Configuring the Half-Height Gigabit Ethernet Line Card for the Cisco uBR10012 Universal Broadband Router

This document describes procedures and Cisco IOS commands for configuring and monitoring the Half-Height Gigabit Ethernet (HHGE) line card in the Cisco uBR10012 router.

History for the Half-Height Gigabit Ethernet Line Card Feature Cisco uBR10012 Universal Broadband Router

Release	Modification
12.3(21)BC1	Support for the GLC-T SFP module.
12.3(13)BC	This feature was introduced.

Finding Support Information for Platforms and Cisco IOS Software Images

Use Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access Cisco Feature Navigator at http://www.cisco.com/go/fn. You must have an account on Cisco.com. If you do not have an account or have forgotten your username or password, click **Cancel** at the login dialog box and follow the instructions that appear.

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Prerequisites for Configuring the Half-Height Gigabit Ethernet Line Card

To use the HHGE line card, you must ensure the following:

- Cisco IOS Release 12.3(13)BC or later release is installed on your system.
- A Cisco Performance Routing Engine 2 (PRE2) module is installed in the router.

Restrictions for Configuring the Half-Height Gigabit Ethernet Line Card

The following restrictions apply to the HHGE line card:

- It must be used with a PRE2 module.
- It must be placed only in slot 3 and slot 4 in the Cisco uBR10012 universal broadband router. Using slots 1 and slot 2 causes a conflict with the Timing, Communication, and Control Plus (TCC+) modules.

Information About the Half-Height Gigabit Ethernet Line Card

This section describes the Cisco Half-Height Gigabit Ethernet line card.

Benefits

The HHGE provides the following benefits to cable Multiple Service Operators (MSOs), service providers, and their partners and customers:

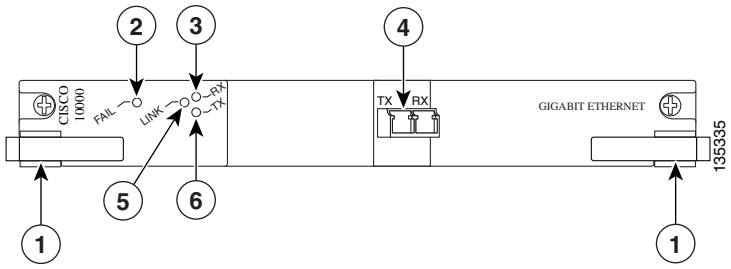
- Provides 1-port full- duplex 1-Gbps data rate
- Supports EtherChannel network
- Supports OIR for 1000BASE-SX or 1000BASE-LX GBICs, as described in the IEEE 802.3z specifications
- Provides redundant trunks in one chassis slot
- Increases throughput density and load balancing, which enhances high availability
- Supports trunk redundancy in a single slot, which frees up a slot for additional subscriber cards

Feature Overview

The HHGE line card (see Figure 1) contains a single Gigabit Ethernet port that provides a trunk uplink to switches and core routers. The HHGE line card provides the Cisco uBR10012 universal broadband router with an IEEE 802.3z- compliant Ethernet interface that can run up to 1 Gbps in full-duplex mode. The line card uses a small form-factor pluggable (SFP) GigaBit Interface Converter (GBIC) module and supports a variety of Gigabit Ethernet interface types (SX, LX/LH, and ZX), which you can change or upgrade at any time.

Faceplate and LEDs

Figure 1 Half-Height Gigabit Ethernet Line Card Faceplate



1	Ejector levers	4	SFP Gigabit Interface Converter
2	FAIL LED (yellow)	5	Link status LED (green)
3	Receive packet LED (green)	6	Transmit packet LED (green)

LEDs

This HHGE line card faceplate contains the following LEDs that continuously indicate line card status as well as the status of the port during operation (see Figure 1):

- FAIL (yellow)—This LED lights during portions of the POST (Power-On Self Test), but remains off after the POST on a properly working line card. If the line card fails during operation, this LED lights and an alarm event occurs.

  The FAIL LED blinks during the following SFP GBIC faults:

  - An SFP GBIC other than a Cisco brand is inserted.
  - A non-Gigabit Ethernet SFP GBIC is inserted.
  - A hardware problem occurs in a valid SFP GBIC.
- LINK (green)—When on, this LED indicates that a carrier signal exists. If negotiation is enabled (at both ends), it indicates successful completion and the port can pass traffic.

  Note This LED can also be on if the line card is in internal loopback.

  When off, this LED indicates that no carrier signal is detected, negotiation failed, or the port is administratively down.
- RX (green)—When on, this status LED indicates that packets are being received. When this LED is off, the line card is not receiving packets.
- TX (green)—When on, this status LED indicates that packets are being transmitted. When this LED is off, the line card is not transmitting packets.

