



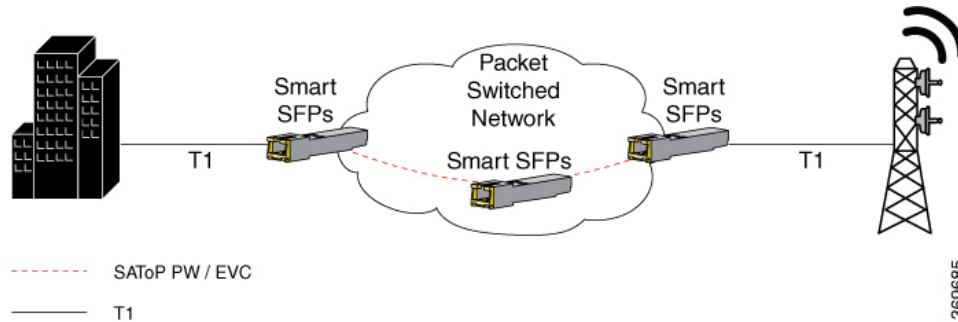
Configuring TPoP Smart SFP

Table 1: Feature History

Feature Name	Release Information	Description
Support for T1 framed Smart TPoP pluggable	Cisco IOS XE Bengaluru 17.6.1	<p>You can configure the following features for T1 in framed mode:</p> <ul style="list-style-type: none"> • Loopback, framing, line code encoding, cable length, and jitter buffer • BERT • Performance monitoring counters and alarms • Alarm profiling • Clock recovery modes <p>These features that are configured on framed and unframed T1 interfaces help you to monitor the traffic and troubleshoot errors or failures efficiently.</p>
Support for E1 framed Smart TPoP pluggable	Cisco IOS XE Bengaluru 17.6.1	<p>You can configure the following features for E1 in framed and unframed modes:</p> <ul style="list-style-type: none"> • Loopback, framing, line code encoding, cable length, and jitter buffer • BERT • Performance monitoring counters and alarms • Alarm profiling • Clock recovery modes <p>These features that are configured on framed and unframed E1 interfaces help you to monitor the traffic and troubleshoot errors or failures efficiently.</p>

Transparent PDH over Packet (TPoP) Smart SFP is a special type of transceiver, which provides solution to encapsulate a T1 or E1 stream into a SAToP packet, suitable for pseudowire (PW) transport over a packet switched network (PSN).

Figure 1: Network View with TPoP SSFPs



The key component of TPoP is the interworking function that provides packetization, depacketization, and clock recovery that translate the TDM bit stream to a packet stream, and conversely. TPoP approach is similar to the SAToP method, where the entire T1 or E1 is encapsulated in a single circuit emulating pseudowire and transport it to a single destination over the PSN.

- [Features of TPoP Smart SFP, on page 2](#)
- [TPoP Prerequisites, on page 3](#)
- [Restrictions for TPoP Smart SFP, on page 4](#)
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Features of TPoP Smart SFP

The TPoP smart SFP supports the following Cisco ASR 920 series routers:

- NCS4201-SA
- NCS4202-SA

The TPoP smart SFP supports the following features:

- Unframed SAToP support on the below optics:
 - ONS-SI-DS1-TPOP
- Starting with Cisco IOS XE Bengaluru 17.6.1, framed SAToP is supported on the below optics:
 - SFP-T1F-SATOP-I
 - SFP-E1F-SATOP-I
- Supports local and network loopback.
- Supports Interworking Functionality (IWF) Performance Monitoring (PM) counters.
- Supports the following alarms for T1, E1, :
 - T1 unframed—Loss of Signal (LOS)

- T1 framed—LOS, Loss of Frame (LOF), Remote Alarm Indication (RAI), and Alarm Indication Signal (AIS)
- E1 framed—LOS, LOF, RAI, and AIS
- Supports the clock recovery modes such as Adaptive Clock Recovery (ACR), Differential Clock Recovery (DCR), or retiming mode.



