

ASR 9000 VPLS标签交换的组播(LSM)概述和配置示例

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简介

本文描述虚拟专用LAN服务(VPLS)标签交换的组播(LSM) 9000系列聚合服务的路由器的(ASR)运行Cisco IOS XR软件。

先决条件

要求

本文档没有任何特定的要求。

使用的组件

本文档不限于特定的软件和硬件版本。

本文档中的信息都是基于特定实验室环境中的设备编写的。本文档中使用的所有设备最初均采用原始（默认）配置。如果您使用的是真实网络，请确保您已经了解所有命令的潜在影响。

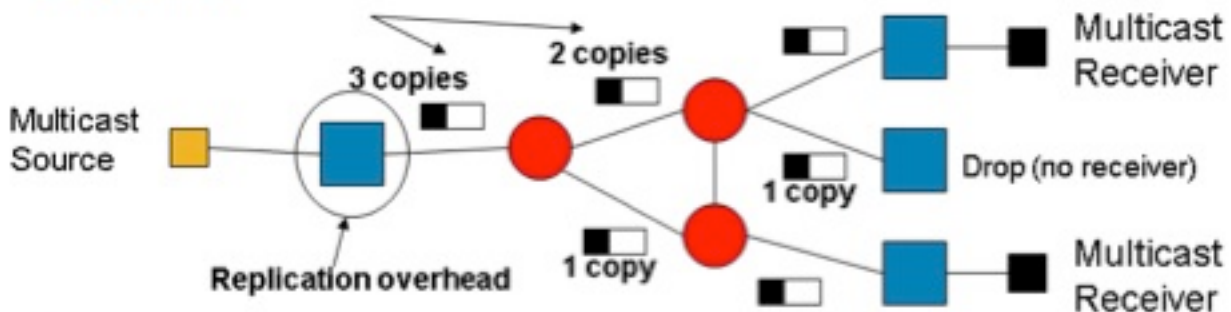
VPLS标签交换的组播(LSM)概述

VPLS模拟在多协议标签交换(MPLS)核心间的LAN服务。点到点(P2P) pseudowires全网状(PWs)设置在参加VPLS域为了提供VPLS仿真的所有服务商边缘路由器之间。广播，组播和未知单播流量在对所有观点扫描器的一个VPLS域被充斥。入口复制用于为了发送在每P2P PWs的该泛洪流量到是同一个VPLS域的一部分的所有远程PE路由器。

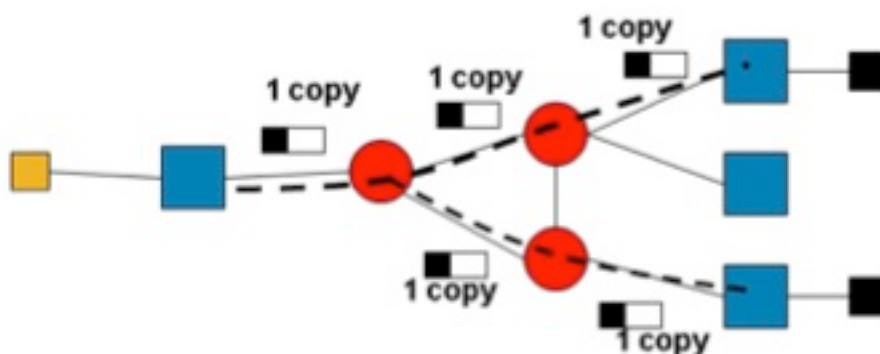
入口复制缺点

- 因为同一数据包也许在每P2P的PW，同一条链路多次发送入口复制是效率低的带宽。
- 当有大量广播和组播VPLS流量时，入口复制能导致重大的被浪费的链路带宽。
- 因为入口PE路由器负复制的全双工重荷，入口复制也资源加强。

Problems



Solution



VPLS LSM功能

VPLS是也使用组播传输的一个广泛部署的服务提供商L2VPN技术。虽然L2技术允许将使用的监听为了优化组播数据流的复制到L2 pseudowires，核心依然是不可知论对组播数据流。结果，同一个流的多个副本穿程核心网络。为了缓和此无效用，与VPLS的对LSM为了介绍在核心的LSM组播树。在Cisco IOS XR软件版本5.1.0中，9000系列的Cisco ASR实现VPLS LSM用点对多点流量工程(P2MP-TE)包括树。VPLS端点自动地发现，并且P2MP-TE树设置使用资源预留协议流量工程(RSVP-TE)，不用可操作的干预。

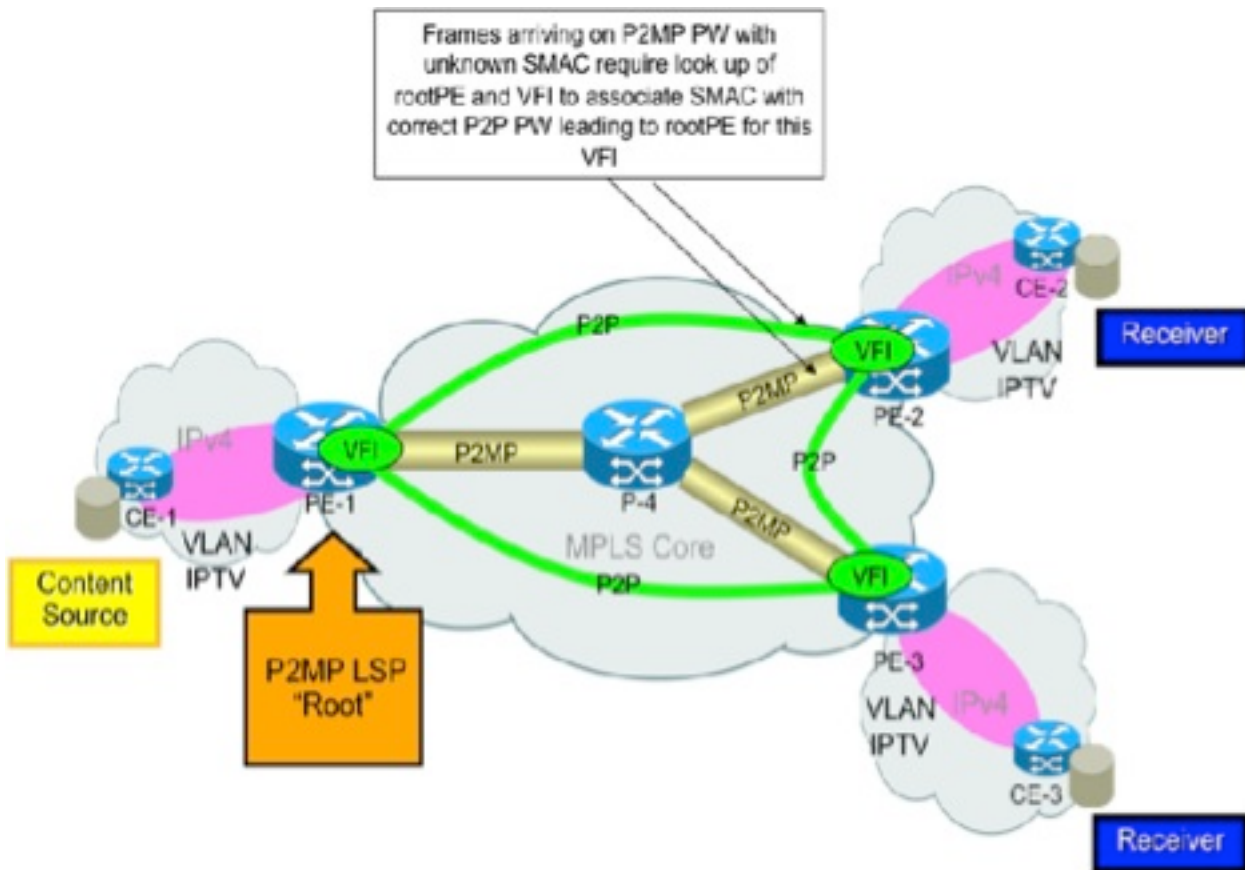
- VPLS LSM解决入口复制缺点。
- VPLS LSM解决方案使用在MPLS核心的P2MP LSP为了运载广播，组播和VPLS域的未知单播流量。
- P2MP LSP允许在MPLS网络至多最佳的节点的复制并且最小化相当数量在网络的信息包复制。
- VPLS LSM解决方案只发送在P2MP LSP的被充斥的VPLS流量。
- 单播VPLS流量在P2P PWs仍然发送。在访问发送的流量PWs继续用入口复制传送。
- P2MP PWs是单向的与P2P PWs相对，双向。
- VPLS LSM解决方案介入—P2MP PW的创建每个VPLS域为了模拟核心的PWs—VPLS P2MP服务在VPLS域。
- Cisco IOS XR版本5.1.0支持VPLS LSM及以后。

VPLS LSM限制

- Cisco IOS XR版本5.1.0 VPLS LSM功能支持仅MPLS流量工程P2MP-TE树设置RSVP-TE。
- P2MP PW可以发信号与BGP仅协议在Cisco IOS XR版本5.1.0。在此第一阶段，参加VPLS域的远程观点扫描器是自动发现的与BGP自动发现(BGP-AD)。
- Cisco IOS XR版本5.1.0不支持静态LDP信令。

媒体访问控制(MAC)学习

在分支PE的MAC学习在P2MP PW到达的帧的执行，好象帧在导致该P2MP的PW根PE的P2P PW接收。在此镜像，在PE-2的MAC学习在根源的P2MP PW LSP到达在PE-1的帧的执行，好象帧在PE-1和PE-2之间的P2P PW到达了。L2VPN控制层面对编程与P2P PW信息的VPLS处理信息负责在P2MP LSP处理的MAC学习的。



