

Circuit Emulation

Circuit Emulation (CEM) is a technology that provides a protocol-independent transport over IP/MPLS networks. It enables proprietary or legacy applications to be carried transparently to the destination, similar to a leased line.

CEM provides a bridge between a Time-Division Multiplexing (TDM) network and a Multiprotocol Label Switching (MPLS) network. The router encapsulates the TDM data in the MPLS packets and sends the data over a CEM pseudowire to the remote Provider Edge (PE) router. As a result, CEM functions as a physical communication link across the packet network.

The router supports the pseudowire type that utilizes CEM transport: Structure-Agnostic TDM over Packet (SAToP) and Circuit Emulation Service over Packet-Switched Network (CESoPSN).

L2VPN over IP/MPLS is supported on the interface modules.

Note We recommend that you configure the controller in the administratively up mode. Configuration under the administratively down mode is not recommended and it might cause configuration errors.

Note The default behaviour of the CEM pseudowire is always UP irrespective of the controller alarms.

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Restrictions for CEM

- With Synchronous Transport Signal (STS) Circuit Emulation over Packet (CEP) or STS concatenated CEP mode, if you receive a B3 error, then the Remote Error Indication (REI) won't be generated. Request for Comments (RFC) reference—RFC 4842.
- Not all combinations of payload size and dejitter buffer size are supported. If you apply an incompatible payload size or dejitter buffer size configuration, the router rejects it and reverts to the previous configuration.
- The RSP switchover with physical SSO is above 50 ms as follows:

- R0 to R1 is 5 seconds
- R1 to R0 is 10 seconds

- CEM interface doesn't support idle-cas parameter.
- The **cem description** command is not supported on the CEM circuits that are created using the smart SFP.
- The speed CLI option is not supported with T1 or E1 CEM group and channel group configuration.
- The speed 56 option with DS0 circuits is not supported and by default all DS0 circuits operate at 64 kbps speed only.

How to Configure CEM

This section provides information about how to configure CEM. CEM provides a bridge between a Time Division Multiplexing (TDM) network and a packet network, MPLS. The chassis encapsulates the TDM data in the MPLS packets and sends the data over a CEM pseudowire to the remote Provider Edge (PE) chassis.

Shutting Down a CEM Channel

To shut down a CEM channel, use the **shutdown** command in CEM configuration mode. The **shutdown** command is supported only under CEM mode and not under the CEM class.

Configuring CEM Classes

A CEM class is a single step configuration of CEM parameters such as payload size and dejitter buffer that you can perform at the global configuration mode and apply this CEM class on an individual CEM interfaces.

Thus the CEM class allows you to create a single configuration template for multiple CEM pseudowires.

Follow these steps to configure a CEM class:

Note

- The CEM parameters can be configured either by using CEM class or on CEM interface directly.
- The CEM parameters at the local and remote ends of a CEM circuit must match; otherwise, the pseudowire between the local and remote PE chassis does not come up.
- When a CEM is created on a controller, syslog messages and SNMP traps are generated indicating CEM UP or DOWN status, even though the controller is in the shutdown state.

```
enable
configure terminal
class cem mycemclass
payload-size 512
dejitter-buffer 12
exit
interface cem 0/0/1
```

```
cem 0
cem class mycemclass
xconnect 10.10.10.10 200 encapsulation mpls
exit
```



Note Removing the global CEM class that is associated with CEM interface/CEM group will remove the configuration from all the associated CEM.

Configuring CEM Parameters

The following sections describe the parameters you can configure for CEM circuits.

Calculating Payload Sizes for T1 and E1 Interfaces

Payload size for a CEM class denotes the number of bytes encapsulated into a single IP packet and you configure the payload size using the **payload-size** command. The size argument specifies the number of bytes in the payload of each packet. The range is from 32 to 1312 bytes.

Default Payload Sizes

Default payload sizes for an unstructured CEM channel are as follows:

- T1 = 192 bytes
- E1 = 256 bytes
- DS0 = 32 bytes

Default payload sizes for a structured CEM channel depend on the number of time slots that constitute the channel. Payload size (L in bytes), number of time slots (N), and packetization delay (D in milliseconds) have the following relationship: L = 8*N*D. The default payload size is selected in such a way that the packetization delay is always 1 millisecond. For example, a structured CEM channel of 16xDS0 has a default payload size of 128 bytes.



Note Both payload-size and dejitter-buffer must be configured simultaneously.

