



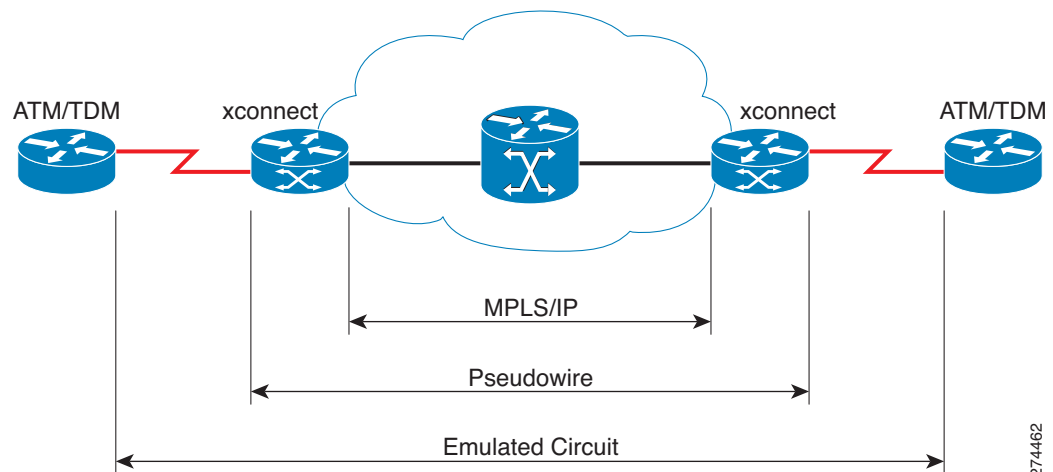
## Configuring Pseudowire

Cisco Pseudowire Emulation Edge-to-Edge (PWE3) allows you to transport traffic using traditional services such as E1/T1 over a packet-based backhaul technology such as MPLS or IP. A pseudowire (PW) consists of a connection between two provider edge (PE) devices that connects two attachment circuits (ACs), such as ATM VPIs/VCIs or E1/T1 links.

The following sections describe how to configure pseudowire on the Cisco MWR 2941:

- [Understanding Pseudowire, page 23-1](#)
- [Configuring Pseudowire, page 23-3](#)
- [Configuration Examples for Pseudowire, page 23-18](#)

**Figure 23-1** Cisco MWR 2941 Router in a PWE3—Example



## Understanding Pseudowire

PWs manage encapsulation, timing, order, and other operations in order to make it transparent to users; the PW tunnel appears as an unshared link or circuit of the emulated service.

There are limitations that impede some applications from utilizing a PW connection. For more information, see the section describing the PW service.

Cisco supports the following standards-based PWE types:

- [Structure-Agnostic TDM over Packet](#), page 23-2
- [Structure-Aware TDM Circuit Emulation Service over Packet-Switched Network](#), page 23-2
- [Transportation of Service Using ATM over MPLS](#), page 23-2
- [Transportation of Service Using Ethernet over MPLS](#), page 23-3

## Structure-Agnostic TDM over Packet

SAToP encapsulates TDM bit-streams (T1, E1, T3, E3) 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, multiplex in a T3 circuit, 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).

For instructions on how to configure SAToP, see [Configuring Structure-Agnostic TDM over Packet \(SAToP\)](#). For a sample SAToP configuration, see [Configuration Examples for Pseudowire](#).

## Structure-Aware TDM Circuit Emulation Service over Packet-Switched Network

CESoPSN encapsulates structured (NxDS0) TDM signals as PWs over PSNs. It complements similar work for structure-agnostic emulation of TDM bit-streams, such as PWE3-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 supports channel-associated signaling (CAS) for E1 and T1 interfaces. CAS provides signaling information within each DS0 channel as opposed to using a separate signaling channel. CAS also referred to as in-band signaling or robbed bit signaling.

For instructions on how to configure SAToP, see [Configuring Circuit Emulation Service over Packet-Switched Network \(CESoPSN\)](#). For a sample SAToP configuration, see [Configuration Examples for Pseudowire](#).

## Transportation of Service Using ATM over MPLS

An Asynchronous Transfer Mode (ATM) over MPLS PW is used to carry ATM cells over an MPLS network. It is an evolutionary technology that allows you to migrate packet networks from legacy networks, yet provides transport for legacy applications. ATM over MPLS is particularly useful for transporting 3G voice traffic over MPLS networks.

You can configure ATM over MPLS in the following modes:

- N-to-1 Cell Mode—Maps one or more ATM virtual channel connections (VCCs) or virtual permanent connection (VPCs) to a single pseudowire.
- 1-to-1 Cell Mode—Maps a single ATM VCC or VPC to a single pseudowire.
- Port Mode—Map one physical port to a single pseudowire connection.

The Cisco MWR 2941 also supports cell packing and PVC mapping for ATM over MPLS pseudowires.

**Note**

Release 15.1(1)MR does not support ATM over MPLS N-to-1 Cell Mode or 1-to-1 Cell Mode.

For more information about how to configure ATM over MPLS, see [Configuring Transportation of Service Using ATM over MPLS](#). For sample ATM over MPLS configurations, see [Configuration Examples for Pseudowire](#).

## 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 MWR 2941 implementation of EoMPLS PWs is compliant with the RFC 4447 and 4448 standards.

For instructions on how to create an EoMPLS PW, see [Configuring Transportation of Service Using Ethernet over MPLS](#).

### Limitations

When configuring an EoMPLS pseudowire on the Cisco MWR 2941, you cannot configure an IP address on the same interface as the pseudowire.

## Configuring Pseudowire

This section describes how to configure pseudowire on the Cisco MWR 2941. The Cisco MWR 2941 supports pseudowire connections using SAToP, CESoPSN, and ATM over MPLS. The following sections describe how to configure pseudowire connections on the Cisco MWR 2941.

- [Using Pseudowire Classes, page 23-4](#)
- [Using CEM Classes, page 23-5](#)
- [Configuring a Backup Peer, page 23-6](#)
- [Configuring Structure-Agnostic TDM over Packet \(SAToP\), page 23-7](#)
- [Configuring Circuit Emulation Service over Packet-Switched Network \(CESoPSN\), page 23-7](#)
- [Configuring Transportation of Service Using ATM over MPLS, page 23-10](#)
- [Configuring Transportation of Service Using Ethernet over MPLS, page 23-17](#)

For full descriptions of each command, see the [Cisco MWR 2941 Mobile Wireless Edge Router IOS Command Reference, Release 15.0\(1\)MR](#). For pseudowire configuration examples, see [Configuration Examples for Pseudowire, page 23-18](#)

## Using Pseudowire Classes

A pseudowire class allows you to create a single configuration template for multiple pseudowire connections. You can apply pseudowire classes to all pseudowire types. Follow these steps to configure a pseudowire class:

|        | Command   | Purpose  |
|--------|---|--|
| Step 1 | <code>enable</code><br><br><b>Example:</b><br>Router> <code>enable</code>   | Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>Enter your password if prompted.</li> </ul>   |
| Step 2 | <code>configure terminal</code><br><br><b>Example:</b><br>Router# <code>configure terminal</code>   | Enters global configuration mode.  |
| Step 3 | Router(config)# <code>pseudowire-class newclass</code>  | Creates a new pseudowire class.  |
| Step 4 | Router(config-pw-class)# <code>encapsulation mpls</code>  | Sets an encapsulation type. For an ATM over MPLS pseudowire, use <b>mpls</b> . For a CESoPSN pseudowire using UDP encapsulation, use <b>udp</b> .  |
| Step 5 | Router(config-pw-class)# <code>mpls experimental 5</code>   | Specifies the 3-bit EXP field in the MPLS label used for pseudowire packets.<br><br><b>Note</b> For more information about the <b>mpls experimental</b> command, see the <a href="#">Cisco MWR 2941 Mobile Wireless Edge Router IOS Command Reference, Release 15.0(1)MR</a> . |
| Step 6 | Router(config-pw-class)# <code>preferred-path peer 50.0.0.1</code>  | Specifies a preferred path if there are multiple paths that traffic can cross within the pseudowire class.<br><br><b>Note</b> This command applies only to MPLS pseudowires.   |
| Step 7 | Router(config)# <code>interface atm0/ima0</code><br>Router(config-if)# <code>pvc 0/40 l2transport</code><br>Router(cfg-if-atm-l2trans-pvc)# <code>encapsulation aa10</code> | Configures the pseudowire interface to use for the new pseudowire class. This example shows an ATM IMA interface.  |
| Step 8 | Router(cfg-if-atm-l2trans-pvc)# <code>xconnect 1.1.1.1 40 pw-class myclass</code>   | Binds an attachment circuit to the ATM IMA interface to create an ATM pseudowire. Use the <b>pw-class</b> parameter to specify the pseudowire class that the ATM pseudowire interface uses.  |
| Step 9 | <code>exit</code><br><br><b>Example:</b><br>Router(config)# <code>exit</code><br>Router#  | Exits configuration mode.  |

**Note**

You cannot use the encapsulation **mpls** parameter with the **pw-class** parameter.

