RSP-based Non-Intrusive Monitor Ports

Table 1: Feature History

Feature Name	Release Information	Description
TAP and Split TAP Support for Protected Interfaces	Cisco IOS XE Cupertino 17.7.1	TAP and split TAP support for the following protected interfaces on both receive and transmit direction: • Automatic Protection Switching (APS) • Unidirectional Path Switching Ring (UPSR) • Card Protection Group (CPG) With this feature support, you can perform monitoring and debugging on these virtual protection interfaces.
Test Access Port (TAP) or Test Access Digroup (TAD)	Cisco IOS XE Bengaluru 17.6.1	Support for Test access port or digroup (TAP/TAD) in the following aspects: • Non-intrusive monitoring for both receive and transmit directions. • Split and terminate cross connection for intrusive testing in both directions. The TAP feature helps in monitoring and debugging purpose.

Feature Name	Release Information	Description
RSP-based Non-Intrusive Monitor Ports	Cisco IOS XE Bengaluru 17.5.1	This feature allows you to transmit data to multiple connections from a single source using the RSP-based non-intrusive monitor port TAP port. It establishes a one-way cross-connect listen connection that listens to either the source or destination of an existing cross-connect or a local connect connection. This feature is only supported on Cisco RSP3 module.
		This feature is supported on the following CEM interface modules:
		• 48-port T1/E1 CEM interface module
		• 48-port T3/E3 CEM interface module
		• 1-port OC48/ STM-16 or 4-port OC-12/OC-3 / STM-1/STM-4 + 12-Port T1/E1 + 4-Port T3/E3 CEM interface module
		• ASR 900 Combo 8-Port SFP GE and 1-Port 10 GE 20G interface module

Prior to Cisco IOS XE Bengaluru Release 17.5.1, it was not possible to transmit data to multiple connections from a single CEM source.

With Cisco IOS XE Bengaluru Release 17.5.1, you can transmit data to multiple connections from a single source using the RSP-based non-intrusive monitor port or Terminal Access Point (TAP) port. The destination port at which the traffic is monitored is a listen-only port. This port can only receive traffic but cannot transmit. It establishes a one-way cross-connect listen connection that listens to either the source or destination of an existing cross-connect or a local connect connection. The listen connection takes a standard cross-connect and sends the traffic to multiple 'listen only' destinations. Thus, the data can be transmitted to multiple connections from a single source. This feature is supported on Cisco RSP3 module.

This feature is supported on the following CEM interface modules:

- 48-port T1/E1 CEM interface module

- 48-port T3/E3 CEM interface module

- 1-port OC48/ STM-16 or 4-port OC-12/OC-3 / STM-1/STM-4 + 12-Port T1/E1 + 4-Port T3/E3 CEM interface module

- ASR 900 Combo 8-Port SFP GE and 1-Port 10 GE 20G interface module

Starting with Cisco IOS XE Bengaluru 17.6.1, you can enable TAP or TAD point to monitor the traffic as listen-only connections in the following directions for local connect and/or cross-connect scenarios:

- Receive direction (Rx)

- Transmit direction (Tx)

The default TAP configuration is Tx and the Tx direction support is available from Cisco IOS XE Bengaluru 17.5.1.

In addition, you can split the TAP or TAD session and monitor for intrusive testing. The original traffic is affected unlike the Tx and Rx where the traffic is replicated.

The split TAP and monitor session supports in the following directions:

- Split Receive direction (Split-Rx)

- Split Transmit direction (Split-Tx)

The directions Tx or Rx is considered with respect to the core interface in the network.

Source and destination ports can be in the same or different router.

TAP Support for Protected Interfaces

Starting with Cisco IOS XE Cupertino 17.7.1, you can enable TAP or split TAP for the following protected interfaces on both receive and transmit direction:

- Automatic Protection Switching (APS)

- Unidirectional Path Switching Ring (UPSR)

- Card Protection Group (CPG)

UPSR Protection

SONET local connect and cross connect are supported at VT-15 CEP, STS-1c, STS-3c, STS-12c, and STS-48c levels. UPSR is also supported on TDM endpoints that are mapped to a pseudowire. T1 SAToP, T3 SAToP, and CT3 are supported on an UPSR ring only with local connect mode.

Starting with Cisco IOS XE Fuji 16.9.x, the cross connect of T1, T3, and CT3 circuits to UPSR is supported.

Single TAP Destination

In the figure below, the ingress traffic at port A is tapped at port C. Port C is a listen-only port, which can only receive the traffic but cannot transmit. Thus, the traffic is transmitted from port A to port B and from port A to port C. Port C can be present on the same IM or on different IMs of the same router as that of port A. Port C can be present on different routers (remote nodes) connected via a pseudowire.

Figure 1: Single TAP Destination
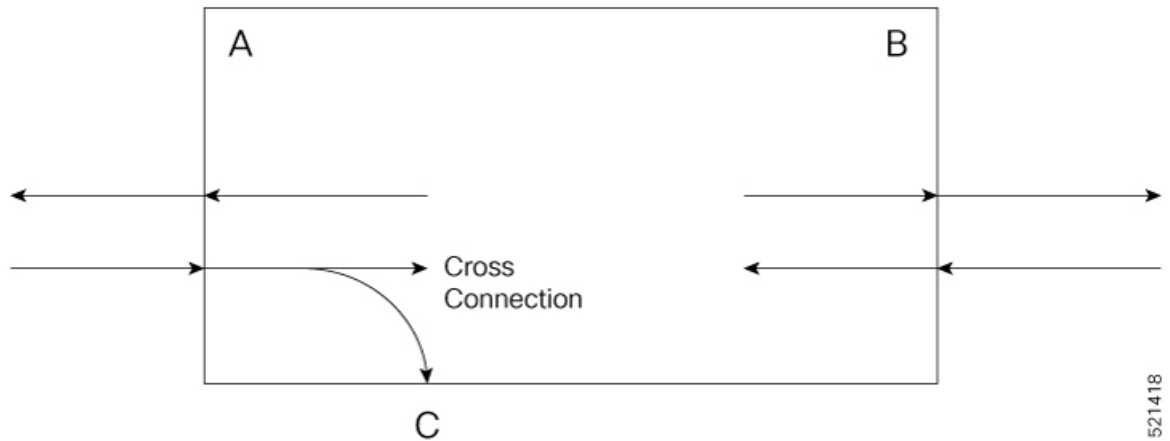
Multiple TAP Destinations

In the figure below, the ingress traffic at port A is tapped at the listen-only ports C, D, E, and F. Thus, the traffic is transmitted from port A to ports B, C, D, E, and F. Ports C, D, E, and F can be present on the same IM or on different IMs of the same router as that of port A. Port C, D, E, and F can be present on different routers (remote nodes) connected via a pseudowire to port A.

Figure 2: Multiple TAP Destinations
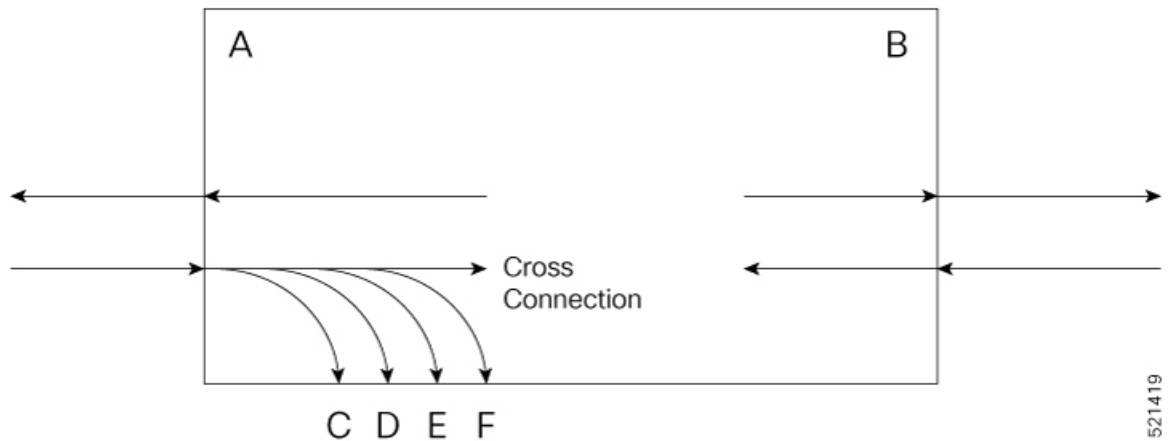
Restrictions

- SSO is *not* supported.

- High availability is *not* supported.

- For releases prior to Cisco IOS XE Bengaluru 17.6.1, to configure TAP on an original xconnect or to create a TAP xconnect connection with more than 12 circuits, use the following command:

no cef table output-chain build indirection

You must configure the above-mentioned command before configuring TAP for L2VPN. This command increases the convergence on all existing circuits in the router on core flaps.

- The range of monitor session ID for CEM interfaces is from 16 to 1015.

- This feature is *not* supported on 1-port OC-192 Interface module or 8-port Low Rate Interface Module.

- This feature is *not* supported on circuits with protected core, FRR core, tunnel core, or with ECMP.

- TAP xconnects are *not* supported on protected core, FRR core, tunnel core, or with ECMP.

