clock rate

To configure the clock rate for the hardware connections on serial interfaces such as network interface modules (NIMs) and interface processors to an acceptable bit rate, use the **clock rate** command in interface configuration mode. To remove the clock rate if you change the interface from a DCE to a DTE device, use the **no** form of this command. Using the **no** form of this command on a DCE interface sets the clock rate to the hardware-dependent default value.

clock rate *bps*

no clock rate

Syntax Description

bps	Desired clock rate, in bits per second: **1200**, **2400**, **4800**, **960**0, **19200**, **38400**, **56000**, **64000**, **72000**, **125000**, **148000**, **250000**, **500000**, **800000**, **1000000**, **1300000**, **2000000**, **4000000**, or **8000000**. For the synchronous serial port adapters (PA-8T-V35, PA-8T-X21, PA-8T-232, and PA-4T+), a nonstandard clock rate can be used. You can enter any value from 300 to 8000000 bps. The clock rate you enter is rounded (adjusted), if necessary, to the nearest value that your hardware can support except for the following standard rates: **1200**, **2400**, **4800**, **960**0, **14400**, **19200**, **28800**, **38400**, **56000**, **64000**, **128000**, or **2015232**.

Defaults

No clock rate is configured.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.
11.3	This command was modified to include nonstandard clock rates for the PA-8T-V35, PA-8T-X21, PA-8T-232, and PA-4T+ synchronous serial port adapters.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

Cable Length

Be aware that the fastest speeds might not work if your cable is too long, and that speeds faster than 148,000 bits per second are too fast for EIA/TIA-232 signaling. It is recommended that you only use the synchronous serial EIA/TIA-232 signal at speeds up to 64,000 bits per second. To permit a faster speed, use EIA/TIA-449 or V.35.

Synchronous Serial Port Adapters

For the synchronous serial port adapters (PA-8T-V35, PA-8T-X21, PA-8T-232, and PA-4T+) on Cisco 7200 series routers, and on second-generation Versatile Interface Processors (VIP2s) in Cisco 7500 series routers, the clock rate you enter is rounded (if needed) to the nearest value that your hardware can support. To display the clock rate value for the port adapter, use the **show running-config** command.

If you plan to netboot your router over a synchronous serial port adapter interface and have a boot image prior to Cisco IOS Release 11.1(9)CA that does not support nonstandard (rounded) clock rates for the port adapters, you must use one of the following standard clock rates:

- **1200**
- **2400**
- **4800**
- **9600**
- **19200**
- **38400**
- **56000**
- **64000**

Examples

The following example shows how to set the clock rate on the first serial interface to 64,000 bps:

```
Router(config)# interface serial 0
Router(config-if)# clock rate 64000
```

The following example shows how to set the clock rate on a synchronous serial port adapter in slot 5, port 0 to 1,234,567 bps. In this example, the clock rate is adjusted to 1,151,526 bps.

```
Router(config)# interface serial 5/0
Router(config-if)# clock rate 1234567
%Clockrate rounded to nearest value that your hardware can support.
```

The following example shows how to determine the exact clock rate that the serial interface was rounded to by using the **show running-config** command.

```
Router# show running-config

Building configuration...
.
.
.
!
interface Serial5/0
 no ip address
 clockrate 1151526
!
.
.
.
```

clock-rate

To map a payload type to a predefined frequency use the **clock-rate** *pt_type frequency* command in the monitor metric RTP mode. To remove the payload mapping, use the **no** form of this command.

clock-rate *pt_type frequency*

no clock-rate *pt_type frequency*

Syntax Description

pt_type	RTP stream payload type to map to a frequency value. Valid value ranges from 1 to 127.
frequency	Frequency value to map to a payload type, valid values are: • 148.5MHz • 148.5/1.001MHz • 27MHz • disable.

Command Default

Command is disabled.

Command Modes

Monitor metric RTP mode

Command History

Release	Modification
15.1(3)S	This command was introduced.

Usage Guidelines

If you do not know the frequency to map to a payload, map the *pt_type* attribute to the **disable** option. Also, the static *pt_type* values range between 1 to 95 and can only be mapped to the **disable** option. If the *pt_type* attribute is not mapped to any frequency, the default frequency of 90kHz is used.

Examples

This example shows how to map the payload type 8 to the **disable** option and payload type 121 to the frequency 27MHz:

```
Router(config-pmap-c-metric)# clock-rate 8 disable
Router(config-pmap-c-metric)# clock-rate 121 27MHz
```

clock rate (interface ATM)

To configure the clock rate between a WAN interface card (WIC) and the serial communication controllers (SCCs) that are used by the WIC, use the **clock rate** command in interface ATM configuration mode. To disable the clock rate setting, use the **no** form of this command.

clock rate [**aal2 | aal5**] *clock-rate-value*

no clock rate [**aal2 | aal5**] *clock-rate-value*

Syntax Description

aal2	(Optional) Specifies the ATM adaptation layer 2 (AAL2) clock rate.
aal5	(Optional) Specifies the ATM adaptation layer 5 (AAL5) clock rate.
clock-rate-value	Clock rate value, which can be changed as follows: • aal2—For Cisco 1700 series routers, the minimum value for asymmetric digital subscriber line (ADSL) and symmetrical high-data-rate digital subscriber line (G.SHDSL) is 4 Mbps. The default value for ADSL and G.SHDSL is 8 Mbps. For Cisco 2600 and Cisco 3600 series routers, the minimum value for ADSL and G.SHDSL is 1 Mbps. The maximum value is 7 Mbps for mainboard slots and 5.3 Mbps for network modules. The default value for ADSL and G.SHDSL is 2.6 Mbps for both mainboard slots and network modules. To make full use of the 2.3 Mbps bandwidth for Voice over ATM (VoATM) nonswitched trunk calls on G.SHDSL, you can change the 1 Mbps default value on Cisco 2600 and Cisco 3600 series routers and configure the AAL2 clock rate as 2.6 Mbps. We recommend, however, that you keep the ADSL SCC clock rate for AAL2 at the default value of 1 Mbps because the upstream of ADSL cannot exceed 1 Mbps. **Note** You should change the AAL2 default value on Cisco 2600 and Cisco 3600 series routers only if you are using G.SHDSL for VoATM nonswitched trunk calls using an NM-HDV. At all other times, the default for AAL2 should remain at 1 Mbps for ADSL and G.SHDSL. • **aal5**—For Cisco 1700 series routers, the minimum value for ADSL and G.SHDSL is 4 Mbps. The default value for ADSL and G.SHDSL is 8 Mbps. For Cisco 2600 and Cisco 3600 series routers, the minimum value for ADSL and G.SHDSL is 1 Mbps. The maximum value is 7 Mbps for mainboard slots and 5.3 Mbps for network modules. The default value for ADSL and G.SHDSL is 2.6 Mbps for both mainboard slots and network modules. **Note** If you configure a clock rate that exceeds the maximum limit, the configuration will fail.

Defaults No clock rate is set

Command Modes Interface ATM configuration

Command History

Release	Modification
12.2(8)YN	This command was introduced.
12.2(13)T	This command was integrated into Cisco IOS Release 12.2(13)T.
12.3(2)T	This command was integrated into Cisco IOS Release 12.3(2)T for the following platforms: Cisco 1721, Cisco 2610XM-2651XM, Cisco 2691, and Cisco 3660.

Usage Guidelines The communication between digital subscriber line (DSL) WICs and a host in a router occurs through a device called the SCC. If a host wants to forward data or send any control traffic to a DSL WIC, it uses SCCs. In the same way, if a DSL WIC wants to forward incoming data from a line to the host, it also uses SCCs. Each DSL WIC installed in the router uses two SCCs. One SCC (SCC-A) is used for AAL5 data traffic, and the other SCC (SCC-B) is used for AAL2 and control traffic. The speed at which the SCC transfers data between a host and a WIC depends on the clock rate with which it has been configured. You can configure this clock rate on the basis of the DSL line rate. Even though the DSL upstream and downstream line rate may vary, the clock rate between the SCC and the DSL WIC is the same for both the transmitting and receiving direction. That is, the communication between the SCC and the DSL WIC is synchronous. Therefore, you need to configure only one clock rate for an SCC that will be used for both transmitting and receiving between an SCC and a DSL WIC.

We always recommend that you configure the SCC clock rate slightly higher than the DSL line rate to accommodate overhead between the SCC and the DSL WIC. For an asynchronous DSL WIC (for example, ADSL), the SCC clock rate depends on either the downstream or the upstream line rate, whichever is the maximum rate. For a synchronous DSL WIC (for example, G.SHDSL), the bandwidth for upstream and downstream is the same. Therefore, the SCC clock rate configuration can be based on either the upstream or the downstream line rate.

Because the maximum line rate for G.SHDSL is 2.312 Mbps, the default SCC clock rate of 2.6 Mbps for AAL5 and 1 Mbps for AAL2 should be sufficient. However, for ADSL, the clock rate may need to be configured on the basis of the current line rate. If AAL2 is used for voice traffic, the AAL2 SCC must be configured to the appropriate clock rate: 1 Mbps for ADSL and 2.6 Mbps for G.SHDSL.

The maximum data rate between an SCC and a DSL WIC depends primarily on the maximum clock rate that the SCC can support. For example, on the Cisco 2600 series mainboard, which supports two DSL WICs, the total SCC clock rate that can be configured for both WICs is 8 Mbps. Therefore, if only one DSL WIC is present on the mainboard, AAL5 and AAL2 clock rates can be configured to 7 Mbps and 1 Mbps, respectively. If two DSL WICs are supported on the mainboard, the total of 8 Mbps should be distributed among the four SCCs.

Network module SCCs also pose similar limitations. That is, on the Cisco 2600 series, the total clock rate for all four SCCs is 8 Mbps. The maximum AAL5 clock rate that may be configured on a network module is 5.3 Mbps. On the Cisco 1700 series, the maximum configurable SCC clock rate for both AAL5 and AAL2 is 8 Mbps.

If the clock rate is not configured, the SCC is reset to the default values.

The clock rate can be configured independently for each SCC. To verify the clock rate setting, use the **show running-config** command.

Examples

The following example shows how to set the clock rate to 2 Mbps for AAL5 and to 1.3 Mbps for AAL2 for a Cisco 2600 or Cisco 3600 series router:

```
Router (config)# interface atm1/0
Router (config-if)# no ip address
Router (config-if)# no atm ilmi-keepalive
Router (config-if)# pvc 6/65
Router (config-if)# clock rate aal5 2000000
Router (config-if)# clock rate aal2 1300000
Router (config-if)# vbr-nrt 640 640 128
Router (config-if)# tx-ring-limit 3
```

Related Commands

Command	Description
show running-config	Displays the current configuration.

clock rate (interface serial)

To configure the clock rate for the hardware connections on serial interfaces, such as network interface modules (NIMs) and interface processors, to an acceptable bit rate, use the **clock rate** command in interface configuration mode or Circuit Emulation Module (CEM) configuration mode. To remove the clock rate if you change the interface from a DCE to a DTE device, use the **no** form of this command. Using the **no** form of this command on a DCE interface sets the clock rate to the hardware-specific default value.

clock rate {**line** | *rate*}

no clock rate

Syntax Description

line	Specifies that the clock source is the network. **Note** This keyword is not supported on CEM serial interfaces.
rate	Desired clock rate, in bits per second (bps): **1200**, **2400**, **4800**, **9600**, **19200**, **38400**, **56000**, **64000**, **72000**, **125000**, **148000**, **250000**, **500000**, **800000**, **1000000**, **1300000**, **2000000**, **4000000**, or **8000000**. For some synchronous serial port adapters a nonstandard clock rate can be used. Refer to the hardware documentation for specific supported Lvalues. You can enter any value from 300 to 8000000 bps. The clock rate you enter is rounded (adjusted), if necessary, to the nearest value that your hardware can support except for the following standard rates: **1200**, **2400**, **4800**, **9600**, **14400**, **19200**, **28800**, **38400**, **56000**, **64000**, **128000**, or **2015232**.

Defaults

No clock rate is configured.

