EtherChannel for the Cisco CMTS

This document describes the features, benefits and configuration of Cisco EtherChannel technology on the Cisco Cable Modem Termination System (CMTS).

EtherChannel is a technology by which to configure and aggregate multiple physical Ethernet connections to form a single logical port with higher bandwidth. The first EtherChannel port configured on the Cisco CMTS serves as the EtherChannel bundle master by default, and each slave interface interacts with the network using the MAC address of the EtherChannel bundle master.

EtherChannel ports reside on a routing or bridging end-point. The router or switch uses EtherChannel to increase bandwidth utilization in either half- or full-duplex mode, and load balances the traffic across the multiple physical connections.

EtherChannel on the Cisco CMTS supports inter-VLAN routing with multiple devices and standards, and supports Ten Gigabit EtherChannel (GEC) on the Cisco cBR series routers.

Finding Feature Information

Your software release may not support all the features that are documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. The Feature Information Table at the end of this document provides information about the documented features and lists the releases in which each feature is supported.

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Hardware Compatibility Matrix for the Cisco cBR Series Routers

Note

The hardware components that are introduced in a given Cisco IOS-XE Release are supported in all subsequent releases unless otherwise specified.

Restrictions for EtherChannel on the Cisco CMTS

The following restrictions apply to both the Cisco uBR10012 and Cisco uBR7246VXR routers with Cisco IOS Release 12.2(9a)BC and earlier supported releases, and Cisco IOS Release 12.2(33)SCA and later releases:

• EtherChannel on the Cisco CMTS is limited to Network Layer 3 functions, and does not support Data-Link Layer 2 EtherChannel functions as with certain other Cisco product platforms.
• The Port Aggregation Protocol (PAgP) is not supported on the Cisco CMTS as with other Cisco product platforms (such as the CatOS switch).
• Only the IEEE 802.1Q trunking protocol is supported on the Cisco CMTS. ATM trunking is not supported on the Cisco uBR10012 or Cisco uBR7246VXR routers as of this release.
• Only the IEEE 802.1Q trunking protocol is supported on the Cisco CMTS. ATM trunking is not supported on the Cisco cBR series routers.
• The maximum supported links per bundle is 8.
• EtherChannel on Cisco CMTS supports only physical ports or interfaces that have the same speed.
• Starting Cisco IOS Release 12.2(33)BC, EtherChannel on the Cisco uBR10012 router does not support MQC QOS. You can use Equal Cost Multi Path (ECMP) load balancing instead of EtherChannel.
• EtherChannel on the Cisco cBR series routers does not support MQC QOS. You can use Equal Cost Multi Path (ECMP) load balancing instead of EtherChannel.
• Layer 3 configurations on member interfaces of EtherChannel are not supported.
• Port Channel configuration is not supported on Gigabit Ethernet interface of Cisco uBR-MC3GX60 line card.
• MAC Address Accounting feature on port channel is not supported.

Information About EtherChannel on the Cisco CMTS

Several Cisco product platforms currently support EtherChannel, such as the Cisco 7200 Series and Cisco Catalyst Switches. This document describes EtherChannel on the following Cisco CMTS router platforms:

This section contains the following:

Introduction to EtherChannel on the Cisco CMTS

EtherChannel is based on proven industry-standard technology. The Cisco CMTS supports EtherChannel with several benefits, including the following:

• EtherChannel on the Cisco CMTS supports subsecond convergence times.
• EtherChannel can be used to connect two switch devices together, or to connect a router with a switch.
• A single EtherChannel connection supports a higher bandwidth between the two devices.
• The logical port channels on either Cisco CMTS platform provide fault-tolerant, high-speed links between routers, switches, and servers.
• EtherChannel offers redundancy and high availability on the Cisco CMTS. Failure of one connection causes a switch or router to use load balancing across the other connections in the EtherChannel.
• Load balancing on the Cisco CMTS supports dynamic link addition and removal without traffic interruption.
• EtherChannel supports inter-VLAN trunking. Trunking carries traffic from several VLANs over a point-to-point link between the two devices. The network provides inter-VLAN communication with trunking between the Cisco CMTS router and one or more switches. In a campus network, trunking is configured over an EtherChannel link to carry the multiple VLAN information over a high-bandwidth channel.

