

ASR 9000 VPLS のラベル スイッチド マルチキャスト (LSM) の概要と設定例

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概要

このドキュメントでは、Cisco IOS® XR を実行するアグリゲーション サービス ルータ (ASR) 9000 シリーズの、仮想プライベート LAN サービス (VPLS) ラベル スイッチド マルチキャスト (LSM) について説明します。

前提条件

要件

このドキュメントに関する固有の要件はありません。

使用するコンポーネント

このドキュメントは、特定のソフトウェアやハードウェアのバージョンに限定されるものではありません。

このドキュメントの情報は、特定のラボ環境にあるデバイスに基づいて作成されたものです。このドキュメントで使用するすべてのデバイスは、クリアな（デフォルト）設定で作業を開始しています。ネットワークが稼働中の場合は、コマンドが及ぼす潜在的な影響を十分に理解しておく必要があります。

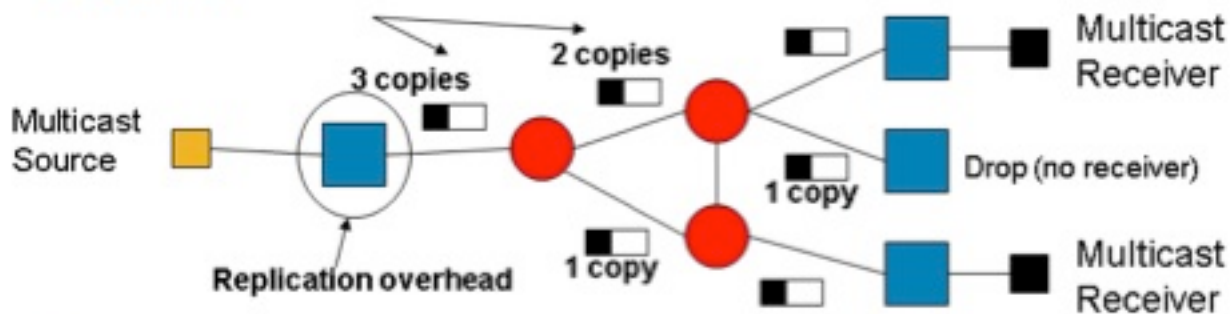
VPLS ラベル スイッチド マルチキャスト (LSM) の概要

VPLS は、マルチプロトコル ラベル スイッチング (MPLS) コアを通じて、LAN サービスをエミュレートします。ポイントツーポイント (P2P) 疑似回線 (PW) のフル メッシュは、VPLS エミュレーションを実現するために、VPLS ドメインに参加しているすべてのプロバイダー エッジ (PE) ルータ間でセットアップされます。ブロードキャスト、マルチキャスト、および不明なユニキャストトラフィックは、VPLS ドメイン内で、すべての PE にフラッディングされます。入力レプリケーションは、同じ VPLS ドメインに含まれるすべてのリモート PE ルータに、フラッディングされたトラフィックを各 P2P PW で送信するために使用されます。

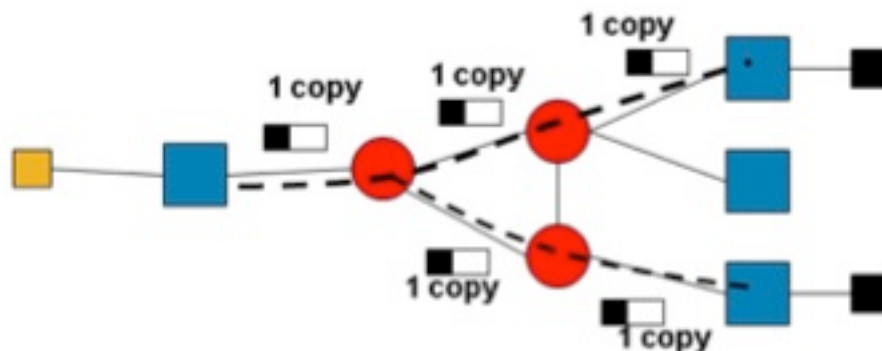
入力レプリケーションの欠点

- 入力レプリケーションは、同じパケットが各 P2P PW の同じリンクで複数回送信されることがあるため、帯域幅の効率が悪くなります。
- ブロードキャストおよびマルチキャストの VPLS トラフィックが大量にある場合は、入力レプリケーションによって、リンク帯域幅の無視できない浪費が発生する可能性があります。
- さらに、レプリケーションのすべての負担は入力 PE ルータが引き受けるため、入力レプリケーションによって、リソースも大量に消費されます。