**Note**

The use of the **xconnect** command can vary depending on the type of pseudowire you are configuring.

## Using CEM Classes

A CEM class allows you to create a single configuration template for multiple CEM pseudowires. Follow these steps to configure a CEM class:


**Note**

You cannot apply a CEM class to other pseudowire types such as ATM over MPLS.

|        | Command   | Purpose   |
|--------|---|---|
| Step 1 | <b>enable</b><br><br><b>Example:</b><br>Router> enable  | Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>Enter your password if prompted.</li> </ul>  |
| Step 2 | <b>configure terminal</b><br><br><b>Example:</b><br>Router# configure terminal  | Enters global configuration mode.   |
| Step 3 | Router(config)# <b>class cem mycemclass</b>   | Creates a new CEM class   |
| Step 4 | Router(config-cem-class)# <b>payload-size 512</b><br>Router(config-cem-class)# <b>dejitter-buffer 10</b><br>Router(config-cem-class)# <b>idle-pattern 0x55</b>  | Enter the configuration commands common to the CEM class. This example specifies a payload size, dejitter buffer, and idle pattern.   |
| Step 5 | Router(config-cem-class)# <b>exit</b>   | Returns to the config prompt.   |
| Step 6 | Router(config)# <b>interface cem 0/0</b><br>Router(config-if)# <b>no ip address</b><br>Router(config-if)# <b>cem 0</b><br>Router(config-if-cem)# <b>cem class mycemclass</b><br>Router(config-if-cem)# <b>xconnect 10.10.10.10 200 encapsulation mpls</b> | Configure the CEM interface that you want to use for the new CEM class.<br><b>Note</b> The use of the <b>xconnect</b> command can vary depending on the type of pseudowire you are configuring. |
| Step 7 | Router(config-if-cem)# <b>exit</b><br>Router(config-if)#  | Exits the CEM interface.  |
| Step 8 | <b>exit</b><br><br><b>Example:</b><br>Router(config)# exit<br>Router#   | Exits configuration mode.   |

## Configuring a Backup Peer

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 MWR 2941 diverts traffic to the backup PW. Follow these steps to configure a backup peer.

|        | Command   | Purpose  |
|--------|---|--|
| Step 1 | <b>enable</b><br><br><b>Example:</b><br>Router> <b>enable</b>   | Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>   |
| Step 2 | <b>configure terminal</b><br><br><b>Example:</b><br>Router# <b>configure terminal</b>                       | Enters global configuration mode.  |
| Step 3 | Router(config)# <b>backup peer</b><br><i>peer-router-ip-address vcid</i><br><i>[pw-class pw-class name]</i> | Defines the address and VC of the backup peer.   |
| Step 4 | Router(config)# <b>backup delay</b><br><i>enable-delay {disable-delay  </i><br><b>never}</b>                | Specifies the delay before the router switches pseudowire traffic to the backup peer VC.<br>Where: <ul style="list-style-type: none"> <li>• <i>enable-delay</i>—Time before the backup PW takes over for the primary PW.</li> <li>• <i>disable-delay</i>—Time before the restored primary PW takes over for the backup PW.</li> <li>• <b>never</b>—Disables switching from the backup PW to the primary PW.</li> </ul> |
| Step 5 | <b>exit</b><br><br><b>Example:</b><br>Router(config)# <b>exit</b><br>Router#                                | Exits configuration mode.  |

## Configuring Structure-Agnostic TDM over Packet (SAToP)

Follow these steps to configure SAToP on the Cisco MWR 2941:

|        | Command   | Purpose   |
|--------|---|---|
| Step 1 | <code>enable</code><br><br><b>Example:</b><br>Router> <code>enable</code>   | Enables privileged EXEC mode.<br><ul style="list-style-type: none"><li>Enter your password if prompted.</li></ul>   |
| Step 2 | <code>configure terminal</code><br><br><b>Example:</b><br>Router# <code>configure terminal</code>                                       | Enters global configuration mode.   |
| Step 3 | Router(config)# <code>controller [T1 E1] 0/4</code><br>Router(config-controller)#   | Configures the T1 or E1 interface.  |
| Step 4 | Router(config-if)# <code>cem-group 4 unframed</code>  | Assigns channels on the T1 or E1 circuit to the CEM channel. This example uses the <b>unframed</b> parameter to assign all the T1 timeslots to the CEM channel.           |
| Step 5 | Router(config)# <code>interface CEM0/4</code><br>Router(config-if)# <code>no ip address</code><br>Router(config-if)# <code>cem 4</code> | Defines a CEM group.  |
| Step 6 | Router(config-if)# <code>xconnect 30.30.30.2 304 encapsulation mpls</code>  | 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 7 | <code>exit</code><br><br><b>Example:</b><br>Router(config)# <code>exit</code><br>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 MWR 2941.



### Note

To configure a CESoPSN pseudowire with UDP encapsulation, see [Configuring a CESoPSN Pseudowire with UDP Encapsulation](#), page 23-9.

|         | Command  | Purpose  |
|---------|--|--|
| Step 1  | <b>enable</b><br><br><b>Example:</b><br>Router> enable   | Enables privileged EXEC mode.<br><ul style="list-style-type: none"><li>• Enter your password if prompted.</li></ul>  |
| Step 2  | <b>configure terminal</b><br><br><b>Example:</b><br>Router# configure terminal   | Enters global configuration mode.  |
| Step 3  | Router(config)# <b>controller [e1 t1] 0/0</b><br>Router(config-controller)#  | Enters configuration mode for the E1 or T1 controller.   |
| Step 4  | Router(config-controller)# <b>mode {atm   cas}</b>   | Sets the controller in asynchronous transfer mode (ATM) or channel-associated signaling (CAS) mode.  |
| Step 5  | Router(config-controller)# <b>cem-group 5 timeslots 1-24</b>   | Assigns channels on the T1 or E1 circuit to the circuit emulation (CEM) channel. This example uses the <b>timeslots</b> parameter to assign specific timeslots to the CEM channel.   |
| Step 6  | Router(config-controller)# <b>exit</b><br>Router(config)#  | Exits controller configuration.  |
| Step 7  | Router(config)# <b>interface CEM0/5</b><br>Router(config-if-cem)# <b>cem 5</b><br>Router(config-if-cem)# <b>signaling inband-cas</b> | Defines a CEM channel.   |
| Step 8  | Router(config-if-cem)# <b>xconnect 30.30.30.2 305 encapsulation mpls</b>   | 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.<br><br><b>Note</b> 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 <b>ip route 30.30.30.2 255.255.255.255 1.2.3.4</b> . |
| Step 9  | Router(config-if-cem)# <b>exit</b><br>Router(config)#  | Exits the CEM interface.   |
| Step 10 | <b>exit</b><br><br><b>Example:</b><br>Router(config)# exit<br>Router#  | Exits configuration mode.  |



## Configuring a CESoPSN Pseudowire with UDP Encapsulation

Follow these steps to configure a CESoPSN pseudowire with UDP encapsulation:

|         | Command   | Purpose  |
|---------|---|--|
| Step 1  | <code>enable</code><br><br><b>Example:</b><br>Router> <code>enable</code>                         | Enables privileged EXEC mode.<br><ul style="list-style-type: none"><li>Enter your password if prompted.</li></ul>  |
| Step 2  | <code>configure terminal</code><br><br><b>Example:</b><br>Router# <code>configure terminal</code> | Enters global configuration mode.  |
| Step 3  | Router(config)# <code>pseudowire-class udpClass</code>  | Creates a new pseudowire class.  |
| Step 4  | Router(config-pw-class)# <code>encapsulation udp</code>   | Specifies the UDP transport protocol.  |
| Step 5  | Router(config-pw-class)# <code>ip local interface Loopback1</code>                                | Configures the IP address of the provider edge (PE) router interface to be used as the source IP address for sending tunneled packets.   |
| Step 6  | Router(config-pw-class)# <code>ip tos value 100</code>  | Specifies the type of service (ToS) level for IP traffic in the pseudowire.  |
| Step 7  | Router(config-pw-class)# <code>ip ttl 100</code>  | Specifies a value for the time-to-live (TTL) byte in the IP headers of Layer 2 tunneled packets.   |
| Step 8  | Router(config-pw-class)# <code>exit</code><br>Router(config)#                                     | Exits pseudowire-class configuration mode.   |
| Step 9  | Router(config)# <code>controller [e1 t1] 0/0</code><br>Router(config-controller)#                 | Enters E1 or T1 controller configuration mode.   |
| Step 10 | Router(config-controller)# <code>cem-group 5 timeslots 1-24</code>                                | Assigns channels on the T1 or E1 circuit to the circuit emulation (CEM) channel. This example uses the <b>timeslots</b> parameter to assign specific timeslots to the CEM channel.   |
| Step 11 | Router(config-controller)# <code>exit</code><br>Router(config)#                                   | Exits controller configuration.  |
| Step 12 | Router(config)# <code>interface CEM0/5</code><br>Router(config-if-cem)# <code>cem 5</code>        | Defines a CEM channel.   |
| Step 13 | Router(config-if-cem)# <code>xconnect 30.30.30.2 305 pw-class udpClass</code>                     | 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.<br><br><b>Note</b> 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 <code>ip route 30.30.30.2 255.255.255.255 1.2.3.4</code> . |
| Step 14 | Router(config-if-cem)# <code>udp port local 50000 remote 55000</code>                             | Specifies a local and remote UDP port for the connection.<br><br><b>Note</b> Valid port values for CESoPSN pseudowires using UDP are from 49152–57343.   |

|         | Command   | Purpose                   |
|---------|---|---------------------------|
| Step 15 | Router(config-if-cem)# <b>exit</b><br>Router(config)#     | Exits the CEM interface.  |
| Step 16 | <b>exit</b>   | Exits configuration mode. |
|         | <b>Example:</b><br>Router(config)# <b>exit</b><br>Router# |                           |