Command Modes

Interface configuration
CEM configuration in Circuit Emulation Module (CEM)

Command History

Release	Modification
10.0	This command was introduced.
11.3	This command was modified to include nonstandard clock rates for the PA-8T-V35, PA-8T-X21, PA-8T-232, and PA-4T+ synchronous serial port adapters.
12.3(2)T	This command was modified to include the **line** keyword.
12.4(5)M	The value range for the *rate* argument was updated to support additional baud rates of 300, 600, 1792K, and 1920K bps on CEM Network Modules.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

Using the **no** form of this command on a DCE interface sets the clock rate to the hardware-dependent default value.

Cable Length

Be aware that the fastest speeds might not work if your cable is too long and that speeds faster than 148,000 bits per second are too fast for EIA/TIA-232 signaling. It is recommended that you use the synchronous serial EIA/TIA-232 signal at speeds up to 64,000 bits per second only. To permit a faster speed, use EIA/TIA-449 or V.35.

Synchronous Serial Port Adapters

For the synchronous serial port adapters (PA-8T-V35, PA-8T-X21, PA-8T-232, and PA-4T+) on Cisco 7200 series routers and on second-generation Versatile Interface Processors (VIP2s) in Cisco 7500 series routers, the clock rate that you enter is rounded (if needed) to the nearest value that your hardware can support. To display the clock rate value for the port adapter, use the **show running-config** command.

If you plan to boot from a network (TFTP) server over a synchronous serial port adapter interface and have a boot image prior to Cisco IOS Release 11.1(9)CA that does not support nonstandard (rounded) clock rates for the port adapters, you must use one of the following standard clock rates:

1200, 2400, 4800, 9600, 19200, 38400, 56000, 64000

CEM Network Modules

The following clock rates are supported on CEM Network Modules:

200, 300, 400, 600, 800, 1200, 1800, 2400, 3200, 3600, 4800, 6400, 7200, 8000, 9600, 12000, 12800, 14400, 16000, 16800, 19200, 24000, 28800, 32000, 38400, 48000, 56000, 57600, 64000, 76800, 84000, 96000, 112000, 115200, 128000, 144000, 168000, 192000, 224000, 230400, 256000, 288000, 336000, 384000, 448000, 512000, 672000, 768000, 772000, 896000, 1024000, 1152000, 1344000, 1536000, 1544000, 1792000, 1920000, 2048000

Examples

Network as Clock Source Example

The following example shows how to set the clock rate to use the network as the clock source:

```
Router(config)# interface serial 0
Router(config-if)# clock rate line
```

Clock Rate on Synchronous Serial Port Example

The following example shows how to set the clock rate on a synchronous serial port adapter in slot 5, port 0 to 1,234,567 bps. In this example, the clock rate is adjusted to 1,151,526 bps.

```
Router(config)# interface serial 5/0
Router(config-if)# clock rate 1234567
%Clockrate rounded to nearest value that your hardware can support.
```

Clock Rate Rounded on Serial Enterface Example

The following example shows how to determine the exact clock rate that the serial interface was rounded to by using the **show running-config** command.

```
Router# show running-config

Building configuration...
.
.
.
!
```

```
interface Serial5/0
 no ip address
 clockrate 1151526
!
```

CEM Channel Example

This example shows the statistics for the current CEM configuration.

```
Router# show cem 4/1/0
cem info
cem 4/1/0 is up
Line state is up
Operational state is active
Near end ip address: 172.31.28.2, udp port: 15901
Far end ip address: 172.31.28.10, udp port: 15901
IP payload size: 512
IP dscp : 0x28
Idle pattern length: 8 , Idle Pattern: 0xFF
Payload compression is disabled
Data protection is disabled
Dejitter buffer size is 60 ms
Channel clock rate is 2048000 bps
Physical interface is E1 unframed
Ingress packets: 32505156, dropped: 0, overruns: 0
Egress packets: 32505158, dropped: 637, lost pkts: 0
Egress out of sequence pkts: 0
Egress overruns: 16, underruns: 244
Egress corrupt pkts rcvd: 0
30 second ingress rate 2050321 bits/sec, 500 packets/sec
30 second egress rate 2050184 bits/sec, 500 packets/sec
Tx interrupts: 32504249
Reorder queue flush: 0, visited: 0, max wait window: 0
Network jitter max: 8 ms, average: 1 ms, min: 0 ms
Adaptive clock ppm correction is 2 tracking
Event history: 0x00230058
Pkts dropped by burst limit: 0
Global stats for slot 4
************************
Egr free buf: 255
Egr host overruns: 0
Egr unknown dest count: 0
Last unknown dest ip : 0.0.0.0, port: 0
Last unknown dest src ip : 0.0.0.0, port: 0
Egr process switched: 0
Egr oos: 0
Egr unknown src count: 0, last unknown src ip: 0.0.0.0, port: 0
Ingr overruns: 0
NM cpu: 53.56 53.51 53.45 53.54
```

Related Commands

Command	Description
show running-config	Displays the current configuration.
show cem	Displays circuit emulation statistics.

clock rate network-clock

To configure the network clock rate (speed) for serial ports 0 or 1 in DCE mode, use the **clock rate network-clock** command in interface configuration mode. To cancel the network clock rate value, use the **no** form of this command.

clock rate network-clock *rate*

no clock rate network-clock *rate*

Syntax Description

rate	Network clock rate, in kbps per second. The range is from 56 to 2048. The value entered should be a multiple of the value set for the **network-clock base-rate** command. There is no default rate.

Defaults

No clock rate is set.

Command Modes

Interface configuration

Command History

Release	Modification
11.3(1)MA	This command was introduced on the Cisco MC3810 multiservice access concentrator.

Usage Guidelines

This command uses a synchronized clock on the serial port. The use of this command allows the clock on the serial port to be synchronized with the clock source of controller T1 0.

To configure the clock rate for a serial port in DTE mode, use the **clock rate line** command.

Examples

The following example shows how to configure the clock rate on serial port 1 in DCE mode:

```
Router(config)# interface serial 1
Router(config-if)# clock rate network-clock 2048
```

Related Commands

Command	Description
clock rate line	Configures the line clock rate for serial ports 0 or 1 in DTE mode.
clock source (MC3810)	Specifies the clock source of a DS1 link on the Cisco MC3810 multiservice access concentrator.
network-clock base-rate	Configures the network clock base rate for universal I/O serial ports 0 and 1 on the Cisco MC3810 multiservice concentrator.

clock source

To configure the clock source of a DS1 link, enter the **clock source** command in interface configuration, controller configuration, or ATM interface configuration mode. To restore the default **line** setting, use the **no** form of this command.

clock source {**line** | **internal** | **loop-timed**}

no clock source

Syntax Description

line	Specifies that the T1/E1 link uses the recovered clock from the line. This is the default.
internal	Specifies that the T1/E1 link uses the internal clock from the interface.
loop-timed	Specifies that the T1/E1 interface takes the clock from the Rx (line) and uses it for Tx.

Defaults

The default value is **line**.

Command Modes

Interface configuration

Controller configuration for the Cisco MC3810 multiservice access concentrator.

ATM interface configuration for the Cisco 2600 and 3600 series routers.

Command History

Release	Modification
10.3	This command was introduced.
11.1 CA	This command was modified to support the E1-G.703/G.704 serial port adapter, PA-E3 serial port adapters, and Cisco 7200 series routers.
11.3 MA	This command was introduced as a controller configuration command for the Cisco MC3810.
12.0(5)T and 12.0(5)XK	The command was introduced as an ATM interface configuration command for the Cisco 2600 and 3600 series routers.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

This command sets clocking for individual T1/E1 links.

Make sure that you specify the clock source correctly for each link, even if you are planning to specify that a certain link will provide clocking for all the links in an IMA group. Because links may be taken in and out of service, requiring that the system select another link for common clocking, any link in an IMA group may provide the common clock.

If the ATM interface is part of an IMA group, you can use the **loop-timed** keyword to specify that the clock source is the same as the IMA group clock source.

Examples

On a Cisco 2600 or 3600 series router, the following example specifies an internal clock source for the link:

```
Router(config)# interface atm 0/2
Router(config-if)# clock source internal
```

Related Commands

Command	Description
ima clock-mode	Sets the transmit clock mode for an ATM IMA group.

clock source(10GE)

To specify the clock source of a 10 Gigabit Ethernet (GE) line card, use the **clock source** command in interface configuration mode. To restore the clock source to its default setting, use the **no** form of this command.

clock source {**internal** | **line** | **loop**}

no clock source {**internal** | **line** | **loop**}

Syntax Description

internal	Uses the internal clock. This is the default.
line	Recovers the clock from the line.
loop	Uses local loop timing.

Command Default

The default is internal.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
12.2(33)SRD1	This command was introduced for the 7600-ES+ITU-2TG and 7600-ES+ITU-4TG.

Usage Guidelines

When the clock source is **internal**, the port receive (Rx) clock is not eligible as the system clock source. The port transmit (Tx) clock is synchronized to the system clock.

When the clock source is **line**, the port Rx clock is eligible as the system clock source. The port Tx clock is synchronized to the system clock.

When the clock source is **loop**, the port Rx clock is not eligible as the system clock source. The port Tx clock is synchronized to its own Rx clock.

Examples

The following example shows how to specify line timing as the clock source:

```
Router(config)# interface TenGigabitEthernet 1/1
Router(config-if)# clock source line
```

The following example shows how to specify the internal clock on the interface provided by the 7600-ES+ITU-2TG or the 7600-ES+ITU-4TG:

```
Router(config)# interface TenGigabitEthernet 1/1
Router(config-if)# clock source internal
```

Related Commands

Command	Description
network-clock select	Selects a source for the network clock.
show network-clocks	Displays the current configured and active network clock sources.
show platform hardware network-clocks	Displays network clocks for an ES+ line card.

clock source (AS5200)

To select the clock source for the time-division multiplexing (TDM) bus in a Cisco AS5200 access server, use the **clock source** command in interface configuration mode. To restore the clock source to its default setting, use the **no** form of this command.

clock source {**line** {**primary** | **secondary**} | **internal**}

no clock source line {**primary** | **secondary**}

Syntax Description

line	Clock source on the active line.
primary	Primary TDM clock source.
secondary	Secondary TDM clock source.
internal	Selects the free running clock (also known as internal clock) as the clock source.

Defaults

The primary TDM clock source is from the T1 0 controller.

The secondary TDM clock source is from the T1 1 controller.

Command Modes

Interface configuration

Command History

Release	Modification
11.2	This command was introduced.
12.2(13)T	This command is no longer supported in Cisco IOS Mainline or Technology-based (T) releases. It may continue to appear in 12.2S-Family releases.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

To use the clocking coming in from a T1 line, configure the **clock source line primary** command on the T1 interface that has the most reliable clocking. Configure the **clock source line secondary** command on the T1 interface that has the next best known clocking. With this configuration, the primary line clocking is backed up to the secondary line if the primary clocking shuts down.

Examples

The following example configures the Cisco AS5200 access server to use T1 controller 0 as the primary clock source and T1 controller 1 as the secondary clock source:

```
Router(config)# controller t1 0
Router(config-controller)# clock source line primary
Router(config)# controller t1 1
Router(config-controller)# clock source line secondary
```

clock source (CEM)

To configure the clock source of a circuit emulation (CEM) network module port, use the **clock source** command in CEM configuration mode or controller configuration mode. To return to the default clock source, use the **no** form of this command.