Problems



Solution



VPLS LSM の機能

VPLS とは、広域展開されたサービスプロバイダーの L2VPN テクノロジーのことです。これは、マルチキャストの転送にも使用されます。L2 テクノロジーは、マルチキャストトラフィックを最適に L2 疑似回線にレプリケーションするために使用できますが、コア部分はマルチキャストトラフィックに関わりません。そのため、同じフローの複数のコピーが、コアネットワークを通過することになります。この効率性の低さを軽減するために、LSM と VPLS をペアにして、コア上に LSM マルチキャスト ツリーを導入します。Cisco IOS-XR ソフトウェア リリース 5.1.0 では、Cisco ASR 9000 シリーズは、ポイントツーマルチポイントトラフィックエンジニアリング (P2MP-TE) を含むツリーによって VPLS LSM を実装します。VPLS のエンドポイントは自動的に検出され、P2MP-TE ツリーは、Resource Reservation Protocol トラフィックエンジニアリング (RSVP-TE) を使用してセットアップされます。この操作に介入する必要はありません。

- VPLS LSM により、入力レプリケーションの欠点が解決されます。
- VPLS LSM ソリューションでは、MPLS コアに P2MP LSP を使用して、VPLS ドメインのブロードキャスト、マルチキャスト、および不明なユニキャストトラフィックを伝送します。
- P2MP LSP により、最適なノードで MPLS ネットワーク内のレプリケーションが可能になり、ネットワーク内のパケットレプリケーションの量が最小になります。
- VPLS LSM ソリューションでは、フラグディングされた VPLS トラフィックのみを P2MP LSP で送信します。
- ユニキャスト VPLS トラフィックは、P2P PW で送信されます。アクセス PW で送信されるトラフィックは、引き続き入力レプリケーションによって送信されます。

