



Clock Recovery System for CESoPSN

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

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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

Clock Recovery System in CESoPSN

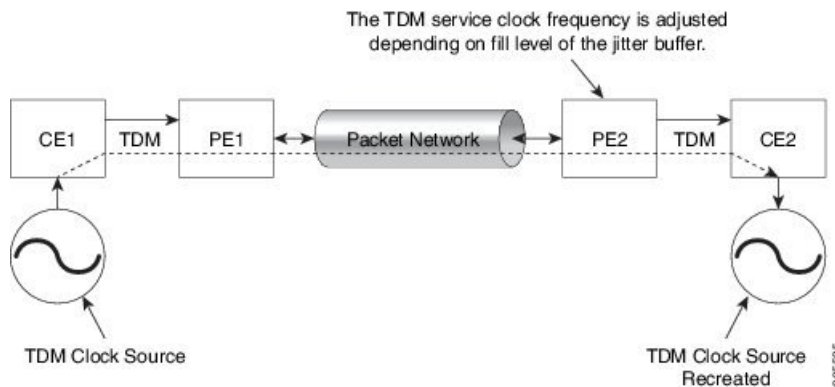
The Clock Recovery System is able to recover the service clock using two methods, the Adaptive Clock Recovery and Differential Clock Recovery.

Adaptive Clock Recovery in CESoPSN

When emulating TDM over PSNs, the physical layer clock is sometimes not available to both ends. Adaptive Clock Recovery (ACR) is a technique where the clock from the TDM domain is mapped through the packet domain. The sending Inter Working Function (IWF) processes outgoing packets with an internal free-running

clock, and the receiving IWF creates a clock based on packet arrival. The service clock frequency is adjusted depending on fill level of the jitter buffer.

- When sending TDM digital signal over PSN, the TDM data is inserted into packets in the master IWF and sent to the desired destination (slave IWF).
- The rate at which the packets are transmitted to the PSN is constant. Due to the nature of the PSN, the packets might arrive to the destination in bursts and with varying rate.
- The long-term average of this rate is equal to the insertion rate at the master IWF. Moreover, the packets in the PSN might switch their order and even be lost.
- The IWF at the far end of the PSN (slave IWF) recovers the service clock (E1/T1) used by the master IWF.
- The recovered clock is used by the slave IWF for the transmission of the data back into the TDM lines.
- The master IWF aggregates the TDM data and creates the PWE packets; these packets are transmitted to the PSN.
- The packets are received by the slave IWF and stored in a jitter buffer designed to absorb the packet delay variation (PDV).
- The packets are extracted from the jitter buffer and the clock recovery algorithm updates the service clock based on the timing information available.

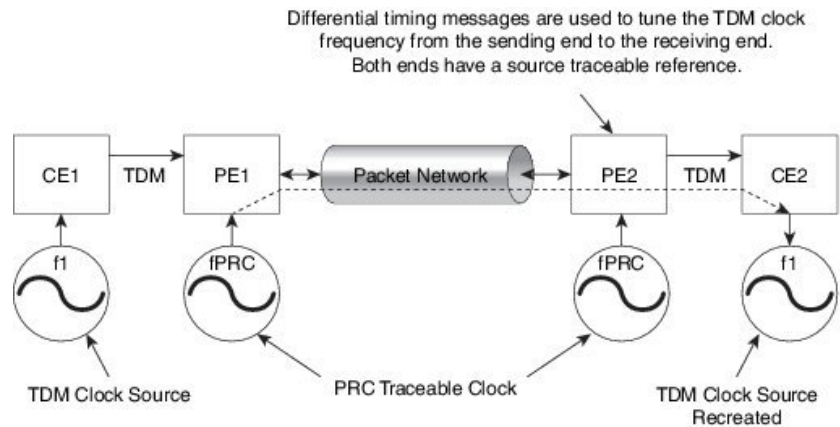


Differential Clock Recovery in CESoPSN

DCR (Differential Clock Recovery) is another technique used for Circuit Emulation (CEM) to recover clocks based on the difference between PE clocks. The clock from the TDM domain is mapped through the packet domain. It differs from ACR in that a PRC traceable clock is used at each 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. Because of this, the recovered clock is not affected by PDV when using DCR.

