Clock Recovery System for SAToP

The Clock Recovery System recovers the service clock using Adaptive Clock Recovery (ACR) and Differential Clock Recovery (DCR).

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.
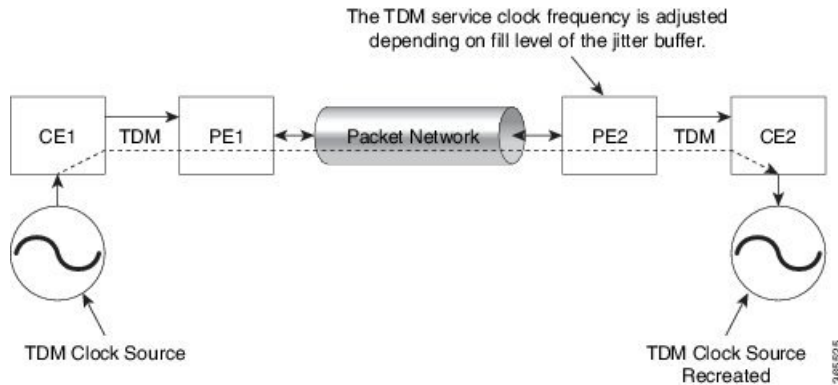
Information About Clock Recovery

Adaptive Clock Recovery (ACR)

Adaptive Clock Recovery (ACR) is an averaging process that negates the effect of random packet delay variation and captures the average rate of transmission of the original bit stream. ACR recovers the original clock for a synchronous data stream from the actual payload of the data stream. In other words, a synchronous clock is derived from an asynchronous packet stream. ACR is a technique where the clock from the TDM domain is mapped through the packet domain, but is most commonly used for Circuit Emulation (CEM). ACR is supported on unframed and framed modes of SAToP.

Note   Framing type should be maintained same in all routers end to end.

Effective Cisco IOS XE Everest 16.5.1, ACR is supported on the 8-port T1/E1 interface module.

The TDM service clock frequency is adjusted depending on fill level of the jitter buffer.

CE1 TDM PE1 ←→ Packet Network ←→ PE2 TDM CE2

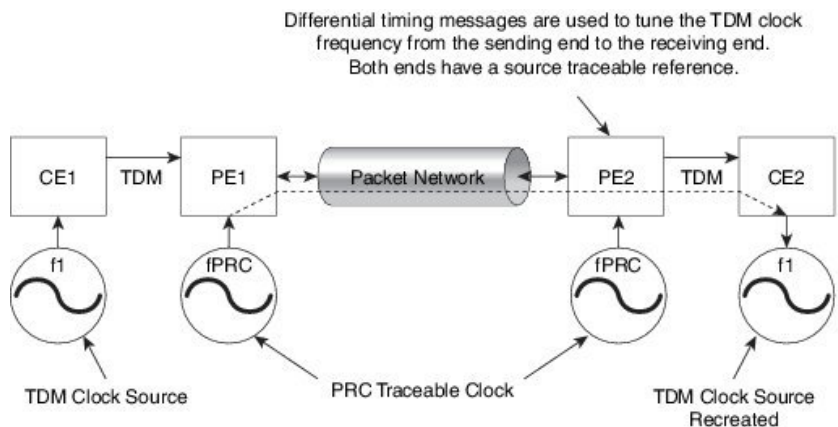TDM Clock Source

TDM Clock Source Recreated

Differential Clock Recovery (DCR)

Differential Clock Recovery (DCR) is another technique used for Circuit Emulation (CEM) to recover clocks based on the difference between PE clocks. TDM clock frequency are tuned to receive differential timing messages from the sending end to the receiving end. A traceable clock is used at each end, which ensures the recovered clock is not affected by packet transfer. DCR is supported on unframed and framed modes of SAToP.

Note   Framing type should be maintained same in all routers end to end.

Differential timing messages are used to tune the TDM clock frequency from the sending end to the receiving end. Both ends have a source traceable reference.

CE1 TDM PE1 ←→ Packet Network ←→ PE2 TDM CE2

f1 fPRC fPRC f1

TDM Clock Source   PRC Traceable Clock   TDM Clock Source Recreated

Benefits of Clock Recovery

- Customer-edge devices (CEs) can have different clock from that of the Provide-edge devices (PEs).

Scaling Information

IM Card	Pseudowires Supported (Number of Clocks Derived)
48-Port T3/E3 CEM Interface Module	1344

Prerequisites for Clock Recovery

- The clock of interface modules must be used as service clock.

- CEM must be configured before configuring the global clock recovery.

- RTP must be enabled for DCR in CEM, as the differential clock information is transferred in the RTP header.

Restrictions for Clock Recovery

- The reference clock source is used and locked to a single clock.

- The clock ID should be unique for a particular interface module for ACR or DCR configuration.

