Cisco IOS Software Configuration for the 1-Port Channelized OC-12/STM-4 (DS3) Line Card

This document describes the software configuration procedure for the 1-port channelized OC-12/STM-4 (DS3) line card on the Cisco 12000 Series Router. This line card is sometimes referred to as the Channelized OC-12 to DS3 line card or the OC12-DS3 line card.

Feature History for the 1-Port Channelized OC-12/STM-4 (DS3)

Release	Modification
11.2(19)GS4	This feature was introduced.
12.0(8)S	This feature was introduced on the 12.0 S train.

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.

Contents

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Prerequisites for the 1-Port Channelized OC-12/STM-4 (DS3) Line Card

The Cisco 12000 Series Router must have at least one clock and scheduler card (CSC) installed that provides a one-quarter bandwidth to support the requirements of the 1-port channelized OC-12/STM-4 (DS3) line card.

Information About the 1-Port Channelized OC-12/STM-4 (DS3) Line Card

The 1-port channelized OC-12/STM-4 (DS3) line card provides 12 channels of DS3 multiplexed over a single 622-Mbps OC-12 port. The 1-port channelized OC-12/STM-4 (DS3) line card interfaces through an Add Drop Multiplexer (ADM) with other DS3 line cards at DS3 line rates in a configuration that usually consists of a Cisco 7200 Series Router and a Cisco 7500 Series Router configured with the packet-over-E3/T3 (POET) port adapter, or a third-party T3 data service unit (DSU) such as Digital Link, Larscom, or Kentrox.

The 1-port channelized OC-12/STM-4 (DS3) line card interfaces with the Cisco 12000 Series Router switch fabric and provides one OC-12 duplex SC single-mode intermediate-reach Synchronous Optical Network (SONET) connection.

How to Configure the 1-Port Channelized OC-12/STM-4 (DS3) Line Card

The following sections provide information for configuring and verifying the configuration.

Configuring the OC-12 Controller

Use the **configure** command to configure the new OC-12 controller. A Cisco 12000 Series Router identifies a controller by *slot/port*. The current OC-12 controller-configurable parameter settings are displayed as part of the **show controller oc12** *number***/0** command, as in the following example:

```
Router# show controller oc12 1/0
  OC12_CH_DS31/0
   The current state of the controller is up
   Current configurable parameter settings:
    Clock source is LINE, Payload scrambling is ON
    Loopback is NONE
Router#
```

(Remainder of displayed text omitted from example)

Table 1 shows the default OC-12 controller configuration of a 1-port channelized OC-12/STM-4 (DS3) line card in a Cisco 12000 Series Router. In controller configuration mode, select an OC-12 controller for configuration using the **controller oc12** *slot/port* command.

Table 1   1-Port Channelized OC-12/STM-4 (DS3) Line Card Controller Configuration Default Values

Parameter	Configuration Command	Default Value
Clock source	**[no] clock source [internal | line]**	line
Loop internal	**[no] loopback [internal | line]**	no loopback
Shutdown	**[no] shutdown**	no shutdown

The following steps make up a basic controller configuration for the 1-port channelized OC-12/STM-4 (DS3) line card on a router.

Step 1   Enter global configuration mode by entering **configure terminal** at the privileged EXEC prompt:

```
Router# configure terminal
Router(config)#
```

Step 2   Enter controller configuration mode by entering the **controller OC-12** *slot/port* global configuration command and specify the router slot number and port number:

```
Router(config)# controller OC12 1/0
Router(config-controller)#
```

Step 3   Set the clock source by entering the **clock source** controller configuration command and specify *line* or *internal*:

```
Router(config-controller)# [no] clock source {line | internal}
```

Use the **no** form of this command to restore the default value, line.

Step 4   To change the OC-12 controller payload scrambling:

```
Router(config-controller)# [no] scramble
```

Use the **no** form of this command to remove scrambling. The default value is scrambling.

Step 5   To change the OC-12 controller loopback mode:

```
Router(config-controller)# [no] loopback {line | internal}
```

Use the **no** form of this command to remove the loop.

Step 6   To change the shutdown state to up and enable the controller, enter the **no shutdown** controller configuration command:

```
Router(config-controller)# [no] shutdown
```

The **no shutdown** command passes an **enable** command to the 1-port channelized OC-12/STM-4 (DS3) line card. It also causes the line card to configure itself based on the previous configuration commands sent.

Configuring the DS3 Serial Interface

After you verify the OC-12 controller configuration, you can configure the associated DS3 channel and serial interfaces on the OC-12 controller. Be prepared with the information you will need, such as the interface IP address.

The following sections describe how to enable an interface and specify IP routing. You may also need to enter other configuration commands, depending on your system configuration requirements. For descriptions of configuration commands and the configuration options available, refer to the appropriate software publications listed in the "Related Documents" section on page 19.

