CHAPTER 7

Configuring Pseudowire

This chapter provides information about configuring pseudowire features on the Cisco ME 3600X-24CX Series Switch. It contains the following sections:

Pseudowire Overview

The following sections provide an overview of pseudowire support on the Cisco ME 3600X-24CX Series Switch.

Circuit Emulation Overview

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

The Cisco ME 3600X-24CX Series Switch supports two pseudowire types that utilize CEM transport: Structure-Agnostic TDM over Packet and Circuit Emulation Service over Packet-Switched Network. The following sections provide an overview of these pseudowire types.

Structure-Agnostic TDM over Packet

SAToP encapsulates TDM bit-streams (T1, E1) as PWs over PSNs. It disregards any structure that may be imposed on streams, in particular the structure imposed by the standard TDM framing.

The protocol used for emulation of these services does not depend on the method in which attachment circuits are delivered to the PEs. For example, a T1 attachment circuit is treated the same way for all delivery methods, including: PE on copper, mapped into a virtual tributary of a SONET/SDH circuit, or carried over a network using unstructured Circuit Emulation Service (CES). Termination of specific carrier layers used between the PE and circuit emulation (CE) is performed by an appropriate network service provider (NSP).

In the SAToP mode the interface is considered as a continuous framed bit stream. The packetization of the stream is done according to IETF RFC 4553. All signaling is carried out transparently as a part of a bit stream. Figure 7-1 shows the frame format in Unstructured SAToP mode.

Figure 7-1 Unstructured Mode Frame Format

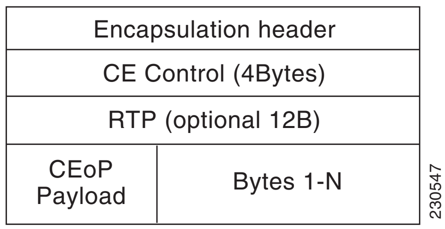


Table 7-1 shows the payload and jitter limits for the T1 lines in the SAToP frame format.

Table 7-1 SAToP T1 Frame: Payload and Jitter Limits

Maximum Payload	Maximum Jitter	Minimum Jitter	Minimum Payload	Maximum Jitter	Minimum Jitter
960	320	10	192	64	2

Table 7-2 shows the payload and jitter limits for the E1 lines in the SAToP frame format.

Table 7-2 SAToP E1 Frame: Payload and Jitter Limits

Maximum Payload	Maximum Jitter	Minimum Jitter	Minimum Payload	Maximum Jitter	Minimum Jitter
1280	320	10	256	64	2

For instructions on how to configure SAToP, see Configuring Structure-Agnostic TDM over Packet (SAToP).

Circuit Emulation Service over Packet-Switched Network

CESoPSN encapsulates structured (NxDS0) TDM signals as PWs over public switched networks (PSNs). It complements similar work for structure-agnostic emulation of TDM bit streams, such as SAToP. Emulation of NxDS0 circuits saves PSN bandwidth and supports DS0-level grooming and distributed cross-connect applications. It also enhances resilience of CE devices due to the effects of loss of packets in the PSN.

CESoPSN identifies framing and sends only the payload, which can either be channelized T1s within DS3 or DS0s within T1. DS0s can be bundled to the same packet. The CESoPSN mode is based on IETF RFC 5086.

Each supported interface can be configured individually to any supported mode. The supported services comply with IETF and ITU drafts and standards.

Figure 7-2 shows the frame format in CESoPSN mode.

Figure 7-2 Structured Mode Frame Format

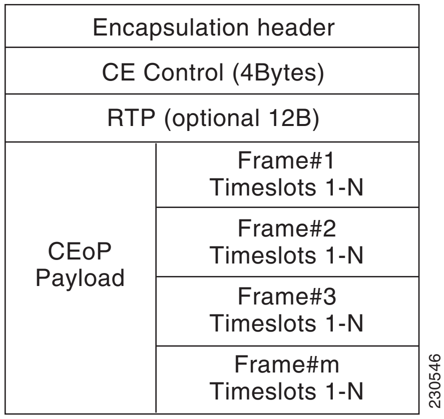


Table 7-3 shows the payload and jitter for the DS0 lines in the CESoPSN mode.

