



Configuring Collapsed Forwarding

This module contains the following topics:

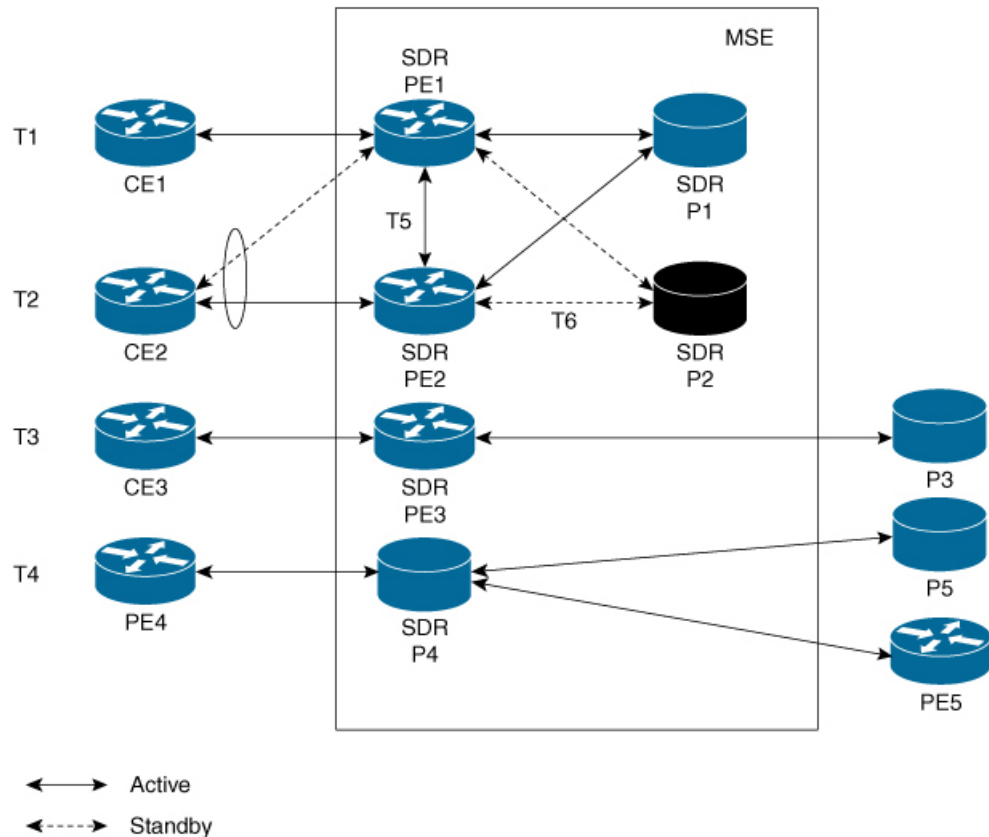
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Overview of Collapsed Forwarding

Cisco multi-switch edge (MSE) solution leverages the capabilities of the Cisco NCS 6000 series router to host multiple logical SDRs which can act as core or edge routers based on how the SDRs are configured.

The following figure specifies all the possible topologies supported by the Cisco MSE solution.

Figure 1: Supported Topologies by Cisco MSE



- Topology T1- In this topology, all the PE SDRs converge to a common core router P1 to achieve statistical multiplexing gain.
- Topology T2- This topology is to support redundancy at the service provider edge (dual homing) or can be also used for load balancing.
- Topology T3 - In this topology, the service edge router converges to the external core router, outside the MSE.
- Topology T4 - In this topology, external edge router converges to the core router inside the MSE.
- Topology T5 - This topology is used for edge router connectivity for terminating the traffic without going to the core internal router.
- Topology T6 - This topology is to support core router redundancy. In case P1 router goes down, P2 as redundant router runs with the same configuration.

For forwarding traffic from one SDR to another SDR, the existing solution was to connect the SDRs using external cables and ports. This approach is not cost effective for the service providers since it reduces the availability of ports for services. To overcome this issue, Cisco MSE solution uses another approach known as collapsed forwarding.

In collapsed forwarding, inter SDR traffic is handled by the internal fabric itself without requiring the external cables. A newly created SDR interface functions as a point-to-point virtual interface, connecting SDR routers

in the system. This virtual interface that connects two SDRs to each other is known as cross SDR interconnect (CSI) interface.