A Cisco 12000 Series Router identifies an interface on the 1-port channelized OC-12/STM-4 (DS3) line card by its chassis slot number, line card port number, and DS3 channel number, in the format *slot/port:channel*. For example, the *slot/port:channel#* address of the first DS3 serial interface on a 1-port channelized OC-12/STM-4 (DS3) line card installed in line card slot 1 is *1/0:1*. The port number is 0.

Table 2 shows the default DS3 serial interface configuration of an enabled line card. At the prompt, specify the new interface to configure by entering the **interface** command, followed by the *type* (**serial**) and *slot/port:channel#.*

Table 2   1-Port Channelized OC-12/STM-4 (DS3) Line Card Configuration Default Values

Parameter	Configuration Command	Default Value
Cyclic Redundancy Check	**crc [16 | 32]**	16
Encapsulation	**encapsulation [hdlc | ppp]**	hdlc
Framing	**framing {c-bit | m13}**	c-bit
Idle character mode	**[no] idle-character [flags | marks]**	flags
Invert data	**[no] invert data**	no invert data
Keepalive	**[no] keepalive**	keepalive
Maximum transmission unit (mtu)	**[no] mtu** *bytes*	4470 bytes
Transmitter delay	[no] **transmitter-delay** *# of idle characters*	0

Use the following procedures to configure the 1-port channelized OC-12/STM-4 (DS3) line card:

Step 1   Enter privileged EXEC mode by entering the **enable** command. The system will prompt you for a password if one is set.

```
Router> enable
Router#
```

Press the **Return** key after each configuration step, unless otherwise noted.

Step 2   Enter global configuration mode by entering the **configure terminal** command:

```
Router# configure terminal
Router(config)#
```

Step 3   At the global configuration mode prompt, specify the new interface to configure by entering the **interface** command, followed by the *type* (**serial**) and *slot/port:channel#* (line card slot number/port number:channel number).

The prompt changes to interface configuration mode. The following example is for a 1-port channelized OC-12/STM-4 (DS3) line card in chassis slot 1:

```
Router(config)# interface serial 1/0:1
Router(config-if)#
```

Step 4   Specify framing by selecting the **framing c-bit** serial interface configuration command:

```
Router(config-if)# framing c-bit
```

Step 5   Enable payload scrambling by selecting the **scramble** serial interface configuration command:

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

Step 6   Assign an IP address and subnet mask to the interface with the **ip address** configuration command, as in the following example:

```
Router(config-if)# ip address 10.1.2.3 255.0.0.0
```

Step 7   Turn off keepalive messages:

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

Although some encapsulations benefit from keepalive processing (for example, HDLS), Cisco 12000 Series Routers do not require keepalive messages.

Step 8   Change the shutdown state to up and enable the interface:

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

The **no shutdown** command passes an **enable** command to the 1-port channelized OC-12/STM-4 (DS3) line card. It also causes the line card to configure itself based on the previous configuration commands sent.

Step 9   Add any other configuration commands required to enable routing protocols and adjust the interface characteristics.

Step 10   When you have included all the configuration commands to complete the configuration, type **end** or enter **^Z** (hold down the **Control** key while you press **Z**) to exit configuration mode.

Step 11   Write the new configuration to memory:

```
Router# copy running-config startup-config
Router#
```

The system displays an OK message when the configuration has been stored.

After you have completed your configuration, you can check it using **show** commands. For an explanation of **show** commands, see the "Using show Commands to Check System Status" section on page 8.

Cisco Remote Connection Management

The 1-port channelized OC-12/STM-4 (DS3) line card consists of high-density DS3 service through 12 channels that provide DS3 interfaces through fiber-optic connectors for the Cisco 12000 Series Router. There are two sides to the network, a local (near-end) side and a remote (far-end) side. The 1-port channelized OC-12/STM-4 (DS3) line card supports three third-party DSU vendors (Digital-Link, Kentrox, and Larscom) and Internet Service Provider (ISP)-provided DS3 lines to enable connections between a router and another device.

You can connect the local (near-end) DS3 port to the remote (far-end) DS3 port using a third-party DSU. Then use the **telnet** command from the local DS3 port to communicate with the remote DS3 port to verify the DSU mode settings. If necessary, change the DSU mode settings on the local DS3 port to match the DSU mode settings on the remote DS3 port. When the local and remote DS3 ports are configured with matching DSU mode settings, you can start passing data traffic between the near end and the far end of the network.

If the **telnet** command does not allow the local DS3 port to communicate with the remote DS3 port, it indicates that the DSU mode settings on the local and remote DS3 ports do not match. You can establish direct communication by removing the third-party DSU between the local and remote DS3 ports, and using the default DSU mode, Cisco. When you establish a direct connection between the local and remote DS3 ports, you can use Cisco IOS software commands that are specific to the Cisco Remote Connection Management feature to verify the DSU mode settings on the remote DS3 port. (See Table 1.) After the local and remote DS3 configuration settings match and you verify network connectivity, you can reinsert a third-party DSU into the configuration.