Note Retiming mode is the default mode (Using common clock source through SYNC E or same external source for PE nodes)

- Supports cable length and jitter buffer.
- Peer end side of the TPOp smart SFP could be TPOp smart SFP or IM that supports the SAToP protocol.
- Supports BERT, line encoding, and performance monitoring on the below optics:
 - SFP-T1F-SATOP-I
 - SFP-E1F-SATOP-I

TPOp Prerequisites

- The Multiprotocol Label Switching (MPLS) and Interior Gateway Protocol (IGP) endpoints are up and running fine between the PE nodes.
- Use either one of the following modes for node synchronization:
 - Ensure that SyncE is configured.
 - Use the PTP Telecom profile, G.8265.1 for frequency synchronization, for CEM.
 - If SyncE and PTP Telecom profile/G.8265.1 for frequency synchronization are not supported for CEM, then use ACR to time TPOp CEM psedowires.
- Port interface should be set as default using the **default int Gig 0/0/8** command before inserting TPOp smart SFP on GE or 10GE port.
- The GE or 10GE port interface is brought up using the **no shutdown** command.
- In cases where a non-TPOp SFP is to be inserted on any port from which any TPOp smart SFP is removed, then before inserting non-TPOp SFP, the TPOp smart SFP configuration is removed using the following commands:
 - For T1
 - no platform smart-sfp interface Gig x/y/z type t1**
 - no platform smart-sfp interface TenGig x/y/z type t1**
 - For T1 Framed
 - no platform smart-sfp interface Gig x/y/z type t1-framed**

- For E1 Framed

no platform smart-sfp interface Gig x/y/z type e1-framed



Note Recovered clock configuration needs to be removed before applying the **no platform** command.

Restrictions for TPOp Smart SFP

- The payload for T1 is limited to 192 bytes, and for T3 is limited to 1024 bytes.
- It's observed that the ACR and DCR clock status may change from **locked** state to **acquiring** state, and the opposite way. This is the expected behavior and doesn't have any impact on functionality.
- Framed SAToP and CESoP aren't supported on ONS-SI-DS1-TPOP.
- CESoP isn't supported in framed T1, E1, or T3.
- BERT and BERT statistics aren't supported on ONS-SI-DS1-TPOP.
- Error insertion in BERT isn't supported.
- PMON counters aren't supported on ONS-SI-DS1-TPOP.
- The Cisco ASR-920-24SZ-M router supports a maximum of 8 TPOp smartSFPs and only on any of the 12 GE ports of the top row, which has odd-numbered ports.
- The Cisco ASR-920-12SZ-IM router supports a maximum of eight TPOp smart SFPs on four GE and four 10GE ports.
- Remote loopback isn't supported.

How to Configure TPOp Smart SFP

Enabling TPOp Smart SFP

To enable TPOp smart SFP on the unframed T1 mode, enter the following commands:

```
Router# configure terminal
Router(config)# platform smart-sfp interface gig slot/bay/port type T1
Router(config)# exit
```

To enable TPOp smart SFP on the T1 framed mode, enter the following commands:

```
Router# configure terminal
Router(config)# platform smart-sfp interface gig slot/bay/port type T1-FRAMED
Router(config)# exit
```

To enable TPOp smart SFP on the E1 framed mode, enter the following commands:

```
Router# configure terminal
Router(config)# platform smart-sfp interface gig slot/bay/port type E1-FRAMED
Router(config)# exit
```

Configuring CEM Circuits

To configure CEM circuits on unframed T1 TPOp, enter the following commands:

```
enable
configure terminal
controller t1 0/0/10
cem-group 0 unframed
end
```

To configure CEM circuits on framed T1 TPOp, enter the following commands:

```
enable
configure terminal
controller t1 0/0/10
cem-group 0 framed
end
```

To configure CEM circuits on unframed E1 TPOp, enter the following commands:

```
enable
configure terminal
controller e1 0/0/10
cem-group 0 unframed
end
```

To configure CEM circuits on framed E1 TPOp, enter the following commands:

```
enable
configure terminal
controller e1 0/0/10
cem-group 0 framed
end
```

Configuring Cable Length

You can configure a cable length (in feet) on the unframed T1 mode for releases before Cisco IOS XE Bengaluru 17.6.1. Starting with Cisco IOS XE Bengaluru 17.6.1, you can configure the cable length on the framed T1 mode.



Note Cable length is not supported on the E1 TPOp smart SFP.