  Note Because this line card operates in full-duplex mode, both the RX and TX LEDs can be on at the same time.

SFP Gigabit Ethernet Interface Converter Modules and Cable Specifications

The HHGE line card supports single Ethernet interfaces based on SFP GBIC technology. The following SFPs are supported by this line card:

- 1000BASE-SX SFP—The SFP-GE-S, 1000BASE-SX SFP operates on ordinary multimode fiber optic link spans of up to 550 meters in length.
- 1000BASE-LX/LH SFP—The SFP-GE-L, 1000BASE-LX/LH SFP operates on ordinary single-mode fiber optic link spans of up to 10,000 meters in length.
- 1000BASE-ZX SFP—The GLC-ZX-SM, 1000BASE-ZX SFP operates on ordinary single-mode fiber optic link spans of up to 70 kilometers (km) in length. Link spans of up to 100 km are possible using premium single-mode fiber or dispersion-shifted single-mode fiber. The SFP provides an optical link budget of 23 dB—the precise link span length depends on multiple factors such as fiber quality, number of splices, and connectors.

  When shorter distances of single-mode fiber are used, it may be necessary to insert an inline optical attenuator in the link, to avoid overloading the receiver. A 5-decibel (dB) or 10-dB inline optical attenuator should be inserted between the fiber optic cable plant and the receiving port on the GLC-ZX-SM at each end of the link whenever the fiber optic cable span is less than 25 km.
- 1000BASE-T SFP— Support for the GLC-T, 1000BASE-T SFP module was introduced in Cisco IOS Release 12.3(23)BC1.

  The Cisco GLC-T, 1000BASE-T SFP module connects a Gigabit Interface Converter (GBIC) port to Category 5 wiring via a standard RJ-45 interface. The maximum Category 5 wiring distance is 100 m. The module provides with an option of connecting to a backhaul network interface. For more information on the Cisco GLC-T 1000BASE-T SFP, see *Gigabit Interface Converter (GBIC) Module and Small Form-Factor Pluggable (SFP) GBIC Module Install. Info. and Specifications* http://www.cisco.com/en/US/docs/routers/7200/install_and_upgrade/gbic_sfp_modules_install/5067g.html

Note The required line card SFP GBIC is shipped already installed in the line card. Cisco sells individual SFP GBICs separately and you can change the type of Gigabit Ethernet interface supported by this line card by simply changing its SFP GBIC.

Table 1 lists the interface types supported by the HHGE line card.

Table 1 GBIC Port Cabling Specifications

SFP GBIC	Wavelength (nm)	Fiber Type	Core Size (microns)	Modal Bandwidth (MHz/km)	Cable Distance
1000BASE-SX SFP-GE-S	850	MMF	62.5 62.5 50.0 50.0	160 200 400 500	722 ft (220 m) 902 ft (275 m) 1640 ft (500 m) 1804 ft (550 m)
1000BASE-LX/LH SFP-GE-L	1300	MMF[1] SMF	62.5 50.0 50.0 8 to 10	500 400 500 —	1804 ft (550 m) 1804 ft (550 m) 1804 ft (550 m) 32,808 ft (10 km)

Table 1 GBIC Port Cabling Specifications

SFP GBIC	Wavelength (nm)	Fiber Type	Core Size (microns)	Modal Bandwidth (MHz/km)	Cable Distance
1000BASE-ZX GLC-ZX-SM	1550	SMF	9, 10	—	43.4 to 62 miles (70 to 100 km)[2]
1000BASE-T GLC-T	NA	NA	NA	NA	328 ft (100 m)

1. A mode-conditioning patch cord is required. Using an ordinary patch cord with MMF, 1000BASE-LX/LH SFP modules, and a short link distance (ten meters) can cause transceiver saturation resulting in an elevated bit error rate (BER). In addition, when using the LX/LH SFP module with 62.5-micron diameter MMF, you must install a mode-conditioning patch cord between the SFP module and the MMF cable on both the transmit and receive ends of the link. The mode-conditioning patch cord is required for link distances greater than 984 ft (300 m).
2. The 1000BASE-ZX SFP module can reach up to 100 km by using dispersion-shifted SMF or low attenuation SMF; the distance depends on fiber quality, number of splices, and connectors.

For more information about the SFPs, see the following URL:
http://www.cisco.com/en/US/products/hw/modules/ps5000/tsd_products_support_series_home.html

Gigabit Ethernet Line Card Default Values

Table 2 lists default values for the Gigabit Ethernet line cards. Table 2 includes the command used for modifying a default value and indicates if a value needs to be the same (or opposite) on the remote end of the connection.

