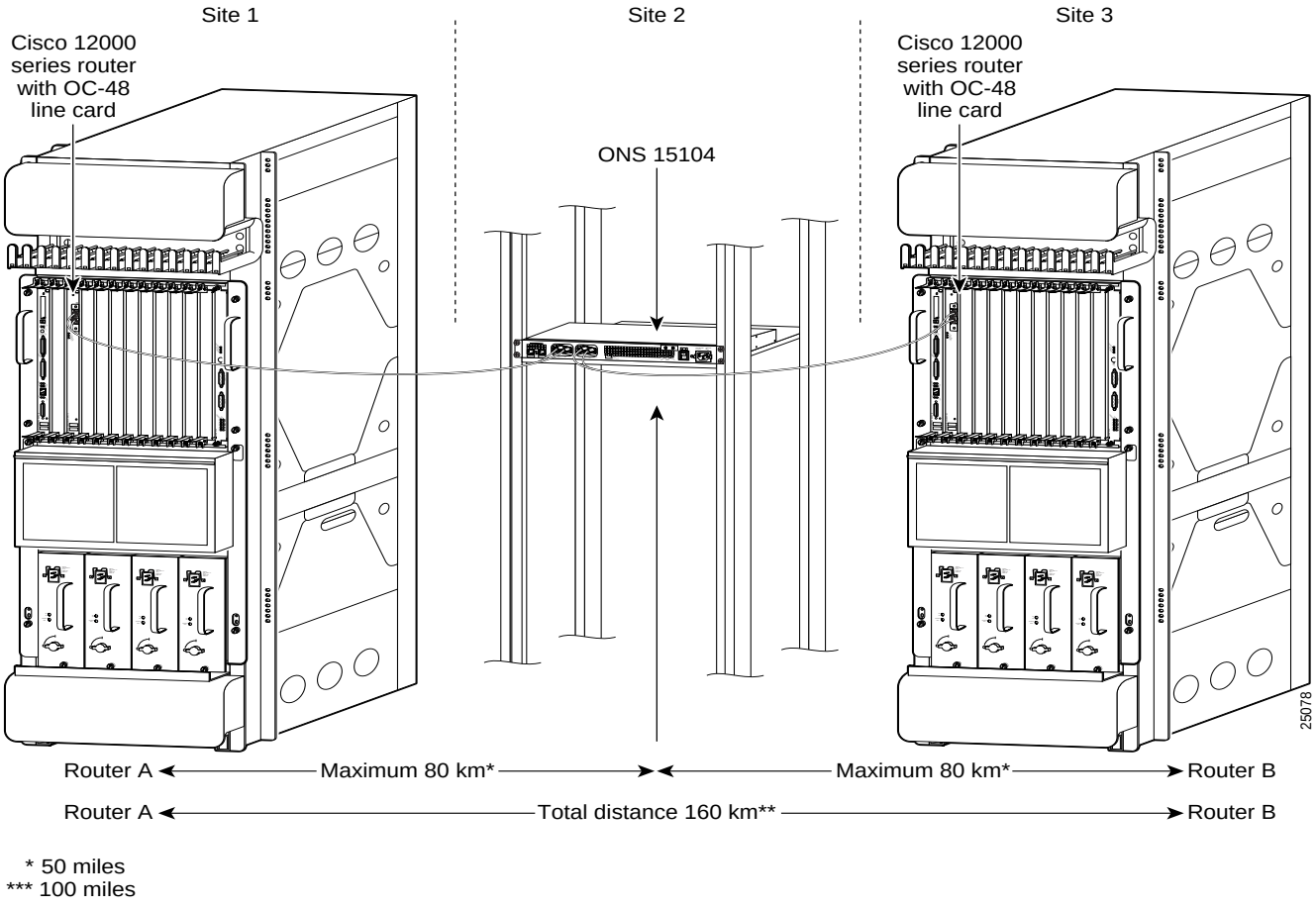
Cisco ONS 15104 Feature Module

Cisco ONS 15104 Overview

The Cisco ONS 15104 is a bidirectional Optical Carrier-48/Synchronous Transport Module-16 (OC-48/STM-16) regenerator that transmits optical signals up to distances of 50 miles (80 kilometers). In an OC-48 SONET installation, the Cisco ONS 15104 significantly extends the separation between two routers, depending on the quality of the fiber-optic cabling. (See Figure 1.)

Figure 1 Two Cisco 12000 Series Routers Configured with One Cisco ONS 15104



* 50 miles
*** 100 miles

The Cisco ONS 15104 provides an end-to-end Internet Protocol (IP) transport for long distances by forwarding Synchronous Optical Network/Synchronous Digital Hierarchy (SONET/SDH) traffic at OC-48 line rates.

When you connect the ONS 15104's regeneration ports to an OC-48 line card in a router, you also connect to SDCC interfaces, SDCC0 or SDCC1, and Cisco ONS 15104 controller modules, Regen 0 and Regen 1. The SDCC interfaces and Cisco ONS 15104 controller modules regenerate traffic and manage traffic paths.

When you power up the Cisco ONS 15104 for the first time, it goes through a system bootstrap startup sequence that boots the Cisco IOS software that is installed from Flash memory. The Cisco ONS 15104 runs a power-on self-test (POST) that verifies basic operation of the CPU, memory, and interfaces. When all of the configuration files are loaded, the console terminal displays the following System Configuration Dialog prompt:

```
--- System Configuration Dialog ---

Would you like to enter the initial configuration dialog? [yes/no]:
```

(Portion of displayed text is omitted from example.)

You can use AutoInstall to automatically configure the Cisco ONS 15104. When the Cisco ONS 15104 is connected to the Ethernet port, AutoInstall starts after the power-on self test completes.

To ensure that AutoInstall works properly, your system administrator must preconfigure the Transmission Control Protocol/Internet Protocol (TCP/IP) host on your network and put the required configuration files in the Cisco ONS 15104's nonvolatile random-access memory (NVRAM). The NVRAM contains configuration information for Cisco IOS, ROM Monitor, and system information. You can use Cisco IOS commands to configure the memory partitions. The new configuration does not take effect until it is saved to NVRAM, and the router is reloaded.

Note AutoInstall works only when you connect the Cisco ONS 15104 through the Ethernet port.

To enter Set-Up Configuration Mode and manually enter Cisco IOS commands, you must boot the Cisco ONS 15104 without any default configuration settings. You can invoke Set-Up Configuration Mode when the Cisco ONS 15104 is connected to the network through either the Ethernet port or the OC-48 regenerator ports.