Cisco Ten Gigabit EtherChannel on the Cisco cBR Series Routers

Cisco Ten Gigabit EtherChannel (GEC) is high-performance Ethernet technology that provides gigabit-per-second transmission rates. It provides flexible, scalable bandwidth with resiliency and load sharing across links for switches, router interfaces, and servers.

Ten GEC on the Cisco cBR series routers with the following EtherChannel capabilities:
• Supports IEEE 802.1Q encapsulation for inter-VLAN networking.
• Supports a maximum of eight physical Ten Gigabit Ethernet ports to be combined as one logical EtherChannel link.
• Supports bandwidth up to 40 Gbps (half duplex) for a combined total of up to 80 Gbps (full duplex).

How to Configure EtherChannel on the Cisco CMTS

This section contains the following:

Configuring Ten Gigabit EtherChannel on the Cisco CMTS

Before you begin
• Ten Gigabit Ethernet cabling is completed and the ports are operational on the router and network.
• LAN interfaces are configured and operational on the router and network, with IP addresses and subnet masks.

Note
• The Cisco cBR series routers support up to eight physical connectors to be configured as one logical Ten GEC port.

SUMMARY STEPS
1. enable
2. configure terminal
3. interface port-channel n
4. `exit`
5. `interface tengigabitethernet slot/subslot/port`
6. `shutdown`
7. Use one of the following commands:
   - For static Ten GEC configuration, use the `channel-group number` command.
   - For dynamic Ten GEC configuration, use the `channel-group number mode {active | passive}` command.
8. `no shutdown`
9. `end`

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td><strong>enable</strong></td>
</tr>
<tr>
<td>Example:</td>
<td>Enters privileged EXEC mode.</td>
</tr>
<tr>
<td><code>Router&gt; enable</code></td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td><code>configure terminal</code></td>
</tr>
<tr>
<td>Example:</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><code>Router# configure terminal</code></td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td><code>interface port-channel n</code></td>
</tr>
<tr>
<td>Example:</td>
<td>Creates an EtherChannel interface. The first EtherChannel interface</td>
</tr>
<tr>
<td><code>Router(config)# interface port-channel 1</code></td>
<td>configured becomes the bundle master for all ports in the EtherChannel group. The MAC address of the first EtherChannel interface is the MAC address for all EtherChannel interfaces in the group.</td>
</tr>
<tr>
<td></td>
<td>To remove an EtherChannel interface from the EtherChannel group, use the <strong>no</strong> form of this command.</td>
</tr>
<tr>
<td></td>
<td>If the first EtherChannel interface in the group is later removed, the second EtherChannel interface in the group becomes the bundle master by default.</td>
</tr>
<tr>
<td></td>
<td>Repeat this step on every EtherChannel port to be bundled into a Ten GEC group. This configuration must be present on all EtherChannel interfaces before the EtherChannel group can be configured.</td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td><code>exit</code></td>
</tr>
<tr>
<td>Example:</td>
<td>Exits interface configuration mode and returns to global configuration mode.</td>
</tr>
<tr>
<td><code>Router(config-if)# exit</code></td>
<td></td>
</tr>
</tbody>
</table>
## Purpose

### Step 5

**Command or Action**

`interface tengigabitethernet slot/subslot/port`

**Example:**

```
Router# interface gigabitethernet 4/1/0
```

**Purpose**

Selects the Ten Gigabit Ethernet interface that you wish to add as a member EtherChannel link in the EtherChannel bundle, and enters interface configuration mode.

**Note**

We recommend that the link being added to the Cisco CMTS EtherChannel be shut down prior to configuring it as a member of the EtherChannel. Use the `shutdown` command in interface configuration mode immediately before completing the following steps in this procedure.

### Step 6

**Command or Action**

`shutdown`

**Example:**

```
Router(config-if)# shutdown
```

**Purpose**

Shuts down the interface selected in step 5 before configuring it as a member of the EtherChannel.

### Step 7

Use one of the following commands:

- For static Ten GEC configuration, use the `channel-group number` command.
- For dynamic Ten GEC configuration, use the `channel-group number mode {active | passive}` command.

**Example:**

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

**Purpose**

Adds the Ten Gigabit Ethernet interface to the EtherChannel Group, associating that interface with an EtherChannel link. To remove an EtherChannel group and the associated ports from the Cisco CMTS, use the `no` form of this command.