Table 2 Gigabit Ethernet Line Card Defaults

Command Name	Default Setting	Command Syntax	Remote Side Setting
auto-negotiation	Enabled	[**no**] **negotiation auto**	Same
mtu	1500 (half-height)	**mtu** [bytes]	Same

Half-Height Gigabit Ethernet Line Card Syntax

To specify an interface number in a configuration command, use the syntax in Table 3 to identify interfaces on the HHGE line cards.

Table 3 HHGE Interface Syntax

Card	Slot	Subslot	Port
HHGE	3 and 4	0 and 1	0

The following example shows the syntax for configuring an HHGE line card in slot 3:

```
Router(config)# interface GigabitEthernet 3/0/0
```

How to Configure the Half-Height Gigabit Ethernet Line Card

The following sections describe configuration commands used for configuring the HHGE line card.

Configuring the Interface

Use the following procedure to create a basic configuration (enabling an interface and specifying IP routing) for a Gigabit Ethernet interface. Be prepared with the information you need, such as the interface IP address.

Prerequisites

Cisco IOS Release 12.3(21)BC1 or later release

Restrictions

The HHGE must be in slots 3/0/0, 3/1/0, 4/0/0, or 4/1/0.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface gigabitethernet** [*slot/subslot/port*]
4. **ip address** [*xxx.xxx.xxx.xx*]
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose
Step 3	**interface gigabitethernet** [*slot/subslot/port*] **Example:** `Router#(config t) interface gigabitethernet 3/0/0`	Selects the interface slot, subslot, and port, and enters interface configuration mode.
Step 4	**ip address** [*xxx.xxx.xxx.xx xxx.xxx.xxx.x*] **Example:** `Router(config-if)# ip address 192.168.172.12 255.255.255.0`	Assigns an IP address and subnet mask to the interface.
Step 5	**end** **Example:** `Router(config-if)# end`	Exits the configuration mode.

Example

The following example defines the initial steps for configuring the HHGE interface:

```
Router# configure terminal
Router(config)# interface gigabitethernet 3/0/0
Router(config-if)# ip address 192.168.172.12 255.255.255.0
Router(config-if)# end
```

Enabling Auto-Negotiation

To set auto-negotiation mode for a Gigabit Ethernet interface, use the **negotiation auto** command.

To remove auto-negotiation, use the **no** form of the command.

Selecting the **no negotiation auto** command causes the interface to enter a state called *force-link-up*.

Prerequisites

None

Restrictions

None

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface gigabitethernet** [*slot/subslot/port*]
4. **negotiation auto**
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface gigabitethernet** [*slot/subslot/port*] **Example:** `Router(config)# interface gigabitethernet 3/0/0`	Selects the slot, subslot, and port to configure, and enters interface configuration mode.
Step 4	**negotiation auto** **Example:** `router(config-if)# negotiation auto`	Selects auto-negotiation. If necessary, modify the HHGE line card configuration or that of the remote device to ensure that, where appropriate, they use the same settings. For more information, refer to Table 2.
Step 5	**end** **Example:** `Router(config-if)# end`	Exits the configuration mode.

Example

The following example defines auto-negotiation mode for a Gigabit Ethernet interface:

```
Router# configure terminal
Router(config)# interface gigabitethernet 3/0/0
Router(config-if)# negotiation auto
Router(config-if)# end
```

Assigning a MAC Address

Use the **mac-address** command to preserve a MAC address when you move a line card to a new slot or chassis. You may want to preserve the MAC address if you have an access list that refers to it. If you use this command, you should change the address on the original slot so that you do not have two slots with the same address.

To assign a user- defined MAC address for a Gigabit Ethernet interface, use the **mac-address** command. To remove the user-defined MAC address, use the **no** form of the command.

mac-address *address*

The *address* variable is a two-byte hexadecimal value.

Prerequisites

None

Restrictions

None

SUMMARY STEPS

1. **configure terminal**
2. **interface gigabitethernet** [*slot/subslot/port*]
3. **mac-address** *address*
4. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 2	**interface gigabitethernet** [*slot/subslot/port*] **Example:** `Router(config)# interface gigabitethernet 3/0/0`	Defines the slot address where the MAC is applied.
Step 3	**mac-address** *address* **Example:** `Router(config-if)# mac-address 6000.0001.0003`	Defines the MAC address.
Step 4	**end** **Example:** `Router(config-if)# end`	Exits the configuration mode.

