



## Managing TDM-CEM Services (RAN Backhaul)

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This chapter describes how to use Prime Provisioning to manage CEM classes, work with TDM-CEM policies, and manage TDM-CEM service requests. It contains the following sections:

- [Overview of RAN Backhaul Services, page 4-1](#)
- [Overview of the CEM TDM Service, page 4-3](#)
- [Prerequisites, page 4-4](#)
- [Managing CEM Classes, page 4-4](#)
- [Creating a TDM-CEM Policy, page 4-7](#)
- [Using Template Variables in TDM-CEM Services, page 4-11](#)
- [Managing TDM-CEM Service Requests, page 4-11](#)
- [Sample Configlets for TDM-CEM Services, page 4-21](#)

### Overview of RAN Backhaul Services

Radio access network (RAN) transport manages the backhaul traffic (both voice and data) from the cell site base transceiver stations (BTSs) to aggregation nodes and to base station controllers (BSCs), between BSCs, and between the BSC and an associated mobile switching center (MSC). [Figure 4-1](#) shows an example RAN backhaul topology.

Figure 4-1 Example RAN Backhaul Topology

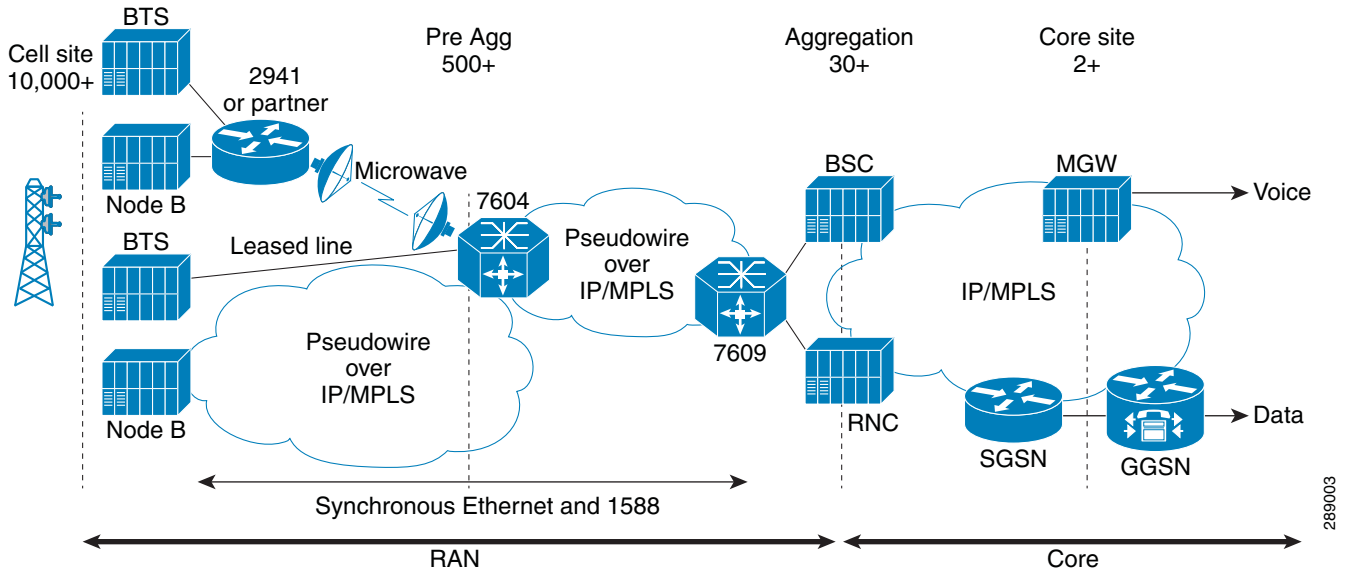
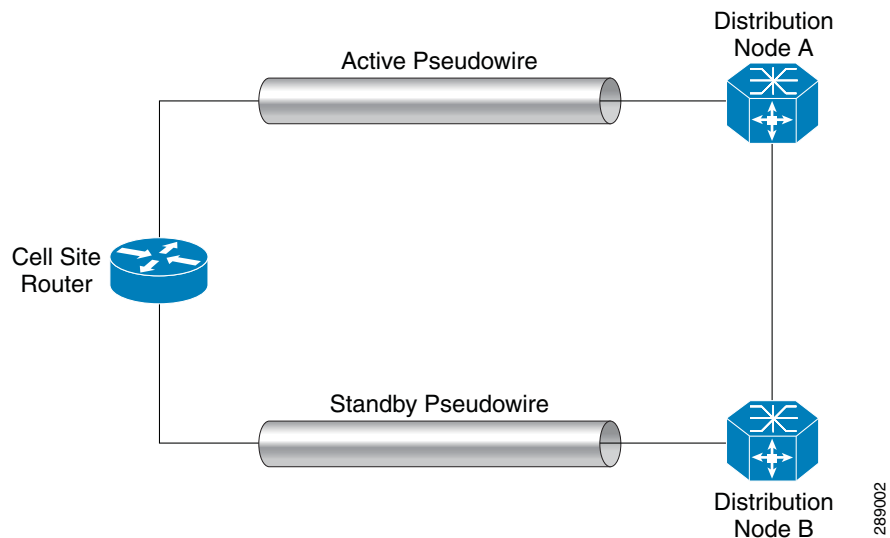


Figure 4-2 is an abstracted topology view that is used in this chapter when discussing how to configure RAN backhaul services in the Prime Provisioning GUI.

Figure 4-2 Abstracted RAN Backhaul Topology



Prime Provisioning is able to provision Internet Protocol based Radio Access Networking (IP RAN) services. This is performed through the Ethernet Virtual Circuit (EVC) policies and service requests within Prime Provisioning to configure the following services to enable RAN backhaul services:

- Circuit Emulation Time Delay Multiple Access (TDM-CEM)
- Pseudowire provisioning of Asynchronous Transfer Mode (ATM)

In addition, the EVC service requests use CEM and pseudowire class objects to bundle common attributes for reuse on every node where the service is provisioned.

The basic workflow for configuring and managing RAN backhaul services in Prime Provisioning, involves the following tasks:

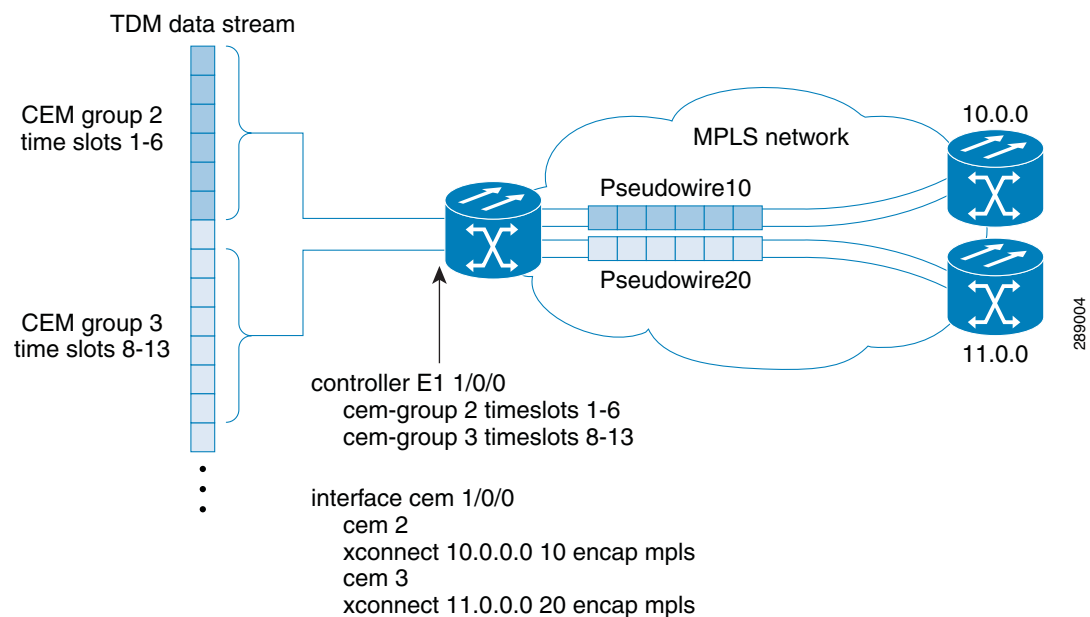
1. Verify prerequisites and preform necessary setup tasks.
2. Create CEM and/or pseudowire classes to be used in RAN backhaul policies and service requests.
3. Create the TDM-CEM or ATM policy.
4. Create template(s) for use in the TDM-CEM or ATM service request.
5. Create the TDM-CEM or ATM service request.
6. Deploy the service request to the device(s) on the network.