Supported Features and Restrictions

This section provides information about the supported features and restrictions for collapsed forwarding configuration.

- The CSI interface is a point-to-point interface that can be configured with IPv4 or IPv6 address.
- Only routing protocols, MPLS, and multicast can be configured over the CSI interface.
- QoS, ACL, and NetFlow are not supported over the CSI interface.
- Sub interfaces of VLANs for CSI interface is not supported.
- For a system, only up to 15 CSI interfaces are supported.

Configuring Collapsed Forwarding

Configuring collapsed forwarding includes the following steps.

1. Create named SDRs using the system administration configuration mode.
2. Configure the CSI interface using the system administration configuration mode.
3. Assign the IP addresses for the CSI interface on the required SDRs from XR configuration mode.
4. Configure the routing protocols between SDR1 and SDR2 over the CSI interface.

Example: Creating Named SDRs

This example shows how to create named SDRs. In this example, two named SDRs, SDR1 and SDR2 are created and RP resources and line cards are allocated to the SDRs.

```

sysadmin-vm:0_RP0(config)# sdr sdr1
sysadmin-vm:0_RP0(config-sdr-sdr1)# resources mgmt_ext_vlan 11
sysadmin-vm:0_RP0(config-sdr-sdr1)# resources card-type RP
sysadmin-vm:0_RP0(config-card-type-RP)# vm-memory 11
sysadmin-vm:0_RP0(config-card-type-RP)# vm-cpu 4
sysadmin-vm:0_RP0(config-card-type-RP)# location 0/RP0
sysadmin-vm:0_RP0(config-location-0/RP0)# location 0/RP1
sysadmin-vm:0_RP0(config-location-0/RP1)# exit
sysadmin-vm:0_RP0(config-sdr-sdr1)# location 0/0
sysadmin-vm:0_RP0(config-sdr-sdr1)# commit
sysadmin-vm:0_RP0(config)# sdr sdr2
sysadmin-vm:0_RP0(config-sdr-sdr2)# resources mgmt_ext_vlan 12
sysadmin-vm:0_RP0(config-sdr-sdr2)# resources card-type RP
sysadmin-vm:0_RP0(config-card-type-RP)# vm-memory 11
sysadmin-vm:0_RP0(config-card-type-RP)# vm-cpu 4
sysadmin-vm:0_RP0(config-sdr-sdr2)# location 0/RP0
sysadmin-vm:0_RP0(config-location-0/RP0)# location 0/RP1
sysadmin-vm:0_RP0(config-location-0/RP1)# exit
sysadmin-vm:0_RP0(config-sdr-sdr2)# location 0/1
sysadmin-vm:0_RP0(config-sdr-sdr2)# commit
sysadmin-vm:0_RP0# config

```

```

sysadmin-vm:0_RP0(config)# console attach-sdr location 0/RP0 tty-name console1 sdr-name
SDR1
sysadmin-vm:0_RP0(config)# console attach-sdr location 0/RP1 tty-name console1 sdr-name
SDR1
sysadmin-vm:0_RP0(config)# console attach-sdr location 0/RP0 tty-name console2 sdr-name
SDR2
sysadmin-vm:0_RP0(config)# console attach-sdr location 0/RP1 tty-name console2 sdr-name
SDR2
sysadmin-vm:0_RP0(config)# commit

```

For detailed information about configuring named SDRs, see [Setup Console Access for Named-SDR](#).

Example: Configuring the CSI Interface

This example shows how to configure the CSI interface between two SDRs. When you perform this task, a single point-to-point link is created with one endpoint in SDR1 (called `csi1` in SDR1) and the other endpoint in SDR2 (also called `csi1` in SDR2). You can configure up to 15 CSI interfaces and the CSI-ID can be a number from 1 to 15.

```

sysadmin-vm:0_RP0(config)# connect sdr sdr1 sdr2 csi-id 1

```

Example: Configuring IP addresses on the CSI Interfaces

Once the CSI interface is created, you need to configure IP addresses for the CSI interface on the inter connected SDRs using the XR configuration mode.