互联网组管理协议监听的(IGMPSN)支持

两个支持互联网组管理协议(IGMP)窥探(IGMPSN) P2MP P树的头和尾在参加VPLS LSM的网桥域的。这允许在一个虚拟转发实例(VFI) PWs的IGMPSN组播数据流受益于P2MP LSP提供的资源优化。如果IGMPSN在与一个或更多VFI参加VPLS LSM的PWs的一个网桥域启用，所有第2层(L2)组播数据流在P2MP P树头发送关联与网桥域。L2组播路由用于为了转发流量到本地接收机，以太网流点(EFPs)，不参加VPLS LSM的访问PWs和VFI PWs。

当IGMPSN在是P2MP LSP尾标的网桥域时启用，在P2MP LSP接收的L2组播数据流的优化处理为本地接收机完成(即附件电路(AC)网桥端口(位/秒)和访问PW位/秒)。

注意： Cisco IOS XR版本5.1.0不支持监听组播的标签转发协议(MLDP)。

支持的缩放

Cisco IOS XR版本5.1.0支持最多1000个P2MP通道或1000 P2MP每人的PWs/尾标路由器。

VPLS LSM配置

P2MP自动隧道配置

```
interface GigabitEthernet0/1/1/0
!
interface GigabitEthernet0/1/1/1
!
auto-tunnel p2mp
tunnel-id min 100 max 200
```

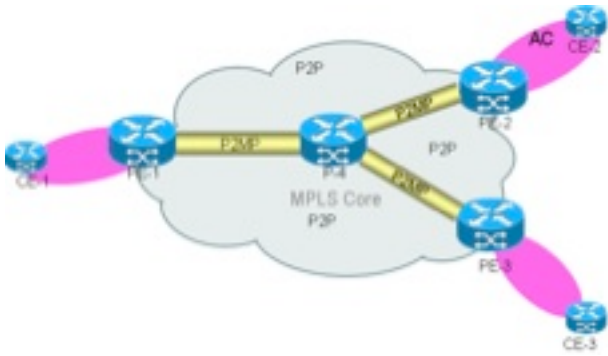
MPLS TE快速重新路由(FRR)配置

```
mpls traffic-eng
interface GigabitEthernet0/1/1/0
auto-tunnel backup
nhop-only
!
!
interface GigabitEthernet0/1/1/1
auto-tunnel backup
nhop-only
!
!
auto-tunnel p2mp
tunnel-id min 100 max 200
!
auto-tunnel backup
tunnel-id min 1000 max 1500
!
attribute-set p2mp-te set1
bandwidth 10000
fast-reroute
record-route
!
```

L2VPN配置

```
l2vpn
bridge group bg1
bridge-domain bg1_bd1
interface GigabitEthernet0/1/1/10.1
!
vfi bg1_bd1_vfi
vpn-id 1
autodiscovery bgp
rd auto
route-target 209.165.201.1:1
signaling-protocol bgp
ve-id 100
!
!
multicast p2mp
signaling-protocol bgp
!
transport rsvp-te
attribute-set p2mp-te set1
!
```

拓扑示例和配置



P2MP通道是自动发现的通道。不支持静态P2MP通道。

没有使用静态隧道配置。如果作为芽节点，必须启用自动P2MP隧道配置在所有PE路由器并且在P路由器。芽节点同时是中央点和尾端路由器。

与配置的一拓扑示例显示此处。在此拓扑方面，P2MP PWs创建在三观点扫描器和作为芽节点的P路由器之间。所有三个PE路由器作为题头(入口流量)和尾标(出口流量)。

PE1配置

```
RP/0/RSP0/CPU0:PE1#show run
hostname PE1
!
ipv4 unnumbered mpls traffic-eng Loopback0
!
interface Loopback0
  ipv4 address 209.165.200.225 255.255.255.255
!
interface GigabitEthernet0/1/1/0
  description connected P router
  ipv4 address 209.165.201.1 255.255.255.224
!
interface GigabitEthernet0/1/1/1
  description connected to P router
  ipv4 address 209.165.201.151 255.255.255.224
  transceiver permit pid all
!
interface GigabitEthernet0/1/1/10
  transceiver permit pid all
!
interface GigabitEthernet0/1/1/10.1 l2transport
  encapsulation dot1q 1
!
router ospf 100
  router-id 209.165.200.225
  area 0
  mpls traffic-eng
  interface Loopback0
  !
  interface GigabitEthernet0/1/1/0
  !
  interface GigabitEthernet0/1/1/1
  !
  !
  mpls traffic-eng router-id 209.165.200.225
!
router bgp 100
  nsr
```



```

    nhop-only
    !
    !
    auto-tunnel p2mp
    tunnel-id min 100 max 200
    !
    auto-tunnel backup
    tunnel-id min 1000 max 1500
    !
    attribute-set p2mp-te set1
    bandwidth 10000
    fast-reroute
    record-route
    !
    !
    mpls ldp
    nsr
    graceful-restart
    router-id 209.165.200.225
    interface GigabitEthernet0/1/1/0
    !
    interface GigabitEthernet0/1/1/1
    !
    !
    end

```

RP/0/RSP0/CPU0:PE1#

P配置

```

RP/0/RSP0/CPU0:P#show run
hostname P
ipv4 unnumbered mpls traffic-eng Loopback0
interface Loopback0
    ipv4 address 209.165.200.226 255.255.255.255
    !
interface GigabitEthernet0/1/1/0
    description connected to PE1 router
    ipv4 address 209.165.201.2 255.255.255.224
    transceiver permit pid all
    !
interface GigabitEthernet0/1/1/1
    description connected to PE1 router
    ipv4 address 209.165.201.152 255.255.255.224
    transceiver permit pid all
    !
interface GigabitEthernet0/1/1/3
    description connected to PE2 router
    ipv4 address 209.165.201.61 255.255.255.224
    !
interface GigabitEthernet0/1/1/4
    transceiver permit pid all
    !
interface GigabitEthernet0/1/1/4.1 l2transport
    encapsulation dot1q 1
    !
interface GigabitEthernet0/1/1/8
    description connected to PE3 router
    ipv4 address 209.165.201.101 255.255.255.224
    !
router ospf 100
    nsr
    nsf cisco

```



```
area 0
mpls traffic-eng
interface Loopback0
!
interface GigabitEthernet0/1/1/0
!
interface GigabitEthernet0/1/1/1
!
interface GigabitEthernet0/1/1/3
!
interface GigabitEthernet0/1/1/8
!
!
mpls traffic-eng router-id 209.165.200.226
!
router bgp 100
nsr
bgp router-id 209.165.200.226
bgp graceful-restart
address-family l2vpn vpls-vpws
!
neighbor 209.165.200.225
remote-as 100
update-source Loopback0
address-family l2vpn vpls-vpws
!
!
neighbor 209.165.200.227
remote-as 100
update-source Loopback0
address-family l2vpn vpls-vpws
!
!
neighbor 209.165.200.228
remote-as 100
update-source Loopback0
address-family l2vpn vpls-vpws
!
!
!
l2vpn
bridge group bg1
bridge-domain bg1_bd1
interface GigabitEthernet0/1/1/4.1
!
vfi bg1_bd1_vfi
vpn-id 1
autodiscovery bgp
rd auto
route-target 209.165.201.1:1
signaling-protocol bgp
ve-id 200
!
!
multicast p2mp
signaling-protocol bgp
!
transport rsvp-te
attribute-set p2mp-te set1
!
!
!
!
```

```

!
rsvp
 interface GigabitEthernet0/1/1/0
 bandwidth 100000
 !
 interface GigabitEthernet0/1/1/1
 bandwidth 100000
 !
 interface GigabitEthernet0/1/1/3
 bandwidth 100000
 !
 interface GigabitEthernet0/1/1/8
 bandwidth 100000
 !
!
mpls traffic-eng
 interface GigabitEthernet0/1/1/0
 auto-tunnel backup
  nhop-only
 !
 !
 interface GigabitEthernet0/1/1/1
 auto-tunnel backup
  nhop-only
 !
 !
 interface GigabitEthernet0/1/1/3
 !
 interface GigabitEthernet0/1/1/8
 !
 auto-tunnel p2mp
 tunnel-id min 100 max 200
 !
 auto-tunnel backup
 tunnel-id min 1000 max 1500
 !
 attribute-set p2mp-te set1
 bandwidth 10000
 fast-reroute
 record-route
 !
!
mpls ldp
 nsr
 graceful-restart
 router-id 209.165.200.226
 interface GigabitEthernet0/1/1/0
 !
 interface GigabitEthernet0/1/1/1
 !
 interface GigabitEthernet0/1/1/3
 !
 interface GigabitEthernet0/1/1/8
 !
!
end

```

RP/0/RSP0/CPU0:P#

PE2配置

```

RP/0/RSP0/CPU0:PE2#show run
hostname PE2

```

```
ipv4 unnumbered mpls traffic-eng Loopback0
interface Loopback0
  ipv4 address 209.165.200.227 255.255.255.255
!
interface GigabitEthernet0/3/0/2.1 l2transport
  encapsulation dot1q 1
!
interface GigabitEthernet0/3/0/3
  description connected to P router
  ipv4 address 209.165.201.62 255.255.255.224
  transceiver permit pid all
!
router ospf 100
  nsr
  router-id 209.165.200.227
  nsf cisco
  area 0
  mpls traffic-eng
  interface Loopback0
  !
  interface GigabitEthernet0/3/0/3
  !
  !
  mpls traffic-eng router-id 209.165.200.227
!
router bgp 100
  nsr
  bgp router-id 209.165.200.227
  bgp graceful-restart
  address-family l2vpn vpls-vpws
  !
  neighbor 209.165.200.225
  remote-as 100
  update-source Loopback0
  address-family l2vpn vpls-vpws
  !
  !
  neighbor 209.165.200.226
  remote-as 100
  update-source Loopback0
  address-family l2vpn vpls-vpws
  !
  !
  neighbor 209.165.200.228
  remote-as 100
  update-source Loopback0
  address-family l2vpn vpls-vpws
  !
  !
!
l2vpn
  bridge group bg1
  bridge-domain bg1_bd1
  interface GigabitEthernet0/3/0/2.1
  !
  vfi bg1_bd1_vfi
  vpn-id 1
  autodiscovery bgp
  rd auto
  route-target 209.165.201.1:1
  signaling-protocol bgp
  ve-id 300
  !
  !
```



```

bandwidth 1000000
!
!
mpls traffic-eng
interface GigabitEthernet0/2/1/8
!
auto-tunnel p2mp
tunnel-id min 100 max 200
!
auto-tunnel backup
tunnel-id min 1000 max 1500
!
attribute-set p2mp-te set1
bandwidth 10000
fast-reroute
record-route
!
!
mpls ldp
nsr
graceful-restart
router-id 209.165.200.228
interface GigabitEthernet0/2/1/8
!
!
end