Cisco NM-CEM-4SER

clock source {**internal** | **loop** | **adaptive**}

no clock source {**internal** | **loop** | **adaptive**}

Cisco NM-CEM-4TE1

clock source {**internal** | **line** | **adaptive** *channel-number* [**closed-loop** | **open-loop** | **coarse**]}

no clock source {**internal** | **line** | **adaptive** *channel-number* [**closed-loop** | **open-loop** | **coarse**]}

Syntax Description

internal	Specifies that the clocks provided by the port to the attached CPE are derived from the router's TDM bus backplane clock (if one exists in the router) or from the onboard oscillator on the network module. This is the default clock source for a Cisco NM-CEM-4SER.
loop	(Cisco NM-CEM-4SER network module only) Specifies that the clock provided by the port to the attached CPE is derived from the clock received on the same port from the attached CPE.
line	(Cisco NM-CEM-4TE1 network module only) Specifies that the port transmit clock is derived from receive clock on the same port. This is the default clock source for a Cisco NM-CEM-4TE1.
adaptive	Specifies that the clocks provided by the port to the attached CPE are locally synthesized on the basis of the average data content of the local dejitter buffer.
channel-number	(Cisco NM-CEM-4TE1 network module only) Number of the channel whose dejitter buffer is to be used to synthesize the transmit clock of the port.
closed-loop	(Optional; Cisco NM-CEM-4TE1 network module only) Specifies that the adaptive clock algorithm enhancements are used to improve the adaptive clock accuracy. The same clock must be used in both directions for the closed loop mode. This keyword is supported in Cisco IOS Release 12.4(2)T and later releases.
open-loop	(Optional; Cisco NM-CEM-4TE1 network module only) Specifies that some of the adaptive clock algorithm enhancements are used but the clocks do not have to be the same in both directions. This is the default. This keyword is supported in Cisco IOS Release 12.4(2)T and later releases.
coarse	(Optional; Cisco NM-CEM-4TE1 network module only) Specifies that the original adaptive clock algorithm without the enhancements is used. This keyword is supported in Cisco IOS Release 12.4(2)T and later releases.

Command Default

Cisco NM-CEM-4SER

The clock source defaults to **internal**.

Cisco NM-CEM-4TE1

The clock source defaults to **line**.

Command Modes

Cisco NM-CEM-4SER

CEM configuration

Cisco NM-CEM-4TE1

Controller configuration

Command History

Release	Modification
12.3(7)T	This command was introduced.
12.4(2)T	The **closed-loop**, **open-loop**, and **coarse** keywords were added.

Usage Guidelines

When clock source **internal** is specified, the clocks provided by the network module are derived from either of the following source:

- The router's backplane TDM clock frequency (in any router equipped with a TDM backplane bus)
- The master oscillator on the network module (in any router not equipped with a TDM backplane bus)

When the **adaptive** keyword is specified, the clocks provided by the network module are derived from the same source as in the clock source **internal** case. However, the derived frequency is further adjusted up or down on the basis of the measured average fill of the egress dejitter buffer of the connection. If the dejitter buffer is perceived to be slowly filling, the frequency is adjusted slightly upward. If the dejitter buffer is perceived to be slowly depleting, the frequency is adjusted slightly downward.

Cisco NM-CEM-4SER

When the **loop** keyword is specified, the clock provided by the NM-CEM-4SER is the same as the clock provided to the NM-CEM-4SER from the attached CPE. The specification of clock source **loop** is only valid when the **clock mode split** command is specified. The **clock mode** command is used only during configuration of the NM-CEM-4SER.

Cisco NM-CEM-4TE1

In Cisco IOS Release 12.4(2)T, the adaptive clocking algorithm is enhanced to provide better adaptive clock accuracy. Three new keywords are used to specify the preferred mode:

- **closed-loop**—Specifies the closed loop mode. Taking advantage of the fact that a T1 or E1 link uses the same clock in both directions, the adaptive clock algorithm enhancements are used to improve the adaptive clock accuracy. The same clock must be used in both directions for the closed loop mode, and both ends of the CEM must be running a Cisco IOS release that supports the enhanced adaptive clock algorithm. Use the closed loop mode when clock accuracy is required, the master clock from the customer premises equipment (CPE) is of good quality, and the clocks are the same in both directions of the T1 or E1 link.

Note Do not use the closed loop mode in applications where the clocks are different for the two directions of the T1 or E1 link.

- **open-loop**—Specifies the open loop mode. Some of the adaptive clock algorithm is used, but this mode does not require the clocks to be the same in both directions. This mode is compatible with previous Cisco IOS releases and is the default mode if no keyword is specified. Use the open loop mode when the master clock from the CPE is of good quality, but the clocks are not the same in both directions of the T1 or E1 link.
- **coarse**—Specifies the coarse mode. The coarse mode uses the original adaptive clock algorithm and is used when the stability of the master clock derived from the CPE is not guaranteed. This mode is compatible with previous Cisco IOS releases.

Examples

The following example shows how to configure the clock source for the serial CEM network module, NM-CEM-4SER:

```
Router(config-cem)# clock source loop
```

The following example shows how to configure the clock source for the T1/E1 CEM network module, NM-CEM-4TE1:

```
Router(config-controller)# clock source adaptive 6
```

The following example shows how to configure the clock source for an NM-CEM-4TE1 using the closed-loop mode to improve the adaptive clock accuracy:

```
Router(config-controller)# clock source adaptive 5 closed-loop
```

Related Commands

Command	Description
cem	Enters circuit emulation configuration mode.
clock mode	Configures the clock mode on an NM-CEM-4SER network module.
show cem	Displays CEM channel statistics.

clock source (controller)

To set the T1 line clock source, use the **clock source** command in controller configuration mode. To restore the clock source to its default setting, use the **no** form of this command.

Cisco 7200 and Cisco 7500 Series Routers

clock source [**line** {**primary** | **secondary**} | **internal**]

no clock source

Cisco 10000 Series Router

clock source [**line** | **internal**]

no clock source

Syntax Description

line	(Optional) Specifies that the interface will clock its transmitted data from a clock recovered from the line's receive data stream. This is the default.
primary	Specifies the source of primary line clocking. The default primary time-division multiplexing (TDM) clock source is from the T0 controller.
secondary	Specifies the source of secondary line clocking. The default secondary TDM clock source is from the T1 controller.
internal	(Optional) Specifies that the interface will clock its transmitted data from its internal clock.

Defaults

Cisco 7200 and Cisco 7500 Series Routers

The default clock source is **line**.
The default primary TDM clock source is from the T0 controller.
The default secondary TDM clock source is from the T1 controller.
The default clock for the interface's transmitted data is from a clock recovered from the line's receive data stream from the PA-T3 serial port adapter.

Cisco 10000 Series Router

The default clock source is **internal**.

Command Modes

Controller configuration

Command History

Release	Modification
10.3	This command was introduced.
11.1CA	This command was modified to include the T3 serial port adapter and PA-T3 serial port adapter.
12.2(31)SB	This command was integrated into Cisco IOS Release 12.2(31)SB.

Release	Modification
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

This command is available on Cisco 4000, Cisco 7000 series, Cisco 7200 series, Cisco 7500 series, and Cisco 10000 series routers. A T3 interface on a PA-T3 serial port adapter can clock its transmitted data either from its internal clock or from a clock recovered from the line's receive data stream.

Clocking on a T1 Line

To use the clocking coming in from a T1 line, configure the **clock source line primary** command on the controller that has the most reliable clocking. Configure the **clock source line secondary** command on the controller that has the next best known clocking. With this configuration, the primary line clocking is backed up to the secondary line if the primary clocking shuts down.

Cisco 10000 Series Router

The clock source cannot be specified as **line** on both ends of the connection.

Examples

Cisco 7200

The following example shows how to configure the Cisco 7200 to use the T0 controller as the primary clocking source and the T1 controller as the secondary clocking source:

```
C7200(config)# controller t1 0
C7200(config-controller)# clock source line primary
C7200(config-controller)# exit
C7200(config)# controller t1 1
C7200(config-controller)# clock source line secondary
```

Cisco 10000 Series Router

The following example instructs the controller to use a line clock source:

```
Router(config)# controller dsx3 4/0/6
Router(config-controller)# clock source line
```

Related Commands

Command	Description
framing	Selects the frame type for the T1 or E1 data line.
linecode	Selects the line code type for T1 or E1 line.

clock source (CT3IP)

To specify where the clock source is obtained for use by the Channelized T3 Interface Processor (CT3IP) in Cisco 7500 series routers, use the **clock source** command in controller configuration mode. To restore the default clock source, use the **no** form of this command.

clock source {**internal** | **line** | **loop-timed**}

no clock source

Syntax Description

internal	Specifies that the internal clock source is used. This is the default.
line	Specifies that the network clock source is used.
loop-timed	Decouples the controller clock from the system-wide clock set with the **network-clock-select** command. The loop-timed clock enables the Digital Voice Module (DVM) to connect to a PBX and to connect the Multiflex Trunk Module (MFT) to a central office when both the PBX and the central office function as DCE clock sources. This situation assumes that the PBX also takes the clocking from the central office, thereby synchronizing the clocks on the DVM and the MFT.

Defaults

The internal clock source is used.

Command Modes

Controller configuration

Command History

Release	Modification
11.3	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

If you do not specify the **clock source** command, the default internal clock source is used by the CT3IP.

You can also set the clock source for each T1 channel by using the **t1 clock source** controller configuration command.

Note This command replaces the **pos internal-clock** command.

Examples

The following example sets the clock source for the CT3IP to line:

```
Router(config)# controller t3 9/0/0
Router(config-controller)# clock source line
```

Related Commands

Command	Description
network-clock-select	Specifies selection priority for the clock sources.
t1 clock source	Specifies where the clock source is obtained for use by each T1 channel on the CT3IP in Cisco 7500 series routers.

clock source (interface)

To control the clock from which a G.703-E1 interface, an E1-G.703/G.704 serial port adapter, or a PA-E3 serial port adapter clocks its transmitted data, use the **clock source** command in interface configuration mode. To restore the default clock source, use the **no** form of this command.

Cisco 7000, Cisco 7200, and Cisco 7500 Series

clock source {**line** | **internal**}

no clock source

Cisco AS5300 Access Servers

clock source {**line** {**primary** | **secondary**} | **internal**}

no clock source line {**primary** | **secondary**}

Syntax Description

line	Specifies that the interface will clock its transmitted data from a clock recovered from the line's receive data stream. This is the default.
internal	Specifies that the interface will clock its transmitted data from its internal clock.
primary	Specifies the primary time-division multiplexing (TDM) clock source.
secondary	Specifies the secondary TDM clock source.

Defaults

Cisco 7000, Cisco 7200, and Cisco 7500 Series

The clock source is obtained from the receive data stream of the line.

Cisco AS5300 Access Servers

The primary TDM clock source is from the T0 controller.
The secondary TDM clock source is from the T1 controller.

Command Modes

Interface configuration

Command History

Release	Modification
10.3	This command was introduced for the Cisco 4000 series, Cisco 7000 series with RSP7000, and Cisco 7500 series routers with the G.703 E1 interface.
11.1 CA	This command was implemented on the TDM bus in a Cisco AS5200 or Cisco AS5300 access server and was modified to support the E1-G.703/G.704 serial port adapter, PA-E3 serial port adapters, and Cisco 7200 series routers.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

Cisco 7000, Cisco 7200, and Cisco 7500 Series

A G.703-E1 interface, E1-G.703/G.704 serial port adapter, or a PA-E3 serial port adapter can clock its transmitted data from either its internal clock or from a clock recovered from the line's receive data stream.

Cisco AS5300 Access Servers

To use the clocking coming in from a T1 line, configure the **clock source line primary** command on the controller that has the most reliable clocking. Configure the **clock source line secondary** command on the controller that has the next best known clocking. With this configuration, the primary line clocking is backed up to the secondary line if the primary clocking shuts down.

Examples

Cisco 7000, Cisco 7200, and Cisco 7500 Series

The following example shows how to configure the G.703-E1 interface to clock its transmitted data from its internal clock:

```
Router(config)# interface serial 0/1
Router(config-if)# clock source internal
```

Cisco AS5300 Access Servers

The following example shows how to configure the Cisco AS5300 to use serial interface 1/0 as the primary clocking source and the serial interface 2/0 as the secondary clocking source:

```
AS5300(config)# interface serial 1/0
AS5300(config-if)# clock source line primary
AS5300(config-if)# exit
AS5300(config)# interface serial 2/0
AS5300(config-if)# clock source line secondary
```

The following example shows how to specify the T3 interface to clock its transmitted data from its internal clock:

```
Router(config)# interface serial 1/0
Router(config-if)# clock source internal
```

clock source (J1 controller)

To configure the clock source for a J1 controller, use the **clock source** command in controller configuration mode. To restore the clock source to its default setting, use the **no** form of this command.

clock source {**line** | **internal**}

no clock source

Syntax Description

line	The controller recovers the external clock from the line and provides the recovered clock to the internal (system) clock generator. The line value is the default clock source.
internal	The controller synchronizes itself to the internal (system) clock.