## Configuring Transportation of Service Using ATM over MPLS

ATM over MPLS pseudowires allow you to encapsulate and transport ATM traffic across an MPLS network. This service allows you to deliver ATM services over an existing MPLS network.

The following sections describe how to configure transportation of service using ATM over MPLS:

- [Configuring the Controller](#)
- [Configuring an IMA Interface](#)
- [Configuring the ATM over MPLS Pseudowire Interface](#)



### Note

For sample configurations for ATM over MPLS, see [Configuration Examples for Pseudowire](#).

## Configuring the Controller

Follow these steps to configure the controller.

|        | Command  | Purpose  |
|--------|--|--|
| Step 1 | <b>enable</b>  | Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul> |
|        | <b>Example:</b><br>Router> enable                                      |  |
| Step 2 | <b>configure terminal</b>  | Enters global configuration mode.  |
|        | <b>Example:</b><br>Router# configure terminal                          |  |
| Step 3 | Router(config)# <b>card type e1 0 0</b>                                | Configures IMA on an E1 or T1 interface.   |
| Step 4 | Router(config)# <b>controller E1 0/4</b><br>Router(config-controller)# | Specifies the controller interface on which you want to enable IMA.  |
| Step 5 | Router(config-controller)# <b>clock source internal</b>                | Sets the clock source to internal.   |

|        | Command  | Purpose   |
|--------|--|---|
| Step 6 | <pre>Router(config-controller)# ima-group 0 scrambling-payload</pre>                   | <p>If you want to configure an ATM IMA backhaul, use the <b>ima-group</b> command to assign the interface to an IMA group. For a T1 connection, use the <b>no-scrambling-payload</b> to disable ATM-IMA cell payload scrambling; for an E1 connection, use the <b>scrambling-payload</b> parameter to enable ATM-IMA cell payload scrambling.</p> <p>The example assigns the interface to IMA group 0 and enables payload scrambling.</p> |
| Step 7 | <p><b>exit</b></p> <p><b>Example:</b><br/> <pre>Router(config)# exit Router#</pre></p> | Exits configuration mode.   |

**Note**

For more information about configuring IMA groups, see the [“Configuring ATM IMA” section on page 18-6](#).

## Configuring an IMA Interface

If you want to use ATM IMA backhaul, follow these steps to configure the IMA interface.

|        | Command  | Purpose   |
|--------|--|---|
| Step 1 | <p><b>enable</b></p> <p><b>Example:</b><br/> <pre>Router&gt; enable</pre></p>                      | <p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> <li>Enter your password if prompted.</li> </ul> |
| Step 2 | <p><b>configure terminal</b></p> <p><b>Example:</b><br/> <pre>Router# configure terminal</pre></p> | Enters global configuration mode.   |

|        | Command   | Purpose   |
|--------|---|---|
| Step 3 | <pre>Router(config-controller)# interface ATMslot/IMAgroup-number</pre> <p><b>Example:</b></p> <pre>Router(config-controller)# interface atm0/ima0 Router(config-if)#</pre> | <p>Specifies the slot location and port of IMA interface group. The syntax is as follows:</p> <ul style="list-style-type: none"> <li><i>slot</i>—The slot location of the ATM IMA port adapter.</li> <li><i>group-number</i>—The group number of the IMA group.</li> </ul> <p>The example specifies the slot number as 0 and the group number as 0.</p> <p><b>Note</b> To explicitly configure the IMA group ID for the IMA interface, you may use the optional <b>ima group-id</b> command. You cannot configure the same IMA group ID on two different IMA interfaces; therefore, if you configure an IMA group ID with the system-selected default ID already configured on an IMA interface, the system toggles the IMA interface to make the user-configured IMA group ID the effective IMA group ID. At the same, the system toggles the original IMA interface to select a different IMA group ID.</p> |
| Step 4 | <pre>Router(config-if)# no ip address</pre>   | Disables the IP address configuration for the physical layer interface.   |
| Step 5 | <pre>Router(config-if)# atm bandwidth dynamic</pre>   | Specifies the ATM bandwidth as dynamic.   |
| Step 6 | <pre>Router(config-if)# no atm ilmi-keepalive</pre>   | Disables the ILMI keepalive parameters.   |
| Step 7 | <pre>exit</pre> <p><b>Example:</b></p> <pre>Router(config)# exit Router#</pre>  | Exits configuration mode.   |

For more information about configuring IMA groups, see the “[Configuring ATM IMA](#)” section on page 18-6.

## Configuring the ATM over MPLS Pseudowire Interface

You can configure ATM over MPLS in several modes according to the needs of your network. Use the appropriate section according to the needs of your network. You can configure the following ATM over MPLS pseudowire types:

- [Configuring N-to-1 VCC Cell Transport Pseudowire](#)—Maps multiple VCCs to a single pseudowire
- [Configuring N-to-1 VPC Cell Transport](#)—Maps multiple VPCs to a single pseudowire
- [Configuring ATM AAL5 SDU VCC Transport](#)—Maps a single ATM PVC to another ATM PVC
- [Configuring a Port Mode Pseudowire](#)—Maps one physical port to a single pseudowire connection
- [Optional Configurations](#)



### Note

Release 15.1(1)MR does not support N-to-1 VCC Cell Transport for mapping multiple PVCs, 1-to-1 VCC Cell Mode, or PVC mapping.

**Note**

When creating IP routes for a pseudowire configuration, 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 N-to-1 VCC Cell Transport Pseudowire

An N-to-1 VCC cell transport pseudowire maps one or more ATM virtual channel connections (VCCs) to a single pseudowire. Follow these steps to configure an N-to-1 pseudowire.

You can use the following methods to configure an N-to-1 VCC Cell Transport pseudowire.

#### Mapping a Single PVC to a Pseudowire

To map a single PVC to an ATM over MPLS pseudowire, apply the **xconnect** command at the PVC level. This configuration type only uses AAL0 encapsulation. Follow these steps to map a single PVC to an ATM over MPLS pseudowire.

**Note**

Release 15.1(1)MR does not support mapping multiple VCCs to a pseudowire.

|        | Command   | Purpose  |
|--------|---|--|
| Step 1 | <b>enable</b><br><br><b>Example:</b><br>Router> enable  | Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>Enter your password if prompted.</li> </ul>   |
| Step 2 | <b>configure terminal</b><br><br><b>Example:</b><br>Router# configure terminal                                      | Enters global configuration mode.  |
| Step 3 | Router(config)# <b>interface atm0/ima0</b>  | Configures the ATM IMA interface.  |
| Step 4 | Router(config-if)# <b>pvc 0/40</b><br><b>l2transport</b><br>Router(cfg-if-atm-l2trans-pvc)#                         | Defines a PVC. Use the <b>l2transport</b> keyword to configure the PVC as layer 2 virtual circuit.   |
| Step 5 | Router(cfg-if-atm-l2trans-pvc)#<br><b>encapsulation aal0</b>  | Defines the encapsulation type for the PVC.  |
| Step 6 | Router(config-if)# <b>xconnect 1.1.1.1</b><br><b>40 encapsulation mpls</b><br>Router(cfg-if-atm-l2trans-pvc-xconn)# | Binds an attachment circuit to the ATM IMA interface to create a pseudowire. This example creates a pseudowire by binding PVC 40 to the remote peer 1.1.1.1. |
| Step 7 | Router(cfg-if-atm-l2trans-pvp-xconn)#<br><b>end</b><br>Router#  | Exits configuration mode.  |

## Configuring N-to-1 VPC Cell Transport

An N-to-1 VPC cell transport pseudowire maps one or more ATM virtual path connections (VPCs) to a single pseudowire. While the configuration is similar to one-to-one VPC cell mode, this transport method uses the N-to-1 VPC Pseudowire protocol and format defined in RFCs 4717 and 4446. Follow these steps to configure an N-to-1 VPC pseudowire.



