Cisco IOS Software Configuration for the 6-Port Channelized T3 (T1) Line Card

This document describes the software configuration procedure for the 6-port channelized T3 (T1) line card on the Cisco 12000 Series Router. This line card is sometimes referred to as the 6CT3-SMB line card.

Feature History for the 6-Port Channelized T3 (T1) Line Card

Release	Modification
12.0(14)S	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 the 6-Port Channelized T3 (T1) 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 6-port channelized T3 (T1) line card.

Corporate Headquarters:
Cisco Systems, Inc., 170 West Tasman Drive, San Jose, CA 95134-1706 USA

Information About the 6-Port Channelized T3 (T1) Line Card

The 6-port channelized T3 (T1) line card performs High-Level Data Link Control (HDLC) encapsulation and de-encapsulation functions, and all other necessary functions including timing, signaling, and framing, in compliance with DS1 and DS3 specifications.

How to Configure the 6-Port Channelized T3 (T1) Line Card

The following sections provide configuration procedures for the T3 controller and interface:

Identifying T1 and T3 Interface Port Numbers and Addresses

The Cisco 12000 Series Router identifies interface addresses by their line card slot numbers and port numbers, in the format *slot/port*. For example, the slot/port address of an interface on a 6-port channelized T3 (T1) line card installed in line card slot 1 is *1/0*. Even though the card contains only one port, you must use the *slot/port* notation.

For consistency throughout the following configuration examples for the 6-port channelized T3 (T1) line card, the T3 controller address is **t3** *slot/port*.

The interface numbering scheme for the 6-port channelized T3 (T1) line card NxDS0 interfaces is in the form of *slot/port/t1:channel-group number*

where

- *slot* refers to the chassis slot where the 6-port channelized T3 (T1) line card is installed.
- *port* refers to the physical port on the 6-port channelized T3 (T1) line card and is always between 0 and 5.
- *NxDS0* indicate the interface type.
- *T1* lines are numbered 1 to 28.
- *NxDS0 channel-groups* are numbered 0 to 23. In this document, channel-groups are referred to as channels. There can be up to 24 NxDS0 channels per T1and up to 35 NxDS0 channels per T3.

Note T1 lines on the 6-port channelized T3 (T1) line card are numbered 1 to 28, rather than the more traditional zero-based scheme (0 to 27) used with other Cisco line card products. This is to ensure consistency with Telco numbering schemes for T1 lines within channelized T3 equipment.

Configuring the T3 Controller

Procedures and examples for configuring the T3 controller on the 6-port channelized T3 (T1) line card are presented in the following sections:

Selecting a T3 Controller

You must enter the **controller T3** *slot*/*port* command before any other configuration commands to select the T3 controller you want to configure. The example that follows is for a 6-port channelized T3 (T1) line card in slot 6 of a Cisco 12000 Series Router:

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# controller T3 6/0
Router(config-controller)#
```

Setting the Framing Type for the T3 Controller

To specify the framing type, use the controller command **framing** [**c-bit** | **m23** | **auto-detect**].

You can set c-bit framing format as follows:

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

You can set m23 framing format as follows:

```
Router(config-controller)# framing m23
```

Specifying the Cable Length

For the **cablelength** *value* command, user-specified T3 cable lengths are structured into ranges as follows: 0 to 49 feet and 50 to 450 feet. If you enter a cable length value that falls into one of these ranges, the range within which that value applies is used.

Note The configuration is based on feet, not meters.

To specify cable length, use the **cablelength** *value* controller configuration command

where

- *value* is a numeral from 0 to 450 feet (137 meters).
- Default value is 49 feet (15 meters).

In the following example, a cable length of 40 feet (12 meters) is specified.

```
Router(config-controller)# cablelength 40
```

Note In the preceding example, a cable length of 40 feet (12 meters) is specified, which means that the 0- to 49-foot (0 to 15 meters) range is used. If you change the cable length to 45 feet (13 meters), then the 0- to 49-foot range still applies. If you specify a cable length of 100 feet (30 meters), then change it to 200 feet (60 meters), the 50- to 450-foot (15 to 137 meters) range applies in each case; therefore, these changes have no effect. Only moving from one range to the other range has an effect. The actual cable-length number you enter is stored in the configuration file.

Setting the Clock Source for the T3 Controller

To set the selected T3 controller, use the **clock source** {**internal** | **line**} controller configuration command. The default is **clock source internal**.

- The following example shows how to configure a line clock source:

```
Router(config)# controller T3 6/0
Router(config-controller)# clock source line
```

- The following example shows how to configure an internal clock source:

```
Router(config)# controller T3 6/0
Router(config-controller)# clock source internal
```

Using T3 Controller Loopback Modes

To test the T3 controller, use the **loopback** [**local** | **network** | **remote**] controller configuration commands shown in Table 1. To return the T3 controller to its default condition, use the **no** form of the command.

Table 1 Supported T3 Controller Loopback Modes

Loopback Modes	Configuration Mode	Command
Diagnostic or local loopback	**loopback local**	Router(config-controller)# **loopback local**
Network loopback modes	**loopback network**	Router(config-controller)# **loopback network**
Remote T3 loopback	**loopback remote**	Router(config-controller)# **loopback remote**
Equipment network loopback	**equipment network loopback**	Router(config-controller)# **equipment network loopback**
Default value	**default value**	Router(config-controller)# **no loopback**

- Use the **loopback local** controller configuration command to diagnose problems with the 6-port channelized T3 (T1) line card when it is isolated from the network cables. The following example is for a 6-port channelized T3 (T1) line card in slot 6 of the Cisco 12000 Series Router series router:

```
Router(config)# controller T3 6/0
Router(config-controller)# loopback local
```

- Network loopback loops the T3 line back toward the network and can be used to diagnose problems with cables. The following example shows how to configure the T3 controller for network loopback. The T3 controller is on a 6-port channelized T3 (T1) line card in slot 6 and port 0 of the Cisco 12000 Series Router:

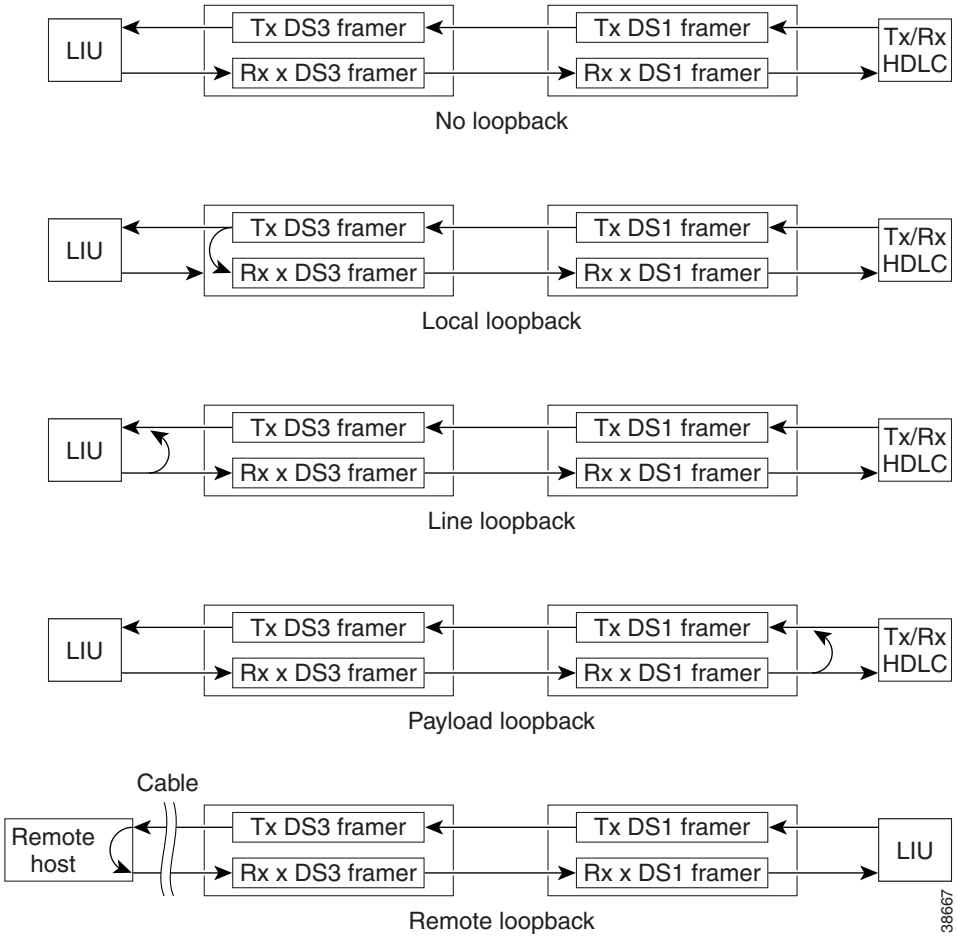
```
Router(config)# controller T3 6/0
Router(config-controller)# loopback network
```

- Remote loopback sends a command to loop the T3 line at the far-end; this can be used to diagnose problems with cables. The following example shows how to configure the T3 controller for remote loopback. The T3 controller is on a 6-port channelized T3 (T1) line card in slot 6 and port 0 of the Cisco 12000 Series Router:

```
Router(config)# controller T3 6/0
Router(config-controller)# loopback remote
```

Figure 1 shows examples of how data is transmitted and received in each loopback mode.

Figure 1 6-Port Channelized T3 (T1) Loopback Modes



Shutting Down the T3 Controller

You can shut down the T3 controller on the 6-port channelized T3 (T1) line card with the **shutdown** controller configuration command. This command sends a DS3 idle signal toward the network. You can bring the T3 controller back up with the **no shutdown** controller configuration command.

The following example is for a 6-port channelized T3 (T1) line card in slot 6 and port 0 of a Cisco 12000 Series Router:

```
Router(config)# controller T3 6/0
Router(config-controller)# shutdown
```

Configuring the T3 Controller to Respond to Remote T3 Loopback Commands

This section explains how to use the **equipment** [**customer** | **network**] **loopback** controller configuration command.

To enable the 6-port channelized T3 (T1) line card to respond to remote T3 loopback commands from the remote T3 equipment, use the **equipment customer loopback** command.

```
Router(config-controller)# equipment customer loopback
```

To enable the 6-port channelized T3 (T1) line card to ignore remote T3 loopback commands, use the **equipment network loopback** command.

```
Router(config-controller)# equipment network loopback
```

Note Remote loopbacks are only available when you use c-bit parity framing.

Configuring T1 Lines

Procedures and examples for configuring T1 channel-groups on the T3 link of the 6-port channelized T3 (T1) line card are presented in the following sections:

Creating a Logical Channel Group on a T1 Line

You can create a logical channel group on a T1 line using the following controller command:

```
t1 t1-line-number channel-group channel-group-number timeslots list-of-timeslots [speed
{56 | 64}]
```

Table 2 describes the syntax of this command.

Table 2 T1 Line Channel Group Syntax

Keyword/Argument	Range	Description
t1-line-number	1 to 28	Any T1 line can have multiple logical channel groups up to the maximum of 35 per T3.
channel-group *channel-group-number*	0 to 23	Defines a logical channel group to be a channelized T1 line (T1 timeslots 1 to 24 can be channelized down to DS0 using channel groups 0 to 23).
timeslots *list-of-timeslots*	1 to 24	Combination of subranges within 1 to 24 (each subrange is a list of timeslots that makes up the T1 line).
speed	56 or 64 kbps	Optional argument that specifies the speed of a timeslot to be either 56 or 64 kbps.

To configure a T1 line, you must enter T3 controller configuration mode and specify the line card slot and port. The following example shows a T3 controller in slot 6 and port 0 and how to configure logical channel group 20 on T1 line 1 and assign channelized timeslots 1 to 5, and 20 to 23:

```
Router(config)# controller T3 6/0
Router(config-controller)# t1 1 channel-group 20 timeslots 1-5, 20-23
```

Note After a T1 channel group is configured, it appears to the Cisco IOS software as a serial interface; therefore, all the configuration commands for a serial interface are available. However, not all commands are applicable to the T1 channel group.

All the encapsulation formats, such as PPP, HDLC, and Frame Relay, are applicable to the configured T1 channel group. Be sure that you are in serial interface configuration mode when you set the encapsulation format.

All the switching types that are applicable to a serial interface are also applicable to the configured T1 channel group.

Removing a Logical Channel Group from a T1 Line

You can remove a logical channel group from a T1 line with the **no t1** *t1-line-number* **channel-group** *channel-group-number* controller command appropriate to your channelized configurations

where

- *t1-line-number* is 1 to 28.
- *channel-group-number* is 0 to 23.

To configure a T1 line, you must enter T3 controller configuration mode and specify the line card slot and port. The following example shows a T3 controller in slot 6 and port 0.

To remove logical channel group 10 from channelized T1 line 1, use the **no t1 1 channel-group 10** controller configuration command.