- When you first configure TAP on a circuit, there is a negligible traffic drop on the original circuit.

- Configuration under monitor is applied only after you exit the privilege mode. Hence, to apply any changes to the existing source or direction, ensure that you first unconfigure the existing source or direction before reconfiguring the feature.

- The split-Rx configuration is not supported on source interface for local connection.

- In SAToP, the loop code detection is disabled by default. Both ESF/FDL loop code and IBOC loop code are transparently sent to CPE.

- In CESoP, the loop code detection is not disabled by default. Under controller configuration, use the **rem-loop-detect-disable** command to disable loop code detection.

- If you are not using STE with unidirectional TAP (Tx/Rx), then the design consideration should be taken to handle control packets that are replicated through TAP session configuration.

- In local connect, only Tx and split-Tx configurations are supported.

- A maximum of 20 tap destinations from a single source is supported. You can tap a maximum of 50 sources. Thus, the total tap scale is 50X20=1000.

- The maximum number of split Tx or split-Rx monitor session that you can configure on a source interface is one.

- TAP is not supported when the iMSG VLAN handoff feature is enabled on the same node.

- TAP feature is supported only on RSP3 for protected interfaces. In UPSR, some of the configurations are not supported for the protected interfaces.

- The N-bits or P-bits of CEM counter keeps increasing in CEP mode of STS-1E, SONET, or SDH frame. The N-bits or P-bits adjust the placement of CEP payload in the SONET or SDH frame, but these bits do not correct the clock. The increment of these bits do not stop until CE and PE clocks are synced with proper clock configuration. This is applicable for all CEM interface modules except T1 or E1 interface module.

How to configure RSP-based Non-Intrusive Monitor Ports

Scenarios for RSP-based Non-Intrusive Monitoring or TAP Port Configuration

The following scenarios show the different configurations of RSP-based non-intrusive monitoring or TAP ports.

The following table shows the TAP monitor session direction for local and cross connections:

Table 2: TAP/TAD Support Direction for Local and Cross Connections

| Pseudowire Type	Monitor Session Direction	Support on Monitor Session Direction
Local Connection	Tx (Passive monitor for traffic transmitted into the pseudowire)	Yes
	Rx (Passive monitor for traffic received from the pseudowire)	No
	Split-Tx (Intrusive test for TDM traffic transmitted into the pseudowire)	Yes
	Split-Rx (Intrusive test for TDM traffic received from the pseudowire)	No
Cross Connection	Tx (Passive monitor for traffic transmitted into the pseudowire)	Yes
	Rx (Passive monitor for traffic received from the pseudowire)	Yes
	Split-Tx (Intrusive test for TDM traffic transmitted into the pseudowire)	Yes
	Split-Rx (Intrusive test for TDM traffic received from the pseudowire)	Yes

Note If TAP configured with multiple modes, and to verify the correct mirror count details at ingress and egress sides, we recommend that you use the **show cem circuit interface cem <bay/slot/port> <cem-group-no>** command. For example, **show cem circuit interface cem 0/7/0 0**.

Scenario 1: Configure Source, Destination, and TAP Port - Local Node

Consider a scenario, where the traffic originating from the CEM interface A on router R1 is transmitted to the CEM interface B via the local connect on router R1. Use the feature to tap or transmit this traffic from CEM interface A to the CEM interface C on the router R1.

Figure 3: TAP Source and Destination on Local Node
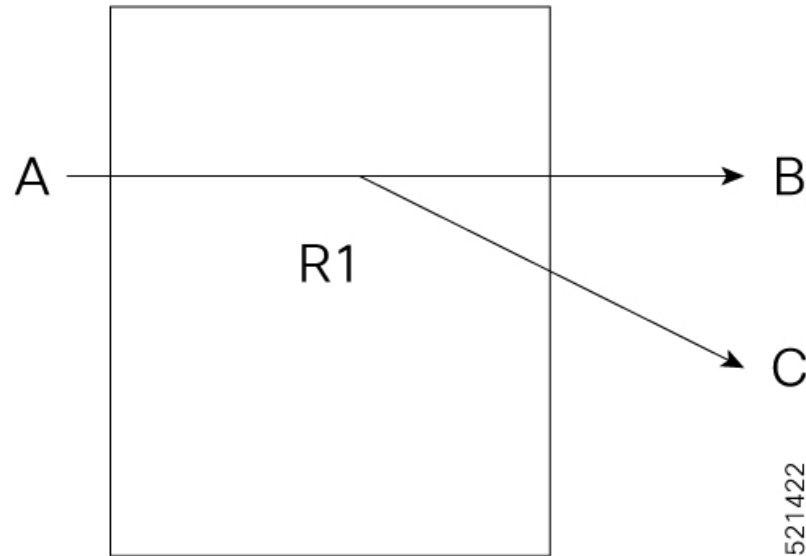
The following example shows the configuration of the tap source and destination on the local node:

1. **Configure CEM on Interface A**

```
enable
configure terminal
controller MediaType 0/5/16
mode sonet
controller sonet 0/5/16
 rate OC3
 sts-1 1
  mode vt-15
  vtg 1 t1 1 cem-group 10 timeslots 1-24
```

2. **Configure CEM on Interface B**

```
enable
configure terminal
controller MediaType 0/5/16
mode sonet
controller sonet 0/5/16
 rate OC3
 sts-1 2
  mode vt-15
  vtg 1 t1 1 cem-group 20 timeslots 1-24
```

3. **Establish Local Connection between Interfaces A and B**

```
enable
configure terminal
connect lc cem0/5/16 10 cem0/5/16 20
```

4. **Configure CEM on Interface C**

```
enable
configure terminal
controller MediaType 0/3/16
mode sonet
controller sonet 0/3/16
```

```
   rate OC3
   sts-1 1
    mode vt-15
    vtg 1 t1 1 cem-group 30 timeslots 1-24
```

5. **Configure TAP Monitor Session**

```
monitor session 20 type rspan-source
no shut
source  interface cem0/5/16 10
destination pseudowire
```

6. **Configure L2VPN to Direct Traffic on Interface C**

```
l2vpn xconnect context tap20
member MONITOR 20
member cem0/3/16 30
```

Verifiy the Port Source and Destination Configuration on Local Node :

Use the **show monitor session all** command to verify the configuration:

```
Router#show monitor session all
Session 20
----------
Type                    : Remote Source Session
Status                  : Admin Enabled
Source Ports            :
     TX Only            : CE0/5/16 10
Destination Ports       : CE0/3/16 30
```
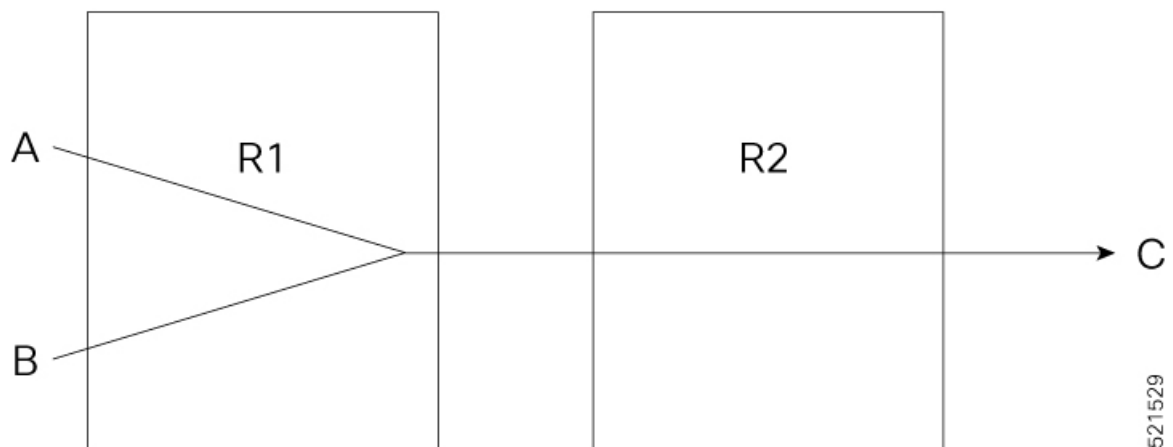
Scenario 2: Configure Source and Destination - Local Node and TAP Port - Remote Node

Consider a scenario where CEM interfaces A and B are on the local node (router R1). The traffic is mirrored or tapped from CEM interface A to the CEM interface C of the remote node (router R2).