The Cisco Remote Connection Management feature is Cisco proprietary. It works only with the channelized 1-port channelized OC-12/STM-4 (DS3) line card and the 6-port or 12-port DS3 line cards in the Cisco 12000 Series Router.

Table 3 shows the default DS3 channel configuration of an enabled 1-port channelized OC-12/STM-4 (DS3) line card. In serial interface channel configuration mode, select an OC-12 controller for configuration using the **interface serial** *slot/port:channel* command.

Table 3   1-Port Channelized OC-12/STM-4 (DS3) Line Card DS3 Channel Configuration Default Values

Parameter	Configuration Command	Default Value
DS3 channel, framing mode	[no] framing [c-bit | m13]	c-bit
DS3 channel, DSU mode	[no] dsu mode [cisco | digital-link | kentrox | larscom]	cisco
DS3 channel, DSU subrate bandwidth	[no] dsu bandwidth *Kilobits/sec*	44210
DS3 channel, remote requests	[no] dsu remote accept	accept
DS3 channel, far-end DSU bandwidth	[no] dsu remote fullrate	user-configured value
DS3 channel, payload scrambling	[no] scramble	no scramble
DS3 channel, loopback mode	[no] loopback [local | network | remote]	no loopback
DS3 channel, BER testing	[no] bert pattern [2^15 | 2^20 | 2^23 | 0s | 1s] interval [1-1440]	no bert

Note   You can use Cisco Remote Connection Management only if (1) both ends of the DS3 line are configured for C-bit parity mode, and (2) the FEAC message from the DS3 payload source terminal to the DS3 payload sink terminal is delivered unaltered.

The Cisco Remote Connection Management feature uses two Cisco-proprietary DS3 C-bit parity Far-End Alarm and Control (FEAC) messages that are not used in the American National Standards Institute (ANSI) standard. Table 4 explains the commands that generate the FEAC messages.

Table 4   Far-End Alarm and Control Messages

Confirmation Message	FEAC Code	Default Value	Commands
DEFAULT_SUBRATE_CONFIG	0x0CFF	fullrate	Router (config-if)# **dsu remote fullrate**
REMOVE_DEFAULT_SUBRATE_CONFIG	0x08FF	user-configured	Router (config-if)# **dsu remote fullrate**

Note   The local port and the remote port must have matching configurations.

The following sections explain how to use Cisco IOS commands for Cisco Remote Connection Management. Table 3 lists the command parameters.

Verifying Local and Remote DS3 Port Settings

You can use **telnet** to determine the DSU mode settings on the remote DS3 port. Once you verify the remote DS3 port settings, you can change the local configuration parameters so that DSU mode settings are the same on both the local and remote DS3 ports. You can set the DSU bandwidth to accept or reject the incoming remote requests from the local DS3 port by entering the **dsu remote accept** interface configuration command.

Selecting a DSU Mode

The DSU mode supports three third-party DSU vendors—Digital-Link, Kentrox, and Larscom—and the default DSU mode, Cisco. If you use a DSU to make the connection between the Cisco 12000 Series Router and another device, the local DS3 port configuration must match the remote DS3 port configuration. Therefore, if the remote DS3 port uses the Kentrox vendor, a request is sent to the local DS3 port to change the DSU mode to Kentrox, by manually entering the **dsu mode** configuration command and specifying the Kentrox DSU. If you make a direct connection between a Cisco 12000 Series Router and another device, you can use the default DSU mode, Cisco. See Figure 2 for configuration examples.

Setting the Sending and Receiving Rate

The local and remote DS3 ports must also agree on whether to use a subrate or fullrate sending and receiving rate, because the speed of the sending and receiving rate is regulated by the DSU mode. If the sending and receiving rates do not match, they will not work. Subrates are specific to DSU modes and must be configured appropriately. The subrate sending and receiving rate is slower and less expensive than the faster, more expensive, fullrate. You can synchronize the local and remote DS3 ports sending and receiving rates by entering the **dsu remote** interface configuration command.

Configuring the DSU Bandwidth Range

The DSU bandwidth range is from 0 to 44210 kbps. The local port and the remote port must have matching configurations. Therefore, if you reduce the effective bandwidth to 3000 on the local port, you must do the same on the remote port by entering the **dsu bandwidth** interface configuration command.

Enabling Payload Scrambling

Payload (data) scrambling converts the data received by the local or remote DS3 ports from any of the three supported third-party DSU vendor modes (Digital-Link, Kentrox, and Larscom) as well as the default, Cisco mode. To enable payload scrambling on the local and remote DS3 ports, you must enter the **scramble** interface configuration command. If you do not enter the **scramble** command, payload scrambling remains disabled by default on the local and remote DS3 ports.