In this chapter, the above workflow tasks are documented for the TDM-CEM service.

## Overview of the CEM TDM Service

Circuit emulation is configured on a circuit emulation over packet (CEoP) shared port adaptor (SPA) to encapsulate time-division multiplexing (TDM) data in MPLS packets. It then sends the data over a CEM pseudowire to the remote provider edge (PE) router. An example topology is shown in [Figure 4-3](#).

**Figure 4-3** Example Circuit Emulation (CEM) Topology



Note the following points about this example:

- A TDM circuit is connected to port 0 on an SPA installed in slot 1, subslot 0 (E1 controller 1/0/0).
- Two pseudowires (PW10 and PW20) are configured to carry TDM data across the MPLS network.
- Two CEM groups (2 and 3) are configured for the data in the TDM time slots.
  - Time slots 1 through 6 are sent over pseudowire 10 to the remote PE router at 10.0.0.0.
  - Time slots 8 through 13 are sent to PE router 11.0.0.0 over pseudowire 20.

The following transport mechanisms are supported:

- SAToP PWE3—Structure Agnostic TDM over Packet / Pseudowire Edge-to-Edge
- CESoPSN PWE3—Circuit Emulation Service over Packet Switched Network / Pseudowire Edge-to-Edge

## Prerequisites

To create TDM-CEM policies and service requests, you must first define the service-related elements in Prime Provisioning, such as target devices and network links. Normally, you create these elements once. For some coverage of these tasks, see [Setting Up the Prime Provisioning Services, page 3-7](#).

Also see other chapters of this guide for how to perform basic infrastructure set up and discovery tasks. The information in the following chapters assumes you have already performed these preliminary tasks.

## Managing CEM Classes

A CEM class object is used to configure CEM interface parameters so that they can be applied to a group of CEM interfaces. The CEM class can then be selected for use in a TDM-CEM policy or service request. The CEM class object is used to configure the **cem class** command and its associated configuration settings on the devices configured by the service.



### Note

TDM-CEM policies and service requests can also use pseudowire classes. Information about creating and managing pseudowire classes is covered in another section of this guide. For more information, see [Creating and Modifying Pseudowire Classes, page 3-15](#).

This section covers the following topics:

- [Creating a CEM Class Object, page 4-4](#)
- [Editing a CEM Class Object, page 4-5](#)
- [Deleting a CEM Class Object, page 4-6](#)
- [Sample Configlets for CEM Classes, page 4-6](#)

## Creating a CEM Class Object

Perform the following steps to create a CEM class.

- 
- Step 1** From the top-level menu in the Prime Provisioning GUI, choose **Inventory > Logical Inventory > CEM Class**.
- The CEM Class window appears.
- Step 2** Click **Create**.
- The Create CEM Class window appears.
- Step 3** Enter appropriate values into the fields of the window as follows:
- **Name**—Name for the CEM class object. This field is mandatory.
  - **Description**—A description for the CEM class. This is optional.

- **Dejitter Buffer**—The size of the dejitter buffer used for network jitter in CEM configuration mode. The range is 1 to 500 milliseconds. This value is optional.
- **Payload Size**—The payload size used in CEM configuration mode. The range is 32 to 1312 bytes. This value is optional.
- **Idle Pattern**—The pattern of data used to replace the content of each lost CESoPSN data packet. The range is from 0x00 to 0xFF, in hexadecimal. The default pattern is 0xFF.
- **Dummy Mode**—The bit pattern that replaces lost and corrupted frames. To enable this mode, use the command `dummy-mode [last-frame | user-defined]`.  
Example: `Router(config-cem)# dummy-mode last-frame`  
The Dummy Mode options are:
  - **User Defined:** If you select this mode, it is mandatory to provide a dummy pattern.
  - **Last Frame:** The default Dummy mode. If you select this mode, the Dummy Pattern field is hidden and the dummy pattern value is automatically selected from the service.
  - **None:** If you select this mode, no attributes related to the mode and the pattern are included.
- **Dummy Pattern (hexadecimal pattern)**—If the Dummy Mode is set to User Defined, you can use the Dummy Pattern option to configure the dummy pattern. The range for this pattern is from 0x0 to 0xFF. The default value for the dummy pattern is 0xFF.  
Example:  
`Router(config-cem)# dummy-pattern 0x55`

**Step 4** Click **Save** to create the CEM class.

If the create operation is successful, a confirmation message appears, and the CEM Class window reappears showing the new CEM class in the Class Name column.

## Editing a CEM Class Object

Perform the following steps to edit a CEM class.

- 
- Step 1** From the top-level menu in the Prime Provisioning GUI, choose **Inventory > Logical Inventory > CEM class**.
- The CEM Class window appears showing any CEM classes already created in Prime Provisioning.
- Step 2** Check the check box for the CEM class you would like to edit.
- Step 3** Click the **Edit** button in the lower right of the window.
- The Edit CEM Class window appears.
- Step 4** Make changes to the attribute values as desired.
- Step 5** Click the **Save** button to save the changes.

If the edit is successful, a confirmation message is given, and the CEM Class window reappears.

---

Usage notes for editing CEM class objects:

- The name of a CEM class cannot be changed after it has been created. Therefore, the Name field cannot be modified when editing a CEM class. All other fields are editable.

- When you edit a CEM class that is being used by a service request, that particular service request is subsumed. When multiple service requests use the edited CEM class, all of service requests are subsumed. “Subsumed” means that the service request goes to the Requested state and is ready for deployment.
- When any of the attributes are changed in a CEM class that is associated with one or more TDM-CEM service requests, then all of the associated or affected service requests will be subsumed. A window appears in the GUI that shows the list of affected service requests. From the list of service requests, you can perform either of the following actions:
  - Click on the **Save** button to save the service request for a later deployment.
  - Click on the **Save and Deploy** button to save the service request. The service request goes to Requested state and is ready for deployment.

## Deleting a CEM Class Object

Perform the following steps to delete a CEM class.

- 
- Step 1** From the top-level menu in the Prime Provisioning GUI, choose **Inventory > Logical Inventory > CEM Class**.

The CEM Class window appears showing any CEM classes already created in Prime Provisioning.

- Step 2** Check the check box for the CEM class you would like to delete.

- Step 3** Click the **Delete** button in the lower right of the window.

A Confirm Delete window appears.

- Step 4** Click the **Delete** button to confirm the deletion.

If the delete operation is successful, a confirmation message appears, and the CEM Class window reappears with the deleted CEM class removed from the Class Name column.

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Usage notes for deleting CEM class objects:

- CEM classes in use with TDM-CEM policies or service requests cannot be deleted.

## Sample Configlets for CEM Classes

The following is a sample configlet generated to create a CEM class:

```
class cem ranCemClass
  payload-size 512
  dejitter-buffer 10
  idle-pattern 0x55
  !
```

The following is a sample configlet showing how a CEM class is included in a configuration:

```
interface cem 0/0
  no ip address
  cem 0
    cem class mycemclass
    xconnect 10.10.10.10 200 encapsulation mpls
  !
```

!

## Creating a TDM-CEM Policy

This section describes how to create a TDM-CEM policy.

You must define a TDM-CEM policy before you can provision a service. A policy can be shared by one or more service requests that have similar service requirements. A policy is a template of most of the parameters needed to define a the service request. After you define the policy, it can be used by all the service requests that share a common set of characteristics. You create a new TDM-CEM policy whenever you create a new type of service or a service with different parameters.

You can also associate Prime Provisioning templates and data files with a policy. See [Using Templates with Policies, page 11-20](#) for more about using templates and data files in policies.

It is also possible to create user-defined attributes within a policy (and service requests based on the policy). For background information on how to use the additional information feature, see [Appendix D, “Adding Additional Information to Services.”](#)

To start defining a TDM-CEM policy, perform the following steps.

---

**Step 1** Choose **Service Design > Policies > Policy Manager**.

The Policy Manager window appears.

**Step 2** Click **Create**.

The Policy Editor window appears.

**Step 3** Choose **EVC** from the Policy Type drop-down list.

The Policy Editor window appears.

**Step 4** Enter a **Policy Name** for the EVC policy.

**Step 5** Choose the **Policy Owner** for the EVC policy.

There are three types of EVC policy ownership:

- Customer ownership
- Provider ownership
- Global ownership—Any service operator can make use of this policy.