Example

The following example defines a MAC address for a Gigabit Ethernet interface:

```
Router# configure terminal
Router(config)# interface gigabitethernet 3/0/0
Router(config-if)# mac-address 6000.0001.0003
Router(config-if)# end
```

Setting and Changing Loopback Mode

To set loopback mode for a Gigabit Ethernet interface, use the **loopback** command. To remove loopback mode, use the **no** form of the command.

loopback [**internal** | **external**

Where:

- external runs a loopback that requires a loopback connector.
- internal runs a loopback at the MAC controller.

Prerequisites

None

Restrictions

None

SUMMARY STEPS

1. **configure terminal**
2. **interface gigabitethernet** [*slot/subslot/port*]
3. **loopback** [internal | external]
4. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 2	**interface gigabitethernet** [*slot/subslot/port*] **Example:** `Router(config)# interface gigabitethernet 3/0/0`	Enters interface configuration mode.
Step 3	**loopback [internal | external]** **Example:** `Router(config-if)# loopback internal`	Sets loopback mode for the interface, where: • **internal** runs a loopback at the MAC controller. • **external** runs a loopback that requires a loopback connector.
Step 4	**end** **Example:** `Router(config-if)# end`	Exits the configuration mode.

Example

The following example defines an internal loopback mode for a Gigabit Ethernet interface:

```
Router# configure terminal
Router(config)# interface gigabitethernet 3/0/0
Router(config-if)# loopback internal
Router(config-if)# end
```

Enabling IEEE 802.1Q Encapsulation

To enable IEEE 802.1Q encapsulation of traffic on a Gigabit Ethernet interface, use the **encapsulation dot1q** command. To remove IEEE 802.1Q encapsulation, use the **no** form of the command.

encapsulation dot1q *vlan-id*

Prerequisites

None

Restrictions

None

SUMMARY STEPS

1. **configure terminal**
2. **interface gigabitethernet** [*slot/subslot/port*]
3. **encapsulation dot1q** *vlan-id*
4. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 2	**interface gigabitethernet** [*slot/subslot/port*] **Example:** `Router(config)# interface gigabitethernet 3/0/0`	Enters interface configuration mode.
Step 3	**encapsulation dot1q** *vlan-id* **Example:** `Router(config-if)# encapsulation dot1q 101`	Enables IEEE 802.1Q encapsulation of traffic onthe interface, where: • *vlan-id* is VLAN identifier. Range is 1 to 1000.

	Command or Action	Purpose
Step 4	**end** **Example:** `Router(config-if)# end`	Exits the configuration mode.

Example

The following example encapsulates VLAN traffic using the IEEE 802.1Q protocol for VLAN 101 on an HHGE interface:

```
Router# configure terminal
Router(config)# interface gigabitethernet 3/0/0
Router(config-if)# encapsulation dot1q 101
Router(config-if)# end
```

Setting the Maximum Transmission Unit

To adjust the maximum transmission unit (MTU) size on a Gigabit Ethernet interface, use the **mtu** command. Use the **no** form of this command to restore the MTU value to its original default value of 1500.

mtu [*bytes*]

Prerequisites

None

Restrictions

None

SUMMARY STEPS

1. **configure terminal**
2. **interface gigabitethernet** [*slot/subslot/port*]
3. **mtu** [*bytes*]
4. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 2	**interface gigabitethernet** [*slot/subslot/port*] **Example:** `Router(config)# interface gigabitethernet 3/0/0`	Enters interface configuration mode.
Step 3	**mtu** [*bytes*] **Example:** `Router(config-if)# mtu 4470`	Sets maximum transmission unit (MTU), where: • *bytes* specifies the size in bytes. Range is 1500 to 4470. If necessary, modify the HHGE line card configuration or that of the remote device to ensure that, where appropriate, they use the same settings. For more information, refer to Table 2.
Step 4	**end** **Example:** `Router(config-if)# end`	Exits the configuration mode.

Example

The following example sets the MTU to 4470 on a Gigabit Ethernet interface:

```
Router# configure terminal
Router(config)# interface gigabitethernet 3/0/0
Router(config-if)# mtu 4470
Router(config-if)# end
```

