



## H-VPLS N-PE Redundancy for MPLS Access

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The H-VPLS N-PE Redundancy for MPLS Access feature enables two network provider edge (N-PE) devices to provide failover services to a user provider edge (U-PE) device in a hierarchical virtual private LAN service (H-VPLS). Having redundant N-PE devices provides improved stability and reliability against link and node failures.

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## Prerequisites for H-VPLS N-PE Redundancy for MPLS Access

- Before configuring this feature, configure your hierarchical virtual private LAN service (H-VPLS) network and make sure it is operating correctly.
- To provide faster convergence, you can enable the MPLS Traffic Engineering—Fast Reroute feature in the Multiprotocol Label Switching (MPLS) core.
- Enable the L2VPN Pseudowire Redundancy feature on the user provider edge (U-PE) devices for MPLS access.

## Restrictions for H-VPLS N-PE Redundancy for MPLS Access

- This feature cannot be used with the VPLS Autodiscovery feature on pseudowires that attach to user provider edge (U-PE) devices. When you create the virtual private LAN service (VPLS), you can manually create the virtual forwarding interface (VFI).
- You cannot configure more than one pseudowire to carry the bridge protocol data unit (BPDU) information between the network provider edge (N-PE) devices.
- You cannot configure a local loopback address as a neighbor when you configure the H-VPLS N-PE Redundancy feature on N-PE devices.

- Only two N-PE devices can be connected to each U-PE device.

## Information About H-VPLS N-PE Redundancy for MPLS Access

### How H-VPLS N-PE Redundancy for MPLS Access

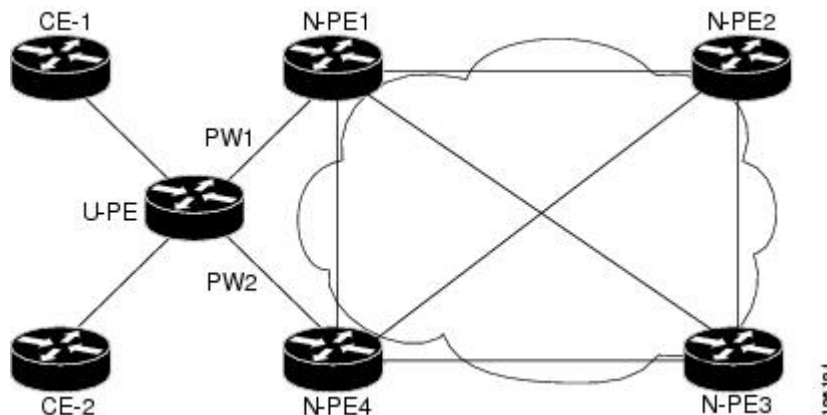
In a network configured with the H-VPLS N-PE Redundancy feature, the user provider edge (U-PE) device is connected to two network provider edge (N-PE) devices. This feature provides a level of redundancy that can tolerate both link and device faults. If a failure occurs in the network that disables one N-PE device from transmitting data, the other N-PE device takes over.

### H-VPLS N-PE Redundancy with MPLS Access Based on Pseudowire Redundancy

For the H-VPLS Redundancy with MPLS Access feature based on pseudowire redundancy, the Multiprotocol Label Switching (MPLS) network has pseudowires to the virtual private LAN service (VPLS) core network provider edge (N-PE) devices.

As shown in the figure below, one pseudowire transports data between the user provider edge (U-PE) device and its peer N-PE devices. When a failure occurs along the path of the U-PE device, the backup pseudowire and the redundant N-PE device become active and start transporting data.

*Figure 1: H-VPLS N-PE Redundancy for MPLS Access Based on Pseudowire Redundancy*



## How to Configure H-VPLS N-PE Redundancy for MPLS Access

### Configuring the VPLS Pseudowire Between the N-PE Devices

Configuring network provider edge (N-PE) redundancy in a hierarchical Virtual Private LAN service (H-VPLS) network requires that you define the VPLS pseudowire for transporting bridge protocol data unit (BPDU) packets (described here) and that you connect that pseudowire to the native VLAN (described in the next

task). This configuration provides a redundancy that provides improved reliability against link and node failures.