Configuring Cyclic Redundancy Checks

The 1-port channelized OC-12/STM-4 (DS3) line card uses a 16-bit Cyclic Redundancy Check by default, but also supports a 32-bit CRC to detect errors in transmitted data. You can set the CRC by entering the **crc** interface configuration command. The router that sends the data divides the bits in the frame message by a predetermined number to calculate a *frame check sequence* (FCS). Before sending the data, the router appends the FCS value to ensure that the frame message contents are exactly divisible by a predetermined number. The router that receives the data divides the frame message by the same predetermined number and calculates the FCS. If the result is not 0, the router that receives the data assumes that a transmission error occurred and sends a request to the router to resend the data.

Note When enabling a 16-bit or 32-bit CRC on a local interface, ensure that the remote device is also configured for a 16-bit or 32-bit CRC.

Configuring the Clock Source

The only exception for matching local and remote DS3 port configurations is that the clock sources must be set opposite each other. Therefore, if you enter the **clock source** *line* controller configuration command, you must enter **clock source** *internal* for the remote DS3 port. The ADM clock source is configured to *internal.*

Specifying DS3 Channel Framing

In interface configuration mode, specify DS3 framing by entering the **framing** [**c-bit** | **m13**] interface configuration. Use the **no** form of this command to return to the default, c-bit framing.

Using show Commands to Check System Status

Each Cisco 12000 Series Router line card maintains information about its configuration, traffic, errors, and so on. You can access this information by using the **show** commands. Following are descriptions and examples of the **show** commands.

- The **show interfaces** command outputs information about the system interfaces. Following is a sample of the **show interface serial** command for port 0 of a line card installed in slot 1, channel 1:

```
Router# show interfaces serial 1/0:1
Serial1/0:1 is up, line protocol is up
  Hardware is OC12-Channelized-to-DS3 channel
  Internet address is 101.5.1.2/24
  MTU 4470 bytes, BW 44210 Kbit, DLY 200 usec, rely 255/255, load 1/255
  Encapsulation HDLC, crc 16, loopback not set
  Keepalive set (10 sec)
  Last input 00:00:05, output 00:00:03, output hang never
```

```
Last clearing of "show interface" counters 1d16h
Queueing strategy: fifo
Output queue 0/40, 0 drops; input queue 0/75, 0 drops
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
   18617 packets input, 1537679 bytes, 0 no buffer
   Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
            0 parity
   0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
   16834 packets output, 2198122 bytes, 0 underruns
   0 output errors, 0 applique, 0 interface resets
   0 output buffer failures, 0 output buffers swapped out
   0 carrier transitions
Router#
```

• The following commands are line card specific and are executed from the line card only. To log on to the line card and execute the following commands, use the **attach** [*slot number*] EXEC command, as shown in the following example:

```
Router# attach 1
slot1# enable
slot1#
```

• To display controller information about an instance of an OC-12 controller, an instance of a DS3 channel controller, or both, as viewed from the line card, use the following versions of the **show controllers oc12** EXEC command:

– **show controllers oc12** *slot/port*

Display information about an OC-12 controller by entering the **show controllers oc12** *slot/port* command for a 1-port channelized OC-12/STM-4 (DS3) line card:

```
Router# show controllers oc12 1/0

OC12_CH_DS31/0
 The current state of the controller is up
 Current configurable parameter settings:
  Clock source is INTERNAL, Loopback is NONE
SECTION
  LOF = 0          LOS = 0          RDOOL = 0          BIP(B1) = 0
  Active Alarms: None
LINE
  AIS = 0          RDI   = 0        FEBE = 0          BIP(B2) = 0
  Active Alarms: None
PATH 1
  AIS = 0          RDI = 0          FEBE = 0          BIP(B3) = 0
  LOP = 0          NEWPTR = 0       PSE = 0           NSE = 0
  Active Alarms: None
  S1S0 = 02, C2 = 04
  PATH TRACE BUFFER : STABLE
PATH 2
  AIS = 0          RDI = 0          FEBE = 0          BIP(B3) = 0
  LOP = 0          NEWPTR = 0       PSE = 0           NSE = 0
  Active Alarms: None
  S1S0 = 03, C2 = FF
  PATH TRACE BUFFER : STABLE
```

(Remainder of displayed text omitted from example.)