- You can configure the cable length in one of the following five ranges:

Table 2: Cable Length Values for T1 - SFP-T1F-SATOP-I, SFP-E1F-SATOP-I, ONS-SI-DS1-TPOP

Cable Length (in ft)	Range (in ft)
110	0–133
220	134–266
330	267–399
440	400–533
550	534–655

To configure the cable length on the unframed and framed T1 modes for TPoP smart SFP, enter the following commands:

```
enable
configure terminal
controller t1 x/y/z
cablelength short <value>
end
```

To configure a cable length of 266 feet on the t1 0/0/0 interface, enter the following commands:

```
enable
configure terminal
controller t1 0/0/10
cablelength short 266
end
```

Configuring Linecode

You can configure linecode encoding on unframed or framed T1 and E1 modes for TPoP smart SFPs.

The TPoP smart SFPs support the following linecode encoding for framed T1 and E1 modes:

- T1 framed SFP—AMI or B8ZS
- E1 framed SFP—HDB3 or AMI

To configure linecode on T1 controller, enter the following commands:

```
router#controller t1 0/0/1
router(config-controller)#linecode {ami | b8zs}
router(config-controller)#end
```

To configure linecode on E1 controller, enter the following commands:

```
router#controller e1 0/0/7
router(config-controller)#linecode {ami | hdb3}
```

```
router(config-controller)#end
```

The following example on how to configure AMI linecode encoding on T1 controller for TPoP:

```
router#controller t1 0/0/1
router(config-controller)#linecode ami
router(config-controller)#end
```

Configuring Dejitter Buffer and Payload

You can configure jitter buffer on unframed T1 for releases prior to Cisco IOS XE Bengaluru 17.6.1. Starting with Cisco IOS XE Bengaluru 17.6.1, you can configure jitter buffer on framed T1, unframed, and framed E1 for TPoP Smart SFP. You can configure a maximum jitter buffer value from 3 through 32 ms.

To configure jitter buffer, enter the following commands:

```
router#interface cem0/0/11
router(config-if)#cem 0
router#dejitter-buffer 5
```

You can configure a payload with size of 192 bytes for T1, 256 bytes for E1.

To configure the payload, enter the following commands:

```
router#interface cem0/0/11
router#cem 0
router#payload-size 192
```

Configuring BERT

You can configure BERT on unframed and framed T1 and E1 for TPoP smart SFPs.

To configure BERT on T1 controller, enter the following commands:

```
router(config)#controller t1 0/0/1
router(config-controller)#bert pattern PRBS interval 1 direction line
router(config-controller)#end
```

The PRBS pattern range for T1 controller is non-inverted 2¹⁵-1 O.151 test pattern and the default pattern for E1 is inverted 2¹⁵-1 .

To configure BERT on E1 controller, enter the following commands:

```
router(config)#controller e1 0/0/3
router(config-controller)#bert pattern PRBS interval 1 direction line
router(config-controller)#end
```

To configure system BERT on T1 controller in the unframed mode, enter the following commands:

```
router(config)#controller t1 0/0/17
```

```
router(config-controller)#bert pattern PRBS interval 1 direction system
router(config-controller)#end
```

To configure system BERT on E1 controller in the unframed mode, enter the following commands:

```
router(config)#controller e1 0/0/17
router(config-controller)#bert pattern PRBS interval 1 direction system
router(config-controller)#end
```



Note The system side BERT is supported only on unframed mode and is not supported with ESF or SF framing. The line side BERT is supported for all framing types.

Loopback on TPoP Smart SFP

TPoP smart SFP supports two types of loopback configurations:

- Local loopback—In a local loopback, the transmitting signal loops back to the receiver signal.
- Network loopback—In a network loopback, the receiving signal loops back to the transmitting signal.