Figure 4: Source and Destination on Local Node and TAP Port on Remote Node

The following example shows the configuration of the source and destination on local node and TAP port on remote node:

1. **Configure CEM on Interface A**

```
enable
configure terminal
```

```
controller MediaType 0/5/16
mode sonet
controller sonet 0/5/16
 rate OC3
 sts-1 1
  mode vt-15
  vtg 1 t1 1 cem-group 10 timeslots 1-24
```

2. Configure CEM on Interface B

```
enable
configure terminal
controller MediaType 0/5/16
mode sonet
controller sonet 0/5/16
 rate OC3
 sts-1 2
  mode vt-15
  vtg 1 t1 1 cem-group 20 timeslots 1-24
```

3. Establish Local Connect between Interface A and Interface B

```
enable
configure terminal
connect lc cem0/5/16 10 cem0/5/16 20
```

4. Configure CEM on Interface C

```
enable
configure terminal
controller MediaType 0/3/16
mode sonet
controller sonet 0/3/16
 rate OC3
 sts-1 1
  mode vt-15
  vtg 1 t1 1 cem-group 30 timeslots 1-24
```

5. Configure Pseudowire and L2VPN Cross Connect on Router R2

```
interface pseudowire100
encapsulation mpls
neighbor 10.1.1.1 100
!
l2vpn xconnect context tap20
member pseudowire100
member cem0/3/16 30
!
```

6. Configure Pseudowire on Router R1

```
interface pseudowire100
encapsulation mpls
neighbor 10.2.2.2 100
!
```

7. Configure TAP Monitor Session on Router R1

```
monitor session 20 type rspan-source
no shut
source  interface cem0/5/16 10
destination pseudowire
```

8. Configure L2VPN on Router R1 to Direct Traffic on Interface C

```
l2vpn xconnect context tap20
member MONITOR 20
member pseudowire100
```

Verify TAP Port Configuration on Local Node

Use the **show monitor session all** command to verify the configuration:

```
Router#show monitor session all
Session 20
----------
Type                    : Remote Source Session
Status                  : Admin Enabled
Source Ports            :
    TX Only             : CE0/5/16 10
Destination Ports       : Pseudowire 100
```

Scenario 3: Configure Source and TAP Port - Local Node and Destination - Remote Node

Consider a scenario, where the traffic originating from the CEM interface A on the local node (router R1) is transmitted to the CEM interface B via the MPLS core interface on the remote node (router R2). Use the feature to tap or transmit this traffic from CEM interface A of the local node (router R1) to CEM interface C of the local node (router R1).

Figure 5: Source and TAP Port on Local Node, and Destination on Remote Node
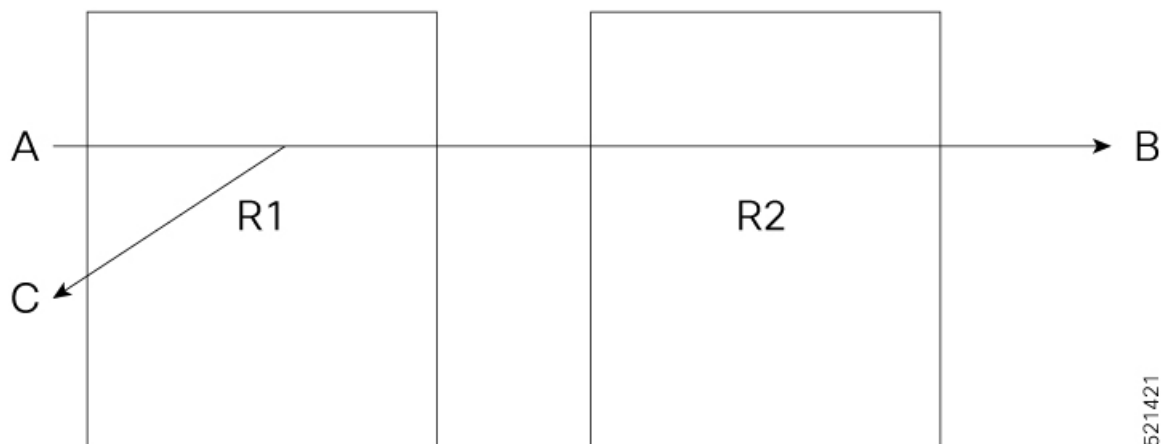
The following example shows the configuration of source and TAP port on the local node, and destination on the remote node:

1. **Configure CEM on Interface A**

   ```
   enable
   configure terminal
   controller MediaType 0/5/16
   mode sonet
   controller sonet 0/5/16
    rate OC3
    sts-1 1
     mode vt-15
     vtg 1 t1 1 cem-group 10 timeslots 1-24
   ```

2. **Configure CEM on Interface B**

```
enable
configure terminal
controller MediaType 0/3/16
mode sonet
controller sonet 0/3/16
 rate OC3
 sts-1 1
  mode vt-15
  vtg 1 t1 1 cem-group 20 timeslots 1-24
```

3. Configure Pseudowire and L2VPN Cross Connect on Router R1

```
interface pseudowire100
encapsulation mpls
neighbor 10.2.2.2 100
!
l2vpn xconnect context original_xc
member pseudowire100
member cem0/5/16 10
!
```

4. Configure Pseudowire and L2VPN Cross Connect on Router R2

```
interface pseudowire100
encapsulation mpls
neighbor 10.1.1.1 100
!
l2vpn xconnect context original_xc
member pseudowire100
member cem0/3/16 20
```

5. Configure CEM on Interface C

```
enable
configure terminal
controller MediaType 0/5/16
mode sonet
controller sonet 0/5/16
 rate OC3
 sts-1 2
  mode vt-15
  vtg 1 t1 1 cem-group 20 timeslots 1-24
```

6. Configure TAP Monitor Session on Router R1

```
monitor session 20 type rspan-source
no shut
source  interface cem0/5/16 10
destination pseudowire
```

7. Configure L2VPN on Router R1 to Direct Traffic on Interface C

```
l2vpn xconnect context tap20
member MONITOR 20
member cem0/5/16 20
```

Verify TAP Port Configuration on Local Node

Use the **show monitor session all** command to verify the configuration:

```
Router#show monitor session all
Session 20
----------
Type                    : Remote Source Session
```

```
Status                  : Admin Enabled
Source Ports            :
    TX Only             : CE0/5/16 10
Destination Ports       : CE0/5/16 20
```

Scenario 4: Configure Source - Local Node and TAP Port and Destination - Remote Node

Consider the scenario below, where the traffic originating from the CEM interface A on local node (router R1) is transmitted to the CEM interface B via the MPLS core interface on the remote node (router R2). Use the feature to tap or transmit this traffic from CEM interface A of the local node (router R1) to the CEM interface C of the remote node (router R2).

Figure 6: Source on Local Node, and TAP Port and Destination on Remote Node
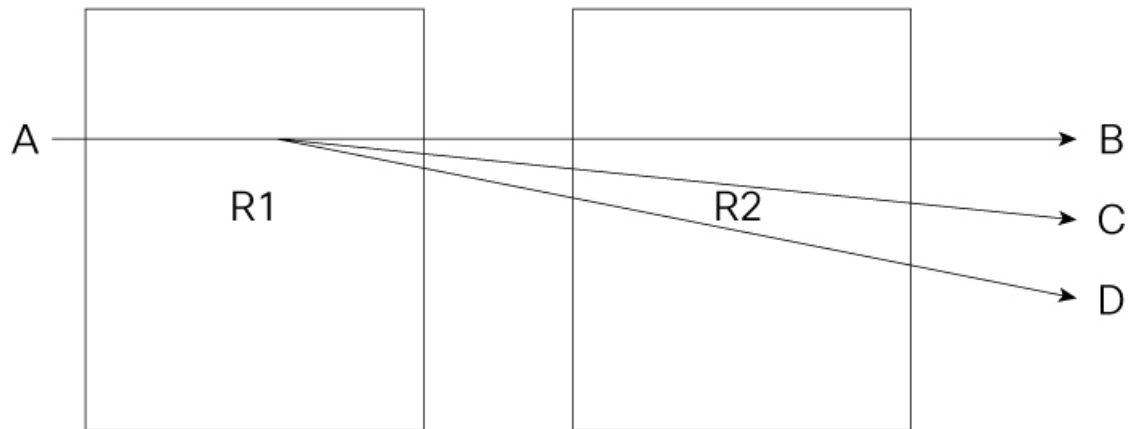
The following example shows the configuration of source on the local node, and TAP port and destination on the remote node:

1. **Configure CEM on Interface A**

```
enable
configure terminal
controller MediaType 0/5/16
mode sonet
controller sonet 0/5/16
 rate OC3
 sts-1 1
  mode vt-15
  vtg 1 t1 1 cem-group 10 timeslots 1-24
```

2. **Configure CEM on Interface B**

```
enable
configure terminal
controller MediaType 0/3/16
mode sonet
controller sonet 0/3/16
 rate OC3
 sts-1 1
  mode vt-15
  vtg 1 t1 1 cem-group 20 timeslots 1-24
```

3. **Configure Pseudowire and L2VPN Cross Connect on Router R1**

```
interface pseudowire100
encapsulation mpls
```

```
neighbor 10.2.2.2 100
!
l2vpn xconnect context original_xc
member pseudowire100
member cem0/5/16 10
!
```

4.   Configure Pseudowire and L2VPN Cross Connect on Router R2

```
interface pseudowire100
encapsulation mpls
neighbor 10.1.1.1 100
!
l2vpn xconnect context original_xc
member pseudowire100
member cem0/3/16 20
!
```

5.   Configure CEM on Interface C on Router R2

```
enable
configure terminal
controller MediaType 0/3/16
mode sonet
controller sonet 0/3/16
 rate OC3
 sts-1 2
  mode vt-15
  vtg 1 t1 1 cem-group 30 timeslots 1-24
```

6.   Configure TAP Monitor Session on Router R1

```
monitor session 20 type rspan-source
no shut
source  interface cem0/5/16 10
destination pseudowire
```

7.   Configure Pseudowire on Router R1 for TAP

```
interface pseudowire200
encapsulation mpls
neighbor 10.2.2.2 200
!
```

8.   Configure L2VPN on Router R1 for TAP Interface

```
l2vpn xconnect context TAP
member pseudowire200
member monitor 20
```

9.   Configure Pseudowire on Router R2 for TAP

```
interface pseudowire200
encapsulation mpls
neighbor 10.1.1.1 200
```

10.   Configure L2VPN on Router R2 for TAP Interface C

```
l2vpn xconnect context TAP
member pseudowire200
member cem0/3/16 30
```

Verify TAP Port Configuration on Local Node

Use the **show monitor session all** command to verify the configuration:

```
Router#show monitor session all
Session 20
----------
Type                     : Remote Source Session
Status                   : Admin Enabled
Source Ports             :
    TX Only              : CE0/5/16 10
Destination Ports        : Pseudowire 200
```

Scenario 5: Configure Source - Local Node and Destination and TAP Port - Different Remote Nodes

Consider a scenario where all the source, destination, and tap interfaces are on different routers. In this scenario, the CEM interface A on the local node (router R1) and the CEM interface B on the remote node (router R2) are cross-connected. The traffic is tapped from the CEM interface A on the local node (router R1) to the CEM interface C on the different remote node (router R3).