This example shows how to configure IPv4 addresses on the CSI interface on SDR1.

```

RP/0/RP0/CPU1:router(config)# interface csi 1
RP/0/RP0/CPU1:router(config-if)# ipv4 address 1.1.1.1 255.255.255.0
RP/0/RP0/CPU1:router(config-if)# exit
RP/0/RP0/CPU1:router(config)# commit

```

This example shows how to configure IPv4 addresses on the CSI interface on SDR2.

```

RP/0/RP0/CPU2:router(config)# interface csi 1
RP/0/RP0/CPU2:router(config-if)# ipv4 address 1.1.1.2 255.255.255.0
RP/0/RP0/CPU1:router(config-if)# exit

```

Example: Configuring the Routing Protocols

This example shows how to configure a routing protocol over the CSI interface. In this example, IS-IS is used as the routing protocol. You need to configure IS-IS on SDR1 and SDR2.

```

RP/0/RP0/CPU1:router(config)# router isis 1
RP/0/RP0/CPU1:router(config-isis)# is-type level-2-only
RP/0/RP0/CPU1:router(config-isis)# net 49.0001.0001.0001.0001.00
RP/0/RP0/CPU1:router(config-isis)# address-family ipv4 unicast
RP/0/RP0/CPU1:router(config-isis-af)# metric-style wide level 1
RP/0/RP0/CPU1:router(config-isis-af)# exit
RP/0/RP0/CPU1:router(config-isis)# interface csi 1
RP/0/RP0/CPU1:router(config-isis-if)# address-family ipv4 unicast
RP/0/RP0/CPU1:router(config-isis-if-af)# exit
RP/0/RP0/CPU1:router(config-isis-if)# exit

```

For more information about configuring the routing protocols including IS-IS on NCS6000, see *Routing Configuration Guide for Cisco NCS 6000 Series Routers*.

Verifying the CSI Interface Configuration

You can verify the CSI interface configuration by using the **ping** command to verify the connectivity to the CSI from the SDR.

This example shows verifying the CSI interface configuration from SDR1 using the **ping** command.

```
RP/0/RP0/CPU1:router# ping 1.1.1.2
Sending 5, 100-byte ICMP Echos to 1.1.1.2, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 99/184/431 ms
```

This example shows verifying the CSI interface configuration from SDR2 using the **ping** command.

```
RP/0/RP0/CPU2:router# ping 1.1.1.1
Sending 5, 100-byte ICMP Echos to 1.1.1.1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 60/125/264 ms
```

COFO Unicast NNH with FRR and BFC

COFO Unicast Neighbor-Next-Hop Forwarding Model

Before Cisco IOS XR Release 6.6.1, in COFO traffic forwarding was based on the next-hop based model, ie, each SDR acts as an independent router interconnected by point-to-point interfaces through the internal fabric. In the next-hop based model each SDR forwards the traffic to all neighboring SDRs before the packet reaches the right destination. As a result, the fabric bandwidth utilization is inefficient.

The issue of bandwidth under utilization is overcome using the NNH (neighbor-next-hop) based forwarding model. NNH is collapsed information of neighbor SDR NNH interface. The collapsed NNH has the platform information which leads the traffic to the correct egress LC or slice of the downstream SDR. Therefore, NNH based model is the most optimal way to forward the intra SDR traffic.

FRR and BFC

From this release onwards, COFO supports Fast Re-route (FRR) and Bundle Fast Convergence (BFC) features.

- FRR—The Fast Re-route feature enables fast traffic recovery upon link or router failure by rerouting the traffic over backup tunnels that bypass failed links or node. These are the FRR types that are supported in this release:
 - IP and LDP FRR—FRR driven by an IGP and LDP protocols.
 - TE FRR—FRR driven by MPLS-TE and RSVP protocols.
- BFC—The Bundle Fast Convergence feature provides the ability to converge bundle members within sub seconds instead of multiple seconds.