Defaults

Clock source is line for the J1 controller.

Command Modes

Controller configuration

Command History

Release	Modification
11.1 T	This command was introduced.
12.2(8)T	The command was introduced as a J1 controller configuration command for the Cisco 2600 and Cisco 3600 series.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

If multiple network modules are present in the router, then each J1 controller must be given a separate priority by configuration of the **network-clock-select** command. The controller having the highest priority will drive the internal clock.

Examples

The following example configures the clock source for line:

```
Router(config)# controller j1 3/0
Router(config-controller)# clock source line
```

Related Commands

Command	Description
network-clock-select	Sets the selection priority for a clock source.

clock source (MC3810)

To specify the clock source of a DS1 link on the Cisco MC3810 multiservice access concentrator, use the **clock source** command in controller configuration mode. To restore the clock source to its default setting, use the **no** form of this command.

clock source {**line** | **internal** | **loop-timed**}

no clock source

Syntax Description

line	Specifies that the DS1 link uses the recovered clock. The line value is the default clock source used when the Multiflex Trunk (MFT) is installed.
internal	Specifies that the DS1 link uses the internal clock. The internal value is the default clock source used when the Digital Voice Module (DVM) is installed.
loop-timed	Specifies that the T1/E1 controller will take the clock from the Rx (line) and use it for Tx. This setting decouples the controller clock from the system-wide clock set with the **network-clock-select** command. The loop-timed clock enables the DVM to connect to a PBX and to connect the MFT to a central office when both the PBX and the central office function as DCE clock sources. This situation assumes that the PBX also takes the clocking from the central office, thereby synchronizing the clocks on the DVM and the MFT.

Defaults

Line (when the MFT is installed)
Internal (when the DVM is installed)

Command Modes

Controller configuration

Command History

Release	Modification
11.1	This command was introduced.
12.2(13)T	This command is no longer supported in Cisco IOS Mainline or Technology-based (T) releases. It may continue to appear in 12.2S-Family releases.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

This command applies to Voice-over-Frame Relay, Voice-over-ATM, and Voice-over-HDLC on the Cisco MC3810.

Note You cannot configure the clock source to the line setting for both T1/E1 controllers at the same time.

Examples

The following example configures the clock source for the MFT to internal, and the clock source for the DVM line on a Cisco MC3810 multiservice access concentrator:

```
Router(config)# controller T1 0
Router(config-controller)# clock source internal

Router(config)# controller T1 1
Router(config-controller)# clock source line
```

clock source (SONET controller)

To specify the clock source of a SONET controller, use the **clock source** command in controller configuration mode. To restore the clock source to its default setting, use the **no** form of this command.

clock source {**internal** | **line** | **loop**}

no clock source

Syntax Description

internal	Specifies that the clock source uses the internal clock provided by the Route Switch Controller (RSC). This is the default.
line	Specifies that the clock source uses the primary system clock from the optical line and the recovered clock will go through the RSC phased locked loop (PLL) circuitry. Can be used when one or more STM-1 cards are installed.
loop	Specifies that the clock source uses the primary system clock from the optical line and the same recovered clock is used in the transmit (tx) direction without going through the RSC PLL circuitry. Can be used when only one STM-1 card is installed.

Defaults

Internal

Command Modes

Controller configuration

Command History

Release	Modification
10.3	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Examples

The following example shows how to specify line timing as the clock source on a SONET controller of an STM-1 card in physical slot number 2 on a Cisco AS5850:

```
Router(config)# controller sonet 2/0
Router(config-controller)# clock source line
```

clock source (T1/E1 controller)

To set clocking for individual T1 or E1 links, use the **clock source** command in controller configuration mode. To return to the default, use the **no** form of this command.

clock source {**line** [**primary** | **bits** | **independent**] | **internal** [**independent**] | **free-running**}

no clock source

Syntax Description

line	Specifies that the phase-locked loop (PLL) on this controller derives its clocking from the external source to which the controller is connected, which is generally the telephone company central office (CO).
primary	(Optional) Specifies that the PLL on this controller derives its clocking from the external source to which the controller is connected. This option also puts a second port, which is generally connected to the PBX, into looped-time mode. Both ports are configured with line, but only the port connected to the external source is configured with primary.
bits	(Optional) Specifies that the controller will derive clocking from the Building Integrated Timing Supply (BITS).
independent	(Optional) Specifies that the port can operate on an independent clocking domain. Before this capability was added, on a 2-port VWIC-MFT, if both ports were configured as **clock source line**, the 2-port was really looped, which meant that it was getting the clock from the first port. With independent clocking mode, this dependency no longer exists, so the keyword **independent** means that both ports can be independently clocked.
internal	Specifies that the clock is generated from the T1 or E1 controller's internal PLL.
free-running	Specifies a free-running clock derived from the oscillator on the motherboard, which is used only for testing and back-to-back connections.

Defaults

The default is **line**.

Command Modes

Controller configuration

Command History

Release	Modification
12.2(2)XB	This command was introduced in controller configuration mode for Cisco 2600 series and Cisco 3660 routers.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T.
12.2(15)T	This command was implemented on the Cisco 2691 and the Cisco 3700 series.
12.3(4)XD	The **bits** keyword was added.

Release	Modification
12.3(7)T	The **bits** keyword was integrated into Cisco IOS Release 12.3(7)T.
12.3(14)T	This command was integrated into Cisco IOS Release 12.3(14)T and the **independent** keyword was added.

Usage Guidelines

For a detailed discussion of clock sources on individual ports, refer to "Clock Sources on Digital T1/E1 Voice Ports" in the Voice Configuration Library at the following URL:
http://www.cisco.com/en/US/products/ps6441/prod_configuration_guide09186a0080565f8a.html

Examples

The following example shows the router providing clock source to two controllers:

```
Router(config)# controller E1 1/0
Router(config-controller)# framing crc
Router(config-controller)# linecoding hdb3
Router(config-controller)# clock source internal
Router(config-controller)# ds0-group timeslots 1-15 type e&m-wink-start
!
Router(config)# controller E1 1/1
Router(config-controller)# framing esf
Router(config-controller)# linecoding b8zs
Router(config-controller)# clock source internal
Router(config-controller)# ds0-group timeslots 1-15 type e&m-wink-start
```

The following example shows the digital voice hardware receiving clocking for the PLL from E1 1/0 and using this clock as a reference to clock E1 1/1. If controller E1 1/0 fails, the PLL internally generates the clock reference to drive E1 1/1.

```
Router(config)# controller E1 1/0
Router(config-controller)# framing crc
Router(config-controller)# linecoding hdb3
Router(config-controller)# clock source line
Router(config-controller)# ds0-group timeslots 1-15 type e&m-wink-start
!
Router(config)# controller E1 1/1
Router(config-controller)# framing crc4
Router(config-controller)# linecoding hdb3
Router(config-controller)# clock source internal
Router(config-controller)# ds0-group timeslots 1-15 type e&m-wink-start
```

The following example shows the router being configured to receive clocking from the BITS.

```
Router(config)# network-clock-participate slot 1
Router(config)# network-clock-select 1 E1 1/1
Router(config)# controller E1 1/1
Router(config-controller)# clock source line bits
```

Related Commands

Command	Description
controller	Configures a T1 or E1 controller and enters controller configuration mode.

clock source (T1/E1 interface)

To configure the clock source of a DS1 link, use the **clock source** command in interface configuration or ATM interface configuration mode. To restore the default line setting, use the **no** form of this command.

clock source {**line** | **internal** | **loop-timed**}

no clock source

Syntax Description

line	Specifies that the T1/E1 link uses the recovered clock from the line. This is the default.
internal	Specifies that the T1/E1 link uses the internal clock from the interface.
loop-timed	Specifies that the T1/E1 interface takes the clock from the Rx (line) and uses it for Tx.

Defaults

line

Command Modes

Interface configuration
ATM interface configuration for the Cisco 2600 and Cisco 3600 series routers

Command History

Release	Modification
10.3	This command was introduced.
11.1CA	This command was modified to support the E1-G.703/G.704 serial port adapter, PA-E3 serial port adapters, and Cisco 7200 series routers.
11.3MA	This command was introduced as a controller configuration command for the Cisco MC3810.
12.0(5)XK	The command was introduced as an ATM interface configuration command for the Cisco 2600 and Cisco 3600 series routers.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

This command sets clocking for individual T1/E1 links.

Make sure that you specify the clock source correctly for each link, even if you are planning to specify that a certain link will provide clocking for all the links in an IMA group. Because links may be taken in and out of service, requiring that the system select another link for common clocking, any link in an IMA group may provide the common clock.

If the ATM interface is part of an IMA group, you can use the **loop-timed** keyword to specify that the clock source is the same as the IMA group clock source.

Examples

On a Cisco 2600 or Cisco 3600 series router, the following example specifies an internal clock source for the link:

```
Router(config)# interface atm 0/2
Router(config-if)# clock source internal
```

Related Commands

Command	Description
ima clock-mode	Sets the transmit clock mode for an ATM IMA group.

clock source (T3/E3 controller)

To specify where the clock source is obtained for use by a T3 or E3 controller, use the **clock source** command in controller configuration mode. To restore the default clock source, use the **no** form of this command.

clock source {**internal** | **line**}

no clock source

Syntax Description

internal	Specifies that the internal clock source is used. This is the default for T3.
line	Specifies that the network clock source is used. This is the default for E3.

Defaults

The internal clock source is used for T3 controllers.
The line clock source is used for E3 controllers.

Command Modes

Controller configuration

Command History

Release	Modification
12.2(11)YT	This command was introduced on the following platforms: Cisco 2650XM, Cisco 2651XM, Cisco 2691, Cisco 3660 series, Cisco 3725, and Cisco 3745 routers.
12.2(15)T	This command was integrated into Cisco IOS Release 12.2(15)T.

Usage Guidelines

If you do not specify the **clock source** command, the default clock source is used.

Configure the **clock source line** command if your telephone company or the remote data service unit provides the master clock of the T3 or E3 connection.

Configure the **clock source internal** command if your router provides the master clock of the T3 or E3 connection.

Note For a back-to-back connection between two T3 or E3 network modules, one controller must be configured for internal clocking while the other controller must be configured for line clocking.

Examples

The following example shows how to set the clock source to line:

```
Router(config)# controller t3 1/0
Router(config-controller)# clock source line
```

Related Commands

Command	Description
controller	Configures a T1 or E1 controller and enters controller configuration mode.

clock switchover

To specify the input lead state change that triggers the clock switching over from line to internal or from internal to line, use the **clock switchover** command in Data Circuit Terminating Equipment (DCE) split mode. To disable the command's effect, use the **no** form of this command.

clock switchover {rts | dtr | ll | rl} {off | on }

no clock switchover

Syntax Description

off | on	On - clock switches over to internal clock when lead state is on; clock switches over to the CPE-provided clock when lead state is off. Default value. Off - clock switches over to internal clock when lead state is off; clock switches over to the CPE-provided clock when lead state is on.
rts | dtr | ll | rl	Standard serial signal control-leads when the switchover is in DTE mode.

Command Default

The default state is on.

Command Modes

DCE split mode (off / on).

Command History

Release	Modification
12.4(20)YA	This command was introduced.
12.4(22)T	This command is integrated into Cisco IOS Release 12.4(22)T.

Usage Guidelines

You can use the **clock switchover** command to switch the clock source over to internal clock. The switchover ensures continuity of the CEM channel when disruption in receiving the clock from the customer premises equipment (CPE) occurs. To specify the input lead state change that triggers the clock switching over from line to internal or from internal to line, use this option in DCE split mode.

