The bridge to possible

EVPN

troubleshooting and debugging

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BRKSPG-2473

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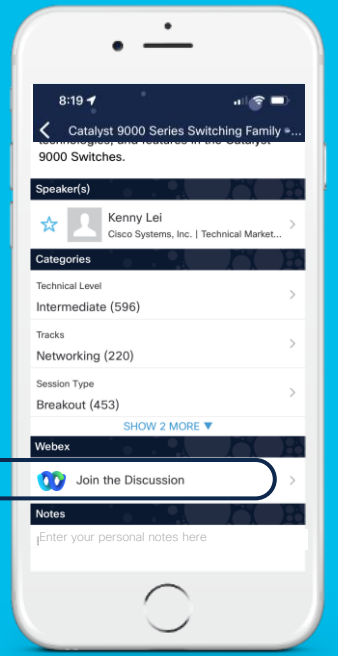


Agenda

- Introduction
- L2VPN basics
- Migration from L2VPN to EVPN
- L2VPN and EVPN Interconnect
- EVPN and L3VPN interconnect (IRB)

Introduction

L2VPN/L3VPN vs EVPN?

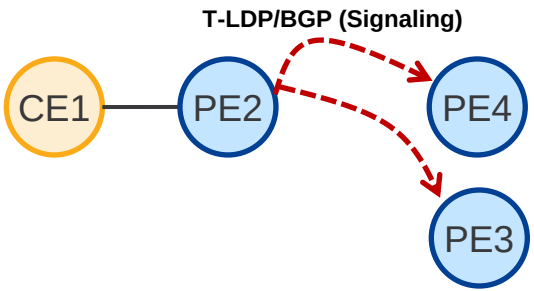
- L2VPN served as a platform for L2 services in Service Provider network
  - L3VPN for L3 services
- Businesses are migrating to EVPN
  - EVPN brings powerful feature set within L2
  - During transition L2VPN and EVPN can co-exist

Thus, we are here to explore!

Briefly about L2VPN and EVPN

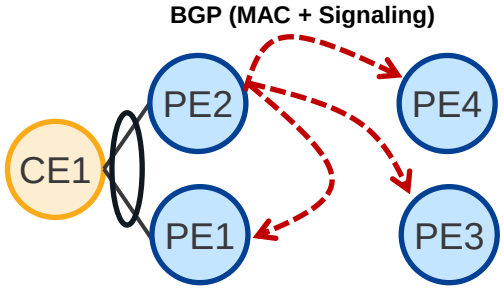
HIDDEN

L2VPN



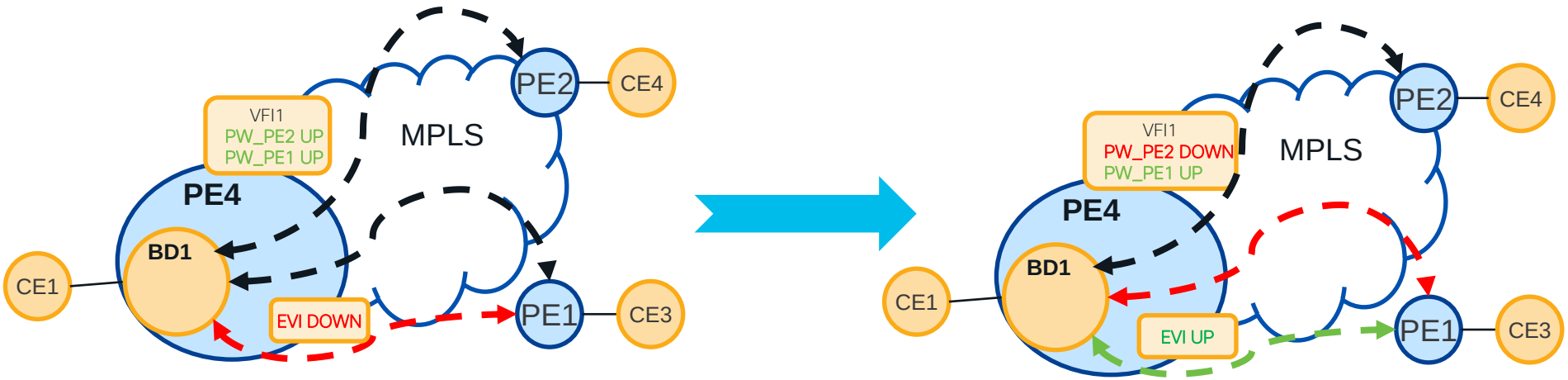
- No multi-homing
- MAC Learning Local
- Split-Horizon (VFI)
- Uses T-LDP or BGP across MPLS/SR Core
  - Bring up pseudo-wire
  - Exchange Labels

EVPN

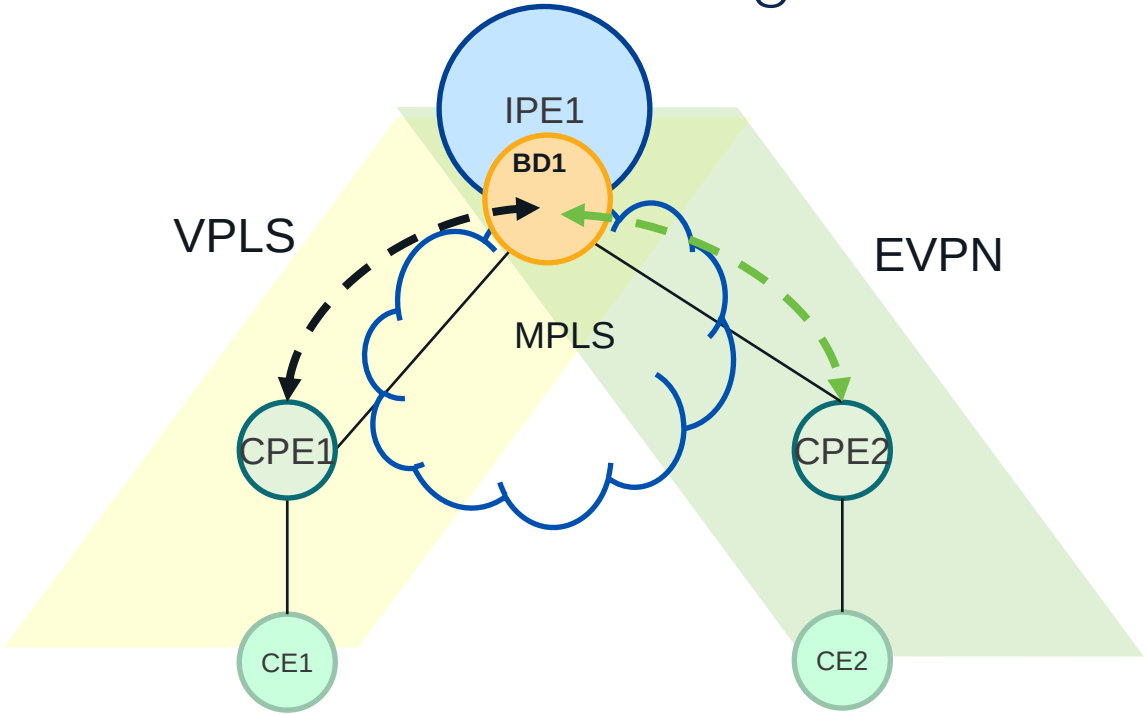


- Ethernet Segment ID to support multi-homing
- BGP across MPLS/SR core:
  - MAC NLRI reachability (Route-type 2) MAC Routing
  - ES-EAD and EVI-EAD: (route-type 1), Split-horizon and Aliasing
  - Inclusive multicast reachability (Route-type 3): BUM
  - Ethernet Segment Route: (route-type4), DF-election

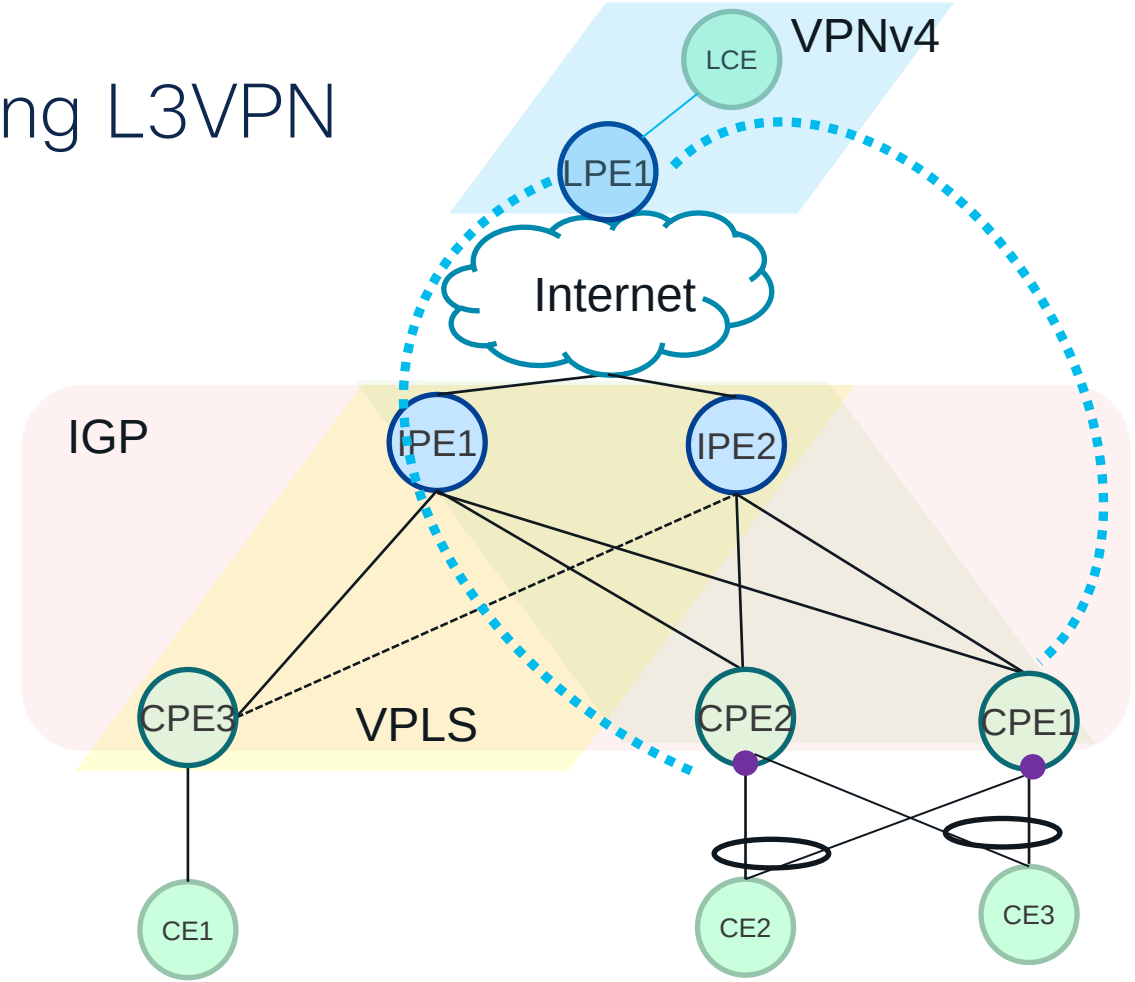
VPLS & EVPN Seamless Integration – Migration



VPLS & EVPN Seamless Integration – Interworking



Integrating L3VPN



L2VPN/EVPN Basics

L2VPN Config and Topology

EFP configuration (PE configuration)

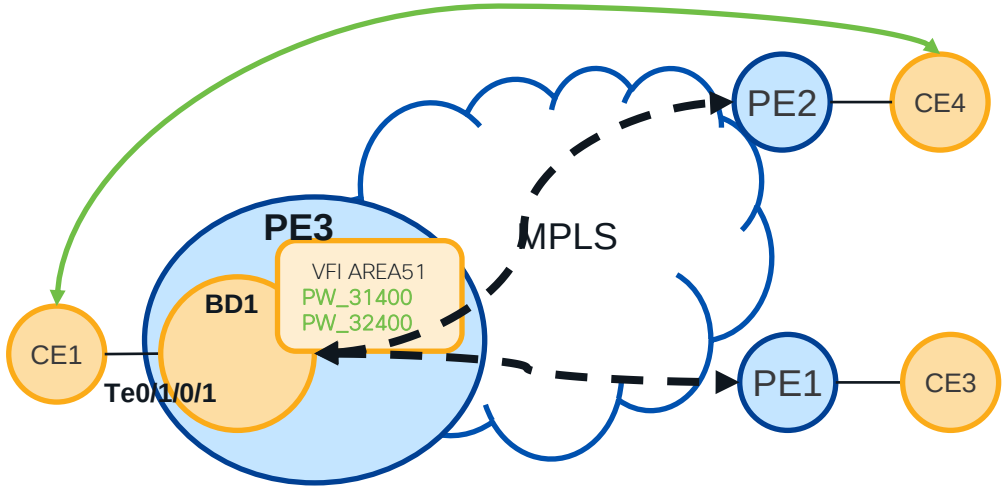
```
interface TenGigE0/1/0/1.400 l2transport
 encapsulation dot1q 400
 rewrite ingress tag pop 1 symmetric
```

VPLS Bridge Configuration (PE configuration)

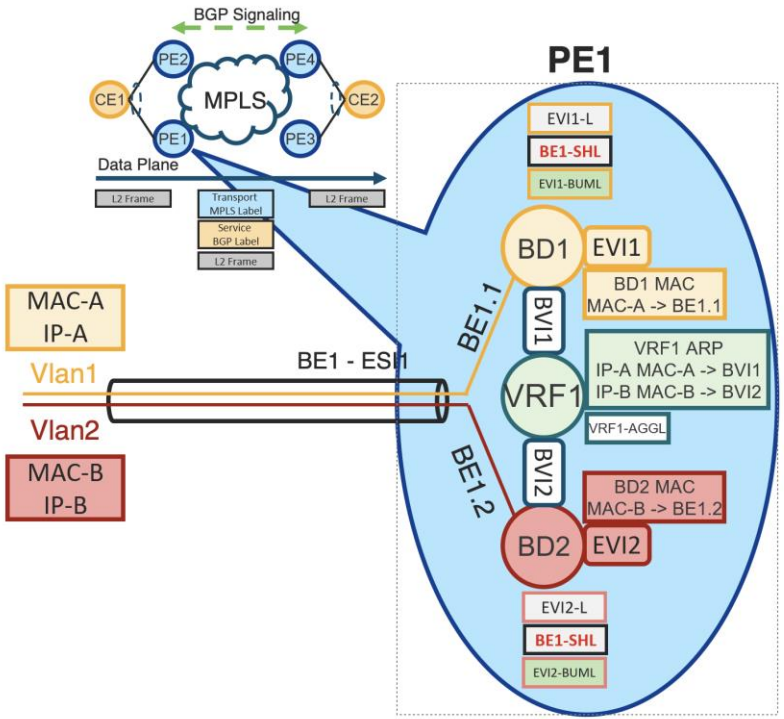
```
l2vpn
 bridge group L2VPN
  bridge-domain AREA51
   interface TenGigE0/1/0/1.400
   !
   vfi AREA51
    neighbor 1.1.1.1 pw-id 31400
    neighbor 2.2.2.2 pw-id 32400
```

Enabling additional settings under Bridge Domain

```
l2vpn
 bridge group L2VPN
  bridge-domain AREA51
   mac withdraw
   mac limit maximum 2000
```



EVPN Routes – Cheat Sheet



Source: EVPN Deep Dive with IOS-XR Configuration examples for Service Provider Metro and Data Center - BRKSPG-3965

PE1 – Advertises:

RT-4 Ethernet Segment Route
- I have **ESI1** in case when someone needs this information for Designated Forwarder(DF) Election

RT-1 Per ESI Ethernet Auto-Discovery (AD) Route
- I have **ESI1**
- ESI1 is All-Active
- AC with ESI1 is connected to **EVI1** and **EVI2**
- My Split Horizon Label for ESI1 is BE1-SHL

RT-1 Per EVI Ethernet Auto-Discovery (AD) Route(s)
- **EVI1** per-EVI (Aliasing) Label is EVI1-L
- **EVI2** per-EVI (Aliasing) Label is EVI2-L

RT-3 Inclusive Multicast Route(s)
- **EVI1** Label for BUM traffic is EVI1-BUML
- **EVI2** Label for BUM traffic is EVI2-BUML

RT-2 MAC/IP Advertisement Route(s)
- **MAC-A** in **EVI1** via label EVI1-L and **IP-A** in **VRF1** via label VRF1-AGGL
- **MAC-B** in **EVI2** via label EVI2-L and **IP-B** in **VRF1** via label VRF1-AGGL