Note The Cisco ONS 15104 configuration must be saved to NVRAM to survive system crash/reload, regardless of the commands that are set before or after normal operation. Most commands take effect right away before saving them to NVRAM using the **copy run start** command. However, memory partitioning can only be done during system initialization and system reload. That is why memory partitioning takes effect only after saving Cisco ONS 15104 configuration to NVRAM and system reload.

The Cisco ONS 15104 uses standard Cisco IOS software and standard configuration methods.

Benefits

The Cisco ONS 15104 is best used when two or more routers on a network are more than 50 miles (80 kilometers) apart in a remote area. You can connect a Cisco ONS 15104 between two Cisco 12000 series routers to carry a signal up to 50 miles (80 km) with high quality single-mode long reach fiber.

Restrictions

The Cisco ONS 15104 has the following restrictions.

- AutoInstall is accessible only when you connect the Cisco ONS 15104 through the Ethernet port.
- The Cisco ONS 15104 baud rate must be set at 9600 during normal operation.
- The Cisco ONS 15104 controller module interfaces must be configured to monitor the SONET section overhead on incoming data.
- The Cisco ONS 15104 works only when the Section Data Communications Channel (SDCC) interfaces are on the same subnet, and internet protocol (IP) routing is enabled.
- The Cisco ONS 15104 works only when you enable Routing Information Protocol (RIP) on the SDCC interfaces.

Related Documents

Cisco product documentation that relates to the Cisco ONS 15104 includes:

- *Cisco ONS 15104 Installation and Configuration Guide*
- *Regulatory Compliance and Safety Information Guide for the Cisco ONS 15104*
- *1xOC48 Packet-over-SONET* (*POS*) *Installation and Configuration Guide*

Supported Platforms

The Cisco ONS 15104 is compatible with the following Cisco 12000 series routers:

- Cisco 12016
- Cisco 12012
- Cisco 12008

Prerequisites

The person(s) who will install, configure, and maintain the Cisco ONS 15104 must be familiar with basic router configuration practices, and more specifically with Cisco 12000 series routers, so that they can connect the Cisco ONS 15104 to system network devices. The person(s) must be familiar with optical and telecommunications networks, Cisco IOS software, and be able to perform software configuration and diagnostic procedures on the Cisco ONS 15104.

To ensure that AutoInstall works properly, your system administrator must preconfigure the TCP/IP host on your network and put the required configuration files in NVRAM. NVRAM contains configuration information for Cisco IOS, ROM Monitor, and system information. Cisco IOS software commands will be used to configure the memory partitions. The new configuration commands must be saved to NVRAM to take effect, using the **copy run start** command.

Timesaver Ask your system administrator or review the network plan to verify network IP addresses before you begin to configure the Cisco ONS 15104.

Supported MIBs and RFCs

The Cisco ONS 15104 supports the following MIBs and RFCs:

- OLD-CISCO-CHASSIS-MIB.my
- OLD-CISCO-FLASH-MIB.my
- OLD-CISCO-INTERFACES-MIB.my
- OLD-CISCO-IP-MIB.my
- OLD-CISCO-MEMORY-MIB.my
- OLD-CISCO-SYS-MIB.my
- OLD-CISCO-TS-MIB.my
- RFC1213-MIB.my
- RFC1398-MIB.my
- RFC1595-MIB.my (SONET MIB)
- CISCO-CDP-MIB.my
- CISCO-CONFIG-MAN-MIB.my
- CISCO-ENTITY-VENDORTYPE-OID-MIB.my
- CISCO-ENVMON-MIB.my
- CISCO-FLASH-MIB.my
- CISCO-GENERAL-TRAPS.my
- CISCO-IMAGE-MIB.my
- CISCO-MEMORY-POOL-MIB.my
- CISCO-SYSLOG-MIB.my
- ENTITY-MIB.my
- IANAifType-MIB.my
- IF-MIB.my
- RS-232-MIB.my
- SNMPv2-CONF.my
- SNMPv2-MIB.my
- SNMPv2-SMI.my

- SNMPv2-TC.my
- CISCO-CDP-MIB-V1SMI.my
- CISCO-CONFIG-MAN-MIB-V1SMI.my
- CISCO-ENTITY-VENDORTYPE-OID-MIB-V1SMI.my
- CISCO-ENVMON-MIB-V1SMI.my
- CISCO-FLASH-MIB-V1SMI.my
- CISCO-IMAGE-MIB-V1SMI.my
- CISCO-MEMORY-POOL-MIB-V1SMI.my
- CISCO-SYSLOG-MIB-V1SMI.my
- ENTITY-MIB-V1SMI.my
- IANAifType-MIB-V1SMI.my
- IF-MIB-V1SMI.my
- RS-232-MIB-V1SMI.my
- SNMPv2-MIB-V1SMI.my
- SNMPv2-SMI-V1SMI.my
- SNMPv2-TC-V1SMI.my

Note For descriptions of supported MIBs and how to use them, see Cisco's MIB web site on Cisco Connection Online (CCO) at http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml.

Configuration Tasks

To configure the Cisco ONS 15104, perform the tasks in the following sections:

- Use AutoInstall on page 6 (Optional)

or

- Use the Set-Up Configuration Dialog on page 6 (Optional)
- Configure Cisco ONS 15104 Interfaces on page 7 (Required)

Use AutoInstall

Use AutoInstall to automatically enter the default interface configuration commands. To invoke AutoInstall, perform the following tasks, beginning at the user prompt.

Step	Command	Task
1	`Would you like to enter the initial configuration dialog? [yes/no]: **y(es)**`	Enter **y**(es) to start AutoInstall.
2	`Regen# **copy running-config startup-config**`	Enter the **copy running-config startup-config** EXEC command to save the configuration to NVRAM.

Use the Set-Up Configuration Dialog

To manually configure the Cisco ONS 15104 using the Set-Up Configuration Dialog, enter **no** at the set-up utility prompt to erase the default configuration. To invoke the Set-Up Configuration Dialog, perform the following tasks, beginning at the user prompt.

Step	Command	Task
1	`Would you like to enter the initial configuration dialog? [yes/no]: **n(o)**`	Enter **n**(o) to erase the default configuration and start the System Configuration Dialog.
2	`Regen# **copy running-config startup-config**` `Regen#`	Enter the **copy running-config startup-config** EXEC command to save your configuration to NVRAM.

Configure Cisco ONS 15104 Interfaces

The following sections describe tasks that include the following:

- Configure the SDCC Interfaces in the Cisco ONS 15104 Ports on page 7 (Required)
- Configure the Cisco ONS 15104 Controller Module Interfaces on page 9 (Required)
- Configure the Ethernet Interface on page 10 (Required)

Configure the SDCC Interfaces in the Cisco ONS 15104 Ports

To create the LAN interface connections through two OC-48 regeneration ports, you must be sure that the two SDCC interfaces, SDCC0 and SDCC1, have sequential IP addresses. You may have to reconfigure the SDCC interfaces to achieve this. This is a required task.