**Note** Release 15.1(1)MR does not support mapping multiple VPCs to a pseudowire.

|        | Command   | Purpose  |
|--------|---|--|
| Step 1 | <code>enable</code><br><br><b>Example:</b><br>Router> enable  | Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>Enter your password if prompted.</li> </ul>   |
| Step 2 | <code>configure terminal</code><br><br><b>Example:</b><br>Router# configure terminal  | Enters global configuration mode.  |
| Step 3 | Router(config)# <b>interface atm0/ima0</b><br>Router(config-if)#  | Configures the ATM IMA interface.  |
| Step 4 | Router(config-if)# <b>atm pvp 10</b><br><b>l2transport</b><br>Router(cfg-if-atm-l2trans-pvp)#   | Maps a PVP to a pseudowire   |
| Step 5 | Router(cfg-if-atm-l2trans-pvp)#<br><b>xconnect 30.30.30.2 305 encapsulation</b><br><b>mpls</b><br>Router(cfg-if-atm-l2trans-pvp-xconn)# | Binds an attachment circuit to the ATM IMA interface to create a pseudowire. This example creates a pseudowire by binding the ATM circuit 305 to the remote peer 30.30.30.2. |
| Step 6 | Router(cfg-if-atm-l2trans-pvp-xconn)#<br><b>end</b><br>Router#  | Exits configuration mode.  |

## Configuring ATM AAL5 SDU VCC Transport

An ATM AAL5 SDU VCC transport pseudowire maps a single ATM PVC to another ATM PVC. Follow these steps to configure an ATM AAL5 SDU VCC transport pseudowire.

|        | Command  | Purpose  |
|--------|--|--|
| Step 1 | <code>enable</code><br><br><b>Example:</b><br>Router> enable                         | Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>Enter your password if prompted.</li> </ul> |
| Step 2 | <code>configure terminal</code><br><br><b>Example:</b><br>Router# configure terminal | Enters global configuration mode.  |
| Step 3 | Router(config)# interface atm<br>0/ima0<br>Router(config-if)#                        | Configures the ATM IMA interface.  |

|        | Command   | Purpose   |
|--------|---|---|
| Step 4 | Router(config-if)# <b>pvc 0/12<br/>l2transport</b><br>Router(cfg-if-atm-l2trans-pvc)#     | Configures a PVC and specify a VCI/VPI.   |
| Step 5 | Router(cfg-if-atm-l2trans-pvc)#<br><b>encapsulation aal5</b>                              | Sets the PVC encapsulation type to AAL5.<br><b>Note</b> You must use AAL5 encapsulation for this transport type.  |
| Step 6 | Router(cfg-if-atm-l2trans-pvc)#<br><b>xconnect 25.25.25.25 125<br/>encapsulation mpls</b> | Binds an attachment circuit to the ATM IMA interface to create a pseudowire. This example creates a pseudowire by binding the ATM circuit 125 to the remote peer 25.25.25.25. |
| Step 7 | <b>exit</b>   | Exits configuration mode.   |
|        | <b>Example:</b><br>Router(config)# exit<br>Router#  |   |

### Configuring a Port Mode Pseudowire

A port mode pseudowire allows you to map an entire ATM interface to a single pseudowire connection. Follow these steps to configure a port mode pseudowire:

|        | Command  | Purpose   |
|--------|--|---|
| Step 1 | <b>enable</b><br><br><b>Example:</b><br>Router> enable                         | Enables privileged EXEC mode.<br><ul style="list-style-type: none"> <li>Enter your password if prompted.</li> </ul>   |
| Step 2 | <b>configure terminal</b><br><br><b>Example:</b><br>Router# configure terminal | Enters global configuration mode.   |
| Step 3 | Router(config)# <b>interface atm<br/>0/ima0</b>                                | Configures the ATM interface.   |
| Step 4 | Router(cfg-if)# <b>xconnect<br/>25.25.25.25 2000 encapsulation mpls</b>        | Binds an attachment circuit to the ATM IMA interface to create a pseudowire. This example creates a pseudowire by binding the ATM circuit 200 to the remote peer 25.25.25.25. |
| Step 5 | <b>exit</b><br><br><b>Example:</b><br>Router(config)# exit<br>Router#          | Exits configuration mode.   |

## Optional Configurations

You can apply the following optional configurations to a pseudowire link.

### Configuring Cell Packing

Cell packing allows you to improve the efficiency of ATM-to-MPLS conversion by packing multiple ATM cells into a single MPLS packet. Follow these steps to configure cell packing.

|        | Command   | Purpose   |
|--------|---|---|
| Step 1 | <b>enable</b><br><br><b>Example:</b><br>Router> enable  | Enables privileged EXEC mode.<br><ul style="list-style-type: none"><li>Enter your password if prompted.</li></ul>   |
| Step 2 | <b>configure terminal</b><br><br><b>Example:</b><br>Router# <b>configure terminal</b>   | Enters global configuration mode.   |
| Step 3 | Router(config)# <b>int atm1/0</b>   | Configures the ATM interface.   |
| Step 4 | Router(config)# <b>int atm1/0</b><br>Router(config-if)# <b>atm mcpt-timers</b><br><b>1000 2000 3000</b>   | Defines the three Maximum Cell Packing Timeout (MCPT) timers under an ATM interface. The three independent MCPT timers specify a wait time before forwarding a packet.            |
| Step 5 | Router(config)# <b>pvc 0/11</b><br><b>l2transport</b><br>Router(cfg-if-atm-l2trans-pvc)#<br><b>encapsulation aa10</b><br>Router(cfg-if-atm-l2trans-pvc)#<br><b>cell-packing 20 mcpt-timer 3</b> | Specifies the maximum number of cells in PW cell pack and the cell packing timer that the Cisco MWR 2941 uses. This example specifies 20 cells per pack and the third MCPT timer. |
| Step 6 | <b>end</b><br><br><b>Example:</b><br>Router(cfg-if-atm-l2trans-pvc)# <b>end</b><br>Router#  | Exits configuration mode.   |



## Configuring Transportation of Service Using Ethernet over MPLS

Ethernet over MPLS PWs allow you to transport Ethernet traffic over an existing MPLS network. For an overview of Ethernet over MPLS pseudowires, see [Transportation of Service Using Ethernet over MPLS](#), page 23-3.

### Configuring VLAN Mode

An Ethernet over MPLS pseudowire in VLAN mode creates a connection based on an existing VLAN ID on the Cisco MWR 2941. Follow these steps to configure an Ethernet over MPLS pseudowire in VLAN mode.

|        | Command   | Purpose  |
|--------|---|--|
| Step 1 | <b>enable</b><br><br><b>Example:</b><br>Router> enable  | Enables privileged EXEC mode.<br><ul style="list-style-type: none"><li>Enter your password if prompted.</li></ul>  |
| Step 2 | <b>configure terminal</b><br><br><b>Example:</b><br>Router# configure terminal  | Enters global configuration mode.  |
| Step 3 | Router(config)# interface vlan 100  | Creates the VLAN interface to bind to a pseudowire.  |
| Step 4 | Router(config-if)# <b>xconnect 1.1.1.2 101 encapsulation mpls</b>   | Binds the Ethernet port interface to an attachment circuit to create a pseudowire. This example uses virtual circuit (VC) 101 to uniquely identify the PW. Ensure that the remote VLAN is configured with the same VC.<br><br><b>Note</b> 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 <b>ip route 30.30.30.2 255.255.255.255 1.2.3.4</b> . |
| Step 5 | Router(config-if)# <b>interface GigabitEthernet 0/1</b><br>Router(config-if)# <b>switchport trunk allowed vlan 100</b><br>Router(config-if)# <b>switchport mode trunk</b> | Adds the GigabitEthernet interface to the VLAN.  |
| Step 6 |   | Creates a corresponding configuration on the remote router with the same VCID value. This configuration uses VCID 101.   |
| Step 7 | <b>exit</b><br><br><b>Example:</b><br>Router(config)# exit<br>Router#   | Exits configuration mode.  |



#### Note

The Cisco MWR 2941 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.

**Note**

For more information about configuring VLANs on the Cisco MWR 2941, see the “[Configuring VLANs](#)” section on page 7-1.

## Configuration Examples for Pseudowire

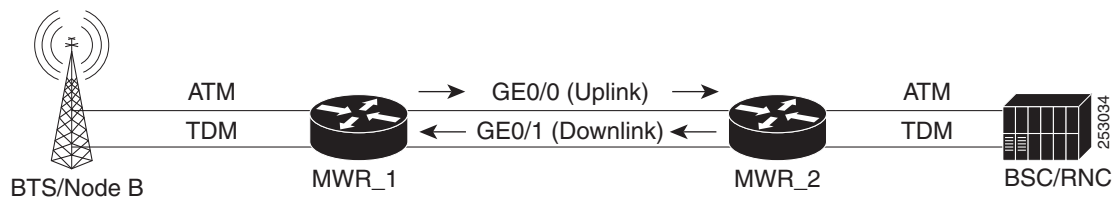
The following sections contain full configuration examples for pseudowire connections.