RT-5 Prefix Advertisement Route(s)
- IPv4/6 prefix of **BVI1** in **VRF1** via label VRF1-AGGL
- IPv4/6 prefix of **BVI2** in **VRF1** via label VRF1-AGGL

VPLS Programming Verification

HIDDEN

```
RP/0/RSP0/CPU0:PE4#show ethernet tags TenGigE0/1/0/1.400
Interface               St  MTU  Ly Outer           Inner            Xtra -,+
Te0/1/0/1.400           Up  1518 L2 .1Q:400         -                -    1 0
```

```
RP/0/RSP0/CPU0:PE4#show l2vpn bridge-domain summary
Sat Nov 20 11:35:17.492 EDT
Number of groups: 2, VLAN switches: 0
Number of bridge-domains: 3, Up: 3, Shutdown: 0, Partially-programmed: 0
Number of ACs: 3 Up: 3, Down: 0, Partially-programmed: 0
Number of PWs: 2 Up: 2, Down: 0, Standby: 0, Partially-programmed: 0
```

```
RP/0/RSP0/CPU0:PE4#show l2vpn bridge-domain bd-name AREA51
Sat Nov 20 11:36:57.391 EDT
Legend: pp = Partially Programmed.
Bridge group: L2VPN, bridge-domain: AREA51, id: 2, state: up, ShgId: 0, MSTi: 0
  Aging: 300 s, MAC limit: 2000, Action: none, Notification: syslog
  Filter MAC addresses: 0
  ACs: 1 (1 up), VFIs: 1, PWs: 1 (1 up), PBBs: 0 (0 up), VNIs: 0 (0 up)
  List of ACs:
    Te0/1/0/1.400, state: up, Static MAC addresses: 0
  List of Access PWs:
  List of VFIs:
    vfi AREA51 (up)
      Neighbor 1.1.1.1 pw-id 31400, state: up, Static MAC addresses: 0
  List of Access VFIs:
```

VPLS Bridge Domain Details

HIDDEN

```
RP/0/RSP0/CPU0:PE4#show l2vpn bridge-domain bd-name AREA51 det
Legend: pp = Partially Programmed.
Bridge group: L2VPN, bridge-domain: AREA51, id: 2, state: up, ShgId: 0, MSTi: 0
  Coupled state: disabled
  VINE state: Default
  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: 2000, Action: none, Notification: syslog
  MAC limit reached: no, threshold: 75%
  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
  DHCPv4 Snooping profile: none
  IGMP Snooping: disabled
  IGMP Snooping profile: none
  MLD Snooping profile: none
  Storm Control: disabled
  Bridge MTU: 1500
  MIB cvplsConfigIndex: 3
  Filter MAC addresses:
  P2MP PW: disabled
  Multicast Source: Not Set
  Create time: 16/11/2021 11:14:43 (4d00h ago)
  No status change since creation
  ACs: 1 (1 up), VFIs: 1, PWs: 1 (1 up), PBBs: 0 (0 up), VNIs: 0 (0 up)
```

```
List of ACs:
   AC: TenGigE0/1/0/1.400, state is up
     Type VLAN; Num Ranges: 1
     Rewrite Tags: []
     VLAN ranges: [400, 400]
     MTU 1500; XC ID 0x1a03e88; interworking none
     MAC learning: enabled
     Flooding:
       Broadcast & Multicast: enabled
       Unknown unicast: enabled
     MAC aging time: 300 s, Type: inactivity
     MAC limit: 2000, Action: none, Notification: syslog
     MAC limit reached: no, threshold: 75%
     MAC port down flush: enabled
     MAC Secure: disabled, Logging: disabled
     Split Horizon Group: none
     E-Tree: Root
     Dynamic ARP Inspection: disabled, Logging: disabled
     IP Source Guard: disabled, Logging: disabled
     DHCPv4 Snooping: disabled
     DHCPv4 Snooping profile: none
     IGMP Snooping: disabled
     IGMP Snooping profile: none
     MLD Snooping profile: none
     Storm Control: bridge-domain policer
     Static MAC addresses:
     Statistics:
      packets: received 6 (multicast 0, broadcast 1, unknown unicast 0, unicast 6), sent 6
      bytes: received 650 (multicast 0, broadcast 60, unknown unicast 0, unicast 650), sent 650
       MAC move: 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
```

VPLS Bridge Domain Details– cont.

HIDDEN

```
List of Access PWs:
  List of VFIs:
    vfi AREA51 (up)
      PW: neighbor 1.1.1.1, PW ID 31400, state is up ( established )
        PW class not set, XC ID 0xa000000d
        Encapsulation MPLS, protocol LDP
        Source address 4.4.4.4
        PW type Ethernet, control word disabled, interworking none
        Sequencing not set
        Ignore MTU mismatch: Disabled
        Transmit MTU zero: Disabled
        LSP : Up

        PW Status TLV in use
          MPLS         Local                          Remote
          ------------ ------------------------------ ------------------------
          Label        24010                          24011
          Group ID     0x2                            0x4
          Interface    AREA51                         AREA51
          MTU          1500                           1500
          Control word disabled                       disabled
          PW type      Ethernet                       Ethernet
          VCCV CV type 0x2                            0x2
                       (LSP ping verification)        (LSP ping verification)
          VCCV CC type 0x6                            0x6
                       (router alert label)           (router alert label)
                       (TTL expiry)                   (TTL expiry)
          ------------ ------------------------------ ------------------------
```

```
  Incoming Status (PW Status TLV):
          Status code: 0x0 (Up) in Notification message
        MIB cpwVcIndex: 2684354573
        Create time: 16/11/2021 11:14:43 (4d00h ago)
        Last time status changed: 20/11/2021 11:17:42 (00:19:32 ago)
        Last time PW went down: 16/11/2021 11:20:24 (4d00h ago)
        MAC withdraw messages: sent 1, received 1
        Forward-class: 0
        Static MAC addresses:
        Statistics:
          packets: received 6 (unicast 5), sent 6
          bytes: received 650 (unicast 590), sent 650
          MAC move: 0
        Storm control drop counters:
          packets: broadcast 0, multicast 0, unknown unicast 0
          bytes: broadcast 0, multicast 0, unknown unicast 0
      MAC learning: enabled
      Flooding:
        Broadcast & Multicast: enabled
        Unknown unicast: enabled
      MAC aging time: 300 s, Type: inactivity
      MAC limit: 2000, Action: none, Notification: syslog
      MAC limit reached: no, threshold: 75%
      MAC port down flush: enabled
      MAC Secure: disabled, Logging: disabled
      Split Horizon Group: none
      E-Tree: Root
      DHCPv4 Snooping: disabled
      DHCPv4 Snooping profile: none
      IGMP Snooping: disabled
      IGMP Snooping profile: none
      MLD Snooping profile: none
      Storm Control: bridge-domain policer
      DHCPv4 Snooping: disabled
*SNIP*
```

VPLS MAC Learning

HIDDEN

```
RP/0/RSP0/CPU0:PE4#show l2vpn forwarding bridge-domain L2VPN:AREA51 mac-address loc 0/1/CPU0
Sat Nov 20 12:07:24.155 EDT
 To Resynchronize MAC table from the Network Processors, use the command...
    l2vpn resynchronize forwarding mac-address-table location <r/s/i>

Mac Address    Type    Learned from/Filtered on    LC learned Resync Age/Last Change Mapped to
-------------- ------- -------------------------- ---------- ---------------------- --------------
d867.d954.5a45 dynamic Te0/1/0/1.400               N/A        20 Nov 12:01:24        N/A
d867.d948.b66d dynamic (1.1.1.1, 31400)            N/A        20 Nov 12:01:24        N/A
```

Per-NP data path counters

HIDDEN

```
RP/0/RSP0/CPU0:PE4#show controller np counter np0 loc 0/1/CPU0

Read 27 non-zero NP counters:
Offset  Counter                                  FrameValue   Rate (pps)
--------------------------------------------------------------------------------
  0  NULL_STAT_0                                 11         1
 16  MDF_TX_LC_CPU                               73         7
 17  MDF_TX_WIRE                               2008       184
 21  MDF_TX_FABRIC                             2015       185
 33  PARSE_FAB_RECEIVE_CNT                     2006       184
 37  PARSE_INTR_RECEIVE_CNT                    5638       516
 41  PARSE_INJ_RECEIVE_CNT                        2         0
 45  PARSE_ENET_RECEIVE_CNT                    2016       185
 49  PARSE_TM_LOOP_RECEIVE_CNT                   52         5
 53  PARSE_TOP_LOOP_RECEIVE_CNT                2000       183
 63  DBG_RSV_EP_L_RSV_ING_L3_IFIB                15         1
 64  DBG_RSV_EP_L_RSV_ING_L3_IFIB_MATCH          15         1
 67  DBG_RSV_EP_L_RSV_ING_L3_RSLTS_MATCH         15         1
 68  DBG_RSV_EP_L_RSV_ING_PUNT                   88         8
 80  DBG_RSV_EP_L_RSV_PW_DISPOSE               1000        92
 81  DBG_RSV_EP_L_RSV_VPLS_PW_IMPOSE           1000        92
524  MDF_PIPE_LPBK                             2000       183
```

VPLS hw specific show commands

HIDDEN

```
RP/0/RSP0/CPU0:PE4#show l2vpn forwarding interface TenGigE0/1/0/1.400 hardw ingress detail loc 0/1/CPU0
Local interface: TenGigE0/1/0/1.400, Xconnect id: 0x1a03e88, Status: up
  Segment 1
    AC, TenGigE0/1/0/1.400, status: Bound
    Statistics:
      packets: received 4014 (multicast 0, broadcast 1, unknown unicast 348, unicast 3666), sent 4012
      bytes: received 473420 (multicast 0, broadcast 60, unknown unicast 40890, unicast 432530), sent 473300
      MAC move: 0
      packets dropped: PLU 0, tail 0
      bytes dropped: PLU 0, tail 0
  Segment 2
    Bridge id: 2, Split horizon group id: 0
**SNIP**
Platform AC context:
  Ingress AC: VPLS, State: Bound
    Flags: Port Level MAC Limit
  XID: 0x01a03e88, SHG: None
  actns - last: Oct 10 18:51:13.4294966959, bind/unbind: Jan 27 09:25:53.1556
  uIDB: 0x001d, NP: 0
  slot mask[R0]: 0x8, slot mask[R1]: 0x0, NP flood mask: 0x0001, SW XID Learnkey: 6
  NP0
    Ingress uIDB:
      Flags: L2, Status, Ext Required, VPLS
      Stats Ptr: 0x5300b7, uIDB index: 0x001d, Wire Exp Tag: 1
      BVI Bridge Domain: 0, BVI Source XID: 0x00000000
      Local Switch dest XID: 0x01a03e88
      UIDB IF Handle: 0x06000102, Source Port: 0, Num VLANs: 0
    Xconnect ID: 0x01a03e88, NP: 0
      Type: AC
      Flags: Learn enable, VPLS, CP Learning
      uIDB Index: 0x001d
      Bridge Domain ID: 2, Learn Key: 6, MAC Cntr ID: 0xec2170, msti: 5,
      Main interface IF Handle: 0x06000100
    Bridge Port     :  Bridge 2 Port 0
      Flags: Active Member
      XID: 0x01a03e88
```

VPLS hw specific show commands

HIDDEN

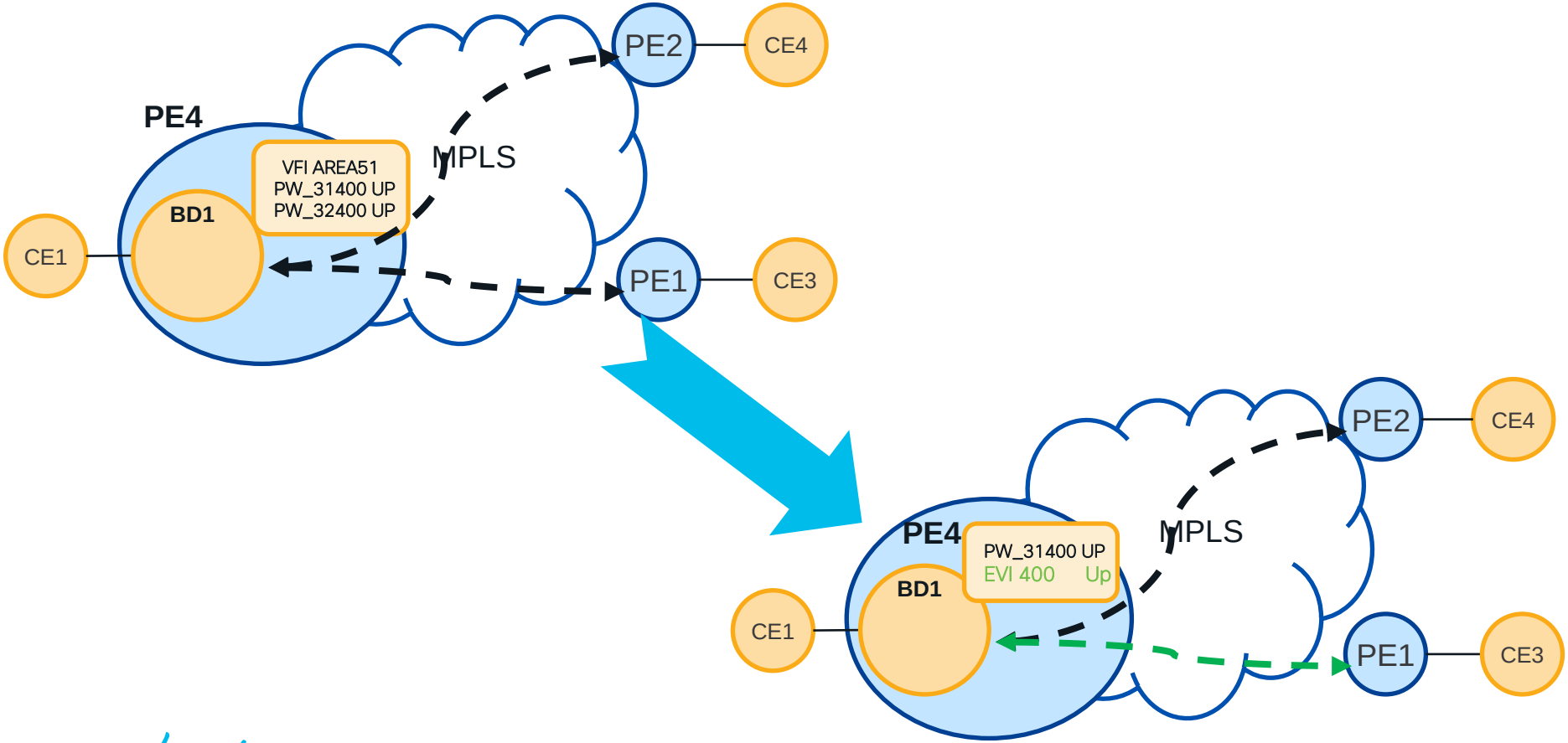
```
RP/0/RSP0/CPU0:PE4#show l2vpn forwarding neighbor 1.1.1.1 pw-id 31400 hardware egress det location 0/1/CPU0
Sat Nov 20 12:05:00.913 EDT
Xconnect id: 0xa000000d, Status: up
  Segment 1
    MPLS, Destination address: 1.1.1.1, pw-id: 31400, status: Bound
    Pseudowire label: 24011
    Control word disabled
    Statistics:
      packets: received 1011 (unicast 1009), sent 1011
      bytes: received 115220 (unicast 115046), sent 119240
      MAC move: 0
      packets dropped: PLU 0, tail 0, out of order 0
      bytes dropped: PLU 0, tail 0, out of order 0
  Segment 2
    Bridge id: 2, Split horizon group id: 1
**SNIP**
Platform PW context:
  Egress PW: VPLS, State: Bound
  XID: 0xa000000d, bridge: 2, MAC limit: 2000, l2vpn ldi index: 1, vc label: 24011,
  nr_ldi_hash: 0x7a, r_ldi_hash: 0x53, lag_hash: 0x42, hash_ext: 0xde, SHG: VFI Enabled
    Flags: MAC Limit Port Level
    actns - last: Oct  2 14:22:25.566, bind/unbind: Oct 13 07:02:57.531
  Trident Layer Flags: None
  NP0
    Xconnect ID: 0xa000000d, NP: 0
      Type: Pseudowire (no control word)
      Flags: Learn enable, Type 5, VPLS
      VC label hash, nR-LDI Hash: 0x7a, R-LDI Hash: 0x2a, LAG Hash: 0x42,
      Hashow Ext: 0xde, VC output label: 0x05dcb (24011), LDI: 0x0001, stats ptr: 0x00536c98
      Bridge Domain ID: 2, Learn Key: 2, MAC Cntr ID: 0xec2172, SHG: 1
```

Debug: VPLS problem isolation checklist HIDDEN

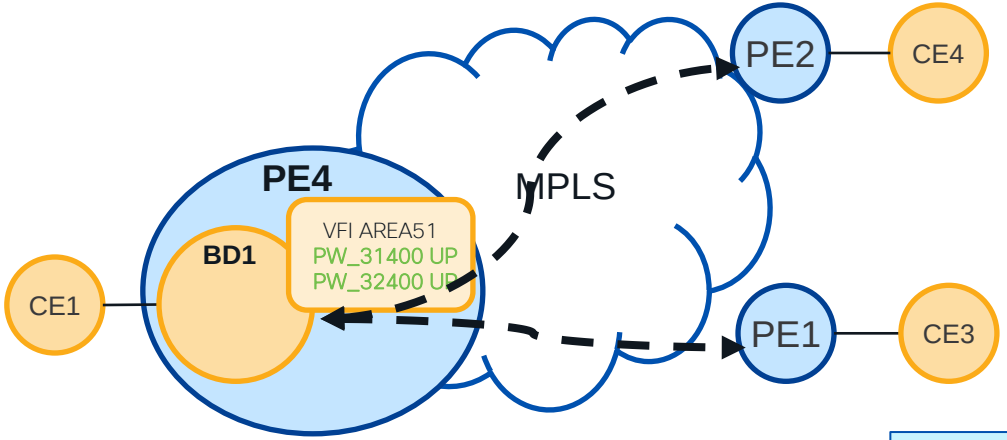
- Why are my ACs in unresolved state?
  - Check if the AC is configured with l2transport.
  - Check if “encapsulation” and “no shut” has been configured on all ACs.
- Why are my ACs down?
  - If the AC interface is DOWN, check if the interface is shutdown or the fiber is connected, bring it in UP state. Check if there is an MTU mismatch.
- Why are my PWs down?
  - Verify that LDP has core and loopback interface.
  - Verify LDP targeted session with neighbors.
  - Check if ping works.
  - Verify that IGP has core and loopback interface.
  - Check if PW up message was sent/received.
- Traffic is down! but bridge, AC and PW are up… why?
  - Check counters.
  - Determine which LC/intf is dropping the traffic.
  - Get counters on interface, sub-interface, ucode, octopus/bridge and fabric.
  - Dump L2 tables. (bridge, XID, HW mac and BD membership)
  - Check if VQI is set properly on fabric.
  - Check MPLS forwarding labels.
  - Check if the labels match.