```

RP/0/RSP0/CPU0:PE3#

验证-显示命令

这些显示命令是有用的为了调试和验证P2MP PW和P2MP MPLS流量工程隧道的状况。

- 显示l2vpn网桥域
- 显示l2vpn网桥域详细信息
- show MPLS traffic-eng tunnels p2mp
- show mpls forwarding标记<label>详细信息
- 表格show MPLS traffic-eng tunnels的p2mp

例如：

```
show l2vpn bridge-domain
```

```
RP/0/RSP0/CPU0:PE1#show l2vpn bridge-domain
```

```
Legend: pp = Partially Programmed.
```

```
Bridge group: bgl, bridge-domain: bgl_bdl, id: 0, state: up, ShgId: 0, MSTi: 0
```

```
Aging: 300 s, MAC limit: 4000, Action: none, Notification: syslog
```

```
Filter MAC addresses: 0
```

```
ACs: 1 (1 up), VFIs: 1, PWs: 3 (3 up), PBBs: 0 (0 up)
```

```
List of ACs:
```

```
  GigabitEthernet0/1/1/10.1, state: up, Static MAC addresses: 0
```

```
List of Access PWs:
```

```
List of VFIs:
```

```
  VFI bgl_bdl_vfi (up)
```

```
    P2MP: RSVP-TE, BGP, 1, Tunnel Up
```

```
    Neighbor 209.165.200.226 pw-id 1, state: up, Static MAC addresses: 0
```

```
    Neighbor 209.165.200.227 pw-id 1, state: up, Static MAC addresses: 0
```

```
    Neighbor 209.165.200.228 pw-id 1, state: up, Static MAC addresses: 0
```

```
RP/0/RSP0/CPU0:PE1#
```

show l2vpn bridge-domain detail

RP/0/RSP0/CPU0:PE1#show l2vpn bridge-domain detail

Legend: pp = Partially Programmed.

Bridge group: bgl, bridge-domain: bgl_bd1, id: 0, state: up, ShgId: 0, MSTi: 0

Coupled state: disabled

MAC learning: enabled

MAC withdraw: enabled

MAC withdraw for Access PW: enabled

MAC withdraw sent on: bridge port up

MAC withdraw relaying (access to access): disabled

Flooding:

Broadcast & Multicast: enabled

Unknown unicast: enabled

MAC aging time: 300 s, Type: inactivity

MAC limit: 4000, Action: none, Notification: syslog

MAC limit reached: no

MAC port down flush: enabled

MAC Secure: disabled, Logging: disabled

Split Horizon Group: none

Dynamic ARP Inspection: disabled, Logging: disabled

IP Source Guard: disabled, Logging: disabled

DHCPv4 snooping: disabled

IGMP Snooping: enabled

IGMP Snooping profile: none

MLD Snooping profile: none

Storm Control: disabled

Bridge MTU: 1500

MIB cvplsConfigIndex: 1

Filter MAC addresses:

P2MP PW: enabled

Create time: 18/02/2014 03:47:59 (00:41:54 ago)

No status change since creation

ACs: 1 (1 up), VFIs: 1, PWs: 3 (3 up), PBBs: 0 (0 up)

List of ACs:

AC: GigabitEthernet0/1/1/10.1, state is up

Type VLAN; Num Ranges: 1

VLAN ranges: [1, 1]

MTU 1504; XC ID 0x8802a7; interworking none

MAC learning: enabled

Flooding:

Broadcast & Multicast: enabled

Unknown unicast: enabled

MAC aging time: 300 s, Type: inactivity

MAC limit: 4000, Action: none, Notification: syslog

MAC limit reached: no

MAC port down flush: enabled

MAC Secure: disabled, Logging: disabled

Split Horizon Group: none

Dynamic ARP Inspection: disabled, Logging: disabled

IP Source Guard: disabled, Logging: disabled

DHCPv4 snooping: disabled

IGMP Snooping: enabled

IGMP Snooping profile: none

MLD Snooping profile: none

Storm Control: disabled

Static MAC addresses:

Statistics:

packets: received 0, sent 0

bytes: received 0, sent 0

Storm control drop counters:

packets: broadcast 0, multicast 0, unknown unicast 0

bytes: broadcast 0, multicast 0, unknown unicast 0

Dynamic ARP inspection drop counters:

packets: 0, bytes: 0

IP source guard drop counters:

packets: 0, bytes: 0

List of Access PWs:

List of VFIs:

VFI bg1_bdl_vfi (up)

P2MP:

Type RSVP-TE, BGP signaling, PTree ID 1

P2MP Status: Tunnel Up

P2MP-TE attribute-set: set1

Tunnel tunnel-mte100, Local Label: 289994

VPN-ID: 1, Auto Discovery: BGP, state is Provisioned (Service Connected)

Route Distinguisher: (auto) 209.165.200.225:32768

Import Route Targets:

209.165.201.1:1

Export Route Targets:

209.165.201.1:1

Signaling protocol: BGP

Local VE-ID: 100 , Advertised Local VE-ID : 100

VE-Range: 10

PW: neighbor 209.165.200.226, PW ID 1, state is up (established)

PW class not set, XC ID 0xc0000001

Encapsulation MPLS, Auto-discovered (BGP), protocol BGP

Source address 209.165.200.225

PW type VPLS, control word disabled, interworking none

Sequencing not set

MPLS	Local	Remote
Label	289959	16030
MTU	1500	1500
Control word disabled		disabled
PW type	VPLS	VPLS
VE-ID	100	200

MIB cpwVcIndex: 3221225473

Create time: 18/02/2014 03:58:31 (00:31:23 ago)

Last time status changed: 18/02/2014 03:58:31 (00:31:23 ago)

MAC withdraw messages: sent 0, received 0

Static MAC addresses:

Statistics:

packets: received 0, sent 0

bytes: received 0, sent 0

Storm control drop counters:

packets: broadcast 0, multicast 0, unknown unicast 0

bytes: broadcast 0, multicast 0, unknown unicast 0

DHCPv4 snooping: disabled

IGMP Snooping profile: none

MLD Snooping profile: none

P2MP-PW:

FEC	Local	Remote
Label	NULL (inclusive tree)	NULL (inclusive tree)
P2MP ID	100	100
Flags	0x00	0x00
PTree Type	RSVP-TE	RSVP-TE
Tunnel ID	100	100
Ext. Tunnel ID	209.165.200.225	209.165.200.226

Statistics:

packets: received 0

bytes: received 0

PW: neighbor 209.165.200.227, PW ID 1, state is up (established)

PW class not set, XC ID 0xc0000002

Encapsulation MPLS, Auto-discovered (BGP), protocol BGP
Source address 209.165.200.225
PW type VPLS, control word disabled, interworking none
Sequencing not set

MPLS	Local	Remote
Label	289944	16030
MTU	1500	1500
Control word disabled		disabled
PW type	VPLS	VPLS
VE-ID	100	300

MIB cpwVcIndex: 3221225474

Create time: 18/02/2014 04:05:25 (00:24:29 ago)

Last time status changed: 18/02/2014 04:05:25 (00:24:29 ago)

MAC withdraw messages: sent 0, received 0

Static MAC addresses:

Statistics:

packets: received 0, sent 0

bytes: received 0, sent 0

Storm control drop counters:

packets: broadcast 0, multicast 0, unknown unicast 0

bytes: broadcast 0, multicast 0, unknown unicast 0

DHCPv4 snooping: disabled

IGMP Snooping profile: none

MLD Snooping profile: none

P2MP-PW:

FEC	Local	Remote
Label	NULL (inclusive tree)	NULL (inclusive tree)
P2MP ID	100	100
Flags	0x00	0x00
PTree Type	RSVP-TE	RSVP-TE
Tunnel ID	100	100
Ext. Tunnel ID	209.165.200.225	209.165.200.227

Statistics:

packets: received 0

bytes: received 0

PW: neighbor 209.165.200.228, PW ID 1, state is up (established)

PW class not set, XC ID 0xc0000003

Encapsulation MPLS, Auto-discovered (BGP), protocol BGP

Source address 209.165.200.225

PW type VPLS, control word disabled, interworking none

Sequencing not set

MPLS	Local	Remote
Label	289929	16045
MTU	1500	1500
Control word disabled		disabled
PW type	VPLS	VPLS
VE-ID	100	400

MIB cpwVcIndex: 3221225475

Create time: 18/02/2014 04:08:11 (00:21:43 ago)

Last time status changed: 18/02/2014 04:08:11 (00:21:43 ago)

MAC withdraw messages: sent 0, received 0

Static MAC addresses:

Statistics:

packets: received 0, sent 0

bytes: received 0, sent 0

Storm control drop counters:

packets: broadcast 0, multicast 0, unknown unicast 0

bytes: broadcast 0, multicast 0, unknown unicast 0
DHCPv4 snooping: disabled
IGMP Snooping profile: none
MLD Snooping profile: none

P2MP-PW:

FEC	Local	Remote
-----	-----	-----
Label	NULL (inclusive tree)	NULL (inclusive tree)
P2MP ID	100	100
Flags	0x00	0x00
PTree Type	RSVP-TE	RSVP-TE
Tunnel ID	100	100
Ext. Tunnel ID	209.165.200.225	209.165.200.228