- [Asymmetric PWE3 Configuration](#), page 23-18
- [PWE3 Redundancy Configuration](#), page 23-26
- [TDM over MPLS Configuration](#), page 23-30
- [ATM over MPLS Configuration](#), page 23-34
- [Ethernet over MPLS Configuration](#), page 23-39

### Asymmetric PWE3 Configuration

The following example shows an Asymmetric PWE3 configuration ([Figure 23-2](#)).

**Figure 23-2** Asymmetric PWE3 Configuration



#### MWR\_1

```

version 12.4
service timestamps debug datetime msec localtime
service timestamps log datetime msec localtime

!
hostname MWR1
!
boot-start-marker
boot-end-marker
!
card type e1 0 0
card type e1 0 1
!
!
ip cef
!
!
controller E1 0/0
clock source internal
cem-group 1 unframed

```

```
!  
controller E1 0/1  
  clock source internal  
  cem-group 20 unframed  
!  
controller E1 0/2  
  clock source internal  
  cem-group 12 unframed  
!  
controller E1 0/3  
  clock source internal  
  cem-group 30 unframed  
!  
controller E1 0/4  
  clock source internal  
  cem-group 8 unframed  
!  
controller E1 0/5  
  clock source internal  
  cem-group 25 unframed  
!  
controller E1 1/0  
  mode atm  
  clock source internal  
!  
controller E1 1/1  
  mode atm  
  clock source internal  
!  
controller E1 1/2  
  mode atm  
  clock source internal  
!  
controller E1 1/3  
!  
!  
pseudowire-class mpls  
  encapsulation mpls  
  preferred-path peer 50.0.0.2  
!  
!  
interface Loopback50  
  ip address 50.0.0.1 255.255.255.255  
!  
interface CEM0/0  
  no ip address  
  cem 1  
  xconnect 50.0.0.2 1 encapsulation mpls  
!  
!  
interface Vlan 20  
  ip address 20.0.0.1 255.0.0.0  
  mpls ip  
!  
interface CEM0/1  
  no ip address  
  cem 20  
  xconnect 50.0.0.2 2 encapsulation mpls  
!  
interface Vlan 60  
  ip address 60.0.0.1 255.0.0.0  
  mpls ip  
!  
interface CEM0/2
```

```

no ip address
cem 12
  xconnect 50.0.0.2 3 encapsulation mpls
!
!
interface CEM0/3
no ip address
cem 30
  xconnect 50.0.0.2 4 encapsulation mpls
!
interface CEM0/4
no ip address
cem 8
  xconnect 50.0.0.2 5 encapsulation mpls
!
!
interface CEM0/5
no ip address
cem 25
  xconnect 50.0.0.2 6 encapsulation mpls
!
interface GigabitEthernet0/0
switchport access vlan 20
duplex auto
speed auto
!
interface GigabitEthernet0/1
switchport access vlan 60
duplex auto
speed auto
!
interface ATM1/0
no ip address
load-interval 30
scrambling-payload
mcpt-timers 1000 5000 10000
no ilmi-keepalive
pvc 0/5 l2transport
  encapsulation aal0
  cell-packing 10 mcpt-timer 3
  xconnect 50.0.0.2 10 pw-class mpls
!
pvc 0/6 l2transport
  xconnect 50.0.0.2 20 pw-class mpls
!
pvc 0/7 l2transport
  encapsulation aal0
  cell-packing 28 mcpt-timer 3
  xconnect 50.0.0.2 30 encapsulation mpls pw-class mpls one-to-one
!
pvc 0/8 l2transport
  xconnect 50.0.0.2 40 pw-class mpls
!
pvc 0/9 l2transport
  encapsulation aal0
  xconnect 50.0.0.2 50 pw-class mpls one-to-one
!
!
interface ATM1/0.1 point-to-point
pvc 0/15 l2transport
  xconnect 50.0.0.2 13 pw-class mpls
!
interface ATM1/0.2 multipoint
  cell-packing 2 mcpt-timer 1

```

```
xconnect 50.0.0.2 12 encapsulation mpls
pvc 0/10 l2transport
  encapsulation aal0
!
pvc 0/11 l2transport
  encapsulation aal0
!
pvc 0/12 l2transport
  encapsulation aal0
!
pvc 0/13 l2transport
  encapsulation aal0
!
!
interface ATM1/0.3 point-to-point
pvc 0/16 l2transport
  encapsulation aal0
  xconnect 50.0.0.2 14 encapsulation mpls
!
!
interface ATM1/0.4 point-to-point
pvc 0/17 l2transport
  encapsulation aal0
  xconnect 50.0.0.2 15 pw-class mpls one-to-one
!
!
interface ATM1/0.6 multipoint
pvc 0/26 l2transport
  xconnect 50.0.0.2 16 pw-class mpls
!
pvc 0/27 l2transport
  encapsulation aal0
  cell-packing 8 mcpt-timer 3
  xconnect 50.0.0.2 17 pw-class mpls
!
pvc 0/28 l2transport
  encapsulation aal0
  cell-packing 16 mcpt-timer 2
  xconnect 50.0.0.2 18 pw-class mpls
!
!
interface ATM1/0.7 multipoint
!
interface ATM1/1
  no ip address
  scrambling-payload
  mcpt-timers 1000 5000 10000
  no ilmi-keepalive
  cell-packing 20 mcpt-timer 2
  xconnect 50.0.0.2 11 encapsulation mpls
pvc 0/21 l2transport
  encapsulation aal0
!
pvc 0/22 l2transport
  encapsulation aal0
!
pvc 0/23 l2transport
  encapsulation aal0
!
!
interface ATM1/1.1 point-to-point
!
interface ATM1/1.2 multipoint
!
```

```

interface ATM1/2
 no ip address
 scrambling-payload
 ima-group 0
 no ilmi-keepalive
!
ip route 50.0.0.2 255.255.255.255 20.0.0.2
!
ip http server
no ip http secure-server
!
!
mpls ldp router-id Loopback50 force
!
!
line con 0
 exec-timeout 0 0
line aux 0
line vty 0 4
 login
!
network-clock-select 1 BITS
!
end

```

**MWR\_2**

```

version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
!
hostname MWR2
!
boot-start-marker
boot-end-marker
!
card type e1 0 0
card type e1 0 1
!
enable password mypassword
!
no aaa new-model
!
ip cef
!
!
controller E1 0/0
 cem-group 1 unframed
!
controller E1 0/1
 cem-group 20 unframed
!
controller E1 0/2
 cem-group 12 unframed
!
controller E1 0/3
 cem-group 30 unframed
!
controller E1 0/4
 cem-group 8 unframed
!
controller E1 0/5
 cem-group 25 unframed

```

```
!  
controller E1 1/0  
  mode atm  
  clock source internal  
!  
controller E1 1/1  
  mode atm  
  clock source internal  
!  
controller E1 1/2  
  mode atm  
  clock source internal  
!  
controller E1 1/3  
  clock source internal  
!  
pseudowire-class mpls  
  encapsulation mpls  
  preferred-path peer 50.0.0.1  
!  
!  
interface Loopback50  
  ip address 50.0.0.2 255.255.255.255  
!  
interface CEM0/0  
  no ip address  
  cem 1  
  xconnect 50.0.0.1 1 encapsulation mpls  
!  
!  
interface Vlan20  
  ip address 20.0.0.2 255.0.0.0  
  mpls ip  
!  
interface Vlan60  
  ip address 60.0.0.2 255.0.0.0  
  mpls ip  
!  
interface GigabitEthernet0/0  
  switchport access vlan 20  
  duplex auto  
  speed auto  
!  
interface GigabitEthernet0/1  
  switchport access vlan 60  
  duplex auto  
  speed auto  
!  
!  
interface CEM0/1  
  no ip address  
  cem 20  
  xconnect 50.0.0.1 2 encapsulation mpls  
!  
!  
interface CEM0/2  
  no ip address  
  cem 12  
  xconnect 50.0.0.1 3 encapsulation mpls  
!  
!  
interface CEM0/3  
  no ip address  
  cem 30
```

```

    xconnect 50.0.0.1 4 encapsulation mpls
    !
    !
interface CEM0/4
no ip address
cem 8
xconnect 50.0.0.1 5 encapsulation mpls
    !
    !
interface CEM0/5
no ip address
cem 25
xconnect 50.0.0.1 6 encapsulation mpls
    !
    !
interface ATM1/0
ip address 1.1.1.2 255.0.0.0
load-interval 30
scrambling-payload
mcpt-timers 1000 5000 10000
no ilmi-keepalive
pvc 0/5 l2transport
encapsulation aal0
cell-packing 25 mcpt-timer 3
xconnect 50.0.0.1 10 pw-class mpls
    !
pvc 0/6 l2transport
xconnect 50.0.0.1 20 pw-class mpls
    !
pvc 0/7 l2transport
encapsulation aal0
cell-packing 12 mcpt-timer 2
xconnect 50.0.0.1 30 encapsulation mpls pw-class mpls one-to-one
    !
pvc 0/8 l2transport
xconnect 50.0.0.1 40 pw-class mpls
    !
pvc 0/9 l2transport
encapsulation aal0
xconnect 50.0.0.1 50 pw-class mpls one-to-one
    !
pvc 0/99
protocol ip 1.1.1.1 broadcast
encapsulation aal5snap
    !
    !
interface ATM1/0.1 point-to-point
pvc 0/15 l2transport
xconnect 50.0.0.1 13 pw-class mpls
    !
    !
interface ATM1/0.2 multipoint
cell-packing 10 mcpt-timer 2
xconnect 50.0.0.1 12 encapsulation mpls
pvc 0/10 l2transport
encapsulation aal0
    !
pvc 0/11 l2transport
encapsulation aal0
    !
pvc 0/12 l2transport
encapsulation aal0
    !
pvc 0/13 l2transport