Migration to EVPN

VPLS & EVPN Seamless Migration



VPLS & EVPN Seamless Migration



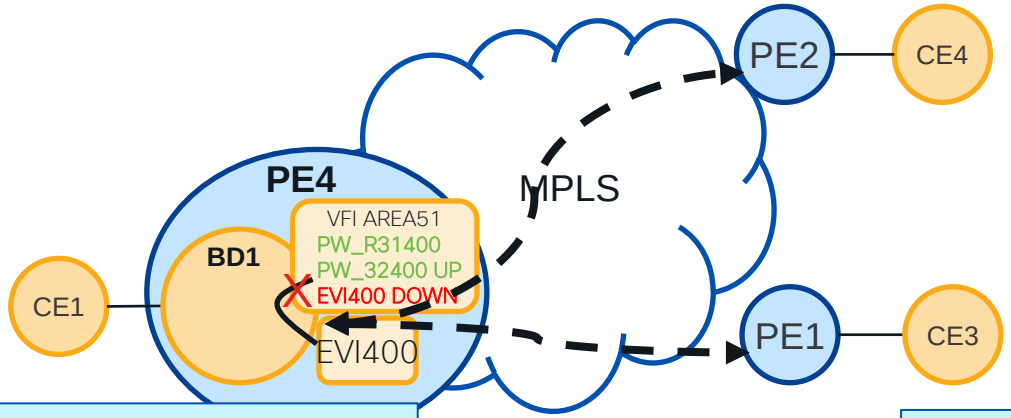
VFI1 is by default in Split Horizon Group 1

- SHG1 protects loops in MPLS Core
- Full mesh of pseudowires(PW) is required for Any-to-Any forwarding

```
l2vpn
 bridge group L2VPN
   bridge-domain AREA51
   interface Te0/1/0/1.400
   !
   vfi AREA51
    neighbor 1.1.1.1 pw-id 31400
    neighbor 2.2.2.2 pw-id 32400
```

```
#show l2vpn bridge-domain bd-name AREA51
Tue Oct 18 15:24:38.739 EDT
Legend: pp = Partially Programmed.
Bridge group: L2VPN, bridge-domain: AREA51, id: 2, state: up, ShgId: 0, MSTi: 0
  Aging: 300 s, MAC limit: 2000, Action: none, Notification: syslog
  Filter MAC addresses: 0
  ACs: 1 (1 up), VFIs: 1, PWs: 2 (2 up), PBBs: 0 (0 up), VNIs: 0 (0 up)
  List of ACs:
    Te0/1/0/1.400, state: up, Static MAC addresses: 0
  List of Access PWs:
  List of VFIs:
    vfi AREA51 (up)
      Neighbor 1.1.1.1 pw-id 31400, state: up, Static MAC addresses: 0
      Neighbor 2.2.2.2 pw-id 32400, state: up, Static MAC addresses: 0
```

VPLS & EVPN Seamless Integration – Migration



VFI1 is by default in Split Horizon Group 1

- SHG1 protects loops in MPLS Core
- Full Mesh of pseudowires(PW) is required

for Any-to-Any forwarding

EVI (only PE4) is also in Split Horizon Group 1

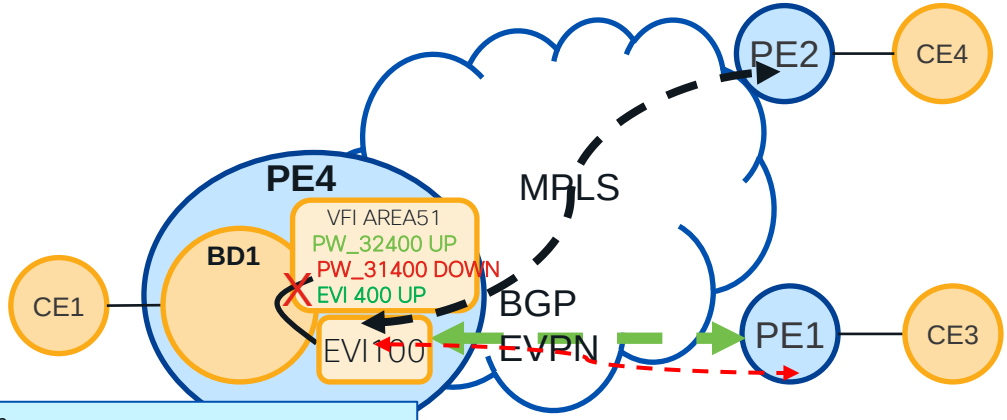
- PE4 doesn't forward data between VFI and EVI

```
l2vpn
 bridge group L2VPN
   bridge-domain AREA51
   interface Te0/1/0/1.400
   !
   vfi AREA51
    neighbor 1.1.1.1 pw-id 31400
    neighbor 2.2.2.2 pw-id 32400
   evi 400

evpn
 evi 400
  advertise-mac
```

```
#show evpn evi vpn-id 400 neighbor det
Tue Oct 18 16:25:53.568 EDT

VPN-ID     Encap  Neighbor IP
---------- ------ ----------------------------------

#show l2vpn bridge-domain bd-name AREA51
Bridge group: L2VPN, bridge-domain: AREA51, id: 2, state: up, ShgId: 0, MSTi: 0
ACs: 1 (1 up), VFIs: 1, PWs: 2 (2 up), PBBs: 0 (0 up), VNIs: 0 (0 up)
  List of EVPNs:
    EVPN, state: up
  List of ACs:
    Te0/1/0/1.400, state: up, Static MAC addresses: 0, MSTi: 5
List of VFIs:
    vfi AREA51 (up)
      Neighbor 1.1.1.1 pw-id 31400, state: up, Static MAC addresses: 0
      Neighbor 2.2.2.2 pw-id 32400, state: up, Static MAC addresses: 0
```

EVI Up but not used yet as no BGP L2VPB EVPN AFI peering to PE2

VPLS & EVPN Seamless Integration – Migration




```
l2vpn
 bridge group L2VPN
   bridge-domain AREA51
   interface Te0/1/0/1.400
   !
   vfi AREA51
    neighbor 1.1.1.1 pw-id 31400
    neighbor 2.2.2.2 pw-id 32400
   evi 400

evpn
 evi 400
  advertise-mac
```

VFI1 is by default in Split Horizon Group 1

- SHG1 protects loops in MPLS Core
- Full Mesh of pseudowires(PW) is required

for Any-to-Any forwarding

EVI is also by default in Split Horizon Group 1

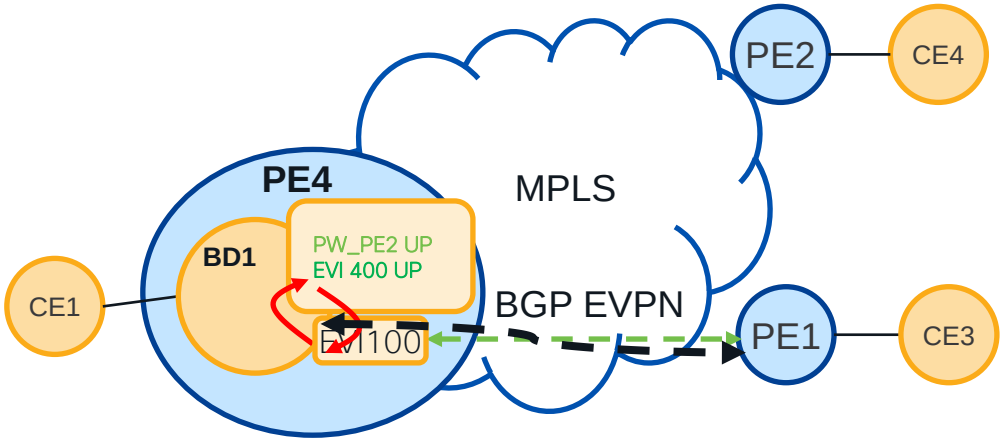
- PE4 doesn't forward data between VFI and EVI

PE4&PE1 run BGP EVPN

- PW_PE1 goes DOWN (on RT3)
- Data Forwarding between PE4 and PE1 via EVI

```
#show evpn evi vpn-id 400 neighbor
Tue Oct 18 16:24:24.169 EDT

VPN-ID     Encap  Neighbor IP
---------- ------ ----------------------------------------
400  MPLS   1.1.1.1

#show l2vpn bridge-domain bd-name AREA51
Bridge group: L2VPN, bridge-domain: AREA51, id: 2, state: up, ShgId: 0, MSTi: 0
ACs: 1 (1 up), VFIs: 1, PWs: 2 (1 up), PBBs: 0 (0 up), VNIs: 0 (0 up)
  List of EVPNs:
    EVPN, state: up
  List of ACs:
    Te0/1/0/1.400, state: up, Static MAC addresses: 0, MSTi: 5
List of VFIs:
    vfi AREA51 (up)
      Neighbor 1.1.1.1 pw-id 31400, state: down, Static MAC addresses: 0
      Neighbor 2.2.2.2 pw-id 32400, state: up, Static MAC addresses: 0
```

What can go wrong?



Regular PW is in SHG0

EVI1 is by default in Split Horizon Group 1

PE4&PE1 run BGP EVPN (we receive RT3)

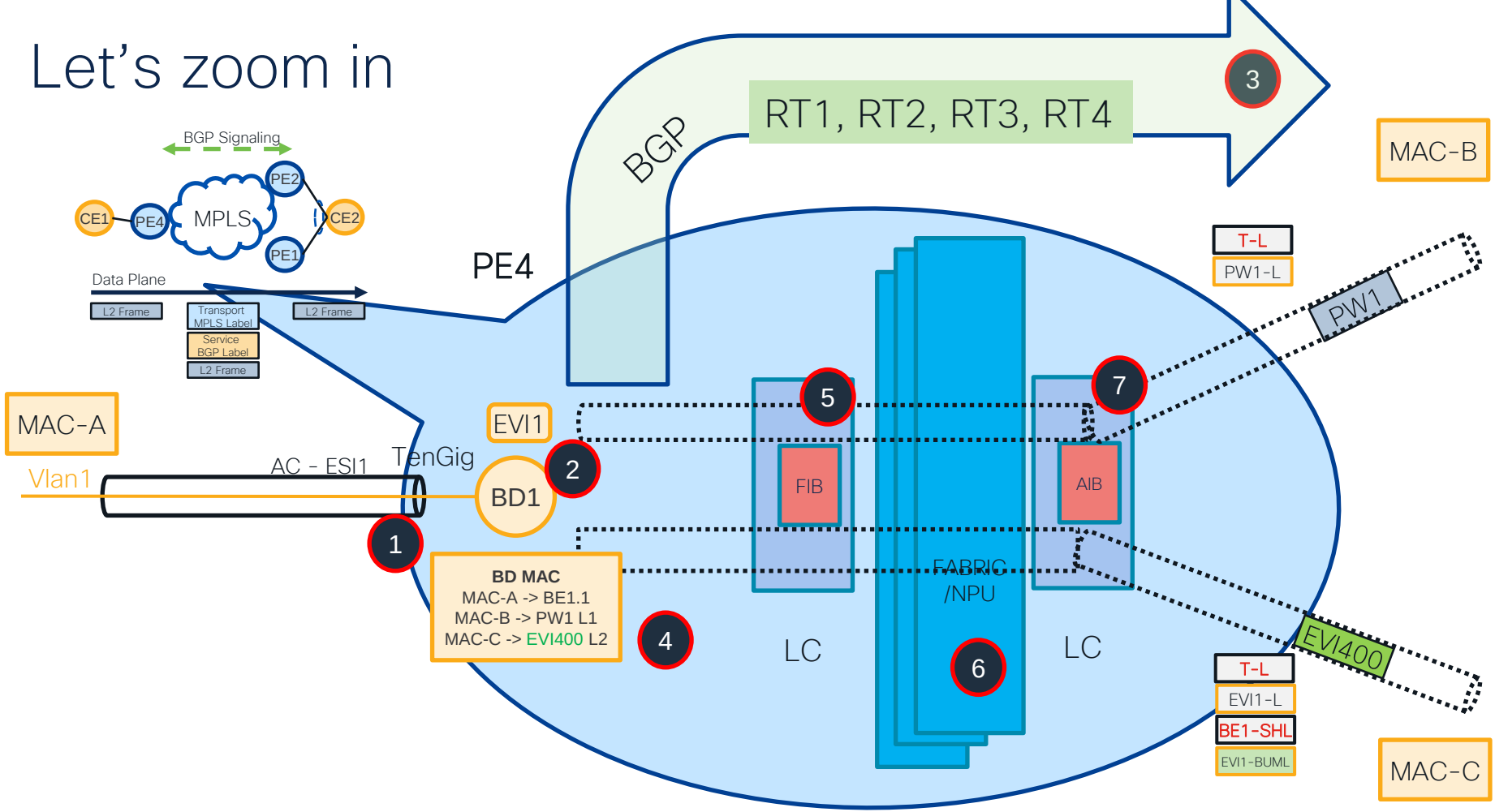
- PW_PE1 does NOT go DOWN
- Loop between PW_PE1 and EVI 100

```
l2vpn
 bridge group L2VPN
   bridge-domain AREA51
   interface Te0/1/0/1.400
   !
   neighbor 1.1.1.1 pw-id 31400
   neighbor 2.2.2.2 pw-id 32400

   evi 400
```