– **show controllers oc12** *slot/port:channel#*

Verify the Cisco Remote Connection Management configuration by entering the **show controllers oc12** *slot/port:channel#* command, as shown in the following example:

```
Router# show controllers oc12 1/0:1

Controller OC12 1/0, interface Serial1/0:1 (DS3 channel 1)
 cdb = 0x616BED10, base_hwidb = 0x613B5540, hwidb = 0x613B6520
 ssb = 0x616C46A0, ds = 0x616C43E8
 Line state is up
  rxLOS inactive, rxLOF inactive, rxAIS inactive
  txAIS inactive, rxRAI inactive, txRAI inactive
 Current configurable parameter settings:
  Loopback is none, Framing is c-bit
  DSU mode is cisco, DSU bandwidth limit is 44210
  Payload scrambling is disabled, CRC is 16
  Bert pattern is disabled, Bert interval is 0
  Transmitter delay is 0, Encapsulation is HDLC
  Idle character is flags, Invert data is disabled
  Remote fullrate has no request outstanding
  Remote accept is enabled, MTU is 4470
 MIB information:
  Data in current interval (366 seconds elapsed):
   0 Line Code Violations, 0 P-bit Coding Violations
   0 C-bit Coding Violations
   0 P-bit Err Secs, 0 P-bit Sev Err Secs
   0 Sev Err Framing Secs, 0 Unavailable Secs
   0 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
  No alarms detected.
Router#
```

– **show controllers oc12 detail**

View details about an OC-12 controller by entering the **show controllers oc12 detail** command:

```
Router# show controllers oc12 detail
OC12_CH_DS31/0
 The current state of the controller is up
 Current configurable parameter settings:
  Clock source is INTERNAL, Loopback is NONE
SECTION
  LOF = 0           LOS = 0           RDOOL = 0           BIP(B1) = 0
  Active Alarms: None
LINE
  AIS = 0           RDI   = 0         FEBE = 0           BIP(B2) = 0
  Active Alarms: None
PATH 1
  AIS = 0           RDI = 0           FEBE = 0         BIP(B3) = 0
  LOP = 0           NEWPTR = 0        PSE = 0          NSE = 0
  Active Alarms: None
  S1S0 = 02, C2 = 04
  PATH TRACE BUFFER : STABLE
  61 6D 69 74 2D 62 66 72  00 00 00 00 00 00 00 00    anew-day........
  00 00 00 00 00 00 00 00  53 65 72 69 61 6C 35 2F    ........Serial5/
  30 3A 31 00 00 00 31 30  31 2E 35 2E 31 2E 31 00    0:1...101.5.1.1.
  00 00 00 00 00 00 30 30  30 30 30 30 30 30 0D 0A    ......00000000..
PATH 2
  AIS = 0           RDI = 0           FEBE = 0         BIP(B3) = 0
  LOP = 0           NEWPTR = 0        PSE = 0          NSE = 0
  Active Alarms: None
  S1S0 = 03, C2 = FF
  PATH TRACE BUFFER : STABLE
  FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF    ................
  FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF    ................
```

```
           FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF    ................
           FF FF FF FF FF FF FF FF  FF FF FF FF FF FF FF FF    ................
     Router
```

- Use the **show protocols** command to display the global (system-wide) and interface-specific status of any configured Level 3 protocol.

- Use the **show running-config** command to display the currently running configuration in RAM. Here is an example:

```
Router# show running-config
Building configuration...

Current configuration:
!
! No configuration change since last restart
!
version 12.0
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
service internal
!
clock timezone PST -8
clock summer-time PDT recurring
clock calendar-valid
!

ip subnet-zero
ip ftp source-interface Ethernet0
ip ftp username anewday
ip ftp password anewday
no ip domain-lookup
ip host apark 201.205.254.254
frame-relay switching
clns routing
!
controller OC12 1/0
 clock source internal
!
!
interface Serial 1/0:1
 ip address 100.1.1.1 255.255.255.0
 no ip directed-broadcast
 encapsulation ppp
 crc 32
 dsu mode kentrox
!
interface Serial 1/0:2
 ip address 100.2.2.2 255.255.255.0
 no ip directed-broadcast
 dsu mode larscom
 dsu bandwidth 30000
!
```

(Remainder of displayed text omitted from example.)

Using Loopback Commands

The 1-port channelized OC-12/STM-4 (DS3) line card supports loopback modes for both the OC-12 controller and for each of the associated DS3 channels. Specify the loopback mode by entering one of the **loopback** interface configuration commands shown in Table 5. Use the **no** form of this command to restore the default value, **no loopback**, which represents the normal operation between the local end (TX) and the remote end (RX).

Table 5   DS3 Supported Loopback Modes

Loopback modes	Configuration Mode	Command
Diagnostic or local loopback	**loopback local**	Router(config-if)# **loopback local**
Network loopback	**loopback network**	Router(config-if)# **loopback network**
Remote loopback	**loopback remote**	Router(config-if)# **loopback remote**
Default value	**default value**	Router(config-if)# **no loopback**

Figure 1 shows data flows for the various loopback modes.