```



```
        encapsulation aal0
    !
    !
interface ATM1/0.3 point-to-point
    pvc 0/16 l2transport
        encapsulation aal0
        xconnect 50.0.0.1 14 encapsulation mpls
    !
    !
interface ATM1/0.4 point-to-point
    pvc 0/17 l2transport
        encapsulation aal0
        xconnect 50.0.0.1 15 pw-class mpls one-to-one
    !
    !
interface ATM1/0.6 multipoint
    pvc 0/26 l2transport
        xconnect 50.0.0.1 16 pw-class mpls
    !
    pvc 0/27 l2transport
        encapsulation aal0
        cell-packing 18 mcpt-timer 3
        xconnect 50.0.0.1 17 pw-class mpls
    !
    pvc 0/28 l2transport
        encapsulation aal0
        cell-packing 24 mcpt-timer 2
        xconnect 50.0.0.1 18 pw-class mpls
    !
    !
interface ATM1/0.7 multipoint
    !
interface ATM1/1
    no ip address
    scrambling-payload
    mcpt-timers 1000 5000 10000
    no ilmi-keepalive
    cell-packing 20 mcpt-timer 2
    xconnect 50.0.0.1 11 encapsulation mpls
    pvc 0/21 l2transport
        encapsulation aal0
    !
    pvc 0/22 l2transport
        encapsulation aal0
    !
    pvc 0/23 l2transport
        encapsulation aal0
    !
    !
interface ATM1/2
    no ip address
    scrambling-payload
    ima-group 0
    no ilmi-keepalive
    !
ip route 50.0.0.1 255.255.255.255 60.0.0.1
    !
    !
ip http server
no ip http secure-server
    !
    !
mpls ldp router-id Loopback50 force
    !
```

```

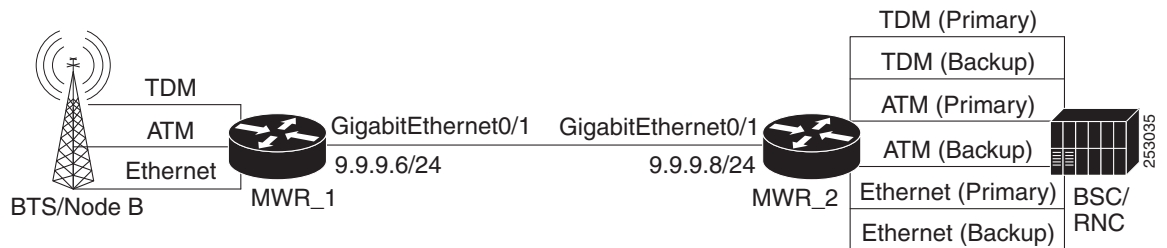
!
!
line con 0
  exec-timeout 0 0
line aux 0
line vty 0 4
  exec-timeout 0 0
  login
!
network-clock-select 1 BITS
!
end

```

## PWE3 Redundancy Configuration

The following example shows a PWE3 Redundancy configuration (Figure 23-3).

**Figure 23-3 PWE3 Redundancy Configuration**



### MWR\_1

```

version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
!
hostname mwr-1
!
boot-start-marker
boot-end-marker
!
card type e1 0 1
card type e1 0 2
!
ip cef
!
controller E1 0/0
  clock source internal
  cem-group 0 unframed
!
controller E1 0/1
!
controller E1 0/2
!
controller E1 0/3
  clock source internal
!
controller E1 1/0
  mode atm
  clock source internal
!

```

```
controller E1 1/1
!
controller E1 1/2
!
controller E1 1/3
  clock source internal
!
interface CEM0/0
  cem 0
  xconnect 2.2.2.2 1 encapsulation mpls
  backup peer 2.2.2.2 2
  backup delay 20 20
!
interface ATM1/0
  no ip address
  scrambling-payload
  no ilmi-keepalive
  pvc 0/1 l2transport
  encapsulation aal0
  xconnect 2.2.2.2 3 encapsulation mpls
  backup peer 2.2.2.2 4
  backup delay 20 20
!
interface Loopback0
  no ip address
!
interface Loopback1
  ip address 1.1.1.1 255.255.255.255
  load-interval 30
!
interface Loopback101
  no ip address
!
!
interface Vlan 9
  ip address 9.9.9.6 255.255.255.0
  mpls ip
!
interface Vlan 10
  no ip address
  no ptp enable
  xconnect 2.2.2.2 10 encapsulation mpls
  backup peer 2.2.2.2 20
!
interface GigabitEthernet0/1
  switchport access vlan 9
  duplex auto
  speed auto
!
interface GigabitEthernet0/2
  switchport access vlan 10
  duplex auto
  speed auto
!
!
ip forward-protocol nd
ip route 2.2.2.2 255.255.255.255 9.9.9.8
!
!
control-plane
!
!
line con 0
```

```

exec-timeout 0 0
logging synchronous
line aux 0
line vty 0 4
exec-timeout 0 0
password mypassword
login
!
exception data-corruption buffer truncate
!
end

```

**MWR\_2**

```

!
version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
!
hostname mwr-pe2
!
boot-start-marker
boot-end-marker
!
card type e1 0 0
card type e1 0 1
card type e1 0 2
!
!
ip cef
!
!
controller E1 0/0
cem-group 0 unframed
!
controller E1 0/1
clock source internal
cem-group 0 unframed
!
controller E1 0/2
!
controller E1 0/3
clock source internal
!
controller E1 0/4
clock source internal
!
controller E1 0/5
!
controller E1 1/0
mode atm
clock source internal
!
controller E1 1/1
clock source internal
!
controller E1 1/2
clock source internal
!
controller E1 1/3
mode atm
clock source internal
!
! Primary

```

```
interface CEM0/0
cem 0
  xconnect 1.1.1.1 1 encapsulation mpls
!
! Backup
interface CEM0/1
cem 0
  xconnect 1.1.1.1 2 encapsulation mpls
!
! Primary
interface ATM1/0
  no ip address
  scrambling-payload
  no ilmi-keepalive
pvc 0/1 l2transport
  encapsulation aal0
  xconnect 1.1.1.1 3 encapsulation mpls
!
! Backup
interface ATM1/3
  no ip address
  scrambling-payload
  no ilmi-keepalive
pvc 0/1 l2transport
  encapsulation aal0
  xconnect 1.1.1.1 4 encapsulation mpls
!
!
interface Loopback1
  ip address 2.2.2.2 255.255.255.255
!
!
interface Vlan 9
  ip address 9.9.9.8 255.255.255.0
  mpls ip
!
interface Vlan 10
  no ip address
  no ptp enable
  xconnect 1.1.1.1 10 encapsulation mpls
!
interface Vlan 20
  no ip address
  no ptp enable
  xconnect 1.1.1.1 20 encapsulation mpls
!
interface GigabitEthernet0/1
  switchport access vlan 9
  duplex auto
  speed auto
!
interface GigabitEthernet0/2
  switchport access vlan 10
  duplex auto
  speed auto
!
interface GigabitEthernet0/3
  switchport access vlan 20
  duplex auto
  speed auto
!
!
ip forward-protocol nd
ip route 1.1.1.1 255.255.255.255 9.9.9.6
```

```

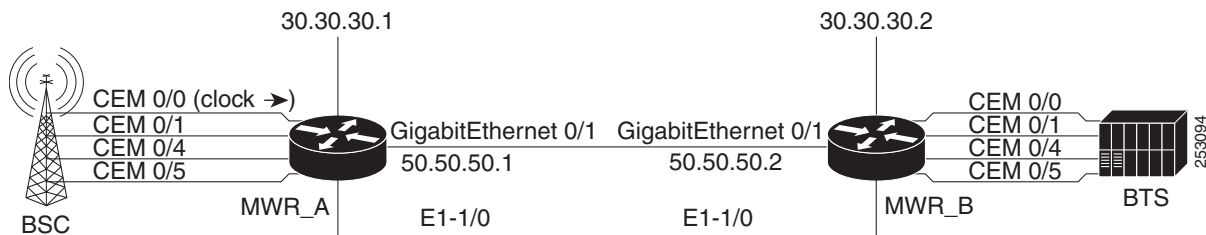
!
!
mpls ldp router-id Loopback1 force
!
control-plane
!
no call rsvp-sync
!
!
!
line con 0
  exec-timeout 0 0
  logging synchronous
line aux 0
line vty 0 4
  exec-timeout 0 0
  password mypassword
  login
!
exception data-corruption buffer truncate
!
end

```

## TDM over MPLS Configuration

Figure 23-4 shows a TDM over MPLS configuration. The configuration uses both SAToP and CESoPSN for E1 and T1.