This ownership has relevance when the Prime Provisioning Role-Based Access Control (RBAC) comes into play. For example, an EVC policy that is customer-owned can only be seen by operators who are allowed to work on this customer-owned policy. Similarly, operators who are allowed to work on a provider's network can view, use, and deploy a particular provider-owned policy.

**Step 6** Click **Select** to choose the owner of the EVC policy.

The policy owner was established when you created customers or providers during Prime Provisioning setup. If the ownership is global, the Select function does not appear.

**Step 7** Choose the **Circuit-Emulation-TDM** as the **Policy Type**.

**Step 8** Click **Next**.

The Policy Editor window appears.

**Step 9** Continue with the steps contained in the next section, [Setting the Service Options, page 4-8](#).

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## Setting the Service Options

To set the service options for the TDM-CEM policy, perform the following steps.


**Note**

The MPLS Core Connectivity attributes set to PSEUDOWIRE by default and cannot be changed.

**Step 1** Choose one of the **TDM CEM** from the drop-down list.

The choices are:

- **SAToP\_UNFRAMED**—Structure-agnostic TDM over packet. This mode used to encapsulate T1 or E1 or SERIAL unstructured (unchannelized) services over packet-switched networks. In SAToP mode, bytes are sent out as they arrive on the TDM line. Bytes do not have to be aligned with any framing. In this mode, the interface is considered as a continuous framed bit stream. All signaling is carried transparently as a part of a bit stream.
- **CESoPN\_TIMESLOT**—Circuit emulation services over packet-switched network. This mode is used to encapsulate T1 or E1 or SERIAL structured (channelized) services over PSN. CESoPN identifies framing and sends only payload, which can be channelized T1s within DS3, and DS0s within T1. DS0s can be bundled into the same packet.

**Step 2** Choose the **CEM Container Type** from the drop-down list.

The choices are:

- **T1**—T-1 digital circuit. Transmits voice/data over the PSTN network at 1.544 Mbps using the DS-1 (Digital Signalling level 1) signaling format.
- **E1**—E-1 digital circuit. Transmits 30 64Kbps digital channels (DS0) for voice or data calls, plus a 64Kbps channel for signaling, and a 64Kbps channel for framing and maintenance.
- **SERIAL**— SERIAL data circuit-terminating equipment (DCE). Sub-Rate (<64kbps) serial line speeds, only one time slot is used in the TDM frame.


**Note**

Sub-rate (below DS0 bandwidth) Async (R232) data over MPLS MPLS using T1/E1 CESoP is not supported.

**Step 3** Choose the **Framing Type** from the drop-down list.

The choices are:

- **SDH**—Synchronous Digital Hierarchy.
- **SONET**—Synchronous Optical Networking.

These are related standards for synchronous data transmission over fiber optic networks. Details of these protocols are not covered in this user guide.

**Step 4** Click **Next**.

The Policy Editor window appears.

**Step 5** Continue with the steps contained in the next section, [Setting the Service Attributes, page 4-9](#).



## Setting the Service Attributes

To set the service attributes for the TDM-CEM policy, perform the following steps.

- 
- Step 1** Check the **Enable PseudoWire Redundancy** check box to enable pseudowire redundancy (alternative termination device) under certain conditions.
- See [Appendix B, “Terminating an Access Ring on Two N-PEs”](#) and, specifically, the section [Using N-PE Redundancy in FlexUNI/EVC Service Requests, page B-3](#), for notes on how this option can be used.
- Step 2** Check the **AutoPick VC ID** check box to have Prime Provisioning autopick the VC ID during service request creation.
- If this check box is unchecked, the operator will be prompted to specify a VC ID during service request creation.
- Usage notes:
- When AutoPick VC ID is checked, Prime Provisioning allocates a VC ID for pseudowires from the Prime Provisioning-managed VC ID resource pool.
- Step 3** Click **Next**.
- The Policy Editor window appears.
- Step 4** Continue with the steps contained in the next section, [Using Pseudowire and CEM Classes, page 4-9](#).
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## Using Pseudowire and CEM Classes

To specify a pseudowire or CEM class to be used by the TDM-CEM policy, perform the following steps.

- 
- Step 1** Check the **Use PseudoWireClass** check box to enable the selection of a pseudowire class.
- This attribute is unchecked by default.
- Usage notes:
- The pseudowire class name is used for provisioning **PseudoWireClass** commands on IOS and IOS XR devices. See [Creating and Modifying Pseudowire Classes, page 3-15](#) for additional information on pseudowire class support.
  - If **Use PseudoWireClass** is checked, an additional attribute, **PseudoWireClass** appears in the GUI. Click the **Select** button to choose a pseudowire class previously created in Prime Provisioning.
- Step 2** Select an L2VPN group name for the CEM class from the drop-down list. Your options are:
- ISC
  - VPNSC
  - Other options derived from a configurable DCPL property.
- Usage Notes:
- This attribute is used for provisioning the L2VPN group name on IOS XR devices. For information about how to define the L2VPN Group Name choices available in the drop-down list, see [Defining L2VPN Group Names for IOS XR Devices](#).
  - The L2VPN Group Name attribute is not available if the MPLS core connectivity type is set as VPLS in the window.

- Step 3** To enable Prime Provisioning to generate an E-Line name automatically, check the **Autopick E-Line Name** checkbox. Or, specify the point-to-point (p2p) E-line name for the CEM class manually. This attribute is not available if the MPLS core connectivity type is set to VPLS in the window. If you enable Prime Provisioning to generate the E-Line name automatically, the E-line name generated is of the format **HostNameOfDeviceAtTerminalA\_VCID**. In case of the Z-backup nodes, the format used is **HostNameOfDeviceAtTerminalA\_BackupVCID**. E-Line Name is only applicable for IOS XR devices.
- Step 4** Check the **Use CEM Class** check box to enable the selection of a CEM class. This attribute is unchecked by default.
- Usage notes:
- The CEM class is used for provisioning **cem class ranCemClass** commands on IOS devices. See [Managing CEM Classes, page 4-4](#) for additional information on CEM class support.
  - If **Use CEM Class** is checked, an additional attribute, **CEM Class**, appears in the GUI. Click the **Select** button to choose a CEM class that was previously created in Prime Provisioning.
  - Use CEM Class is applicable to IOS and IOS-XR devices.
- Step 5** Click **Next**.  
The Policy Editor window appears.
- Step 6** Continue with the steps contained in the next section, [Adding User-Defined Fields into the TDM-CEM Policy Workflow, page 4-10](#).

## Adding User-Defined Fields into the TDM-CEM Policy Workflow

The Additional Information window allows you to create user-defined attributes within the policy (and service requests based on the policy). For information on how to use the additional information feature, see [Appendix D, “Adding Additional Information to Services.”](#)

Continue with the steps contained in the next section, [Enabling Template Association, page 4-10](#).

## Enabling Template Association

The Prime Provisioning template feature gives you a means to download free-format CLIs to a device. If you enable templates, you can create templates and data files to download commands that are not currently supported by Prime Provisioning.



### Note

Template variable support is available for TDM-CEM services. An example template and data file is available containing the CEM-related variables. See the next section [Using Template Variables in TDM-CEM Services, page 4-11](#), for how to access and use this template.

- Step 1** To enable template association for the policy, click the **Next** button in the Interface Attribute window (before clicking **Finish**).

The Template Association window appears. In this window, you can enable template support and, optionally, associate templates and data files with the policy. For instructions about associating templates with policies and how to use the features in this window, see [Using Templates with Policies, page 11-20](#).

- Step 2** When you have completed setting up templates and data files for the policy, click **Finish** in the Template Association window to close it and return to the Policy Editor window.
- Step 3** To save the TDM-CEM policy, click **Finish**.
- 

To create a service request based on an CDM TEM policy, see [Managing TDM-CEM Service Requests, page 4-11](#).

## Using Template Variables in TDM-CEM Services

This section describes how to access and use the example CEM template in Prime Provisioning.

To create a data file for the example CEM template, perform the following steps.