Figure 1   Transmit and Receive Loopback Data Flows
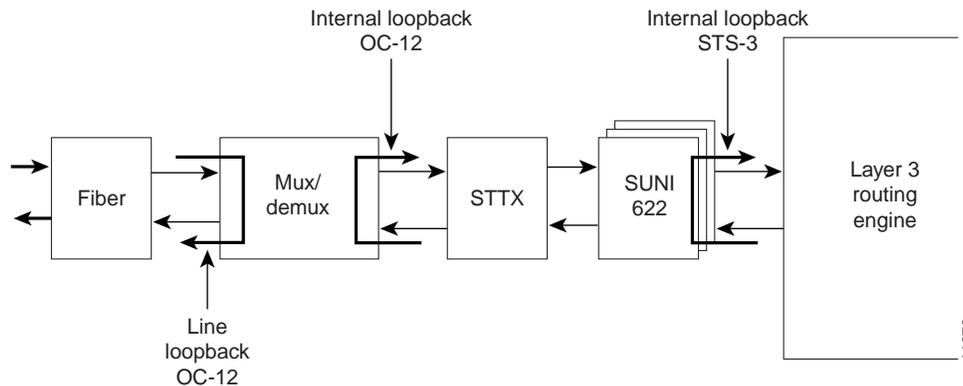
OC-12 Controller Loopback Mode

The OC-12 controller supports two loopback modes:

• Internal—This loopback mode loops data from the transmit path to the receive path at the mux/demux location on the line card, allowing diagnostics to send data to itself at the OC-12 level without relying on external connections. In controller configuration mode, set the loopback mode to internal, using the [**no**] **loopback** [**internal** | **line**] configuration command:

```
Router(config-controller)# loopback internal
Router(config-controller)#
```

Use the **no** form of this command to restore the default value, no loopback.

- Line—This loopback mode loops data from the receive path to the transmit path at the mux/demux part on the line card, returning all received data at the OC-12 level to the far end. In controller configuration mode, set the loopback mode to line, using the **[no] loopback [internal | line]** configuration command:

```
Router(config-controller)# loopback line
Router(config-controller)#
```

Use the **no** form of this command to restore the default value to no loopback.

DS3 Channel Loopback Mode

The DS3 channel supports three loopback modes:

- Local—This loopback mode loops data from the transmit path to the receive path at the QJET location on the line card, allowing diagnostics to send data to itself over a single channel without relying on external connections. In serial interface configuration mode, set the loopback mode to local, using the **[no] loopback [local | network | remote]** configuration command, as in the following example:

```
Router(config-if)# loopback local
```

Use the **no** form of this command to restore the default value, no loopback.

- Network—This loopback mode loops data from the STS1 receive path to the STS1 transmit path at the Mapper location on the line card, returning all received data over a single channel to the far end. In controller configuration mode, set the loopback mode to local, using the **[no] loopback** [**local | network | remote**] configuration command:

```
Router(config-if)# loopback network
```

Use the **no** form of this command to restore the default value, no loopback.

- Remote—This loopback mode sends an FEAC message over a single channel to the far end, requesting that it transition into network loopback mode. In controller configuration mode, set the loopback mode to local, using the [**no**] **loopback** [**local | network | remote**] configuration command, as in the following example:

```
Router(config-if)# loopback remote
```

Use the **no** form of this command to restore the default value, no loopback.

Configuring DS3 Port BER Testing

You can set one local DS3 serial port to bit error rate test (BERT) mode while the remaining local serial ports continue to transmit and receive normal traffic. A BERT checks communication between the local and the remote DS3 ports. If traffic is not being transmitted or received, create a back-to-back loopback BER test and send out a predictable stream to ensure that you receive the same data that was transmitted. To determine if the remote DS3 serial port returns the BERT pattern unchanged, the system administrator for the remote router must manually set the remote DS3 serial port to **loopback network line**, while you enter a **bert pattern** interface configuration command at specified time intervals on the local DS3 serial port.

The following example shows the output from a back-to-back loopback BER test. The router types are a Cisco 12012 Router on the local (near) end, and a Cisco 12008 Router on the remote (far) end. Keepalive is disabled, while the loopback network line test runs between both routers. Clock source is

set to **internal** on the local OC-12 controller in slot 1 with IP address 10.0.0.2. Clock source is set to **line** on the remote OC-12 controller in slot 1 with IP address 11.0.0.1. A BERT pattern is entered between local serial port 8/1 and remote serial port 5/1:

```
clock source internal----------clock source line
no keepalive-------------------loopback network line----------no keepalive
Router:[gsr-1]-----------------[mfr-1]
[BERT Pattern]
Serial8/1----------------------Serial5/1
[11.0.0.2]---------------------[11.0.0.1]


Router(config)# interface serial 6/0
Router(config-if)# bert pattern 2^23 interval 10
Router(config-if)#
```

Table 6 lists the BERT patterns, explains how to invoke them, and specifies test intervals between 1 and 1140 minutes long. The **no bert pattern** interface configuration command terminates an ongoing BER test and returns the local and remote DS3 serial ports to the default value.