Figure 23-4 TDM over MPLS Configuration



### MWR\_A

```

!
version 12.4
service timestamps debug datetime msec localtime show-timezone
service timestamps log datetime msec localtime show-timezone
no service password-encryption
!
hostname mwr_A
!
boot-start-marker
boot-end-marker
!
card type e1 0 0
card type e1 0 1
enable password xxx
!
no aaa new-model
clock timezone est -5
!

```

```
ip cef
!
controller E1 0/0
cem-group 0 timeslots 1-31
description E1 CESoPSN example
!
controller E1 0/1
clock source internal
cem-group 1 unframed
description E1 SATOP example
!
controller E1 0/4
clock source internal
cem-group 4 unframed
description E1 SATOP example
!
controller E1 0/5
clock source internal
cem-group 5 timeslots 1-24
description E1 CESoPSN example
!
controller E1 1/0
clock source internal
!
controller E1 1/1
!
interface Loopback0
ip address 30.30.30.1 255.255.255.255
!
interface GigabitEthernet0/1
ip address 50.50.50.1 255.255.255.0
mpls ip
!
interface CEM0/0
no ip address
cem 0
  xconnect 30.30.30.2 300 encapsulation mpls
!
interface CEM0/1
no ip address
cem 1
  xconnect 30.30.30.2 301 encapsulation mpls
!
!
interface CEM0/4
no ip address
cem 4
  xconnect 30.30.30.2 304 encapsulation mpls
!
!
interface CEM0/5
no ip address
cem 5
  xconnect 30.30.30.2 305 encapsulation mpls
!
!
no ip classless
ip route 30.30.30.2 255.255.255.255 50.50.50.2
!
no ip http server
no ip http secure-server
!
line con 0
password xxx
```

```

login
line aux 0
password xxx
login
no exec
line vty 0 4
password xxx
login
!
network-clock-select 1 BITS
end

```

**MWR\_B**

```

!
version 12.4
service timestamps debug datetime msec localtime show-timezone
service timestamps log datetime msec localtime show-timezone
no service password-encryption
!
hostname mwr_B
!
boot-start-marker
boot-end-marker
!
card type e1 0 0
card type e1 0 1
enable password xxx
!
no aaa new-model
clock timezone est -5
!
ip cef
!
controller E1 0/0
clock source internal
cem-group 0 timeslots 1-31
description E1 CESoPSN example
!
controller E1 0/1
clock source internal
cem-group 1 unframed
description E1 SATOP example
!
controller E1 0/4
clock source internal
cem-group 4 unframed
description T1 SATOP example
!
controller E1 0/5
clock source internal
cem-group 5 timeslots 1-24
description T1 CESoPSN example
!
controller E1 1/0

!
controller E1 1/1
!
interface Loopback0
ip address 30.30.30.2 255.255.255.255
!
!

```



```

interface GigabitEthernet0/1
ip address 50.50.50.2 255.255.255.0
mpls ip
!
interface CEM0/0
no ip address
cem 0
  xconnect 30.30.30.1 300 encapsulation mpls
!
interface CEM0/1
no ip address
cem 1
  xconnect 30.30.30.1 301 encapsulation mpls
!
interface CEM0/4
no ip address
cem 4
  xconnect 30.30.30.1 304 encapsulation mpls
!
!
interface CEM0/5
no ip address
cem 5
  xconnect 30.30.30.1 305 encapsulation mpls
!
!
no ip classless
ip route 30.30.30.1 255.255.255.255 50.50.50.1
!
no ip http server
no ip http secure-server
!
line con 0
password xxx
login
line aux 0
password xxx
login
no exec
line vty 0 4
password xxx
login
!
network-clock-select 1 E1 1/0
end

```

## CESoPSN with UDP Configuration

The following configuration uses CESoSPN with UDP encapsulation.



### Note

This section provides a partial configuration intended to demonstrate a specific feature.

```

interface Loopback0
ip address 2.2.2.8 255.255.255.255
!
pseudowire-class udpClass
encapsulation udp

```

```

protocol none
ip local interface Loopback 0
!
controller E1 0/13
clock source internal
cem-group 0 timeslots 1-31
!
interface cem 0/13
cem 0
xconnect 2.2.2.9 200 pw-class udpClass
udp port local 50000 remote 55000

```

**Note**

You cannot use the vrf interface as a tunnel source to establish the PW. You must use only the interface which is present in the global routing table.

## ATM over MPLS Configuration

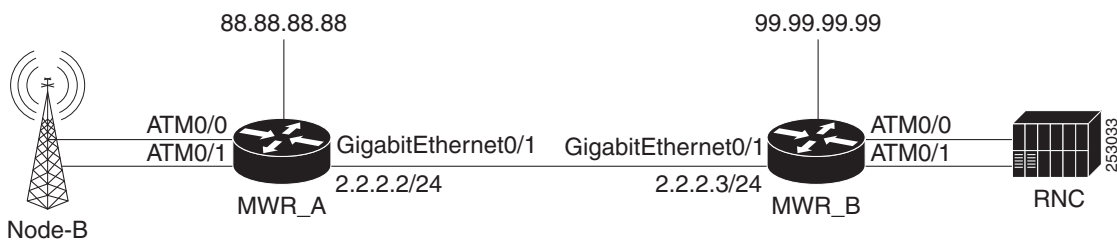
This example shows how to accomplish the following configurations (Figure 23-5):

**Note**

Release 15.1(1)MR does not support N-to-1 VCC Cell Transport for mapping multiple PVCs, 1-to-1 VCC Cell Mode, or PVC mapping.

- AAL5 SDU mode PW on 0/1 PVC 0/100
- N:1 VCC cell mode PW on 0/1 PVC 0/101
- Multiple PVCs N:1 VCC cell mode PW on 0/1.1
- 1:1 VCC cell mode PW on 0/1 PVC 0/102
- Cell-packing for port mode PWs
- VCC cell-relay mode PWs
- PVC mapping for 0/1.1 N:1 VCC cell relay PWs

**Figure 23-5 ATM over MPLS Configuration**

**MWR\_A**

```

!
version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
!
hostname mwr_A
!

```

```
boot-start-marker
boot-end-marker
!
card type e1 0 0
card type e1 0 1
logging buffered 4096
enable password mypassword
!
!
ip cef
!
!
no ip domain lookup
!
!
controller E1 0/0
 mode atm
  clock source internal
!
controller E1 0/1
 mode atm
  clock source internal
!
controller E1 0/2
 mode atm
  clock source internal
!
controller E1 0/3
 mode atm
  clock source internal
!
controller E1 0/4
!
controller E1 0/5
!
controller E1 1/0
!
controller E1 1/1
!
pseudowire-class mpls-exp-5
 encapsulation mpls
  mpls experimental 5
!
!
interface Loopback0
 ip address 88.88.88.88 255.255.255.255
!
interface ATM0/0
 no ip address
 scrambling-payload
  mcpt-timers 1000 2000 3000
 no ilmi-keepalive
  cell-packing 28 mcpt-timer 3
 xconnect 99.99.99.99 100 encapsulation mpls
 pvc 1/35 12transport
  encapsulation aal0
!
 pvc 1/36 12transport
  encapsulation aal0
!
 pvc 1/37 12transport
  encapsulation aal0
!
interface GigabitEthernet0/0
```

```

!
interface ATM0/1
  no ip address
  load-interval 30
  scrambling-payload
  mcpt-timers 1000 2000 3000
  no ilmi-keepalive
  pvc 0/10
  !
  pvc 0/100 l2transport
    encapsulation aal5
    xconnect 99.99.99.99 1100 encapsulation mpls
  !
  pvc 0/101 l2transport
    encapsulation aal0
    cell-packing 28 mcpt-timer 3
    xconnect 99.99.99.99 1101 encapsulation mpls
  !
  pvc 0/102 l2transport
    encapsulation aal0
    cell-packing 28 mcpt-timer 3
    xconnect 99.99.99.99 1102 encapsulation mpls
  !
  pvc 0/103 l2transport
    encapsulation aal0
    cell-packing 28 mcpt-timer 3
    xconnect 99.99.99.99 1103 pw-class mpls-exp-5
  !
!
interface ATM0/1.1 multipoint
  cell-packing 28 mcpt-timer 3
  xconnect 99.99.99.99 1200 encapsulation mpls
  pvc 1/35 l2transport
    encapsulation aal0
    pw-pvc 2/135
  !
  pvc 1/36 l2transport
    encapsulation aal0
    pw-pvc 2/136
  !
  pvc 1/37 l2transport
    encapsulation aal0
    pw-pvc 2/137
  !
!
interface GigabitEthernet0/1
  description interface to 7600 fas 3/5
  ip address 2.2.2.2 255.255.255.0
  duplex auto
  speed auto
  mpls ip
  no keepalive
!
interface ATM0/2
  no ip address
  scrambling-payload
  no ilmi-keepalive
!
interface ATM0/3
  no ip address
  scrambling-payload
  no ilmi-keepalive
!
ip route 99.99.99.99 255.255.255.255 2.2.2.3