Follow the steps in this section to configure both the SDCC interfaces.

SDCC Interface Prerequisites

One of the following must be true for SDCC interfaces to work properly. Beginning in privileged EXEC mode:

- All SDCC interfaces can be on the same subnet. Routing Information Protocol (RIP) and IP routing must be enabled on each Cisco ONS 15104.
- All SDCC interfaces can be on different subnets. IP routing and RIP must be enabled on each Cisco ONS 15104.

  For example, when two routers that are on two different subnets are connected to the Cisco ONS 15104, you must enable RIP on each subnet.

Enable Routing Information Protocol and Configuring the SDCC0 Interface

To enable RIP on the SDCC interfaces, be sure that the IP address for each SDCC interface overlaps the networks configured for the RIP protocol. Complete the following tasks, beginning in privileged EXEC mode:

Step	Command	Task
1	`Regen# configure terminal` `Regen(config)#`	Enter the **configure terminal** command to enter global configuration mode.
2	`Regen(config)# router rip`	Enter the **router rip** global configuration command.
3	`Regen(config)# network 10.0.0.0 (subnet 1)`	Enter the **network** global configuration command and specify the IP address and subnet mask of the router that is connected to the Cisco ONS 15104.
4	`Regen(config)# interface SDCC0` `Regen(config-if)#`	Enter the **interface SDCC0** global configuration command.
5	`Regen(config-if)# ip address 10.a.b.c 255.255.255.0` `Regen(config-if)#`	Enter the **ip address** interface configuration command and specify the IP address and subnet mask.

6	`Regen(config-if)# keepalive`
	`Regen(config-if)# no shutdown`
	`Regen(config-if)#`
		Add the **keepalive** interface configuration command to keep the interface up.
		Enter a **no shutdown** interface configuration command to prevent data traffic shutdowns.

Step	Command	Task
7	`Regen(config-if)# end` `Regen#`	Enter **end** to return to privileged EXEC mode.

8	`Regen# show interface SDCC0`
	
	`interface SDCC0`
	`bandwidth 192`
	`ip address 10.a.b.c 255.255.255.0`
	`ip directed-broadcast`
	`keepalive`
	`crc 32`
	`!`
		Enter the **show interface SDCC0** EXEC command to verify the new SDCC0 interface configuration.

Enable Routing Information Protocol and Configuring the SDCC1 Interface

To enable RIP and configure the SDCC1 interface, complete the following tasks, beginning in privileged EXEC mode:

Step	Command	Task
1	`Regen# configure terminal` `Regen(config)#`	Enter the **configure terminal** command to enter global configuration mode.
2	`Regen(config)# router rip`	Enter the **router rip** global configuration command.
3	`Regen(config)# network 11.0.0.0 (subnet 2)`	Enter the **network** global configuration command and specify the IP address and subnet mask of each router that is connected to the ONS 15104.
4	`Regen(config)# interface SDCC1`	Enter the **interface** global configuration command and specify the SDCC1 interface.
5	`Regen(config-if)# ip address 11.x.y.z 255.255.255.0` `Regen(config-if)#`	Configure the SDCC1 interface using the **ip address** interface configuration command and enter the IP address and subnet mask.

6	`Regen(config-if)# keepalive`
	`Regen(config-if)# no shutdown`
	`Regen(config-if)#`
		Add the **keepalive** interface configuration command to keep the interface up.
		Enter a **no shutdown** interface configuration command to prevent data traffic shutdowns.

7	`Regen(config-if)# exit`
	`Regen(config)# exit`
	`Regen#`
		Enter **exit** to return to the privileged EXEC mode.

8	`Regen# show interface SDCC1`
	
	`interface SDCC1`
	`bandwidth 192`
	`ip address 11.x.y.z 255.255.255.0`
	`ip directed-broadcast`
	`keepalive`
	`crc 32`
	`!`
		Enter the **show interface SDCC1** EXEC command to verify the new IP address for the SDCC1 interface.

Configure the Cisco ONS 15104 Controller Module Interfaces

When you connect two Cisco ONS 15104 ports to a two-port OC-48 line card, you also connect the two Cisco ONS 15104 controller module interfaces Regen 0 and Regen 1. When the connection occurs, the Regen controller module interfaces are automatically up. The Regen controllers monitor the SONET section overhead on incoming data.

Follow the configuration tasks in this section to configure the Cisco ONS 15104 controller module interfaces, beginning in privileged EXEC mode. To access commands that will allow you to modify regen controller parameters, enter the **regen** controller configuration command and specify the command option.

Note The configuration of the controllers in their default state is usually adequate. The special configurations are only for advanced users in special networks (Add Drop Multiplexer [ADM] connections and/or Synchronous Digital Hierarchy [SDH] networks).

Step	Command	Task
1	`Regen# configure controller` `Regen(config-controller)#`	Enter the **configure controller** EXEC command to enter controller configuration mode.
2	`Regen(config-controller)# regen overhead j0 0x1` `Regen(config-controller)#`	To specify overhead, enter the **regen overhead j0** controller configuration command and specify the range of values for j0.
3	`Regen(config-controller)# regen framing sdh`	To specify framing, enter the **regen framing** controller configuration command and specify the framer format.
4	`Regen(config-controller)# regen report rxclk-fail` `Regen(config-controller)#`	To enable the Cisco ONS 15104 alarms, enter the **regen report** controller configuration command and specify the alarm type. Enter the **no regen report** command to disable the ONS 15104's alarms.

5	`Regen# show controller regen 0`
	`Regen0 is up`
	`Error Count:`
	`RxClockFail = 0 SLOS = 1 SLOF = 1`
	`BIP(B1) = 0`
	
	`Active Defects: LOS LOF`
	`Active Alarms: SLOS`
	`Alarm reporting enabled for: RxClockFail SLOS SLOF B1-TCA`
	
	`B1 TCA threshold: B1 = 10e-6`
	
	`Framer 0, addr=0x68004000:`
	`Regen#`
	
	(Portion of displayed text omitted from example)
		To verify controller status, enter the **show controllers regen** EXEC command and specify 0 or 1.

6	`Regen# copy running-config startup-config` `Regen#`	Enter the **copy running-config startup-config** privileged EXEC command to save your configuration changes to NVRAM.

