Clock Recovery System for SAToP

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

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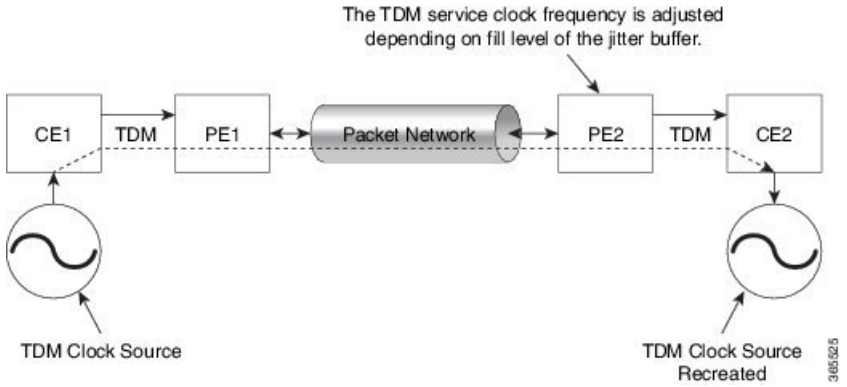
Information About Clock Recovery

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.

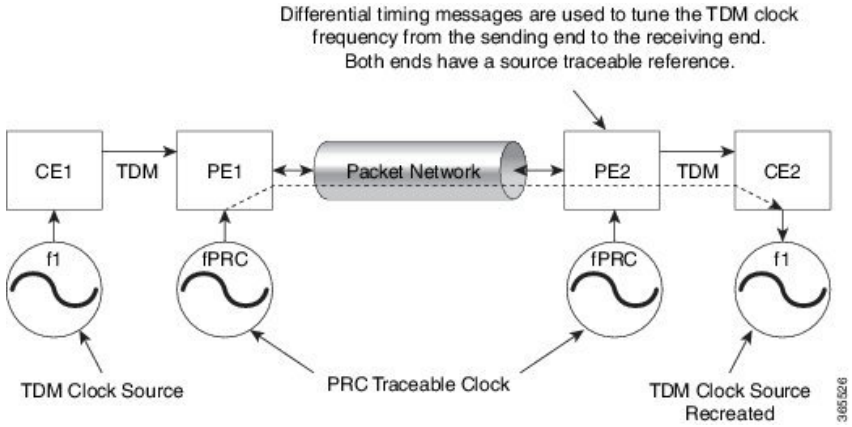
Effective Cisco IOS XE Everest 16.5.1, ACR is supported on the 8-port T1/E1 interface module.



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.



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)
T1 CEM Interface Module	1476

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

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Configuring Adaptive Clock Recovery of T1 Interfaces for SAToP

Before configuring Adaptive Clock Recovery, CEM must be configured. Below are the guidelines to configure clock recovery:

- The node (chassis) on which the DS1 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 64 bytes.

To configure the clock on T1 interfaces for SAToP in controller mode:

```
enable
configure terminal
controller t1 0/4/0
cem-group 0 unframed
clock source recovered 1
exit
```

To configure the clock recovery on T1 interfaces in global configuration mode, use the following commands:

```
recovered-clock 0 1
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.

Configuring Adaptive Clock Recovery of T3 Interfaces for SAToP

Before configuring Adaptive Clock Recovery, CEM must be configured. Below are the guidelines to configure clock recovery:

- The node (router) on which the 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 interfaces for SAToP in controller mode:

```
enable
configure terminal
controller t3 0/4/12
cem-group 0 unframed
clock source recovered 1
exit
```

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

```
recovered-clock 0 1
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 Adaptive Clock Recovery Configuration of T3 Interfaces for SAToP

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

```
Router# show recovered-clock
Recovered clock status for subslot 0/1
---------------------------------------
Clock     Type   Mode         CEM    Status    Frequency Offset(ppb) Circuit-No
0          DS3    ADAPTIVE      0    ACQUIRED      n/a                12 (Port)
```

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

```
Router# show running-config | section 0/4/12
controller MediaType 0/4/12
mode t3
controller T3 0/4/12
cem-group 0 unframed
clock source recovered 1
cablelength 224
interface CEM 0/4/12
no ip address
cem 0
```

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

```
Router# show running-config | section recovered-clock
recovered-clock 0 0
clock recovered 1 adaptive cem 12 0
```

Configuring Differential Clock Recovery of T3 Interfaces for SAToP

- 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 interface for SAToP in controller mode:

```
enable
configure terminal
controller t3 0/4/12
cem-group 0 unframed
clock source recovered 1
exit
```

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

```
interface cem 0/4/12
cem 0
rtp-present
```

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

```
recovered-clock 0 1
clock recovered 1 differential cem 12 0
exit
```

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

Configuring Clock Recovery on STS-1e Controller for Framed SAToP

Table 1: Feature History

Feature Name	Release Information	Description
STS1E Framed SAToP Support on IMA3G	Cisco IOS XE Bengaluru 17.4.1	Support on clock recovery on STS-1e controller for framed SAToP on the following modes: • T3 • CT3 • VT-15

Starting from Cisco IOS XE Bengaluru 17.4.1, ACR and DCR are supported on STS-1e controller for framed SAToP.

To configure the clock on STS-1e controller for framed SAToP on the T3 mode, enter the following commands:

```
enable
configure terminal
controller STS-1e slot/bay/port
sts-1 1
mode t3
t3 framing c-bit
cem-group 0 framed
t3 clock source recovered 1
```

To configure the clock on STS-1e controller for framed SAToP on the CT3 mode, enter the following commands:

```
enable
configure terminal
controller STS-1e slot/bay/port
sts-1 1
clock source internal
mode ct3
t3 framing c-bit
t1 1 cem-group 0 framed
t1 1 clock source recovered 1
```

To configure the clock on STS-1e controller for framed SAToP on the VT-15 mode, enter the following commands:

```
enable
configure terminal
controller STS-1e slot/bay/port
sts-1 1
mode vt-15
vtg 1 t1 1 cem-group 0 framed
vtg  1 t1 1 clock source recovered 2
```

The following example shows how to configure the clock on STS-1e controller for framed SAToP on the T3 mode:

```
enable
configure terminal
controller STS-1e 0/8/12
sts-1 1
mode t3
t3 framing c-bit
cem-group 0 framed
t3 clock source recovered 1
```

The following example shows how to configure the clock on STS-1e controller for framed SAToP on the CT3 mode:

```
enable
configure terminal
controller STS-1e 0/8/12
sts-1 1
clock source internal
mode ct3
t3 framing c-bit
t1 1 cem-group 0 framed
t1 1 clock source recovered 1
```

The following example shows how to configure the clock on STS-1e controller for framed SAToP on the VT-15 mode:

```
enable
configure terminal
controller STS-1e 0/8/12
sts-1 1
mode vt-15
vtg 1 t1 1 cem-group 0 framed
vtg 1t1 1 clock source recovered 2
```

Associated Commands

The commands used to configure adaptive clock recovery and differential clock recovery are:

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
clock recovered differential 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

Commands	URL
recovered-clock	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-o1.html#wp8262293900
controller t1/e1	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c2.html#wp1472647421
clock-source	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c2.html#wp6081785140
network-clock input-source	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-l2.html

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