Configuring Loopback on TPoP

Configuring Network Loopback

Follow these steps to configure a network loopback on T1 for TPoP:

```
enable
configure terminal
controller t1 x/y/z
loopback network line
exit
```

Configuring Local Loopback

Follow these steps to configure a local loopback on T1 for TPoP:

```
enable
configure terminal
controller t1 x/y/z
loopback local
exit
```

The following example explains on how to configure the network loopback on T1 for TPoP:

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

The following example explains on how to configure the local loopback on T1 for TPoP:

```
Router(config)#controller t3 0/0/4
Router(config-controller)#loopback local
```


Verifying Loopback at Controller Level

Use the **show controller t1 x/y/z** command to verify the local loopback configuration on T1 controller for TPoP smart SFP.

```
Router#show controllers T1 0/0/4
T1 0/0/4 is up (Local Loopback)
  Applique type is 2xGE-4x10GE-FIXED
  Cablelength is short 133
  No alarms detected.
  alarm-trigger is not set
  Soaking time: 3, Clearance time: 10
  AIS State:Clear  LOS State:Clear  LOF State:Clear
  Framing is unframed, Line Code is B8ZS, Clock Source is Internal.
  BER thresholds:  SF = 10e-3  SD = 10e-6
  Data in current interval (0 seconds elapsed):
    Near End
      0 Line Code Violations, 0 Path Code Violations
      0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
      0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
      0 Path Failures, 0 SEF/AIS Secs
    Far End
      0 Line Code Violations, 0 Path Code Violations
      0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
      0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
      0 Path Failures
```

Use the **show controller t1 x/y/z** command to verify the network loopback configuration on TPoP smart SFP.

```
router#show controller T1 0/0/4
T1 0/0/4 is up (Network Line Loopback)
  Applique type is 2xGE-4x10GE-FIXED
  Cablelength is short 133
  No alarms detected.
  alarm-trigger is not set
  Soaking time: 3, Clearance time: 10
  AIS State:Clear  LOS State:Clear  LOF State:Clear
  Framing is unframed, Line Code is B8ZS, Clock Source is Internal.
  BER thresholds:  SF = 10e-3  SD = 10e-6
  Data in current interval (0 seconds elapsed):
    Near End
      0 Line Code Violations, 0 Path Code Violations
      0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
      0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
      0 Path Failures, 0 SEF/AIS Secs
    Far End
      0 Line Code Violations, 0 Path Code Violations
      0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
      0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
      0 Path Failures
```

Use the **show controller t1 x/y/z** command to verify the local loopback configuration for framed T1 mode on TPoP smart SFP.

```
router#show controller t1 0/0/1
T1 0/0/1 is up (Local Loopback)
  Applique type is 24xGE-4x10GE-FIXED-S
  Cablelength is short 133
  Receiver has no alarms.
  alarm-trigger is not set
```

```

Soaking time: 3, Clearance time: 10
Framing is ESF, Line Code is B8ZS, Clock Source is Internal.
BER thresholds: SF = 10e-3 SD = 10e-6
Data in current interval (0 seconds elapsed):
Near End
  0 Line Code Violations, 0 Path Code Violations
  0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
  0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
  0 Path Failures, 1 SEF/AIS Secs
Far End
  0 Line Code Violations, 0 Path Code Violations
  0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
  0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
  0 Path Failures

```

Use the **show controller t1 x/y/z** command to verify the network loopback configuration for framed T1 mode on TPoP smart SFP.

```

router#show controller t1 0/0/1
T1 0/0/1 is up (Network Line Loopback)
  Applique type is 24xGE-4x10GE-FIXED-S
  Cablelength is short 133
  No alarms detected.
  alarm-trigger is not set
  Soaking time: 3, Clearance time: 10
  Framing is ESF, Line Code is B8ZS, Clock Source is Internal.
  BER thresholds: SF = 10e-3 SD = 10e-6
  Data in current interval (0 seconds elapsed):
  Near End
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
    0 Path Failures, 2 SEF/AIS Secs
  Far End
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
    0 Path Failures

```

Use the **show controller e1 x/y/z** command to verify the local loopback configuration for E1 framed mode on TPoP smart SFP.

```

router#show controllers e1 0/0/12
E1 0/0/12 is up (Local Loopback)
  Applique type is 12xGE-4x10GE-FIXED
  Cablelength is Unknown
  Receiver has no alarms.
  alarm-trigger is not set
  Framing is crc4, Line Code is HDB3, Clock Source is Internal.
  BER thresholds: SF = 10e-5 SD = 10e-5
  Data in current interval (80 seconds elapsed):
  Near End
    495 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 1 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 79 Unavail Secs
    1 Path Failures, 0 SEF/AIS Secs
  Far End
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 79 Unavail Secs
    1 Path Failures