Configure the Ethernet Interface

To create a LAN interface connection through the Ethernet port on the Cisco ONS 15104, you must configure the Ethernet interface as Ethernet0. Follow these steps to configure the Ethernet interface beginning in privileged EXEC mode:

Step	Command	Task
1	`Regen# configure terminal` `Regen(config)#`	Enter the **configure terminal** command to enter global configuration mode.
2	`Regen(config)# interface ethernet0` `Regen(config-if)#`	Enter the **interface Ethernet 0** global configuration command which puts you in interface configuration mode for the Ethernet interface. The prompt changes to interface configuration mode.
3	`Regen(config-if)# ip address 20.15.5.9 255.255.255.0` `Regen(config-if)#`	Assign an IP address and subnet mask by entering the **ip address** interface configuration command.
4	`Regen(config-if)# end` `Regen#`	Enter **end** to return to privileged EXEC mode.
5	`Regen# copy running-config startup-config` `Regen#`	Enter the **copy running-config startup-config** EXEC command to save your configuration changes to NVRAM.

This concludes the Cisco ONS 15104 configuration tasks with LAN-accessible interfaces.

Use the Console Port

The Cisco ONS 15104 console port provides local access when it is connected to a terminal server or a modem. You can communicate with the Cisco ONS 15104 through a PC or VTY.

Use the console port on the Cisco ONS 15104 to do the tasks in the following sections:

- Change the Baud Rate on page 10
- Download through the Console Port on page 12
- Use Xmodem Commands on page 12

Change the Baud Rate

To use the console port to download files, you need to increase the baud rate. The console port baud rate speed determines the length of time it takes to download files to the Cisco ONS 15104. You can temporarily increase the console port baud rate to 115200 bps to decrease downloading time. The default console port parameters are 9600 bps, 8 data bits, no parity, 2 stop bits. The console port supports the following baud rates:

Table 1 Supported Baud Rates for the Cisco ONS 15104

Baud rate	Baud rate
1200 bps	19200 bps
2400 bps	38400 bps
4800 bps	57600 bps
9600 bps	115200 bps

For details on downloading files through the console port, see the section “Download through the Console Port” section on page 12.

Table 2 shows the downloading speeds for the console port or the Ethernet port.

Table 2 Download Speed According to Baud Rate

Cisco ONS 15104 Interface	Baud Rate	Time Length
Console port	9600 bps (default)	30 to 40 minutes
Console port	115200 bps	6 minutes
Ethernet port (configured)	10 Mbps	5 to 10 seconds

Note Cisco recommends that you only use a console port speed of 115200 bps for downloading purposes because characters may be dropped by PC applications during normal console sessions at baud rates higher than 9600 bps. After downloading the software, be sure to reset the console port baud rate to 9600 bps.

After the Ethernet port is configured, it has a default baud rate of 10 Mbps and takes only 5 to 10 seconds to download the software using TFTP commands. For details on the Ethernet port, see the sections “Configure the Ethernet Interface” section on page 10, and “Download Through the Ethernet Port” section on page 13.

To change the console port baud rate, follow the configuration tasks in this section, beginning in ROM Monitor mode:

Step	Command	Task

1	`rommon 1 > confreg`
	`Configuration Summary`
	`enabled are:`
	`break/abort has effect`
	`console baud:9600`
	`boot:the ROM Monitor`
	
	`do you wish to change the configuration? y/n  [n]: y`
	`enable  "diagnostic mode"? y/n  [n]:`
	`enable  "use net in IP bcast address"? y/n  [n]:`
	`enable  "load rom after netboot fails"? y/n  [n]:`
	`enable  "use all zero broadcast"? y/n  [n]:`
	`disable "break/abort has effect"? y/n  [n]:`
	`enable  "ignore system config info"? y/n  [n]:`
	`change console baud rate? y/n  [n]: y`
	`change the boot characteristics? y/n  [n]:`
	
	After you answer yes to the prompt to change the console baud rate, a list of different console baud speeds displays on the screen. Choose the 115200 bps baud rate.
	
	`Configuration Summary`
	`enabled are:`
	`break/abort has effect`
	`console baud:115200`
	`boot:the ROM Monitor`
	
	`do you wish to change the configuration? y/n  [n]:`
		Enter the **confreg** command in ROM Monitor mode.

Step	Command	Task
2	None.	Download a Cisco IOS software image using an option described in this section.
3	`rommon 2 > confreg`	Reset the baud rate to the default parameters by entering the previously shown **confreg** command.

Download through the Console Port

Cisco recommends using **xmodem** commands to download a Cisco IOS software image only as a disaster recovery mechanism, because you must be physically present at the Cisco ONS 15104 to connect a PC to the console port.

Note Using the **xmodem** command to copy a Cisco IOS software image will erase all Flash memory partitions.

Use Xmodem Commands

In ROM Monitor mode, use the **xmodem** commands to download a Cisco IOS software image through the console port.

Step	Command	Task

1	`rommon 1 > xmodem <image name> (copy to flash)`
	or
	`rommon 2 > xmodem -r <image name> (run from RAM)`
		Use the **xmodem** *filename* command to begin receiving a Cisco IOS software image through the console port.
		where
		image name specifies the name of the Cisco IOS software image that will be written to Flash memory.

2	None	After you enter the **xmodem** command, a screen output displays.
3	`rommon 3 > y(es)`	Enter **y(**es**)** and start the xmodem transmission from within your terminal emulation software.

After you enter the **xmodem** command, the following screen output displays:

```
System Bootstrap, Version 12.0(19990409:171649) [ROMMON_Apr9 102]
Copyright (c) 1994-1999 by cisco Systems, Inc.
REGEN48 platform with 16384 Kbytes of main memory

rommon 1 > xmodem regen-i4-mz.final
Do not start the sending program yet...
         File size           Checksum   File name
   1382456 bytes (0x151838)   0x5db4    regen-i4-mz.final
         4 bytes (0x4)        0xceff    snmpboots (deleted)
         4 bytes (0x4)        0xcdff    snmpboots
WARNING:All existing data in bootflash will be lost!
Invoke this application only for disaster recovery.
Do you wish to continue? y/n  [n]: y
Ready to receive file regen-i4-mz.final ...
```

The screen output will show the xmodem transmission while it is copying the new Cisco IOS software image to Flash memory, then notify you when the file transfer is complete.

This concludes the section on using the console port.

Download Through the Ethernet Port

To download Cisco IOS software images through the configured Ethernet port, use one of the methods described in this section:

- Download from Flash Memory on page 13

or

- Download from a Local or Remote TFTP Server on page 13

or

- Download Using FTP or RCP on page 14

Download from Flash Memory

To download a Cisco IOS software image from Flash memory, follow the configuration tasks in this section, beginning in privileged EXEC mode.

Step	Command	Task
1	`Regen# configure terminal`	Enter **configure terminal** to enter global configuration mode.
2	`Regen (config)# boot system flash filename` `Regen (config)#`	To download from Flash memory, enter the **boot system flash** command, replace *filename* with the filename of the Cisco IOS image.
3	`Regen (config)# end` `Regen#`	When the download is completed, the global configuration prompt returns. Enter **end** to return to privileged EXEC mode.