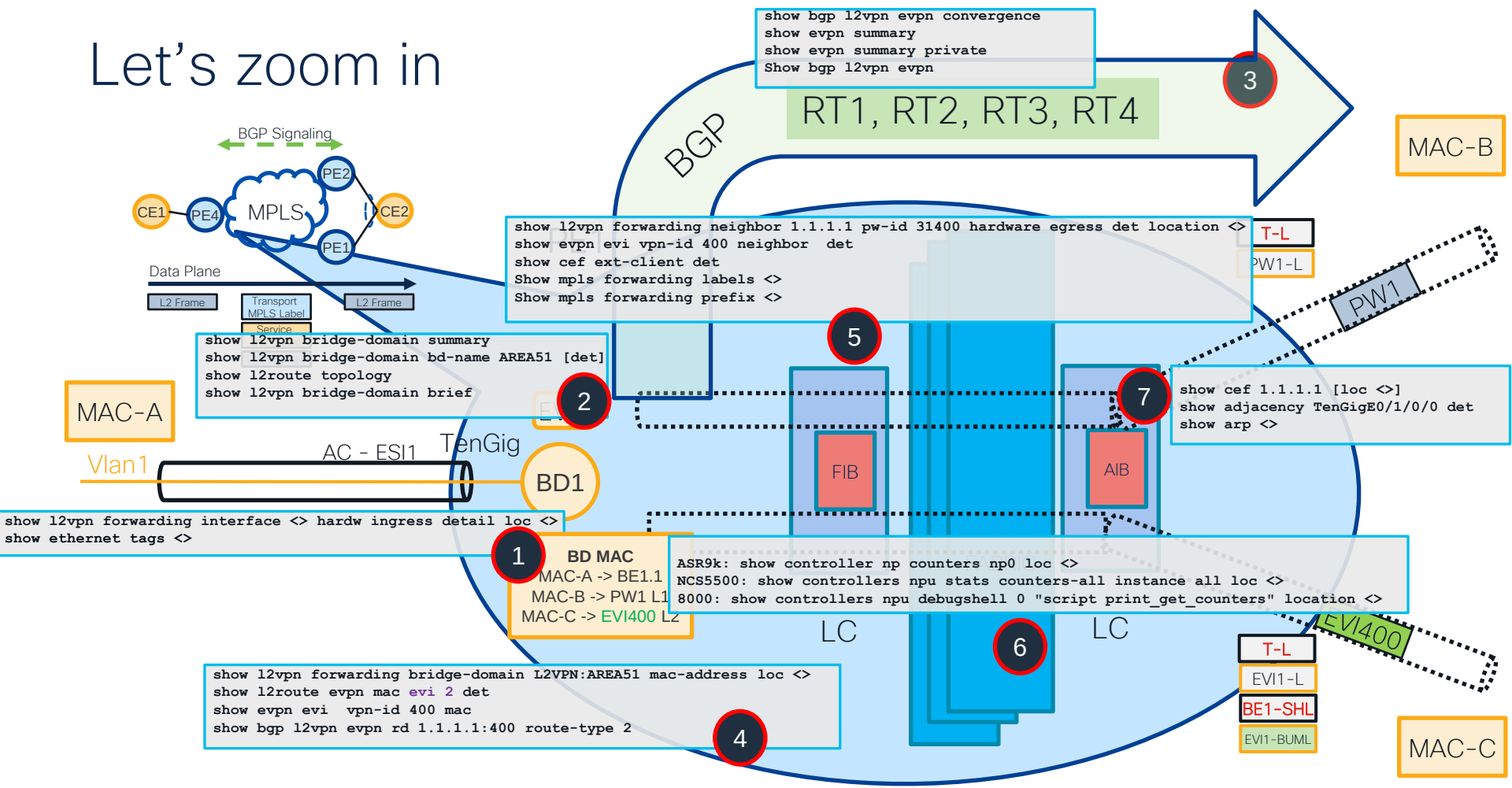
No VFI

```
#show evpn evi vpn-id 400 neighbor
Tue Oct 18 16:24:24.169 EDT

VPN-ID     Encap  Neighbor IP
---------- ------ ---------------------------------------
400  MPLS   1.1.1.1

#show l2vpn bridge-domain bd-name AREA51
Bridge group: L2VPN, bridge-domain: AREA51, id: 2, state: up, ShgId: 0, MSTi: 0
ACs: 1 (1 up), VFIs: 1, PWs: 2 (1 up), PBBs: 0 (0 up), VNIs: 0 (0 up)
  List of EVPNs:
    EVPN, state: up
  List of ACs:
    Te0/1/0/1.400, state: up, Static MAC addresses: 0, MSTi: 5
List of VFIs:
    vfi AREA51 (up)
      Neighbor 1.1.1.1 pw-id 31400, state: up, Static MAC addresses: 0
      Neighbor 2.2.2.2 pw-id 32400, state: up, Static MAC addresses: 0
```

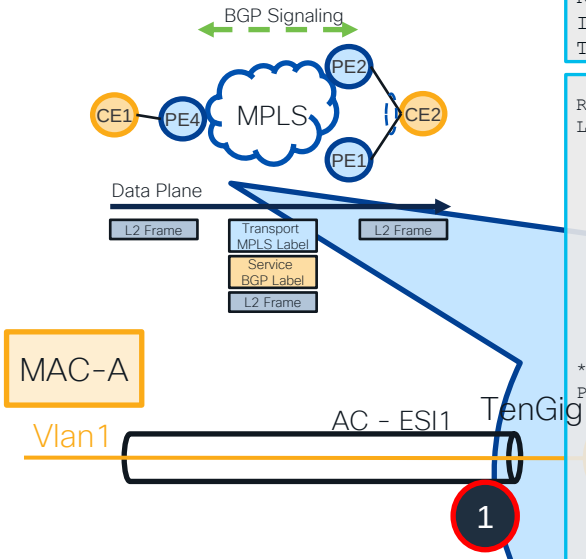
Let's zoom in



Let's zoom in



1. L2 Ingress Interface




```
RP/0/RSP0/CPU0:PE4#show ethernet tags TenGigE0/1/0/1.400
Interface                St  MTU  Ly Outer             Inner            Xtra -,+
Te0/1/0/1.400            Up  1518 L2 .1Q:400           -                -    1 0
```

```
RP/0/RSP0/CPU0:PE4#show l2vpn forwarding interface TenGigE0/1/0/1.400 hardw ingress detail loc 0/1/CPU0
Local interface: TenGigE0/1/0/1.400, Xconnect id: 0x1a03e88, Status: up
  Segment 1
    AC, TenGigE0/1/0/1.400, status: Bound
    Statistics:
      packets: received 4014 (multicast 0, broadcast 1, unknown unicast 3666), sent 4012
      bytes: received 473420 (multicast 0, broadcast 60, unknown unicast 4089[illegible]st 432530), sent 473300
      MAC move: 0
      packets dropped: PLU 0, tail 0
      bytes dropped: PLU 0, tail 0
  Segment 2
    Bridge id: 2, Split horizon group id: 0
**SNIP**
Platform AC context:
 Ingress AC: VPLS, State: Bound
   Flags: Port Level MAC Limit
 XID: 0x01a03e88, SHG: None
 actns - last: Oct 10 18:51:13.42[illegible]966959, bind/unbind: Jan 27 09:25:53.1556
 uIDB: 0x001d, NP: 0
 slot mask[R0]: 0x8, slot mask[R1]: 0x0, NP[illegible]d mask: 0x0001, SW XID Learnkey: 6
 NP0
   Ingress uIDB:
     Flags: L2, Status, Ext Required, VPLS
     Stats Ptr: 0x5300b7, uIDB index: 0x001d, Wire Exp Tag: 1
     BVI Bridge Domain: 0, BVI Source XID: 0x00000000
     Local Switch dest XID: 0x01a03e88
     UIDB IF Handle: 0x06000102, Source Port: 0, Num VLANs: 0
   Xconnect ID: 0x01a03e88, NP: 0
     Type: AC
     Flags: Learn enable, VPLS, CP Learning
     uIDB Index: 0x001d
     Bridge Domain ID: 2, Learn Key: 6, MAC Cntr ID: 0xec2170, msti: 5,
     Main interface IF Handle: 0x06000100
   Bridge Port     :  Bridge 2 Port 0
     Flags: Active Member
     XID: 0x01a03e88
```

XID and Bridge port must be programmed in the hardware for the port.

AC by default is SHG 0, “split-horizon group” for SHG 2

What can go wrong?

1
```
RP/0/RSP0/CPU0:PE4# show l2vpn xconnect detail
Group XG-POD1, XC XC-POD1-EVPN-VPWS, state is unresolved; Interworking none
  AC: Bundle-Ether1.10, state is unresolved
  EVPN: neighbor 5.5.5.5, PW ID: evi 1000, ac-id 100, state is down ( provisioned )
```
Both AC and EVPN down

2
```
Bundle-Ether1.10 is administratively down, line protocol is administratively down
Hardware is Aggregated Ethernet interface(s), address is fa16.3e07.5dc2
  Internet address is Unknown
```
Found AC down

3
```
Bundle-Ether1.10 is up, line protocol is up
Hardware is Aggregated Ethernet interface(s), address is fa16.3e07.5dc2
  Internet address is Unknown
```
Fix AC

4
```
RP/0/RSP0/CPU0:PE4# show l2vpn xconnect detail
Group XG-POD1, XC XC-POD1-EVPN-VPWS, state is unresolved; Interworking none
  AC: Bundle-Ether1.10, state is unresolved
  EVPN: neighbor 5.5.5.5, PW ID: evi 1000, ac-id 100, state is down ( provisioned )
```
Still both down. Why?!

5
```
RP/0/0/CPU0:PE1(config)#int Bundle-Ether1.10 l2transport
Bundle-Ether1.10 is up, line protocol is up
Hardware is Aggregated Ethernet interface(s), address is fa16.3e07.5dc2
  Layer 2 Transport Mode
```
AC needs to be **L2**

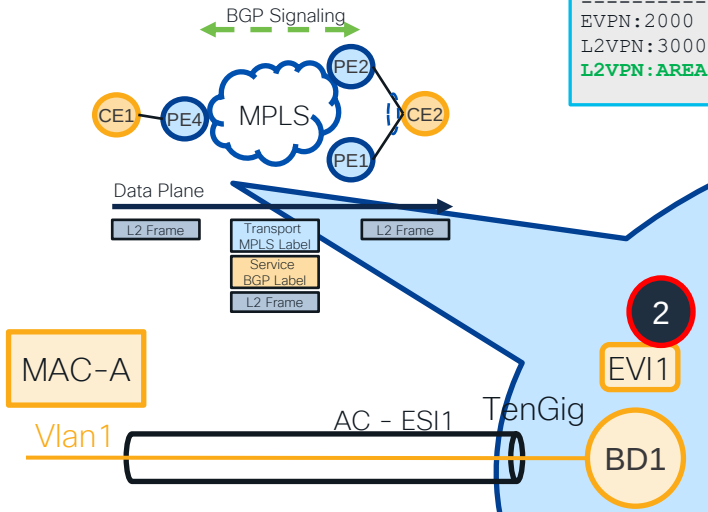
6
```
Group XG-POD1, XC XC-POD1-EVPN-VPWS, state is up; Interworking none
  AC: Bundle-Ether1.10, state is up
  EVPN: neighbor 5.5.5.5, PW ID: evi 1000, ac-id 100, state is up ( established )
```
Check if AC has
rewrite ingress tag pop 1 symmetric

7

```
RP/0/RSP0/CPU0:PE1#show ethernet tags TenGigE0/1/0/1.400

Interface      St  MTU  Ly Outer           Inner          Xtra -,+
Te0/1/0/1.400  Up  1518 L2 .1Q:400        -              -    1 0
```

```
RP/0/RSP0/CPU0:PE4#show ethernet tags TenGigE0/1/0/1.400

Interface      St  MTU  Ly Outer           Inner          Xtra -,+
Te0/1/0/1.400  Up  1518 L2 .1Q:400        -              -    0 0
```

2. Bridge Domain




```
RP/0/RSP0/CPU0:PE4#show l2vpn bridge-domain brief
Legend: pp = Partially Programmed.
Bridge Group:Bridge-Domain Name  ID     State          Num ACs/up   Num PWs/up    Num PBBs/up Num
VNIs/up
------------------------------ ------ -------------- ------------ ------------- ----------- ----
EVPN:2000                        0      up             2/2          0/0           0/0         0/0
L2VPN:3000                       1      up             0/0          1/1           0/0         0/0
L2VPN:AREA51                     2      up             1/1          2/2           0/0         0/0
```

L2VPN

```
RP/0/RSP0/CPU0:PE4#show l2vpn bridge-domain summary
Sun Nov 21 10:37:44.455 EDT
Number of groups: 2, VLAN switches: 0
Number of bridge-domains: 3, Up: 3, Shutdown: 0, Partially-
programmed: 0
Default: 3, pbb-edge: 0, pbb-core: 0
Number of ACs: 3 Up: 3, Down: 0, Partially-programmed: 0
Number of PWs: 3 Up: 2, Down: 1, Standby: 0, Partially-programmed: 0
```

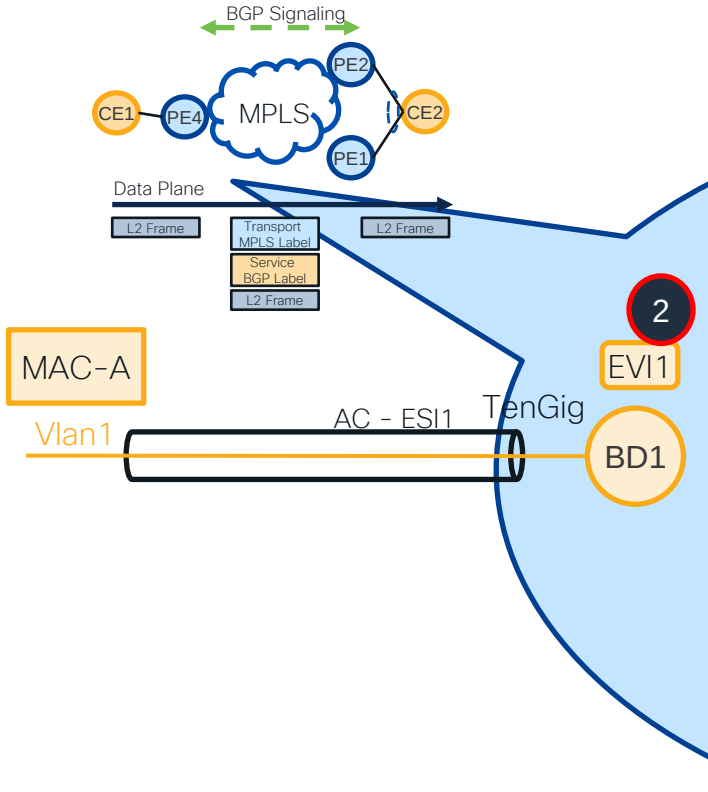
L2RIB

```
RP/0/RSP0/CPU0:PE4#show l2route topology
Topology ID   Topology Name    Type
-----------   -------------    ----
0              2000            L2VRF
1              3000            L2VRF
2              AREA51          L2VRF
4294967294     GLOBAL          N/A
4294967295     ALL             N/A
```

EVPN

```
RP/0/RSP0/CPU0:PE4#show evpn evi
Sat Oct 29 14:59:10.832 EDT

VPN-ID     Encap      Bridge Domain                 Type
---------- ---------- ----------------------------- -------------------
10         MPLS       2000                          EVPN
100        MPLS       3000                          EVPN
400        MPLS       AREA51                        EVPN
1000       MPLS       VPWS:1000                     VPWS (vlan-unaware)
65535      MPLS       ES:GLOBAL                     Invalid
```

2. Bridge Domain



L2VPN

```
RP/0/RSP0/CPU0:PE4#show l2vpn bridge-domain bd-name AREA51
Sun Nov 21 10:38:44.671 EDT
Legend: pp = Partially Programmed.
Bridge group: L2VPN, bridge-domain: AREA51, id: 2, state: up, ShgId: 0, MSTi: 0
  Aging: 300 s, MAC limit: 2000, Action: none, Notification: syslog
  Filter MAC addresses: 0
  ACs: 1 (1 up), VFIs: 1, PWs: 2 (1 up), PBBs: 0 (0 up), VNIs: 0 (0 up)
  List of EVPNs:
    EVPN, state: up
  List of ACs:
    Te0/1/0/1.400, state: up, Static MAC addresses: 0, MSTi: 5
  List of Access PWs:
  List of VFIs:
    vfi AREA51 (up)
      Neighbor 1.1.1.1 pw-id 31400, state: down, Static MAC addresses: 0
      Neighbor 2.2.2.2 pw-id 32400, state: up, Static MAC addresses: 0
  List of Access VFIs:
```

EVPN

```
RP/0/RSP0/CPU0:PE4#show evpn evi vpn-id 400 det
VPN-ID     Encap      Bridge Domain                 Type
---------- ---------- ----------------------------- -------
400        MPLS       AREA51                        EVPN
   Stitching: Regular
   Unicast Label  : 24005
   Multicast Label: 24006
   Flow Label: N
   Control-Word: Enabled
   Advertise MACs: Yes
   Advertise BVI MACs: No
   Aliasing: Enabled
   Preferred Nexthop Mode: Off
   RD Config: none
   RD Auto  : (auto) 4.4.4.4:400
   RT Auto  : 100:400
   Route Targets in Use           Type
   ------------------------------ --------------------
   100:400                        Import
   100:400                        Export
```