```

```

!
!
ip http server
no ip http secure-server
!
!
mpls ldp router-id Loopback0
!
!
line con 0
  exec-timeout 0 0
line aux 0
line vty 0 4
  exec-timeout 0 0
  privilege level 15
  password mypassword
  login
!
network-clock-select 1 E1 1/0
!
end

```

**MWR\_B**

```

!
version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
!
hostname mwr_B
!
boot-start-marker
boot-end-marker
!
card type e1 0 0
card type e1 0 1
logging buffered 4096
enable password mypassword
!
!
ip cef
!
!
no ip domain lookup
!
!
controller E1 0/0
  mode atm
!
controller E1 0/1
  mode atm
!
controller E1 0/2
  mode atm
!
controller E1 0/3
  mode atm
!
controller E1 0/4
!
controller E1 0/5
!
pseudowire-class mpls-exp-5
  encapsulation mpls

```

```

mpls experimental 5
!
!
interface Loopback0
 ip address 99.99.99.99 255.255.255.255
!
interface ATM0/0
 no ip address
 scrambling-payload
 mcpt-timers 1000 2000 3000
 no ilmi-keepalive
 cell-packing 28 mcpt-timer 3
 xconnect 88.88.88.88 100 encapsulation mpls
 pvc 1/35 l2transport
 encapsulation aal0
!
 pvc 1/36 l2transport
 encapsulation aal0
!
 pvc 1/37 l2transport
 encapsulation aal0
!
!
interface GigabitEthernet0/0
!
interface ATM0/1
 no ip address
 scrambling-payload
 mcpt-timers 1000 2000 3000
 no ilmi-keepalive
 pvc 0/2
!
 pvc 0/100 l2transport
 encapsulation aal5
 xconnect 88.88.88.88 1100 encapsulation mpls
!
 pvc 0/101 l2transport
 encapsulation aal0
 cell-packing 28 mcpt-timer 3
 xconnect 88.88.88.88 1101 encapsulation mpls
!
 pvc 0/102 l2transport
 encapsulation aal0
 cell-packing 28 mcpt-timer 3
 xconnect 88.88.88.88 1102 encapsulation mpls
!
 pvc 0/103 l2transport
 encapsulation aal0
 cell-packing 28 mcpt-timer 3
 xconnect 88.88.88.88 1103 pw-class mpls-exp-5
!
interface ATM0/1.1 multipoint
 cell-packing 28 mcpt-timer 3
 xconnect 88.88.88.88 1200 encapsulation mpls
 pvc 2/135 l2transport
 encapsulation aal0
!
 pvc 2/136 l2transport
 encapsulation aal0
!
 pvc 2/137 l2transport
 encapsulation aal0
!
!

```

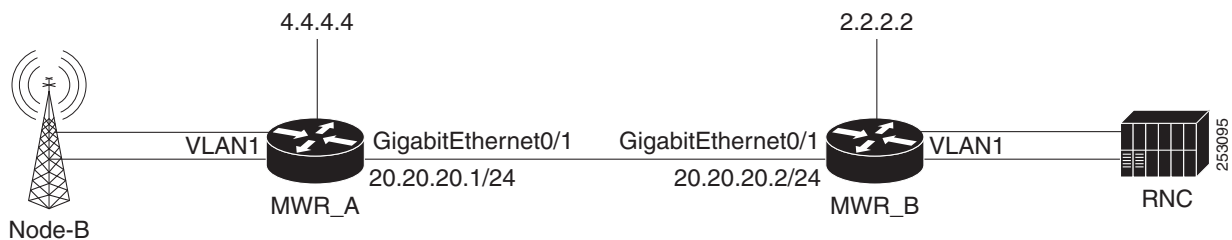
```

interface GigabitEthernet0/1
 ip address 2.2.2.3 255.255.255.0
 duplex auto
 speed auto
 mpls ip
 !
interface ATM0/2
 no ip address
 scrambling-payload
 ima-group 0
 no ilmi-keepalive
 !
interface ATM0/3
 no ip address
 scrambling-payload
 ima-group 0
 no ilmi-keepalive
 !
ip route 88.88.88.88 255.255.255.255 2.2.2.2
 !
 !
ip http server
no ip http secure-server
 !
 !
mpls ldp router-id Loopback0
 !
 !
line con 0
 exec-timeout 0 0
line aux 0
line vty 0 4
 exec-timeout 0 0
 password mypassword
 login
 !
network-clock-select 1 E1 0/0
 !
end

```

## Ethernet over MPLS Configuration

The following configuration example shows an Ethernet pseudowire (aka EoMPLS) configuration.



### MWR\_A

```

!
version 12.4
service timestamps debug datetime msec

```

```

service timestamps log datetime msec
no service password-encryption
!
hostname mwr_A
!
boot-start-marker
boot-end-marker
!
card type e1 0 0
card type e1 0 1
logging buffered 4096
enable password mypassword
!
no aaa new-model
!
network-clock-select 1 E1 0/0
mmi polling-interval 60
no mmi auto-configure
no mmi pvc
mmi snmp-timeout 180
ip cef
!
no ip domain lookup
ip domain name cisco.com
multilink bundle-name authenticated
mpls label protocol ldp
vpdn enable
!
!
controller E1 0/0
mode aim 1
!
controller E1 0/1
mode aim 1
!
controller E1 0/2
mode aim 1
!
controller E1 0/3
mode aim 1
!
controller E1 0/4
!
controller E1 0/5
!
interface Loopback0
ip address 4.4.4.4 255.255.255.255
!
interface GigabitEthernet0/4
switchport trunk allowed vlan 1,2,20,1002-1005
switchport mode trunk
!
interface GigabitEthernet0/5
switchport trunk allowed vlan 1,2,40,1002-1005
switchport mode trunk
!
interface Vlan20
ip address 20.20.20.1 255.255.255.0
no ptp enable
mpls ip
!
interface Vlan40
no ip address
no ptp enable

```



```
xconnect 2.2.2.2 10 encapsulation mpls
!
ip route 2.2.2.2 255.255.255.255 20.20.20.2
!
no ip http server
no ip http secure-server
!
!
mpls ldp router-id Loopback0
!
!
line con 0
  exec-timeout 0 0
line aux 0
line vty 0 4
  exec-timeout 0 0
  password mypassword
  login
!
end
```

### MWR\_B

```
!
version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname mwr_B
!
boot-start-marker
boot-end-marker
!
card type e1 0 0
card type e1 0 1
logging buffered 4096
enable password mypassword
!
no aaa new-model
!
network-clock-select 1 E1 0/0
mmi polling-interval 60
no mmi auto-configure
no mmi pvc
mmi snmp-timeout 180
ip cef
!
no ip domain lookup
ip domain name cisco.com
multilink bundle-name authenticated
mpls label protocol ldp
vpdn enable
!
!
controller E1 0/0
  mode aim 1
!
controller E1 0/1
  mode aim 1
!
controller E1 0/2
```

```
mode aim 1
!
controller E1 0/3
mode aim 1
!
controller E1 0/4
!
controller E1 0/5
!
interface Loopback0
ip address 2.2.2.2 255.255.255.255
!
interface GigabitEthernet0/4
switchport trunk allowed vlan 1,2,20,1002-1005
switchport mode trunk
!
interface GigabitEthernet0/5
switchport trunk allowed vlan 1,2,40,1002-1005
switchport mode trunk
!
interface Vlan20
ip address 20.20.20.2 255.255.255.0
no ptp enable
mpls ip
!
interface Vlan40
no ip address
no ptp enable
xconnect 4.4.4.4 10 encapsulation mpls
!
ip route 4.4.4.4 255.255.255.255 20.20.20.1
!
no ip http server
no ip http secure-server
!
!
mpls ldp router-id Loopback0
!
!
line con 0
exec-timeout 0 0
line aux 0
line vty 0 4
exec-timeout 0 0
password mypassword
login
!
end
```