4	`Regen# copy running-config startup-config`
	`Building configuration ...`
	`[OK]`
	`Regen#`
		Enter the **copy running-config startup-config** EXEC command to save your configuration changes to NVRAM.

Download from a Local or Remote TFTP Server

To quickly download a Cisco IOS software image from a local TFTP server, use the Ethernet port, beginning in privileged EXEC mode.

Step	Command	Task
1	`Regen# configure terminal` `Regen (config)#`	Enter the **configure terminal** command to enter global configuration mode.
2	`Regen (config)# boot system tftp filename ipaddress` `Regen (config)# exit`	To configure the Cisco ONS 15104 to download images through the Ethernet port, enter the **boot system tftp** global configuration command: where *filename* is the filename of the Cisco IOS software image. where *ipaddress* is the IP address of the TFTP server.

Step	Command	Task
3	Regen# **copy running-config startup-config** Building configuration ... [OK] Regen#	Enter the **copy running-config startup-config** EXEC command to save your configuration changes to NVRAM. Using this command erases everything from Flash memory. If you boot from a TFTP server, you can reload files from the TFTP server.

Download Using FTP or RCP

You can use the File Transfer Protocol (FTP) or Remote Copy Protocol (RCP) to download Cisco IOS software images to the Cisco ONS 15104. The Cisco ONS 15104 controllers support FTP server software that resides in the system controller until it is notified that data is ready to be transferred to the Cisco ONS 15104 controller in a specified file.

Use FTP to Download Files

To transfer Cisco IOS software to the Cisco ONS 15104 using FTP, follow the configuration tasks in this section, beginning in privileged EXEC mode.

Step	Command	Task
1	Regen# **configure terminal** Regen(config)#	Enter the **configure terminal** command to enter global configuration mode.
2	Regen(config)# **ftp-server enable** Regen(config)#	Enter the **ftp-server enable** command.
3	Regen(config)# **end** Regen#	Enter **end** to return to privileged EXEC mode.
4	Regen# **copy running-config startup-config** Regen#	Enter the **copy running-config startup-config** EXEC command to save the current running configuration to the startup configuration file in NVRAM.

Use RCP to Download Files

You can copy a file from a network server to the Cisco ONS 15104 using **rcp**, or by using one of the following **copy rcp** EXEC commands. The **copy rcp running-config** command replaces the **configure network** command in the command line. The **copy rcp startup-config** command replaces the **configure overwrite-network** command in the command line. To copy a file from a network server to the Cisco ONS 15104, follow the configuration tasks in this section, beginning privileged EXEC mode.

Step	Command	Task
1	Regen# **configure terminal** Regen(config)#	Enter the **configure terminal** command to enter global configuration mode.
2	Regen(config)# **ip rcmd remote-username** *username*	Enter the **ip rcmd remote-username** global configuration command and specify a username for all copies. You can also change the default remote username.
3	Regen(config)# **end** Regen#	Enter **end** to return to privileged EXEC mode.

Step	Command	Task
4	`Regen# copy system:running-config rcp:[[[//[username@]location]/directory]/filename`	Enter the **copy system:running-config rcp** EXEC command to save the current running configuration file to the startup configuration file in NVRAM.
5	`Regen(config)# copy nvram:startup-config rcp:[[[//[username@]location]/directory]/filename`	Enter the **copy nvram: startup-config rcp** EXEC command to copy the running configuration to NVRAM start-up configuration.

Note You must enter ROM Monitor mode to use the following downloading option.

Download Using the copy Command

You can download Cisco IOS software images from a TFTP server, using the **copy** command through the Cisco ONS 15104's Ethernet interface or the OC-48 regeneration interface, beginning in user EXEC mode.

Step	Command	Task
1	`Regen> copy tftp flash`	In ROM Monitor mode, enter the **copy tftp flash** EXEC command to download a Cisco IOS software image from a remote server accessible from an Ethernet network interface on a Cisco 12000 series router.
2	`Regen> filename`	The system prompts you to type the *filename*.

Enter ROM Monitor Mode

You must be in ROM Monitor mode to download a Cisco IOS software image using one of the following methods in the following:

- Enter ROM Monitor Mode Automatically on page 15
- Enter ROM Monitor Mode Manually on page 16

Enter ROM Monitor Mode Automatically

You can configure Cisco IOS software to automatically enter the ROM Monitor mode the next time the Cisco ONS 15104 boots by setting virtual configuration register bits 3, 2, 1, and 0 to zero. To configure the Cisco ONS 15104 to automatically enter the ROM Monitor mode, enter the following commands beginning in user EXEC mode:

Step	Command	Task
1	`Router> configure terminal` `Router(config)#`	To configure Cisco IOS software to automatically enter ROM Monitor mode, enter the **config t** EXEC command. The prompt changes to privileged EXEC mode.
2	`Router(config)# config-register 0x0`	Enter the **config-register** EXEC command and set the virtual configuration register bits to **0x0**.
3	`Router(config)# exit`	Enter **exit** to return to privileged EXEC mode.

Step	Command	Task
4	`Router# copy running-config start-config`	Enter the **copy running-config startup-config** EXEC command to save the current running configuration to the startup configuration file in NVRAM.

Enter ROM Monitor Mode Manually

You can manually enter the ROM Monitor mode by following the configuration tasks in this section, beginning with the Cisco ONS 15104 in user EXEC mode:

Step	Command	Task
1	`Router> ^` `rommon 1 >`	When you power-on the Cisco ONS 15104, press the Break key during the first 60 seconds while the system is booting to force the Cisco ONS 15104 to stop booting and enter the ROM Monitor mode. The ROM Monitor mode returns in user EXEC mode.

Download Using tftpdnld Commands

You can download a Cisco IOS software image through the Ethernet port by using the **tftpdnld** command to download the Cisco IOS software image into Flash memory. Follow the tasks in this section to download a Cisco IOS software image, beginning in ROM Monitor mode:

Step	Command	Task
1	`rommon 1 > tftpdnld flash` <*filename*> (copies to flash) or `rommon 2 > tftpdnld -r` (copies to RAM)	In ROM Monitor mode, enter the **tftpdnld** command to download a Cisco IOS software image from a remote server accessible from the Ethernet network where **h**—Displays the **tftpdnld** command help screen. **r**—Loads the Cisco IOS software image only to DRAM and launches the image without writing the image into Flash memory.