- 
- Step 1** In the Prime Provisioning GUI, choose **Service Design > Templates > Template Manager**.  
The Template Manager window appears.
- Step 2** In the **Templates** window, click on the root folder to expand it.  
A list of subfolders appears, with the Examples folder on top.
- Step 3** Click the Examples folder to expand it.  
Several sample templates are visible, including the CEM template.
- Step 4** Click on the CEM folder to choose it.  
The CEM template shows in the Template window, along with a pre-loaded CEMProvisioning data file in the Data File Name column of the table.
- Step 5** Either click the **Edit** button to edit the CEMProvisioning data file or else uncheck it and click **Create Data File** to create a new one.  
In either case, the Data File Editor window appears. You can use this file to map the template variables required for provisioning TDM-CEM services.
- Step 6** When you have made the desired changes to the templates variables, click **Save** to save the changes.
- Step 7** Click **Close** to close the Data File Editor window.
- 

## Managing TDM-CEM Service Requests

This section describes the various tasks of the workflow for managing TDM-CEM service requests. It contains the following sections:

- [Creating a TDM-CEM Service Request, page 4-12](#)
- [Setting the Service Request Details, page 4-12](#)
- [Selecting Devices, page 4-14](#)

- [Modifying the TDM-CEM Service Request, page 4-18](#)
- [Using Templates and Data Files with a TDM-CEM Service Request, page 4-19](#)
- [Saving the TDM-CEM Service Request, page 4-19](#)

## Creating a TDM-CEM Service Request

To begin creating the TDM-CEM service request, perform the following steps.

- 
- Step 1** Choose **Operate > Service Requests > Service Request Manager**.  
The Service Request Manager window appears.
- Step 2** Click **Create**.  
The Service Request Editor window appears.
- Step 3** From the Policy drop-down list, choose an TDM-CEM policy from the policies previously created (see [Creating a TDM-CEM Policy, page 4-7](#)). This will be a policy of type EVC, as noted by (EVC) following the policy name.  
The EVC Service Request editor window appears. This the first window of the workflow in which you can add and modify attributes for the service request. The new service request inherits all the properties of the chosen policy, such as all the editable and non-editable features and pre-set parameters.
- Step 4** Continue with the steps contained in the next section, [Setting the Service Request Details, page 4-12](#).
- 

## Setting the Service Request Details

To set the attributes in the Service Request Details section, perform the following steps.



### Note

The **Job ID** and **SR ID** fields are read-only. When the service request is being created for the first time, the fields display a value of NEW. When an existing service request is being modified, the values of the fields indicate the respective IDs that the Prime Provisioning database holds within the editing flow of the service request.



### Note

The **Policy Name** field is read-only. It displays the name of the policy on which the service request is based. Clicking on the read-only policy name displays a list of all the attribute values set within the policy.

- 
- Step 1** Check the **AutoPick VC ID** check box if you want Prime Provisioning to choose a VC ID.  
If you do not check this check box, you will be prompted to provide the ID in the VC ID field, as covered in the next step.  
When AutoPick VC ID is checked, Prime Provisioning allocates a VC ID for pseudowires from the Prime Provisioning-managed VC ID resource pool. In this case, the text field for the VC ID option is non-editable.
- Step 2** If AutoPick VC ID was unchecked, enter a VC ID in the **VC ID** field.

Usage notes:

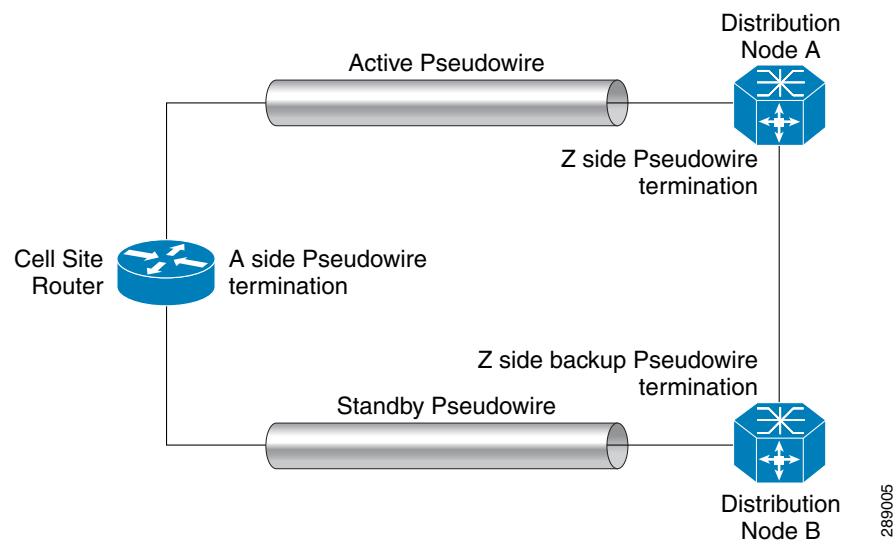
- The VC ID value must be an integer value corresponding to a VC ID.
- When a VC ID is manually allocated, Prime Provisioning verifies the VC ID to see if it lies within Prime Provisioning's VC ID pool. If the VC ID is in the pool but not allocated, the VC ID is allocated to the service request. If the VC ID is in the pool and is already in use, Prime Provisioning prompts you to allocate a different VC ID. If the VC ID lies outside of the Prime Provisioning VC ID pool, Prime Provisioning does not perform any verification about whether or not the VC ID allocated. The operator must ensure the VC ID is available.
- The VC ID can be entered only while creating a service request. If you are editing the service request, the VC ID field is not editable.

**Step 3** Check the **PseudoWire Redundancy** check box to enable pseudowire redundancy (alternative termination device) under certain conditions.

Usage notes:

- When PseudoWire Redundancy is unchecked, pseudowire redundancy is not provisioned in the service request. Therefore, there will be only two devices actively contributing to the service. See [Figure 4-4](#) for an example configuration. One device is the "A" side of the pseudowire and one side is the "Z" side of the pseudowire. In this case, you would not be able to enter a Backup PW VC ID.

**Figure 4-4** Pseudowire Termination Example



- When PseudoWire Redundancy check box is enabled there will be three devices actively contributing to the service. One device will be on the "A" side of pseudowire, and the other device will be on the "Z" side. In this case, you could configure the "Z" backup pseudowire using the Backup PW VC ID attribute.
- See [Appendix B, "Terminating an Access Ring on Two N-PEs"](#) and, specifically, the section [Using N-PE Redundancy in FlexUNI/EVC Service Requests, page B-3](#), for notes on how this option can be used.

**Step 4** If appropriate for the configuration, enter a VC ID for the backup pseudowire in the **Backup PW VC ID** field.

The backup VC ID behaves the same as the VC ID of the primary pseudowire.

**Step 5** Choose the **CEM Container Type** from the drop-down list.

The choices are:

- **T1**—T-1 digital circuit. Transmits voice/data over the PSTN network at 1.544 Mbps using the DS-1 (Digital Signalling level 1) signaling format
- **E1**—E-1 digital circuit. Transmits 30 64Kbps digital channels (DS0) for voice or data calls, plus a 64Kbps channel for signaling, and a 64Kbps channel for framing and maintenance.
- **SERIAL**— SERIAL data circuit-terminating equipment (DCE). Sub-Rate (<64kbps) serial line speeds, only one time slot is used in the TDM frame.



**Note** Sub-rate (below DS0 bandwidth) Async (R232) data over MPLS MPLS using T1/E1 CESoP is not supported.

Usage notes:

- If the CEM Container Type is set to T1, the Framing Type attribute dynamically appears in the GUI, which can be set as covered in the next step.

**Step 6** Choose the **Framing Type** from the drop-down list.

The choices are:

- **SDH**—Synchronous Digital Hierarchy.
- **SONET**—Synchronous Optical Networking.

These are related standards for synchronous data transmission over fiber optic networks. Details of these protocols are not covered in this user guide.

**Step 7** Check the **Use CEM Class** check box to enable the selection of a CEM class object.

Usage notes:

- The CEM class is editable at the service request level. Therefore the CEM class can be modified from the one set in the policy for the service request. If the CEM class is not changed, the one specified in the policy will be retained for service provisioning.
- The CEM class is used for provisioning **cem class ranCemClass** commands on IOS devices. See [Managing CEM Classes, page 4-4](#) for additional information on CEM class support.
- If **Use CEM Class** is checked, an additional attribute, **CEM Class**, appears in the GUI. Click the **Select** button to choose a CEM class previously created in Prime Provisioning.
- Use CEM Class is only applicable for IOS devices.

**Step 8** Continue with the steps contained in the next section, [Selecting Devices, page 4-14](#).

## Selecting Devices

The Select Devices section of the EVC Service Request Editor window allows you to set up links to the N-PE. In Prime Provisioning, devices added for TDM-CEM provisioning are considered as N-PE role-based devices. After the device is selected, you choose controllers and set other attributes for the devices.

The configuration example shown in [Figure 4-4](#) is also used in this section.

Perform the following steps.

- Step 1** Click the **Select Device** link to choose the “A” side pseudowire termination point.  
The Select PE Device window appears.