- When CEM group is configured, dynamic change in clock source is not allowed.

- ACR clock configuration under each controller should be performed before configuring CEM group.

How to Configure ACR and DCR

Configuring ACR for T3/E3

Configuring Adaptive Clock Recovery of T3/E3 Interfaces for SAToP

Before You Begin

- The node (router) on which the 48-Port T3/E3 interface module is configured for ACR, must have its own clock derived from BITS/GPS/Stratum clock.

- The minimum packet size of CEM pseudowires on the network that delivers robust clock recovery is 256 bytes.

To configure the clock on T3/E3 interfaces for SAToP in controller mode, use the following commands:

```
enable
configure terminal
controller t3 0/0/1
clock source recovered 1
cem-group 0 unframed
exit
```

To configure the clock recovery on T3/E3 interfaces in global configuration mode, use the following commands:

```
recovered-clock 0 0
clock recovered 1 adaptive cem 1 0
exit
```

> **Note** The clock configuration on controller must be done before configuring the clock recovery on global configuration mode.

Verifying Adaptive Clock Recovery Configuration of T3/E3 Interfaces for SAToP

Use the **show recovered-clock** command to verify the adaptive clock recovery of T3/E3 interfaces for SAToP:

```
Router# show recovered-clock

Recovered clock status for subslot 0/4
-------------------------------------
Clock    Type    Mode      CEM    Status      Frequency Offset(ppb)  Circuit-No

0        DS3     ADAPTIVE   0     ACQUIRED    n/a                    0 (Port)
```

Use the **show running-config** | **section** command to verify the configuration of adaptive clock of T3/E3 interfaces:

```
Router# show running-config | section 0/0/1
controller MediaType 0/0/1
 mode t3
controller T3 0/0/1
  cem-group 0 unframed
 clock source recovered 1
 cablelength 224
interface CEM0/0/1
 no ip address
 cem 0
```

Use the **show running-config** | **section recovered-clock** command to verify the recovery of adaptive clock of T3/E3 interfaces:

```
Router# show running-config | section recovered-clock
recovered-clock 0 0
 clock recovered 1 adaptive cem 1 0
```

Configuring DCR for T3/E3

Configuring Differential Clock Recovery of T3/E3 Interfaces for SAToP

Before You Begin

- Before you start configuring DCR, RTP must be enabled on the CEM interface. The RTP is used to carry the differential time.

- The minimum packet size of CEM pseudowires on the network that delivers robust clock recovery is 256 bytes.

To configure differential clock recovery on T3/E3 interface for SAToP in controller mode, use the following commands:

```
enable
configure terminal
controller t3 0/0/1
clock source recovered 1
cem-group 0 unframed
exit
```

To configure RTP header under interface, use the following commands:

```
interface cem 0/0/1
cem 0
rtp-present
```

To configure differential clock recovery of T3/E3 interface in global configuration mode, use the following commands:

```
recovered-clock 0 0
clock recovered 1 differential cem 1 0
exit
```

Note The clock configuration on controller must be done before configuring the clock recovery on global configuration mode.

Verifying the Differential Clock Recovery Configuration of T3/E3 Interfaces for SAToP

Use the **show recovered-clock** command to verify the differential clock recovery of T3/E3 interfaces for SAToP:

```
Router# show recovered-clock

Recovered clock status for subslot 0/4
---------------------------------------
Clock   Type   Mode          CEM   Status     Frequency Offset(ppb)   Circuit-No

0       DS3    DIFFERENTIAL   0     ACQUIRED   n/a                     0 (Port)
```

Use the **show running-config** | **section** command to verify the configuration of differential clock of T3/E3 interfaces for SAToP:

```
Router# show running-config | section 0/0/1
controller MediaType 0/0/1
 mode t3
controller T3 0/0/1
  cem-group 0 unframed
 clock source recovered 1
 cablelength 224
interface CEM0/0/1
 no ip address
```

```
cem 0
 rtp-present
```

Use the **show running-config** | **section recovered-clock** command to verify the recovery of differential clock of T3/E3 interfaces:

```
Router# show running-config | section recovered-clock
recovered-clock 0 0
 clock recovered 1 differential cem 1 0
```

Configuring ACR for Channelized T3/T1 or E3/E1

Configuring Adaptive Clock Recovery of Channelized T3/T1 or E3/E1 Interfaces for SAToP

Before You Begin

- The node (chassis) on which the T3/T1 or E3/E1 is configured for ACR, has to have its own clock derived from BITS/GPS/Stratum clock.

- The minimum packet size of CEM pseudowires on the network that delivers robust clock recovery is 256 bytes.