Statistics:

packets: received 0
bytes: received 0

VFI Statistics:

drops: illegal VLAN 0, illegal length 0

RP/0/RSP0/CPU0:PE1#

show mpls traffic-eng tunnels p2mp

RP/0/RSP0/CPU0:PE1#**show mpls traffic-eng tunnels p2mp**

Name: tunnel-mt100 (auto-tunnel for VPLS (l2vpn))

Signalled-Name: auto_PE1_mt100

Status:

Admin: up Oper: up (Up for 00:32:35)

Config Parameters:

Bandwidth: 0 kbps (CT0) Priority: 7 7 Affinity: 0x0/0xffff
Interface Bandwidth: 10000 kbps
Metric Type: TE (default)
Fast Reroute: Enabled, Protection Desired: Any
Record Route: Enabled
Reoptimization after affinity failure: Enabled

Attribute-set: set1 (type p2mp-te)

Destination summary: (3 up, 0 down, 0 disabled) Affinity: 0x0/0xffff

Auto-bw: disabled

Destination: 209.165.200.226

State: Up for 00:32:35

Path options:

path-option 10 dynamic [active]

Destination: 209.165.200.227

State: Up for 00:25:41

Path options:

path-option 10 dynamic [active]

Destination: 209.165.200.228

State: Up for 00:22:55

Path options:

path-option 10 dynamic [active]

Current LSP:

lsp-id: 10004 p2mp-id: 100 tun-id: 100 src: 209.165.200.225 extid:
209.165.200.225

LSP up for: 00:32:35 (since Tue Feb 18 03:58:31 UTC 2014)

Reroute Pending: No

Inuse Bandwidth: 0 kbps (CT0)

Number of S2Ls: 3 connected, 0 signaling proceeding, 0 down

S2L Sub LSP: Destination 209.165.200.226 Signaling Status: connected

S2L up for: 00:32:35 (since Tue Feb 18 03:58:31 UTC 2014)
Sub Group ID: 1 Sub Group Originator ID: 209.165.200.225
Path option path-option 10 dynamic (path weight 1)
Path info (OSPF 100 area 0)
209.165.201.2
209.165.200.226

S2L Sub LSP: Destination 209.165.200.227 Signaling Status: connected
S2L up for: 00:25:41 (since Tue Feb 18 04:05:25 UTC 2014)
Sub Group ID: 2 Sub Group Originator ID: 209.165.200.225
Path option path-option 10 dynamic (path weight 2)
Path info (OSPF 100 area 0)
209.165.201.2
209.165.201.61
209.165.201.62
209.165.200.227

S2L Sub LSP: Destination 209.165.200.228 Signaling Status: connected
S2L up for: 00:22:55 (since Tue Feb 18 04:08:11 UTC 2014)
Sub Group ID: 4 Sub Group Originator ID: 209.165.200.225
Path option path-option 10 dynamic (path weight 2)
Path info (OSPF 100 area 0)
209.165.201.2
209.165.201.101
209.165.201.102
209.165.200.228

Reoptimized LSP (Install Timer Remaining 0 Seconds):

None

Cleaned LSP (Cleanup Timer Remaining 0 Seconds):

None

LSP Tunnel 209.165.200.226 100 [10005] is signalled, connection is up

Tunnel Name: auto_P_mt100 **Tunnel Role: Tail**

InLabel: GigabitEthernet0/1/1/0, 289995

Signalling Info:

Src 209.165.200.226 Dst 209.165.200.225, Tun ID 100, Tun Inst 10005, Ext ID
209.165.200.226

Router-IDs: upstream 209.165.200.226
local 209.165.200.225

Bandwidth: 0 kbps (CT0) Priority: 7 7 DSTE-class: 0

Soft Preemption: None

Path Info:

Incoming Address: 209.165.201.1

Incoming:

Explicit Route:

Strict, 209.165.201.1

Strict, 209.165.200.225

Record Route:

IPv4 209.165.201.2, flags 0x0

Tspec: avg rate=0 kbits, burst=1000 bytes, peak rate=0 kbits

Session Attributes: Local Prot: Set, Node Prot: Not Set, BW Prot: Not Set

Soft Preemption Desired: Not Set

Resv Info: None

Record Route: Empty

Resv Info:

Record Route: Empty

Fspec: avg rate=0 kbits, burst=1000 bytes, peak rate=0 kbits

LSP Tunnel 209.165.200.227 100 [10003] is signalled, connection is up

Tunnel Name: auto_PE2_mt100 **Tunnel Role: Tail**

InLabel: GigabitEthernet0/1/1/0, 289998

Signalling Info:

Src 209.165.200.227 Dst 209.165.200.225, Tun ID 100, Tun Inst 10003, Ext ID

209.165.200.227

Router-IDs: upstream 209.165.200.226
 local 209.165.200.225

Bandwidth: 0 kbps (CT0) Priority: 7 7 DSTE-class: 0

Soft Preemption: None

Path Info:

Incoming Address: 209.165.201.1

Incoming:

Explicit Route:

 Strict, 209.165.201.1

 Strict, 209.165.200.225

Record Route:

 IPv4 209.165.201.2, flags 0x0

 IPv4 209.165.201.62, flags 0x0

Tspec: avg rate=0 kbits, burst=1000 bytes, peak rate=0 kbits

Session Attributes: Local Prot: Set, Node Prot: Not Set, BW Prot: Not Set

 Soft Preemption Desired: Not Set

Resv Info: None

Record Route: Empty

Resv Info:

 Record Route: Empty

 Fspec: avg rate=0 kbits, burst=1000 bytes, peak rate=0 kbits

LSP Tunnel 209.165.200.228 100 [10004] is signalled, connection is up

Tunnel Name: auto_PE3_mt100 **Tunnel Role: Tail**

InLabel: GigabitEthernet0/1/1/0, 289970

Signalling Info:

 Src 209.165.200.228 Dst 209.165.200.225, Tun ID 100, Tun Inst 10004, Ext ID

209.165.200.228

Router-IDs: upstream 209.165.200.226
 local 209.165.200.225

Bandwidth: 0 kbps (CT0) Priority: 7 7 DSTE-class: 0

Soft Preemption: None

Path Info:

Incoming Address: 209.165.201.1

Incoming:

Explicit Route:

 Strict, 209.165.201.1

 Strict, 209.165.200.225

Record Route:

 IPv4 209.165.201.2, flags 0x0

 IPv4 209.165.201.102, flags 0x0

Tspec: avg rate=0 kbits, burst=1000 bytes, peak rate=0 kbits

Session Attributes: Local Prot: Set, Node Prot: Not Set, BW Prot: Not Set

 Soft Preemption Desired: Not Set

Resv Info: None

Record Route: Empty

Resv Info:

 Record Route: Empty

 Fspec: avg rate=0 kbits, burst=1000 bytes, peak rate=0 kbits

Displayed 1 (of 2) heads, 0 (of 0) midpoints, 3 (of 4) tails

Displayed 1 up, 0 down, 0 recovering, 0 recovered heads

RP/0/RSP0/CPU0:PE1#

show mpls forwarding labels <label> detail

RP/0/RSP0/CPU0:PE1#**show mpls forwarding labels 289994 detail**

Local Label	Outgoing Label	Prefix or ID	Outgoing Interface	Next Hop	Bytes Switched
-------------	----------------	--------------	--------------------	----------	----------------

289994 P2MP TE: 100
 Updated Feb 18 03:58:32.360

```
TE Tunnel Head, tunnel ID: 100, tunnel ifh: 0x8000e20
IPv4 Tableid: 0xe0000000, IPv6 Tableid: 0xe0800000
Flags:IP Lookup:not-set, Expnulv4:not-set, Expnulv6:set
Payload Type v4:set, Payload Type v6:not-set, l2vpn:set
Head:set, Tail:not-set, Bud:not-set, Peek:not-set, inclusive:set
Ingress Drop:not-set, Egress Drop:not-set
Platform Data: {0x2000000, 0x2000000, 0x0, 0x0}, RPF-ID:0x80003
VPLS Disposition: Bridge ID: 0, SHG ID: 0, PW Xconnect ID: 0x0
```

```
mpls paths: 1, local mpls paths: 0, protected mpls paths: 1
```

```
16005 P2MP TE: 100 Gi0/1/1/0 209.165.201.2 0
```

```
Updated Feb 18 03:58:32.360
```

```
My Nodeid:65, Interface Nodeid:2065, Backup Interface Nodeid:2065
```

```
Packets Switched: 0
```

```
RP/0/RSP0/CPU0:PE1#
```

```
show mpls traffic-eng tunnels p2mp tabular
```

```
RP/0/RSP0/CPU0:PE1#show mpls traffic-eng tunnels p2mp tabular
```

Tunnel Name	LSP ID	Destination Address	Source Address	State	FRR State	LSP Role	Path Prot
^tunnel-mte100	10004	209.165.200.226	209.165.200.225	up	Ready	Head	
^tunnel-mte100	10004	209.165.200.227	209.165.200.225	up	Ready	Head	
^tunnel-mte100	10004	209.165.200.228	209.165.200.225	up	Ready	Head	
auto_P_mt100	10005	209.165.200.225	209.165.200.226	up	Inact	Tail	
auto_PE2_mt100	10003	209.165.200.225	209.165.200.227	up	Inact	Tail	
auto_PE3_mt100	10004	209.165.200.225	209.165.200.228	up	Inact	Tail	

```
* = automatically created backup tunnel
```

```
^ = automatically created P2MP tunnel
```

```
RP/0/RSP0/CPU0:PE1#
```

排除故障VPLS LSM

常见配置问题

P2MP问题的多数常见原因在L2VPN显示此处。

- LSM的BGP配置正确地是相同的象那为BGP-AD。确保通过配置BGP邻居的address-family l2vpn VPLSvpws导出/导入l2vpn VPLSvpws地址家族路由。
- 有MPLS并且组播配置错误。

在P2MP PWs通过的接口必须启用MPLS流量工程。

```
show l2vpn bridge-domain
```

```
RP/0/RSP0/CPU0:PE1#show l2vpn bridge-domain
```

```
Legend: pp = Partially Programmed.
```

```
Bridge group: bg1, bridge-domain: bg1_bd1, id: 0, state: up, ShgId: 0, MSTi: 0
```

```
Aging: 300 s, MAC limit: 4000, Action: none, Notification: syslog
```

```
Filter MAC addresses: 0
```

```
ACs: 1 (1 up), VFIs: 1, PWs: 3 (3 up), PBBs: 0 (0 up)
```

List of ACs:

GigabitEthernet0/1/1/10.1, state: up, Static MAC addresses: 0

List of Access PWs:

List of VFIs:

VFI bg1_bdl_vfi (up)

P2MP: RSVP-TE, BGP, 1, Tunnel Up

Neighbor 209.165.200.226 pw-id 1, state: up, Static MAC addresses: 0

Neighbor 209.165.200.227 pw-id 1, state: up, Static MAC addresses: 0

Neighbor 209.165.200.228 pw-id 1, state: up, Static MAC addresses: 0

RP/0/RSP0/CPU0:PE1#

show l2vpn bridge-domain detail

RP/0/RSP0/CPU0:PE1#show l2vpn bridge-domain detail

Legend: pp = Partially Programmed.