```

Use the **show controller e1 x/y/z** command to verify the local loopback configuration for E1 unframed mode on TPOp smart SFP.

```
router#show controllers e1 0/0/12
E1 0/0/17 is up (Local Loopback)
Applique type is 24xGE-4x10GE-FIXED-S
Cablelength is Unknown
No alarms detected.
alarm-trigger is not set
Framing is unframed, Line Code is HDB3, Clock Source is Internal.
BER thresholds: SF = 10e-5 SD = 10e-5
Data in current interval (0 seconds elapsed):
Near End
0 Line Code Violations, 0 Path Code Violations
0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
0 Path Failures, 0 SEF/AIS Secs
Far End
0 Line Code Violations, 0 Path Code Violations
0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
0 Path Failures
```

Performance Monitoring on TPOp

You can view the statistics or error count generated on the TPOp SFP.

The TPOp Smart SFP in the T1 or E1 framed mode supports the following counters to monitor the performance.

- Line Code Violation (LCV)
- Path Code Violation (PCV)

For T1 and E1 links, the Loss of Frame (LOF) failure is declared when an OOF defect is detected. Based on OOF and other alarms, the below existing counters and their far-end counters are calculated.

- Framed Loss Seconds (SELS)
- Line Errored Seconds (LES)
- Errored Seconds (ES)
- Severely Errored Seconds (SES)
- Unavailable Seconds (UAS)
- Errored Seconds Far End (ES-FE)
- Severely Errored Seconds in Far End (SES-FE)
- Unavailable Seconds in Far End (UAS-FE)
- AIS Seconds (AISS/SEF)
- Failure Count at Path (FCP)



Note Far-end counters are supported only in ESF framing mode and not supported in unframed and SF modes.

To view the statistics or error count generated, use the **show controller t1** command:

```
router#show controller t1 0/0/1
T1 0/0/1 is up
  Applique type is 24xGE-4x10GE-FIXED-S
  Cablelength is short 133
  No alarms detected.
  alarm-trigger is not set
  Soaking time: 3, Clearance time: 10
  Framing is ESF, Line Code is B8ZS, Clock Source is Internal.
  BER thresholds: SF = 10e-3 SD = 10e-6
  Data in current interval (0 seconds elapsed):
    Near End
      0 Line Code Violations, 0 Path Code Violations
      0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
      0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
      0 Path Failures, 0 SEF/AIS Secs
    Far End
      0 Line Code Violations, 0 Path Code Violations
      0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
      0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
      0 Path Failures
```

Configuring Clocking Recovery System for TPoP

Adaptive Clock Recovery

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.

For more information, see [Adaptive Clock Recovery](#).

Differential Clock Recovery

Differential Clock Recovery (DCR) is another technique that is used for Circuit Emulation (CEM) to recover clocks based on the difference between PE clocks.

For more information, see [Differential Clock Recovery](#).

Prerequisites for Clock Recovery

- You must configure CEM before configuring the global clock recovery.
- RTP is enabled by default for DCR in CEM. If DCR configuration is removed, then you must remove the RTP configuration manually under CEM.

Configuring ACR

To configure the clock for TPoP in the T1 controller mode, use the following commands:

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

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

To configure the clock for TPoP in the E1 controller mode, use the following commands:

```
enable
configure terminal
controller e1 0/0/1
clock source recovered 1
cem-group 0 framed
exit
```

```
enable
configure terminal
controller e1 0/0/1
clock source recovered 1
cem-group 0 unframed
exit
```



Note For ACR mode: Wander compliant to ITU-T G.823/G.824 for traffic interfaces, and MEF18. The Wander Performance is only validated and measured according to ITU-T G.8261 test case TC1, performance for other test cases and PDV impairments is not tested or guaranteed.

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

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

Verifying ACR Configuration for TPoP

Use the **show recovered-clock** command to verify the adaptive clock recovery of T1 interfaces for TPoP:

```
Router#show recovered-clock
Recovered clock status for subslot 0/0
-----
Clock   Type      AUG-MAP  Mode      CEM   Status   Frequency  Offset (ppb)  Circuit-No
-----
1       T1        NA       ADAPTIVE  0     ACQUIRED NA         NA            1 (Port)
      Priority
      NA
```



Note Starting with release Cisco IOS XE Cupertino 17.9.1, TPoP T1/E1 clock status is accurately displayed in the recovered clock status output.