### Procedure

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b> <b>Example:</b>  Device> enable	Enables privileged EXEC mode.  • Enter your password if prompted.
<b>Step 2</b>	<b>configure terminal</b> <b>Example:</b>  Device# configure terminal	Enters global configuration mode.
<b>Step 3</b>	<b>l2 vfi name manual</b> <b>Example:</b>  Device(config)# l2 vfi vfitest1 manual	Creates a Layer 2 virtual forwarding interface (VFI) and enters Layer 2 VFI manual configuration mode.
<b>Step 4</b>	<b>vpn id id-number</b> <b>Example:</b>  Device(config-vfi)# vpn id 10	Specifies the VPN ID.
<b>Step 5</b>	<b>bridge-domain bridge-id</b>	Configures the router to derive bridge domains from the encapsulation VLAN list.
<b>Step 6</b>	<b>neighbor remote-router-id vc-id {encapsulation encapsulation-type   pw-class pw-name} [no-split-horizon]</b> <b>Example:</b>  Device(config-vfi)# neighbor 10.2.2.2 3 encapsulation mpls	Specifies the peer IP address of the redundant N-PE device and the type of tunnel signaling and encapsulation mechanism.
<b>Step 7</b>	<b>end</b> <b>Example:</b>  Device(config-vfi)# end	Exits Layer 2 VFI manual configuration mode and returns to privileged EXEC mode.

### Example

You can also configure the VPLS pseudowire between the N-PE devices using this alternate method.

```
RoutDeviceer> enable
Device# configure terminal
Device(config)# l2vpn vfi context vfi110
Device(config-vfi)# vpn id 10
```

```

Device(config-vfi)# exit
Device(config)# bridge-domain 100
Device(config-bd)# member vfi vfi110
Device(config-vfi)# member 172.16.10.2 4 encapsulation mpls
Device(config-vfi)# end

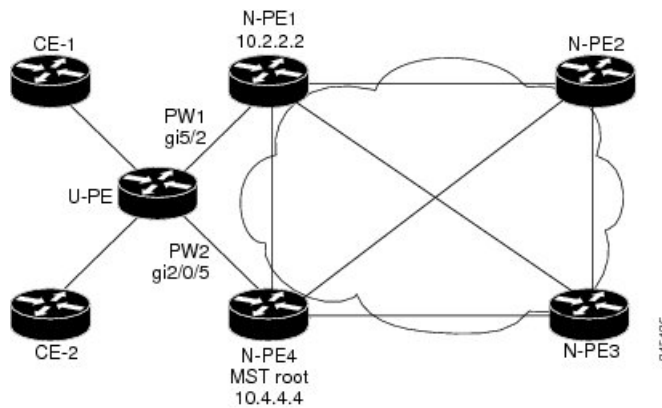
```

## Configuration Examples for H-VPLS N-PE Redundancy for MPLS Access

### Example: H-VPLS N-PE Redundancy for MPLS Access

The figure below shows a configuration that is set up for the H-VPLS N-PE Redundancy with MPLS Access feature.

**Figure 2: H-VPLS N-PE Redundancy with MPLS Access Topology**



The table below shows the configuration of two network provider edge (N-PE) devices.

Table 1: Example: H-VPLS N-PE Redundancy for MPLS Access

N-PE1	N-PE4
<pre> 12 vfi l2trunk manual    vpn id 10    bridge-domain 10     neighbor 10.4.4.4 encapsulation mpls    !  spanning-tree mode mst spanning-tree extend system-id ! spanning-tree mst configuration revision 10 instance 1 vlan 20 !  interface GigabitEthernet 0/5/2 service instance 5 ethernet encapsulation dot1q 10 bridge-domain 10 </pre>	<pre> 12 vfi l2trunk manual    vpn id 10    bridge-domain 10     neighbor 10.2.2.2 encapsulation mpls    !  spanning-tree mode mst spanning-tree extend system-id ! spanning-tree mst configuration revision 10 instance 1 vlan 20 ! spanning-tree mst 1 priority 0 !  interface GigabitEthernet 0/5/2 service instance 5 ethernet encapsulation dot1q 10 bridge-domain 10 </pre>

## Additional References

### Related Documents

Related Topic	Document Title
Cisco IOS commands	<a href="#">Cisco IOS Master Command List, All Releases</a>
MPLS commands	<a href="#">Cisco IOS Multiprotocol Label Switching Command Reference</a>
L2VPN pseudowire redundancy	“L2VPN Pseudowire Redundancy” feature module in the <i>MPLS Layer 2 VPNs Configuration Guide</i> .
H-VPLS	“ <a href="#">Configuring VPLS</a> ” in the “Configuring Multiprotocol Label Switching on the Optical Services Modules” chapter in the <i>Optical Services Modules Installation and Configuration Notes</i> , 12.2SR document.
MPLS traffic engineering	“MPLS Traffic Engineering Fast Reroute Link and Node Protection” feature module in the <i>MPLS Traffic Engineering: Path, Link, and Node Protection Configuration Guide</i> (part of the Multiprotocol Label Switching Configuration Guide Library)