### Step 8

**Command or Action**

`no shutdown`

**Example:**

```
Router(config-if)# no shutdown
```

**Purpose**

Enables the interface on which EtherChannel is configured.

### Step 9

**Command or Action**

`end`

**Example:**

```
Router(config-if)# end
```

**Purpose**

Returns to privileged EXEC mode. IP traffic should be visible on the network with completion of the above steps.

## Troubleshooting Tips

Once interface operations are confirmed (prior to this procedure), and EtherChannel configurations have been verified (next procedure), any difficulty experienced through the EtherChannel links may pertain to inter-VLAN or IP routing on the network, or perhaps very high bandwidth consumption.

See the “Additional References” section on page 10 for further resources in troubleshooting these and additional configurations.
What to Do Next

Additional IP, access list, inter-VLAN or load balancing configurations may be made to the Cisco CMTS and these changes will be supported in the running EtherChannel configuration without service disruption from EtherChannel.

Refer to the “Additional References” section on page 11 for more information.

Verifying EtherChannel on the Cisco CMTS

Links can be added or removed from an EtherChannel interface without traffic interruption. If an Ethernet link in an EtherChannel interface fails, traffic previously carried over the failed link switches to the remaining links within the EtherChannel. There are a number of events that can cause a link to be added or removed including adding or removing a link using commands and simulating link failure and recovery (as with (no)shutdown links).

Cisco EtherChannel supports online insertion and removal (OIR) of field-replaceable units (FRUs) in the Cisco CMTS chassis. Ports that remain active during OIR of one FRU will take over and support the traffic bandwidth requirements without service disruption. However, OIR is not described in this procedure.

Refer to the “Additional References” section on page 10 for complete OIR procedures and guidelines for the respective FRU.

Procedure

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example: Router&gt; enable</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong> show interface port-channel n</td>
<td>Verifies the EtherChannel configuration on the Cisco CMTS for the selected EtherChannel group.</td>
</tr>
<tr>
<td>Example: Router# show interface port-channel 1</td>
<td>• n—The identifying number for the Port Channel group to display.</td>
</tr>
</tbody>
</table>

Configuration Examples for EtherChannel on the Cisco CMTS

The sequential configuration example and commands in Table 2 illustrate the configuration of Etherchannel on a Cisco uBR7264VXR router with a five-port sensor:

The following example illustrates Gigabit EtherChannel (GEC) information for the port-channel interface of 2 as configured on a Cisco uBR10012 router with the PRE2 performance routing engine model.

The following example illustrates Ten Gigabit EtherChannel information for the port-channel interface of 2. This configuration is comprised of three GEC port channels as follows:

• Member 0 is the GEC interface bundle master.
• Member 2 is the final slave interface in this GEC group.
These three port-channel interfaces (members) comprise one GEC group that is set up with a GEC peer on the network.

Router# show interface port-channel 2
Port-channel2 is up, line protocol is up
Hardware is GEChannel, address is 8888.8888.8888 (bia 0000.0000.0000)
Internet address is 101.101.101.1/16
MTU 1500 bytes, BW 3000000 Kbit, DLY 10 usec,
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, loopback not set
Keepalive set (10 sec)
ARP type: ARPA, ARP Timeout 04:00:00
No. of members in this channel: 3
No. of configured members in this channel: 3
No. of passive members in this channel: 0
No. of active members in this channel: 3
Member 0 : GigabitEthernet1/0/0 , Full-duplex, 1000Mb/s
Member 1 : GigabitEthernet3/0/0 , Full-duplex, 1000Mb/s
Member 2 : GigabitEthernet2/0/0 , Full-duplex, 1000Mb/s
No. of Non-active members in this channel: 0
Last input 00:00:02, output never, output hang never
Last clearing of "show interface" counters never
Input queue: 0/225/0/0 (size/max/drops/flushes); Total output drops: 0
Queueing strategy: fifo
Output queue: 0/120 (size/max)
30 second input rate 17292000 bits/sec, 9948 packets/sec
30 second output rate 17315000 bits/sec, 9935 packets/sec
866398790 packets input, 3324942446 bytes, 0 no buffer
Received 2 broadcasts, 0 runts, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
0 watchdog, 0 multicast, 0 pause input
0 input packets with dribble condition detected
866394055 packets output, 3323914794 bytes, 0 underruns
0 output errors, 0 collisions, 0 interface resets
0 babbles, 0 late collision, 0 deferred
0 lost carrier, 0 no carrier, 0 pause output
0 output buffer failures, 0 output buffers swapped out