2. Bridge Domain

L2VPN

2

```
RP/0/RSP0/CPU0:PE4#show l2vpn bridge-domain bd-name AREA51 det
Sun Nov 21 10:43:33.201 EDT
Legend: pp = Partially Programmed.
Bridge group: L2VPN, bridge-domain: AREA51, id: 2, state: up, ShgId: 0
  Coupled state: disabled
  VINE state: EVPN Native
  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: 2000, Action: none, Notification: syslog
***SNIP***
  Bridge MTU: 1500
  MIB cvplsConfigIndex: 3
  Filter MAC addresses:
  P2MP PW: disabled
  Multicast Source: Not Set
  Create time: 16/11/2021 11:14:43 (4d23h ago)
  No status change since creation
  ACs: 1 (1 up), VFIs: 1, PWs: 2 (1 up), PBBs: 0 (0 up)
  List of EVPNs:
    EVPN, state: up
      evi: 400
      XC ID 0x80000009
     Statistics:
       packets: received 0 (unicast 0), sent 2
       bytes: received 0 (unicast 0), sent 112
       MAC move: 0
```

```
List of ACs:
    AC: TenGigE0/1/0/1.400, state is up
      Type VLAN; Num Ranges: 1
      Rewrite Tags: []
      VLAN ranges: [400, 400]
      MTU 1500; XC ID 0x1a03e88; interworking none; MSTi 5
      MAC learning: enabled
      Flooding:
        Broadcast & Multicast: enabled
        Unknown unicast: enabled
      MAC aging time: 300 s, Type: inactivity
      MAC limit: 2000, Action: none, Notification: syslog
      MAC limit reached: no, threshold: 75%
      MAC port down flush: enabled
      MAC Secure: disabled, Logging: disabled
      Split Horizon Group: none
      E-Tree: Root
      Dynamic ARP Inspection: disabled, Logging: disabled
      IP Source Guard: disabled, Logging: disabled
      DHCPv4 Snooping: disabled
      DHCPv4 Snooping profile: none
      IGMP Snooping: disabled
      IGMP Snooping profile: none
      MLD Snooping profile: none
      Storm Control: bridge-domain policer
      Static MAC addresses:
      Statistics:
        packets: received 2013 (multicast 0, broadcast 1, unknown unicast 2, unicast 2011), sent 2011
        bytes: received 2180 (multicast 0, broadcast 60, unknown unicast 120, unicast 2000), sent 2180
      MAC move: 0
      Storm control drop counters:
        packets: broadcast 0, multicast 0, unknown unicast 0
        bytes: broadcast 0, multicast 0, unknown unicast 0
```

2. Bridge Domain

L2VPN

2

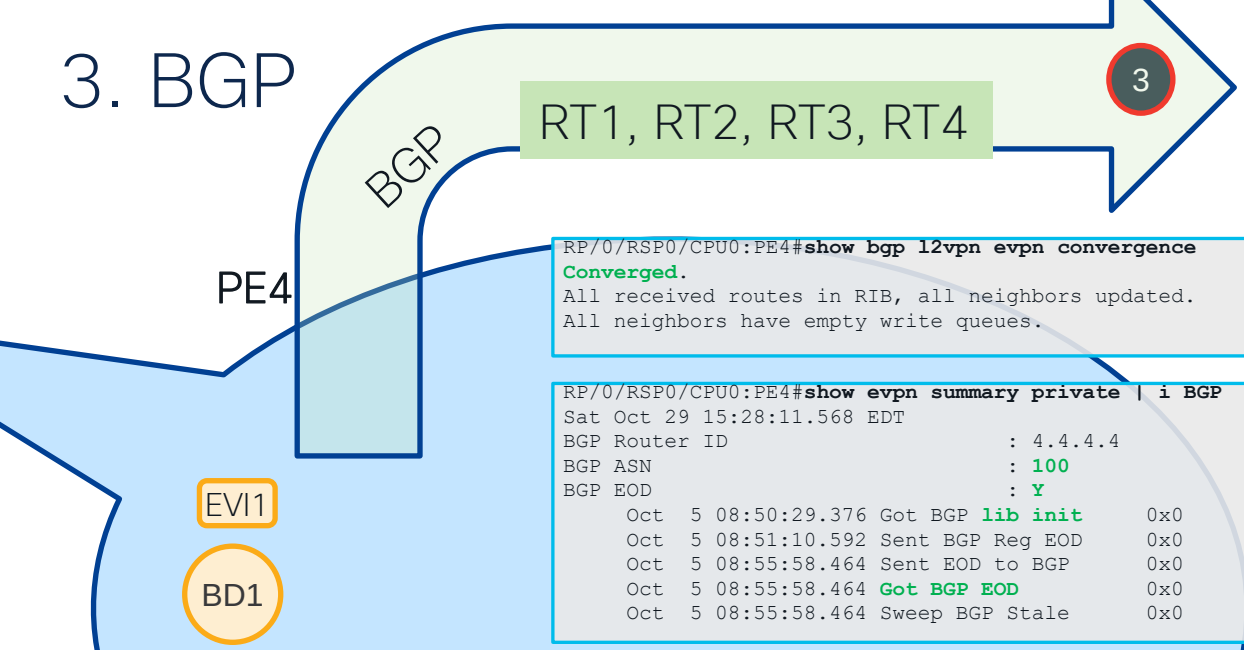
```
List of Access PWs:
  List of VFIs:
    vfi AREA51 (up)
   PW: neighbor 1.1.1.1, PW ID 31400, state is down (all ready)(Segment-down)
        PW class not set, XC ID 0xa000000d
        Encapsulation MPLS, protocol LDP
        Source address 4.4.4.4
        PW type Ethernet, control word disabled, interworking none
        Sequencing not set
        Ignore MTU mismatch: Disabled
        Transmit MTU zero: Disabled
        LSP : Up

        PW Status TLV in use
          MPLS         Local                          Remote
          ------------ ------------------------------ ----------------------
          Label        24010                          24012
          Group ID     0x2                            0x5
          Interface    AREA51                         AREA51
          MTU          1500                           1500
          Control word disabled                       disabled
          PW type      Ethernet                       Ethernet
          VCCV CV type 0x2                            0x2
                       (LSP ping verification)        (LSP ping verification)
          VCCV CC type 0x6                            0x6
                       (router alert label)           (router alert label)
                       (TTL expiry)                   (TTL expiry)
          ------------ ------------------------------ ----------------------
        Incoming Status (PW Status TLV):
          Status code: 0x10 (PW Down) in Notification message
        MIB cpwVcIndex: 2684354573
        Create time: 16/11/2021 11:14:43 (4d23h ago)
        Last time status changed: 20/11/2021 12:34:38 (22:08:54 ago)
        Last time PW went down: 20/11/2021 12:34:38 (22:08:54 ago)
```

```
PW: neighbor 2.2.2.2, PW ID 32400, state is up ( established )
        PW class not set, XC ID 0xa00007df
        Encapsulation MPLS, protocol LDP
        Source address 4.4.4.4
        PW type Ethernet, control word disabled, interworking none
        Sequencing not set
        Ignore MTU mismatch: Disabled
        Transmit MTU zero: Disabled
        LSP : Up

        PW Status TLV in use
          MPLS         Local                          Remote
          ------------ ------------------------------ ----------------------
          Label        24011                          24011
          Group ID     0x2                            0x5
          Interface    AREA51                         AREA51
          MTU          1500                           1500
          Control word disabled                       disabled
          PW type      Ethernet                       Ethernet
          VCCV CV type 0x2                            0x2
                       (LSP ping verification)        (LSP ping verification)
          VCCV CC type 0x6                            0x6
                       (router alert label)           (router alert label)
                       (TTL expiry)                   (TTL expiry)
          ------------ ------------------------------ ----------------------
        Incoming Status (PW Status TLV):
          Status code: 0x0 (Up) in Notification message
        MIB cpwVcIndex: 2684356575
        Create time: 21/11/2021 10:32:37 (00:10:55 ago)
        Last time status changed: 21/11/2021 10:32:37 (00:10:55 ago)
        MAC withdraw messages: sent 0, received 0
        Forward-class: 0
        Static MAC addresses:
        Statistics:
          packets: received 0 (unicast 0), sent 0
          bytes: received 0 (unicast 0), sent 0
          MAC move: 0
```

Alternatively

```
RP/0/RSP0/CPU0:PE4#show l2vpn forwarding neighbor 1.1.1.1 pw-id 31400 hardware egress det location 0/1/CPU0
Sun Nov 21 11:06:29.336 EDT
Xconnect id: 0xa000000d, Status: down
```

3. BGP




```
RP/0/RSP0/CPU0:PE4#show bgp l2vpn evpn convergence
Converged.
All received routes in RIB, all neighbors updated.
All neighbors have empty write queues.
```

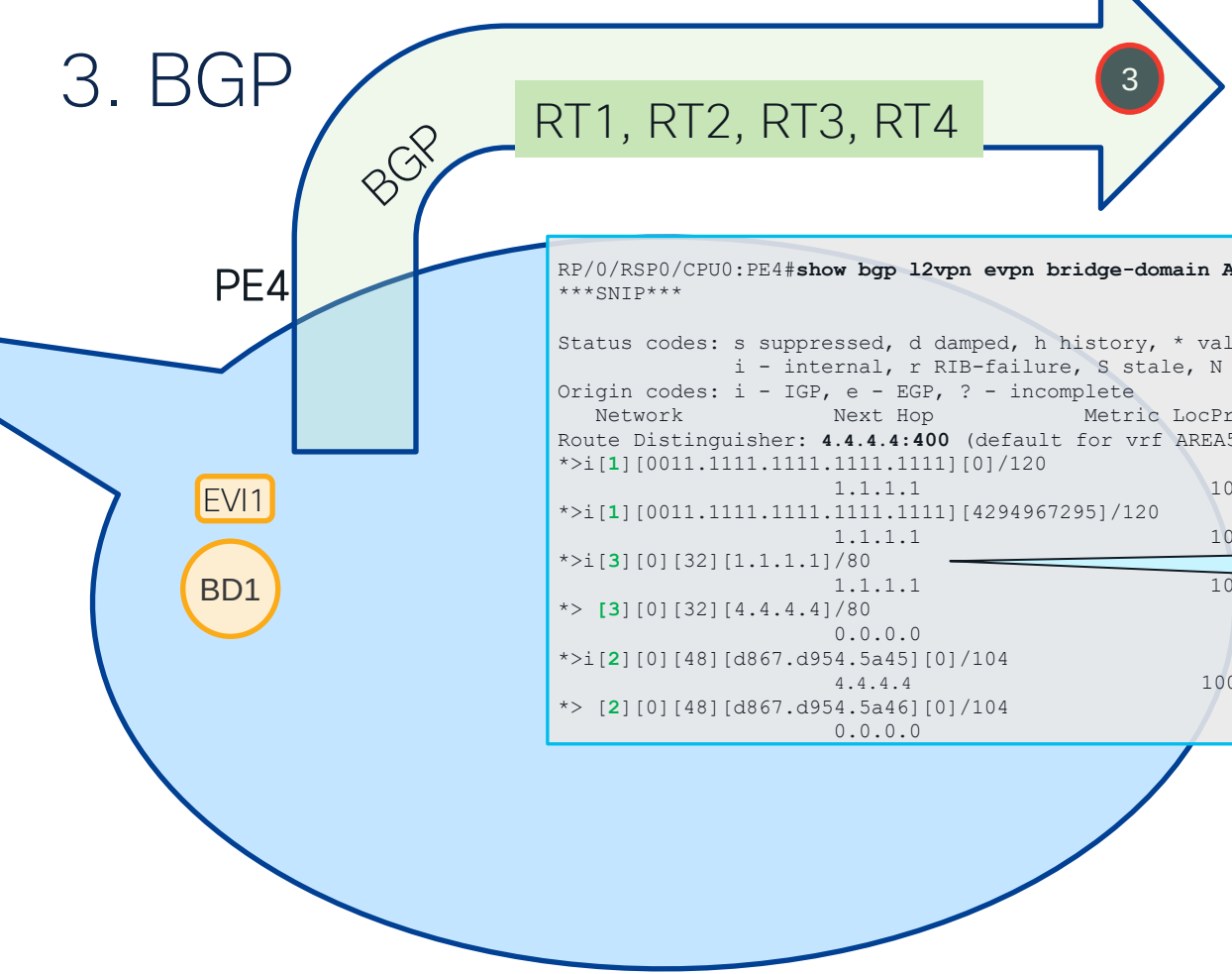
```
RP/0/RSP0/CPU0:PE4#show evpn summary private | i BGP
Sat Oct 29 15:28:11.568 EDT
BGP Router ID                   : 4.4.4.4
BGP ASN                         : 100
BGP EOD                         : Y
     Oct  5 08:50:29.376 Got BGP lib init     0x0          0x0          0x0          0x3030303    -  -
     Oct  5 08:51:10.592 Sent BGP Reg EOD     0x0          0x0          0x0          0x0          -  -
     Oct  5 08:55:58.464 Sent EOD to BGP      0x0          0x0          0x0          0x0          -  -
     Oct  5 08:55:58.464 Got BGP EOD          0x0          0x0          0x0          0x0          -  -
     Oct  5 08:55:58.464 Sweep BGP Stale      0x0          0x0          0x0          0x0          -  -
```

What can go wrong?!

Check:
- l2vpn evpn AF configured
- evpn configured
- check changes around timestamp

```
RP/0/RSP0/CPU0:PE4#show bgp l2vpn evpn convergence
% None of the requested address families are configured for instance 'default'(31966)
<snip>
     Apr 20 02:14:43.968 BGP Router id update 0x0          0xffff0000   0x0          0x0          -  -
     Apr 20 02:14:43.968 Got BGP RID          0x0          0x0          0x106a8c0    0x0          -  -
     Apr 20 02:14:43.968 Got BGP lib deinit   0x0          0x0          0x0          0x0          -  -
     Apr 20 02:15:22.880 BGP Router id update 0x106a8c0    0xffff0000   0x0          0x0          -  -
     Apr 20 02:15:22.880 Got BGP RID          0x0          0x0          0x0          0x106a8c0    -  -
</snip>
```