Implementation Consideration

These points must be considered before configuring COFO:

- Any VPN disposition traffic from the core to the customer follows the NH based forwarding model with explicit-null enabled.
- Any L2 disposition traffic from the core to the customer follows the NH based forwarding model as L2 label info is not collapsed at the ingress.
- Any L3VPN disposition traffic from the core to the customer follows the NH way of forwarding for connected routes redistributed into BGP.
- The traffic traversing from RSVP tunnels with Ingress SDR as midpoint follows the NH based forwarding model.
- Equal-cost multi-path allows a router to insert more than one path to a destination in the routing table to enable load balancing. While configuring ECMP, the maximum path value should be more than the actual ECMP path of the egress SDR. If not then there will be traffic drops due to mismatch of ECMP path at ingress and egress SDR.
- ISIS incremental SPF configuration is not supported for COFO NNH.
- During a line card OIR (online insertion and removal) and slice shut, the traffic hit is longer even though BFC is enabled.
- Traffic drop is observed when the TE FRR is triggered by the BFD on SU (shared uplink) and the trigger is not notified to a VPN.

Recommendation

Under router ISIS configuration, you should configure advertise link attribute to enable COFO NNH. This is required to enable ISIS to collapse the NNH info.

Configuring LDP FRR for COFO

Configuring collapsed forwarding with tunnel fast re-route includes the following step:



Note IGP and LDP is enabled in the network.

1. Configure a bundle interface under ISIS

Example: Configuring a bundle interface under ISIS

```
configure
router isis 124
 interface Bundle-Ether bundlether1
  address-family ipv4 unicast
  fast-reroute per-prefix
!
```

Verification

Before the LDP or IGP FRR triggers, use the **show cef fast-reroute** command to view the active and standby nodes:

```

router#sh cef fast-reroute

Prefix          Next Hop          Interface
192.168.1.1/32  192.168.10.2     bundlether1
                 192.168.10.8     bundlether2 (!) /*backup node*/

```

The above output shows *bundlether1* as Active node and *bundlether2* as Standby or backup node.

Now verify the FRR after the LDP FRR or IGP FRR trigger.

```

router#sh cef fast-reroute

Prefix          Next Hop          Interface
192.168.1.1/32  192.168.10.2     bundlether1 (!) /*backup node*/
                 192.168.10.8     bundlether2

```

Configuring TE FRR for COFO

Configuring collapsed forwarding with tunnel fast re-route includes the following steps:



Note MPLS TE is enabled in the network.

1. Configure the primary and backup TE tunnel
2. Configure a backup tunnel under the TE configuration

Example: Configuring Primary and Backup MPLS-TE tunnel

```

mpls traffic-eng
 interface Bundle-Ether151
   backup-path tunnel-te 2

interface tunnel-te1
 ipv4 unnumbered Loopback0
 autoroute announce
 !
 destination 192.168.1.1
 policy-class 4
 record-route
 path-option 1 dynamic
 path-option 2 explicit name SU-P1
 !

interface tunnel-te2
 ipv4 unnumbered Loopback0
 !
 destination 192.168.1.1
 policy-class 5
 record-route
 path-option 1 explicit name SU-P2-P1
 path-option 2 dynamic
 !

```

Verification

Use the `show mpls traffic-eng fast-reroute database` command to verify the FRR trigger:

```
router#show mpls traffic-eng fast-reroute database
```

```
LSP midpoint FRR information:
```

LSP Identifier	Local Label	Out Intf/ Label	FRR Intf/ Label	Status
192.168.1.1 0 [4]	16006	bundlether1:16011	tt2:Pop	Ready

In the above LSP starting at headend 192.168.1.1 traverses through the primary (protected) interface bundlether1. When the bundlether1 goes down, traffic is forwarded via the tunnel-te 2 (backup). This action is a Pop action as this is a next-hop tunnel, i.e, the remote label for the original LSP is popped before being forwarded to P2.

Layer 2 Interface Support on CSI

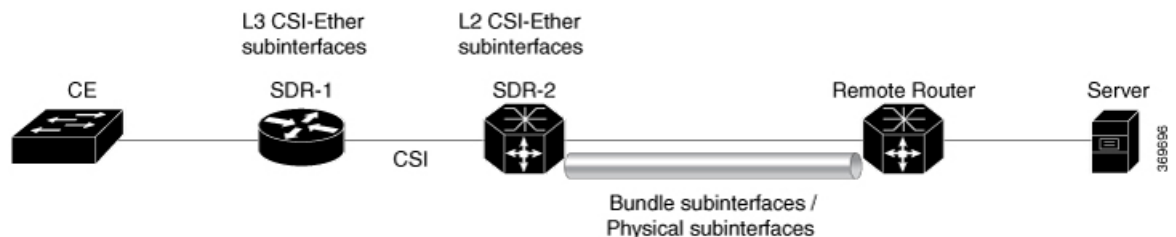
The Layer 2 Interface Support on CSI feature provides a Layer 2 connectivity between the Secure Domain Routers (SDRs). This feature introduces a new virtual interface that is called CSI-Ether interface that enables forwarding of Layer 2 frames between the SDRs.