**Note** The device types supported at the “A” node include MWR 2941-DC, 760X, ASR901, ASR903, and ME36xx series devices having appropriate CEoP and SPA line cards.

- Step 2** Choose the appropriate device and click **Save**.

- Step 3** In the Controller column, choose the desired controllers from the drop-down list for the device.

Usage notes:

- The controllers that display in the drop-down list depend on the value of in the CEM Container Type attribute specified above.
- If the CEM Container Type is TI, only T1 controllers are populated in the list. If the container type is E1, only E1 controllers appear in the list. If the container type is SERIAL, only SERIAL controllers appear in the list.
- If there are no controllers for the given type on the selected device, the drop-down list will be empty.
- Also, if CEM Container Type is TI, the value of the addition Framing Type attribute changes the list of controllers. For example, if the Framing Type is SONET, then SONET controllers are displayed in the controller list. Then selecting a SONET controller from the list and clicking on Edit opens the SONET controller attributes window. If the Framing Type is SDH, then selecting a SONET controller from the list and clicking Edit opens the SDH controller attributes window.

- Step 4** After selecting the controller for the “A” side termination device, click the **Edit** link in the Link Attributes column to set the controller attributes.

The EVC Service Request Editor - Standard UNI Details window appears. This displays a list of either T1/E1/SERIAL controller attributes.

- Step 5** Set T1/E1/SERIAL controller attributes for the “A” side terminal device.

#### Attributes for T1/E1controller:

- **Auto-Pick CEM Group ID**—By default, the check box is always checked and the CEM group ID text box is disabled. The auto-generated CEM group ID appears in the CEM group ID text box after deploying the service request. To enter the value manually, uncheck the check box and enter the value in the CEM group ID text box.
- **CEM Group ID**—The CEM Group ID under the controller creates a CEM interface that has the same slot/subslot/port information as the controller. The number it can take depends on the E1 or T1 line.
- **Clock Source**—INTERNAL or LINE. The default is INTERNAL.
- **Time-Slot Range**—A value from 1 to 31 for T1 controllers, or from 1 to 24 for E1 controllers.



**Note** Note that the Time-Slot Range attribute only appears if the TDM CEM attribute in the policy was set to CESoPN\_TIMESLOT. It does not appear if the attribute was set to SAToP\_UNFRAMED.

#### Attributes for SERIALcontroller:

- **Channel Group**—The value is always default. The default value is 0.
- **Raw Socket Packet Length**—A value from 2 to 1400.

- **Raw Socket Packet Timer**—A value from 3 to 1000.
- **Number of Data Bits**—The values are 5, 6, 7 and 8.
- **Terminal Parity**—NONE, EVEN, ODD, MARK and SPACE from the drop-down list.
- **Async line stop bits**—The values are 1, 1.5 and 2.
- **Transmit and Receive Speeds**—A value from 0 to 4294967295.
- **Use PseudoWireClass**—Check the check box to associate an existing pseudowire class with the service request. A Select button appears in the GUI, which you can use to choose a pseudowire class. Uncheck the check box to dissociate the pseudowire class from the service request.
- **Use Backup PseudoWireClass**—(This attribute is only available when the Pseudowire Redundancy attribute is checked.) Check the check box to associate an existing pseudowire class as a backup pseudowire class with the service request. A Select button appears in the GUI, which you can use to choose a backup pseudowire class. Uncheck the check box to dissociate the pseudowire class from the service request. The functionality is similar to Pseudowire Class selection in the service request window. The Use Backup PseudowireClass attribute is only applicable for “A” terminals and not for “Z” and “Z - Backup” terminals.
- **L2VPN Group Name**— Select an L2VPN group name for the CEM class from the drop-down list. Your options are SC, VPNSC, and other options derived from a configurable DCPL property. This attribute is used for provisioning the L2VPN group name on IOS XR devices. For information about how to define the L2VPN Group Name choices available in the drop-down list, see Defining L2VPN Group Names for IOS XR Devices. The L2VPN Group Name attribute is not available if the MPLS core connectivity type is set as VPLS in the window.
- **Autopick E-Line Name**— Select this checkbox to enable Prime Provisioning to generate an E-Line name automatically. Or, specify the point-to-point (p2p) E-line name for the CEM class manually. This attribute is not available if the MPLS core connectivity type is set to VPLS in the window. If you enable Prime Provisioning to generate the E-Line name automatically, the E-line name generated is of the format **HostNameOfDeviceAtTerminalA\_VCID**. In case of the Z-backup nodes, the format used is **HostNameOfDeviceAtTerminalA\_BackupVCID**. E-Line Name is only applicable for IOS XR devices.

- Step 6** After setting the attributes for the T1/E1/SERIAL controllers for the “A” terminal device, click **OK**. The EVC Service Request Editor window reappears.
- Step 7** Select the “Z” and, if applicable, the “Z - Backup” terminal devices and their controllers following the same steps you performed for the “A” terminal device.
- SONET controllers are populated in the Controller drop-down list for “Z” and “Z - Backup” terminal devices.
- Step 8** After selecting the controllers for these termination devices, click the **Edit** link in the Link Attributes column to set the controller attributes.
- The Standard UNI Details window appears, displaying SONET controller attributes,
- Step 9** Set the SONET controller attributes.
- The SONET attributes that display in this window depend on the CEM Container Type, SONET controller framing type, administrative unit group (AUG) mapping, and channelization mode. This is summarized in [Table 4-1](#).



Table 4-1 CEM Container Type and SONET Controller Attributes

CEM Container Type	SONET Controller Framing Sequence	AUG Mapping	Channelization Mode (IOS)	Channelization Mode (IOS-XR)
E1	SDH	Au-4	C-12	C-12-E1
T1	SDH	Au-3	C-11	C-11-T1
T1	SONET	N/A	STS-1	VT15-T1
SERIAL	SONET	N/A	N/A	N/A

The superset of possible attributes is provided below for reference. What actually appears in the GUI depends on the selections previously made in the GUI.

- **Auto-Pick CEM Group ID**—When the Auto-Pick CEM Group ID check box is checked the CEM group ID text box is disabled. The auto-generated CEM group ID appears in the CEM group ID text box after deploying the service request.
- **CEM Group ID**—The CEM Group ID under the controller creates a CEM interface that has the same slot/subslot/port information as the controller. The number it can take depends on the E1 or T1 line. A number from 0 to 23.
- **Clock Source**—INTERNAL or LINE. The default is INTERNAL.
- **AUG-Mapping**—Configures administrative unit group (AUG) mapping when SDH framing is selected. au-3 or au-4.
- **Resource Availability**—Click this link to check the resources that have been configured or provisioned on the same controller that belongs to the same device through a different service in Prime Provisioning. This feature is applicable to EVC-TDM service blades on IOS and XR platforms only. It is not applicable to ATM services.
- **Width**—Width of an E1 controller. The value can range from 1 to 3. By default, the value is 3. This field is hidden when an IOS device is selected.
- **Channelization Mode**— Mode used to specify TDM Channelization. c-11, c-12, or sts-1.
- **au3 Number**—A number in the range from 1 to 3. This is used to configure a particular Administrative Unit type 3 (AU-3) of an E1 line that has been mapped to an AU-.3.
- **sts-1 Number**—A number user to identify a Synchronous Transport Signal. A number from 1 to 3.
- **sts-1 Mode**—Synchronous Transport Signal. It specifies VT-15 as the STS-1 mode of operation.
- **tug-2 Number**—Tributary Unit group type 2 (TUG-2). A number from 1 to 3, or 1 to 7, depending on the container type (E1 or T1). The user must set the value in the text box. There is no default value.
- **tug-3 Number**—Tributary Unit group type 3 (TUG-3). A number from 1 to 3. The user must set the value in the text box. There is no default value.
- **VTG Number**—Virtual tributary group carrying a T1. A number, or range of numbers, from 1 to 7.
- **T1 Line Number**—Specifies the T1 number for which service needs to be configured. A number from 1 to 4.
- **E1 Number**—Specifies the E1 number for which a service needs to be configured. A number from 1 to 3.
- **Time Slot**—A number from 1 to 24, or 1 to 31, depending on the container type (E1 or T1)
- **Time-Slot Range**—A number from 1 to 31 for T1 controllers, or from 1 to 24 for E1 controllers.



**Note** Note that the Time-Slot Range attribute only appears if the TDM CEM attribute in the policy was set to CESoPN\_TIMESLOT. It does not appear if the attribute was set to SAToP\_UNFRAMED.