To configure adaptive clock on a channelized T3/T1 or E3/E1 interfaces under controller for SAToP in controller mode, use the following commands:

```
enable
configure terminal
controller t3 0/0/1
t1 1 clock source recovered 1
t1 1 cem-group 0 unframed
exit
```

To configure recovery of adaptive clock of channelized T3/T1 or E3/E1 interfaces in global configuration mode, use the following commands:

```
recovered-clock 0 0
clock recovered 1 adaptive cem 1 0
exit
```

Note The clock configuration on controller must be done before configuring the clock recovery on global configuration mode.

To remove the clock configuration in ACR and DCR, you must remove the recovery clock configuration in global configuration mode and then remove the controller configuration.

Verifying the Adaptive Clock Recovery Configuration of Channelized T3/T1 or E3/E1 Interfaces for SAToP

Use the **show recovered-clock** command to verify the adaptive clock recovery of T3/T1 or E3/E1 interfaces for SAToP:

```
Router# show recovered-clock
```

```
Recovered clock status for subslot 0/4
----------------------------------------

Clock    Type      Mode      CEM    Status    Frequency Offset(ppb)  Circuit-No
0        DS3-ds1   ADAPTIVE   0     ACQUIRED  n/a                    0/1 (Port/t1)
```

Use the **show running-config** | **section** command to verify the configuration of adaptive clock of channelized T3/T1 or E3/E1 interfaces:

```
Router# show running-config | section 0/0/1
controller MediaType 0/0/1
 mode t3
controller T3 0/0/1
 framing c-bit
 cablelength 224
 t1 1 cem-group 0 unframed
 t1 1 clock source recovered 1
interface CEM0/0/1
 no ip address
 cem 0
```

Use the **show running-config** | **section recovered-clock** command to verify the recovery of adaptive clock of channelized T3/T1 or E3/E1 interfaces:

```
Router# show running-config | section recovered-clock
recovered-clock 0 0
 clock recovered 1 adaptive cem 1 0
```

Configuring DCR for Channelized T3/T1 or E3/E1

Configuring Differential Clock Recovery of Channelized T3/T1 or E3/E1 Interfaces for SAToP

Before You Begin

- Before you start configuring DCR, RTP must be enabled on the CEM interface. The RTP is used to carry the differential time.

- The minimum packet size of CEM pseudowires on the network that delivers robust clock recovery is 256 bytes.

To configure differential clock on a channelized T3/T1 or E3/E1 interfaces under controller in controller mode, use the following commands:

```
enable
configure terminal
controller t3 0/0/1
t1 1 clock source recovered 1
t1 1 cem-group 0 unframed
exit
```

To configure RTP header under channelized T3/T1 or E3/E1 interfaces, use the following commands:

```
interface cem 0/0/1
cem 0
rtp-present
```

To configure recovery of differential clock of channelized T3/T1 or E3/E1 interfaces in global configuration mode, use the following commands:

```
recovered-clock 0 0
clock recovered 1 differential cem 1 0
exit
```

Note The clock configuration on controller must be done before configuring the clock recovery on global configuration mode.

Verifying the Differential Clock Recovery Configuration of Channelized T3/T1 or E3/E1 Interfaces for SAToP

Use the **show recovered-clock** command to verify the differential clock recovery of T3/T1 or E3/E1 interfaces for SAToP:

```
Router# show recovered-clock

Recovered clock status for subslot 0/4
--------------------------------------

Clock   Type       Mode          CEM     Status    Frequency Offset(ppb) Circuit-No

0       DS3-ds1    DIFFERENTIAL  0       ACQUIRED  n/a                   0/1 (Port/t1)
```

Use the **show running-config | section** command to verify the configuration of differential clock of channelized T3/T1 or E3/E1 interfaces:

```
Router# show running-config | section 0/0/1
controller MediaType 0/0/1
 mode t3
controller T3 0/0/1
 framing c-bit
 cablelength 224
 t1 1 cem-group 0 unframed
 t1 1 clock source recovered 1
interface CEM0/0/1
 no ip address
 cem 0
  rtp-present
```

Use the **show running-config | section recovered-clock** command to verify the recovery of differential clock of channelized T3/T1 or E3/E1 interfaces:

```
Router# show running-config | section recovered-clock
recovered-clock 0 0
 clock recovered 1 differential cem 1 0
```

Associated Commands

The commands used to adaptive clock recovery and differential clock recovery on 48-Ports T3/E3 Interface Module.

Commands	URL
clock recovered adaptive cem	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c2.html#wp8894393830
cem-group	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c1.html#wp2440628600
recovered-clock	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-o1.html#wp8262293900
controller t3/e3	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c2.html#wp1921350260
clock-source	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c2.html#wp6081785140

Additional References for Clock Recovery

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases

Standards and RFCs

Standard/RFC	Title
ITU -T G.8261	*Timing and synchronization aspects in packet networks*

MIBs

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

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html