Some cloud applications in the service provider network, such as the speed test, Internet Protocol Service Level Agreement (IPSLA), and so on, are sensitive to latency and jitter. To avoid extra L3 hops, you can use Layer 2 connectivity between the cloud applications in your network and the customer edge (CE) facing SDRs.

You can interconnect two SDRs through a single point-to-point link using the **connect sdr** command in the sysadmin mode. This creates a CSI-Ether interface along with the CSI interface between these two SDRs. You must use this CSI-Ether interface only as VLAN subinterface. You can configure the dot1q identifier on the CSI-Ether VLAN subinterface. You can create up to 10 dot1q VLAN subinterfaces. The range is from 1 to 10. You must use the same dot1q encapsulation identifier for a given VLAN subinterface on the SDRs and the remote router.

Topology

Figure 2: Layer 2 Interface Support on CSI



In this topology, the SDR-2 is a Layer 2 cross-connect and its layer 3 neighborhood is between SDR-1 and the remote router. On SDR-2, configure CSI-Ether subinterface as Layer 2 interface towards SDR-1, and configure bundle or physical subinterface as Layer 2 interface towards the remote router. Configure L2 cross-connect between CSI-Ether subinterface and bundle or physical subinterface. On SDR-1, configure CSI-Ether subinterface as Layer 3 interface. Similarly, configure bundle or physical subinterface as Layer 3 interface on the remote router. Configure Layer 3 neighborhood between SDR-1 and the remote router using IGP or BGP.

Configure Layer 2 Interface on CSI

Configuration Example

Perform this task to configure this feature.

```

/* Configure SDR-1 */
Router# configure
Router(config)# interface CSI-Ether4.1
Router(config-subif)# ipv4 address 192.0.2.1 255.255.255.0
Router(config-subif)# encapsulation dot1q 1
Router(config-subif)# exit
Router(config)# interface CSI-Ether4.2
Router(config-subif)# ipv4 address 198.51.100.1 255.255.255.0
Router(config-subif)# encapsulation dot1q 2
Router(config-subif)# commit

/* Configure SDR-2 */
Router# configure
Router(config)# interface CSI-Ether4.1 l2transport
Router(config-subif)# encapsulation dot1q 1
Router(config-subif)# exit
Router(config)# interface CSI-Ether4.2 l2transport
Router(config-subif)# encapsulation dot1q 2
Router(config-subif)# exit
Router(config)# l2vpn
Router(config-l2vpn)# pw-class mpls
Router(config-l2vpn-pwc)# encapsulation mpls
Router(config-l2vpn-pwc-mpls)# exit
Router(config-l2vpn-pwc)# exit
Router(config-l2vpn)# xconnect group SDR2_SDR1
Router(config-l2vpn-xc)# p2p SDR_SDR
Router(config-l2vpn-xc-p2p)# interface CSI-Ether4.1
Router(config-l2vpn-xc-p2p)# interface Bundle-Ether15221.1
Router(config-l2vpn-xc-p2p)# exit
Router(config-l2vpn-xc)# p2p SDR_SDR1
Router(config-l2vpn-xc-p2p)# interface CSI-Ether4.2
Router(config-l2vpn-xc-p2p)# interface Bundle-Ether15221.2
Router(config-l2vpn-xc-p2p)# commit

/* Configure Remote Router */
Router# configure
Router(config)# interface Bundle-Ether15221
Router(config-if)# mtu 9500
Router(config-if)# exit

Router(config)# interface Bundle-Ether15221.1
Router(config-subif)# ipv4 address 192.0.2.2 255.255.255.0
Router(config-subif)# encapsulation dot1q 1
Router(config)# interface Bundle-Ether15221.2
Router(config-subif)# ipv4 address 198.51.100.2 255.255.255.0
Router(config-subif)# encapsulation dot1q 2
Router(config-subif)# exit