Figure 7: Source on Local Node, and Destination and TAP Port on Different Remote Node
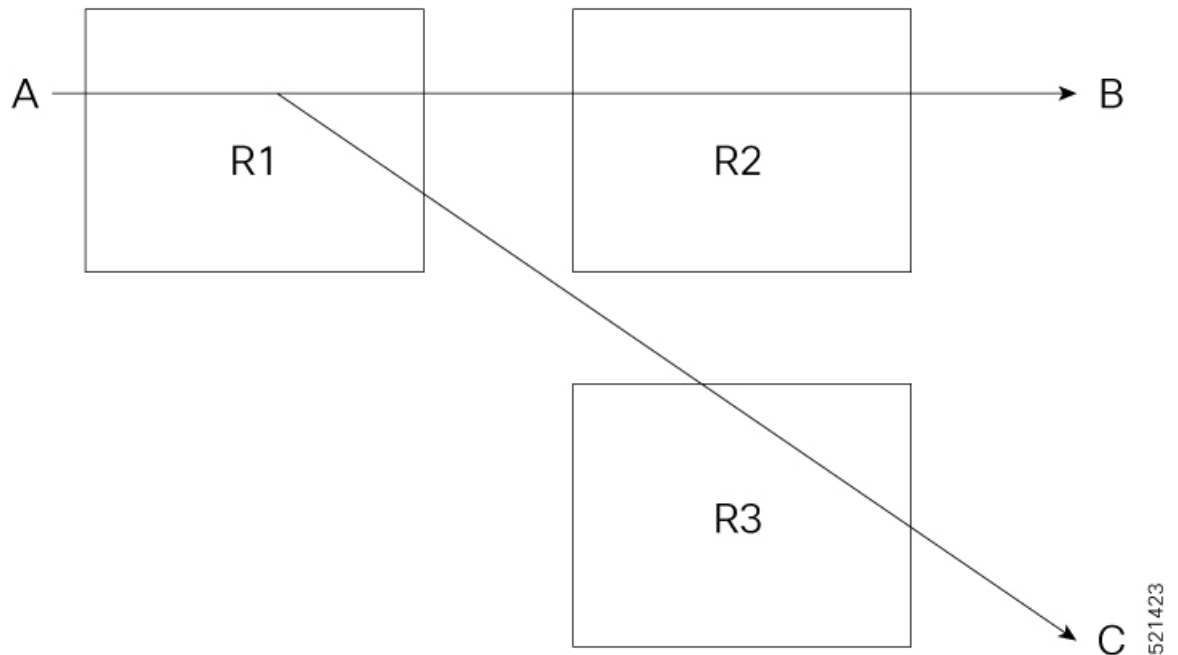
The following example shows the configuration of source on local node, and destination and TAP port on different remote nodes:

1. **Configure CEM on Interface A on Router R1**

   ```
   enable
   configure terminal
   controller MediaType 0/5/16
   mode sonet
   controller sonet 0/5/16
    rate OC3
    sts-1 1
     mode vt-15
     vtg 1 t1 1 cem-group 10 timeslots 1-24
   ```

2. **Configure CEM on Interface B on Router R2**

```
enable
configure terminal
controller MediaType 0/3/16
mode sonet
controller sonet 0/3/16
 rate OC3
 sts-1 1
  mode vt-15
  vtg 1 t1 1 cem-group 10 timeslots 1-24
```

3. Configure Pseudowire and L2VPN Cross Connect on Router R1

```
interface pseudowire100
encapsulation mpls
neighbor 10.2.2.2 100
!
l2vpn xconnect context original_xc
member pseudowire100
member cem0/5/16 10
!
```

4. Configure Pseudowire and L2VPN Cross Connect on Router R2

```
interface pseudowire100
encapsulation mpls
neighbor 10.1.1.1 100
!
l2vpn xconnect context original_xc
member pseudowire100
member cem0/3/16 10
!
```

5. Configure CEM for Interface C on Router R3

```
enable
configure terminal
controller MediaType 0/4/16
mode sonet
controller sonet 0/4/16
 rate OC3
 sts-1 1
  mode vt-15
  vtg 1 t1 1 cem-group 10 timeslots 1-24
```

6. Configure TAP Monitor Session on Router R1

```
monitor session 20 type rspan-source
no shut
source interface cem0/5/16 10
destination pseudowire
```

7. Configure Pseudowire and L2VPN Cross Connect on Router R1 for TAP

```
interface pseudowire200
encapsulation mpls
neighbor 10.3.3.3 200
!
l2vpn xconnect context TAP
member pseudowire200
member monitor 20
!
```

8. Configure Pseudowire on Router R3

```
interface pseudowire200
encapsulation mpls
neighbor 10.1.1.1 200
!
```

9. **Configure L2VPN on Router R3**

```
l2vpn xconnect context TAP
member pseudowire200
member cem0/4/16 10
```

Verify TAP Port Configuration on Local Node

Use the **show monitor session all** command to verify the configuration:

```
Router#show monitor session all
Session 20
----------
Type                    : Remote Source Session
Status                  : Admin Enabled
Source Ports            :
    TX Only             : CE0/5/16 10
Destination Ports       : Pseudowire 200
```
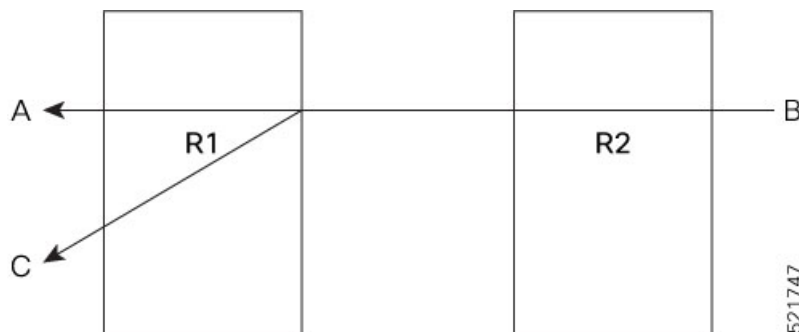
Scenario 6 - Configure Monitor Rx

Consider a scenario, where the traffic originating from the CEM interface B on the local node (router R2) is transmitted to the CEM interface A via the MPLS core interface on the remote node (router R1). Create a TAP C on R1 to monitor the Rx traffic.

Figure 8: Monitor Rx Session

The following example shows the configuration of monitor Rx session:

1. **Configure CEM on Interface A on Router R1**

```
enable
configure terminal
controller MediaType 0/5/16
mode sonet
controller sonet 0/5/16
 rate OC3
 sts-1 1
  mode vt-15
  vtg 1 t1 1 cem-group 0 timeslots 1-24
```

2. **Configure CEM on Interface B on Router R2**

```
enable
configure terminal
```

```
controller MediaType 0/2/19
mode sonet
controller sonet 0/2/19
 rate OC3
 sts-1 1
  mode vt-15
  vtg 1 t1 1 cem-group 0 timeslots 1-24
```

3. Configure Pseudowire and L2VPN Cross Connect on Router R1

```
enable
configure terminal
interface pseudowire100
encapsulation mpls
neighbor 10.2.2.2 100
!
l2vpn xconnect context original_xc
member pseudowire100
member cem0/5/16 0
!
```

4. Configure Pseudowire and L2VPN Cross Connect on Router R2

```
enable
configure terminal
interface pseudowire100
encapsulation mpls
neighbor 10.1.1.1 100
!
l2vpn xconnect context original_xc
member pseudowire100
member cem0/2/19 0
```

5. Verify if the L2VPN cross connect is up on Router R1

```
router#show xconnect all
Legend:    XC ST=Xconnect State  S1=Segment1 State  S2=Segment2 State
  UP=Up        DN=Down           AD=Admin Down      IA=Inactive
  SB=Standby  HS=Hot Standby     RV=Recovering      NH=No Hardware

XC ST  Segment 1                         S1 Segment 2                         S2
------+--------------------------------+--+--------------------------------+--
UP pri mpls 10.2.2.2:100                 UP  ac CE0/5/16:0(CESoPSN Basic)    UP
```