Table 6   DS3-Supported BERT Patterns

BERT Pattern	To Invoke	Command
2^15	A pseudorandom repeating pattern that is 32767 bits long	Router (config-if)# **bert pattern 2^15 interval 10**
2^20	A pseudorandom repeating pattern that is 1048575 bits long	Router (config-if)# **bert pattern 2^20 interval 10**
qrss 2^20	**A** quasirandom signal source	Router (config-if)# **bert pattern qrss**
2^23	**A** pseudorandom repeating pattern that is 8388607 bits long	Router (config-if)# **bert pattern 2^23 interval 10**

Checking Bit Errors Using a BERT

Following is an example of the **bert pattern** command and specified time intervals that will cause the BERT to send the pseudorandom pattern 2^23 and repeat on the first DS3 channel for 10 minutes:

```
Router# configure terminal
Router(config)# interface serial 1/0:1
Router(config-if)# bert pattern 2^23 interval 10
Router(config-if)# end
Router(config)# end
Router#
```

Entering Errors in BER Tests

To insert intentional errors into the BER test stream, use the following command syntax:
bert errors [*no-of-errors*], where the *no-of-errors* default is 1 and the range is 1 to 255, inclusive. The following example shows the command used to insert five errors into the current BER test stream that is running the pseudorandom pattern 2^23 that repeats on the first DS3 channel for 10 minutes:

```
Router# configure terminal
Router(config)# interface serial 1/0:1
Router(config-if)# bert pattern 2^23 interval 10
Router(config-if)# bert errors 5
Router(config-if)# end
Router(config)# end
Router#
```

Using show Commands to Verify BERT Configuration

When the DS3 serial port is running a BERT, the serial port state is down, and only BERT data is passed. You can use the **show** commands shown in Table 7 to verify if the line card state is up or down.

Table 7   Show Commands for BERT Configuration

Commands	Explanation
show controller oc12 *n/port:channel*	Shows the current controller status, where *n* is the slot number.
show controller oc12 1/0:1 bert	Shows the fields of a BER test that is still in progress.

The following output indicates that BERT is enabled with a pattern of 2^23 and an interval of 10 minutes:

```
Router# show controller oc12 1/0:1 bert

Interface Serial1/0 (DS3 port 1)
 BERT information:
  State            :enabled (sync'd)
  Pattern          :2^23
  Interval         :10 minutes
  Time remaining   :00:09:44
  Total errors     :0
  Time this sync   :00:00:10
  Errors this sync :0
  Sync count       :1
Router#
```

Note   The bit error test patterns from the serial ports on a 1-port channelized OC-12/STM-4 (DS3) line card are framed test patterns; therefore, they are inserted into the payload of a framed T3 signal.

The following example shows the information of a BER test that is still in progress:

```
Router# show controller OC12 1/0:1 bert

Interface Serial1/0:1 (DS3 port 1)
 BERT information:
  State           :enabled (sync'd)
  Pattern         :2^23
  Interval        :10 minutes
  Time remaining  :00:01:44
  Total errors    :0
  Time this sync  :00:08:10
  Errors this sync :0
  Sync count      :1
Router#
```

Note   When the DS3 is running a BERT, the Total Bit Errors value is not valid if the Status field is Not Sync.

The following is an example of a screen display from a completed BER test:

```
Router# show controller OC12 1/0:1 bert

Interface Serial1/0:1 (DS3 port 1)
 BERT information:
  State           :disabled (sync'd, completed)
  Pattern         :2^23
  Interval        :10 minutes
  Time remaining  :00:00:00
  Total errors    :0
  Time this sync  :00:09:54
  Errors this sync :0
  Sync count      :1
Router#
```

Table 8 provides explanations of the BERT display fields in the previous examples:

Table 8   BER Test Display Fields

| BERT Information	Explanation
State: enabled (not synchronized)	BER test is active, but the hardware has not currently synchronized. Errors are counted only when the hardware has synchronized.
State: enabled (synchronized)	BER test is active, and the hardware has synchronized. Any errors encountered are counted.
State: disabled (not synchronized, failed)	BER test is finished and the test resulted in failure, either because the hardware never synchronized or the physical layer interface module (PLIM) declared the test a failure.
State: disabled (synchronized, completed)	BER test is finished because the interval expired.
State: disabled (synchronized, aborted)	BER test is finished as a result of a user request (for example, **no bert**)
Pattern	Can be any one of the supported BERT patterns.
Interval	Can be any value from 1 to 1440 (units are in minutes).

