Routed Pseudowire

This feature combines the Layer 2 forwarding with Layer 3 routing functionality and enables configuring EoMPLS and routing simultaneously on an SVI (Interface VLAN). This allows Layer 3 traffic to be routed into an EoMPLS pseudowire domain.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see 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 for Routed Pseudowire" section on page 11.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn. An account on Cisco.com is not required.

Contents

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Prerequisites for Routed Pseudowire

- Ensure that you have the appropriate Cisco routers and switches. This feature supports the following Integrated Series Router Generation 2 (ISR G2) platforms with EHWIC-4/8ESG:
    - Cisco 89x and 888EAISR G2
    - Cisco 19xx ISR G2
    - Cisco 29xx ISR G2
    - Cisco 39xx ISR G2
- Ensure that you have the appropriate ether-switch modules installed in ISR G2.
    - HWIC-4ESW, HWIC-4ESW-POE
    - HWIC-D-9ESW,HWIC-D-9ESW-POE
    - EHWIC-4ESG, EHWIC-4ESG-P
    - EHWIC-D-8ESG, EHWIC-D-8ESG-P

Note You cannot use the EHWIC switch in conjunction with the HWICs.

- This feature supports Release 15.2(4)M and later releases.
- IP packets must arrive untagged at the SVI for the Layer 3 lookup.

Restrictions for Routed Pseudowire

- Configuration through SNMP/MIB is not supported.
- No physical ports will be associated with SVI (Interface VLAN).
- The SVI will stay up if both IP address and xconnect statements are configured.
- VPLS as a feature is not supported in ISR G2 routers.

Information About Routed Pseudowire

Routed pseudowire (PW) is a Layer 3 interface within the ISR G2 routers. All the standard IOS Layer 3 features can be applied to this interface. This interface is not associated with any physical interface.

Routed pseudowire is created when the IP address and xconnect commands are simultaneously present on a VLAN interface. This allows Layer 3 traffic to be routed into an EoMPLS pseudowire domain.

How to Configure Routed Pseudowire CLI and Interface Code

The VPLS and SVI-based EoMPLS Routed Pseudowire Support feature makes it possible to route (Layer 3), as well as switch (Layer 2), frames for pseudowire connections between provider edge (PE) devices.

Both point-to-point PE connections, in the form of Ethernet over MPLS (EoMPLS), and multipoint PE connections, in the form or Virtual Private LAN Services (VPLS), are supported. The ability to route frames to and from these interfaces now makes it possible to terminate a pseudowire into a Layer 3 network (VPN or global) on the same router or to tunnel Layer 3 frames over a Layer 2 tunnel (EoMPLS or VPLS).

The feature supports faster network convergence in the event of a physical interface or device failure through the MPLS Traffic Engineering (MPLS-TE) and Fast Reroute (FRR) features of the network. In particular, the feature enables MPLS TE-FRR protection for Layer 3 multicast over a VPLS domain.

Configuring Routed PseudoWire CLI and Interface Code

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip vrf** *vrf-name*
4. **interface vlan** *vlan_num* (Optional)
5. **ip vrf forwarding** *vrf-name* (Optional)
6. **ip address** *ip-address subnet-mask*
7. **xconnect** *remote-ip-address vc-id* **encapsulation mpls**
8. **end**
9. **show xconnect all**
10. **show mpls l2transport vc detail**
11. **copy running-config startup-config** (Optional)

DETAILED STEPS

	Command or Action	Purpose

Step 1	`enable`
	
	Example:
	`Router> enable`
		Enables privileged EXEC mode.
		
		  • Enter your password if prompted.

Step 2	`configure terminal`
	
	Example:
	`Router# configure terminal`
		Enters global configuration mode.