Examples

The following example shows how the **clock switchover <input_lead> <off | on >** command is used to check the input lead state for the clock switchover feature:

```
Router(mode-prompt)# clock switchover dtr on
```

clock-port

To specify the clocking mode of a Precision Time Protocol clock port, enter clock port configuration mode using the **clock-port** command in the PTP clock configuration mode. To remove a clocking mode configuration, use the **no** form of this command.

clock-port *name* {**slave** | **master**}

no clock-port *name* {**slave** | **master**}

Syntax Description

name	Specifies a name for the clock port.
slave	Sets the clock port to PTP slave mode; the port exchanges timing packets with a PTP master device.
master	Sets the clock port to PTP master mode; the port exchanges timing packets with PTP slave devices.

Command Default

This command is disabled by default.

Command Modes

PTP clock configuration (config-ptp-clk)

Command History

Release	Modification
15.0(1)S	This command was introduced.

Usage Guidelines

This command defines a new clock port and enters clock port configuration mode.

Examples

The following example shows how to configure a PTP clock port:

```
Router# configure terminal
Router# ptp clock boundary domain 0
Router(config-ptp-clk)# clock-port slave slaveport
Router(config-ptp-port)# clock source 8.8.8.1
Router(config-ptp-port)# sync limit 1
Router(config-ptp-port)# announce timeout 4
Router(config-ptp-port)# delay-req interval 2
Router(config-ptp-port)# end
```

Related Commands

Command	Description
ptp clock	Creates a PTP clock instance.

cmt connect

To start the processes that perform the connection management (CMT) function and to allow the ring on one fiber to be started, use the **cmt connect** command in user EXEC or privileged EXEC mode.

cmt connect [**fddi** [*port* | *slot*/*port*] [**phy-a** | **phy-b**]]

Syntax Description

fddi	(Optional) Identifies this as a FDDI interface.
port	(Optional) Port number. Refer to the appropriate hardware manual for slot and port information.
slot	(Optional) Slot number. Refer to the appropriate hardware manual for slot and port information.
phy-a	(Optional) Selects Physical Sublayer A.
phy-b	(Optional) Selects Physical Sublayer B.

Command Modes

User EXEC
Privileged EXEC

Command History

Release	Modification
10.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

In normal operation, the FDDI interface is operational once the interface is connected and configured. The **cmt connect** command allows the operator to start the processes that perform the CMT function.

The **cmt connect** command is not needed in the normal operation of FDDI; this command is used mainly in interoperability tests.

This command does not have a **no** form. To stop the CMT processes, use the **cmt disconnect** command.

Examples

The following examples demonstrate use of the **cmt connect** command for starting the CMT processes on the FDDI ring.

The following command starts all FDDI interfaces:

```
Router# cmt connect fddi
```

The following command starts both fibers on FDDI interface unit 0:

```
Router# cmt connect fddi 0
```

The following command on the Cisco 7200 series or Cisco 7500 series starts both fibers on FDDI interface unit 0:

```
Router# cmt connect fddi 1/0
```

The following command starts only Physical Sublayer A on FDDI interface unit 0:

```
Router# cmt connect fddi 0 phy-a
```

Related Commands

Command	Description
cmt disconnect	Stops the CMT processes.

cmt disconnect

To stop the processes that perform the connection management (CMT) function and to allow the ring on one fiber to be stopped, use the **cmt disconnect** command in user EXEC or privileged EXEC mode.

cmt disconnect [**fddi** [*port* | *slot*/*port*] [**phy-a** | **phy-b**]]

Syntax Description

fddi	(Optional) Identifies this as a FDDI interface.
port	(Optional) Port number. Refer to the appropriate hardware manual for slot and port information.
slot	(Optional) Slot number. Refer to the appropriate hardware manual for slot and port information.
phy-a	(Optional) Selects Physical Sublayer A.
phy-b	(Optional) Selects Physical Sublayer B.

Command Modes

User EXEC
Privileged EXEC

Command History

Release	Modification
10.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

In normal operation, the FDDI interface is operational once the interface is connected and configured, and is turned on using the **no shutdown** command in interface configuration mode. The **cmt disconnect** command allows the operator to stop the processes that perform the CMT function and allow the ring on one fiber to be stopped.

The **cmt disconnect** command is not needed in the normal operation of FDDI; this command is used mainly in interoperability tests.

This command does not have a **no** form. To start the CMT processes, use the **cmt connect** command.

Examples

The following examples demonstrate use of the **cmt disconnect** command for stopping the CMT processes on the FDDI ring.

The following command stops all FDDI interfaces:

```
Router# cmt disconnect fddi
```

The following command stops both fibers on FDDI interface unit 0:

```
Router# cmt disconnect fddi 0
```

The following command on the Cisco 7200 series or Cisco 7500 series stops both fibers on FDDI interface unit 0:

```
Router# cmt disconnect fddi 1/0
```

The following command stops only Physical Sublayer A on the FDDI interface unit 0. This command causes the FDDI media to go into a wrapped state so that the ring will be broken.

```
Router# cmt disconnect fddi 0 phy-a
```

The following command on the Cisco 7500 series stops only Physical Sublayer A on FDDI interface unit 0 in slot 1. This command causes the FDDI media to go into a wrapped state so that the ring will be broken.

```
Router# cmt disconnect fddi 1/0 phy-a
```

Related Commands

Command	Description
cmt connect	Starts the CMT processes.

compress

To configure software compression for Link Access Procedure, Balanced (LAPB), PPP, and High-Level Data Link Control (HDLC) encapsulations, use the **compress** command in interface configuration mode. To disable compression, use the **no** form of this command.

compress {**predictor** | **stac**}

no compress {**predictor** | **stac**}

Cisco VIP2 Cards

compress {**predictor** | **stac** [**distributed** | **software**]}

no compress {**predictor** | **stac** [**distributed** | **software**]}

Cisco 7200 Series and Cisco 7500 Series

compress {**predictor** | **stac** [**csa** *slot* | **software**]}

no compress {**predictor** | **stac** [**csa** *slot* | **software**]}

PPP Encapsulation

compress [**predictor** | **stac** | **mppc** [**ignore-pfc**]]

no compress [**predictor** | **stac** | **mppc** [**ignore-pfc**]]

Syntax Description

predictor	Specifies that a predictor (RAND) compression algorithm will be used on LAPB and PPP encapsulation. Compression is implemented in the software installed in the router's main processor.
stac	Specifies that a Stacker (LZS) compression algorithm will be used on LAPB, HDLC, and PPP encapsulation. For all platforms except Cisco 7200 series and platforms that support the Virtual Interface Processor 2 (VIP2), compression is implemented in the software installed in the router's main processor. On Cisco 7200 series and on VIP2s in Cisco 7500 series, specifying the **compress stac** command with no options causes the router to use the fastest available compression method for PPP encapsulation only: • If the router contains a compression service adapter (CSA), compression is performed in the CSA hardware (hardware compression). • If a CSA is not available, compression is performed in the software installed on the VIP2 (distributed compression). • If a VIP2 is not available, compression is performed in the router's main processor (software compression).
distributed	(Optional) Specifies that compression is implemented in the software that is installed in a VIP2. If the VIP2 is not available, compression is performed in the router's main processor (software compression).
software	(Optional) Specifies that compression is implemented in the Cisco IOS software installed in the router's main processor.

csa *slot*	(Optional) Specifies the CSA to use for a particular interface.
mppc	(Optional) Specifies that the Microsoft Point-to-Point Compression (MPPC) compression algorithm be used.
ignore-pfc	(Optional) Specifies that the protocol field compression flag negotiated through Link Control Protocol (LCP) will be ignored.

Defaults

Compression is disabled.

Command Modes

Interface configuration

Command History

Release	Modification
10.3	This command was introduced.
11.3P	The following keywords were added: • **distributed** • **software** • **csa** *slot*
11.3T	The following keywords were added: • **mppc** • **ignore-pfc**
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Note This command replaces the **compress predictor** command.

Usage Guidelines

Point-to-Point Compression

Compression reduces the size of frames through lossless data compression. You can configure point-to-point software compression for all LAPB, PPP, and HDLC encapsulations. The compression algorithm used is a predictor algorithm (the RAND compression algorithm), which uses a compression dictionary to predict what the next character in the frame will be.

End-point devices must be configured to use the same compression method (predictor, Stacker or MPPC).

HDLC encapsulations supports the Stacker compression algorithm. PPP and LAPB encapsulations support both predictor and Stacker compression algorithms.

MPPC Compression

The **compress** command using the **mppc** and **ignore-pfc** options support compression between Cisco routers and access servers and Microsoft clients, such as Windows 95 and Windows NT. MPPC implements an LZ-based compression algorithm that uses a compression dictionary to compress PPP

packets. The **ignore-pfc** keyword instructs the router to ignore the protocol field compression flag negotiated by LCP. For example, the standard protocol field value for IP is 0x0021 when compression is disabled and 0x21 when compression is enabled. When the **ignore-pfc** option is enabled, the router will continue to use the uncompressed value (0x0021). Using the **ignore-pfc** option is helpful for some asynchronous driver devices that use an uncompressed protocol field (0x0021), even though the pfc is negotiated between peers. If protocol rejects are displayed when the **debug ppp negotiation** command is enabled, setting the **ignore-pfc** option may remedy the problem.

HDLC Encapsulations

For HDLC encapsulations, you can specify a Stacker compression algorithm by using the **stac** keyword. PPP and LAPB encapsulations support both predictor and Stacker compression algorithms.

Public Data Network Connections

Compression requires that both ends of the serial link be configured to use compression. You should never enable compression for connections to a public data network.

Cisco 7200 and Cisco 7500 Series

Using CSA hardware compression on Cisco 7200 series routers and Cisco 7500 series routers removes the compression and decompression responsibilities from the VIP2 or the main processor installed in the router. By using the **compress stac** command, the router determines the fastest compression method available on the router.

On Cisco 7200 series routers and Cisco 7500 series routers, hardware compression on the compression service adapter (CSA) is supported for PPP links. When using hardware compression on Cisco 7200 series routers with multiple CSAs, you can optionally specify which CSA is used by the interface to perform compression. If no CSA is specified, the router determines which CSA is used. On Cisco 7500 series routers, the router uses the CSA on the same VIP2 as the interface.

System Performance

Caution When compression is performed in software installed in the router's main processor, it might affect system performance significantly. We recommend that you disable compression if the CPU load exceeds 40 percent. To display the CPU load, use the **show process cpu** EXEC command.

If the majority of your traffic is already compressed files, we recommend that you not use compression. If the files are already compressed, the additional processing time spent in attempting unsuccessfully to compress them again will slow system performance.

Table 1 provides general guidelines for deciding which compression type to select.

Table 1 Compression Guidelines

Situation	Compression Type to Use
Bottleneck is caused by the load on the router.	Predictor
Bottleneck is the result of line bandwidth or hardware compression on the CSA is available.	Stacker
Most files are already compressed.	None

Software compression makes heavy demands on the router's processor. The maximum compressed serial line rate depends on the type of Cisco router that you are using and which compression algorithm you specify. Table 2 shows a summary of the compressed serial line rates for software compression. The

maximums shown in Table 2 apply to the "combined" serial compressed load on the router. For example, a Cisco 4000 series router could handle four 64-kbps lines using Stacker compression or one 256-kbps line. These maximums also assume that there is very little processor load on the router aside from compression. Lower these numbers when the router is required to do other processor-intensive tasks.

Table 2 Combined Compressed Serial Line Rates (Software Compression)

Compression Method	Cisco 1000 Series	Cisco 3000 Series	Cisco 4000 Series	Cisco 4500 Series	Cisco 4700 Series	Cisco 7000 Family
Stacker (kbps)	128	128	256	500	T1	256
Predictor (kbps)	256	256	500	T1	2xT1	500

Hardware compression can support a combined line rate of 16 Mbps.

Cisco recommends that you do not adjust the maximum transmission unit (MTU) for the serial interface and the LAPB maximum bits per frame (N1) parameter.

Note The best performance data compression algorithms adjust their compression methodology as they identify patterns in the data. To prevent data loss and support this adjustment process, the compression algorithm is run over LAPB to ensure that everything is sent in order, with no missing data and no duplicate data.