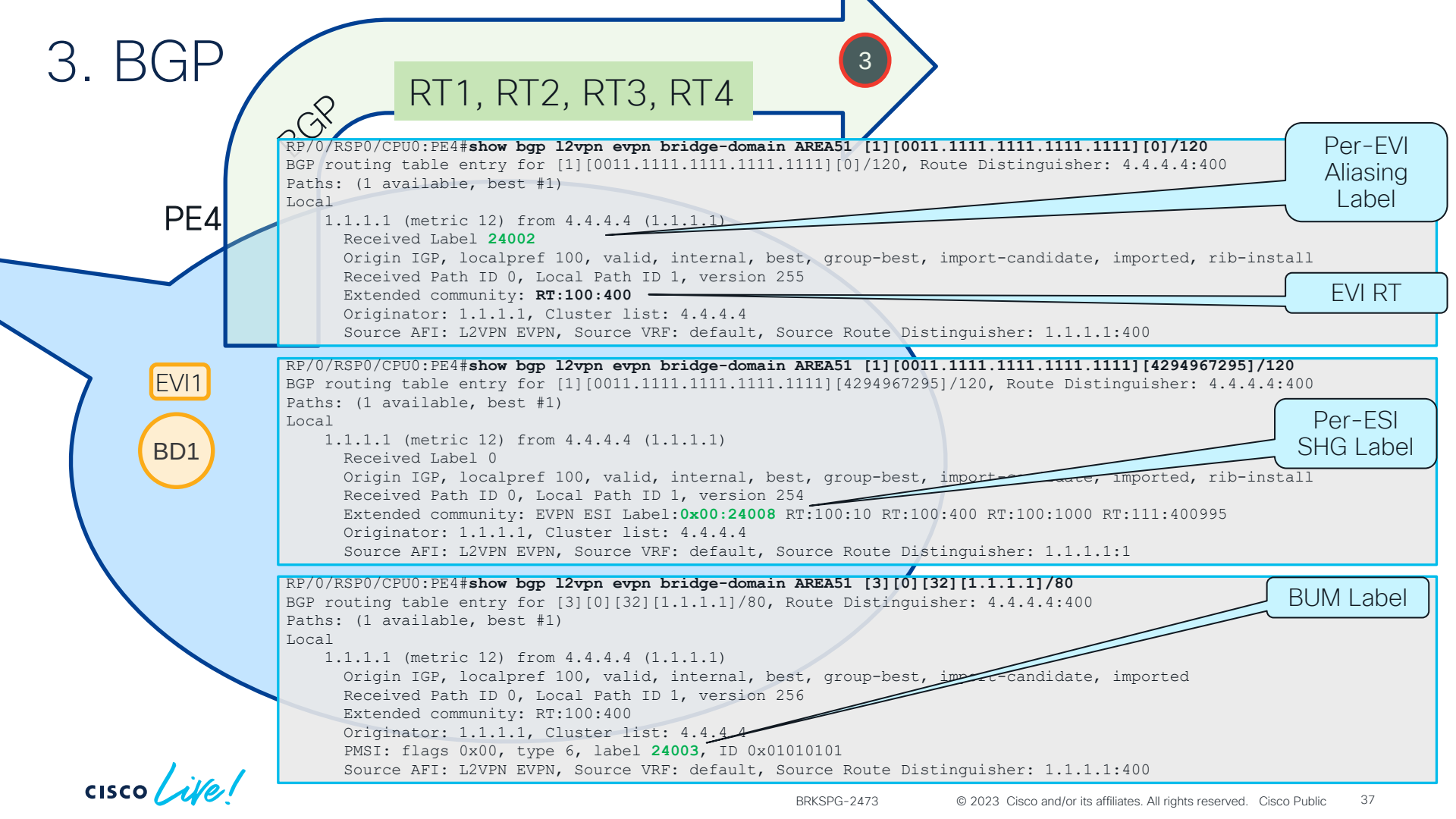
3. BGP



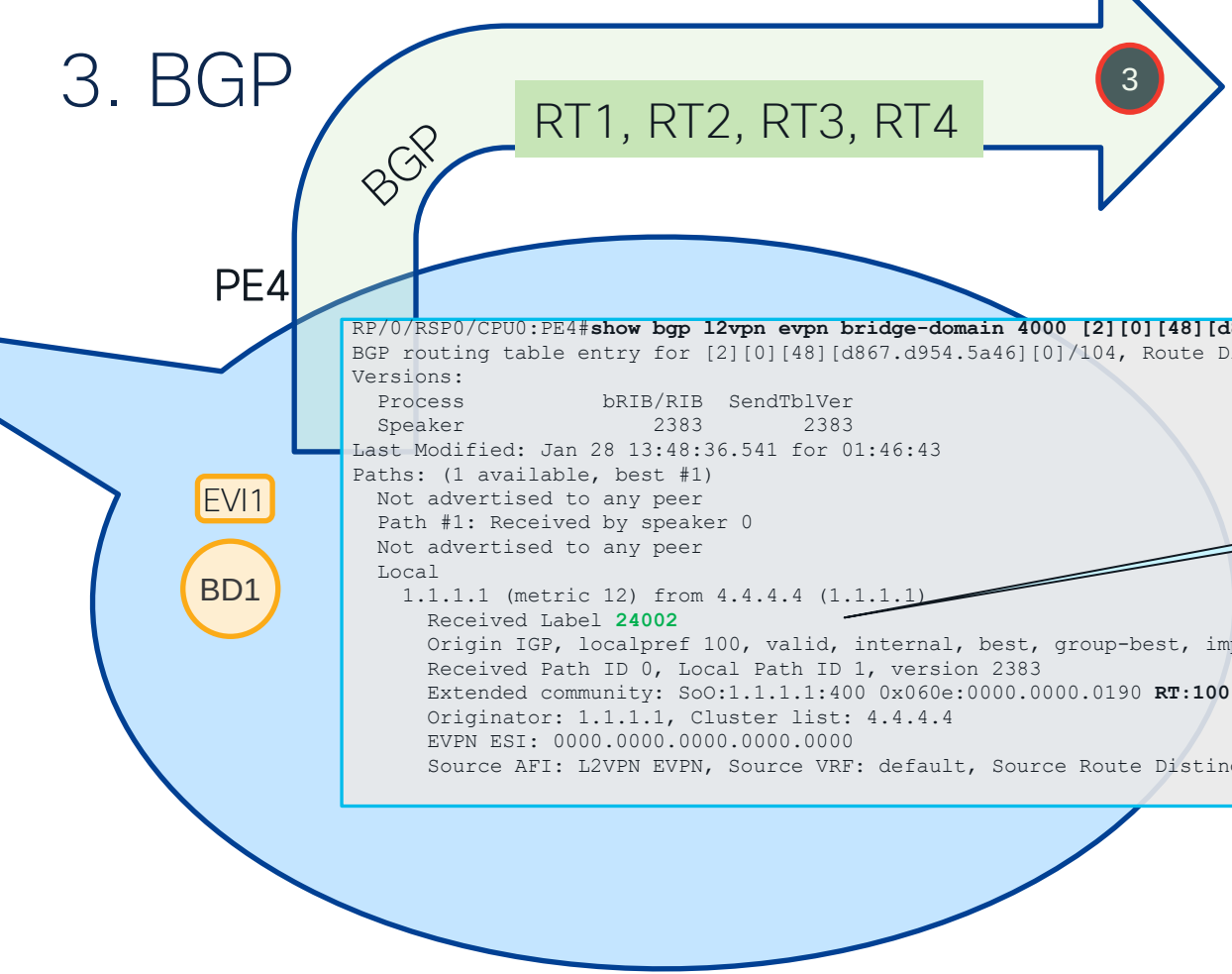

```
RP/0/RSP0/CPU0:PE4#show bgp l2vpn evpn bridge-domain AREA51
***SNIP***

Status codes: s suppressed, d damped, h history, * valid, > best
              i - internal, r RIB-failure, S stale, N Nexthop-discard
Origin codes: i - IGP, e - EGP, ? - incomplete
   Network            Next Hop            Metric LocPrf Weight Path
Route Distinguisher: 4.4.4.4:400 (default for vrf AREA51)
*>i[1][0011.1111.1111.1111.1111][0]/120
                      1.1.1.1                  100      0 i
*>i[1][0011.1111.1111.1111.1111][4294967295]/120
                      1.1.1.1                  100      0 i
*>i[3][0][32][1.1.1.1]/80
                      1.1.1.1                  100      0 i
*> [3][0][32][4.4.4.4]/80
                      0.0.0.0                           0 i
*>i[2][0][48][d867.d954.5a45][0]/104
                      4.4.4.4                  100      0 i
*> [2][0][48][d867.d954.5a46][0]/104
                      0.0.0.0                           0 i
```

RT3 triggers PW->EVI switchover

3. BGP



3. BGP

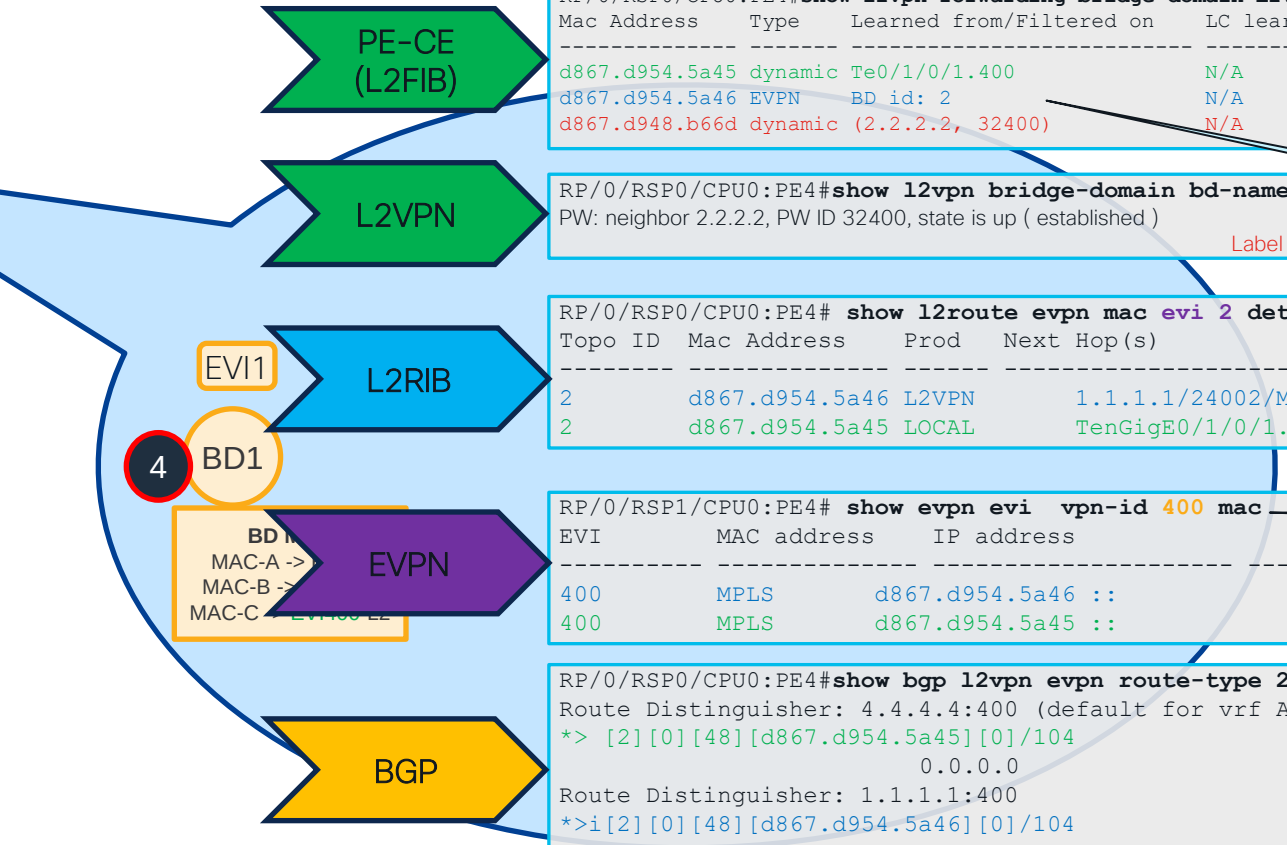



```
RP/0/RSP0/CPU0:PE4#show bgp l2vpn evpn bridge-domain 4000 [2][0][48][d867.d954.5a46][0]/104
BGP routing table entry for [2][0][48][d867.d954.5a46][0]/104, Route Distinguisher: 4.4.4.4:400
Versions:
  Process           bRIB/RIB  SendTblVer
  Speaker               2383        2383
Last Modified: Jan 28 13:48:36.541 for 01:46:43
Paths: (1 available, best #1)
  Not advertised to any peer
  Path #1: Received by speaker 0
  Not advertised to any peer
  Local
    1.1.1.1 (metric 12) from 4.4.4.4 (1.1.1.1)
      Received Label 24002
      Origin IGP, localpref 100, valid, internal, best, group-best, import-candidate, imported, rib-install
      Received Path ID 0, Local Path ID 1, version 2383
      Extended community: SoO:1.1.1.1:400 0x060e:0000.0000.0190 RT:100:400
      Originator: 1.1.1.1, Cluster list: 4.4.4.4
      EVPN ESI: 0000.0000.0000.0000.0000
      Source AFI: L2VPN EVPN, Source VRF: default, Source Route Distinguisher: 1.1.1.1:400
```

Peer Label

EVPN RT

4. L2VPN/EVPN : MAC Forwarding Tables




```
RP/0/RSP0/CPU0:PE4#show l2vpn forwarding bridge-domain L2VPN:AREA51 mac-address loc 0/1/CPU0
Mac Address    Type    Learned from/Filtered on    LC learned Resync Age/Last Change Mapped to
-------------- ------- --------------------------- ---------- ---------------------- ---------
d867.d954.5a45 dynamic Te0/1/0/1.400               N/A        04 Nov 17:12:23        N/A
d867.d954.5a46 EVPN    BD id: 2                    N/A        N/A                    N/A
d867.d948.b66d dynamic (2.2.2.2, 32400)            N/A        04 Nov 17:12:23        N/A
```

```
RP/0/RSP0/CPU0:PE4#show l2vpn bridge-domain bd-name AREA51 det
PW: neighbor 2.2.2.2, PW ID 32400, state is up ( established )
                                        Label    24011              24011
```

BD ID

```
RP/0/RSP0/CPU0:PE4# show l2route evpn mac evi 2 det
Topo ID  Mac Address    Prod   Next Hop(s)                    Seq No  Flags  Slot    ESI
-------- -------------- ------ ------------------------------ -------- -------    ----
2        d867.d954.5a46 L2VPN      1.1.1.1/24002/ME, N/A      0       BRcv
2        d867.d954.5a45 LOCAL      TenGigE0/1/0/1.400, N/A    0       BLRcv  0/1/CPU0
```

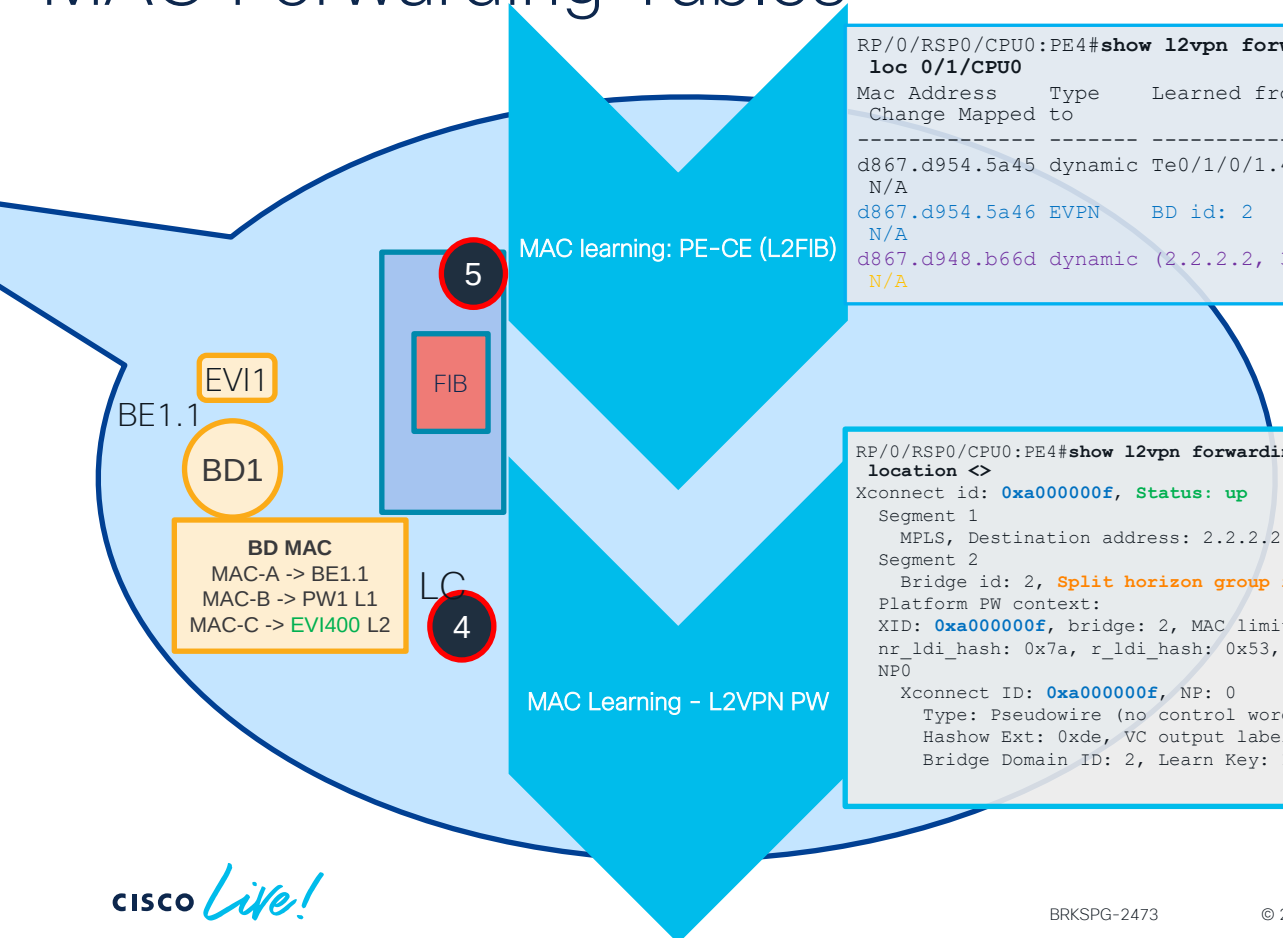
EVI ID

```
RP/0/RSP1/CPU0:PE4# show evpn evi  vpn-id 400 mac
EVI        MAC address    IP address                Nexthop                  Label
---------- -------------- ------------------------- ------------------------
400        MPLS       d867.d954.5a46 ::             1.1.1.1                  24002
400        MPLS       d867.d954.5a45 ::             TenGigE0/1/0/1.400       24005
```

```
RP/0/RSP0/CPU0:PE4#show bgp l2vpn evpn route-type 2
Route Distinguisher: 4.4.4.4:400 (default for vrf AREA51)
*> [2][0][48][d867.d954.5a45][0]/104
                        0.0.0.0                                0 i
Route Distinguisher: 1.1.1.1:400
*>i[2][0][48][d867.d954.5a46][0]/104
                      1.1.1.1                     100        0 i
```

4-5. I2VPN/EVPN : MAC Forwarding Tables

HIDDEN

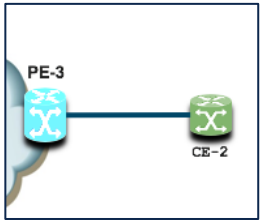



```
RP/0/RSP0/CPU0:PE4#show l2vpn forwarding bridge-domain L2VPN:AREA51 mac-address
 loc 0/1/CPU0
Mac Address    Type    Learned from/Filtered on    LC learned Resync Age/Last
 Change Mapped to
-------------- ------- --------------------------- ---------- ------------------
d867.d954.5a45 dynamic Te0/1/0/1.400               N/A        04 Nov 17:12:23
 N/A
d867.d954.5a46 EVPN    BD id: 2                    N/A        N/A
 N/A
d867.d948.b66d dynamic (2.2.2.2, 32400)            N/A        04 Nov 17:12:23
 N/A
```

XID and SHG match between SW and HW

```
RP/0/RSP0/CPU0:PE4#show l2vpn forwarding neighbor 2.2.2.2 pw-id 32400 hardware egress det
 location <>
Xconnect id: 0xa000000f, Status: up
  Segment 1
    MPLS, Destination address: 2.2.2.2, pw-id: 32400, status: Bound
  Segment 2
    Bridge id: 2, Split horizon group id: 1
  Platform PW context:
  XID: 0xa000000f, bridge: 2, MAC limit: 2000, l2vpn ldi index: 1, vc label: 24011,
  nr_ldi_hash: 0x7a, r_ldi_hash: 0x53, lag_hash: 0x42, hash_ext: 0xde, SHG: VFI Enabled
  NP0
    Xconnect ID: 0xa000000f, NP: 0
      Type: Pseudowire (no control word)
      Hashow Ext: 0xde, VC output label: 0x05dcb (24011), LDI: 0x0001, stats ptr: 0x00536cc8
      Bridge Domain ID: 2, Learn Key: 12, MAC Cntr ID: 0xec2174, SHG: 1
```

What can go wrong?!