	Command or Action	Purpose
Step 3	**ip vrf** *vrf-name* **Example:** Router(config)# ip vrf blue	Configures the command to enable VRF. • The *vrf-name* argument is the name assigned to a VRF.
Step 4	**interface vlan** *vlan_num* **Example:** Router(config-if)# interface vlan300	(Optional) Enters interface configuration mode and configure SVI. **Note** This SVI interface is not associated to any Layer 2 physical interface.
Step 5	**ip vrf forwarding** *vrf-name* **Example:** Router(config-if)# ip vrf forwarding blue	(Optional) Associates a VRF with an interface or subinterface.
Step 6	**ip address** *ip-address subnet-mask* **Example:** Router(config-if)# ip address 210.0.0.1 255.0.0.0	Specifies the IP address and mask for the interface.
Step 7	**xconnect** *remote-ip-address vc-id* **encapsulation mpls** **Example:** Router(config-if)# xconnect 4.4.4.4 40 encapsulation mpls	Binds an 802.1Q VLAN attachment circuit (VC).
Step 8	**end** **Example:** Router(config-if)# end	Returns to privileged EXEC mode.
Step 9	**show xconnect all** **Example:** Router# show xconnect all	Verifies the configuration.
Step 10	**show mpls l2transport vc detail** **Example:** Router# show mpls l2transport vc detail	Displays the detailed information about the active virtual connections that are enabled to route Layer 2 packets on a PE device.
Step 11	**copy running-config start-up config** **Example:** Router# copy running-config start-up config	(Optional) Saves your entries in the configuration file.

Troubleshooting Tips

Use the following verification commands on PE:
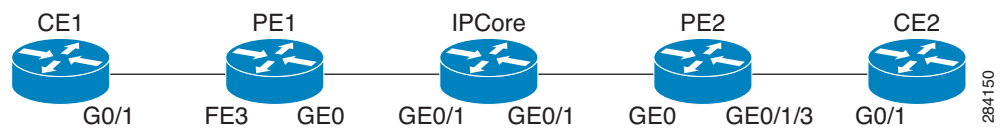
• **show xconnect all**

• **show ip route vrf** *vrf-name*

Configuration Examples for Routed Pseudowire and Interface Code

Example: Routed Pseudowire

The following example shows how to configure routed pseudowire:

Sample Topology

CE1 Configuration

```
interface GigabitEthernet0/0
 ip address 200.0.0.2 255.0.0.0
 load-interval 30
 duplex auto

router ospf 200
network 200.0.0.0 0.255.255.255 area 0
```

PE1 Configuration

```
ip vrf blue

interface Loopback1
 ip vrf forwarding blue
 ip address 11.0.0.1 255.255.255.255

interface Loopback0
 ip address 2.2.2.2 255.255.255.255

interface Vlan100
 ip vrf forwarding blue
 ip address 200.0.0.1 255.0.0.0
 load-interval 30

interface Vlan300
 ip vrf forwarding blue
 ip address 210.0.0.1 255.0.0.0
 xconnect 4.4.4.4 40 encapsulation mpls

interface FastEthernet3
 switchport access vlan 100
 no ip address
 load-interval 30
!
interface GigabitEthernet0/0
 ip address 20.0.0.1 255.0.0.0
 load-interval 30
 duplex auto
```

```
router ospf 100
 mpls ldp autoconfig area 0
 network 2.2.2.2 0.0.0.0 area 0
 network 20.0.0.0 0.0.0.255 area 0

router ospf 200 vrf blue
 router-id 11.0.0.1
 passive-interface Vlan100
 network 11.0.0.1 0.0.0.0 area 0
 network 200.0.0.0 0.255.255.255 area 0
 network 210.0.0.0 0.255.255.255 area 0
```

IP Core Configuration

```
interface Loopback0
 ip address 3.3.3.3 255.255.255.255

interface GigabitEthernet0/1
 ip address 20.0.0.2 255.0.0.0
 duplex auto
 speed auto
 no keepalive

interface GigabitEthernet0/2
 ip address 30.0.0.1 255.0.0.0
 load-interval 30
 duplex auto
 speed auto
 no keepalive

router ospf 100
 mpls ldp autoconfig area 0
 network 3.3.3.3 0.0.0.0 area 0
 network 20.0.0.0 0.0.0.255 area 0
 network 30.0.0.0 0.0.0.255 area 0
```

PE 2 Configuration

```
ip vrf blue

interface Loopback1
 ip vrf forwarding blue
 ip address 11.0.0.3 255.255.255.255

interface Loopback0
 ip address 4.4.4.4 255.255.255.255

interface Vlan100
 ip vrf forwarding blue
 ip address 220.0.0.1 255.0.0.0
 load-interval 30

interface Vlan300
 ip vrf forwarding blue
 ip address 210.0.0.2 255.0.0.0
 xconnect 2.2.2.2 40 encapsulation mpls

interface GigabitEthernet0/0
 ip address 30.0.0.2 255.0.0.0
 load-interval 30
 duplex auto

interface GigabitEthernet0/0/3
```

```
 switchport access vlan 100

router ospf 100
 mpls ldp autoconfig area 0
 network 4.4.4.4 0.0.0.0 area 0
 network 30.0.0.0 0.0.0.255 area 0

router ospf 200 vrf blue
 router-id 11.0.0.3
 network 11.0.0.3 0.0.0.0 area 0
 network 210.0.0.0 0.255.255.255 area 0
 network 220.0.0.0 0.255.255.255 area 0
```