2	`rommon 3 > IP_ADDRESS=172.15.19.11`
	`rommon 4 > IP_SUBNET_MASK=255.255.255.0`
	`rommon 5 > DEFAULT_GATEWAY=172.16.19.1`
	`rommon 6 > TFTP_SERVER=172.15.20.10`
	`rommon 7 > TFTP_FILE=/tftpboot/regen-ih-mz`
	`rommon 8 > tftpdnld`
	
	`IP_ADDRESS=172.15.19.11`
	`IP_SUBNET_MASK=255.255.255.0`
	`DEFAULT_GATEWAY=172.16.19.1`
	`TFTP_SERVER=172.15.20.10`
	`TFTP_FILE=/tftpboot/`
	
	`Invoke this command for disaster recovery only.`
	`WARNING: all existing data in all partitions on flash will be lost!`
	`Do you wish to continue? y/n: [n]:`
		After you specify the variables, you must reenter the **tftpdnld** command.

Step	Command	Task
3	`rommon 9 >` **`y`** `rommon 10 >`	Enter **y**(es) to begin downloading the Cisco IOS software image. When the process is complete, the ROM Monitor mode prompt appears on your screen.

Exit ROM Monitor Mode

Use the following ROM Monitor commands to exit the ROM Monitor mode, and enter IOS mode:

Step	Command	Task
1	rommon 10 > **boot**	Enter the **boot** or (**b**) command to boot the first image in Flash memory.
2	rommon 11 > **boot flash**:[*name*]	Enter the **boot** or (**b**) command to boot the Cisco IOS software from the Flash memory.
3	rommon 12 > **boot** *filename tftpserver* For example: rommon 7 > **boot regenerator 172.15.19.11**	Enter the **boot** or (**b**) *filename tftpserver* command to boot from the specified file through the network from the specified TFTP server. For this command to work, there must be a Cisco IOS software image in Flash such that it can be used as a boot helper.

This completes configuration tasks that describe downloading files.

Monitor and Maintain the Cisco ONS 15104

To help identify and isolate the problem source, follow the procedures in the following sections:

Use show Commands to Check System Status

To provide information about system processes, the Cisco IOS software includes an extensive list of EXEC commands that begin with the word **show**, which, when executed, display detailed tables of system information. Following is a list of some of the common show commands for the Cisco ONS 15104.

- Use the **show interfaces** command to verify the status of the Cisco ONS 15104 network interfaces.

```
Regen# show interface SDCC0

interface SDCC0
bandwidth 192
ip address 171.71.100.67 255.255.255.0
ip directed-broadcast
keepalive
crc 32
!
Regen#
```

- Use the **show ip interface brief** to display the IP addresses of all the network interfaces on the Cisco ONS 15104:

```
Regen# show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
Ethernet0              10.1.0.2        YES NVRAM  up                    up
SDCC0                  11.1.0.2        YES NVRAM  up                    up
SDCC1                  12.1.0.2        YES NVRAM  up                    up
Regen#
```

- Use the **show controller regen x** (x=0 or 1) command to check the SONET/SDH alarms. The LOS alarm means that there is no signal on the fiber line or that the fiber is not connected, and it will cause the SONET Rx green LED to turn off. If an error message displays on the console terminal, refer to the *System Error Messages Guide* for your version of Cisco IOS software. If you experience other problems that you are unable to solve, contact a service representative for assistance.

```
Regen# show controller regen 0
Regen0 is up
Error Count:
  RxClockFail = 0          SLOS = 1          SLOF = 1
  BIP(B1) = 0

Active Defects: LOS LOF
Active Alarms:  SLOS
Alarm reporting enabled for: RxClockFail SLOS SLOF B1-TCA

B1 TCA threshold:  B1 = 10e-6


Framer 0, addr=0x68004000:

general_cntrl=0x0, active_led=0x1 ,gpio_port_mode=0x0,
gpio_port_data=0x0, gpio_port_cntrl=0xF ,mask_3=0x0,
mask_2=0xFF, mask_1=0xFF ,diag=0x0 ,
rsp_cntrl_1=0x10, ttog_cntrl=0x0 ,ttog_ovrhd_src_1=0x8C ,
Link Status=0xE0, LED control=0x80,regen_cntrl=0xA0,
Regen#
```

Table 3 explains the output from the **show controller regen** command.

Table 3 show controller regen Command Output

Output Field	Description
Regen0 is up	Regenerator 0 interface is *administratively up*.
Error Count	Error Count on regenerator 0 interface.
RxClockFail	Receive clock failed error.
SLOS	Loss of signal. There must be a clear, unobstructed path between the transmitters and receivers. Loss of sync. Indicates that an optical module has lost clock synchronization.
SLOF	Loss of frame. Indicates a SONET or SDH framing error.
BIP(B1)	Bit Interleaved Parity. Bit errors in the payload can then be detected and reported as maintenance information.
Active Defects:	Indicates which types of errors have active defects.
Active Alarms:	Indicates which types of alarms are active.
Alarm reporting enabled for:	Indicates which type of alarm reports you selected.
B1 TCA threshold:	B1 BER threshold crossing alarm. Reports B1 bit error rate (BER) threshold crossing alarm errors.
Framer 0, addr=0x68004000:	Describes the framer setting and the contents of the packet overhead.

Erase Configuration Files

If you manually configure the Cisco ONS 15104 and decide to return to using the default configuration, you can erase the configuration file and start again. Follow these steps to erase the configuration file, beginning in privileged EXEC mode:

Step	Command	Task
1	`Regen> enable` `Regen#`	Enter **enable** to enter privileged EXEC mode.

2	`Regen# write erase`
	`Regen# Erasing the nvram filesystem will remove all files! Continue? [confirm]`
	`[OK]`
	`Erase of nvram: complete`
		Enter the **write erase** command.

3	`Regen# reload` `Regen#`	Enter the **reload** EXEC command to load the default configuration file.

Caution The **write erase** EXEC command sequence will erase the entire configuration in NVRAM.

Display Startup Configuration

To display the Cisco ONS 15104's startup configuration, follow these steps, beginning in user EXEC mode:

Step	Command	Task
1	`Regen> enable`	The Cisco ONS 15104 always starts in user EXEC mode, enter **enable** to enter privileged EXEC mode.
2	`Regen# show startup-config`	Enter the **show startup-config** EXEC command.

Complete the Technical Support Checklist

Before you call technical support, be sure to have the following information ready:

- Cisco ONS 15104 type and serial number
- Maintenance contract number or warranty information
- Date you received the new Cisco ONS 15104
- Software release level and hardware configuration
- System software configuration
- Brief description of the problem you are having
- Brief explanation of steps you have taken to isolate the problem

Isolate the Problem

To isolate the problem to a specific subsystem, you must compare what the system is doing to what it should be doing. When problem solving, consider the following subsystems of the Cisco ONS 15104:

- Power system—This subsystem includes the power supply and the cable.
- Cooling system—The fans should go on when power is supplied. The air intake vents and exhaust vents must have adequate ventilation.
- Network interfaces—Use the LEDs related to the network interfaces (Ethernet, SDCC0, and SDCC1) to help identify a failure. For complete information on LED indicators, refer to the section "Interpret Alarms and Alerts," following.
- System cables—This includes all of the interface cables that connect the Cisco ONS 15104 to other devices.