Note For information on configuring Frame Relay compression, refer to the "Configuring Frame Relay" chapter in the *Cisco IOS Wide-Area Networking Configuration Guide*.

Examples

The following example enables hardware compression and PPP encapsulation on serial interface 3/1/0.

```
Router(config)# interface serial 3/1/0
Router(config-if)# encapsulate ppp
Router(config-if)# compress stac
```

The following example enables predictor compression on serial interface 0 for a LAPB link:

```
Router(config)# interface serial 0
Router(config-if)# encapsulation lapb
Router(config-if)# compress predictor
Router(config-if)# mtu 1509
Router(config-if)# lapb n1 12072
```

The following example enables Stacker compression on serial interface 0 for a LAPB link. This example does not set the MTU size and the maximum bits per frame (N1); we recommend that you do not change those LAPB parameters for Stacker compression:

```
Router(config)# interface serial 0
Router(config-if)# encapsulation lapb
Router(config-if)# compress predictor
```

The following example configures BRI interface 0 to perform MPPC:

```
Router(config)# interface BRI0
Router(config-if)# ip unnumbered ethernet0
Router(config-if)# encapsulation ppp
Router(config-if)# isdn spid1 5551234
```

```
Router(config-if)# dialer map ip 172.21.71.74 5551234
Router(config-if)# dialer-group 1
Router(config-if)# compress mppc
```

The following example configures asynchronous interface 1 to implement MPPC and ignore the protocol field compression flag negotiated by LCP:

```
Router(config)# interface async1
Router(config-if)# ip unnumbered ethernet0
Router(config-if)# encapsulation ppp
Router(config-if)# async default routing
Router(config-if)# async dynamic routing
Router(config-if)# async mode interactive
Router(config-if)# peer default ip address 172.21.71.74
Router(config-if)# compress mppc ignore-pfc
```

Related Commands

Command	Description
encapsulation	Sets the encapsulation method used by the interface.
encapsulation x25	Specifies operation of a serial interface as an X.25 device.
exec	Allows an EXEC process on a line.
show compress	Displays compression statistics.
show processes	Displays information about the active processes.

compress mppc

To configure compression using the Microsoft Point-to-Point Compression (MPPC) algorithm on your data compression Advanced Interface Module (AIM) for the Cisco 2600 series router, use the **compress mppc** command in interface configuration mode. To disable MPPC compression, use the **no** form of this command.

compress mppc

no compress mppc

Syntax Description

This command has no arguments or keywords.

Defaults

Disabled

Command Modes

Interface configuration

Command History

Release	Modification
12.0(1)T	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

The MPPC compression algorithm is used to exchange compressed information with a Microsoft NT remote access server.

When configuring PPP on a serial interface, you can use hardware compression on the data compression AIM daughter card for MPPC if one is installed; otherwise you can use software compression.

Examples

The following example shows how to configure the data compression AIM daughtercard for MPPC:

```
Router(config-if)# encapsulate ppp
Router(config-if)# compress mppc
```

Related Commands

Command	Description
clear aim	Clears data compression AIM registers and resets the hardware.
compress stac caim	Specifies the exact hardware compression resource preferred.
encapsulation	Sets the encapsulation method used by the interface.
show compress	Displays compression statistics.

Command	Description
show pas caim	Displays debug information about the data compression AIM daughtercard.
show processes	Displays information about the active processes.

compress stac caim

To specify the hardware compression, use the **compress stac caim** command in interface configuration mode. To disable compression, use the **no** form of this command.

compress stac caim *interface-number*

no compress stac caim *interface-number*

Syntax Description

interface-number	Interface on which compression is enabled. AIM interfaces begin with 0.

Defaults

Disabled

Command Modes

Interface configuration

Command History

Release	Modification
12.0(1)T	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

Hardware Compression

If the router contains a data compression Advanced Interface Module (CAIM), compression is performed in the CAIM hardware.

Using hardware compression in the AIM frees the main processor of the router for other tasks. You can also configure the router to use the Compression Port Module to perform compression by using the distributed option or to use the router's main processor by using the software option. If the Compression Port Module compression is performed in the main processor of the router.

Software Compression

If the CAIM is not available, compression is performed in the main processor of the router.

When compression is performed by the software installed in the router's main memory, system performance might be affected significantly. It is recommended that you disable compression in the main processor if the router CPU load exceeds 40 percent. To display the CPU load, use the **show process cpu** command in EXEC mode.

Examples

The following example specifies that hardware compression should be activated for CAIM interface 0:

```
Router(config-if)# encapsulation ppp
Router(config-if)# compress stac caim 0
```

Related Commands

Command	Description
clear aim	Clears data compression AIM registers and resets the hardware.
encapsulation	Sets the encapsulation method used by the interface.
show compress	Displays compression statistics.
show pas caim	Displays debug information about the data compression AIM daughtercard.
show process cpu	Displays information about the active processes on the router.

connect (module)

To create a connection between two Gigabit Ethernet (GE) enhanced network modules (ENMs) or between the GE port on an installed small-form-factor-pluggable (SFP) module and a GE ENM, or between the GE port on a switch module (SM) and another SM GE port, on a Cisco 2900 series (Cisco 2901 ISRs do not support the HIMI backplane feature.), 3800 series, or 3900 series Integrated Services Router (ISR), use the **connect** command in global configuration mode. To deactivate a connection between two GE modules on a Cisco 3800 series router, use the **no** form of this command.

connect *connection-name* **module** *module1 channel-id1* **module** *module2 channel-id2*

no connect *connection-name*

To create a dedicated connection between two GE ENMs, or between the GE port on an SFP module and a GE ENM, or between the GE port on a SM and another SM GE port, for the purpose of sending data on a specified VLAN on a Cisco 3900 series or 2900 series (Cisco 2901 ISRs do not support **vlan connect** in configuring the HIMI backplane feature.), use the **connect** command in global configuration mode with the **vlan** *vlan-id* syntax. To deactivate a connection between two GE interfaces on a Cisco 3900 series router, 2900 series (Cisco 2901 ISRs do not support **vlan connect** in configuring the HIMI backplane feature.), use the **no** form of this command.

connect *connection-name* **module** *module1* **vlan** *vlan-id* **module** *module2*

no connect *connection-name*

Syntax Description

connection-name	Unique name for this connection.
module *module1 channel-id1*	First of the two GE interfaces on the router between which a connection will be created. • Use the *module1* argument to identify the GE port number. Use the syntax **GigabitEthernet***slot*/*port*, where *slot* is the slot number in which the ENM resides, or 0 for the router onboard SFP GE port, and *port* is either the ENM port number or 0 for the router onboard SFP GE port. The following interfaces are valid: – On the Cisco 3825 and Cisco 3845 routers, the GE port in an installed SFP module – On the Cisco 3825 router, GE interfaces in ENM slots 1 and 2 – On the Cisco 3845 router, GE interfaces in ENM slots 2 and 4 – On the Cisco 2900 (Cisco 2901 ISRs do not support the HIMI backplane feature.) series and the Cisco 3900 series routers, all interfaces and slots are permissible providing your SM and ISM supports the HIMI backplane feature. • Use the *channel-id1* argument to indicate the channel identifier on the interface slots of *module1*. On Cisco 3800 series routers, there is only one channel identifier, so this value must be 0.

module *module2* *channel-id2*	Second half of the two GE interfaces on the router between which a connection will be created. • Use the *module2* argument to identify the GE port number. Use the syntax **GigabitEthernet***slot*/*port*, where *slot* is the slot number in which the ENM resides, or 0 for the onboard SFP GE port, and *port* is either the ENM port number or 0 for the onboard SFP GE port. • Use the *channel-id2* argument to indicate the channel identifier on the interface slots of *module2*. On Cisco 3800 series and Cisco 3900 series routers, there is only one channel identifier, so this value must be 0.
module *module1* **vlan** *vlan-id* **module** *module2*	Specified vlan on two GE interfaces on the router. **Note** On the Cisco 2900 series (Cisco 2901 ISRs do not support **vlan connect** in configuring the HIMI backplane feature.) and Cisco 3900 series routers, if your ISM or SM supports the HIMI backplane and VLAN connection, the module interconnection between the GE port (with the exception of onboard GE ports) on any slot is permitted at any given time.

Command Default

There is no connection between GE ENMs.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.4(2)T	This command was introduced.
15.0(1)M	This command was modified to support the Cisco 3900 series and 2900 series (Cisco 2901 ISRs do not support the HIMI backplane feature.) ISR release.

Usage Guidelines

To create a connection between two GE modules on a Cisco 2900 (Cisco 2901 ISRs do not support the HIMI backplane feature.), 3800, and 3900 series routers using the High-Speed Intrachassis Module Interconnect (HIMI) feature, use the **connect** *connection-name* **module** module1 channel-id1 **module** module2 channel-id2 command in global configuration mode:

Connections can be only established as follows:

- Between the GE port in an installed small-form-factor pluggable (SFP) module on the Cisco 3825 and Cisco 3845 routers
- Between GE interfaces in NME slots 1 and 2 on the Cisco 3825 router
- Between GE interfaces in NME slots 2 and 4 on the Cisco 3845 router

Note A module interconnection between the GE port on an SFP module and an ENM slot or an ENM-to-ENM cross-connection on the Cisco 3800 series routers is permitted at any time, but both types of connections cannot exist at the same time.

Note Connections between the onboard RJ-45 GE ports and ENM slots are not supported.

To create a connection between two GE SMs, to send data on a specified VLAN, on a VLAN on a Cisco 2900 (Cisco 2901 ISRs do not support the HIMI backplane feature.), and 3900, use the connect command with the with the **vlan** *vlan-id* syntax.

If the **connect** command is successfully executed, the router enters connection configuration mode, which is designated by the "config-module-conn" prompt. Once the router is in connection configuration mode, the commands shown in Table 3 can be issued.

Table 3 Connection Configuration Mode Commands

Command	Description
default	Sets a command to its default values. Has no effect on the **connect** command functionality.
exit	Exits connection configuration mode. After you exit connection configuration mode, the actual connection establishment phase starts.
shutdown	Shuts down the connection. This command effectively deactivates the connection.
no	Negates a command or sets it to default. The **no shutdown** command reactivates a previously shut down connection.

To establish a connection, after entering connection configuration mode, issue the **exit** command to return to configuration mode. The connection will be established after you leave connection configuration mode.

Examples

The following example illustrates the creation of a connection between the onboard port GigabitEthernet0/0 and port GigabitEthernet4/0, which resides in ENM slot 4:

```
Router(config)# connect connection1 module GigabitEthernet0/0 0 module
GigabitEthernet4/0 0
Router(config-module-conn)# exit
```

The following example shows the creation of a VLAN connection which is named VLAN 10 and a second VLAN connection which is named VLAN 5.

```
Router(config)# connect connection1 module gi2/0 vlan 10 module gi3/0
Router(config-module-conn)# connect connection2 module gi3/0 vlan 5 module gi4/0
Router(config-module-conn)# exit
```

Related Commands

Command	Description
show connection	Displays the status of interworking connections.

controller dsl

To configure the digital subscriber line (DSL) controller and enter controller configuration mode, use the **controller dsl** command in global configuration mode. This command does not have a **no** form.

controller dsl *slot*/*port*

Syntax Description

slot	Slot number of the DSL controller. Valid numbers are 0 and 1.
/*port*	Port number of the DSL controller. Valid numbers are 0 and 1. The slash mark (/) is required between the *slot* argument and the *port* argument.

Defaults

No default behavior or values.

Command Modes

Global configuration

Command History

Release	Modification
12.3(4)XD	This command was introduced on Cisco 2600 series and Cisco 3700 series routers.
12.3(7)T	This command was integrated into Cisco IOS Release 12.3(7)T on Cisco 2600 series and Cisco 3700 series routers.
12.3(11)T	This command was implemented on Cisco 2800 and Cisco 3800 series routers.
12.3(14)T	This command was implemented on Cisco 1800 series routers.

Usage Guidelines

This command is used to enter controller configuration mode for the controller in the specified slot and port. If the controller is present, it is automatically set to a default set of values, including customer premises equipment (CPE) mode and annex A.