- **Use PseudoWireClass**—Check the check box to associate an existing pseudowire class with the service request. A Select button appears in the GUI, which you can use to choose a pseudowire class. Uncheck the check box to dissociate the pseudowire class from the service request.

**Step 10** After the SONET controller values are set, click **OK**.

The EVC Service Request Editor window appears.

**Step 11** If desired, use the **Swap Terminals** drop-down list to reorder the devices in relation to the terminals.

The choices are based on the configuration:

- **Swap A - Z**
- **Swap A - Z Backup**
- **Swap Z- Z Backup**

Choose one of the options to perform the swap operation. The devices reorder in the Select Devices column based on the selection.

Usage notes:

- The Swap Terminals button only appears when you first create the service request. If you later edit the service request, the button does not appear and you cannot perform the swap operation at that time.
- The Swap A - Z Backup and Swap Z - Z Backup options are available only when the Pseudowire Redundancy attribute is checked.
- When devices and terminals are swapped, the controllers must be reset in the Controller column.

**Step 12** When you have completed setting the attributes in the EVC Service Request Editor window, click the **Save** button at the bottom of the window to save the settings and create the service request.

If any attributes are missing or incorrectly set, Prime Provisioning displays a warning. Make any corrections or updates needed (based on the information provided by Prime Provisioning), and click the **Save** button.

For information on modifying an EVC service request see the section [Modifying the TDM-CEM Service Request, page 4-18](#). For additional information about saving an TDM-CEM service request, see [Saving the TDM-CEM Service Request, page 4-19](#).

## Modifying the TDM-CEM Service Request

You can modify a TDM-CEM service request if you must change or modify the links or other settings of the service request.

To modify a service request, perform the following steps.

**Step 1** Choose **Operate > Service Requests > Service Request Manager**.

The Service Request Manager window appears, showing service requests available in Prime Provisioning.

- Step 2** Check a check box for a service request.
- Step 3** Click **Edit**.  
EVC Service Request Editor window appears.
- Step 4** Modify any of the attributes, as desired.
- Step 5** To add a template/data file to an attachment circuit, see the section [Using Templates and Data Files with a TDM-CEM Service Request](#), page 4-19.
- Step 6** When you are finished editing the TDM-CEM service request, click **Save**.  
For additional information about saving an TDM-CEM service request, see [Saving the TDM-CEM Service Request](#), page 4-19.
- 

## Using Templates and Data Files with a TDM-CEM Service Request

Prime Provisioning does not support configuration of all the available CLI commands on a device being managed by the application. In order to configure such commands on the devices, you can use Prime Provisioning Template Manager functionality. Templates can be associated at the policy level on a per-device role basis. Templates can be overridden at service request level, if the policy-level setting permits the operator to do so.

To associate templates and data files in a service request select any link in the Service Request Editor window and click the **Template** button at the bottom of the window.



### Note

If the template feature has not been enabled in the associated policy then the Template button will not be available for selection.

The SR Template Association window appears. In this window, you can associate templates at a per-device level. The SR Template Association window lists the devices comprising the link, the device roles, and the template(s)/data file(s) associated with the devices. In this case, the template(s)/data file(s) have not yet been set up.

For further instructions on how to associate templates and data files with a service request, see [Using Templates with Service Requests](#), page 11-24.

## Saving the TDM-CEM Service Request

To save an TDM-CEM service request, perform the following steps.

- Step 1** When you have finished setting the attributes for the service request, click **Save** to create the service request.
- If the service request is successfully created, the Service Request Manager window appears. The newly created TDM-CEM service request is added with the state of REQUESTED.
- If, however, the service request creation fails for some reason (for example, a value chosen is out of bounds), you are warned with an error message. In such a case, you should correct the error and save the service request again.

**Step 2** If you are ready to deploy the TDM-CEM service request, see [Deploying Service Requests, page 10-9](#).

For sample configlets for TDM-CEM services, see the section [Sample Configlets for TDM-CEM Services, page 4-21](#).

## Creating an E1-E1, T1-T1 and SERIAL- SERIAL circuit using Prime Provisioning

Prime Provisioning enables you to provision an E1-E1 circuit by selecting E1 controllers at both Terminal A and Terminal Z ends of the PW terminal. To select the E1 controller at Z-backup terminal in the service request, the Enable PseudoWire Redundancy check box must be selected during Service Request creation.

The table below lists the different possible combinations for either E1-E1 or T1-T1 or SERIAL-SERIAL service provisioning.

**Table 4-2** Combinations for E1-E1 or T1-T1 Service Provisioning

Controller at A	Controller at Z	Controller at Z-Backup
E1 (IOS)	E1 (IOS/IOS-XR)	E1 (if PW redundancy enabled) (IOS/IOS-XR)
T1 (IOS)	T1 (IOS/IOS-XR)	T1 (if PW redundancy enabled) (IOS/IOS-XR)
SERIAL (IOS)	SERIAL (IOS)	SERIAL (if PW redundancy enabled) (IOS)

To view the sample configlets generated between E1 controllers, see:

- [TDM-CEM between E1 controllers \(IOS-XR device\), page 4-29](#)
- [TDM-CEM between T1 controllers \(IOS device\), page 4-30](#)

# Sample Configlets for TDM-CEM Services

This section provides sample configlets for RAN backhaul service provisioning in Prime Provisioning. It contains the following subsections:

- [Overview, page 4-21](#)
- [TDM-CEM using SAToP PW3, page 4-22](#)
  - [TDM-CEM using framing type SDH \(IOS-XR device\), page 4-23](#)
  - [TDM-CEM using framing type SONET \(IOS device\), page 4-24](#)
  - [TDM-CEM using framing type SONET \(IOS-XR device\), page 4-25](#)
- [TDM-CEM using CESoPSN, page 4-27](#)
  - [TDM-CEM between E1 controllers \(IOS device\), page 4-28](#)
  - [TDM-CEM between E1 controllers \(IOS-XR device\), page 4-29](#)
  - [TDM-CEM between T1 controllers \(IOS device\), page 4-30](#)
  - [TDM-CEM between T1 controllers \(IOS-XR device\), page 4-31](#)
  - [TDM-CEM between SERIAL controllers \(IOS device\), page 4-32](#)

## Overview

The configlets provided in this section show the CLIs generated by Prime Provisioning for particular services and features. Each configlet example provides the following information:

- Service
- Feature
- Devices configuration (network role, hardware platform, relationship of the devices and other relevant information)
- Sample configlets for each device in the configuration
- Comments

**Note**

The configlets generated by Prime Provisioning are only the delta between what needs to be provisioned and what currently exists on the device. This means that if a relevant CLI is already on the device, it does not show up in the associated configlet.

**Note**

The CLIs shown in bold are the most relevant commands.

## TDM-CEM using SAToP PW3

### Configuration

- Service: RAN Backhaul.
- Feature: This sections contains sample configlets that would be generated for TDM-CEM SAToP PW3 service on a cell site router and two distribution nodes (A and B).
- Device configuration:
  - The cell site router is an MWR 2941-DC router with an IOS image.  
Controller: E1 0/0  
Interface(s): CEM 0/0
  - Distribution node A is a 760X series device with IOS image.  
Contoller: SONET 3/0/0  
Interface(s): CEM 3/0/0
  - Distribution node B is a 760X series device with IOS image.  
Contoller: SONET 3/0/0  
Interface(s): CEM 3/0/0

### Configlets

#### Cell Site Router

```
pseudowire-class c76a3-1
  encapsulation mpls
!
pseudowire-class c76a3-2
  encapsulation mpls
!
controller E1 0/0
  clock source internal
  cem-group 0 unframed
!
interface CEM0/0
  no ip address
  cem 0
  xconnect 10.0.0.1 2090102001 pw-class c76a3-1
  backup peer 10.0.0.4 2090403001 pw-class c76a3-2
```

Distribution Node A	Distribution Node B
<pre> pseudowire-class c76a3-1  encapsulation mpls  preferred-path interface Tunnel211 ! controller SONET 3/0/0  ais-shut  framing sdh  clock source line  aug mapping au-4 !  au-4 1 tug-3 2   mode c-12  tug-2 1 e1 1 description m29a2-3(CEM0/0)   tug-2 1 e1 1 cem-group 100 unframed ! interface CEM3/0/0  no ip address  cem 100   xconnect 10.0.0.1 2090102001 pw-class   c76a3-1 sequencing both </pre>	<pre> pseudowire-class c76a3-2  encapsulation mpls  preferred-path interface Tunnel340 ! controller SONET 3/0/0  ais-shut  framing sdh  clock source line  aug mapping au-4 !  au-4 1 tug-3 2   mode c-12  tug-2 1 e1 1 description m29a2-3(CEM0/0)   tug-2 1 e1 1 cem-group 100 unframed   tug-2 1 e1 1 framing unframed ! interface CEM3/0/0  cem 100   xconnect 10.0.0.4 2090403001 pw-class   c76a3-2 sequencing both </pre>

**Comments**

- None.

