td>
<td>9</td>
<td>193.55</td>
<td>1548.915</td>
</tr>
<tr>
<td>46</td>
<td>10</td>
<td>193.60</td>
<td>1548.515</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>47</td>
<td>11</td>
<td>193.65</td>
<td>1548.115</td>
</tr>
<tr>
<td>48</td>
<td>12</td>
<td>193.70</td>
<td>1547.715</td>
</tr>
<tr>
<td>49</td>
<td>13</td>
<td>193.75</td>
<td>1547.316</td>
</tr>
<tr>
<td>50</td>
<td>14</td>
<td>193.80</td>
<td>1546.917</td>
</tr>
<tr>
<td>51</td>
<td>15</td>
<td>193.85</td>
<td>1546.518</td>
</tr>
<tr>
<td>52</td>
<td>16</td>
<td>193.90</td>
<td>1546.119</td>
</tr>
<tr>
<td>53</td>
<td>17</td>
<td>193.95</td>
<td>1545.720</td>
</tr>
<tr>
<td>54</td>
<td>18</td>
<td>194.00</td>
<td>1545.322</td>
</tr>
<tr>
<td>55</td>
<td>19</td>
<td>194.05</td>
<td>1544.924</td>
</tr>
<tr>
<td>56</td>
<td>20</td>
<td>194.10</td>
<td>1544.526</td>
</tr>
<tr>
<td>57</td>
<td>21</td>
<td>194.15</td>
<td>1544.128</td>
</tr>
<tr>
<td>58</td>
<td>22</td>
<td>194.20</td>
<td>1543.730</td>
</tr>
<tr>
<td>59</td>
<td>23</td>
<td>194.25</td>
<td>1543.333</td>
</tr>
<tr>
<td>60</td>
<td>24</td>
<td>194.30</td>
<td>1542.936</td>
</tr>
<tr>
<td>61</td>
<td>25</td>
<td>194.35</td>
<td>1542.539</td>
</tr>
<tr>
<td>62</td>
<td>26</td>
<td>194.40</td>
<td>1542.142</td>
</tr>
<tr>
<td>63</td>
<td>27</td>
<td>194.45</td>
<td>1541.746</td>
</tr>
<tr>
<td>64</td>
<td>28</td>
<td>194.50</td>
<td>1541.349</td>
</tr>
<tr>
<td>65</td>
<td>29</td>
<td>194.55</td>
<td>1540.953</td>
</tr>
<tr>
<td>66</td>
<td>30</td>
<td>194.60</td>
<td>1540.557</td>
</tr>
<tr>
<td>67</td>
<td>31</td>
<td>194.65</td>
<td>1540.162</td>
</tr>
<tr>
<td>68</td>
<td>32</td>
<td>194.70</td>
<td>1539.766</td>
</tr>
<tr>
<td>69</td>
<td>33</td>
<td>194.75</td>
<td>1539.371</td>
</tr>
<tr>
<td>70</td>
<td>34</td>
<td>194.80</td>
<td>1538.976</td>
</tr>
<tr>
<td>71</td>
<td>35</td>
<td>194.85</td>
<td>1538.581</td>
</tr>
<tr>
<td>72</td>
<td>36</td>
<td>194.90</td>
<td>1538.186</td>
</tr>
<tr>
<td>73</td>
<td>37</td>
<td>194.95</td>
<td>1537.792</td>
</tr>
<tr>
<td>74</td>
<td>38</td>
<td>195.00</td>
<td>1537.397</td>
</tr>
<tr>
<td>75</td>
<td>39</td>
<td>195.05</td>
<td>1537.003</td>
</tr>
<tr>
<td>76</td>
<td>40</td>
<td>195.10</td>
<td>1536.609</td>
</tr>
<tr>
<td>77</td>
<td>41</td>
<td>195.15</td>
<td>1536.216</td>
</tr>
<tr>
<td>78</td>
<td>42</td>
<td>195.20</td>
<td>1535.822</td>
</tr>
</tbody>
</table>
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
-----------------

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

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>High Alarm</th>
<th>Low Alarm</th>
<th>High Warning</th>
<th>Low Warning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rx Power Threshold(dBm)</td>
<td>-2.9</td>
<td>-30.9</td>
<td>-7.0</td>
<td>-26.9</td>
</tr>
<tr>
<td>Tx Power Threshold(dBm)</td>
<td>5.9</td>
<td>-5.0</td>
<td>2.9</td>
<td>-1.0</td>
</tr>
<tr>
<td>LBC Threshold(mA)</td>
<td>75.00</td>
<td>25.00</td>
<td>70.00</td>
<td>30.00</td>
</tr>
<tr>
<td>Temp. Threshold(celsius)</td>
<td>75.00</td>
<td>-5.0</td>
<td>70.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Voltage Threshold(volt)</td>
<td>3.63</td>
<td>2.97</td>
<td>3.46</td>
<td>3.13</td>
</tr>
</tbody>
</table>

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

// 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

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

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
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 40 Gigabit Ethernet port to be split into four independent and logical 10 Gigabit Ethernet ports.

Configure Breakout in a Port

Configuring breakout in a port:

```
RP/0/RP0/CPU0:uut# configure
Fri Oct 11 23:58:47.165 UTC
RP/0/RP0/CPU0:uut(config)# controller optics 0/1/0/28
RP/0/RP0/CPU0:uut(config-Optics)# breakout 4x10
RP/0/RP0/CPU0:uut(config-Optics)# commit
Fri Oct 11 23:59:51.261 UTC
RP/0/RP0/CPU0:uut(config-Optics)# end
RP/0/RP0/CPU0:uut#
```

Remove the Breakout Configuration

Removing the breakout configuration:

```
RP/0/RP0/CPU0:uut# configure
Sat Oct 12 00:01:38.673 UTC
RP/0/RP0/CPU0:uut(config)# controller optics 0/1/0/28
RP/0/RP0/CPU0:uut(config-Optics)# no breakout 4x10
RP/0/RP0/CPU0:uut(config-Optics)# commit
Sat Oct 12 00:01:55.864 UTC
RP/0/RP0/CPU0:uut(config-Optics)# end
```

Verify a Breakout Configuration

Verifying a breakout configuration:

```
RP/0/RP0/CPU0:uut# show running-config controller optics 0/1/0/28
Sat Oct 12 00:11:33.962 UTC
controller Optics0/1/0/28
breakout 4x10
!
```

```
RP/0/RP0/CPU0:uut# show int br location 0/1/CPU0 | i Te0/1/0/28
Sat Oct 12 00:11:38.609 UTC
  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
```