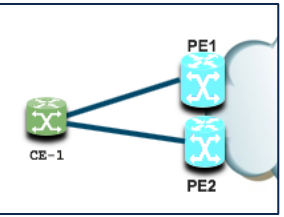



```
RP/0/RSP1/CPU0:PE-3# show l2vpn for  bridge-domain XG-POD1:XC-POD1-EVPN mac loc 0/6/cpu0
Mac Address    Type    Learned from/Filtered on    LC learned Resync Age/Last Change  Mapped to
-------------- ------- --------------------------- ---------- ------------------ -----------
cccc.cccc.cccc dynamic Gi0/6/0/3.20                    N/A        16 Sep 13:02:07        N/A
RP/0/RSP1/CPU0:PE-3#
```

Missing remote MAC in l2fib

```
RP/0/RSP1/CPU0:PE-3# show bgp l2vpn evpn rd 5.5.5.5:2000 route-type 2 | i aaaa.aaaa.aaaa
RP/0/RSP1/CPU0:PE-3#
```

Same in l2rib/evpn/BGP




```
RP/0/RSP0/CPU0:PE1# show l2vpn forwarding bridge-domain EVPN:2000 mac loc 0/0/CPU0
Mac Address    Type    Learned from/Filtered on    LC learned Resync Age/Last Change  Mapped to
-------------- ------- --------------------------- ---------- ------------------ -----------
---
cccc.cccc.cccc EVPN    BD id: 10000                N/A        N/A                    N/A
aaaa.aaaa.aaaa dynamic BE1                         N/A        09 Jan 20:29:52        N/A
```

MAC is present in l2fib

```
RP/0/RSP0/CPU0:PE1# show evpn evi mac
EVI        MAC address    IP address                                Nexthop                                  Label
---------- -------------- ----------------------------------------- ---------------------------------------- --------
2000        cccc.cccc.cccc::                                         4.4.4.4                                  24025
```

But missing in EVPN

```
RP/0/RSP0/CPU0:PE1# show run evpn
evpn
 evi 100
 !
 interface Bundle-Ether1
```

Missing “advertise-mac”

4. I2VPN/EVPN : BUM/SHG

```
RP/0/RSP0/CPU0:PE4#show l2vpn forwarding bridge-domain L2VPN:AREA51 evpn inclusive-multicast det loc 0/1/CPU0
Mon Nov  7 14:47:03.589 EDT
Bridge-Domain Name               BD-ID  XCID       TEP-id     Next Hop             Label/VNI  Encap    Status  E-Tree
-------------------------------- ------ ---------- ---------- -------------------- ---------- -------- ------- ------
L2VPN:AREA51                     2      0x80000009
   Status: bound
   Flags: default multicast replication
                                                   0xffffffff 1.1.1.1              24003      10       bound   Root
```

```
RP/0/RSP0/CPU0:PE4#show evpn evi vpn-id 400 inclusive-multicast det
Mon Nov  7 14:50:24.751 EDT

VPN-ID     Encap  EtherTag   Originating IP
---------- ------ ---------- ---------------------------------------
400        MPLS   0          1.1.1.1
    TEPid  : 0xffffffff
    PMSI Type: 6
    Nexthop: 1.1.1.1
    Label  : 24003
    SR-TE Info: N/A
    Source : Remote
    E-Tree : Root
400        MPLS   0          4.4.4.4
    TEPid  : 0xffffffff
    PMSI Type: 6
    Nexthop: ::
    Label  : 24006
    SR-TE Info: N/A
    Source : Local
    E-Tree : Root
```

EVI1

BD1

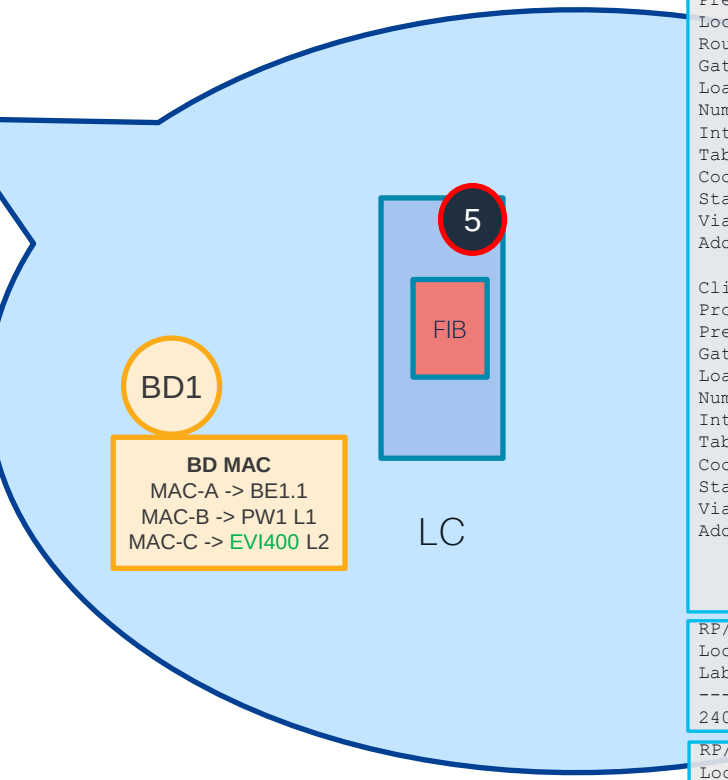
BD MAC
MAC-A -> BE1.1
MAC-B -> PW1 L1
MAC-C -> EVI400 L2

4

Peer in same ESI

```
RP/0/RSP0/CPU0:PE4#show evpn ethernet-segment esi 0011.1111.1111.1111.1111 det
***SNIP***
 Remote SHG labels : 1
             24008 : nexthop 3.3.3.3
```

5. FIB NextHop




```
RP/0/RSP0/CPU0:PE4#show evpn evi vpn-id 400 neighbor  det
VPN-ID     Encap  Neighbor IP
---------- ------ ----------------------------------------
400        MPLS   1.1.1.1
```

EVPN Nexthop

```
RP/0/RSP0/CPU0:PE4#show cef ext-client det
Client Name       : l2vpn_mgr (comp-id: 0xa27) (0x72702b48)
Protocol          : ipv4
Prefix            : 1.1.1.1 (0x72703000)
Local Label       : 24017
Route Version     : 27
Gateway array     : 7225ba30 (0x40040b8/1)
Loadinfo          : 0 (0x0/0)
Number of notifs  : 2
Interest type     : MPLS reachability notify
Table Id          : 0xe0000000
Cookie Value      : 6c3276706e5f6d67720000000
State             : resolved
Via               : MPLS::24017/0
Added to pend list: Nov 16 11:20:13.495

Client Name       : l2fib_mgr (comp-id: 0x7e6d) (0x72702698)
Protocol          : ipv4
Prefix            : 1.1.1.1 (0x727034b0)
Gateway array     : 7225fab8 (0x40b8/1)
Loadinfo          : 72871300 (0x40c441/1)
Number of notifs  : 2
Interest type     : Per-Prefix registration for EOS0 LDI updates
Table Id          : 0xe0000000
Cookie Value      : 6c326669625f6d67720000000
State             : resolved, cached plat context
Via               : MPLS::24017/0
Added to pend list: Nov 16 11:20:13.495
    Load distribution: 0 (refcount 1)
    Hashow  OK  Interface                 Address
    0       Y   TenGigE0/1/0/0            remote
```

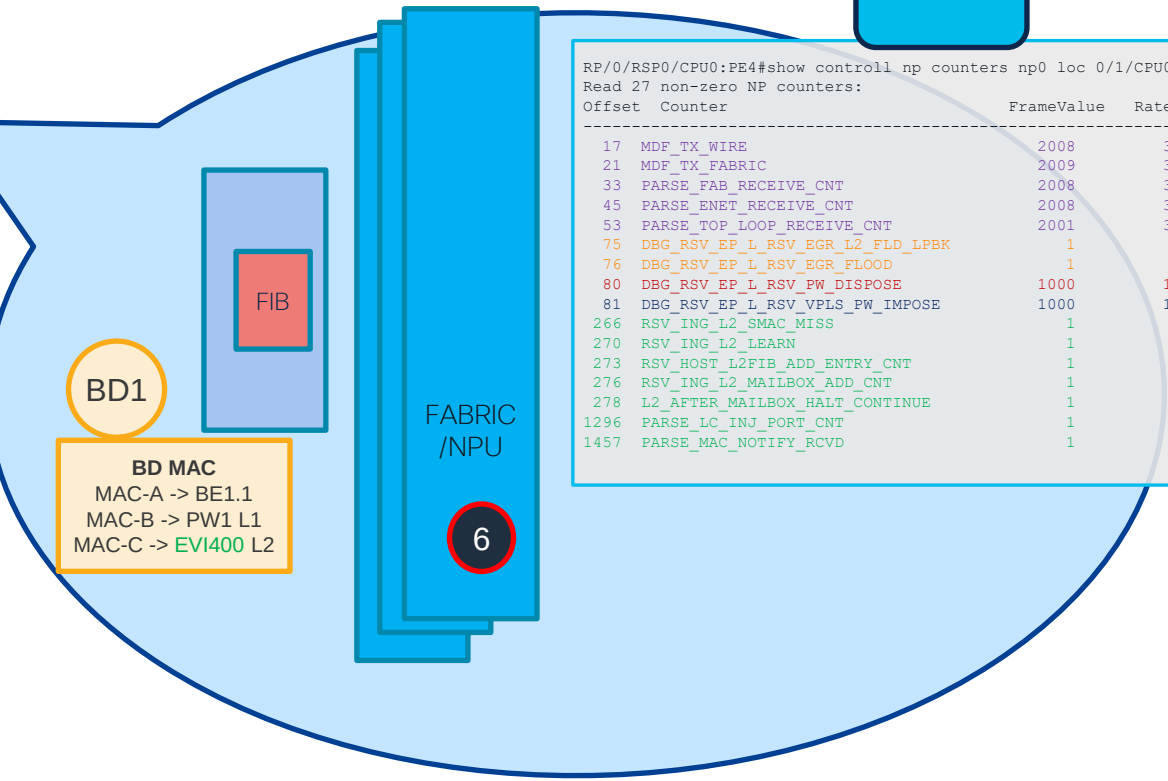
Nexthop Local Label For L2 clients

Corresponding Remote Label

```
RP/0/RSP0/CPU0:PE4#show mpls for labels 24017
Local  Outgoing    Prefix            Outgoing     Next Hop        Bytes
Label  Label       or ID             Interface                    Switched
------ ----------- ----------------- ------------ --------------- ------------
24017  24004       1.1.1.1/32        Te0/1/0/0    192.168.34.4    12093503
```

```
RP/0/RSP0/CPU0:PE4#show mpls for prefix 1.1.1.1/32
Local  Outgoing    Prefix            Outgoing     Next Hop        Bytes
Label  Label       or ID             Interface                    Switched
------ ----------- ----------------- ------------ --------------- ------------
24017  24004       1.1.1.1/32        Te0/1/0/0    192.168.34.4    12092269
```

6. Fabric/NPU data path counters (e.g. ASR9k)



EVPN

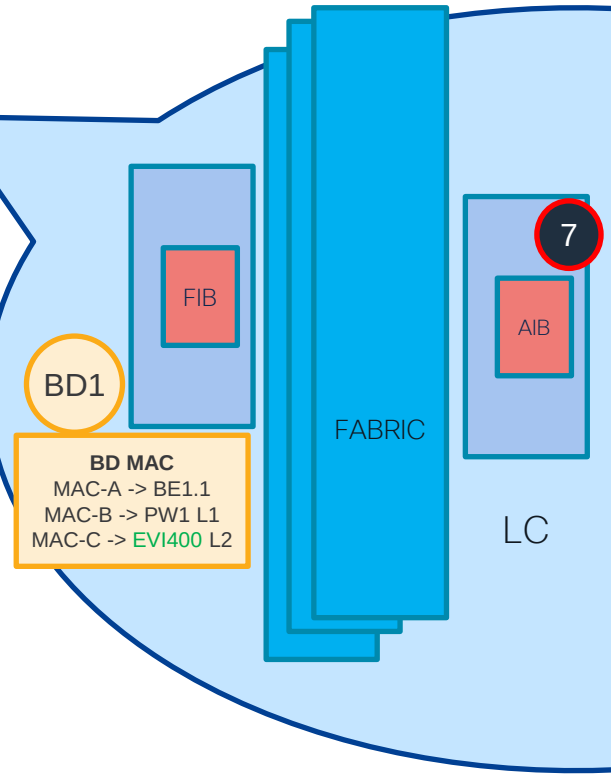
```
RP/0/RSP0/CPU0:PE4#show controll np counters np0 loc 0/1/CPU0
Read 27 non-zero NP counters:
Offset  Counter                                  FrameValue   Rate (pps)
--------------------------------------------------------------------------
  17  MDF_TX_WIRE                                    2008          310
  21  MDF_TX_FABRIC                                  2009          310
  33  PARSE_FAB_RECEIVE_CNT                          2008          310
  45  PARSE_ENET_RECEIVE_CNT                         2008          310
  53  PARSE_TOP_LOOP_RECEIVE_CNT                     2001          308
  75  DBG_RSV_EP_L_RSV_EGR_L2_FLD_LPBK                  1            0
  76  DBG_RSV_EP_L_RSV_EGR_FLOOD                        1            0
  80  DBG_RSV_EP_L_RSV_PW_DISPOSE                    1000          154
  81  DBG_RSV_EP_L_RSV_VPLS_PW_IMPOSE                1000          154
 266  RSV_ING_L2_SMAC_MISS                               1            0
 270  RSV_ING_L2_LEARN                                   1            0
 273  RSV_HOST_L2FIB_ADD_ENTRY_CNT                       1            0
 276  RSV_ING_L2_MAILBOX_ADD_CNT                         1            0
 278  L2_AFTER_MAILBOX_HALT_CONTINUE                     1            0
1296  PARSE_LC_INJ_PORT_CNT                              1            0
1457  PARSE_MAC_NOTIFY_RCVD                              1            0
```

VPLS

```
RP/0/RSP0/CPU0:PE4#show controll np counters np0 loc 0/1/CPU0
Read 27 non-zero NP counters:
Offset  Counter                                  FrameValue   Rate (pps)
--------------------------------------------------------------------------
  17  MDF_TX_WIRE                                    2007          409
  21  MDF_TX_FABRIC                                  2011          409
  33  PARSE_FAB_RECEIVE_CNT                          2008          409
  45  PARSE_ENET_RECEIVE_CNT                         2009          409
  53  PARSE_TOP_LOOP_RECEIVE_CNT                     2001          407
  75  DBG_RSV_EP_L_RSV_EGR_L2_FLD_LPBK                  1            0
  76  DBG_RSV_EP_L_RSV_EGR_FLOOD                        1            0
  80  DBG_RSV_EP_L_RSV_PW_DISPOSE                    1000          204
  81  DBG_RSV_EP_L_RSV_VPLS_PW_IMPOSE                1000          204
 266  RSV_ING_L2_SMAC_MISS                               2            0
 270  RSV_ING_L2_LEARN                                   2            0
 273  RSV_HOST_L2FIB_ADD_ENTRY_CNT                       1            0
 276  RSV_ING_L2_MAILBOX_ADD_CNT                         1            0
 278  L2_AFTER_MAILBOX_HALT_CONTINUE                     1            0
1296  PARSE_LC_INJ_PORT_CNT                              1            0
1457  PARSE_MAC_NOTIFY_RCVD                              2            0
```

