



H-VPLS N-PE Redundancy for MPLS Access

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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Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table at the end of this module.

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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.

- Make sure that the PE-to-customer edge (CE) interface is configured with a list of allowed VLANs.
- 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

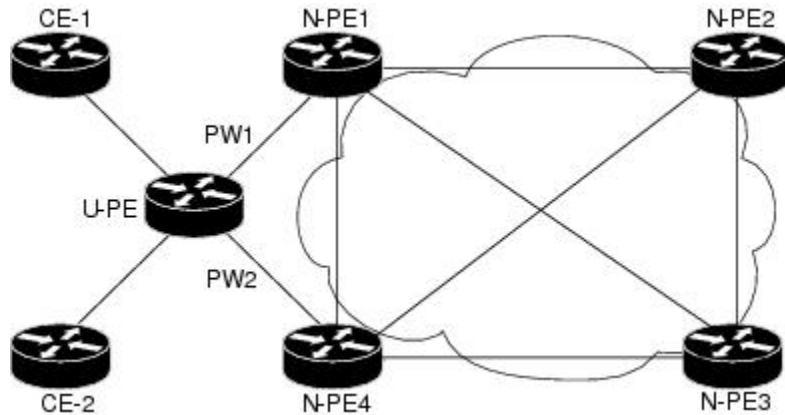
In a network configured with the H-VPLS N-PE Redundancy feature, the user provider edge (U-PE) device is connected to two network provider edge (N-PE) devices. This feature provides a level of redundancy that can tolerate both link and device faults. If a failure occurs in the network that disables one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

SUMMARY STEPS

1. enable
2. configure terminal
3. l2 vfi name manual
4. vpn id id-number
5. forward permit l2protocol all
6. neighbor remote-router-id vc-id {encapsulation encapsulation-type | pw-class pw-name} [no-split-horizon]
7. end

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable	Enables privileged EXEC mode.

	Command or Action	Purpose
	Example: Device> enable	<ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	l2 vfi name manual Example: Device(config)# l2 vfi vfitest1 manual	Creates a Layer 2 virtual forwarding interface (VFI) and enters Layer 2 VFI manual configuration mode.
Step 4	vpn id id-number Example: Device(config-vfi)# vpn id 200	Specifies the VPN ID.
Step 5	forward permit l2protocol all Example: Device(config-vfi)# forward permit l2protocol all	Creates a pseudowire that is to be used to transport BPDU packets between the two N-PE devices.
Step 6	neighbor remote-router-id vc-id {encapsulation encapsulation-type pw-class pw-name} [no-split-horizon] Example: 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.
Step 7	end Example: Device(config-vfi)# end	Exits Layer 2 VFI manual configuration mode and returns to privileged EXEC mode.

Configuring the SVI for the Native VLAN

Perform this task to configure the switched virtual interface (SVI) for the native VLAN and verify that it is correctly configured.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface vlan *vlan-id***
4. **xconnect vfi *vfi-name***
5. **end**
6. **show vfi *vfi-name***
7. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	interface vlan <i>vlan-id</i> Example: Device(config)# interface vlan 23	Creates a dynamic SVI. <ul style="list-style-type: none"> • To make the SVI active when you create a VLAN, you must configure the VLAN with at least one physical interface that is in the “up” state. Use the show vfi command to display the status of the SVI. The state field will display “up” when the SVI is active.
Step 4	xconnect vfi <i>vfi-name</i> Example: Device(config)# xconnect vfi vfitest1	Specifies the Layer 2 virtual forwarding interface (VFI) that you are binding to the VLAN port.
Step 5	end Example: Device(config-vfi)# end	Ends the current configuration session and returns to privileged EXEC mode.