This configuration is comprised of three Ten GEC port channels as follows:

- Member 0 is the Ten GEC interface bundle master.
- Member 2 is the final slave interface in this Ten GEC group.
- These three port-channel interfaces (members) comprise one Ten GEC group that is set up with a Ten GEC peer on the network.

Router# show interface port-channel 2
Port-channel2 is up, line protocol is up
Hardware is GEChannel, address is 8888.8888.8888 (bia 0000.0000.0000)
Internet address is 101.101.101.1/16
MTU 1500 bytes, BW 3000000 Kbit, DLY 10 usec,
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, loopback not set
Keepalive set (10 sec)
ARP type: ARPA, ARP Timeout 04:00:00
No. of members in this channel: 3
No. of configured members in this channel: 3
No. of passive members in this channel: 0
No. of active members in this channel: 3
Member 0 : TenGigabitEthernet4/1/0 , Full-duplex, 1000Mb/s
Member 1 : TenGigabitEthernet4/1/1 , Full-duplex, 1000Mb/s
Member 2 : TenGigabitEthernet4/1/2 , Full-duplex, 1000Mb/s
Configuration Examples for EtherChannel on the Cisco CMTS

The following example illustrates GEC information for the port-channel interface of 2 as configured on a Cisco uBR7246VXR router.

This configuration is comprised of three port-channel interfaces (members) as follows:

- **Member 0** is the GEC interface bundle master.
- **Member 2** is the final slave interface in this GEC group.
- **These three port-channel interfaces (members)** comprise one GEC group that is set up with a GEC peer on the network.

Router# show interfaces port-channel 2
Port-channel2 is up, line protocol is up
Hardware is GEChannel, address is 000b.bf7d.9c01 (bia 000b.bf7d.9c00)
Internet address is 101.101.101.2/16
MTU 1500 bytes, BW 3000000 Kbit, DLY 10 usec,
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, loopback not set
Keepalive set (10 sec)
ARP type: ARPA, ARP Timeout 04:00:00
No. of members in this channel: 3
No. of configured members in this channel: 3
No. of passive members in this channel: 0
No. of active members in this channel: 3
  Member 0 : GigabitEthernet0/3 , Full-duplex, 1000Mb/s
  Member 1 : GigabitEthernet0/2 , Full-duplex, 1000Mb/s
  Member 2 : GigabitEthernet0/1 , Full-duplex, 1000Mb/s
No. of Non-active members in this channel: 0
Last input 00:13:48, output never, output hang never
Last clearing of "show interface" counters never
Input queue: 0/225/0/0 (size/max/drops/flushes); Total output drops: 0
Queueing strategy: fifo
Output queue: 0/120 (size/max)
30 second input rate 17358000 bits/sec, 9999 packets/sec
30 second output rate 17359000 bits/sec, 10000 packets/sec
  86863935 packets input, 3809968911 bytes, 0 no buffer
  Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
  0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
  0 watchdog, 0 multicast, 0 pause input
  0 input packets with dribble condition detected
  868642883 packets output, 3811242413 bytes, 0 underruns
  2 output errors, 0 collisions, 0 interface resets
  0 babbles, 0 late collision, 0 deferred
  0 lost carrier, 0 no carrier, 0 pause output
  0 output buffer failures, 0 output buffers swapped out
The following example illustrates FastEtherChannel (FEC) information for the port channel interface of 1 as configured on a Cisco uBR7246VXR router.