The central office (CO) and CPE sides of the link must be configured the same in order for a connection to be made. This command is available only when the WIC-1SHDSL-V2 is installed.

Examples

The following example shows how to enter DSL controller configuration mode on the controller in slot 1 and port 0:

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

Related Commands

Command	Description
controller shdsl	Configures the controller status.
debug xdsl application	Displays status of the xDSL if the DSL does not activate as expected.
debug xdsl driver	Displays status when the drivers are downloaded and installed.

Command	Description
debug xdsl eoc	Displays the contents of the embedded operations channel messages.
debug xdsl error	Displays the errors of xDSL process and firmware.
show controller dsl	Displays the DSL controller status and the controller number.
sra	Enables seamless rate adaption mode.

control-lead sampling-rate

To configure the sampling rate of input control leads, use the **control-lead sampling-rate** command in CEM configuration mode.

control-lead sampling-rate *rate*

Syntax Description

rate	Integer that specifies the number of samples per second. Range is from 0 to 20. Default is 0.

Command Default

The input control lead sampling rate defaults to 0 (no sampling).

Command Modes

CEM configuration

Command History

Release	Modification
12.3(7)T	This command was introduced.

Usage Guidelines

This command applies only to serial channels. This command does not have a **no** form; to disable control-lead sampling, set the *rate* argument to 0.

Examples

The following example shows how to configure the ingress control-lead sampling rate to 20 samples per second on a serial CEM port.

```
Router(config-cem)# control-lead sampling-rate 20
```

Related Commands

Command	Description
cem	Enters circuit emulation configuration mode.
clear cem	Clears CEM channel statistics.
control-lead state	Specifies the state of an output control lead.
show cem	Displays CEM channel statistics.

control-lead state

To specify the state of an output control lead, use the **control-lead state** command in CEM configuration mode. The choice of output lead depends on whether the port is DCE or DTE.

control-lead state {**active** | **fail**} *output-lead* {**on** | **off** | **follow**} [{**local** | **remote**} *follow-lead*]

Syntax Description

active	Active template configuration.
fail	Failed template configuration.
output-lead	Specifies the name of the output control lead. The choice of the control lead depends on whether the port is DCE or DTE.
on	Activates the lead.
off	Deactivates the lead.
follow	Specifies the control lead state to follow.
local	(Optional) Specifies a local lead state.
remote	(Optional) Specifies a remote lead state.
follow-lead	(Optional) Specifies the local or remote input control lead for this control lead to follow. The choice of the control lead depends on whether the port is DCE or DTE.

Command Default

The default Active template that is activated depends on whether the port is DCE or DTE. The default Fail template deactivates all signals. Table 4 shows the various control-lead default states.

Table 4 Control-Lead Default States

Lead Number	DCE Name	DTE Name	Active Default	Fail Default
1	CTS	RTS	On	Off
2	DSR	DTR	On	Off
3	DCD	—	On	Off
4	—	LL	Off	—
5	TM	—	On	Off
6	RI	RL	Off	Off

Command Modes

CEM configuration

Command History

Release	Modification
12.3(7)T	This command was introduced.

Usage Guidelines

The state of each output control lead may be specified to assume a constant level (on or off) or to change on the basis of the state of any input control lead, either at the local data port or at the remote data port.

This command applies only to serial ports. This command does not have a **no** form; to disable the control lead, specify the **off** keyword.

Examples

The following example shows how to specify the state of an output control lead.

```
Router(config-cem)# control-lead state active cts on
```

Related Commands

Command	Description
cem	Enters circuit emulation configuration mode.
control-lead sampling-rate	Configures the sampling rate of input control leads.
show cem	Displays CEM channel statistics.

controller

To configure a T1, E1, or J1 controller and enter controller configuration mode, use the **controller** command in global configuration mode.

Cisco 2600 and 3600 Series Routers

controller {**t1** | **e1** | **j1**} *slot*/*port*

Cisco 7200 Series and Cisco 7500 Series Routers

controller {**t1** | **e1**} *slot*/*port*

Cisco AS5300 Access Servers

controller {**t1** | **e1**} *number*

Cisco AS5800 Access Servers

controller t1 *dial-shelf*/*slot*/*t3-port*:*t1-num*

Syntax Description

t1	T1 controller.
e1	E1 controller.
j1	J1 controller.
slot/*port*	Backplane slot number and port number on the interface. Refer to your hardware installation manual for the specific values and slot numbers.
number	Network processor module (NPM) number, in the range 0 through 2.
dial-shelf	Dial shelf chassis in the Cisco AS5800 access server that contains the interface card.
/t3-port	T3 port number. The only valid value is 0.
:*t1-num*	T1 timeslot in the T3 line. The value can be from 1 to 28.

Defaults

No T1, E1, or J1 controller is configured.

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.
10.3	The **e1** keyword was added.
12.0(3)T	Support was added for dial shelves on Cisco AS5800 access servers.
12.2(7)XO	The **j1** keyword was added for the Cisco 2600 and Cisco 3600 series.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.

Usage Guidelines

T1 or E1 Fractional Data Lines

This command is used in configurations where the router or access server is intended to communicate with a T1 or E1 fractional data line. Additional parameters for the T1 or E1 line must be configured for the controller before the T1 or E1 circuits can be configured by means of the **interface** global configuration command.

To view the status of the controllers use the **show controllers** command.

Examples

Cisco 7500 Series Router As a T1 Controller

The following example configures the MIP in slot 4, port 0 of a Cisco 7500 series router as a T1 controller:

```
Router(config)# controller t1 4/0
Router(config-controller)#
```

Cisco AS5800 Access Server with Dial Shelf

The following example configures the T1 controller in shelf 1, slot 0, port 0:

```
Router(config)# controller t1 1/0/0:1
Router(config-controller)#
```

Cisco 3660 As a J1 Controller

The following example configures the Cisco IOS interface card in slot 3, port 0 of a Cisco 3660 as a J1 controller:

```
Router(config)# controller j1 3/0
Router(config-controller)#
```

Related Commands

Command	Description
bert abort	Resets the T1 or E1 controller.
interface serial	Specifies a serial interface created on a channelized E1 or channelized T1 controller (for ISDN PRI, CAS, or robbed-bit signaling).
show controllers content-engine	Displays information about the E1 links supported by the NPM (Cisco 4000) or MIP (Cisco 7500 series).
show controllers j1	Displays information about the J1 link.
show controllers t1	Displays the total number of calls and call durations on a T1 controller.

controller dsl

To configure the digital subscriber line (DSL) controller and enter controller configuration mode, use the **controller dsl** command in global configuration mode. This command does not have a **no** form.

controller dsl *slot*/*port*

Syntax Description

slot	Slot number of the DSL controller. Valid numbers are 0 and 1.
/port	Port number of the DSL controller. Valid numbers are 0 and 1. The slash mark (**/**) is required between the *slot* argument and the *port* argument.

Defaults

No default behavior or values.

Command Modes

Global configuration

Command History

Release	Modification
12.3(4)XD	This command was introduced on Cisco 2600 series and Cisco 3700 series routers.
12.3(7)T	This command was integrated into Cisco IOS Release 12.3(7)T on Cisco 2600 series and Cisco 3700 series routers.
12.3(11)T	This command was implemented on Cisco 2800 and Cisco 3800 series routers.
12.3(14)T	This command was implemented on Cisco 1800 series routers.

Usage Guidelines

This command is used to enter controller configuration mode for the controller in the specified slot and port. If the controller is present, it is automatically set to a default set of values, including customer premises equipment (CPE) mode and annex A.

The central office (CO) and CPE sides of the link must be configured the same in order for a connection to be made. This command is available only when the WIC-1SHDSL-V2 is installed.

Examples

The following example shows how to enter DSL controller configuration mode on the controller in slot 1 and port 0:

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

Related Commands

Command	Description
controller shdsl	Configures the controller status.
debug xdsl application	Displays status of the xDSL if the DSL does not activate as expected.
debug xdsl driver	Displays status when the drivers are downloaded and installed.

Command	Description
debug xdsl eoc	Displays the contents of the embedded operations channel messages.
debug xdsl error	Displays the errors of xDSL process and firmware.
show controller dsl	Displays the DSL controller status and the controller number.

controller dwdm

To configure a Dense Wavelength-Division Multiplexing (DWDM) controller, use the **controller dwdm** command in global configuration mode. This command does not have a **no** form.

controller dwdm *slot/port*

Syntax Description

slot/port	Number of the chassis slot that contains the interface, where: • slot—Chassis slot number. • /port—Port number.

Command Default

No default behavior or values

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(33)SRD1	This command was introduced on the Cisco 7600 series router.

Examples

The following example shows how to configure a DWDM controller in slot 3:

```
Router(config)# controller dwdm 3/1
```

Related Commands

Command	Description
g709 fec	Configures the FEC for the DWDM controller.
g709 odu threshold	Configures thresholds for selected ODU BER alarms.
g709 otu threshold	Configures thresholds for selected OTU BER alarms.
no g709 odu report	Disables the logging of selected ODU alarms.
no g709 otu report	Disables the logging of selected OTU alarms.
show controller dwdm	Displays ITU-T G.709 alarms, alerts, and counters.
show platform dwdm alarm history	Displays platform DWDM alarm history.
transport-mode	Configures a transport mode.

controller e3

To configure an E3 controller and enter controller configuration mode, use the **controller e3** command in global configuration mode.

controller e3 *slot/port*

Syntax Description

slot/port	Number of the slot and port being configured. Refer to the appropriate hardware manual for slot and port information. The slash mark is required.

Defaults

No E3 controller is configured.

Command Modes

Global configuration

Command History

Release	Modification
11.1	This command was introduced.
12.2(11)YT	This command was integrated into Cisco IOS Release 12.2(11)YT and implemented on the following platforms: Cisco 2650XM, Cisco 2651XM, Cisco 2691, Cisco 3660 series, Cisco 3725, and Cisco 3745 routers.
12.2(15)T	This command was integrated into Cisco IOS Release 12.2(15)T.

Examples

The following example shows the E3 controller configured in slot 0, port 0:

```
Router(config)# controller e3 0/0
Router(config-controller)#
```

Related Commands

Command	Description
controller t3	Configures a T3 controller and enters controller configuration mode.
show controllers e3	Displays information about E3 controllers.
show controllers t3	Displays information about T3 controllers.

controller sonet

To configure a SONET controller and enter controller configuration mode, use the **controller sonet** command in global configuration mode.

controller sonet *slot/port*

Syntax Description

slot	Physical slot number. The slot number is in a range either from 0 to 5 or 8 to 13, depending on the slot in which the STM-1 card resides.
/port	SONET port number. The port number is always 0 because only one STM-1 port is supported per interface. The slash mark is required.

Defaults

port: 0

Command Modes

Global configuration

Command History

Release	Modification
12.0(14)S	This command was introduced.
12.2(15)T	This command was integrated into Cisco IOS Release 12.2(15)T.

Usage Guidelines

This command does not have a **no** form because the SONET controller is created automatically when the STM-1 trunk card is detected by the Cisco AS5850. Use this command to specify which slot number the STM-1 card is plugged into and to configure different attributes under controller configuration mode.

Examples

The following example shows how to specify that the SONET controller is in slot number 2:

```
Router(config)# controller sonet 2/0
Router(config-controller)#
```

Related Commands

Command	Description
show controllers sonet	Displays information about SONET controllers.

controller t3

To configure the Channelized T3 Interface Processor (CT3IP) in Cisco 7500 series routers or the CT3 feature board in Cisco AS5800 access servers, use the **controller t3** command in global configuration mode. To delete the defined controller, use the **no** form of this command.

Cisco 7500 Series

controller t3 *slot*/*port-adapter*/*port*

no controller t3 *slot*/*port-adapter*/*port*

Cisco AS5800 Access Server

controller t3 *dial-shelf*/*slot*/*t3-port*

no controller t3 *dial-shelf*/*slot*/*t3-port*

Syntax Description

slot	Number of the slot being configured. Refer to the appropriate hardware manual for slot and port information./
/*port-adapter*	Number of the port adapter being configured. Refer to the appropriate hardware manual for information about port adapter compatibility.
/*port*	Number of the port being configured. Refer to the appropriate hardware manual for slot and port information.
dial-shelf	Dial shelf chassis in the Cisco AS5800 access server containing the CT3 interface card.
/*slot*	Location of the CT3 interface card in the dial shelf chassis.
/*t3-port*	T3 port number. The only valid value is 0.