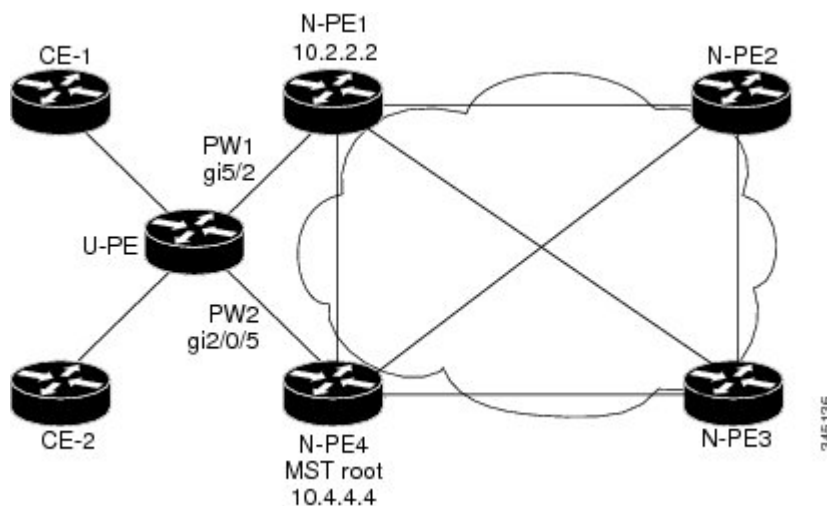
	Command or Action	Purpose
Step 6	show vfi vfi-name Example: Device# show vfi VPLS-2	(Optional) Displays information about the pseudowire between the two network provider edge (N-PE) devices so that you can verify that the H-VPLS N-PE Redundancy feature is correctly configured.
Step 7	end Example: Device# end	Exits privileged EXEC mode and returns to user EXEC mode.

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> l2 vfi l2trunk manual vpn id 10 forward permit l2protocol all neighbor 10.4.4.4 encapsulation mpls ! interface Vlan1 no ip address xconnect vfi l2trunk ! spanning-tree mode mst spanning-tree extend system-id ! spanning-tree mst configuration revision 10 instance 1 vlan 20 ! interface GigabitEthernet5/2 switchport switchport trunk encapsulation dot1q switchport trunk allowed vlan 20 switchport mode trunk </pre>	<pre> l2 vfi l2trunk manual vpn id 10 forward permit l2protocol all neighbor 10.2.2.2 encapsulation mpls ! interface Vlan1 no ip address xconnect vfi l2trunk ! 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 GigabitEthernet2/0/5 switchport switchport trunk allowed vlan 20 switchport mode trunk mls qos trust dscp </pre>

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Command List, All Releases
MPLS commands	Cisco IOS Multiprotocol Label Switching Command Reference
L2VPN pseudowire redundancy	“L2VPN Pseudowire Redundancy” feature module in the <i>MPLS Layer 2 VPNs Configuration Guide</i> .
H-VPLS	“Configuring VPLS” 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
http://www.ietf.org/rfc/rfc4447.txt	<i>Pseudowire Setup and Maintenance Using the Label Distribution Protocol (LDP)</i>
http://www3.ietf.org/proceedings/06mar/IDs/draft-ietf-2vpn-vpls-ldp-08.txt	<i>Virtual Private LAN Services over MPLS</i>
http://www.ietf.org/internet-drafts/draft-ietf-pwe3-segmented-pw-02.txt	<i>Segmented Pseudo Wire</i>
draft-ietf-pwe3-vccv-10.txt	<i>Pseudo Wire Virtual Circuit Connectivity Verification (VCCV)</i>
draft-ietf-pwe3-oam-msg-map-03.txt	<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: http://www.cisco.com/go/mibs

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.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for H-VPLS N-PE Redundancy for MPLS Access

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

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Table 2: Feature Information for H-VPLS N-PE Redundancy for MPLS Access

Feature Name	Releases	Feature Information
H-VPLS N-PE Redundancy for MPLS Access	Cisco IOS XE Release 3.6S	<p>The H-VPLS N-PE Redundancy for MPLS Access feature enables two network provider edge (N-PE) devices to provide redundancy 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.</p> <p>In Cisco IOS XE Release 3.6S, support was added for the Cisco ASR 903 Router.</p> <p>The following commands were introduced or modified: forward permit l2protocol, show mpls l2transport vc.</p>

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.