Instructions for troubleshooting these systems are covered in the following sections.

Verify Network Connectivity

After you install and configure the Cisco ONS 15104, you can use the following commands in user EXEC mode to verify network connectivity:

- **Telnet**—Logs in to a remote node
- **ping**—Sends a special datagram to the destination device, then waits for a reply datagram from that device

- **trace**—Discovers the routes that packets take when traveling from one interface to another

If there is a problem with network connectivity, refer to the “Interpret Alarms and Alerts” section following.

Interpret Alarms and Alerts

All status and alarm reports of the Cisco ONS 15104’s receiving controller are from the receiving (Rx) fiber optic connector side; whereas, commands operating on the transmitting controller affect the transmitting (Tx) fiber-optic connector side. All of the error messages listed in this section are captured in the system log (Syslog) file as part of the console output. Alarm notifications are automatically sent to the network management system.

Error Message
`SONET-4-ALARM: Regen 0: Rx Clock Fail`

Explanation Framer does not see activity on the Rx clock extracted from the received signal.

Recommended Action Hardware failure. Replace the Cisco ONS 15104.

Error Message
`SONET-4-ALARM: Regen 0: SLOS`

Explanation Framer does not detect a signal on receive fiber (all-ones/zeros).

Recommended Action Clean the fiber, check the power levels of the optical line, and if out of specified range, check the upstream equipment or fiber cable.

Error Message
`SONET-4-ALARM: Regen 0: SLOF`

Explanation Framer cannot lock onto incoming signal frame.

Recommended Action Clean the fiber, check the power levels of the optical line, and if out of specified range, check the upstream equipment or fiber cable.

Error Message
`SONET-4-ALERT: Regen 0: B1 BER exceeds threshold`

Explanation The B1 parity error count is higher than the provisioned threshold.

Recommended Action Clean the fiber, check the power levels of the optical line, and if out of specified range, check the upstream equipment or fiber cable.

Error Message
`REGEN_ENV-2- WARNING: Hot sensor temperature at xx deg C`

Explanation The temperature sensor on the card indicates a temperature reading that is higher than 32 to 104°F (0 to 40°C).

Recommended Action Verify the environmental conditions of the Cisco ONS 15104 and lower the temperature of the Cisco ONS 15104’s surroundings.

Error Message `REGEN_ENV-4-ALARM: xV PUP fail`

Explanation Monitored power unit (*x* Volt) failed.

Recommended Action Hardware failure. Replace the Cisco ONS 15104.

Command Reference

This section documents the new or modified commands that are used to configure the Cisco ONS 15104. All other commands used with this feature are documented in the *Cisco IOS Release 12.0 Command Summary.*

- **regen framing**
- **regen overhead**
- **regen report**
- **regen threshold**
- **show controllers regen**
- **show interface**
- **show interface ip brief**

regen framing

Use the **regen framing** command in interface configuration mode to select SDH or SONET. Use the **no** form of this command to disable the Cisco ONS 15104's framing.

regen framing [**sdh** | **sonet**]
no regen framing [**sdh** | **sonet**]

Syntax Description

sdh	Select SDH framing and s1s0=2.
sonet	Select SONET framing and s1s0=0 (default).

Defaults

sonet framing

Command Modes

Configuration controller

Command History

Release	Modification
12.0(6)S	This command was first introduced.

Usage Guidelines

To provision the framer format, use the **regen framing** configuration controller command.

Example

The following example shows how to select sdh framing for a Cisco ONS 15104 interface:

```
Regen(config-controller)# regen framing sdh
Regen(config-controller)#
```

Related Commands

Command	Description
None.	

regen overhead

To specify the Section Trace byte value, use the **regen overhead** configuration controller command. Use the **no** form of this command to disable the Section Trace byte value.

regen overhead j0 [*0x01* | *0xCC*]
no regen overhead j0 [*0x01* | *0xCC*]

Syntax Description

0x01	Specifies the byte value for compatibility.
0xCC	Specifies the default byte value.

Defaults

0xCC

Command Modes

Configuration controller

Command History

Release	Modification
12.0(6)S	This command was first introduced.

Usage Guidelines

Use the **regen overhead** configuration controller command to monitor and operate the SONET section overhead on incoming data. **j0** equals the byte value in the range of 0x00 to 0xFF (0 to 255). **j0** is the section trace byte, and *value* is 0x1 for interoperability with some SDH devices in Japan. The default value is 0xCC.

Example

The following example shows how to assign the range of byte values for **regen overhead** that will monitor and operate the SONET section overhead on incoming data.

```
Regen(config-controller)# regen overhead j0 255
Regen(config-controller)#
```

Related Commands

Command	Description
None.	

regen report

To enable Cisco ONS 15104 alarm reports, use the **regen report** command in regen configuration controller command. Use the **no** form of this command to disable the **regen report** alarm.

regen report {**b1-tca** | **j0-mismatch** | **rxclk-fail** | **slof** | **slos**}
no regen report{**b1-tca** | **j0-mismatch** | **rxclk-fail** | **slof** | **slos**}

Syntax Description

b1-tca	B1 BER threshold crossing alert (TCA)
j0-mismatch	Section Trace Mismatch
rxclk-fail	Receive Clock failed
slof	Section Loss of Frame
slos	Section Loss of Signal

Defaults

No default behavior or values.

Command Modes

Controller configuration

Command History

Release	Modification
12.0(6)S	This command was first introduced.

Usage Guidelines

Use the **regen report** controller configuration command to specify the type of report you want to enable or disable. You can specify and enable multiple **regen report** commands.

Example

The following example shows how to enable the Cisco ONS 15104 controller to provide a section loss of frame report:

```
Regen(config-controller)# regen report slof
Regen(config-controller)#
```

Related Commands

Command	Description
None.	

regen threshold

To specify the values of the regen B1-threshold for B1-TCA, use the **regen threshold** configuration controller command. Use the **no** form of this command to disable the **regen threshold** alarm.

regen threshold b1-tca *9* **value**
no regen threshold b1-tca *9* **value**

Syntax Description

value	Value is an exponent value in the range of 3 to 9 to represent a bit error rate in the range of 10^-3 to 10^-9.

Defaults

No default behavior or values.

Command Modes

Configuration controller

Command History

Release	Modification
12.0(6)S	This command was first introduced.