CE2 Configuration

```
interface GigabitEthernet0/0
 ip address 220.0.0.2 255.0.0.0
 load-interval 30
 duplex auto

router ospf 200
network 220.0.0.0 0.255.255.255 area 0
```

Troubleshooting Tips

Verifying RPW Status on PE Routers

```
PE1# show xconnect all
Legend:    XC ST=Xconnect State  S1=Segment1 State  S2=Segment2 State
  UP=Up       DN=Down           AD=Admin Down     IA=Inactive
  SB=Standby  RV=Recovering      NH=No Hardware
XC ST  Segment 1                      S1 Segment 2                      S2
------+-------------------------------+--+-------------------------------+--
UP    ac  Vl300:300(Eth VLAN)        UP mpls 4.4.4.4:40                 UP


PE2# show xconnect all
Legend:    XC ST=Xconnect State  S1=Segment1 State  S2=Segment2 State
  UP=Up       DN=Down           AD=Admin Down     IA=Inactive
  SB=Standby  RV=Recovering      NH=No Hardware

XC ST  Segment 1                      S1 Segment 2                      S2
------+-------------------------------+--+-------------------------------+--
UP    ac  Vl300:300(Eth VLAN)        UP mpls 4.4.4.4:40                 UP
```

Verifying MPLS Pseudowire OAM Ping

```
PE2# ping vrf blue 210.0.0.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 210.0.0.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms


PE1# ping vrf blue 210.0.0.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 210.0.0.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/3/4 ms
```

Verifying VRF Routing Table on PE Routers

```
PE1# show ip route vrf blue

Routing Table: blue
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP
       + - replicated route, % - next hop override

Gateway of last resort is not set

      11.0.0.0/32 is subnetted, 2 subnets
C        11.0.0.1 is directly connected, Loopback1
O        11.0.0.3 [110/2] via 210.0.0.2, 00:18:22, Vlan300
C     200.0.0.0/8 is directly connected, Vlan100
      200.0.0.0/32 is subnetted, 1 subnets
L        200.0.0.1 is directly connected, Vlan100
C     210.0.0.0/8 is directly connected, Vlan300
      210.0.0.0/32 is subnetted, 1 subnets
L        210.0.0.1 is directly connected, Vlan300
O     220.0.0.0/8 [110/2] via 210.0.0.2, 00:18:22, Vlan300

PE2# show ip route vrf blue
Routing Table: blue
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP
       + - replicated route, % - next hop override

Gateway of last resort is not set

      11.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
C        11.0.0.0/8 is directly connected, Loopback1
O        11.0.0.1/32 [110/2] via 210.0.0.1, 00:19:16, Vlan300
L        11.0.0.3/32 is directly connected, Loopback1
O     200.0.0.0/8 [110/2] via 210.0.0.1, 00:19:16, Vlan300
C     210.0.0.0/8 is directly connected, Vlan300
      210.0.0.0/32 is subnetted, 1 subnets
L        210.0.0.2 is directly connected, Vlan300
C     220.0.0.0/8 is directly connected, Vlan100
      220.0.0.0/32 is subnetted, 1 subnets
L        220.0.0.1 is directly connected, Vlan100
```

Verifying End-to-End Ping

```
CE1# ping vrf blue 220.0.0.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 220.0.0.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/3/4 ms

CE2# ping vrf blue 200.0.0.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 220.0.0.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/3/4 ms
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	*Cisco IOS Master Commands List, All Releases*

Standards

Standard	Title
—	No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.

MIBs

MIB	MIBs Link
—	No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.

RFCs

RFC	Title
—	No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.

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 Routed Pseudowire

Table 1 lists the release history for this feature.

Note Table 1 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.

Table 1   ***Feature Information for Routed Pseudowire***

Feature Name	Releases	Feature Information
Routed Pseudowire	15.2(3)T 15.2(4)M	In Cisco IOS Release 15.2(3)T and Cisco IOS Release 15.2(4)M, this feature was introduced on Cisco ISR G2s. For more information about the Prerequisites, see the "Prerequisites for Routed Pseudowire" section on page 2.