## TDM-CEM using framing type SDH (IOS-XR device)

**Configuration**

- Service: RAN Backhaul.
- Feature: This sections contains sample configlets generated for TDM-CEM SAToP PW3 service on a cell site router with an IOS-XR image and two distribution nodes (Z and Z-backup).
- Device configuration:
  - The cell site router could be a device belonging to any of MWR 2941-DC, ASR901, ASR903, 7600X or ME36XX platform running on an IOS image"
    - Controller: E1 0/4
    - Interface(s): CEM 0/4
  - Distribution node A is an ASR9K series device running on IOS-XR image with XR version being: 4.3.0 and above.
    - Contoller: SONET 0/2/0/0
    - Interface(s): CEM0/2/0/0/1/2/2/1:5
  - Distribution node B is an ASR9K series device running on IOS-XR image with XR version being: 4.3.0 and above.
    - Contoller: SONET 0/2/0/0
    - Interface(s): CEM0/2/0/0/1/2/2/1:5

Configlets

Cell Site Router

```
pseudowire-class c76a3-1
  encapsulation mpls
  preferred-path interface Tunnel200
pseudowire-class c76a3-2
  encapsulation mpls
  preferred-path interface Tunnel200
controller E1 0/4
  cem-group 9 timeslots 12-15
interface CEM0/4
  cem 0
  xconnect 10.0.0.1 3090102001 pw-class c76a3-1
  backup peer 10.0.0.4 3090403001 pw-class c76a3-2
```

Distribution Node Z

```
controller SONET0/2/0/0
  au 1
    width 3
    mode tug3
    tug3 2
    mode c12-e1
controller E1 0/2/0/0/1/2/2/1
  cem-group framed 5 timeslots 12
interface CEM0/2/0/0/1/2/2/1:5
  l2transport
l2vpn
  pw-class c76a3-1
    encapsulation mpls
    preferred-path interface tunnel-te
100
  xconnect group ISC
  p2p ems2941q_3090102001
    interface CEM0/2/0/0/1/2/2/1:5
    neighbor 70.70.70.1 pw-id 3090102001
pw-class c76a3-1
```

Node Z-backup (incase of PW Redundancy):

```
controller SONET0/2/0/0
  au 1
    width 3
    mode tug3
    tug3 2
    mode c12-e1
controller E1 0/2/0/0/1/2/2/1
  cem-group framed 5 timeslots 12
interface CEM0/2/0/0/1/2/2/1:5
  l2transport
l2vpn
  pw-class c76a3-2
    encapsulation mpls
    preferred-path interface tunnel-te
100
  xconnect group ISC
  p2p ems2941q_3090403001
    interface CEM0/2/0/0/1/2/2/1:5
    neighbor 70.70.70.1 pw-id 3090403001
pw-class c76a3-2
```

Comments

- None.

# TDM-CEM using framing type SONET (IOS device)

Configuration

- Service: RAN Backhaul.
- Feature: This sections contains sample configlets generated for TDM-CEM SAToP PW3 service on a cell site router with an IOS image and two distribution nodes (Z and Z-backup).
- Device configuration:
  - The cell site router could be a device belonging to either of MWR 2941-DC, ASR901, ASR903, 7600X or ME36XX platforms".
  - Controller: T1 0/5
  - Interface(s): CEM 0/0



- Distribution node A is a 760X series device with IOS image.  
Contoller: SONET 3/2/0  
Interface(s): CEM 3/2/0
- Distribution node B is a 760X series device with IOS image.  
Contoller: SONET 3/2/0  
Interface(s): CEM 3/2/0

**Configlets****Cell Site Router**

```
pseudowire-class c76a3-1
  encapsulation mpls
  preferred-path interface Tunnel200
controller T1 0/5
  cem-group 9 timeslots 20
interface CEM0/5
  cem 9
  xconnect 20.10.10.100 2090102001 pw-class c76a3-1
  backup peer 10.0.0.4 2090403001 pw-class c76a3-2
```

**Distribution Node Z**

```
pseudowire-class c76a3-1
  encapsulation mpls
  preferred-path interface Tunnel200
controller SONET 3/2/0
  sts-1 1
    mode vt-15
    vtg 2 t1 1 cem-group 9 timeslots 12
interface CEM3/2/0
  cem 9
xconnect 100.100.100.2 2090102001 pw-class
c76a3-1
```

**Node Z-backup (incase of PW Redundancy):**

```
pseudowire-class c76a3-2
  encapsulation mpls
  preferred-path interface Tunnel100
controller SONET 3/2/0
  sts-1 1
    mode vt-15
    vtg 2 t1 1 cem-group 8 timeslots 13
interface CEM3/2/0
  cem 9
  xconnect 100.100.100.2 2090403001
pw-class c76a3-2
```

**Comments**

- None.

**TDM-CEM using framing type SONET (IOS-XR device)****Configuration**

- Service: RAN Backhaul.
- Feature: This sections contains sample configlets generated for TDM-CEM SAToP PW3 service on a cell site router with an IOS image and two distribution nodes (Z and Z-backup).
- Device configuration:
  - The cell site router could be a device belonging to either of MWR 2941-DC, ASR901, ASR903, 7600X or ME36XX platforms".  
Controller: T1 0/5  
Interface(s): CEM 0/0

- Distribution node A is an ASR9K series device running on IOS-XR image with XR version being: 4.3.0 and above.  
Contoller: SONET 0/2/0/0  
Interface(s): CEM0/2/0/0/1/2/1/1
- Distribution node B is an ASR9K series device running on IOS-XR image with XR version being: 4.3.0 and above.  
Contoller: SONET 0/2/0/0  
Interface(s): CEM0/2/0/0/1/2/1/1

**Configlets****Cell Site Router**

```
pseudowire-class c76a3-1
  encapsulation mpls
  preferred-path interface Tunnel200
controller T1 0/5
  cem-group 9 timeslots 12
interface CEM0/5
  cem 9
  xconnect 20.10.10.100 2090102001 pw-class c76a3-1
  backup peer 10.0.0.4 2090403001 pw-class c76a3-2
```

**Distribution Node Z**

```
controller SONET0/2/0/0
  sts 2
  mode vt15-t1
controller T1 0/2/0/0/2/4/2
  cem-group framed 12 timeslots 12
interface CEM0/2/0/0/2/4/2:12
  l2transport
l2vpn
  pw-class c76a3-1
  encapsulation mpls
  preferred-path interface tunnel-te
100
  xconnect group ISC
  p2p ems2941g_1525
  interface CEM0/2/0/0/2/4/2
  neighbor 192.18.156.7 pw-id
2090102001
pw-class c76a3-1
```

**Node Z-backup (incase of PW Redundancy):**

```
controller SONET0/2/0/0
  sts 2
  mode vt15-t1
controller T1 0/2/0/0/2/4/2
  cem-group framed 12 timeslots 12
interface CEM0/2/0/0/2/4/2:12
  l2transport
l2vpn
  pw-class c76a3-1
  encapsulation mpls
  preferred-path interface tunnel-te
200
  xconnect group ISC
  p2p ems2941g_1525
  interface CEM0/2/0/0/2/4/2
  neighbor 192.18.156.7 pw-id
2090403001
pw-class c76a3-2
```

## TDM-CEM using CESoPSN

### Configuration

- Service: RAN Backhaul.
- Feature: This sections contains sample configlets that would be generated for TDM-CEM CESoPSN service on a cell site router and two distribution nodes (A and B).
- Device configuration:
  - The cell site router is an MWR 2941-DC router with an IOS image.  
 Contoller: E1 0/4  
 Interface(s): CEM 0/4
  - Distribution node A is a 760X series device with IOS image.  
 Contoller: SONET 3/0/0  
 Interface(s): CEM 3/0/0
  - Distribution node B is a 760X series device with IOS image.  
 Contoller: SONET 3/0/0  
 Interface(s): CEM 3/0/0

### Configlets

#### Cell Site Router

```
pseudowire-class c76a3-1
 encapsulation mpls
!
pseudowire-class c76a3-2
 encapsulation mpls
!
controller E1 0/4
 clock source internal
 cem-group 0 timeslots 1-7
!
interface CEM0/4
 cem 0
  xconnect 10.0.0.1 3090102001 pw-class c76a3-1
  backup peer 10.0.0.4 3090403001 pw-class c76a3-2
```