This configuration is comprised of four port channel interfaces (members) as follows:

- **Member 0**
- **Member 0** is the GEC interface bundle master.
- **Member 3** is the final slave interface in this FEC group.
- These four port-channel interfaces (members) comprise one FEC group that is set up with an FEC peer on the network.

```
Router# show interfaces port-channel 1
Port-channel1 is up, line protocol is up
Hardware is FEChannel, address is 000b.bf7d.9c1c (bia 000b.bf7d.9c00)
Description: test
Internet address is 100.100.100.1/24
MTU 1500 bytes, BW 400000 Kbit, DLY 100 usec,
reliability 255/255, txload 11/255, rxload 11/255
Encapsulation ARPA, loopback not set
Keepalive set (10 sec)
ARP type: ARPA, ARP Timeout 04:00:00
No. of members in this channel: 4
No. of configured members in this channel: 4
No. of passive members in this channel: 0
No. of active members in this channel: 4
Member 0 : FastEthernet2/1 , Full-duplex, 100Mb/s
Member 1 : FastEthernet2/0 , Full-duplex, 100Mb/s
Member 2 : FastEthernet1/1 , Full-duplex, 100Mb/s
Member 3 : FastEthernet1/0 , Full-duplex, 100Mb/s
No. of Non-active members in this channel: 0
Last input 00:14:48, output never, output hang never
Last clearing of "show interface" counters never
Input queue: 0/300/0/0 (size/max/drops/flushes); Total output drops: 0
Queueing strategy: fifo
Output queue: 0/160 (size/max)
30 second input rate 17358000 bits/sec, 9998 packets/sec
30 second output rate 17357000 bits/sec, 9998 packets/sec
869366601 packets input, 3968956491 bytes
868944538 packets output, 3876736548 bytes, 0 underruns
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
0 watchdog
0 input packets with dribble condition detected
0 output errors, 0 collisions, 0 interface resets
0 babbles, 0 late collision, 0 deferred
0 lost carrier, 0 no carrier
0 output buffer failures, 0 output buffers swapped out
```
## Additional References

### Related Documents

<table>
<thead>
<tr>
<th>Related Topic</th>
<th>Document Title</th>
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<tbody>
<tr>
<td><strong>EtherChannel for Cisco Products</strong></td>
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<tr>
<td><strong>Cisco uBR10012 Universal Broadband Router</strong></td>
<td></td>
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<td><strong>Cisco uBR7246VXR Universal Broadband Router</strong></td>
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<tr>
<td><strong>WAN and Inter-VLAN Routing with the Cisco CMTS</strong></td>
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<tr>
<td><strong>Configuring Additional Devices for EtherChannel</strong></td>
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### Standards and RFCs

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<th>Standards</th>
<th>Title</th>
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<td></td>
<td><a href="http://ieeexplore.ieee.org/xpl/tocresult.jsp?isNumber=27089">http://ieeexplore.ieee.org/xpl/tocresult.jsp?isNumber=27089</a></td>
</tr>
</tbody>
</table>

### Technical Assistance

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<tr>
<th>Description</th>
<th>Link</th>
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</thead>
<tbody>
<tr>
<td>The Cisco Support website provides extensive online resources,</td>
<td><a href="http://www.cisco.com/cisco/web/support">http://www.cisco.com/cisco/web/support</a></td>
</tr>
<tr>
<td>including documentation and tools for troubleshooting and resolving</td>
<td></td>
</tr>
<tr>
<td>technical issues with Cisco products and technologies.</td>
<td></td>
</tr>
<tr>
<td>To receive security and technical information about your products,</td>
<td></td>
</tr>
<tr>
<td>you can subscribe to various services, such as the Product Alert</td>
<td></td>
</tr>
<tr>
<td>Tool (accessed from Field Notices), the Cisco Technical Services Newsletter,</td>
<td></td>
</tr>
<tr>
<td>and Really Simple Syndication (RSS) Feeds.</td>
<td></td>
</tr>
<tr>
<td>Access to most tools on the Cisco Support website requires a Cisco.com user</td>
<td></td>
</tr>
<tr>
<td>ID and password.</td>
<td></td>
</tr>
</tbody>
</table>

### Feature Information for EtherChannel on Cisco CMTS

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

**Note**

The following table lists the software release in which a given feature is introduced. Unless noted otherwise, subsequent releases of that software release train also support that feature.

**Table 1: Feature Information for EtherChannel on Cisco CMTS**

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>EtherChannel on Cisco CMTS</td>
<td>Cisco IOS XE Everest 16.6.1</td>
<td>This feature was integrated into Cisco IOS XE Everest 16.6.1 on the Cisco cBR Series Converged Broadband Router.</td>
</tr>
</tbody>
</table>