```

Running Configuration

This section shows the running configuration of Layer 2 Interface on CSI.

```

/* On SDR-1 */
configure

```

```

interface CSI-Ether4.1
ipv4 address 192.0.2.1 255.255.255.0
encapsulation dot1q 1
!
interface CSI-Ether4.2
ipv4 address 198.51.100.1 255.255.255.0
encapsulation dot1q 2
!

/* On SDR-2 */
configure
interface CSI-Ether4.1 l2transport
encapsulation dot1q 1
!
interface CSI-Ether4.2 l2transport
encapsulation dot1q 2
!
l2vpn
pw-class mpls
encapsulation mpls
!
!
xconnect group SDR1_SDR2
p2p SDR_SDR
interface CSI-Ether4.1
interface Bundle-Ether15221.1
!
p2p SDR_SDR1
interface CSI-Ether4.2
interface Bundle-Ether15221.2

/* On Remote Router */
configure
interface Bundle-Ether15221
mtu 9500
!

interface Bundle-Ether15221.1
ipv4 address 192.0.2.2 255.255.255.0
encapsulation dot1q 1
!
interface Bundle-Ether15221.2
ipv4 address 198.51.100.2 255.255.255.0
encapsulation dot1q 2
!
!

```

Verification

Verify Layer 2 Interface on CSI configuration.

Router:SDR-2# **show l2vpn xconnect**

Legend: ST = State, UP = Up, DN = Down, AD = Admin Down, UR = Unresolved,
SB = Standby, SR = Standby Ready, (PP) = Partially Programmed

XConnect Group	Name	ST	Segment 1 Description	ST	Segment 2 Description	ST
SDR1_SDR2	SDR_SDR	UP	CE4.1	UP	BE15221.1	UP
SDR1_SDR2	SDR_SDR1	UP	CE4.2	UP	BE15221.2	UP

Related Topics

- [Layer 2 Interface Support on CSI](#) , on page 8

Associated Commands

- connect sdr
- show l2vpn xconnect

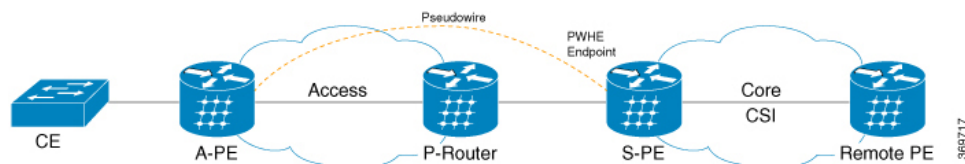
Layer 2 Interface Support on Pseudowire Headend

The Layer 2 Interface Support on Pseudowire Headend feature provides a virtual Layer 2 interface on a pseudowire (PW) for a service provider edge (PE) router. This feature allows termination of access pseudowires (PW) into an L2 domain. This feature allows you to send the L2 traffic over PWs from the access side to the core side. You can provision Lawful Intercept (LI) on a per PWHE interface basis, on a service provider edge (PE) router along with the regular Layer 2 services. This feature reduces the capital expenditure in access and aggregation network. This feature helps the customer network to distribute and scale the customer facing Layer 2 UNI interface set.

Restrictions

- The generic interface list supports only main interfaces, and not subinterfaces.
- Subinterfaces support only bridged interworking (VC type 5) mode.
- You can have a maximum of eight members in the generic interface list.
- There must be a reachability between a given pair of Access Provider Edge (A-PE) and Service Provider Edge (S-PE) apart from PWHE Interface.
- You can configure only one PWHE attachment circuit (AC) on a bridge. However, all 2K bridges can have one PWHE AC.

Figure 3: Layer 2 Support on Pseudowire Headend



Consider a topology where you enable PWHE on S-PE. Create an L2VPN Xconnect from A-PE (interface that connects to CE) to the PWHE interface that is created on S-PE. Configure EVPN or VPLS on S-PE to reach the remote PE. When traffic from CE reaches the A-PE, the A-PE forwards the frames to the PWHE interface on the S-PE. S-PE sends the traffic to the remote PE based on the VLAN configuration.