6. Configure CEM on Interface C on Router R1

```
enable
configure terminal
controller MediaType 0/5/16
mode sonet
controller sonet 0/5/16
 rate OC3
 sts-1 2
  mode vt-15
  vtg 1 t1 1 cem-group 20 timeslots 1-24
```

7. Configure TAP Monitor Session on Router R1

```
configure terminal
monitor session 20 type rspan-source
```

```
      no shut
      source  interface cem0/5/16 0 rx
      destination pseudowire
```

8. **Configure L2VPN on Router R1 to Direct Traffic on Interface C**

```
configure terminal
l2vpn xconnect context tap20
member MONITOR 20
member cem0/5/16 20
```

9. **Verify if both the cross connections are up and running on Router R1**

```
PE1#sh xconnect all
Legend:    XC ST=Xconnect State  S1=Segment1 State  S2=Segment2 State
  UP=Up       DN=Down           AD=Admin Down     IA=Inactive
  SB=Standby  HS=Hot Standby    RV=Recovering     NH=No Hardware

XC ST  Segment 1                          S1 Segment 2                          S2
------+---------------------------------+--+---------------------------------+--
UP pri mpls 10.2.2.2:100                 UP   ac CE0/5/16:0(CESoPSN Basic)    UP
UP pri  ac MONITOR:20(CESoPSN Basic)     UP   ac CE0/5/16:20(CESoPSN Basic)   UP
```

Verify CEM counters on Router R1

Use the **show cem circuit detail** command to verify the CEM counters configuration:

```
Router#show cem circuit detail
CEM0/5/16, ID: 0, Line: UP, Admin: UP, Ckt: ACTIVE
Path Mode : VT15, STS: 1, VTG: 1, T1: 1, CEM Mode: T1-CESoP
Controller state: up, T1/E1 state: up
Idle Pattern: 0xFF, Idle CAS: 0x8 0x8
Dejitter: 6 (In use: 4)
Payload Size: 192
Framing: Framed (DS0 channels: 1-24)
CEM Defects Set
None

Signalling: No CAS
RTP: No RTP

Ingress Pkts:    3000               Dropped:          0
Egress Pkts:     3000               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
Generated Lbits: 0                  Received Lbits:      0
Generated Rbits: 0                  Received Rbits:      0
Generated Mbits: 0                  Received Mbits:      0


CEM0/5/16, ID: 20, Line: UP, Admin: UP, Ckt: ACTIVE
Path Mode : VT15, STS: 2, VTG: 1, T1: 1, CEM Mode: T1-CESoP
Controller state: up, T1/E1 state: up
Idle Pattern: 0xFF, Idle CAS: 0x8 0x8
Dejitter: 6 (In use: 4)
Payload Size: 192
```

```
Framing: Framed (DS0 channels: 1-24)
CEM Defects Set
None

Signalling: No CAS
RTP: No RTP

Ingress Pkts:    3000              Dropped:             0
Egress Pkts:     3000              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
Generated Lbits: 0                Received Lbits:      0
Generated Rbits: 0                Received Rbits:      0
Generated Mbits: 0                Received Mbits:      0
```

Verify TAP Port Configuration on Router R1

Use the **show monitor session all** to verify the configuration:

```
Router#show monitor session all
Session 20
----------
Type                    : Remote Source Session
Status                  : Admin Enabled
Source Ports            :
    RX Only             : CE0/5/16 0
Destination Ports       : CE0/5/16 20
```
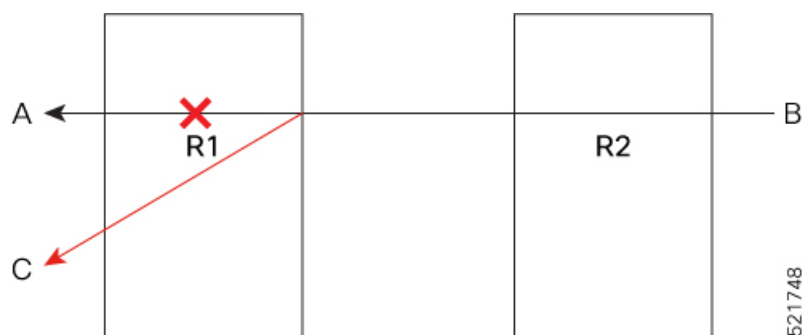
Scenario 7 - Configure Monitor Split-Rx

Consider a scenario, where the traffic originating from the CEM interface B on the local node (router R2) is transmitted to the CEM interface A via the MPLS core interface on the remote node (router R1). The traffic flows from interface B to interface A. Configure split-Rx on interface C. The traffic from interface B to interface A is affected. The traffic flows from interface B to interface C.

Figure 9: Monitor Split Rx Session

The following example shows the configuration of monitor Split Rx session:

1. **Configure CEM on Interface A on Router R1**

   ```
   enable
   configure terminal
   ```

```
controller MediaType 0/5/16
mode sonet
controller sonet 0/5/16
 rate OC3
 sts-1 1
  mode vt-15
  vtg 1 t1 1 cem-group 0 timeslots 1-24
```

2. **Configure CEM on Interface B on Router R2**

```
enable
configure terminal
controller MediaType 0/2/19
mode sonet
controller sonet 0/2/19
 rate OC3
 sts-1 1
  mode vt-15
  vtg 1 t1 1 cem-group 0 timeslots 1-24
```

3. **Configure Pseudowire and L2VPN Cross Connect on Router R1**

```
enable
configure terminal
interface pseudowire100
encapsulation mpls
neighbor 10.2.2.2 100
!
l2vpn xconnect context original_xc
member pseudowire100
member cem0/5/16 0
!
```

4. **Configure Pseudowire and L2VPN Cross Connect on Router R2**

```
enable
configure terminal
interface pseudowire100
encapsulation mpls
neighbor 10.1.1.1 100
!
l2vpn xconnect context original_xc
member pseudowire100
member cem0/2/19 0
```

5. **Verify that the L2VPN cross connect is Up on Router R1**

```
router#show xconnect all
Legend:    XC ST=Xconnect State  S1=Segment1 State  S2=Segment2 State
  UP=Up       DN=Down           AD=Admin Down      IA=Inactive
  SB=Standby  HS=Hot Standby    RV=Recovering      NH=No Hardware

XC ST  Segment 1                          S1 Segment 2                          S2
------+-------------------------------+--+-------------------------------+--
UP pri mpls 10.2.2.2:100                  UP   ac CE0/5/16:0(CESoPSN Basic)   UP
```

6. **Configure CEM on Interface C on Router R1**

```
enable
configure terminal
```

```
controller MediaType 0/5/16
mode sonet
controller sonet 0/5/16
 rate OC3
 sts-1 2
  mode vt-15
  vtg 1 t1 1 cem-group 20 timeslots 1-24
```

7. Configure Split-TAP Monitor Session on Router R1

```
configure terminal
monitor session 20 type rspan-source
no shut
source  interface cem0/5/16 10 split-rx
destination pseudowire
```

8. Configure L2VPN on Router R1 to Direct Traffic on Interface C

```
configure terminal
l2vpn xconnect context tap20
member MONITOR 20
member cem0/5/16 20
```

9. Verify if both the cross connections are Up on Router R1

```
router#show xconnect all
Legend:    XC ST=Xconnect State  S1=Segment1 State  S2=Segment2 State
  UP=Up       DN=Down           AD=Admin Down     IA=Inactive
  SB=Standby  HS=Hot Standby    RV=Recovering     NH=No Hardware

XC ST  Segment 1                         S1 Segment 2                         S2
------+-------------------------------+--+-------------------------------+--
UP pri mpls 10.2.2.2:100                 UP  ac CE0/5/16:0(CESoPSN Basic)    UP
UP pri  ac MONITOR:20(CESoPSN Basic)   UP  ac CE0/5/16:20(CESoPSN Basic)   UP
```

Verify CEM counters on Router R1

Use the **show cem circuit detail** command to verify the CEM counters configuration:

```
Router#show cem circuit detail
CEM0/5/16, ID: 0, Line: UP, Admin: UP, Ckt: ACTIVE
Path Mode : VT15, STS: 1, VTG: 1, T1: 1, CEM Mode: T1-CESoP
Controller state: up, T1/E1 state: up
Idle Pattern: 0xFF, Idle CAS: 0x8 0x8
Dejitter: 6 (In use: 0)
Payload Size: 192
Framing: Framed (DS0 channels: 1-24)
CEM Defects Set
None

Signalling: No CAS
RTP: No RTP

Ingress Pkts:    3000              Dropped:          0
Egress Pkts:     0                 Dropped:          0

CEM Counter Details
Input Errors:    0                 Output Errors:    0
Pkts Missing:    3000              Pkts Reordered:   0
Misorder Drops:  0                 JitterBuf Underrun:  3000
Error Sec:       0                 Severly Errored Sec: 0
```

```
Unavailable Sec: 0                 Failure Counts:      186
Pkts Malformed:  0                 JitterBuf Overrun:   0
Generated Lbits: 0                 Received Lbits:      0
Generated Rbits: 3000             Received Rbits:      0
Generated Mbits: 0                 Received Mbits:      0


CEM0/5/16, ID: 20, Line: UP, Admin: UP, Ckt: ACTIVE
Path Mode : VT15, STS: 2, VTG: 1, T1: 1, CEM Mode: T1-CESoP
Controller state: up, T1/E1 state: up
Idle Pattern: 0xFF, Idle CAS: 0x8 0x8
Dejitter: 6 (In use: 3)
Payload Size: 192
Framing: Framed (DS0 channels: 1-24)
CEM Defects Set
None

Signalling: No CAS
RTP: No RTP

Ingress Pkts:    3000             Dropped:             0
Egress Pkts:     3000             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
Generated Lbits: 0                 Received Lbits:      0
Generated Rbits: 0                 Received Rbits:      0
Generated Mbits: 0                 Received Mbits:      0
```