Bridge group: bg1, bridge-domain: bg1_bdl, id: 0, state: up, ShgId: 0, MSTi: 0

Coupled state: disabled

MAC learning: enabled

MAC withdraw: enabled

MAC withdraw for Access PW: enabled

MAC withdraw sent on: bridge port up

MAC withdraw relaying (access to access): disabled

Flooding:

Broadcast & Multicast: enabled

Unknown unicast: enabled

MAC aging time: 300 s, Type: inactivity

MAC limit: 4000, Action: none, Notification: syslog

MAC limit reached: no

MAC port down flush: enabled

MAC Secure: disabled, Logging: disabled

Split Horizon Group: none

Dynamic ARP Inspection: disabled, Logging: disabled

IP Source Guard: disabled, Logging: disabled

DHCPv4 snooping: disabled

IGMP Snooping: enabled

IGMP Snooping profile: none

MLD Snooping profile: none

Storm Control: disabled

Bridge MTU: 1500

MIB cvplsConfigIndex: 1

Filter MAC addresses:

P2MP PW: enabled

Create time: 18/02/2014 03:47:59 (00:41:54 ago)

No status change since creation

ACs: 1 (1 up), VFIs: 1, PWs: 3 (3 up), PBBs: 0 (0 up)

List of ACs:

AC: GigabitEthernet0/1/1/10.1, state is up

Type VLAN; Num Ranges: 1

VLAN ranges: [1, 1]

MTU 1504; XC ID 0x8802a7; interworking none

MAC learning: enabled

Flooding:

Broadcast & Multicast: enabled

Unknown unicast: enabled

MAC aging time: 300 s, Type: inactivity

MAC limit: 4000, Action: none, Notification: syslog

MAC limit reached: no

MAC port down flush: enabled

MAC Secure: disabled, Logging: disabled

Split Horizon Group: none

Dynamic ARP Inspection: disabled, Logging: disabled

IP Source Guard: disabled, Logging: disabled

DHCPv4 snooping: disabled

IGMP Snooping: enabled
 IGMP Snooping profile: none
 MLD Snooping profile: none
 Storm Control: disabled
 Static MAC addresses:
 Statistics:
 packets: received 0, sent 0
 bytes: received 0, sent 0
 Storm control drop counters:
 packets: broadcast 0, multicast 0, unknown unicast 0
 bytes: broadcast 0, multicast 0, unknown unicast 0
 Dynamic ARP inspection drop counters:
 packets: 0, bytes: 0
 IP source guard drop counters:
 packets: 0, bytes: 0

List of Access PWs:

List of VFIs:

VFI bg1_bdl_vfi (up)

P2MP:

Type RSVP-TE, BGP signaling, PTree ID 1

P2MP Status: Tunnel Up

P2MP-TE attribute-set: set1

Tunnel tunnel-mte100, Local Label: 289994

VPN-ID: 1, Auto Discovery: BGP, state is Provisioned (Service Connected)

Route Distinguisher: (auto) 209.165.200.225:32768

Import Route Targets:

209.165.201.1:1

Export Route Targets:

209.165.201.1:1

Signaling protocol: BGP

Local VE-ID: 100 , Advertised Local VE-ID : 100

VE-Range: 10

PW: neighbor 209.165.200.226, PW ID 1, state is up (established)

PW class not set, XC ID 0xc0000001

Encapsulation MPLS, Auto-discovered (BGP), protocol BGP

Source address 209.165.200.225

PW type VPLS, control word disabled, interworking none

Sequencing not set

MPLS	Local	Remote
Label	289959	16030
MTU	1500	1500
Control word	disabled	disabled
PW type	VPLS	VPLS
VE-ID	100	200

MIB cpwVcIndex: 3221225473

Create time: 18/02/2014 03:58:31 (00:31:23 ago)

Last time status changed: 18/02/2014 03:58:31 (00:31:23 ago)

MAC withdraw messages: sent 0, received 0

Static MAC addresses:

Statistics:

 packets: received 0, sent 0

 bytes: received 0, sent 0

Storm control drop counters:

 packets: broadcast 0, multicast 0, unknown unicast 0

 bytes: broadcast 0, multicast 0, unknown unicast 0

DHCPv4 snooping: disabled

IGMP Snooping profile: none

MLD Snooping profile: none

P2MP-PW:

FEC	Local	Remote
-----	-----	-----

Label	NULL (inclusive tree)	NULL (inclusive tree)
P2MP ID	100	100
Flags	0x00	0x00
PTree Type	RSVP-TE	RSVP-TE
Tunnel ID	100	100
Ext. Tunnel ID	209.165.200.225	209.165.200.226

Statistics:

packets: received 0
bytes: received 0

PW: neighbor 209.165.200.227, PW ID 1, state is up (established)

PW class not set, XC ID 0xc0000002

Encapsulation MPLS, Auto-discovered (BGP), protocol BGP

Source address 209.165.200.225

PW type VPLS, control word disabled, interworking none

Sequencing not set

MPLS	Local	Remote
Label	289944	16030
MTU	1500	1500
Control word	disabled	disabled
PW type	VPLS	VPLS
VE-ID	100	300

MIB cpwVcIndex: 3221225474

Create time: 18/02/2014 04:05:25 (00:24:29 ago)

Last time status changed: 18/02/2014 04:05:25 (00:24:29 ago)

MAC withdraw messages: sent 0, received 0

Static MAC addresses:

Statistics:

packets: received 0, sent 0
bytes: received 0, sent 0

Storm control drop counters:

packets: broadcast 0, multicast 0, unknown unicast 0
bytes: broadcast 0, multicast 0, unknown unicast 0

DHCPv4 snooping: disabled

IGMP Snooping profile: none

MLD Snooping profile: none

P2MP-PW:

FEC	Local	Remote
Label	NULL (inclusive tree)	NULL (inclusive tree)
P2MP ID	100	100
Flags	0x00	0x00
PTree Type	RSVP-TE	RSVP-TE
Tunnel ID	100	100
Ext. Tunnel ID	209.165.200.225	209.165.200.227

Statistics:

packets: received 0
bytes: received 0

PW: neighbor 209.165.200.228, PW ID 1, state is up (established)

PW class not set, XC ID 0xc0000003

Encapsulation MPLS, Auto-discovered (BGP), protocol BGP

Source address 209.165.200.225

PW type VPLS, control word disabled, interworking none

Sequencing not set

MPLS	Local	Remote
Label	289929	16045
MTU	1500	1500
Control word	disabled	disabled
PW type	VPLS	VPLS
VE-ID	100	400


```

-----
MIB cpwVcIndex: 3221225475
Create time: 18/02/2014 04:08:11 (00:21:43 ago)
Last time status changed: 18/02/2014 04:08:11 (00:21:43 ago)
MAC withdraw messages: sent 0, received 0
Static MAC addresses:
Statistics:
  packets: received 0, sent 0
  bytes: received 0, sent 0
Storm control drop counters:
  packets: broadcast 0, multicast 0, unknown unicast 0
  bytes: broadcast 0, multicast 0, unknown unicast 0
DHCPv4 snooping: disabled
IGMP Snooping profile: none
MLD Snooping profile: none
P2MP-PW:

```

FEC	Local	Remote
Label	NULL (inclusive tree)	NULL (inclusive tree)
P2MP ID	100	100
Flags	0x00	0x00
PTree Type	RSVP-TE	RSVP-TE
Tunnel ID	100	100
Ext. Tunnel ID	209.165.200.225	209.165.200.228

```

Statistics:
  packets: received 0
  bytes: received 0

```

```

VFI Statistics:
  drops: illegal VLAN 0, illegal length 0

```

```
RP/0/RSP0/CPU0:PE1#
```

```
show mpls traffic-eng tunnels p2mp
```

```
RP/0/RSP0/CPU0:PE1#show mpls traffic-eng tunnels p2mp
```

```
Name: tunnel-mte100 (auto-tunnel for VPLS (l2vpn))
```

```
Signalled-Name: auto_PE1_mt100
```

```
Status:
```

```
Admin: up Oper: up (Up for 00:32:35)
```

```
Config Parameters:
```

```
Bandwidth: 0 kbps (CT0) Priority: 7 7 Affinity: 0x0/0xffff
```

```
Interface Bandwidth: 10000 kbps
```

```
Metric Type: TE (default)
```

```
Fast Reroute: Enabled, Protection Desired: Any
```

```
Record Route: Enabled
```

```
Reoptimization after affinity failure: Enabled
```

```
Attribute-set: set1 (type p2mp-te)
```

```
Destination summary: (3 up, 0 down, 0 disabled) Affinity: 0x0/0xffff
```

```
Auto-bw: disabled
```

```
Destination: 209.165.200.226
```

```
State: Up for 00:32:35
```

```
Path options:
```

```
  path-option 10 dynamic [active]
```

```
Destination: 209.165.200.227
```

```
State: Up for 00:25:41
```

```
Path options:
```

```
  path-option 10 dynamic [active]
```

```
Destination: 209.165.200.228
```

```
State: Up for 00:22:55
```

```
Path options:
```

path-option 10 dynamic [active]