```
Router(config)# controller T3 6/0
Router(config-controller)# no t1 1 channel-group 10
```

Setting the Framing Format on a T1 Line

You can specify the T1 framing format using the **t1** *t1-line-number* **framing** {**esf** | **sf**} controller command

where

- default framing format is Extended Super Frame (ESF).
- *t1-line-number* is 1 to 28.

To configure a T1 line, you must enter T3 controller configuration mode and specify the line card slot and port. The following examples show a T3 controller in slot 6 and port 0.

- The following example shows how to set ESF framing format for T1 line 16:

```
Router(config)# controller T3 6/0
Router(config-controller)# t1 16 framing esf
```

- To set Super Frame (SF) framing format for T1 line 6, use the **t1 6 framing sf** controller command:

```
Router(config)# controller T3 6/0
Router(config-controller)# t1 6 framing sf
```

- Additional options to set SF framing formats follow:

```
Router(config-controller)# t1 6 framing ?
    esf  Extended Superframe Framing format
    sf   Superframe Framing Format

Router(config-controller)# t1 6 framing sf ?
    hdlc-idle  Specify the HDLC idle pattern on a T1

Router(config-controller)# t1 6 framing sf hdlc-idle ?
    0x7E  Use 0x7E as HDLC idle pattern
    0xFF  Use 0xFF as HDLC idle pattern
```

- The following SF framing format example contains all the previous command options:

```
Router(config-controller)# t1 6 framing sf hdlc-idle 0x7e
```

Note When you select SF framing, consider using the **no** *t1-line-number* **yellow detection** command to turn off yellow alarm detection, because the yellow alarm can be incorrectly detected with SF framing. You can use the [**no**] **t1** *t1-line-number* **yellow** {**detection** | **generation**} command (where *t1-line-number* is 1 to 28) to turn the detection or generation of a yellow alarm on and off.

Setting the Clock Source on a T1 Line

You can set the internal or line (network) clock source for a T1 line with the **t1** *t1-line-number* **clock source** {**internal** | **line**} controller command

where

- *t1-line-number* is 1 to 28.
- default clock source is **internal**.

Note You can set the clock source to use internal clocking for testing purposes. One end of a T1 circuit *must* provide the clock source.

- The following example shows how to instruct T1 line 1 to use an internal clock source.

```
Router(config)# controller T3 6/0
Router(config-controller)# t1 1 clock source internal
```

- The following example shows how to instruct T1 line 16 to use a line clock source.

```
Router(config)# controller T3 6/0
Router(config-controller)# t1 16 clock source line
```

Using the ping Command to Verify Network Connectivity

Using the **ping** command, you can verify that an interface port is functioning properly. The **ping** command sends echo request packets out to a remote device at an IP address that you specify. After sending an echo request, the system waits a specified time for the remote device to reply. Each echo reply is displayed as an exclamation point (!) on the console terminal; each request that is not returned before the specified timeout is displayed as a period (.). A series of exclamation points (!!!!!) indicates a good connection; a series of periods (.....) or the messages [timed out] or [failed] indicate a bad connection.

Following is an example of a successful **ping** command to a remote server with the address 10.0.0.10:

```
Router# ping 10.0.0.10
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echoes to 10.0.0.10, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/15/64 ms
Router#
```

If the connection fails, verify that you have the correct IP address for the destination and that the device is active (powered on), then repeat the **ping** command.

Proceed to the next section, "Using T1 Interface Loopback Modes," to finish checking network connectivity.

Using T1 Interface Loopback Modes

If you have difficulty with the 6-port channelized T3 (T1) line card configuration or installation, you can troubleshoot the problem using the **t1** *t1-line-number* **loopback** [**local** | **network** {**line** | **payload**}| **remote** {**line** {**fdl** {**ansi** | **bellcore**}| **payload** [**fdl**] [**ansi**]}] T3 controller configuration command, where *t1-line-number* is 1 to 28. (See Table 3.)

Table 3 Supported T1 Interface Loopback Modes

Loopback modes	Configuration Mode	Command
Diagnostic or local loopback	**loopback local**	Router(config-controller)# **t1** *t1-line-number* **loopback local**
Network loopback modes		
Line loopback	**loopback network line**	Router(config-controller)# **t1** *t1-line-number* **loopback network line**
Payload loopback	**loopback network payload**	Router(config-controller)# **t1** *t1-line-number* **loopback network payload**
Remote loopback line fdl modes		
Remote loopback line fdl ansi	**loopback remote line fdl ansi**	Router(config-controller)# **t1** *t1-line-number* **loopback remote line fdl ansi**
Remote loopback line fdl bellcore	**loopback remote line fdl bellcore**	Router(config-controller)# **t1** *t1-line-number* **loopback remote line fdl bellcore**
Remote loopback payload fdl mode		
Remote loopback payload fdl ansi	**loopback remote payload fdl ansi**	Router(config-controller)# **t1** *t1-line-number* **loopback remote payload fdl ansi**
Default value	**default value**	Router(config-controller)# **no t1** *t1-line-number* **loopback**

Note **fdl loopback** commands are available only for T1 channel groups configured for ESF framing.

Table 4 describes the specific loopback modes.

Table 4 6-Port Channelized T3 (T1) Line Card Loopback Modes

local	Optional. Loops the router output data back toward the router at the T1 framer and sends an alarm indication signal (AIS) out toward the network.
network {**line** | **payload**}	Optional. Loops the data back toward the network before the T1 framer and automatically sets a local loopback at the HDLC controllers (**line**). Loops the payload data back toward the network at the T1 framer and automatically sets a local loopback at the HDLC controllers (**payload**).

Table 4 6-Port Channelized T3 (T1) Line Card Loopback Modes (continued)

remote line fdl {**ansi** | **bellcore**}	Optional. Sends a repeating, 16-bit ESF data link code word (00001110 11111111 for ANSI; 00010010 11111111 for Bellcore) to the remote end, requesting that it enter into a network line loopback. Specify the **ansi** keyword to enable the remote line facility data link (FDL) ANSI bit loopback on the T1 channel, per the ANSI T1.403 specification. Specify the **bellcore** keyword to enable the remote SmartJack loopback on the T1 channel, per the TR-TSY-000312 specification.
remote payload [**fdl**] [**ansi**]	Optional. Sends a repeating, 16-bit ESF data link code word (00010100 11111111) to the remote end, requesting that it enter into a network payload loopback. Enables the remote payload Facility Data Link (FDL) ANSI bit loopback on the T1 channel. You can optionally specify **fdl** and **ansi**, but it is not necessary.

Specify loopback for a T1 line using the following commands:

- To set a T1 line into local loopback mode, use the **loopback local** controller configuration command.

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# controller T3 6/0
Router(config-controller)# t1 1 loopback local
```

- To set a T1 line into network line loopback, use the **loopback network line** controller configuration command.

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# controller T3 6/0
Router(config-controller)# t1 1 loopback network line
```

- To set a T1 line into network payload loopback, use the **loopback network payload** controller configuration command.

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# controller T3 6/0
Router(config-controller)# t1 1 loopback network payload
```

Examples of the **loopback remote** command follow, where the command syntax is:

```
loopback [remote {line {fdl ansi} | payload fdl ansi}]
```

- To set a T1 line into remote line fdl ansi bit loopback, use the **loop remote line fdl ansi** controller configuration command.

```
Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# controller T3 6/0
Router(config-controller)# t1 1 loop remote line fdl ansi
```

- To set the first T1 line into remote payload fdl ansi bit loopback, use the **loop remote payload fdl ansi** controller configuration command.

```
Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# controller T3 6/0
Router(config-controller)# t1 1 loop remote payload fdl ansi
```

Enabling Remote Performance Reports

To enable and disable 1-second transmissions of performance reports through the fdl, use the **t1** *t1-line-number* **fdl ansi** controller configuration command on both ends of the connection, where *t1-line-number* is 1 to 28.

```
Router(config-controller)# t1 t1-line-number fdl ansi
```

You can use this command *only* when the T1 framing is ESF. Use the **no** form of the command to disable remote performance reports. The 6-port channelized T3 (T1) line card does not support controlled slip seconds.