Table 7-3 CESoPSN DS0 Lines: Payload and Jitter Limits

DS0	Maximum Payload	Maximum Jitter	Minimum Jitter	Minimum Payload	Maximum Jitter	Minimum Jitter
1	40	320	10	32	256	8
2	80	320	10	32	128	4
3	120	320	10	33	128	4
4	160	320	10	32	64	2
5	200	320	10	40	64	2
6	240	320	10	48	64	2
7	280	320	10	56	64	2
8	320	320	10	64	64	2
9	360	320	10	72	64	2
10	400	320	10	80	64	2
11	440	320	10	88	64	2
12	480	320	10	96	64	2
13	520	320	10	104	64	2
14	560	320	10	112	64	2
15	600	320	10	120	64	2
16	640	320	10	128	64	2
17	680	320	10	136	64	2
18	720	320	10	144	64	2
19	760	320	10	152	64	2

DS0	Maximum Payload	Maximum Jitter	Minimum Jitter	Minimum Payload	Maximum Jitter	Minimum Jitter
20	800	320	10	160	64	2
21	840	320	10	168	64	2
22	880	320	10	176	64	2
23	920	320	10	184	64	2
24	960	320	10	192	64	2
25	1000	320	10	200	64	2
26	1040	320	10	208	64	2
27	1080	320	10	216	64	2
28	1120	320	10	224	64	2
29	1160	320	10	232	64	2
30	1200	320	10	240	64	2
31	1240	320	10	248	64	2
32	1280	320	10	256	64	2

For instructions on how to configure SAToP, see Configuring Structure-Agnostic TDM over Packet (SAToP).

Transportation of Service Using Ethernet over MPLS

Ethernet over MPLS (EoMPLS) PWs provide a tunneling mechanism for Ethernet traffic through an MPLS-enabled Layer 3 core network. EoMPLS PWs encapsulate Ethernet protocol data units (PDUs) inside MPLS packets and use label switching to forward them across an MPLS network. EoMPLS PWs are an evolutionary technology that allows you to migrate packet networks from legacy networks while providing transport for legacy applications. EoMPLS PWs also simplify provisioning, since the provider edge equipment only requires Layer 2 connectivity to the connected customer edge (CE) equipment. The Cisco ME 3600X-24CX Series Switch implementation of EoMPLS PWs is compliant with the RFC 4447 and 4448 standards.

The Cisco ME3600-24CX Switch supports VLAN rewriting on EoMPLS PWs. If the two networks use different VLAN IDs, the router rewrites PW packets using the appropriate VLAN number for the local network.

Configuring Structure-Agnostic TDM over Packet (SAToP)

Follow these steps to configure SAToP on the Cisco ME 3600X-24CX Series Switch:

	Command	Purpose
Step 1	**enable** **Example:** `Router>` **`enable`**	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router#` **`configure terminal`**	Enters global configuration mode.
Step 3	**card type [T1|E1]**	Selects the card type as T1 or E1
Step 4	**controller [T1|E1] 0/1** **Example:** `Router(config-controller)# controller t1`	Configures the T1 or E1 interface.
Step 5	**cem-group group-number** {**unframed** | **timeslots** *timeslot* } Example: `Router(config-if)#` **`cem-group 4 unframed`**	Assigns channels on the T1 or E1 circuit to the CEM channel. This example uses the **unframed** parameter to assign all the T1 timeslots to the CEM channel.
Step 6	`Router(config)#` **`interface CEM0/4`** `Router(config-if)#` **`no ip address`** `Router(config-if)#` **`cem 4`**	Defines a CEM group.
Step 7	`Router(config-if)#` **`xconnect 30.30.30.2 304 encapsulation mpls`**	Binds an attachment circuit to the CEM interface to create a pseudowire. This example creates a pseudowire by binding the CEM circuit 304 to the remote peer 30.30.2.304.
Step 8	**exit** **Example:** `Router(config)# exit` Router#	Exits configuration mode.

Note When creating IP routes for a pseudowire configuration, we recommend that you build a route from the xconnect address (LDP router-id or loopback address) to the next hop IP address, such as **ip route 30.30.30.2 255.255.255.255 1.2.3.4**.

Configuring Circuit Emulation Service over Packet-Switched Network (CESoPSN)

Follow these steps to configure CESoPSN on the Cisco ME 3600X-24CX Series Switch.