Current LSP:

lsp-id: 10004 p2mp-id: 100 tun-id: 100 src: 209.165.200.225 extid:
209.165.200.225

LSP up for: 00:32:35 (since Tue Feb 18 03:58:31 UTC 2014)

Reroute Pending: No

Inuse Bandwidth: 0 kbps (CT0)

Number of S2Ls: 3 connected, 0 signaling proceeding, 0 down

S2L Sub LSP: Destination 209.165.200.226 Signaling Status: connected

S2L up for: 00:32:35 (since Tue Feb 18 03:58:31 UTC 2014)

Sub Group ID: 1 Sub Group Originator ID: 209.165.200.225

Path option path-option 10 dynamic (path weight 1)

Path info (OSPF 100 area 0)

209.165.201.2

209.165.200.226

S2L Sub LSP: Destination 209.165.200.227 Signaling Status: connected

S2L up for: 00:25:41 (since Tue Feb 18 04:05:25 UTC 2014)

Sub Group ID: 2 Sub Group Originator ID: 209.165.200.225

Path option path-option 10 dynamic (path weight 2)

Path info (OSPF 100 area 0)

209.165.201.2

209.165.201.61

209.165.201.62

209.165.200.227

S2L Sub LSP: Destination 209.165.200.228 Signaling Status: connected

S2L up for: 00:22:55 (since Tue Feb 18 04:08:11 UTC 2014)

Sub Group ID: 4 Sub Group Originator ID: 209.165.200.225

Path option path-option 10 dynamic (path weight 2)

Path info (OSPF 100 area 0)

209.165.201.2

209.165.201.101

209.165.201.102

209.165.200.228

Reoptimized LSP (Install Timer Remaining 0 Seconds):

None

Cleaned LSP (Cleanup Timer Remaining 0 Seconds):

None

LSP Tunnel 209.165.200.226 100 [10005] is signalled, connection is up

Tunnel Name: auto_P_mt100 **Tunnel Role: Tail**

InLabel: GigabitEthernet0/1/1/0, 289995

Signalling Info:

Src 209.165.200.226 Dst 209.165.200.225, Tun ID 100, Tun Inst 10005, Ext ID
209.165.200.226

Router-IDs: upstream 209.165.200.226

local 209.165.200.225

Bandwidth: 0 kbps (CT0) Priority: 7 7 DSTE-class: 0

Soft Preemption: None

Path Info:

Incoming Address: 209.165.201.1

Incoming:

Explicit Route:

Strict, 209.165.201.1

Strict, 209.165.200.225

Record Route:

IPv4 209.165.201.2, flags 0x0

Tspec: avg rate=0 kbits, burst=1000 bytes, peak rate=0 kbits

Session Attributes: Local Prot: Set, Node Prot: Not Set, BW Prot: Not Set

Soft Preemption Desired: Not Set

Resv Info: None
Record Route: Empty
Resv Info:
Record Route: Empty
Fspec: avg rate=0 kbits, burst=1000 bytes, peak rate=0 kbits

LSP Tunnel 209.165.200.227 100 [10003] is signalled, connection is up

Tunnel Name: auto_PE2_mt100 **Tunnel Role: Tail**

InLabel: GigabitEthernet0/1/1/0, 289998

Signalling Info:

Src 209.165.200.227 Dst 209.165.200.225, Tun ID 100, Tun Inst 10003, Ext ID 209.165.200.227

Router-IDs: upstream 209.165.200.226
local 209.165.200.225

Bandwidth: 0 kbps (CT0) Priority: 7 7 DSTE-class: 0

Soft Preemption: None

Path Info:

Incoming Address: 209.165.201.1

Incoming:

Explicit Route:

Strict, 209.165.201.1

Strict, 209.165.200.225

Record Route:

IPv4 209.165.201.2, flags 0x0

IPv4 209.165.201.62, flags 0x0

Tspec: avg rate=0 kbits, burst=1000 bytes, peak rate=0 kbits

Session Attributes: Local Prot: Set, Node Prot: Not Set, BW Prot: Not Set

Soft Preemption Desired: Not Set

Resv Info: None

Record Route: Empty

Resv Info:

Record Route: Empty

Fspec: avg rate=0 kbits, burst=1000 bytes, peak rate=0 kbits

LSP Tunnel 209.165.200.228 100 [10004] is signalled, connection is up

Tunnel Name: auto_PE3_mt100 **Tunnel Role: Tail**

InLabel: GigabitEthernet0/1/1/0, 289970

Signalling Info:

Src 209.165.200.228 Dst 209.165.200.225, Tun ID 100, Tun Inst 10004, Ext ID 209.165.200.228

Router-IDs: upstream 209.165.200.226
local 209.165.200.225

Bandwidth: 0 kbps (CT0) Priority: 7 7 DSTE-class: 0

Soft Preemption: None

Path Info:

Incoming Address: 209.165.201.1

Incoming:

Explicit Route:

Strict, 209.165.201.1

Strict, 209.165.200.225

Record Route:

IPv4 209.165.201.2, flags 0x0

IPv4 209.165.201.102, flags 0x0

Tspec: avg rate=0 kbits, burst=1000 bytes, peak rate=0 kbits

Session Attributes: Local Prot: Set, Node Prot: Not Set, BW Prot: Not Set

Soft Preemption Desired: Not Set

Resv Info: None

Record Route: Empty

Resv Info:

Record Route: Empty

Fspec: avg rate=0 kbits, burst=1000 bytes, peak rate=0 kbits

Displayed 1 (of 2) heads, 0 (of 0) midpoints, 3 (of 4) tails

Displayed 1 up, 0 down, 0 recovering, 0 recovered heads

RP/0/RSP0/CPU0:PE1#

show mpls forwarding labels <label> detail

RP/0/RSP0/CPU0:PE1#**show mpls forwarding labels 289994 detail**

```
Local   Outgoing   Prefix           Outgoing   Next Hop        Bytes
Label   Label       or ID            Interface  Interface       Switched
-----
289994          P2MP TE: 100
Updated Feb 18 03:58:32.360
TE Tunnel Head, tunnel ID: 100, tunnel ifh: 0x8000e20
IPv4 Tableid: 0xe0000000, IPv6 Tableid: 0xe0800000
Flags:IP Lookup:not-set, Expnullv4:not-set, Expnullv6:set
      Payload Type v4:set, Payload Type v6:not-set, l2vpn:set
      Head:set, Tail:not-set, Bud:not-set, Peek:not-set, inclusive:set
      Ingress Drop:not-set, Egress Drop:not-set
Platform Data:0x2000000, 0x2000000, 0x0, 0x0}, RPF-ID:0x80003
VPLS Disposition: Bridge ID: 0, SHG ID: 0, PW Xconnect ID: 0x0

mpls paths: 1, local mpls paths: 0, protected mpls paths: 1

16005          P2MP TE: 100      Gi0/1/1/0      209.165.201.2  0
Updated Feb 18 03:58:32.360
My Nodeid:65, Interface Nodeid:2065, Backup Interface Nodeid:2065
Packets Switched: 0
```

RP/0/RSP0/CPU0:PE1#

show mpls traffic-eng tunnels p2mp tabular

RP/0/RSP0/CPU0:PE1#**show mpls traffic-eng tunnels p2mp tabular**

Tunnel Name	LSP ID	Destination Address	Source Address	State	FRR State	LSP Role	Path Prot
^tunnel-mte100	10004	209.165.200.226	209.165.200.225	up	Ready	Head	
^tunnel-mte100	10004	209.165.200.227	209.165.200.225	up	Ready	Head	
^tunnel-mte100	10004	209.165.200.228	209.165.200.225	up	Ready	Head	
auto_P_mt100	10005	209.165.200.225	209.165.200.226	up	Inact	Tail	
auto_PE2_mt100	10003	209.165.200.225	209.165.200.227	up	Inact	Tail	
auto_PE3_mt100	10004	209.165.200.225	209.165.200.228	up	Inact	Tail	

* = automatically created backup tunnel

^ = automatically created P2MP tunnel

RP/0/RSP0/CPU0:PE1#

- LSM的L2VPN配置在Cisco IOS XR版本5.1.0要求您：

配置VFI的VPN ID配置配置VFI的组播P2MP。Configure传输协议和信令协议，正如在此配置示例：l2vpn

```
bridge group bg
bridge-domain bd1
vfi vf1
  vpn-id 1
  autodiscovery bgp
  rd auto
  route-target 209.165.201.7:1
  signaling-protocol bgp
  ve-id 1
multicast p2mp
  signaling-protocol bgp
```

```
transport rsvp-te
```

- 必须适当地设置LSM题头/尾标。在Cisco IOS XR版本5.1.0中，每LSM尾标也是LSM题头和反过来也是一样地。由于没有在路由器中的明确LSM功能交换，LSM启用的网桥域的所有路由器必须参与LSM。

L2VPN和L2FIB显示命令并且排除故障

- L2VPN管理器进程(l2vpn_mgr)连通与MPLS流量工程(TE)控制进程(te_control)并且请求隧道创建。保证te_control和l2vpn_mgr进程在运行状态用这些命令：
show process l2vpn_mgr show process te_control

- 检查l2vpn_mgr进程请求隧道创建。通道的一个条目应该在此show命令：

```
RP/0/RSP0/CPU0:PE1#show l2vpn atom-db preferred-path
Tunnel          BW Tot/Avail/Resv   Peer ID          VC ID
-----
tunnel-mte1 0/0/0          209.165.200.226  1
                                     209.165.200.227  1
                                     209.165.200.228  1
```