Usage Guidelines

Use the **regen threshold** configuration controller command to determine the values of the Cisco ONS 15104's B1-threshold for (B1 TCA). **b1-tca** is an alarm with a value of 9. If the error rate exceeds 10, the bit error rate will be detected.

Example

The following example shows how to enable a **regen threshold b1-tca** alarm with a value of 9:

```
Regen(config-controller)# regen threshold b1-tca 9
Regen(config-controller)#
```

Related Commands

Command	Description
None.	

show controller regen

To display information about the Regen 0 and Regen 1 controllers, use the **show controller regen** EXEC command.

show controller regen [**0** | **1**]

Syntax Description

number	Identifies the Regen controller, either 0 or 1.

Defaults

No default behavior or values.

Command Modes

EXEC

Command History

Release	Modification
12.0(6)S	This command was first introduced.

Usage Guidelines

Be sure to specify the number of the regen controller when using the **show controller regen** command.

Example

The following output from the **show controller regen 0** EXEC command provides information about Cisco ONS 15104 alarms and events:

```
Regen# show controller regen 0
Regen0 is up
Error Count:
  RxClockFail = 0          SLOS = 1          SLOF = 1
  BIP(B1) = 0

Active Defects: LOS LOF
Active Alarms:  SLOS
Alarm reporting enabled for: RxClockFail SLOS SLOF B1-TCA

B1 TCA threshold:  B1 = 10e-6


Framer 0, addr=0x68004000:

general_cntrl=0x0, active_led=0x1,gpio_port_mode=0x0,
gpio_port_data=0x0, gpio_port_cntrl=0xF ,mask_3=0x0,
mask_2=0xFF, mask_1=0xFF ,diag=0x0,
rsp_cntrl_1=0x10, ttog_cntrl=0x0,ttog_ovrhd_src_1=0x8C ,
Link Status=0xE0, LED control=0x80,regen_cntrl=0xA0,
Regen#
```

Related Commands

Command	Description
None	

show interface

To display information about a specific Cisco ONS 15104 interface, use the **show interface** EXEC command.

show interfaces [**ethernet** | **SDCC0** | **SDCC1**]

Syntax Description

ethernet	Selects the Ethernet port interface statistics for display.
SDCC0	Selects the SDCC0 interface statistics for display.
SDCC1	Selects the SDCC1 interface statistics for display.

Defaults

No default behavior or values.

Command Modes

EXEC

Command History

Release	Modification
10.0	This command was first introduced
12.0(6)S	This command was modified.

Usage Guidelines

Applies to any interface that connects two systems or devices.

Example

The following output provides information about the SDCC0 interface from the **show interface** EXEC command:

```
Regen# show interface SDCC0

interface SDCC0
bandwidth 192
ip address 171.71.100.67 255.255.255.0
ip directed-broadcast
keepalive
crc 32
!
```

Related Commands

Command	Description
show interface ip brief	Displays the IP addresses of all the network interfaces.

show interface ip brief

To display the IP addresses of all the network interfaces on the Cisco ONS 15104, use the **show interface ip brief** EXEC command.

show interface ip brief

Syntax Description

None

Defaults

No default behavior or values.

Command Modes

EXEC

Command History

Release	Modification
10.0	This command was first introduced.
12.0(6)S	This command was modified.

Usage Guidelines

The **show interface ip brief** EXEC command lists all of the interface IP addresses and shows the configuration method as NVRAM or manual.

Examples

The following example displays the output from the **show interface ip brief** EXEC command that lists all of default IP addresses assigned to the Cisco ONS 15104's interfaces during AutoInstall. Note that the Method field indicates that the IR addresses are from NVRAM configuration.

```
Regen# show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
Ethernet0              10.1.0.2        YES NVRAM  up                    up
SDCC0                  11.1.0.2        YES NVRAM  up                    up
SDCC1                  12.1.0.2        YES NVRAM  up                    up
Regen#
```

The following example displays the output from the **show interface ip brief** EXEC command that lists all of the IP addresses for each Cisco ONS 15104 interface. Note that the Method field indicates that the interfaces were configured manually.

```
Regen# show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
Ethernet0              20.15.5.9       YES manual up                    up
SDCC0                  22.1.0.1        YES manual up                    up
SDCC1                  33.1.0.1        YES manual up                    up
Regen#
```

Related Commands

Command	Description
show interfaces	Displays information about Cisco ONS 15104 interfaces.

Glossary

The following are common terms and acronyms for your reference:

- **Command Line Interface** (**CLI**)—Command-line interface.
- **Flash**—High-speed, nonvolatile memory for Cisco IOS software.
- **Internetworking Operating System** (**IOS**)—Cisco networking software.
- **International Telecommunication Union Telecommunication Standardization Sector** (**ITU-T**)—(formerly the Consultative Committee for International Telegraph and Telephone [CCITT]).
- **Local Area Network** (**LAN**)
- **Management Information Base** (**MIB**)
- **Nonvolatile random-access-memory** (**NVRAM**)
- **Optical carrier-n (OC-n)**—The specification for transmitting electrical STS-n signal over optical fiber.
- **Point-to-Point Protocol** (**PPP**)—Provides a standard encapsulation method for transporting multiprotocol datagrams over point-to-point links.
- **Programmable read-only memory** (**PROM**)—ROM that can be programmed using special equipment. PROMs can be programmed only once.
- **Routing Information Protocol** (**RIP**)—Interior Gateway Protocol (IGP) supplied with UNIX BSD systems. RIP uses hop count as a routing metric.
- Read-only memory (ROM)
- **ROM Monitor** (**ROMMON**)
- **Section data communication channels** (**SDCC**)
- **Synchronous Digital Hierarchy** (**SDH**)—International standard for optical digital transmission at hierarchical rates from 155.520 Mbps (STM-1) to 2.5 gigabits per second (Gbps) (STM-16) and greater.
- **Synchronous dynamic random-access memory** (**SDRAM**)
- **Synchronous Optical Network** (**SONET**)—An American National Standards Institute (ANSI) standard (T1.1051988) for optical digital transmission at hierarchical rates from 51.840 Mbps (OC-1) to 2.5 Gbps (OC-48) and greater.
- **Synchronous payload envelope** (**SPE**)—The payload portion of the SONET frame into which the octet-oriented user data is mapped. Octet boundaries are aligned with the SPE octet boundaries.
- **Synchronous Transport Module-n** (**STM-n**)—The SDH specification for data transmission at a rate of n X 155.52Mbps.
- **Synchronous Transport Signal-n** (**STS-n**)—The SONET specification for data transmission at a rate of n X 51.8Mbps.
- **Virtual Terminal** (**VTY**)—Allows control of a Cisco router through network connections.