Note If you do not first enable remote performance data with the **t1** *t1-line-number* **fdl ansi** command, the following is displayed:

```
T1 1 - Remote Performance Data (Not available)
```

Configuring a BER Test on a T1 Line

Bit error rate test (BERT) circuitry is built into the 6-port channelized T3 (T1) line card. The 6-port channelized T3 (T1) supports the following pseudorandom test patterns: **bert pattern** {**2^11** | **2^15** |**2^20**}. Only one BER test circuit exists for all 35 T1 channel-groups. With BER tests, you can test cables and signal problems in the field. You can configure individual T1 channel groups to run an independent BER test.

There are two categories of test patterns that can be generated by the onboard BER test circuitry: pseudorandom and repetitive. The former test patterns are exponential numbers and conform to the Consultative Committee on International Telephony and Telegraphy/International Telecommunications Union (CCITT/ITU) O.151 and O.153 specifications.

Table 5 lists the BERT patterns, explains how to invoke them, and specifies test intervals between 1 and 14,400 minutes long. The **no bert pattern** interface configuration command terminates an ongoing BER test.

Table 5 DS1-Supported BERT Patterns

BERT Pattern	To Invoke	Command
2^11	Pseudorandom repeating pattern that is 2,048 bits long	Router (config-controller)# **t1 x bert pattern 2^11 interval 10**
2^15	Pseudorandom repeating pattern that is 32,767 bits long	Router (config-controller)# **t1 x bert pattern 2^15 interval 10**
2^20	Pseudorandom repeating pattern that is 1,048,575 bits long	Router (config-controller)# **t1 x bert pattern 2^20 interval 10**

Both the total number of error bits transmitted and the total number of bits received are available for analysis. You can set the testing period from 1 minute to 14,400 minutes (240 hours). You can also retrieve the error statistics anytime during the BER test.

Note BER testing for the T3 link is not supported.

When running a BER test, your system expects to receive the same pattern that it is transmitting. To help ensure this, two common options are available:

- Use a loopback somewhere in the link or network.
- Configure remote testing equipment to transmit the same BER test pattern at the same time.

Sending a BERT Pattern on a T1 Line

You can send a BERT pattern on a T1 line with the **t1** *t1-line-number* **bert pattern** *pattern* **interval** *time* [**unframed**] controller configuration command. The unframed option causes the BERT pattern to use the entire T1 bandwidth including the T1 framing, as well as payload bits.

If "unframed" is omitted, the T1 will be either SF or ESF framed as configured by the **T1** *n* **framing** configuration controller command. The BERT pattern will occupy only the T1 payload bits. You can terminate a BER test during the specified test period with the **no t1 bert** command

where

- *t1-line-number* is 1 to 28.
- *time* is 1 to 14,400 minutes.

The following is an example of how to send a BERT pseudorandom pattern of 2^20 through T1 line 10 for 5 minutes:

```
Router(config)# controller T3 6/0
Router(config-controller)# t1 10 bert pattern 2^20 interval 5 unframed
```

Displaying BER Test Results

You can display the results of a BER test using the **show controllers t3** *slot/port/t1-line-number* controller command, where *t1-line-number* is 1 to 28.

You can view the results of a BER test at the following times:

- After you terminate the test using the **no t1 bert** command
- After the test runs completely
- Anytime during the test (in real time)

You can view information about a BER test using the **show controllers t3** *slot/port*:*t1-line-number* controller command, where *t1-line-number* is 1 to 28.

```
Router# show controller t3 6/0:1
T3 6/0 is up.  Hardware is GSR 6 port CT3

T1 1 is up
  timeslots: 1-24
  FDL per AT&T 54016 spec.
  No alarms detected.
  Framing is ESF, Clock Source is Internal
  BERT test result (running)
```

```
Test Pattern : 2^11, Status : Sync, Sync Detected : 1
Interval : 5 minute(s), Time Remain : 5 minute(s)
Bit Errors (since BERT started): 6 bits,
Bits Received (since BERT started): 8113 Kbits
Bit Errors (since last sync): 6 bits
Bits Received (since last sync): 8113 Kbits
```

(Additional display text omitted from this example)

Table 6 provides line-by-line descriptions of the preceding **show controllers** *slot/port/t1-line-number* controller command output:

Table 6 show controllers Command Output

Output Display Line	Description
`BERT test result (running)`	Indicates the current state of the test. In this case, "running" indicates that the BER test is still in process. After a test is completed, "done" is displayed.
`Test Pattern : 2^11, Status : Sync, Sync Detected : 1`	Indicates the test pattern you selected for the test (2^11), the current synchronization state (sync), and the number of times synchronization was detected during this test (1).
`Interval : 5 minute(s), Time Remain : 5 minute(s)`	Indicates the time the test takes to run and the time remaining for the test to run.
`Interval : 5 minute(s), Time Remain : 2 minute(s) (unable to complete)`	For a BER test that you terminate, this line indicates the time the test would have taken to run and the time remaining for the test to run had you not terminated it; "unable to complete" signifies that you interrupted the test.

`Bit Errors(Since BERT Started): 6 bits,`
`Bits Received(Since BERT start): 8113 Kbits`
`Bit Errors(Since last sync): 6 bits`
`Bits Received(Since last sync): 8113 Kbits`
	Show the bit errors that were detected versus the total number of test bits that were received since the test started and since the last synchronization was detected.

Note Unless unframed is selected, the BER test runs over the currently configured framing option for the specified T1 line (ESF or SF). Before running a BER test, be sure to configure the framing option that is appropriate for your application. (Refer to the "Setting the Framing Format on a T1 Line" section on page 8.)

Terminating a BER Test

You can terminate a BER test with the **no t1** *t1-line-number* **bert** controller command, where *t1-line-number* is 1 to 28.

The following example shows how to terminate the BER test running on T1 line 10.

```
Router(config)# controller T3 6/0
```

```
Router(config-controller)# no t1 10 bert
```

This completes the procedures for configuring T1 channel groups for BER tests.