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

```
Router# show running-config | section x/y/z
```

```

controller T1 x/y/z
threshold sd-ber 6
threshold sf-ber 3
framing esf
clock source recovered 1
linecode b8zs
cablelength short 110
cem-group 0 framed
interface CEM x/y/z
no ip address
cem 0
!
```

```

Router#show running-config | sec 0/0/1
platform smart-sfp interface GigabitEthernet0/0/1 type T1-FRAMED
controller T1 0/0/1
  threshold sd-ber 6
  threshold sf-ber 3
  framing esf
  clock source recovered 1
  linecode b8zs
  cem-group 0 framed
interface CEM0/0/1
  no ip address
  cem 0
  xconnect 2.2.2.2 1 encapsulation mpls
```

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

```

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

Configuring DCR

To configure the clock for TPoP in the T1 controller mode, use the following commands:

```

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

```

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

To configure the clock for TPoP in the E1 controller mode, use the following commands:

```

enable
configure terminal
controller e1 0/0/1
```

```
clock source recovered 1
cem-group 0 unframed
exit
```

```
enable
configure terminal
controller e1 0/0/1
clock source recovered 1
cem-group 0 framed
exit
```

The **rtp-present** is added by default, when DCR is configured.

To configure RTP header in global configuration mode, use the following commands:

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

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

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

Verifying DCR Configuration for TPOp

Use the **show recovered-clock** command to verify the differential clock recovery of T1 interfaces for TPOp:

```
Router#show recovered-clock
Recovered clock status for subslot 0/0
-----
Clock      Type      AUG-MAP  Mode      CEM  Status  Frequency Offset (ppb)  Circuit-No
          Priority
1          T1        NA       DIFFERENTIAL 0  NA      NA          1 (Port)
          NA
```



Note There is a hardware limitation to display the status of the clock. The **show recovered-clock** command is just an indication for the configured recovered clock.

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

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

```

Router#show running-config | sec 0/0/1
platform smart-sfp interface GigabitEthernet0/0/1 type T1-FRAMED
controller T1 0/0/1
  threshold sd-ber 6
  threshold sf-ber 3
  framing esf
  clock source recovered 1
  linecode b8zs
  cem-group 0 framed
interface CEM0/0/1
  no ip address
  cem 0
  rtp-present
  xconnect 2.2.2.2 1 encapsulation mpls
!
```

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

```

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

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

```

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

Verifying TPoP Smart SFP Configuration

Use the following show commands to verify the TPoP smart SFP configuration:

- **show controller {t1} slot/subslot/port**—Displays the TPoP Smart SFP information available in the slot/subslot/port, if any, along with the other controllers information. T1 specifies the TPoP T1 specific controller.
 - show cem cir id**—Displays the CEM circuit statistics or configuration.
- **show controller {e1} slot/subslot/port**—Displays the TPoP Smart SFP information available in the slot/subslot/port, if any, along with the other controllers information. E1 specifies the TPoP T1 specific controller.
 - show cem cir id**—Displays the CEM circuit statistics or configuration.

```

router#show controller t1 0/0/4
T1 0/0/4 is up (Network Line Loopback)
```



```

Applique type is 2xGE-4x10GE-FIXED
Cablelength is short 133
No alarms detected.
alarm-trigger is not set
Soaking time: 3, Clearance time: 10
AIS State:Clear LOS State:Clear LOF State:Clear
Framing is unframed, Line Code is B8ZS, Clock Source is Internal.
BER thresholds: SF = 10e-3 SD = 10e-6
Data in current interval (0 seconds elapsed):
Near End
  0 Line Code Violations, 0 Path Code Violations
  0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
  0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
  0 Path Failures, 0 SEF/AIS Secs
Far End
  0 Line Code Violations, 0 Path Code Violations
  0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
  0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
  0 Path Failures

```