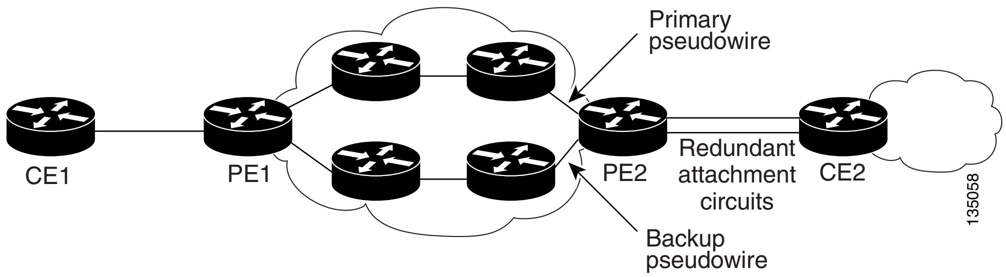
	Command	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**card type [T1|E1]**	Selects the card type as T1 or E1.
Step 4	`Router(config)#` **controller [e1|t1] 0/0** `Router(config-controller)#`	Enters configuration mode for the E1 or T1 controller.
Step 5	`Router(config-controller)#` **cem-group 5 timeslots 1-24**	Assigns channels on the T1 or E1 circuit to the circuit emulation (CEM) channel. This example uses the **timeslots** parameter to assign specific timeslots to the CEM channel.
Step 6	`Router(config-controller)#` **exit** `Router(config)#`	Exits controller configuration.
Step 7	`Router(config)#` **interface CEM0/5** `Router(config-if-cem)#` **cem 5**	Defines a CEM channel.
Step 8	`Router(config-if-cem)#` **xconnect 30.30.30.2 305 encapsulation mpls**	Binds an attachment circuit to the CEM interface to create a pseudowire. This example creates a pseudowire by binding the CEM circuit 5 to the remote peer 30.30.30.2. **Note** When creating IP routes for a pseudowire configuration, we recommend that you build a route from the xconnect address (LDP router-id or loopback address) to the next hop IP address, such as **ip route 30.30.30.2 255.255.255.255 1.2.3.4.**
Step 9	`Router(config-if-cem)#` **exit** `Router(config)#`	Exits the CEM interface.
Step 10	**exit** **Example:** `Router(config)# exit`	Exits configuration mode.

Configuring Pseudowire Redundancy

A backup peer provides a redundant pseudowire (PW) connection in the case that the primary PW loses connection; if the primary PW goes down, the Cisco ME 3600X-24CX Series Switch diverts traffic to the backup PW. This feature provides the ability to recover from a failure of either the remote PE router or the link between the PE router and CE router.

Figure 7-3 shows an example of pseudowire redundancy.

Figure 7-3 Pseudowire Redundancy



Note You must configure the backup pseudowire to connect to a router that is different from the primary pseudowire.

Follow these steps to configure a backup peer:

	Command	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal**	Enters global configuration mode.
Step 3	**pseudowire-class** [*pw-class-name*]	Specify the name of a Layer 2 pseudowire class and enter pseudowire class configuration mode.
Step 4	**encapsulation mpls**	Specifies MPLS encapsulation.
Step 5	**interface cem** *card/number*	Enters configuration mode for the cem interface. **Note** The card number is always 0.
Step 6	Router(config-if)# **xconnect 1.1.1.2 101 encapsulation mpls**	Binds the Ethernet port interface to an attachment circuit to create a pseudowire.
Step 7	Router(xconnect)# **backup peer** *peer-router-ip-address vcid* [**pw-class** *pw-class name*]	Defines the address and VC of the backup peer.
Step 8	**exit**	Exits configuration mode.

Verifying the Interface Configuration

You can use the following commands to verify your 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 attached circuit.

```
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
--------------------------------------------------------------
CEM0/1         1    UP        UP        ACTIVE          --/--
CEM0/1         2    UP        UP        ACTIVE          --/--
CEM0/1         3    UP        UP        ACTIVE          --/--
CEM0/1         4    UP        UP        ACTIVE          --/--
CEM0/1         5    UP        UP        ACTIVE          --/--
```

- **show cem circuit**—*D*isplays the detailed information about that particular circuit.

```
Router# show cem circuit 1
CEM0/1, ID: 1, Line State: UP, Admin State: UP, Ckt State: ACTIVE
Idle Pattern: 0xFF, Idle cas: 0x8, Dummy Pattern: 0xFF
Dejitter: 5, Payload Size: 40
Framing: Framed, (DS0 channels: 1-5)
Channel speed: 56
CEM Defects Set
Excessive Pkt Loss RatePacket Loss

Signalling: No CAS
Ingress Pkts:    25929              Dropped:             0
Egress Pkts:     0                  Dropped:             0
CEM Counter Details
Input Errors:    0                  Output Errors:       0
Pkts Missing:    25927              Pkts Reordered:      0
Misorder Drops:  0                  JitterBuf Underrun:  1
Error Sec:       26                 Severly Errored Sec: 26
Unavailable Sec: 5                  Failure Counts:      1
Pkts Malformed:  0
```

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

```
Router# show cem circuit summary
CEM Int.       Total Active  Inactive
--------------------------------------
CEM0/1          5     5       0
```

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