Configure Layer 2 Interface on Pseudowire Headend

Configuration Example

This section describes how you can configure Layer 2 Interface on Pseudowire Headend on S-PE, A-PE, and remote router.

S-PE Configuration

```

/* S-PE Configuration */

/* Configure generic interface list for PWHE interface and attach the generic interface
list with a PWHE interface. */
Router# configure
Router(config)# generic-interface-list gill
Router(config-gen-if-list)# interface Bundle-Ether200
Router(config-gen-if-list)# exit

Router(config)# interface PW-Ether1
Router(config-if)# attach generic-interface-list gill

/* Configure Layer 2 transport and PW class for PWHE interface */

Router# configure
Router(config)# interface PW-Ether1.1 l2transport
Router(config-subif)# encapsulation dot1q 1
Router(config-subif)# mtu 1514
Router(config-subif)# service-policy input ingress-parent
Router(config-subif)# exit
Router(config)# l2vpn
Router(config-l2vpn)# pw-class pwe
Router(config-l2vpn-pwc)# encapsulation mpls
Router(config-l2vpn-pwc-mpls)# control-word
Router(config-l2vpn-pwc-mpls)# transport-mode ethernet

/* Configure cross-connect for PWHE interface */

Router# configure
Router(config)# l2vpn
Router(config-l2vpn)# xconnect group xcpw1
Router(config-l2vpn-xc)# p2p 1
Router(config-l2vpn-xc-p2p)# interface PW-Ether1
Router(config-l2vpn-xc-p2p)# neighbor ipv4 192.0.2.1 pw-id 1
Router(config-l2vpn-xc-p2p-pw)# pw-class pwe

/* Configure the bridge domain */

Router# configure
Router(config)# l2vpn
Router(config-l2vpn)# bridge group bg1
Router(config-l2vpn-bg)# bridge-domain bd1
Router(config-l2vpn-bg-bd)# interface PW-Ether1.1
Router(config-l2vpn-bg-bd-ac)# exit
Router(config-l2vpn-bg-bd)# vfi vf
Router(config-l2vpn-bg-bd-vfi)# neighbor 198.51.100.1 pw-id 1

```

A-PE Configuration

```

/* A-PE Configuration */

/* Configure PWHE Ethernet interface */

```

```

Router# configure
Router(config)# interface HundredGigE0/3/0/2.1 l2transport
Router(config-subif)# encapsulation dot1q 1
Router(config-subif)# mtu 1514

/* Configure cross-connect for PWHE interface */

Router# configure
Router(config)# l2vpn
Router(config-l2vpn)# xconnect group xcpw1
Router(config-l2vpn-xc)# p2p 1
Router(config-l2vpn-xc-p2p)# interface HundredGigE0/3/0/2.1
Router(config-l2vpn-xc-p2p)# neighbor ipv4 203.0.113.1 pw-id 1
Router(config-l2vpn-xc-p2p-pw)# pw-class pwe

```

Remote Router Configuration

```

/* Configure PWHE Ethernet interface */
Router# configure
Router(config)# interface HundredGigE0/5/0/1.1 l2transport
Router(config-subif)# encapsulation dot1q 1
Router(config-subif)# mtu 1514

/* Configure the bridge domain */
Router# configure
Router(config)# l2vpn
Router(config-l2vpn)# bridge group bg1
Router(config-l2vpn-bg)# bridge-domain bd1
Router(config-l2vpn-bg-bd)# interface HundredGigE0/5/0/1.1
Router(config-l2vpn-bg-bd-ac)# exit
Router(config-l2vpn-bg-bd)# vfi vf
Router(config-l2vpn-bg-bd-vfi)# neighbor 203.0.113.1 pw-id 1

```

Running Configuration

This section shows Layer 2 Interface on Pseudowire Headend running configuration.

```

/* On S-PE */
configure
  generic-interface-list gill
    interface Bundle-Ether200
  !
  interface PW-Ether1
    attach generic-interface-list gill
  !
configure
  interface PW-Ether1.1 l2transport
    encapsulation dot1q 1
    mtu 1514
    service-policy input ingress-parent

l2vpn
  pw-class pwe
    encapsulation mpls
    control-word
    transport-mode ethernet
  !
  !
l2vpn
  xconnect group xcpw1
    p2p 1
    interface PW-Ether1