Configuring 6-Port Channelized T3 (T1) Line Card Interfaces

Follow these steps to configure the 6-port channelized T3 (T1) line card interface, beginning in privileged EXEC mode:

Step 1 Enter the **configure terminal** EXEC command to enter global configuration mode as follows:

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
```

Step 2 Specify the 6-port channelized T3 (T1) line card interface by entering the **interface serial** *slot*/*port*/**t1**:*t1 channel group number* global configuration command.

```
Router(config)# interface serial 6/0/1:0
Router(config-if)#
```

The prompt changes to interface configuration mode.

Step 3 Use the **ip address** interface configuration command to specify an interface by an IP address and subnet mask:

```
Router(config-if)# ip address 10.0.0.1 255.255.255.0
Router(config-if)#
```

Step 4 Add any additional configuration commands required to enable protocols and set the T1 line characteristics.

Step 5 To change the shutdown state to up and enable the interface, use the **no shutdown** interface command:

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

Step 6 Repeat Step 2 through Step 5 to configure additional T1 channel groups as required.

Step 7 Enter **exit** to exit configuration mode:

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

Step 8 Write the new configuration to nonvolatile random access memory (NVRAM) by using the **copy running-config startup-config** command:

```
Router# copy running-config startup-config
[OK]
Router#
```

Configuring MDRR with WRED

Modified Deficient Round Robin (MDRR) with Weighted Random Early Detection (WRED) defines the packet values and assigns a traffic priority rating, using the procedures in the following sections:

- Configuring CoS Queue Group Template, page 16

Random Early Detection (RED) is a congestion avoidance mechanism that takes advantage of TCP congestion control mechanism. By randomly dropping packets prior to periods of high congestion, RED tells the packet source to decrease its transmission rate. Assuming the packet source is using TCP, it will decrease its transmission rate until all the packets reach their destination, indicating that the congestion is cleared.

Weighted RED (WRED) generally drops packets selectively based on IP precedence. Packets with a higher IP precedence are less likely to be dropped than packets with a lower precedence. Thus, higher-priority traffic is delivered with a higher probability than lower-priority traffic. However, you can also configure WRED to ignore IP precedence when making drop decisions so that nonweighted RED is achieved.

For additional information on configuring WRED, refer to the online publication *Weighted Random Early Detection on the Cisco 12000 Series Router*, available on the documentation CD-ROM or at http://www.cisco.com.

Configuring CoS Queue Group Template

To group together RED/MDRR parameters that you want linked to different queues, create a class of service (CoS) queue group template. The queue group lets you establish two or more basic WRED parameter settings that you can apply to many different CoS queues. By using a queue group, you need not reconfigure each interface and CoS queue separately. Next, enter the CoS queue group name, where *name* is the CoS queue group identifier.

To create a queue group template and enter CoS queue group configuration mode:

```
Router(config)# cos-queue-group name
Router(config-cos-que)#
```

Configuring RED for Transmit Queues

Each CoS interface queue can be configured independently. The RED parameters can be configured on a per-interface/per-IP procedure value. To configure RED for the transmit link queues, perform the following procedure in interface configuration mode:

Step 1 Configure RED for the transmit link queues and associate a CoS queue group name with the transmit queues on this interface:

```
Router(config-if)# tx-cos name
Router(config-if)#
```

Step 2 Exit interface configuration mode and return to global configuration mode:

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

Configuring RED for To Fabric Queues

A 6-port channelized T3 (T1) line card sends packets to the switching fabric, addressing up to 16 destination slots. Depending on the line card type, a total of 128 queues (16 slots with 8 queues) or 2048 queues (16 slots, 16 interfaces per slot, 8 queues per interface) are available. In addition, there are eight CoS queues for IP multicast traffic. Each CoS queue can be configured independently. The RED parameters can be configured on a per-slot/per-IP precedence values.

Note You can configure a maximum of eight CoS queues and one IP multicast CoS queue on a line card. For line cards that support 2048 queues, CoS queue parameters apply to all interfaces on a particular destination slot.

Step 1 Define a slot table name and enter slot table configuration mode by using the **slot-table-cos** *name* command.

```
Router(config)# slot-table-cos name
Router(config)#
```

Step 2 Define destination slot parameters for this slot table name by using the **destination-slot** {*number* | **all**} *name* command.

```
Router(config)# destination-slot {number | all} name
Router(config)#
```

Step 3 Define multicast parameters for this slot table name by using the **multicast** *name* command.

```
Router(config)# multicast name
Router(config)#
```

Step 4 Exit slot table name configuration mode and return to global configuration mode by using the **exit** command.

```
Router(config)# exit
Router(config)#
```

Step 5 Link the slot-table-cos template to the line card where you want RED performed by using the **rx-cos-slot** {*number* | **all**} *name* command.

```
Router(config)# rx-cos-slot number name
Router(config)#
```

Changing WRED Parameters

This section provides procedures that enable you to change WRED parameters, beginning in interface configuration mode. This default is used in a CoS queue group, when a **random-detect-label** is configured and associated with IP precedence levels, using the **precedence** command.

When you enable WRED with the random-detect command, you can optionally configure all values as follows:

- Select a specific 6-port channelized T3 (T1) line card interface by using the **interface serial** *slot/port/t1:channel group* command:

```
Router(config)# interface serial slot/port/t1:channel-group
Router(config-if)#
```

Selecting Exponential-Weighting-Constant

The default value for WRED exponential-weighting-constant is 3. This default is used in a CoS queue group, when a random-detect-label is configured and associated with IP precedence levels, using the **precedence** command. The default value for the Cisco 12000 Series Router is 1. For the 6-port channelized T3 (T1) line card, the default value is 3.

Note The default value is based on the best available data. Cisco recommends that you do not change the parameter unless you have determined that your application would benefit from the changed value. If the value of the weighing-constant gets too high, WRED will not react to congestion. Packets will be transmitted as if WRED were not in effect. If the value on the other end gets too low, WRED will overreact to temporary traffic bursts and drop traffic unnecessarily.

For a DS1 link, the bandwidth (B) is determined as follows:

```
B = 1.54Mbps/(8bits/byte)/1500(bytes/packet) = 125
```

The basic formula for establishing a starting value is as follows:

```
exponential-weighting-constant = 10/B = 0.08 for DS1
0.08~=2^-3
```

This result, approximately 2^-3, gives the configuration value 3 for the exponential-weighting constant.

Selecting Minimum Threshold

For a DS1 link, pipesize (P) in maximum packets or bandwidth-delay product is determined as follows:

```
P (or BDP) =  RTT * DS1 rate (bytes/s) * 8 /Packetsize
where,
RTT = Round trip time set to 100 milliseconds, DS1 rate = 1.544
Mbits/sec = 193,000 bytes/s
Packetsize = 1500 bytes/packet
For a DS1 line rate P = ~103
```

Minimum threshold is a ratio of P and varies from 0.01P to 0.3P; the recommended value is 0.25 P. Table 7 shows the minimum threshold values for various link speeds.

Table 7 Minimum Threshold Values

Link Speed	Threshold (min)
DS1	26
2*DS1	51
4*DS1	103
8*DS1	206

Selecting Maximum Threshold

Maximum threshold is also a ratio of P and varies from 1.0P to 1.5P; the recommended value is 1.0P. Maximum threshold is constrained by the need for the slope of the line between the minimum threshold and maximum threshold to be a power of two.

Table 8 shows the maximum threshold values for various link speeds.

Table 8 Maximum Threshold Values

Ink Speed	Threshold (max)
DS1	103
2*DS1	206
4*DS1	412
8*DS1	824

Configuration Examples

The following configuration example output defines the configuration for the **ds1-tx** queue group for a T1 channel group. Precedence and random-detect-label commands were used to configure the WRED parameters:

```
interface Serial8/2/1:0
 ip address 10.1.1.1 255.255.0.0
 no ip directed-broadcast
 no ip mroute-cache
 clock source internal
 tx-cos ds3-tx
!
!
cos-queue-group ds3-tx
 precedence 0 random-detect-label 0
 precedence 1 random-detect-label 1
 precedence 2 random-detect-label 2
 precedence 3 random-detect-label 3
 precedence 4 random-detect-label 4
 precedence 5 random-detect-label 5
 precedence 6 random-detect-label 6
 precedence 7 random-detect-label 6
 random-detect-label 0 110 367 1
 random-detect-label 1 150 500 2
 random-detect-label 2 250 600 3
 random-detect-label 3 350 700 4
 random-detect-label 4 450 800 5
 random-detect-label 5 550 900 6
 random-detect-label 6 650 1000 7
 exponential-weighting-constant 3
!
```

Configuring Distributed Multilink Point-to-Point Protocol

Configuring distributed Multilink Point-to-Point Protocol (MLPPP) is presented in the following sections:

- Create a Multilink Bundle, page 20

- Assign an Interface to a Multilink Bundle, page 20
- Disable PPP Multilink Fragmentation, page 21

MLPPP allows you to increase the bandwidth of your network links beyond that of a single T1 line without having to purchase a T3 line. By using an MPLLL link, you can combine T1 lines in a 6-port channelized T3 (T1) line card on a Cisco 12000 Series Router into a bundle that has the combined bandwidth of multiple T1 lines. You choose the number of bundles and the number of T1 lines in each bundle.

An individual MLPPP bundle can span multiple T3s on the same line card. Bundles cannot span multiple line cards.

A bundle can be composed of one to eight T1 lines, or an individual line that can span multiple T3s. Each T1 component must be of equal bandwidth.

For additional information, refer to the feature module *Configuring Media-Independent PPP and Mulilink PPP*.

Create a Multilink Bundle

A multilink bundle consists of a maximum of eight T1s. To create a multilink bundle, use the following commands, beginning in global configuration mode:

Step 1 Enter multilink interface configuration mode:

```
Router# configure terminal
Router(config)# interface multilink group-number
```

Step 2 Assign an IP address to the multilink interface:

```
Router(config-if)# ip address address mask
Router(config-if)#
```

Step 3 Enable PPP encapsulation:

```
Router(config-if)# encapsulation ppp
Router(config-if)#
```

Step 4 Enable multilink PPP:

```
Router(config-if)# ppp multilink
Router(config-if)#
```

Assign an Interface to a Multilink Bundle

To assign an interface to a multilink bundle, use the following commands in interface configuration mode:

Step 1 Remove any specified IP address.

```
Router(config-if)# no ip address
```

Step 2 Set the frequency of keepalive packets.

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

Step 3 Enable PPP encapsulation.

```
Router(config-if)# encapsulation ppp
```

Step 4 Assign the interface to a multilink bundle.

```
Router(config-if)# multilink-group group-number
```

Step 5 Enable multilink PPP.

```
Router(config-if)# ppp multilink
```

Step 6 Optional: Enable Challenge Handshake Authentication Protocol (CHAP) authentication.

```
Router(config-if)# ppp authentication chap
```

Disable PPP Multilink Fragmentation

By default, PPP multilink fragmentation is enabled. To disable PPP multilink fragmentation, use the following command in interface configuration mode:

- Disable PPP multilink fragmentation.

```
Router(config-if)# no ppp multilink fragmentation
Router(config-if)# exit
Router#
```

Note Enabling fragmentation reduces the delay latency among bundle links, but adds some load to the CPU. Disabling fragmentation can result in better throughput. If your data traffic is consistently of a similar size, Cisco recommends that you disable fragmentation. In this case, the benefits of fragmentation might be outweighed by the added load on the CPU.

Using show Commands to Verify T3 Controller and Interface Status

After installing the 6-port channelized T3 (T1) line card, use **show** commands to display the status of the T3 controller, T1 channel groups, and the 6-port channelized T3 (T1) line card interface. Following are descriptions and examples of the **show** commands you can use to check the configuration. Descriptions are limited to fields that are relevant for verifying the 6-port channelized T3 (T1) line card configuration.

- The **show version** command displays the configuration of the system hardware (the channel of each line card installed), the software release, the names and sources of configuration files, and the boot images. Ensure that the list includes the new 6-port channelized T3 (T1) line card interface.

```
Router# show version
Cisco Internetwork Operating System Software
IOS (tm) GS Software (GSR-P-M),Version 12.0(14)S
Copyright (c) 1986-2000 by cisco Systems, Inc.
Compiled Wed 10-May-00 10:37
Image text-base: 0x60010908, data-base: 0x61544000

ROM: System Bootstrap, Version 11.2(9)GS5, DEPLOYMENT RELEASE
BOOTFLASH: GS Software (GSR-BOOT-M), Version 11.2(9)GS7, DEPLOYMENT, RELEASE

mfr25 uptime is 3 hours, 35 minutes
System returned to ROM by reload
System image file
```

```
cisco 12008/GRP (R5000) processor (revision 0x01) with 262144K bytes of memory.
R5000 CPU at 200Mhz, Implementation 35, Rev 2.1, 512KB L2 Cache
Last reset from power-on

1 Route Processor Card
2 Clock Scheduler Cards
3 Switch Fabric Cards
1 six-port Channelized T3 controller (6 T3s)
1 Ethernet/IEEE 802.3 interface(s)
2 Serial network interface(s)
507K bytes of non-volatile configuration memory.

20480K bytes of Flash PCMCIA card at slot 0 (Sector size 128K).
8192K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x0
```

- The **show controller** *type slot/port* command displays the status of the default T1 and T3 (which is specified in RFC 1406). The command **show controller T3** *slot/port* displays the T1 alarm condition. The command **show controller t1** *slot/port* command displays the detailed information for a particular T1, including the T3 alarms and all 28 T1 alarms.