Command Examples

The following examples include:

show interfaces

The **show interfaces gigabitethernet** command is used to indicate the type of Gigabit Ethernet line card installed, and the media type.

```
Router# show interfaces gigabitethernet 4/0/0
GigabitEthernet4/0/0 is up, line protocol is up
```

```
Hardware is Half-height Gigabit Ethernet MAC Controller, address is 0005.00e3.fd00
Internet address is 40.1.1.1/16
MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec,
        reliability 255/255, txload 1/255, rxload 2/255
Encapsulation ARPA, loopback not set
Keepalive set (10 sec)
Full-duplex, 1000Mb/s, link type is autonegotiation, media type is SX
output flow-control is XOFF, input flow-control is XOFF
ARP type: ARPA, ARP Timeout 04:00:00
Last input 00:00:07, output 00:00:03, output hang never
Last clearing of "show interface" counters 01:09:13
Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
Queueing strategy: fifo
Output queue: 0/40 (size/max)
30 second input rate 9613000 bits/sec, 20029 packets/sec
30 second output rate 452000 bits/sec, 884 packets/sec
   73181143 packets input, 95919224 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, 69 multicast, 0 pause input
   0 input packets with dribble condition detected
   44824427 packets output, 2868784657 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
```

show controllers

The **show controllers** command shows the type of SFP module installed in the Gigabit Ethernet line card.

```
Router# show controllers gigabitethernet 4/0/0
Interface GigabitEthernet4/0/0(idb 0x70CAE948)
Hardware is Half-height Gigabit Ethernet MAC Controller, network connection mode is auto
  network link is up
  loopback type is none
  SFP type is 1000BASE-SX
  ip_routecache=0x11(dfs=0/mdfs=0), max_mtu=1524
  c10k_ge1h_ds=0x63E34E4C
  resets=3, reset_init=1, reset_restart=3
  link_state_reason=7
```

show running config

The **show running config** command shows which line cards are installed in which slots. Half-height line cards are installed in slot 3 (0, 1) and slot 4 (0, 1).

```
Router# show running-config

card 1/1 2cable-tccplus
card 2/0 1gigethernet-1
card 2/1 2cable-tccplus
card 3/0 1gigethernet-hh-1
card 4/0 1gigethernet-hh-1
card 4/1 1gigethernet-hh-1
card 5/0 5cable-mc520u-d
```

Upgrading to a Half-Height Gigabit Ethernet Line Card

This section provides instructions for upgrading from two full height gigabit Ethernet line cards to half-height Gigabit Ethernet line cards.

Step 1 Verify traffic is passing through slot 3/0 and slot 4/0.

Step 2 Administratively shut down the line card in slot 3/0 and let traffic reroute through slot 4/0.

Step 3 Remove the full-height line card in slot 3/0.

Step 4 Install the slot splitter into slot 3/0.

Step 5 Install the HHGE line card in slot splitter 3/0/0.

Step 6 Configure and bring up the HHGE line card in slot 3/0/0.

Step 7 Repeat Step 2, Step 5, and Step 6 for the HHGE line card in slot 3/1/0

Step 8 Repeat Step 1 through Step 7 for the full-height line card in slot 4/0.

Additional References

Related Documents

Document Name	Document Link
Cisco UBR10012 Universal Broadband Router Release Notes	http://www.cisco.com/en/US/products/hw/cable/ps2209/prod_release_notes_list.html
Cisco uBR10012 Universal Broadband Router Software Configuration Guide	http://www.cisco.com/en/US/docs/cable/cmts/ubr10012/configuration/guide/scg.html
Cisco uBR10012 Universal Broadband Router Hardware Installation Guide	http://www.cisco.com/en/US/docs/cable/cmts/ubr10012/installation/guide/hig.html
Regulatory Compliance and Safety Information for the Cisco uBR10012 Universal Broadband Router	http://www.cisco.com/en/US/docs/cable/cmts/ubr10012/regulatory/compliance/ub10rcsi.html

Standards

Standard	Title
DOCSIS 1.0	Data Over Cable Service Interface Specification 1.0
DOCSIS 1.1	Data Over Cable Service Interface Specification 1.1
DOCSIS 2.0	Data Over Cable Service Interface Specification 2.0
IEEE 802.1q	VLAN frame-tagging standard
IEEE 802.3x	Flow control standard
IEEE 802.3ab	1000BASE-T, or Gigabit CX standard (using UTP Cat-5 cabling) specification
IEEE 802.3z	Gigabit Ethernet specification

MIBs

MIB	MIBs Link
• Cisco IF-MIB • Cisco Entity-MIB • Cisco Ethernet Link-MIB • Cisco GE-MIB	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
RFC 1213	*Management Information Base for Network Management of TCP/IP-based internets:MIB-II*
RFC 1573	*Evolution of the Interfaces Group of MIB-II*
RFC 2863	The Interfaces Group MIB

Command Reference

This feature uses no new or modified commands.

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly *What's New in Cisco Product Documentation*, which also lists all new and revised Cisco technical documentation, at:

http://www.cisco.com/en/US/docs/general/whatsnew/whatsnew.html

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This document is to be used in conjunction with the documents listed in the Additional References section.