Verify TAP Port Configuration on Router R1

Use the **show monitor session** *<session-id>* or **show monitor session all** to verify the configuration:

```
Router#show monitor session 20
Session 20
----------
Type                    : Remote Source Session [SPLIT]
Status                  : Admin Enabled
Source Ports            :
    RX Only             : CE0/5/16 0
Destination Ports       : CE0/5/16 20
```

Scenario 8 - Configure Monitor Split-Tx

Consider a scenario, where the traffic originating from the CEM interface A on the local node (router R1) is transmitted to the CEM interface B via the MPLS core interface on the remote node (router R2). The traffic flows from interface A to interface B. Configure split-Tx on interface C. The traffic from interface A to interface B is affected. The traffic flows from interface A to interface C.

Figure 10: Monitor Split Tx Session

The following example shows the configuration of monitor Split Tx session:

1. **Configure CEM on Interface A on Router R1**

```
enable
configure terminal
controller MediaType 0/5/16
mode sonet
controller sonet 0/5/16
 rate OC3
 sts-1 1
  mode vt-15
  vtg 1 t1 1 cem-group 0 timeslots 1-24
```

2. **Configure CEM on Interface B on Router R2**

```
enable
configure terminal
controller MediaType 0/2/19
mode sonet
controller sonet 0/2/19
 rate OC3
 sts-1 1
  mode vt-15
  vtg 1 t1 1 cem-group 0 timeslots 1-24
```

3. **Configure Pseudowire and L2VPN Cross Connect on Router R1**

```
enable
configure terminal
interface pseudowire100
encapsulation mpls
neighbor 10.2.2.2 100
!
l2vpn xconnect context original_xc
member pseudowire100
member cem0/5/16 0
!
```

4. **Configure Pseudowire and L2VPN Cross Connect on Router R2**

```
enable
configure terminal
interface pseudowire100
encapsulation mpls
neighbor 10.1.1.1 100
```

```
!
l2vpn xconnect context original_xc
member pseudowire100
member cem0/2/19 0
```

5. **Verify that the L2VPN cross connect is Up on Router R1**

```
router#show xconnect all
Legend:    XC ST=Xconnect State  S1=Segment1 State  S2=Segment2 State
  UP=Up       DN=Down           AD=Admin Down     IA=Inactive
  SB=Standby  HS=Hot Standby    RV=Recovering     NH=No Hardware

XC ST   Segment 1                            S1 Segment 2                           S2
------+------------------------------+--+------------------------------+--
UP pri mpls 10.2.2.2:100                     UP   ac CE0/5/16:0(CESoPSN Basic)     UP
```

6. **Configure CEM on Interface C**

```
enable
configure terminal
controller MediaType 0/5/16
mode sonet
controller sonet 0/5/16
 rate OC3
 sts-1 2
  mode vt-15
  vtg 1 t1 1 cem-group 20 timeslots 1-24
```

7. **Configure Split-TAP Monitor Session on Router R1**

```
configure terminal
monitor session 20 type rspan-source
no shut
source  interface cem0/5/16 0 split-tx
destination pseudowire
```

8. **Configure L2VPN on Router R1 to Direct Traffic on Interface C**

```
configure terminal
l2vpn xconnect context tap20
member MONITOR 20
member cem0/5/16 20
```

9. **Verify if both the cross connections are Up on Router R1**

```
router#show xconnect all
Legend:    XC ST=Xconnect State  S1=Segment1 State  S2=Segment2 State
  UP=Up       DN=Down           AD=Admin Down     IA=Inactive
  SB=Standby  HS=Hot Standby    RV=Recovering     NH=No Hardware

XC ST   Segment 1                            S1 Segment 2                           S2
------+------------------------------+--+------------------------------+--
UP pri mpls 10.2.2.2:100                     UP   ac CE0/5/16:0(CESoPSN Basic)     UP
UP pri   ac MONITOR:20(CESoPSN Basic)        UP   ac CE0/5/16:20(CESoPSN Basic)    UP
```

Verify CEM counters on R1

Use the **show cem circuit detail** command to verify the CEM counters configuration:

```
Router#show cem circuit detail
CEM0/5/16, ID: 0, Line: UP, Admin: UP, Ckt: ACTIVE
Path Mode : VT15, STS: 1, VTG: 1, T1: 1, CEM Mode: T1-CESoP
Controller state: up, T1/E1 state: up
Idle Pattern: 0xFF, Idle CAS: 0x8 0x8
Dejitter: 6 (In use: 4)
Payload Size: 192
Framing: Framed (DS0 channels: 1-24)
CEM Defects Set
None

Signalling: No CAS
RTP: No RTP

Ingress Pkts:    3000              Dropped:           0
Egress Pkts:     3000              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
Generated Lbits: 0                Received Lbits:      0
Generated Rbits: 0                Received Rbits:      0
Generated Mbits: 0                Received Mbits:      0


CEM0/5/16, ID: 20, Line: UP, Admin: UP, Ckt: ACTIVE
Path Mode : VT15, STS: 2, VTG: 1, T1: 1, CEM Mode: T1-CESoP
Controller state: up, T1/E1 state: up
Idle Pattern: 0xFF, Idle CAS: 0x8 0x8
Dejitter: 6 (In use: 3)
Payload Size: 192
Framing: Framed (DS0 channels: 1-24)
CEM Defects Set
None

Signalling: No CAS
RTP: No RTP

Ingress Pkts:    3000              Dropped:           0
Egress Pkts:     3000              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
Generated Lbits: 0                Received Lbits:      0
Generated Rbits: 0                Received Rbits:      0
Generated Mbits: 0                Received Mbits:      0
```

Verify CEM counters on Router R2

Use the **show cem circuit detail** command to verify the CEM counters configuration:

```
Router#show cem circuit detail
CEM0/2/19, ID: 0, Line: UP, Admin: UP, Ckt: ACTIVE
Path Mode : VT15, STS: 1, VTG: 1, T1: 1, CEM Mode: T1-CESoP
```

```
Controller state: up, T1/E1 state: up
Idle Pattern: 0xFF, Idle CAS: 0x8 0x8
Dejitter: 6 (In use: 0)
Payload Size: 192
Framing: Framed (DS0 channels: 1-24)
CEM Defects Set
None

Signalling: No CAS
RTP: No RTP

Ingress Pkts:    5000                Dropped:            0
Egress Pkts:     0                   Dropped:            0

CEM Counter Details
Input Errors:    0                   Output Errors:      0
Pkts Missing:    5000                Pkts Reordered:     0
Misorder Drops:  0                   JitterBuf Underrun: 5000
Error Sec:       0                   Severly Errored Sec: 0
Unavailable Sec: 0                   Failure Counts:     312
Pkts Malformed:  0                   JitterBuf Overrun:  0
Generated Lbits: 0                   Received Lbits:     0
Generated Rbits: 5000                Received Rbits:     0
Generated Mbits: 0                   Received Mbits:     0
```

Verify TAP Port Configuration on Router R1

Use the **show monitor session** *<session-id>* or **show monitor session all** to verify the configuration:

```
Router#show monitor session 20
Session 20
----------
Type                    : Remote Source Session [SPLIT]
Status                  : Admin Enabled
Source Ports            :
   TX Only              : CE0/5/16 0
Destination Ports       : CE0/5/16 20
```

Scenario 9 - Configure TAP for APS Protection

Consider a scenario, where the interface A is configured with APS group on router R1 and interface B is configured without APS group on router R2. The traffic originating from the CEM interface B on the local node (router R2) is transmitted to the CEM interface A via the MPLS core interface on the remote node (router R1). Create a TAP C on R1 to monitor the Rx traffic.