**Standards**

Standard	Title
<a href="http://www.ietf.org/rfc/rfc4447.txt">http://www.ietf.org/rfc/rfc4447.txt</a>	<i>Pseudowire Setup and Maintenance Using the Label Distribution Protocol (LDP)</i>
<a href="http://www3.ietf.org/proceedings/06mar/IDs/draft-ietf-l2vpn-vpls-ldp-08.txt">http://www3.ietf.org/proceedings/06mar/IDs/draft-ietf-l2vpn-vpls-ldp-08.txt</a>	<i>Virtual Private LAN Services over MPLS</i>
<a href="http://www.ietf.org/internet-drafts/draft-ietf-pwe3-segmented-pw-02.txt">http://www.ietf.org/internet-drafts/draft-ietf-pwe3-segmented-pw-02.txt</a>	<i>Segmented Pseudo Wire</i>
<a href="#">draft-ietf-pwe3-vccv-10.txt</a>	<i>Pseudo Wire Virtual Circuit Connectivity Verification (VCCV)</i>
<a href="#">draft-ietf-pwe3-oam-msg-map-03.txt</a>	<i>Pseudo Wire (PW) OAM Message Mapping</i>

**MIBs**

MIB	MIBs Link
Pseudowire Emulation Edge-to-Edge MIBs for Ethernet, Frame Relay, and ATM Services	To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL:  <a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a>

**Technical Assistance**

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	<a href="http://www.cisco.com/cisco/web/support/index.html">http://www.cisco.com/cisco/web/support/index.html</a>

# Glossary

**CE device**—customer edge device. A device that belongs to a customer network, which connects to a PE device to utilize MPLS VPN network services.

**LAN**—local-area network. High-speed, low-error data network covering a relatively small geographic area. LANs connect workstations, peripherals, terminals, and other devices in a single building or other geographically limited areas.

**MPLS**—Multiprotocol Label Switching. A packet-forwarding technology, used in the network core, that applies data link layer labels to tell switching nodes how to forward data, resulting in faster and more scalable forwarding than network layer routing normally can do.

**MSTP**—Multiple Spanning Tree Protocol. MSTP enables multiple VLANs to be mapped to the same spanning-tree instance, reducing the number of spanning-tree instances needed to support a large number of VLANs.

**N-PE**—network provider edge device. This device acts as a gateway between the MPLS core and edge domains.

**PE device**—provider edge device. The PE device is the entry point into the service provider network. The PE device is typically deployed on the edge of the network and is administered by the service provider.

**pseudowire**—A pseudowire is a virtual connection that, in the context of VPLS, connects two SVIs. It is a mechanism that carries the elements of an emulated service from one PE device to one or more PE devices over a packet switched network (PSN). A pseudowire is bidirectional and consists of a pair of unidirectional MPLS virtual circuits (VCs). A pseudowire can be used to connect a point-to-point circuit.

**QinQ**—An IEEE 802.1Q VLAN tunnel. A mechanism for constructing multipoint Layer 2 VPN using Ethernet switches.

**redundancy**—The duplication of devices, services, or connections so that, in the event of a failure, they can perform the work of those that failed.

**router**—A network layer device that uses one or more metrics to determine the optimal path along which network traffic should be forwarded. Routers forward packets from one network to another based on network layer information.

**spanning tree**—Loop-free subset of a network topology.

**U-PE**—user provider edge device. This device connects CE devices to the service.

**VFI**—virtual forwarding instance. A VFI is a collection of data structures used by the data plane, software-based or hardware-based, to forward packets to one or more VCs.

**VLAN**—Virtual LAN. Group of devices on one or more LANs that are configured (using management software) so that they can communicate as if they were attached to the same wire, when in fact they are located on a number of different LAN segments.

**VPLS**—Virtual Private LAN Service. VPLS describes an architecture that delivers Layer 2 service that emulates an Ethernet LAN across a wide-area network (WAN) and inherits the scaling characteristics of a LAN.

**VPLS redundancy**—Also called N-PE redundancy. Allows U-PEs to be dual-homed (to their N-PEs) in a loop-free topology with MPLS or QinQ as the access or aggregation domain.

**VPN**—Virtual Private Network. Allows IP traffic to travel securely over public TCP/IP networks and the Internet by encapsulating and encrypting all IP packets. VPN uses a tunnel to encrypt all information at the IP level.