Distribution Node A	Distribution Node B
<pre>pseudowire-class c76a3-1  encapsulation mpls  preferred-path interface Tunnel211 ! controller SONET 3/0/0  ais-shut  framing sdh  clock source line  aug mapping au-4 ! au-4 1 tug-3 2  mode c-12 tug-2 2 e1 2 description m29a2-3 (CEM0/4 cem 0)   tug-2 2 e1 2 cem-group 104 timeslots 1-7 ! interface CEM3/0/0  cem 104   xconnect 10.0.0.1 3090102001 pw-class c76a3-1 sequencing both</pre>	<pre>pseudowire-class c76a3-2  encapsulation mpls  preferred-path interface Tunnel340 ! controller SONET 3/0/0  ais-shut  framing sdh  clock source line  aug mapping au-4 ! au-4 1 tug-3 2  mode c-12 tug-2 2 e1 2 description m29a2-3 (CEM0/4 cem 0)   tug-2 2 e1 2 cem-group 104 timeslots 1-7 ! interface CEM3/0/0  cem 104   xconnect 10.0.0.4 3090403001 pw-class c76a3-2 sequencing both</pre>

Comments

- None.

# TDM-CEM between E1 controllers (IOS device)

Configuration

- Service: RAN Backhaul.
- Feature: This sections contains sample configlets that is generated for TDM-CEM CESoPSN service deployed between E1 controllers on an IOS device.
- Device configuration- The cell site router is a router with an IOS image.

Configlets

Cell Site Router
<pre>pseudowire-class PW_4  encapsulation mpls  preferred-path interface Tunnel200 pseudowire-class PW_7  encapsulation mpls  preferred-path interface Tunnel300 controller E1 0/5  cem-group 9 unframed interface CEM0/5  cem 9   xconnect 20.10.10.100 10234 pw-class PW_4   backup peer 10.0.0.4 2090403001 pw-class PW_7</pre>

Distribution Node A	Distribution Node B
<pre>pseudowire-class PW_5   encapsulation mpls   preferred-path interface Tunnel200 controller E1 0/5   cem-group 9 unframed interface CEM0/5   cem 9     xconnect 20.10.10.100 10234 pw-class PW_5</pre>	<pre>pseudowire-class PW_6   encapsulation mpls   preferred-path interface Tunnel200 controller E1 0/7   cem-group 9 unframed interface CEM0/7   cem 9     xconnect 20.10.10.100 2090403001 pw-class PW_6</pre>

#### Comments

- None.

## TDM-CEM between E1 controllers (IOS-XR device)

#### Configuration

- Service: RAN Backhaul.
- Feature: This sections contains sample configlets that is generated for TDM-CEM CESoPSN service deployed between E1 controllers on an IOS-XR device.
- Device configuration- The cell site router is a router with an IOS-XR image.

#### Configlets

##### Cell Site Router

```
pseudowire-class PW_4
  encapsulation mpls
  preferred-path interface Tunnel200
pseudowire-class PW_7
  encapsulation mpls
  preferred-path interface Tunnel300
controller E1 0/5
  cem-group 9 unframed
interface CEM0/5
  cem 9
    xconnect 20.10.10.100 10234 pw-class PW_4
    backup peer 10.0.0.4 2090403001 pw-class PW_7
```

Distribution Node A	Distribution Node B
<pre> controller E1 0/2/0/0/1/2/1/1   cem-group unframed interface CEM0/2/0/0/1/2/1/1   l2transport l2vpn   pw-class PW_1H     encapsulation mpls     preferred-path interface tunnel-te 100   xconnect group ISC   p2p ems2941q_10234     interface CEM0/2/0/0/1/2/1/1     neighbor 70.70.70.1 pw-id 10234   pw-class PW_1H </pre>	<pre> controller E1 0/2/0/0/1/2/1/1   cem-group unframed interface CEM0/2/0/0/1/2/1/1   l2transport l2vpn   pw-class PW_1H2     encapsulation mpls     preferred-path interface tunnel-te 101   xconnect group ISC   p2p ems2941q_2090403001     interface CEM0/2/0/0/1/2/1/1     neighbor 70.70.70.1 pw-id 2090403001   pw-class PW_1H2 </pre>

Comments

- None.

## TDM-CEM between T1 controllers (IOS device)

Configuration

- Service: RAN Backhaul.
- Feature: This sections contains sample configlets that is generated for TDM-CEM CESoPSN service deployed between T1 controllers.
- Device configuration- The cell site router is a router with an IOS image.

Configlets

Cell Site Router
<pre> pseudowire-class PW_4   encapsulation mpls   preferred-path interface Tunnel200 pseudowire-class PW_7   encapsulation mpls   preferred-path interface Tunnel300 controller T1 0/5   cem-group 9 unframed interface CEM0/5   cem 9   xconnect 20.10.10.100 10234 pw-class PW_4     backup peer 10.0.0.4 2090403001 pw-class PW_7 </pre>

Distribution Node A	Distribution Node B
<pre>pseudowire-class PW_5   encapsulation mpls   preferred-path interface Tunnel200 controller T1 0/5   cem-group 9 unframed interface CEM0/5   cem 9     xconnect 20.10.10.100 10234 pw-class PW_5</pre>	<pre>pseudowire-class PW_6   encapsulation mpls   preferred-path interface Tunnel200 controller T1 0/7   cem-group 9 unframed interface CEM0/7   cem 9     xconnect 20.10.10.100 2090403001 pw-class PW_6</pre>

**Comments**

- None.

## TDM-CEM between T1 controllers (IOS-XR device)

**Configuration**

- Service: RAN Backhaul.
- Feature: This sections contains sample configlets that is generated for TDM-CEM CESoPSN service deployed between T1 controllers.
- Device configuration- The cell site router is a router with an IOS-XR image.

**Configlets****Cell Site Router**

```
pseudowire-class PW_4
  encapsulation mpls
  preferred-path interface Tunnel200
pseudowire-class PW_7
  encapsulation mpls
  preferred-path interface Tunnel300
controller T1 0/5
  cem-group 9 unframed
interface CEM0/5
  cem 9
    xconnect 20.10.10.100 10234 pw-class PW_4
    backup peer 10.0.0.4 2090403001 pw-class PW_7
```

Distribution Node A	Distribution Node B
<pre> controller T1 0/2/0/0/1/2/1/1   cem-group unframed interface CEM0/2/0/0/1/2/1/1   l2transport l2vpn   pw-class PW_1H     encapsulation mpls     preferred-path interface tunnel-te 100   xconnect group ISC     p2p ems2941q_10234     interface CEM0/2/0/0/1/2/1/1     neighbor 70.70.70.1 pw-id 10234     pw-class PW_1H </pre>	<pre> controller T1 0/2/0/0/2/1/1   cem-group unframed interface CEM0/2/0/0/2/1/1   l2transport l2vpn   pw-class PW_1H2     encapsulation mpls     preferred-path interface tunnel-te 101   xconnect group ISC     p2p ems2941q_2090403001     interface CEM0/2/0/0/2/1/1     neighbor 70.70.70.1 pw-id 2090403001     pw-class PW_1H2 </pre>

**Comments**

- None.

## TDM-CEM between SERIAL controllers (IOS device)

**Configuration**

- Service: RAN Backhaul.
- Feature: This sections contains sample configlets that is generated for TDM-CEM CESoPSN service deployed between SERIAL controllers.
- Device configuration- The cell site router is a router with an IOS image.

**Configlets**

Terminal - A	Terminal - Z
<pre> pseudowire-class newpw-cls   encapsulation mpls controller SERIAL 0/5/0   physical-layer async   channel-group 0 interface Serial0/5/0   no ip address   encapsulation trans   xconnect 192.168.18.123 1098 encapsulation mpls pw-class newpw-cls line 0/5/0   raw-socket packet-length 98   raw-socket packet-timer 78   databits 6   parity odd   stopbits 1   speed 900 </pre>	<pre> pseudowire-class newpw-cls   encapsulation mpls controller SERIAL 0/3/13   physical-layer async   channel-group 0 interface Serial0/3/13   no ip address   encapsulation trans   xconnect 192.18.156.10 1098 encapsulation mpls pw-class newpw-cls line 0/3/13   raw-socket packet-length 98   raw-socket packet-timer 87   databits 5   parity none   stopbits 1   speed 900 </pre>