Figure 11: Monitor Rx Session
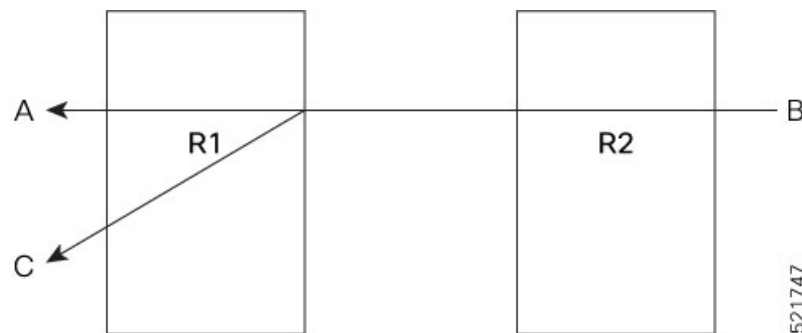
The following example shows the configuration of TAP for APS:

1. Create an APS Group (Working Controller) on Router R1

```
enable
configure terminal
controller MediaType 0/10/18
mode sonet
controller SONET 0/10/18
no snmp trap link-status
rate OC12
no ais-shut
alarm-report all
threshold sf-ber 3
clock source internal
aps group 2
aps working 1
aps group acr 2
sts-1 1
 clock source internal
 sts-1 2
  clock source internal
interface CEM0/10/19
 no ip address
```

Note If there is no back to back connection on work or protected interfaces and to avoid alarms, we recommend that you configure loopback local on the work and protected interaces using the following command:

loopback local

2. Create an APS Group (Protect Controller) on Router R1

```
enable
configure terminal
controller MediaType 0/13/18
mode sonet
controller SONET 0/13/18
no snmp trap link-status
rate OC12
no ais-shut
alarm-report all
threshold sf-ber 3
clock source internal
aps group 2
aps protect 10.1.1.1
aps group acr 2
sts-1 1
 clock source internal
 sts-1 2
  clock source internal
interface CEM0/13/18
 no ip address
```

Note If there is no back to back connection on work or protected interfaces and to avoid alarms, we recommend that you configure loopback local on the work and protected interaces using the following command:

loopback local

3. **Configure Controller B on Router R2 without APS**

```
enable
configure terminal
controller MediaType 0/13/19
mode sonet
controller sonet 0/13/19
 rate OC12
 sts-1 1
  mode vt-15
  vtg 1 t1 1 cem-group 0 unframed
```

4. **Configure CEM on Interface A on Router R1**

```
enable
configure terminal
controller sonet-acr 2
  sts-1 1
  mode vt-15
  vtg 1 t1 1 cem-group 0 unframed
```

5. **Configure Pseudowire and L2VPN Cross Connect on Router R1**

```
enable
configure terminal
interface pseudowire100
encapsulation mpls
neighbor 10.2.2.2 100
!
l2vpn xconnect context original_xc
member pseudowire100
member cem-acr 2 0
!
```

6. **Configure Pseudowire and L2VPN Cross Connect on Router R2**

```
enable
configure terminal
interface pseudowire100
encapsulation mpls
neighbor 10.1.1.1 100
!
l2vpn xconnect context original_xc
member pseudowire100
member cem0/13/19 0
```

7. **Verify if the L2VPN cross connect is up on Router R1**

```
router#show xconnect all
Legend:    XC ST=Xconnect State  S1=Segment1 State  S2=Segment2 State
  UP=Up      DN=Down             AD=Admin Down      IA=Inactive
  SB=Standby  HS=Hot Standby     RV=Recovering      NH=No Hardware

XC ST  Segment 1                        S1 Segment 2                        S2
------+-------------------------------+--+-------------------------------+--
UP pri mpls 10.2.2.2:100                UP  ac CE2:0(CESoPSN Basic)    UP
```

8. **Configure CEM on Interface C on Router R1**

```
enable
configure terminal
```

```
controller MediaType 0/5/16
mode sonet
controller sonet 0/5/16
 rate OC12
 sts-1 1
  mode vt-15
  vtg 1 t1 1 cem-group 20 unframed
```

9. Configure TAP Monitor Session on Router R1

```
monitor session 20 type rspan-source
no shut
source interface cem-acr 2 0 rx
destination pseudowire
```

10. Configure L2VPN on Router R1 to Direct Traffic on Interface C

```
configure terminal
l2vpn xconnect context tap20
member MONITOR 20
member cem0/5/16 20
```

11. Verify if both the cross connections are up and running on Router R1

```
PE1#sh xconnect all
Legend:    XC ST=Xconnect State  S1=Segment1 State  S2=Segment2 State
  UP=Up      DN=Down            AD=Admin Down     IA=Inactive
  SB=Standby  HS=Hot Standby    RV=Recovering     NH=No Hardware

XC ST  Segment 1                            S1 Segment 2                            S2
------+-------------------------------+--+-------------------------------+--
UP pri mpls 10.2.2.2:100               UP   ac CE2:0(CESoPSN Basic)    UP
UP pri  ac MONITOR:20(CESoPSN Basic)   UP   ac CE0/5/16:20(CESoPSN Basic)  UP
```

Verify CEM counters on Router R1

Use the **show cem circuit detail** command to verify the CEM counters configuration:

```
Router#show cem circuit detail
CEM-ACR 2, ID: 0, Line: UP, Admin: UP, Ckt: ACTIVE
Path Mode : VT15, STS: 1, VTG: 1, T1: 1, CEM Mode: T1-CESoP
Controller state: up, T1/E1 state: up
Idle Pattern: 0xFF, Idle CAS: 0x8 0x8
Dejitter: 6 (In use: 4)
Payload Size: 192
Framing: Framed (DS0 channels: 1-24)
CEM Defects Set
None

Signalling: No CAS
RTP: No RTP

Ingress Pkts:    3000              Dropped:          0
Egress Pkts:     3000              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
```

```
Generated Lbits: 0                    Received Lbits:    0
Generated Rbits: 0                    Received Rbits:    0
Generated Mbits: 0                    Received Mbits:    0

CEM0/5/16, ID: 20, Line: UP, Admin: UP, Ckt: ACTIVE
Path Mode : VT15, STS: 1, VTG: 1, T1: 1, CEM Mode: T1-CESoP
Controller state: up, T1/E1 state: up
Idle Pattern: 0xFF, Idle CAS: 0x8 0x8
Dejitter: 6 (In use: 4)
Payload Size: 192
Framing: Framed (DS0 channels: 1-24)
CEM Defects Set
None

Signalling: No CAS
RTP: No RTP

Ingress Pkts:    3000                 Dropped:           0
Egress Pkts:     3000                 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
Generated Lbits: 0                    Received Lbits:    0
Generated Rbits: 0                    Received Rbits:    0
Generated Mbits: 0                    Received Mbits:    0
```

Verify CEM counters on Router R2

Use the **show cem circuit detail** command to verify the CEM counters configuration:

```
Router#show cem circuit detail
CEM0/13/19, ID: 0, Line: UP, Admin: UP, Ckt: ACTIVE
Path Mode : VT15, STS: 1, VTG: 1, T1: 1, CEM Mode: T1-CESoP
Controller state: up, T1/E1 state: up
Idle Pattern: 0xFF, Idle CAS: 0x8 0x8
Dejitter: 6 (In use: 4)
Payload Size: 192
Framing: Framed (DS0 channels: 1-24)
CEM Defects Set
None

Signalling: No CAS
RTP: No RTP

Ingress Pkts:    3000                 Dropped:           0
Egress Pkts:     3000                 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
Generated Lbits: 0                    Received Lbits:    0
Generated Rbits: 0                    Received Rbits:    0
Generated Mbits: 0                    Received Mbits:    0
```

Verify TAP Port Configuration on Router R1

Use the **show monitor session all** to verify the configuration:

```
Router#show monitor session all
Session 20
----------
Type                    : Remote Source Session
Status                  : Admin Enabled
Source Ports            :
    RX Only             : CEM-ACR 2 0
Destination Ports       : CE0/5/16 20
```

Scenario 10 - Configure TAP for CPG Protection

Consider a scenario, where the CPG controller is configured on router R1 with CEM, and non-CPG controller is configured on the same router R1 with CEM group. Create a TAP C on R1 to monitor the Tx traffic.

Figure 12: TAP Source and Destination on Local Node
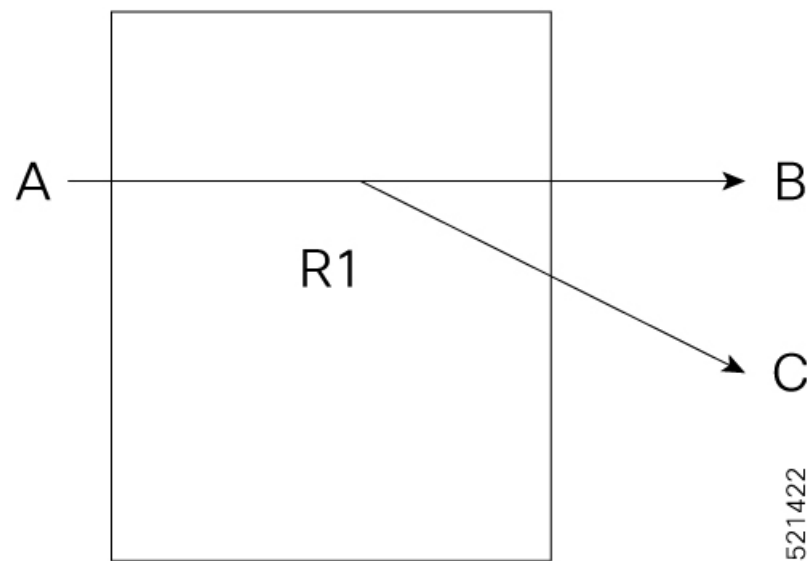
1. **Configure Card Protection Group**

    ```
    enable
    configure terminal
    card-protection 4
    primary slot 0 bay 0
    backup slot 0 bay 5
    end
    ```

![Note]

Note   (Optional) By default the card protection is non-revertive, if necessary you can change to revertive.