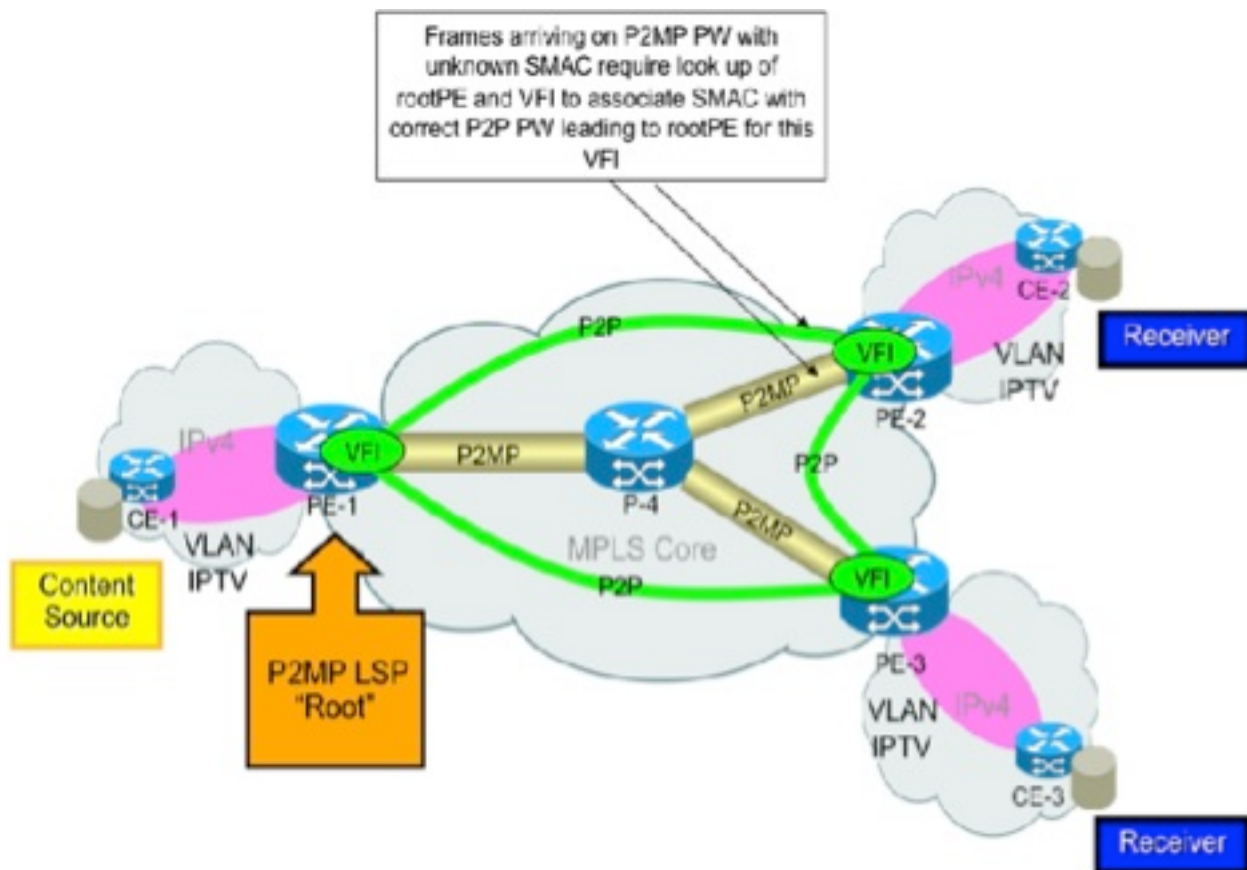
- 単方向である P2P PW とは対照的に、P2MP PW は双方向です。
- VPLS LSM ソリューションでは、VPLS ドメインのコア PW に向けた VPLS P2MP サービスをエミュレートするために、VPLS ドメインごとの P2MP PW の作成が必要になります。
- VPLS LSM は、Cisco IOS XR リリース 5.1.0 以降でサポートされています。

VPLS LSM の制限事項

- Cisco IOS-XR リリース 5.1.0 の VPLS LSM 機能は、RSVP-TE による MPLS トラフィックエンジニアリング P2MP-TE ツリーのセットアップのみをサポートします。
- P2MP PW は Cisco IOS-XR リリース 5.1.0 の場合に限り、BGP プロトコルで信号を送信できます。この最初のフェーズでは、VPLS ドメインに参加しているリモート PE が、BGP 自動検出 (BGP-AD) によって自動検出されます。
- 静的な LDP シグナリングは、Cisco IOS XR リリース 5.1.0 ではサポートされていません。

Media Access Control (MAC) ラーニング

P2MP PW で到達するフレームについてのリーフ PE での MAC ラーニングは、その P2MP PW のルート PE につながる P2P PW でフレームが受信された場合と同様に行われます。この画像では、PE-1 をルートとする P2MP PW LSP で到着するフレームについての PE-2 での MAC ラーニングは、PE-1 と PE-2 の間の P2P PW で到着したフレームと同様に行われます。L2VPN のコントロールプレーンには、P2MP LSP の配置に関する MAC ラーニングのために、P2P PW 情報を使用して VPLS 配置情報をプログラミングする責任があります。



Internet Group Management Protocol スヌーピング (IGMPSN) のサポート

Internet Group Management Protocol (IGMP) スヌーピング (IGMPSN) は、VPLS LSM に参加しているブリッジドメイン内の P2MP P ツリーのヘッドとテールの両方でサポートされます。これにより、仮想転送インスタンス (VFI) PW 上の IGMPSN マルチキャストトラフィックは、P2MP LSP によって提供されるリソースの最適化を利用できるようになります。VPLS LSM に参加している 1 つ以上の VFI PW を含むブリッジドメインで IGMPSN が有効化されている場合は、すべてのレイヤ 2 (L2) マルチキャストトラフィックが、ブリッジドメインに関連付けられた P2MP P ツリーのヘッドを通じて送信されます。L2 マルチキャストのルートは、VPLS LSM に参加していないローカルのレシーバ、イーサネットフローポイント (EFP)、アクセス PW、および VFI PW にトラフィックを転送するために使用されます。