Calculating Payload Sizes for T3 and E3 Interfaces

To specify the number of bytes encapsulated into a single IP packet, use the **payload-size** command. The size argument specifies the number of bytes in the payload of each packet.

Default payload sizes for T3/E3 interface are:

- T3/E3 clear channel= 1024 bytes
- T3/E3 channelized = 192 bytes

Default payload sizes for a structured CEM channel depend on the number of time slots that constitute the channel. Payload size (L in bytes), number of time slots (N), and packetization delay (D in milliseconds) have

the following relationship: L = 8*N*D. The default payload size is selected in such a way that the packetization delay is always 1 millisecond.

Note Both payload-size and dejitter-buffer must be configured simultaneously. When you select a value of payload-size, the acceptable range of dejitter-buffer for that payload size is displayed.

Setting the Dejitter Buffer Size

Dejitter Buffer is a buffering mechanism to account for a delay variation in the CEM packet stream. The buffer size is the amount of time you allocate to compensate for the network filter. The configured dejitter-buffer size is converted from milliseconds to packets and rounded up to the next integral number of packets. To set the size of the dejitter-buffer (in milliseconds), use the **dejitter-buffer** *value* command. The value range is from 1 to 32; the default is 5.

Configuring CEM Parameter on CEM Interface

Table 1: Feature History

Feature Name	Release Information	Description
CEM Description Command	Cisco IOS XE Dublin 17.12.1	You can add description for a cem group up to 200 characters using the **description** command.

The CEM parameters can be configured directly on CEM interface. Follow these steps to configure CEM parameters:

```
enable
configure terminal
interface cem 0/0/1
cem 0
description description
payload-size 512 dejitter-buffer 12
xconnect 10.10.10.10 200 encapsulation mpls
exit
```

Verifying the Interface Configuration

Use the following commands to verify the pseudowire configuration:

- **show cem circuit**—Displays information about the circuit state, administrative state, the CEM ID of the circuit, and the interface on which it is configured. If **xconnect** is configured under the circuit, the command output also includes information about the attachment circuit status.

```
Router# show cem circuit
 ?

  <0-504>    CEM ID
  detail     Detailed information of cem ckt(s)
  interface  CEM Interface
  summary    Display summary of CEM ckts
  |          Output modifiers
Router# show cem circuit
```

```
CEM Int.       ID   Line      Admin     Circuit         AC
---------------------------------------------------------
CEM 0/4/0       1    UP        UP        ACTIVE          --/--
CEM 0/4/0       2    UP        UP        ACTIVE          --/--
CEM 0/4/0       3    UP        UP        ACTIVE          --/--
CEM 0/4/0       4    UP        UP        ACTIVE          --/--
CEM 0/4/0       5    UP        UP        ACTIVE          --/--
```

- **show cem circuit** *cem-id* — Displays the detailed information about that particular circuit.

```
Router# show cem circuit 0

CEM 0/4/0, ID: 0, Line: UP, Admin: UP, Ckt: ACTIVE
Controller state: down, T3 state: up
Idle Pattern: 0x55, Idle CAS: 0x8
Dejitter: 10 (In use: 0)
Payload Size: 1024
Framing: Unframed
CEM Defects Set
None

Signalling: No CAS
RTP: No RTP

Ingress Pkts:    11060               Dropped:             0
Egress Pkts:     11061               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
```

- **show cem circuit summary**—Displays the number of circuits which are up or down for each interface.

```
Router# show cem circuit summary

CEM Int.       Total Active  Inactive
---------------------------------------
CEM 0/4/0       1     1       0
```

- **show running configuration**—The **show running configuration** command shows detail on each CEM group.

- **show cem circuit description**—Displays the CEM interface details with description.

Use the **show cem circuit description** command

```
Router#show cem circuit description
CEM Int.       ID   Ctrlr     Admin     Circuit    Description
 ---------------------------------------------------------------
CEM0/3/16      29   DOWN      UP        Active          cem29_description
Router#show cem circuit interface cem 0/3/16 29 description
CEM Int.       ID   Ctrlr     Admin     Circuit    Description
 ---------------------------------------------------------------
CEM0/3/16      29   DOWN      UP        Active       cem29_description
```

```
Router#show cem circuit 29 description
CEM Int.       ID    Ctrlr     Admin     Circuit    Description
 ---------------------------------------------------------------
CEM0/3/16       29    DOWN      UP        Active       cem29_description
```