    ```
    card-protection 4
    revertive time [30-720]
    end
    ```

2. **Configures CEM on T1 Controller—Source Node (Router 1)**

```
enable
configure terminal
controller t1 8/3/0
cem 0 unframed
end
```

3. **Configures CEM on non-CPG T1 controller—Destination Node on Same Router R1**

```
enable
configure terminal
controller t1 0/10/19
cem 0 unframed
end
```

4. **Configure Local Connect on CEM Interface**

```
l2vpn xconnect context lc
member  cem 8/3/0 0
member cem0/10/19 0
end
```

5. **Configure CEM on Interface C**

```
enable
configure terminal
controller t1 0/3/0
cem 0 unframed
```

6. **Configure TAP Monitor Session on T1 Controller**

```
monitor session 20 type rspan-source
no shut
source interface cem8/3/0 0 tx
destination pseudowire
```

7. **Configure L2VPN on Router R1 to Tap the Traffic on Interface C**

```
configure terminal
l2vpn xconnect context tap20
member MONITOR 20
member cem0/3/0 0
```

Verify CEM Counters on T1 Controller

Use the **show cem circuit detail** command to verify the CEM counters configuration:

```
Router#show cem circuit detail
CEM8/3/0, ID: 0, Line: UP, Admin: UP, Ckt: ACTIVE
Mode :Unchannelized, CEM Mode: T1-SAToP
Controller state: up, T1/E1 state: up
Idle Pattern: 0xFF, Idle CAS: 0x8 0x8
Dejitter: 6 (In use: 3)
Payload Size: 1024
Framing: Unframed
CEM Defects Set
None
```

```
Signalling: No CAS
RTP: No RTP

Ingress Pkts: 8102584 Dropped: 0
Egress Pkts: 8105758 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: 6400
Generated Lbits: 8102584 Received Lbits: 0
Generated Rbits: 0 Received Rbits: 0

CEM0/3/0, ID: 0, Line: UP, Admin: UP, Ckt: ACTIVE
Mode :Unchannelized, CEM Mode: T1-SAToP
Controller state: up, T1/E1 state: up
Idle Pattern: 0xFF, Idle CAS: 0x8 0x8
Dejitter: 6 (In use: 3)
Payload Size: 1024
Framing: Unframed
CEM Defects Set
None
Signalling: No CAS
RTP: No RTP
Ingress Pkts: 8102584 Dropped: 0
Egress Pkts: 8105758 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: 6400
Generated Lbits: 8102584 Received Lbits: 0
Generated Rbits: 0 Received Rbits: 0
```

Verify TAP Port Configuration

Use the show monitor session all to verify the configuration:

```
Router#show monitor session all
Session 20
----------
Type : Remote Source Session
Status : Admin Enabled
Source Ports :
TX Only : CE8/3/0 0
Destination Ports : CE0/3/0 0
```

Scenario 11 - Configure TAP for UPSR Protection

Consider a scenario, where the UPSR work and protect paths are created on router R1, and original destination is created on router R2. The traffic originating from the CEM interface B on the router R2 is transmitted to the CEM interface A via the MPLS core interface on the remote node (router R1). Create a TAP C on R1 to monitor the Rx traffic.

Figure 13: Monitor Rx Session
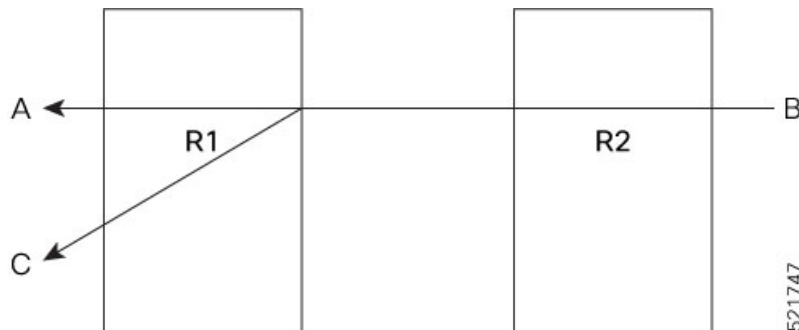
The following example shows the configuration of TAP for UPSR:

1. **Create UPSR on Router R1**

```
protection-group 2 type vt1.5
controller protection-group 2
type vt1.5
cem-group 16002 unframed
```

```
controller sonet 0/4/0
sts-1 1
mode vt-15
vtg 1 t1 2 protection-group 2 working
```

```
controller sonet 0/5/0
sts-1 1
mode vt-15
vtg 1 t1 2 protection-group 2 protect
```

2. **Configure CEM on Interface B on Router R2**

```
enable
configure terminal
controller MediaType 0/12/6
mode sonet
controller sonet 0/12/6
 rate OC12
 sts-1 1
  mode vt-15
   vtg 1 t1 2 cem-group 0 unframed
```

3. **Configure Pseudowire and L2VPN Cross Connect on Router R1**

```
enable
configure terminal
interface pseudowire100
encapsulation mpls
neighbor 10.2.2.2 100
!
l2vpn xconnect context original_xc
member pseudowire100
```

```
member cem-pg 2 16002
!
```

4. Configure Pseudowire and L2VPN Cross Connect on Router R2

```
enable
configure terminal
interface pseudowire100
encapsulation mpls
neighbor 10.1.1.1 100
!
l2vpn xconnect context original_xc
member pseudowire100
member cem0/12/6 0
```

5. Verify if the L2VPN cross connect is up on Router R1

```
router#show xconnect all
Legend:    XC ST=Xconnect State  S1=Segment1 State  S2=Segment2 State
  UP=Up       DN=Down             AD=Admin Down      IA=Inactive
  SB=Standby  HS=Hot Standby      RV=Recovering      NH=No Hardware

XC ST  Segment 1                          S1 Segment 2                          S2
------+-------------------------------+--+-------------------------------+--
UP pri mpls 10.2.2.2:100                  UP  ac CEM-PG 2:16002(CESoPSN Basic)   UP
```

6. Configure CEM on Interface C on Router R1

```
enable
configure terminal
controller MediaType 0/5/16
mode sonet
controller sonet 0/5/16
 rate OC12
 sts-1 1
  mode vt-15
  vtg 1 t1 2 cem-group 20 unframed
```

7. Configure TAP Monitor Session on Router R1

```
monitor session 20 type rspan-source
no shut
source interface cem-pg 2 16002 rx
destination pseudowire
```

8. Configure L2VPN on Router R1 to Direct Traffic on Interface C

```
configure terminal
l2vpn xconnect context tap20
member MONITOR 20
member cem0/5/16 20
```

9. Verify if both the cross connections are up and running on Router R1

```
PE1#sh xconnect all
Legend:    XC ST=Xconnect State  S1=Segment1 State  S2=Segment2 State
  UP=Up       DN=Down             AD=Admin Down      IA=Inactive
  SB=Standby  HS=Hot Standby      RV=Recovering      NH=No Hardware

XC ST  Segment 1                          S1 Segment 2                          S2
```

```
------+--------------------------------+--+--------------------------------+--
UP pri mpls 10.2.2.2:100                     UP  ac CEM-PG 2:16002(CESoPSN Basic)    UP
UP pri  ac MONITOR:20(CESoPSN Basic)   UP  ac CE0/5/16:20(CESoPSN Basic)   UP
```

Verify CEM counters on Router R1

Use the **show cem circuit detail** command to verify the CEM counters configuration:

```
Router#show cem circuit detail
CEM-PG 2, ID: 16002, Line: UP, Admin: UP, Ckt: ACTIVE
Path Mode : VT15, STS: 1, VTG: 1, T1: 2, CEM Mode: T1-CESoP
Controller state: up, T1/E1 state: up
Idle Pattern: 0xFF, Idle CAS: 0x8 0x8
Dejitter: 6 (In use: 4)
Payload Size: 192
Framing: Framed (DS0 channels: 1-24)
CEM Defects Set
None

Signalling: No CAS
RTP: No RTP

Ingress Pkts:    3000               Dropped:           0
Egress Pkts:     3000               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
Generated Lbits: 0                  Received Lbits:     0
Generated Rbits: 0                  Received Rbits:     0
Generated Mbits: 0                  Received Mbits:     0


CEM0/5/16, ID: 20, Line: UP, Admin: UP, Ckt: ACTIVE
Path Mode : VT15, STS: 1, VTG: 1, T1: 2, CEM Mode: T1-CESoP
Controller state: up, T1/E1 state: up
Idle Pattern: 0xFF, Idle CAS: 0x8 0x8
Dejitter: 6 (In use: 4)
Payload Size: 192
Framing: Framed (DS0 channels: 1-24)
CEM Defects Set
None

Signalling: No CAS
RTP: No RTP

Ingress Pkts:    3000               Dropped:           0
Egress Pkts:     3000               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
Generated Lbits: 0                  Received Lbits:     0
Generated Rbits: 0                  Received Rbits:     0
```

```
Generated Mbits: 0                    Received Mbits:      0
```

Verify TAP Port Configuration on Router R1

Use the **show monitor session all** to verify the configuration:

```
Router#show monitor session all
Session 20
----------
Type                    : Remote Source Session
Status                  : Admin Enabled
Source Ports            :
    RX Only             : CEM-PG 2 16002
Destination Ports       : CE0/5/16 20
```