```

router#show controller e1 0/0/17
E1 0/0/17 is up
Applique type is 24xGE-4x10GE-FIXED-S
Cablelength is Unknown
No alarms detected.
alarm-trigger is not set
Framing is crc4, Line Code is HDB3, Clock Source is Internal.
BER thresholds: SF = 10e-5 SD = 10e-5
Data in current interval (190 seconds elapsed):
Near End
  0 Line Code Violations, 0 Path Code Violations
  0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
  0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
  0 Path Failures, 0 SEF/AIS Secs
Far End
  0 Line Code Violations, 0 Path Code Violations
  0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
  1 Errored Secs, 0 Bursty Err Secs, 1 Severely Err Secs, 0 Unavail Secs
  0 Path Failures

```

```

router#show controller e1 0/0/12
E1 0/0/12 is up (Local Loopback)
Applique type is 12xGE-4x10GE-FIXED
Cablelength is Unknown
Receiver has no alarms.
alarm-trigger is not set
Framing is crc4, Line Code is HDB3, Clock Source is Internal.
BER thresholds: SF = 10e-5 SD = 10e-5
Data in current interval (750 seconds elapsed):
Near End
  14 Line Code Violations, 0 Path Code Violations
  0 Slip Secs, 2 Fr Loss Secs, 2 Line Err Secs, 0 Degraded Mins
  2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs, 0 Unavail Secs
  0 Path Failures, 2 SEF/AIS Secs
Far End
  0 Line Code Violations, 0 Path Code Violations
  0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
  0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
  0 Path Failures

```

```

Router#show cem cir int CEM 0/0/4

```

```
CEM0/0/4, ID: 0, Line: UP, Admin: UP, Ckt: ACTIVE
Mode :T1, CEM Mode: T1-SAToP
Controller state: up, T1/E1 state: up
Idle Pattern: 0xFF, Idle CAS: 0x8
Dejitter: 5 (In use: 0)
Payload Size: 192
Framing: Unframed
CEM Defects Set
None
```

```
Signalling: No CAS
RTP: No RTP
```

```
Ingress Pkts:      8273275          Dropped:           0
Egress Pkts:       8273275          Dropped:           0
```

```
CEM Counter Details
Input Errors:      0                Output Errors:      0
Pkts Missing:      0                Pkts Reordered:    0
Misorder Drops:    0                JitterBuf Underrun: 0
Error Sec:          0                Severly Errored Sec: 0
Unavailable Sec:   0                Failure Counts:     0
Pkts Malformed:    0                JitterBuf Overrun: 0
```

```
Router#show cem circuit int CEM 0/0/1
```

```
CEM0/0/1, ID: 0, Line: UP, Admin: UP, Ckt: ACTIVE
Mode :T1, CEM Mode: T1-SAToP
Controller state: up, T1/E1 state: up
Idle Pattern: 0xFF, Idle CAS: 0x8 0x8
Dejitter: 5 (In use: 0)
Payload Size: 192
Framing: Framed SAToP
CEM Defects Set
None
```

```
Signalling: No CAS
RTP: Configured, RTP-HDR Compression: Disabled
```

```
Ingress Pkts:      122663          Dropped:           0
Egress Pkts:       122663          Dropped:           0
```

```
CEM Counter Details
Input Errors:      0                Output Errors:      0
Pkts Missing:      0                Pkts Reordered:    0
Misorder Drops:    0                JitterBuf Underrun: 0
Error Sec:          0                Severly Errored Sec: 0
Unavailable Sec:   0                Failure Counts:     0
Pkts Malformed:    0                JitterBuf Overrun: 0
```

```
router#show cem circuit 0
```

```
CEM0/0/12, ID: 0, Line: UP, Admin: UP, Ckt: ACTIVE
Mode :E1, CEM Mode: E1-SAToP
Controller state: up, T1/E1 state: up
Idle Pattern: 0xFF, Idle CAS: 0x8 0x8
Dejitter: 5 (In use: 0)
Payload Size: 256
Framing: Framed SAToP
CEM Defects Set
None
```

```
Signalling: No CAS
RTP: No RTP

Ingress Pkts: 6000 Dropped: 0

Egress Pkts: 6000 Dropped: 0

CEM Counter Details
Input Errors: 0 Output Errors: 0

Pkts Missing: 0 Pkts Reordered: 0

Misorder Drops: 0 JitterBuf Underrun: 0

Error Sec: 0 Severly Errored Sec: 0

Unavailable Sec: 0 Failure Counts: 0

Pkts Malformed: 0 JitterBuf Overrun: 0
```