IGMPSN が P2MP LSP のテールに当たるブリッジドメインで有効化されている場合、P2MP LSP で受信した L2 マルチキャストトラフィックの配置の最適化は、ローカルレシーバ (つまり、接続回線 (AC) のブリッジポート (BP) とアクセス PW の BP) にあわせて実行されます。

注: Multicast Label Distribution Protocol (MLDP) スヌーピングは、Cisco IOS XR リリース 5.1.0 ではサポートされていません。

サポートされるスケール

Cisco IOS XR リリース 5.1.0 では、ヘッド/テールルータごとに、最大 1000 個の P2MP トンネル、または最大 1000 個の P2MP PW をサポートします。

VPLS LSM の設定

P2MP の自動トンネル設定

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

MPLS TE Fast Reroute (FRR) の設定

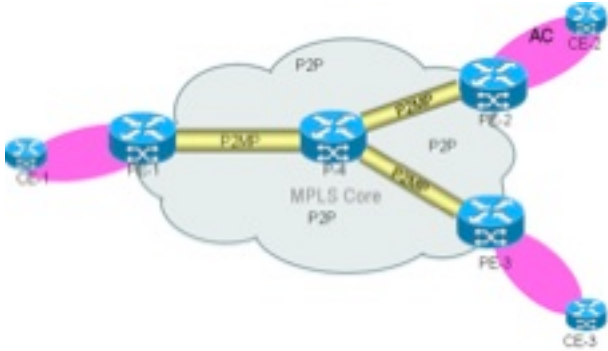
```
mpls traffic-eng
 interface GigabitEthernet0/1/1/0
 auto-tunnel backup
  nhop-only
 !
 !
 interface GigabitEthernet0/1/1/1
 auto-tunnel backup
  nhop-only
 !
 !
 auto-tunnel p2mp
 tunnel-id min 100 max 200
 !
 auto-tunnel backup
 tunnel-id min 1000 max 1500
 !
 attribute-set p2mp-te set1
 bandwidth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

L2VPN の設定

```
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
!
```

サンプルのトポロジと設定



P2MP トンネルは、自動検出されるトンネルです。静的な P2MP トンネルはサポートされません。

静的なトンネル設定は使用されません。自動 P2MP トンネル設定は、すべての PE ルータで有効にする必要があります。また、P ルータがバド ノードとして動作する場合は、この設定を P ルータでも有効にする必要があります。バド ノードはミッドポイント ルータであり、同時にテール エンド ルータでもあります。

次に、サンプルのトポロジと設定を示します。このトポロジでは、P2MP PW が 3 つの PE と、バド ノードとして動作する 1 つの P ルータの間に作成されます。3 つの PE ルータは、すべてヘッド (入カトラフィックの場合) およびテール (出カトラフィックの場合) として機能します。

PE1 設定

```
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
```



```

!
interface GigabitEthernet0/1/1/1
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
!
!
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 の設定

```

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 設定

```
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
```



```
!  
interface GigabitEthernet0/2/1/8  
  description connected to P router  
  ipv4 address 209.165.201.102 255.255.255.224  
  transceiver permit pid all  
!  
interface GigabitEthernet0/2/1/11  
  transceiver permit pid all  
!  
interface GigabitEthernet0/2/1/11.1 l2transport  
  encapsulation dot1q 1  
!  
router ospf 100  
  nsr  
  router-id 209.165.200.228  
  nsf cisco  
  area 0  
  mpls traffic-eng  
  interface Loopback0  
  !  
  interface GigabitEthernet0/2/1/8  
  !  
  !  
  mpls traffic-eng router-id 209.165.200.228  
!  
router bgp 100  
  nsr  
  bgp router-id 209.165.200.228  
  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 209.165.200.227  
  remote-as 100  
  update-source Loopback0  
  address-family l2vpn vpls-vpws  
  !  
  !  
!  
l2vpn  
  bridge group bg1  
  bridge-domain bg1_bd1  
  interface GigabitEthernet0/2/1/11.1  
  !  
  vfi bg1_bd1_vfi  
  vpn-id 1  
  autodiscovery bgp  
  rd auto  
  route-target 209.165.201.1:1  
  signaling-protocol bgp  
  ve-id 400  
  !  
  !
```


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_bd1_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_mtl100 **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  Next Hop       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   LSP      Destination      Source           FRR   LSP   Path
Name     ID        Address          Address          State  State Role 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#
```