```
Router#show controller t3 6/0
T3 6/0 is up.  Hardware is GSR 6 port CT3
  Applique type is Channelized T3
  No alarms detected.
  FEAC code received:No code is being received
  Framing is M23, Line Code is B3ZS, Clock Source is Internal
  Equipment customer loopback
  Data in current interval (544 seconds elapsed):
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation, 0 P-bit Err Secs
     0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
     0 Unavailable Secs, 0 Line Errored Secs
     0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
  Data in Interval 1:
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation, 0 P-bit Err Secs
     0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
     0 Unavailable Secs, 0 Line Errored Secs
     0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
  Data in Interval 2:
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation, 0 P-bit Err Secs
     0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
     0 Unavailable Secs, 0 Line Errored Secs
     0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
  Data in Interval 3:
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation, 0 P-bit Err Secs
     0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
     0 Unavailable Secs, 0 Line Errored Secs
     0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
  Total Data (last 3 15 minute intervals):
     0 Line Code Violations, 0 P-bit Coding Violation,
     0 C-bit Coding Violation, 0 P-bit Err Secs,
     0 P-bit Severely Err Secs, 0 Severely Err Framing Secs,
     0 Unavailable Secs, 0 Line Errored Secs,
     0 C-bit Errored Secs, 0 C-bit Severely Errored Secs

  T1 1 is up
  timeslots:1-24
  FDL per ANSI T1.403 and AT&T 54016 spec.
```

```
  No alarms detected.
  Framing is ESF, Clock Source is Internal
  Data in current interval (581 seconds elapsed):
     0 Line Code Violations, 0 Path Code Violations
     0 Slip Secs, 9 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
     9 Errored Secs, 0 Bursty Err Secs, 9 Severely Err Secs
     0 Unavail Secs, 0 Stuffed Secs
  Data in Interval 1:
     0 Line Code Violations, 0 Path Code Violations
     0 Slip Secs, 8 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
     8 Errored Secs, 0 Bursty Err Secs, 8 Severely Err Secs
     0 Unavail Secs, 0 Stuffed Secs
  Data in Interval 2:
     0 Line Code Violations, 0 Path Code Violations
     0 Slip Secs, 14 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
     14 Errored Secs, 0 Bursty Err Secs, 14 Severely Err Secs
     0 Unavail Secs, 0 Stuffed Secs
  Data in Interval 3:
     0 Line Code Violations, 0 Path Code Violations
     0 Slip Secs, 9 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
     9 Errored Secs, 0 Bursty Err Secs, 9 Severely Err Secs
     0 Unavail Secs, 0 Stuffed Secs
  Total Data (last 3 15 minute intervals):
     0 Line Code Violations,0 Path Code Violations,
     0 Slip Secs, 31 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
     31 Errored Secs, 0 Bursty Err Secs, 31 Severely Err Secs
     0 Unavail Secs, 0 Stuffed Secs
Router#
```

- The **show controller** *type slot/port* **brief** command displays limited information about a T3 and all configured T1s.

```
Router# show controller t3 6/0 brief
T3 6/0 is up.  Hardware is GSR 6 port CT3
  Applique type is Channelized T3
  No alarms detected.
  FEAC code received:No code is being received
  Framing is M23, Line Code is B3ZS, Clock Source is Internal
  Equipment customer loopback

  T1 1 is up
  timeslots:1-24
  FDL per ANSI T1.403 and AT&T 54016 spec.
  No alarms detected.
  Framing is ESF, Clock Source is Internal

  T1 2 is up
  timeslots:1-24
  FDL per ANSI T1.403 and AT&T 54016 spec.
  No alarms detected.
  Framing is ESF, Clock Source is Internal

  T1 3 is up
  timeslots:1-24
  FDL per ANSI T1.403 and AT&T 54016 spec.
  No alarms detected.
  Framing is ESF, Clock Source is Internal
```

- Another permutation of the preceding **show controller** *type slot/port:t1 channel* **brief** command shows output from the T3 controller and an individual T1 line that you specify, by adding *:t1 channel*, where *t1 channel* is a number in the range between 1 and 28.

```
Router# show controller t3 6/0:1 brief
T3 6/0 is up.  Hardware is GSR 6 port CT3
```

```
  T1 1 is up
  timeslots: 1-24
  FDL per AT&T 54016 spec.
  No alarms detected.
  Framing is ESF, Clock Source is Line
Router#
```

- To display remote (far-end) performance data, use the **show controllers t3** *slot*/*port* **remote performance** command.

```
Router# show controller t3 3/3 remote performance
T3 3/3 is up.  Hardware is GSR 6 port CT3

  T1 1 - Remote Performance Data
  Data in current interval (225 seconds elapsed):
     0 Line Code Violations, 0 Path Code Violations
     0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
     0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs
     0 Unavail Secs
  Data in Interval 1:
     0 Line Code Violations, 3 Path Code Violations
     0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
     2 Errored Secs, 1 Bursty Err Secs, 0 Severely Err Secs
     0 Unavail Secs
  Total Data (last 1 15 minute intervals):
     3 Path Code Violations
     0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
     2 Errored Secs, 1 Bursty Err Secs, 0 Severely Err Secs
     0 Unavail Secs

  T1 2 - Remote Performance Data
  Data in current interval (854 seconds elapsed):
     0 Line Code Violations, 0 Path Code Violations
     0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
     0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs
     0 Unavail Secs

  T1 3 - Remote Performance Data
  Data in current interval (828 seconds elapsed):
     0 Line Code Violations, 1 Path Code Violations
     0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
     1 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs
     0 Unavail Secs

  T1 4 - Remote Performance Data
  Data in current interval (525 seconds elapsed):
     0 Line Code Violations, 3 Path Code Violations
     0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
     2 Errored Secs, 1 Bursty Err Secs, 0 Severely Err Secs
     0 Unavail Secs
```

(Additional display text is not shown.)

- To display remote performance data, use the **show controllers t3** *slot*/*port* **remote performance brief** command.

```
Router# show controller t3 3/3 remote performance brief
T3 3/3 is up.  Hardware is GSR 6 port CT3

  T1 1 - Remote Performance Data
  Data in current interval (396 seconds elapsed):
     0 Line Code Violations, 0 Path Code Violations
     0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
```

```
   0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs
   0 Unavail Secs
Total Data (last 1 15 minute intervals):
   3 Path Code Violations
   0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
   2 Errored Secs, 1 Bursty Err Secs, 0 Severely Err Secs
   0 Unavail Secs

T1 2 - Remote Performance Data
Data in current interval (134 seconds elapsed):
   0 Line Code Violations, 0 Path Code Violations
   0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
   0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs
   0 Unavail Secs
Total Data (last 1 15 minute intervals):
   0 Path Code Violations
   0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
   0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs
   0 Unavail Secs

T1 3 - Remote Performance Data
Data in current interval (99 seconds elapsed):
   0 Line Code Violations, 0 Path Code Violations
   0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
   0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs
   0 Unavail Secs
Total Data (last 1 15 minute intervals):
   1 Path Code Violations
   0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
   1 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs
   0 Unavail Secs

T1 4 - Remote Performance Data
Data in current interval (696 seconds elapsed):
   0 Line Code Violations, 3 Path Code Violations
   0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
   2 Errored Secs, 1 Bursty Err Secs, 0 Severely Err Secs
   0 Unavail Secs
```

(Additional displayed text is not shown.)

- To display remote (far-end) performance data in a tabular format, use the **show controllers t3** *slot*/*port* **remote performance tabular** command.