```

```

    neighbor ipv4 203.0.113.1 pw-id 1 pw-id 1
    pw-class pwe
!
l2vpn
bridge group bg1
  bridge-domain bd1
  interface interface PW-Ether1.1
!
vfi vf
  neighbor 198.51.100.1 pw-id 1

```

```

/* On A-PE */

```

```

configure
interface HundredGigE0/3/0/2.1 l2transport
  encapsulation dot1q 1
  mtu 1514
!

l2vpn
xconnect group xcpw1
  p2p 1
  interface HundredGigE0/3/0/2.1
    neighbor ipv4 3.3.3.3 pw-id 1
    pw-class pwe
  !
!

l2vpn
xconnect group APE2-PE1-PORT
  p2p APE2-PE1-5001
  interface TenGigE0/0/0/0
    neighbor ipv4 100.1.1.1 pw-id 5001
    pw-class APE2-PE1-PORT
  !
!

```

```

/* On Remote Router */

```

```

interface HundredGigE0/5/0/1.1 l2transport
  encapsulation dot1q 1
  mtu 1514
!

l2vpn
bridge group bg1
  bridge-domain bd1
  interface HundredGigE0/5/0/1.1
!
vfi vf
  neighbor 203.0.113.1 pw-id 1

```

Verification

The show outputs given in the following section display the details of the configuration of PW Ethernet interface and cross-connect, and the status of their configuration on S-PE and A-PE.

```

/* S-PE Configuration */

```

```
Router-S-PE# show l2vpn xconnect summary
```

```
Mon Jul 15 07:25:34.504 UTC
Number of groups: 4000
Number of xconnects: 4000
Up: 4000 Down: 0 Unresolved: 0 Partially-programmed: 0
AC-PW: 4000 AC-AC: 0 PW-PW: 0 Monitor-Session-PW: 0
Number of Admin Down segments: 0
Number of MP2MP xconnects: 0
Up 0 Down 0
Advertised: 0 Non-Advertised: 0
Number of CE Connections: 0
Advertised: 0 Non-Advertised: 0
Backup PW:
Configured : 0
UP : 0
Down : 0
Admin Down : 0
Unresolved : 0
Standby : 0
Standby Ready: 0
Backup Interface:
Configured : 0
UP : 0
Down : 0
Admin Down : 0
Unresolved : 0
Standby : 0
```

```
Router-S-PE# show l2vpn bridge-domain summary
```

```
Mon Jul 15 07:26:27.388 UTC
Number of groups: 1, VLAN switches: 0
Number of bridge-domains: 2001, Up: 2001, Shutdown: 0, Partially-
programmed: 0
Default: 2001, pbb-edge: 0, pbb-core: 0
Number of ACs: 2001 Up: 2001, Down: 0, Partially-programmed: 0
Number of PWs: 2001 Up: 2001, Down: 0, Standby: 0, Partially-programmed: 0
Number of P2MP PWs: 0, Up: 0, Down: 0, other-state: 0
Number of VNIs: 0, Up: 0, Down: 0, Unresolved: 0
```

```
/* A-PE configuration details */
```

```
Router-A-PE#show l2vpn xconnect summary
```

```
Mon Jul 15 07:23:54.838 UTC
Number of groups: 4001
Number of xconnects: 4001
Up: 4000 Down: 0 Unresolved: 0 Partially-programmed: 0
AC-PW: 4001 AC-AC: 0 PW-PW: 0 Monitor-Session-PW: 0
Number of Admin Down segments: 0
Number of MP2MP xconnects: 0
Up 0 Down 0
Advertised: 0 Non-Advertised: 0
Number of CE Connections: 0
Advertised: 0 Non-Advertised: 0
Backup PW:
Configured : 0
UP : 0
Down : 0
Admin Down : 0
```

```
Unresolved : 0
Standby : 0
Standby Ready: 0
Backup Interface:
Configured : 0
UP : 0
Down : 0
Admin Down : 0
Unresolved : 0
Standby : 0
```

Related Topics

- [Layer 2 Interface Support on Pseudowire Headend](#), on page 11

Associated Commands

- `show l2vpn xconnect`
- `show l2vpn bridge-domain`