VPLS LSM のトラブルシューティング

一般的な設定上の問題

L2VPN で P2MP の問題が発生する一般的な原因は、次のとおりです。

- LSM の BGP 設定が BGP-AD の場合とまったく同じになっている。BGP ネイバーに **address-family l2vpn vpls-vpws** を設定することで、l2vpn vpls-vpws アドレス ファミリ ルートを必ずエクスポートおよびインポートしてください。

- MPLS とマルチキャストに設定エラーがある。

MPLS トラフィック エンジニアリングは、P2MP PW が通過するインターフェイス上で有効にする必要があります。

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_bd1_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_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-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 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, 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#

- Cisco IOS XR リリース 5.1.0 では、LSM の L2VPN を設定するために、次の作業が必要になります。

VFI の VPN ID 構成を設定する。VFI のマルチキャスト P2MP を設定する。ここに示す設定例のように、トランスポート プロトコルとシグナリング プロトコルを設定します。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
```

- LSM のヘッドおよびテールを正しく設定する必要があります。Cisco IOS XR リリース 5.1.0 では、各 LSM テールが LSM ヘッドでもあります (その逆も同じです)。ルータ間には明示的な LSM 機能交換がないため、LSM が有効化されているブリッジ ドメインに含まれるすべてのルータは、LSM に参加している必要があります。

L2VPN および L2FIB の Show コマンドとトラブルシューティング

- L2VPN マネージャ プロセス (l2vpn_mgr) は、MPLS トラフィック エンジニアリング (TE) 制御プロセス (te_control) と通信して、トンネルの作成を要求します。次のコマンドを使用して、te_control プロセスと l2vpn_mgr プロセスが実行状態であることを確認します。

```
show process l2vpn_mgr
show process te_control
```

- l2vpn_mgr プロセスがトンネル作成を要求したことを確認します。次の show コマンドの出力に、トンネルのエントリが含まれている必要があります。

```
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 は te_control プロセスからトンネル情報を受信する必要があります。次の show コマンドの出力に、ゼロ以外の詳細 (tunnel-id、Ext.tunnel-id、tunnel-ifh、p2mp-id など) が含まれていることを確認します。

```
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 は、他のすべての PE ルータに向けて Provider Multicast Service Instance (PMSI) をアドバタイズする必要があります。 l2vpn_mgr が、設定した VFI の PMSI を送信したことを確認します。 イベント **LSM Head: send PMSI** が、VFI のイベント履歴に示されている必要があります。

```
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 - -
-----
```

```
[...]
```

- その他のルータの L2VPN は、すぐ前に送信された PMSI を受信している必要があります。 **LSM Tail: PMSI received** が、受信側のイベント履歴に示されていることを確認します。

```
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 - -
-----
```

```
[...]
```

- 各ルータは、LSM のヘッドとテールの両方であり、PMSI を送信し、その他の各ルータから PMSI を受信する必要があります。最初に確認したルータは、その他の各ノードから PMSI を受信する必要があります。
- レイヤ 2 Forwarding Information Base (L2FIB) は、L2VPN からヘッド情報を受信する必要があります、その情報をラインカードにダウンロードする必要があります。

```
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 は、L2VPN から各 PW のテーブル情報を受信する必要があり、その情報をプラットフォームにダウンロードする必要があります。

```
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: 0x00ec1e60

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: 0x00ec1e60

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: 0x00ec1e60

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: 0x00ec1e60

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: 0x00ec1e60

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#