Defaults

Cisco 7500 Series

No T3 controller is configured.

Cisco AS5800 Access Server

No default behavior or values.

Command Modes

Global configuration

Command History

Release	Modification
11.3	This command was introduced.
12.0(3)T	This command was implemented on the Cisco AS5800 access server.

Usage Guidelines

This command is used to configure the CT3IP and the 28 T1 channels. After the T1 channels are configured, continue to configure each T1 channel as a serial interface by using the **interface serial** global configuration command

Examples

Cisco 7500 Series

The following example configures the CT3IP in slot 3:

```
Router(config)# controller t3 3/0/0
```

Cisco AS5800 Access Server

The following example configures the T3 controller in shelf 3, slot 0, port 0 and T1 time slot 1:

```
Router(config)# controller t3 3/0/0
```

Related Commands

Command	Description
controller	Configures a T1, E1, or J1 controller and enters controller configuration mode.
interface	Specifies a serial interface created on a channelized E1 or channelized T1 controller (for ISDN PRI, CAS, or robbed-bit signaling).

copy flash lex

To download an executable image from Flash memory on the core router to a LAN Extender, use the **copy flash lex** command in privileged EXEC mode.

copy flash lex *number*

Syntax Description

number	Number of the LAN Extender interface to which to download an image from Flash memory.

Command Modes

Privileged EXEC

Command History

Release	Modification
10.3	This command was introduced.
12.2(15)T	This command is no longer supported in Cisco IOS Mainline or Technology-based (T) releases. It may continue to appear in 12.2S-Family releases.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

If you attempt to download a version of the software older than what is currently running on the LAN Extender, a warning message is displayed.

This command does not have a **no** form.

Examples

The following example copies the executable image *namexx* to LAN Extender interface 0:

```
Router# copy flash lex 0
Name of file to copy? namexx
Address of remote host [255.255.255.255] <cr>
writing namexx !!!!!!!!!!!!!!!!!!!!!!!!copy complete
```

Related Commands

Command	Description
copy tftp lex	Downloads an executable image from a TFTP server to a LAN Extender.

copy tftp lex

To download an executable image from a TFTP server to the LAN Extender, use the **copy tftp lex** command privileged EXEC mode.

copy tftp lex *number*

Syntax Description

number	Number of the LAN Extender interface to which to download an image.

Command Modes

Privileged EXEC

Command History

Release	Modification
10.3	This command was introduced.
12.2(15)T	This command is no longer supported in Cisco IOS Mainline or Technology-based (T) releases. It may continue to appear in 12.2S-Family releases.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

If you attempt to download a version of the software older than what is currently running on the LAN Extender, a warning message is displayed.

This command does not have a not form.

Examples

The following example copies the file *namexx* from the TFTP server:

```
Router# copy tftp lex 0
Address or name of remote host (255.255.255.255]? 10.108.1.111
Name of file to copy? namexx
OK to overwrite software version 1.0 with 1.1 ?[confirm] Y
Loading namexx from 10.108.13.111!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 127825/131072 bytes]

Successful download to LAN Extender
```

crc

To set the length of the cyclic redundancy check (CRC), use the **crc** command in interface configuration mode. To set the CRC length to the default value, use the **no** form of this command.

crc *size-in-bits*

no crc

Syntax Description

size-in-bits	CRC size in bits. Valid values are 16 and 32. The default is 16.

Defaults

Cisco 7500 Series Router

16 bits

Cisco 10000 Series Router

32 bits

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.
12.2(31)SB	This command was integrated into Cisco IOS Release 12.2(31)SB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

All interfaces use a 16-bit CRC by default, but also support a 32-bit CRC. CRC is an error-checking technique that uses a calculated numeric value to detect errors in transmitted data. The designators 16 and 32 indicate the length (in bits) of the frame check sequence (FCS). A CRC of 32 bits provides more powerful error detection, but adds overhead. Both the sender and receiver must use the same setting.

CRC-16, the most widely used CRC rate throughout the United States and Europe, is used extensively with WANs. CRC-32 is specified by IEEE 802 and as an option by some point-to-point transmission standards. It is often used on Switched Multimegabit Data Service (SMDS) networks and LANs.

Examples

The following example enables the 32-bit CRC on serial interface 3/0:

```
Router(config)# interface serial 3/0
Router(config-if)# crc 32
```

crc bits 5

To enable generation of CRC5 (per ITU Recommendation G.704 and G.703) to improve data integrity, use the **crc bits 5** command in interface configuration mode. To disable this function, use the **no** form of this command.

crc bits 5

no crc bits 5

Syntax Description

This command has no arguments or keywords.

Defaults

CRC5 checking is disabled.

Command Modes

Interface configuration

Command History

Release	Modification
11.1 CA	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

This command is available for the JT2 6.3-MHz serial port adapter (PA-2JT2) on the second-generation Versatile Interface Processor (VIP2), in Cisco 7500 series routers, and in Cisco 7000 series routers with the Cisco 7000 series Route Switch Processor (RSP7000) and the Cisco 7000 series Chassis Interface (RSP7000CI).

This command is useful for checking data integrity while operating in framed mode. CRC5 provides additional protection for a frame alignment signal under noisy conditions. For data transmission at JT2 (6.312 Mbps), the G.704 standard suggests 5 bits CRC. Refer to ITU Recommendation G.704 for a definition of CRC5.

You can also use the **crc** command to set the CRC size for the High-Level Data Link Control (HDLC) controllers.

Examples

The following example enables CRC5 generation on the PA-2JT2 port adapter and also sets the CRC size to 32 bits:

```
Router(config)# interface serial 0/0
Router(config-if)# crc 32
Router(config-if)# crc bits 5
```

Related Commands

Command	Description
crc	Sets the length of the CRC.

crc4

To enable generation of CRC4 (per ITU Recommendation G.704 and G.703) to improve data integrity, use the **crc4** command in interface configuration mode. To disable this function, use the **no** form of this command.

crc4

no crc4

Syntax Description

This command has no arguments or keywords.

Defaults

Disabled

Command Modes

Interface configuration

Command History

Release	Modification
10.3	This command was introduced.
11.1 CA	This command was implemented on the Cisco 7200 series router and the E1-G.703/G.704 serial port adapter.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

This command applies to the Cisco 7200 series, Cisco 7000 series, and Cisco 7500 series routers. This command is supported on the Fast Serial Interface Processor (FSIP) and the E1-G.703/G.704 serial port adapter.

This command is useful for checking data integrity while operating in framed mode. CRC4 provides additional protection for a frame alignment signal under noisy conditions. For data transmission at E1 (2.048 Mbps), the G.704 standard suggests 4 bits CRC. Refer to CCITT Recommendation G.704 for a definition of CRC4.

You can also use the **crc** command to set the CRC size for the High-Level Data Link Control (HDLC) controllers.

Examples

The following example enables CRC4 generation on the E1-G.703/G.704 serial port adapter and also sets the CRC size to 32 bits:

```
Router(config)# interface serial 0/0
Router(config-if)# crc 32
Router(config-if)# crc4
```

Related Commands

Command	Description
crc	Sets the length of the CRC.

crc-threshold

To define a severely errored second (SES) by specifying the number of cyclic redundancy check (CRC) errors that occur in one second, use the **crc-threshold** command in controller configuration mode. To return to the default value, use the **no** form of this command.

crc-threshold *value*

no crc-threshold

Syntax Description

value	Number of CRC errors in one second that results in the second being declared a severely errored second (SES). Range is from 0 to 3000. Default is 320.

Command Default

A default SES is defined by a value of 320 CRC errors per second.

Command Modes

Controller configuration

Command History

Release	Modification
12.3(7)T	This command was introduced.

Usage Guidelines

On a T1 port, this command applies only if extended super frame (ESF) framing is used because the super frame (SF) (also known as D4) frame structure does not include any CRC protection.

This command does not apply to an E1 port.

Examples

The following example shows how to set the CRC threshold at 512 CRC errors in one second.

```
Router(config-controller)# crc-threshold 512
```

ctunnel mode

To transport IPv4 and IPv6 packets over Connectionless Network Service (CLNS) tunnel (CTunnel), use the **ctunnel mode** command in interface configuration mode. To return the ctunnel to the default **cisco** mode, use the **no** form of this command.

ctunnel mode [**gre** | **cisco**]

no ctunnel mode

Syntax Description

gre	(Optional) Sets the ctunnel mode to Generic Routing Encapsulation (GRE) for transporting IPv6 packets over the CLNS network.
cisco	(Optional) Returns the ctunnel mode to the default cisco.

Command Default

Cisco encapsulation

Command Modes

Interface configuration

Command History

Release	Modification
12.3(7)T	This command was introduced.
12.2(25)S	This command was integrated into Cisco IOS Release 12.2(25)S.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.

Usage Guidelines

GRE tunneling of IPv4 and IPv6 packets through CLNS-only networks enables Cisco ctunnels to interoperate with networking equipment from other vendors. This feature provides compliance with RFC 3147, *Generic Routing Encapsulation over CLNS Networks*, which should allow interoperation between Cisco equipment and that of other vendors. in which the same standard is implemented.

RFC 3147 specifies the use of GRE when tunneling packets. The implementation of this feature does not include support for GRE header fields such as those used to specify checksums, keys, or sequencing. Any packets received which specify the use of these features will be dropped.

The default ctunnel mode continues to use the standard Cisco encapsulation. Both ends of the tunnel must be configured with the same mode for it to work. If you want to tunnel ipv6 packets you must use the new gre mode.

Examples

The following example configures a CTunnel from one router to another and shows the CTunnel destination set to 49.0001.1111.1111.1111.00. The ctunnel mode is set to gre to transport IPv6 packets.

```
interface ctunnel 301
 ipv6 address 2001:0DB8:1111:2222::2/64
```

```
ctunnel destination 49.0001.1111.1111.1111.00
ctunnel mode gre
```

Related Commands

Command	Description
clns routing	Enables routing of CLNS packets.
ctunnel destination	Specifies the destination for the CTunnel.
debug ctunnel	Displays debug messages for the IP over a CLNS Tunnel feature.
interface ctunnel	Creates a virtual interface to transport IP over a CLNS tunnel.
ip address	Sets a primary or secondary IP address for an interface.

cut-through

To configure the interfaces on the PA-12E/2FE port adapter to use cut-through switching technology between interfaces within the same bridge group, use the **cut-through** command in interface configuration mode. To return each interface to store-and-forward switching, use the **no** form of this command.

cut-through [**receive** | **transmit**]

no cut-through

Syntax Description

receive	(Optional) Selects cut-through switching technology on received data.
transmit	(Optional) Selects cut-through switching technology on transmitted data.

Defaults

Store-and-forward switching technology (that is, no cut-through)

Command Modes

Interface configuration

Command History

Release	Modification
11.2P	This command was introduced.'
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

Cut-through mode allows switched packets to be transmitted after 64 bytes are received. The transmission of the packets can start before the end of the packet arrives. This reduces the time spent in the switch, but allows packets to be transmitted with bad cyclical redundancy checks (CRCs), because the transmission is initiated before the CRC is received or checked. Store-and-forward mode waits for the entire packet to be received before that packet is forwarded, but will check the CRC before starting transmission.

The PA-12E/2FE port adapter offloads Layer 2 switching from the host CPU by using store-and-forward or cut-through switching technology between interfaces within the same VLAN on the PA-12E/2FE port adapter. The PA-12E/2FE port adapter supports up to four VLANs (bridge groups).

Examples

The following example configures interface 3/0 for cut-through switching:

```
Router(config)# interface fastethernet 3/0
Router(config-if)# bridge-group 10
Router(config-if)# cut-through
Router(config-if)# no shutdown
Router(config-if)# exit
```