```
Router# show controller t3 3/3 remote performance tabular
T3 3/3 is up.  Hardware is GSR 6 port CT3

  T1 1 - Remote Performance Data
  INTERVAL      LCV   PCV   CSS  SELS   LES    DM    ES   BES   SES   UAS
  18:34-18:42     0     0     0     0     0     0     0     0     0     0
  18:19-18:34     0     3     0     0     0     0     2     1     0     0
  Total           0     3     0     0     0     0     2     1     0     0

  T1 2 - Remote Performance Data
  INTERVAL      LCV   PCV   CSS  SELS   LES    DM    ES   BES   SES   UAS
  18:39-18:42     0     0     0     0     0     0     0     0     0     0
  18:24-18:39     0     0     0     0     0     0     0     0     0     0
  Total           0     0     0     0     0     0     0     0     0     0

  T1 3 - Remote Performance Data
  INTERVAL      LCV   PCV   CSS  SELS   LES    DM    ES   BES   SES   UAS
  18:39-18:42     0     0     0     0     0     0     0     0     0     0
  18:24-18:39     0     1     0     0     0     0     1     0     0     0
  Total           0     1     0     0     0     0     1     0     0     0
```

```
  T1 4 - Remote Performance Data
  INTERVAL      LCV    PCV    CSS  SELS   LES    DM    ES   BES   SES   UAS
  18:29-18:42     0      3      0     0     0     0     2     1     0     0

Router#
```

(Additional display text is not shown)

Note If you do not first enable remote performance data with the **t1** *t1-line-number* **fdl ansi** command, the following message displays:

```
T1 1 - Remote Performance Data (Not available)
```

Note The 6-port channelized T3 (T1) line card does *not* support controlled slip seconds.

- The **show interface serial** *type slot/port/t1 channel:t1channel group number* EXEC command displays information about a T1 interface that you specify.

```
Router# show interface serial 6/0/1:0
Serial6/0/1:0 is up, line protocol is up
  Hardware is Channelized-T3
  Internet address is 1.1.1.1/24
  MTU 1500 bytes, BW 1536 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation HDLC, crc 16, loopback not set
  Keepalive not set
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  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
     0 packets input, 0 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 2 abort
     0 packets output, 0 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
     3 carrier transitions no alarm present
  Timeslot(s) Used: 1-24, Transmitter delay is 0 flags
  non-inverted data
Router#
```

- The **show startup-config** command displays the contents of the system configuration file stored in NVRAM. This file should reflect all new configuration changes you made and wrote to memory with the **copy running-config startup-config** command.

```
Router# show startup-config
Using 13193 out of 520184 bytes
!
version 12.0(14)S
no service pad
service timestamps debug uptime
service timestamps log datetime msec localtime
no service password-encryption
service udp-small-servers
service tcp-small-servers
service download-fl
!
hostname mfr30
```

```
!
boot system flash slot0:gsr-p-mz.120-5.5.S
enable password lab
!
clock timezone EST -5
!
ip subnet-zero
ip tftp source-interface Ethernet0
no ip domain-lookup
ip multicast-routing distributed
!
controller T3 6/0
 clock source line
 t1 1 channel-group 0 timeslots 1-24
 t1 2 channel-group 0 timeslots 1-24
 t1 1 clock source Line
!
controller T3 6/1
 shutdown
 clock source line
!
controller T3 6/2
 framing c-bit
 clock source line
 t1 1 channel-group 0 timeslots 1-12
!
```

(Additional display text is not shown.)

- The **show running-config** command displays the contents of a configuration file before it is written to NVRAM.

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

Current configuration:
!
version 12.0(14)S
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
no service auto-reset
!
hostname mfr25
!
enable password lab
!
username Router password 0 foobar
!
ip subnet-zero
no ip domain-lookup
!
controller T3 3/0
 framing m23
 t1 1 channel-group 0 timeslots 1-24
 t1 2 channel-group 1 timeslots 1-24
!
controller T3 3/1
!
controller T3 3/2
!
controller T3 3/3
!
controller T3 3/4
```

```
!
controller T3 3/5
!
interface Multilink1
 ip address 1.1.1.4 255.255.255.0
 no ip directed-broadcast
 no keepalive
 no cdp enable
 ppp multilink
 multilink-group 1
!
interface Multilink2
 no ip address
 no ip directed-broadcast
 no cdp enable
 ppp multilink
 multilink-group 2
!
interface Ethernet0
 ip address 10.1.2.94 255.255.255.0
 no ip directed-broadcast
 no ip route-cache
 no ip mroute-cache
!
interface Serial3/0/1:0
 ip address 1.1.1.2 255.255.255.0
 no ip directed-broadcast
 encapsulation ppp
 no keepalive
 no cdp enable
 ppp multilink
 multilink-group 1
!
interface Serial3/0/2:1
 no ip address
 no ip directed-broadcast
 encapsulation ppp
 no keepalive
 no cdp enable
 ppp multilink
 multilink-group 1
!
router rip
 network 1.0.0.0
!
ip classless
!
end
Router#
```

- **show protocols** displays the protocols configured for the entire system and specific interfaces. If necessary, return to configuration mode to add or remove protocol routing on the system or specific interfaces.

```
Router# show protocols
Global values:
  Internet Protocol routing is enabled
Ethernet0 is up, line protocol is up
  Internet address is 10.1.2.2/24
Serial6/0/1:0 is up, line protocol is up
  Internet address is 10.1.1.3/24
Serial6/0/2:0 is up, line protocol is up
  Internet address is 10.1.1.4/24
Serial6/2/1:0 is down, line protocol is down
```

```
  Internet address is 10.1.1.5/24
Serial6/4/1:0 is up, line protocol is up
  Internet address is 10.0.1.6/24
Router#
```

- Use the **show ppp multilink** command to display information about the newly created multilink bundle:

```
Router# show ppp multilink
Multilink1, bundle name is group1
    Bundle is Distributed
    0 lost fragments, 0 reordered, 0 unassigned, sequence 0x0/0x0 rcvd/sent
    0 discarded, 0 lost received, 1/255 load
    Member links:4 active, 0 inactive (max not set, min not set)
     Serial1/0/0:1
     Serial1/0/0/:2
    Serial1/0/0/:3
         Serial1/0/0/:4
Router#
```

Additional References

The following sections provide references related to the 6-port channelized T3 (T1) 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