- L2VPN必须获得从te_control进程的隧道信息。验证此show命令有非零详细信息例如隧道ID、Ext.tunnel id、通道ifh和p2mp-id：

```
RP/0/RSP0/CPU0:PE1#show l2vpn atom-db preferred-path private
Tunnel tunnel-mte1 0/0/0:
  Peer ID: 209.165.200.226, VC-ID 1
  Peer ID: 209.165.200.227, VC-ID 1
  Peer ID: 209.165.200.228, VC-ID 1
  MTE details:
    tunnel-ifh: 0x08000e20
    local-label: 289994
    p2mp-id: 100
    tunnel-id: 100
    Ext.tunnel-id: 209.165.200.225
```

- L2VPN必须通告供应商多点传送服务器实例(PMSI)到其他PE路由器。检查l2vpn_mgr发送已配置的VFI的PMSI。事件LSM Head:发送PMSI应该是存在事件历史记录里为VFI。

```
RP/0/0/CPU0:one#show l2vpn bridge-domain p2mp private
[...]
Object: VFI
Base info: version=0x0, flags=0x0, type=0, reserved=0
VFI event trace history [Num events: 5]
-----
Time          Event          Flags          Flags
====          =====
Dec  3 08:52:37.504 LSM Head: P2MP Provision 00000001, 00000000 - -
Dec  3 08:52:37.504 BD VPN Add          00000000, 00000000 M -
Dec  3 08:55:56.672 LSM Head: MTE updated  00000001, 00000000 - -
Dec  3 08:55:56.672 LSM Head: send PMSI 00000480, 00002710 - -
-----
[...]
```

- 在其他路由器的L2VPN应该接收发送的PMSI。保证该LSM尾标：接收的PMSI在接收端的事件

历史记录里显示：

```
RP/0/0/CPU0:two#show l2vpn bridge-domain p2mp private
```

```
[...]
```

```
VFI event trace history [Num events: 7]
```

Time	Event	Flags	Flags
====	=====	=====	=====
Dec 3 08:42:49.216	LSM Head: P2MP Provision	00000001, 00000000	- -
Dec 3 08:42:50.240	LSM Head: MTE updated	00000001, 00000070	- -
Dec 3 08:42:50.240	LSM Head: send PMSI	00000480, 00002710	- -
Dec 3 08:43:51.680	BD VPN Add	00000000, 00000000	- -
Dec 3 08:44:59.776	LSM Tail: PMSI received	0100a8c0, 00002710	- -
Dec 3 08:45:00.288	LSM Head: MTE updated	00000001, 00000000	- -

```
[...]
```

- 每个路由器是LSM头和尾，并且应该发送PMSI和接收从其他路由器中的每一的PMSIs。被检查的第一个路由器应该接收从其他节点中的每一的PMSIs。
- 第2层转发信息库(L2FIB)必须获得从L2VPN的顶头信息，并且必须下载他们到线路卡。

```
RP/0/RSP0/CPU0:PE1#show l2vpn forwarding bridge-domain detail location 0/1/CPU0
```

```
Bridge-domain name: bg1:bg1_bd1, id: 0, state: up
MAC learning: enabled
MAC port down flush: enabled
Flooding:
  Broadcast & Multicast: enabled
  Unknown unicast: enabled
MAC aging time: 300 s, Type: inactivity
MAC limit: 4000, Action: none, Notification: syslog
MAC limit reached: no
MAC Secure: disabled, Logging: disabled
DHCPv4 snooping: profile not known on this node
Dynamic ARP Inspection: disabled, Logging: disabled
IP Source Guard: disabled, Logging: disabled
IGMP snooping: disabled, flooding: enabled
MLD snooping: disabled, flooding: disabled
Storm control: disabled
P2MP PW: enabled
Ptree type: RSVP-TE, TE i/f: tunnel-mte100,
nhop valid: TRUE, Status: Bound, Label: 289994
Bridge MTU: 1500 bytes
Number of bridge ports: 4
Number of MAC addresses: 0
Multi-spanning tree instance: 0
```

- L2FIB必须获得从L2VPN的尾标信息每PW的，并且必须下载他们到平台。

```
RP/0/RSP0/CPU0:PE1#show l2vpn forwarding bridge-domain hardware ingress detail location 0/1/CPU0
```

```
Bridge-domain name: bg1:bg1_bd1, id: 0, state: up
MAC learning: enabled
MAC port down flush: enabled
Flooding:
  Broadcast & Multicast: enabled
  Unknown unicast: enabled
MAC aging time: 300 s, Type: inactivity
```

MAC limit: 4000, Action: none, Notification: syslog
MAC limit reached: no
MAC Secure: disabled, Logging: disabled
DHCPv4 snooping: profile not known on this node
Dynamic ARP Inspection: disabled, Logging: disabled
IP Source Guard: disabled, Logging: disabled
IGMP snooping: disabled, flooding: enabled
MLD snooping: disabled, flooding: disabled
Storm control: disabled
P2MP PW: enabled
Ptree type: RSVP-TE, TE i/f: tunnel-mte100,
 nhop valid: TRUE, Status: Bound, Label: 289994
Bridge MTU: 1500 bytes
Number of bridge ports: 4
Number of MAC addresses: 0
Multi-spanning tree instance: 0

Platform Bridge context:

Last notification sent at: 02/18/2014 21:58:55
Ingress Bridge Domain: 0, State: Created
static MACs: 0, port level static MACs: 0, MAC limit: 4000, current MAC limit:
4000, MTU: 1500, MAC limit action: 0
Rack 0 FGIDs:shg0: 0x00000000, shg1: 0x00000002, shg2: 0x00000002
Rack 1 FGIDs:shg0: 0x00000000, shg1: 0x00000000, shg2: 0x00000000
Flags: Virtual Table ID Disable, P2MP Enable, CorePW Attach
P2MP Head-end Info: Head end bound
Tunnel ifhandle: 0x08000e20, Internal Label: 289994, Local LC NP mask: 0x0,
Head-end Local LC NP mask: 0x0, All L2 Mcast routes local LC NP mask: 0x0
Rack: 0, Physical slot: 1, shg 0 members: 1, shg 1 members: 0, shg 2 members: 0

Platform Bridge HAL context:

Number of NPs: 4, NP mask: 0x0008, mgid index: 513, learn key: 0
NP: 3, shg 0 members: 1, shg 1 members: 0, shg 2 members: 0
MAC limit counter index: 0x00ecl60

Platform Bridge Domain Hardware Information:

Bridge Domain: 0 NP 0
Flags: Virtual Table, Learn Enable, P2MP Tree Enabled
Head-end P-Tree Int Label: 289994
Num Members: 0, Learn Key: 0x00, Half Age: 5
fgid shg0: 0x0000, fgid shg1: 0x0002, fgid shg2: 0x0002, mgid index: 513
BD learn cntr: 0x00ecl60
Bridge Domain: 0 NP 1
Flags: Virtual Table, Learn Enable, P2MP Tree Enabled
Head-end P-Tree Int Label: 289994
Num Members: 0, Learn Key: 0x00, Half Age: 5
fgid shg0: 0x0000, fgid shg1: 0x0002, fgid shg2: 0x0002, mgid index: 513
BD learn cntr: 0x00ecl60
Bridge Domain: 0 NP 2
Flags: Virtual Table, Learn Enable, P2MP Tree Enabled
Head-end P-Tree Int Label: 289994
Num Members: 0, Learn Key: 0x00, Half Age: 5
fgid shg0: 0x0000, fgid shg1: 0x0002, fgid shg2: 0x0002, mgid index: 513
BD learn cntr: 0x00ecl60
Bridge Domain: 0 NP 3
Flags: Virtual Table, Learn Enable, P2MP Tree Enabled
Head-end P-Tree Int Label: 289994
Num Members: 1, Learn Key: 0x00, Half Age: 5
fgid shg0: 0x0000, fgid shg1: 0x0002, fgid shg2: 0x0002, mgid index: 513
BD learn cntr: 0x00ecl60
Bridge Member 0, copy 0
Flags: Active, XID: 0x06c002a7
Bridge Member 0, copy 1

Flags: Active, XID: 0x06c002a7

GigabitEthernet0/1/1/10.1, state: oper up

Number of MAC: 0

Statistics:

packets: received 0, sent 0

bytes: received 0, sent 0

Storm control drop counters:

packets: broadcast 0, multicast 0, unknown unicast 0

bytes: broadcast 0, multicast 0, unknown unicast 0

Dynamic arp inspection drop counters:

packets: 0, bytes: 0

IP source guard drop counters:

packets: 0, bytes: 0

Platform Bridge Port context:

Last notification sent at: 02/18/2014 21:58:56

Ingress State: Bound

Flags: None

Platform AC context:

Ingress AC: VPLS, State: Bound

Flags: Port Level MAC Limit

XID: 0x06c002a7, SHG: None

uIDB: 0x001a, NP: 3, Port Learn Key: 0

Slot flood mask rack 0: 0x200000 rack 1: 0x0 NP flood mask: 0x0008

NP3

Ingress uIDB:

Flags: L2, Status, Racetrack Eligible, VPLS

Stats Ptr: 0x5302c9, uIDB index: 0x001a, Wire Exp Tag: 1

BVI Bridge Domain: 0, BVI Source XID: 0x00000000

VLAN1: 0, VLAN1 etype: 0x0000, VLAN2: 0, VLAN2 etype: 0x0000

L2 ACL Format: 0, L2 ACL ID: 0, IPV4 ACL ID: 0, IPV6 ACL ID: 0

QOS ID: 0, QOS Format ID: 0

Local Switch dest XID: 0x06c002a7

UIDB IF Handle: 0x02001042, Source Port: 0, Num VLANs: 0

Xconnect ID: 0x06c002a7, NP: 3

Type: AC

Flags: Learn enable, VPLS

uIDB Index: 0x001a

Bridge Domain ID: 0, Stats Pointer: 0xec1e62

Split Horizon Group: None

Bridge Port : Bridge 0 Port 0

Flags: Active Member

XID: 0x06c002a7

Bridge Port Virt: Bridge 0 Port 0

Flags: Active Member

XID: 0x06c002a7

Storm Control not enabled

Nbor 209.165.200.226 pw-id 1

Number of MAC: 0

Statistics:

packets: received 0, sent 2

bytes: received 0, sent 192

Storm control drop counters:

packets: broadcast 2, multicast 0, unknown unicast 0

bytes: broadcast 192, multicast 0, unknown unicast 0

Dynamic arp inspection drop counters:

packets: 0, bytes: 0

IP source guard drop counters:

packets: 0, bytes: 0

Statistics P2MP:

packets: received 0

bytes: received 0

Platform Bridge Port context:

Last notification sent at: 02/18/2014 21:58:55

Ingress State: Bound

Flags: None

P2MP PW enabled, P2MP Role: tail

Platform PW context:

Ingress PW: VPLS, State: Bound

XID: 0xc0008000, bridge: 0, MAC limit: 4000, l2vpn ldi index: 0x0001, vc label: 16030, nr_ldi_hash: 0xab, r_ldi_hash: 0xbd, lag_hash: 0x17, SHG: VFI Enabled

Flags: MAC Limit Port Level

Port Learn Key: 0

Trident Layer Flags: None

Slot flood mask rack 0: 0x0 rack 1: 0x0 NP flood mask: 0x0000

Primary L3 path: ifhandle: 0x02000100, sfp_or_lagid: 0x00d2

Backup L3 path: Not set

NP0

Xconnect ID: 0xc0008000, NP: 0

Type: Pseudowire (no control word)

Flags: Learn enable, Type 5, Local replication, VPLS

VC label hash, nR-LDI Hash: 0xab, R-LDI Hash: 0xb7, LAG Hash: 0x17,

VC output label: 0x03e9e (16030), LDI: 0x0001, stats ptr: 0x00530258

Bridge Domain ID: 0, Stats Pointer: 0xec1e62

Split Horizon Group: VFI Enabled

NP1

Xconnect ID: 0xc0008000, NP: 1

Type: Pseudowire (no control word)

Flags: Learn enable, Type 5, Local replication, VPLS

VC label hash, nR-LDI Hash: 0xab, R-LDI Hash: 0xb7, LAG Hash: 0x17,

VC output label: 0x03e9e (16030), LDI: 0x0001, stats ptr: 0x00530258

Bridge Domain ID: 0, Stats Pointer: 0xec1e62

Split Horizon Group: VFI Enabled

NP2

Xconnect ID: 0xc0008000, NP: 2

Type: Pseudowire (no control word)

Flags: Learn enable, Type 5, Local replication, VPLS

VC label hash, nR-LDI Hash: 0xab, R-LDI Hash: 0xb7, LAG Hash: 0x17,

VC output label: 0x03e9e (16030), LDI: 0x0001, stats ptr: 0x00530300

Bridge Domain ID: 0, Stats Pointer: 0xec1e62

Split Horizon Group: VFI Enabled

NP3

Xconnect ID: 0xc0008000, NP: 3

Type: Pseudowire (no control word)

Flags: Learn enable, Type 5, Local replication, VPLS

VC label hash, nR-LDI Hash: 0xab, R-LDI Hash: 0xb7, LAG Hash: 0x17,

VC output label: 0x03e9e (16030), LDI: 0x0001, stats ptr: 0x00530488

Bridge Domain ID: 0, Stats Pointer: 0xec1e64

Split Horizon Group: VFI Enabled

Nbor 209.165.200.227 pw-id 1

Number of MAC: 0

Statistics:

packets: received 0, sent 1

bytes: received 0, sent 96

Storm control drop counters:

packets: broadcast 0, multicast 0, unknown unicast 0

bytes: broadcast 0, multicast 0, unknown unicast 0

Dynamic arp inspection drop counters:

packets: 0, bytes: 0

IP source guard drop counters:

packets: 0, bytes: 0

Statistics P2MP:

packets: received 0

bytes: received 0

Platform Bridge Port context:

Last notification sent at: 02/18/2014 21:58:55

Ingress State: Bound

Flags: None

P2MP PW enabled, P2MP Role: tail

Platform PW context:

Ingress PW: VPLS, State: Bound

XID: 0xc0008001, bridge: 0, MAC limit: 4000, l2vpn ldi index: 0x0002, vc label: 16030, nr_ldi_hash: 0xab, r_ldi_hash: 0xbd, lag_hash: 0x17, SHG: VFI Enabled

Flags: MAC Limit Port Level

Port Learn Key: 0

Trident Layer Flags: None

Slot flood mask rack 0: 0x0 rack 1: 0x0 NP flood mask: 0x0000

Primary L3 path: ifhandle: 0x02000100, sfp_or_lagid: 0x00d2

Backup L3 path: Not set

NP0

Xconnect ID: 0xc0008001, NP: 0

Type: Pseudowire (no control word)

Flags: Learn enable, Type 5, Local replication, VPLS

VC label hash, nR-LDI Hash: 0xab, R-LDI Hash: 0xb7, LAG Hash: 0x17,

VC output label: 0x03e9e (16030), LDI: 0x0002, stats ptr: 0x0053025e

Bridge Domain ID: 0, Stats Pointer: 0xec1e64

Split Horizon Group: VFI Enabled

NP1

Xconnect ID: 0xc0008001, NP: 1

Type: Pseudowire (no control word)

Flags: Learn enable, Type 5, Local replication, VPLS

VC label hash, nR-LDI Hash: 0xab, R-LDI Hash: 0xb7, LAG Hash: 0x17,

VC output label: 0x03e9e (16030), LDI: 0x0002, stats ptr: 0x0053025e

Bridge Domain ID: 0, Stats Pointer: 0xec1e64

Split Horizon Group: VFI Enabled

NP2

Xconnect ID: 0xc0008001, NP: 2

Type: Pseudowire (no control word)

Flags: Learn enable, Type 5, Local replication, VPLS

VC label hash, nR-LDI Hash: 0xab, R-LDI Hash: 0xb7, LAG Hash: 0x17,

VC output label: 0x03e9e (16030), LDI: 0x0002, stats ptr: 0x00530306

Bridge Domain ID: 0, Stats Pointer: 0xec1e64

Split Horizon Group: VFI Enabled

NP3

Xconnect ID: 0xc0008001, NP: 3

Type: Pseudowire (no control word)

Flags: Learn enable, Type 5, Local replication, VPLS

VC label hash, nR-LDI Hash: 0xab, R-LDI Hash: 0xb7, LAG Hash: 0x17,

VC output label: 0x03e9e (16030), LDI: 0x0002, stats ptr: 0x0053048e

Bridge Domain ID: 0, Stats Pointer: 0xec1e66

Split Horizon Group: VFI Enabled

Nbor 209.165.200.228 pw-id 1

Number of MAC: 0

Statistics:

packets: received 0, sent 0

bytes: received 0, sent 0

Storm control drop counters:

packets: broadcast 0, multicast 0, unknown unicast 0

bytes: broadcast 0, multicast 0, unknown unicast 0

Dynamic arp inspection drop counters:

packets: 0, bytes: 0

IP source guard drop counters:

packets: 0, bytes: 0

Statistics P2MP:

packets: received 0

bytes: received 0

Platform Bridge Port context:

Last notification sent at: 02/18/2014 21:58:55

Ingress State: Bound

Flags: None

P2MP PW enabled, P2MP Role: tail

Platform PW context:

Ingress PW: VPLS, State: Bound

XID: 0xc0008002, bridge: 0, MAC limit: 4000, l2vpn ldi index: 0x0003, vc label: 16045, nr_ldi_hash: 0x7b, r_ldi_hash: 0xb3, lag_hash: 0xa8, SHG: VFI Enabled

Flags: MAC Limit Port Level

Port Learn Key: 0

Trident Layer Flags: None

Slot flood mask rack 0: 0x0 rack 1: 0x0 NP flood mask: 0x0000

Primary L3 path: ifhandle: 0x02000100, sfp_or_lagid: 0x00d2

Backup L3 path: Not set

NP0

Xconnect ID: 0xc0008002, NP: 0

Type: Pseudowire (no control word)

Flags: Learn enable, Type 5, Local replication, VPLS

VC label hash, nR-LDI Hash: 0x7b, R-LDI Hash: 0xd6, LAG Hash: 0xa8,

VC output label: 0x03ead (16045), LDI: 0x0003, stats ptr: 0x00530264

Bridge Domain ID: 0, Stats Pointer: 0xec1e66

Split Horizon Group: VFI Enabled

NP1

Xconnect ID: 0xc0008002, NP: 1

Type: Pseudowire (no control word)

Flags: Learn enable, Type 5, Local replication, VPLS

VC label hash, nR-LDI Hash: 0x7b, R-LDI Hash: 0xd6, LAG Hash: 0xa8,

VC output label: 0x03ead (16045), LDI: 0x0003, stats ptr: 0x00530264

Bridge Domain ID: 0, Stats Pointer: 0xec1e66

Split Horizon Group: VFI Enabled

NP2

Xconnect ID: 0xc0008002, NP: 2

Type: Pseudowire (no control word)

Flags: Learn enable, Type 5, Local replication, VPLS

VC label hash, nR-LDI Hash: 0x7b, R-LDI Hash: 0xd6, LAG Hash: 0xa8,

VC output label: 0x03ead (16045), LDI: 0x0003, stats ptr: 0x0053030c

Bridge Domain ID: 0, Stats Pointer: 0xec1e66

Split Horizon Group: VFI Enabled

NP3

Xconnect ID: 0xc0008002, NP: 3

Type: Pseudowire (no control word)

Flags: Learn enable, Type 5, Local replication, VPLS

VC label hash, nR-LDI Hash: 0x7b, R-LDI Hash: 0xd6, LAG Hash: 0xa8,

VC output label: 0x03ead (16045), LDI: 0x0003, stats ptr: 0x00530494

Bridge Domain ID: 0, Stats Pointer: 0xec1e68

Split Horizon Group: VFI Enabled

RP/0/RSP0/CPU0:PE1#