In contrast with DCR, a PRC traceable clock source is available at each end. ACR is used when a traceable source is not available at both ends of the PSN link.

The recreated service clock accuracy is dependent on the accuracy between the sending and receiving PRC frequencies.



Benefits of Clock Recovery

- Customer-edge devices (CEs) can have different clock from that of the Provide-edge devices (PEs).
- In CESoPSN, a slave clock is supported for clock redundancy.

Scaling Information

IM Card	Pseudowires Supported (Number of Clocks Derived)
48-Port T1/E1 CEM Interface Module	48

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 T1/E1

Configuring Adaptive Clock Recovery of T1/E1 Interfaces for SAToP

Before You Begin

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/E1 interfaces for SAToP in controller mode, use the following commands:

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

To configure the clock recovery on T1/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 T1/E1 Interfaces for SAToP

Use the **show recovered-clock** command to verify the adaptive clock recovery of T1/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          DS1       ADAPTIVE  0        ACQUIRED    n/a                    0 (Port)
```

Use the **show running-config** command to verify the configuration of adaptive clock of T1/E1 interfaces:

```
Router# show running-config | section 0/0/1
controller T1 0/0/1
  framing unframed
  clock source recovered 1
  linecode b8zs
  cablelength long 0db
  cem-group 0 unframed
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 T1/E1 interfaces:

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

Configuring DCR for T1/E1

Configuring Differential Clock Recovery of T1/E1 Interfaces for SAToP

Before You Begin

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

- 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 64 bytes.

To configure the clock on T1/E1 interfaces for SAToP in controller mode, use the following commands:

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

To configure RTP header on T1/E1 interfaces in global configuration mode, use the following commands:

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

To configure Differential clock recovery of T1/E1 interfaces, use the following commands in global configuration mode:

```
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 T1/E1 Interfaces for SAToP

Use the **show recovered-clock** command to verify the differential clock recovery of T1/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	DS1	DIFFERENTIAL	0	ACQUIRED	n/a	0 (Port)

Use the **show running-config | section** command to verify the configuration of differential clock of T1/E1 interfaces for SAToP:

```
Router# show running-config | section 0/0/1
controller T1 0/0/1
 framing unframed
 clock source recovered 1
 linecode b8zs
 cablelength long 0db
 cem-group 0 unframed
interface CEM 0/0/1
 no ip address
 cem 0
 rtp-present
```

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

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

Configuring Network Clock

To configure a network clock, use the following commands:

```
enable
configure terminal
controller T1 0/5/0
 clock source line
 cem-group 0 unframed
exit
enable
configure terminal
```

```
network-clock input-source 1 controller T1 0/5/0
exit
```

Verifying Network Clocking Configuration

Use `show run | sec network-cl` command to verify the network clocking configuration.

```
network-clock synchronization automatic
network-clock synchronization mode QL-enabled
network-clock input-source 1 controller E1 0/1/0
network-clock wait-to-restore 10 global
rtrl#sh netw synchronization
Symbols:      En - Enable, Dis - Disable, Adis - Admin Disable
              NA - Not Applicable
              * - Synchronization source selected
              # - Synchronization source force selected
              & - Synchronization source manually switched
```

```
Automatic selection process : Enable
Equipment Clock : 2048 (EEC-Option1)
Clock Mode : QL-Enable
ESMC : Enabled
SSM Option : 1
T0 : E1 0/1/0
Hold-off (global) : 300 ms
Wait-to-restore (global) : 10 sec
Tsm Delay : 180 ms
Revertive : No
```

Nominated Interfaces

Interface	SigType	Mode/QL	Prio	QL_IN	ESMC Tx	ESMC Rx
Internal	NA	NA/Dis	251	QL-SEC	NA	NA
*E1 0/1/0	NA	NA/Dis	1	QL-SEC	NA	NA

rtrl#

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
recovered-clock	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-o1.html#wp8262293900

Commands	URL
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	<i>Timing and synchronization aspects in packet networks</i>

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
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>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.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	<p>http://www.cisco.com/cisco/web/support/index.html</p>