Table 8   BER Test Display Fields (continued)

BERT Information	Explanation
Time remaining	Can be any value from 1 second to the interval provided, formatted as *hh:mm:ss*.
Total errors	The total number of errors encountered while the hardware is synchronized.
Time this synchronization	If the hardware is currently synchronized, the amount of time since synchronization began, formatted as *hh:mm:ss*. If it is not currently synchronized but was synchronized earlier, indicates the amount of time that the last or most recent synchronization period lasted, formatted as *hh:mm:ss*.
Errors this synchronization	If the hardware is currently synchronized, the number of errors encountered during the current sync period. If it is not currently synchronized but was synchronized earlier, the number of errors encountered during the last or most recent synchronization period.
Synchronization count	The number of times synchronization was achieved.

Configuration Examples for the 1-Port Channelized OC-12/STM-4 (DS3) Line Card

Figure 2 shows two 1-port channelized OC-12/STM-4 (DS3) line card configuration examples. In the first example, the 1-port channelized OC-12/STM-4 (DS3) line card is channel 1 in router slot 1, and is connected to a Cisco 7500 Series Router with an HSSI port through an external DSU.

In the second example, the 1-port channelized OC-12/STM-4 (DS3) line card is channel 5 in router slot 1, and is connected to a Cisco 7200 Series Router with a T3 serial port adapter with integrated DSUs/CSUs.

Figure 2   1-Port Channelized OC-12/STM-4 (DS3) Line Card Interoperability Diagram
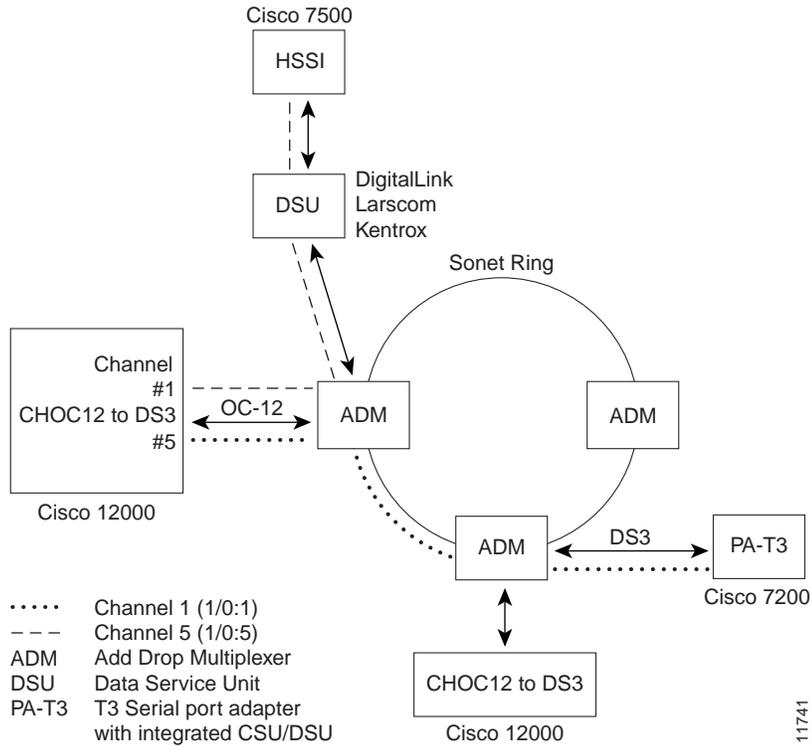
The following example shows a typical configuration for a channel, associated with a 1-port channelized OC-12/STM-4 (DS3) line card, that is connected to a Cisco 7200 Series Router with a T3 serial port adapter (see Figure 2):

```
Router# configure terminal
Router(config)# interface serial 1/0:5
Router(config-if)# dsu mode cisco
Router(config-if)# dsu bandwidth 44210
Router(config-if)# framing c-bit
Router(config-if)# no scramble
Router(config-if)# crc 16
Router(config-if)# keepalive
Router(config-if)# ip address 1.1.5.1 255.255.255.0
Router(config-if)# no shutdown
```

Additional References

The following sections provide references related to the 1-port channelized OC-12/STM-4 (DS3) line card.

Related Documents

Related Topic	Document Title
Hardware installation	*Channelized and Electrical Interface Line Card Installation and Configuration*
Software configuration commands	• *Software Configuration Guide for the Cisco 12000 Series Internet Router* • *Cisco IOS Configuration Fundamentals Configuration Guide* • *Cisco IOS Release 12.0S Release Notes for Cisco 12000 Series Internet Routers*

Technical Assistance

Description	Link
Technical Assistance Center (TAC) home page, containing 30,000 pages of searchable technical content, including links to products, technologies, solutions, technical tips, and tools. Registered Cisco.com users can log in from this page to access even more content.	http://www.cisco.com/public/support/tac/home.shtml