- To/From ICMP echo
- 1st packet BUM
- Received from Core
- Received from AC
- SMAC Learning

7. Tx Adjacency



Recursive Nextop for EVPN Nexthop

```
RP/0/RSP0/CPU0:PE4#show cef 1.1.1.1 [hardware] [loc <>]
1.1.1.1/32, version 27, internal 0x1000001 0x0 (ptr 0x723e0cd0) [1], 0x0 (0x723a749c)…
 Updated Nov 16 11:20:06.532
 remote adjacency to TenGigE0/1/0/0
 Prefix Len 32, traffic index 0, precedence n/a, priority 3
   via 192.168.34.4/32, TenGigE0/1/0/0, 10 dependencies, weight 0, class 0 [flags 0x0]
    path-idx 0 NHID 0x0 [0x72d326e0 0x0]
    next hop 192.168.34.4/32
    remote adjacency
     local label 24017      labels imposed {24004}
```

Hardware Adjacency

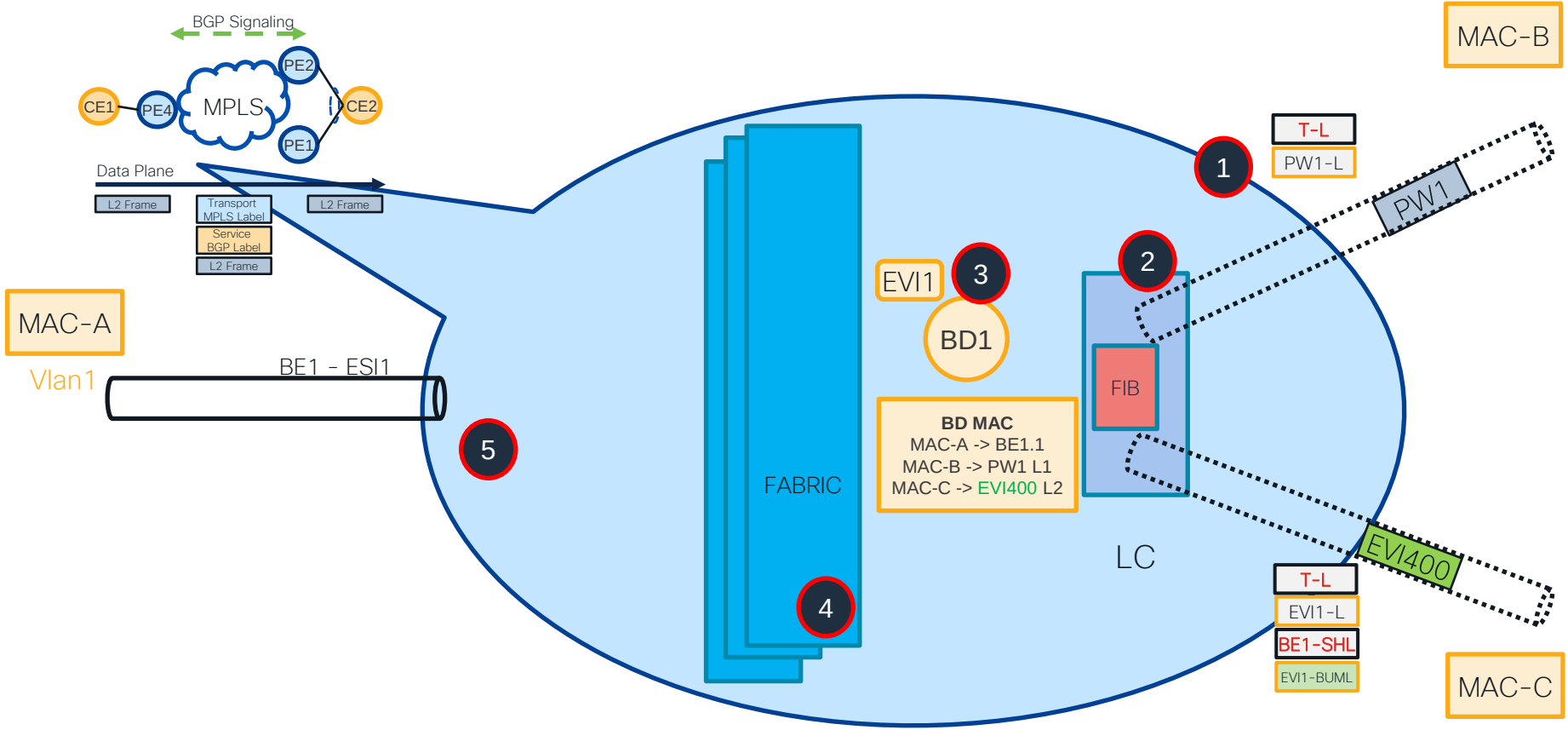
```
RP/0/RSP0/CPU0:PE4#show adjacency TenGigE0/1/0/0 detail [loc <>]
------------------------------------------------------------------------------
0/1/CPU0
------------------------------------------------------------------------------
Interface                  Address                 Version  Refcount Protocol
Te0/1/0/0                   192.168.34.4              3232        2(    0) mpls
                           d867d9545a4400022bde5a4508847
                           mtu: 1500, flags 1 0
                           0 packets, 0 bytes
Te0/1/0/0                   192.168.34.4              3231        2(    0) ipv4
                           d867d9545a4400022bde5a4500800
                           mtu: 1500, flags 1 0
                           0 packets, 0 bytes
```

Adjacency matches RP

```
RP/0/RSP0/CPU0:PE4#show arp 192.168.34.4
------------------------------------------------------------------------------
0/1/CPU0
------------------------------------------------------------------------------
Address         Age        Hardware Addr   State      Type  Interface
192.168.34.4    01:19:39   d867.d954.5a44  Dynamic    ARPA  TenGigE0/1/0/0
```

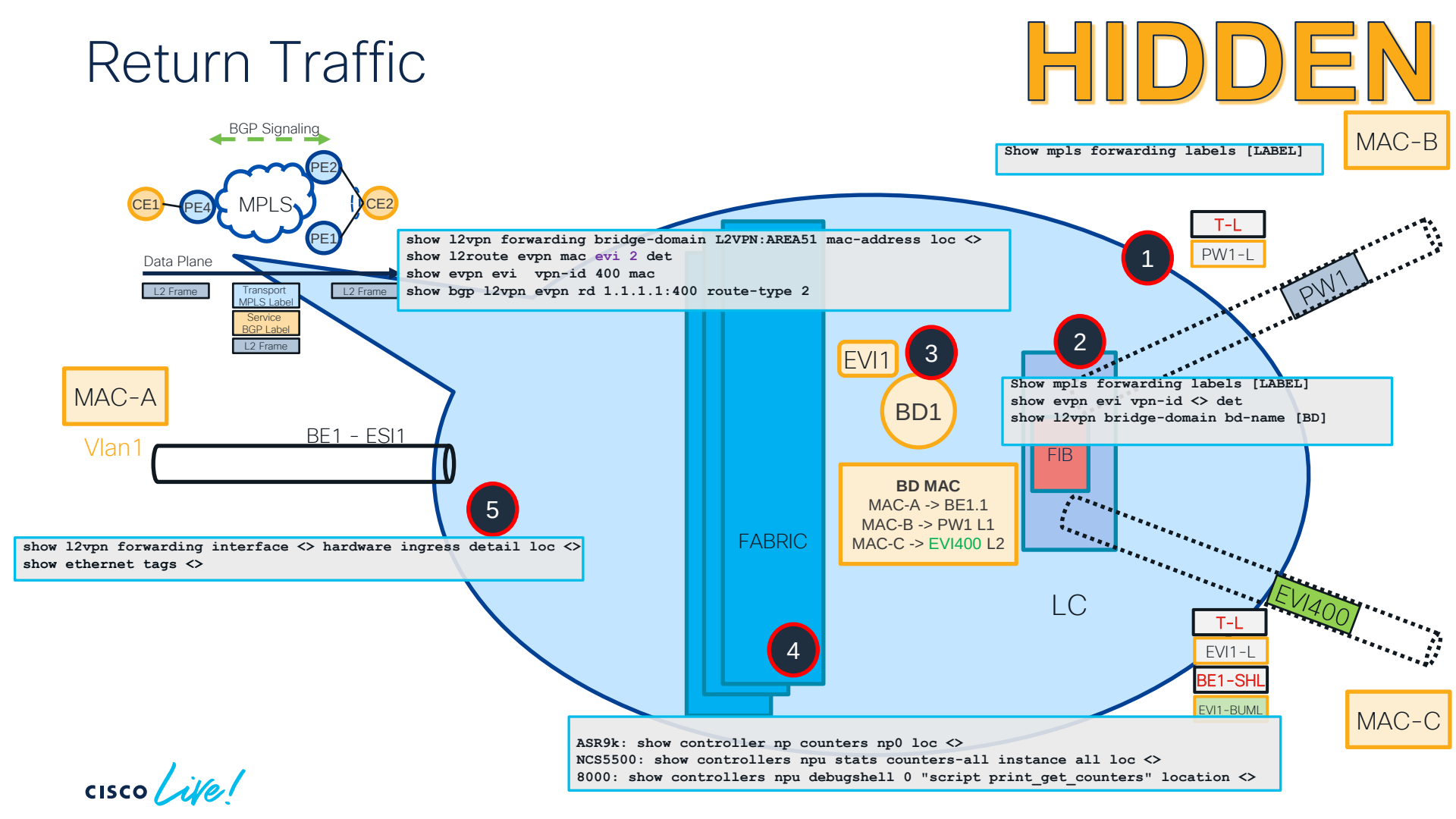
Return Traffic

HIDDEN



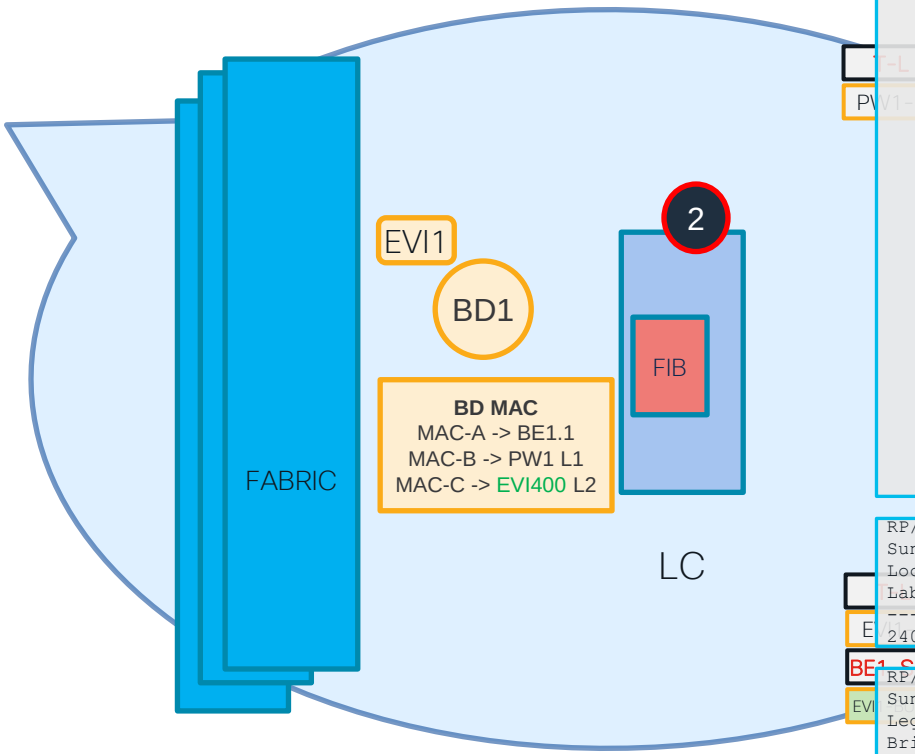
Return Traffic

HIDDEN



2. Service Label

HIDDEN




```
RP/0/RSP0/CPU0:PE4#show evpn evi vpn-id 400 det
VPN-ID     Encap      Bridge Domain                 Type
---------- ---------- ----------------------------- ----------
400        MPLS       AREA51                        EVPN
   Stitching: Regular
   Unicast Label  : 24005
   Multicast Label: 24006
   Flow Label: N
   Control-Word: Enabled
   E-Tree: Root
   Forward-class: 0
   Advertise MACs: Yes
   Advertise BVI MACs: No
   Aliasing: Enabled
   UUF: Enabled
   Re-origination: Enabled
   Multicast source connected: No
   BGP Implicit Import: Enabled
   VRF Name:
   Preferred Nexthop Mode: Off
   RD Config: none
   RD Auto  : (auto) 4.4.4.4:400
   RT Auto  : 100:400
   Route Targets in Use           Type
   ------------------------------ --------------------
   100:400                        Import
   100:400                        Export
```

Local Label programmed

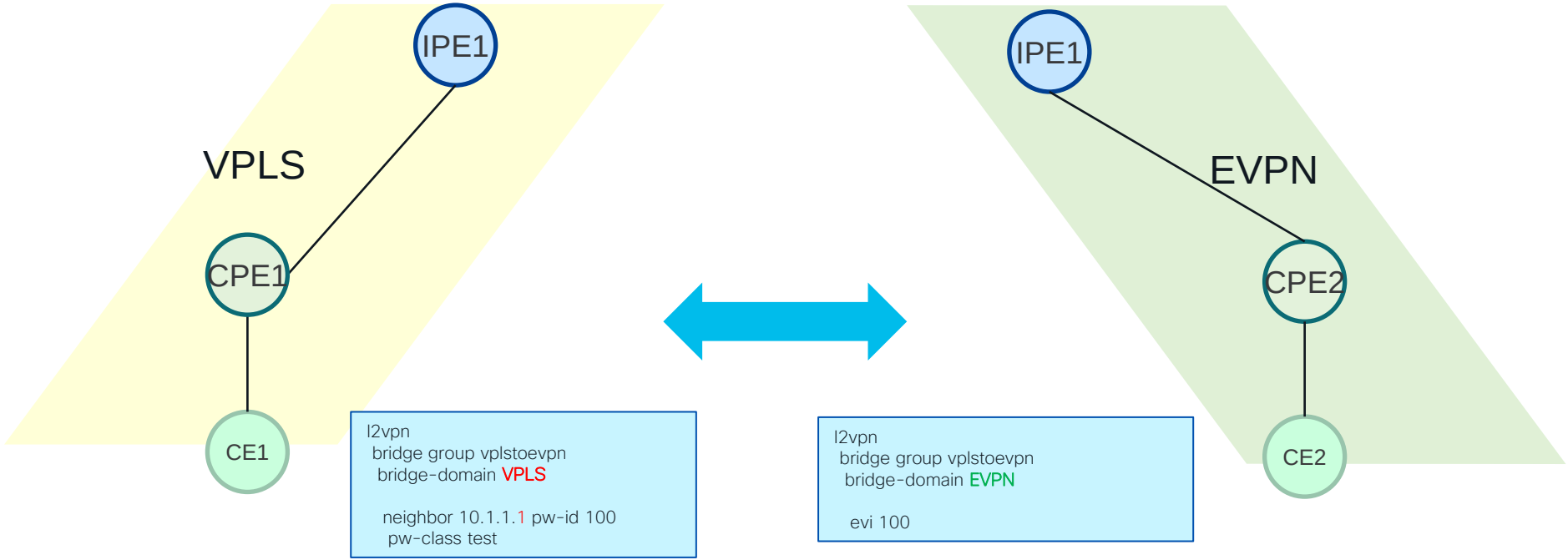
```
RP/0/RSP0/CPU0:PE4#show mpls for labels  24005
Sun Nov 28 12:33:46.925 EDT
Local  Outgoing    Prefix             Outgoing        Next Hop        Bytes
Label  Label       or ID              Interface                       Switched
------ ----------- ------------------ ------------ --------------- ------------
24005  Pop         EVPN:400 U         BD=2 E       point2point     325130
```

Local Label associated with BD

```
RP/0/RSP0/CPU0:PE4#show l2vpn bridge-domain bd-name AREA51
Sun Nov 28 12:36:09.375 EDT
Legend: pp = Partially Programmed.
Bridge group: L2VPN, bridge-domain: AREA51, id: 2, state: up, ShgId: 0, MSTi: 0
```

EVPN Interconnect

Isolated L2VPN and EVPN Domains



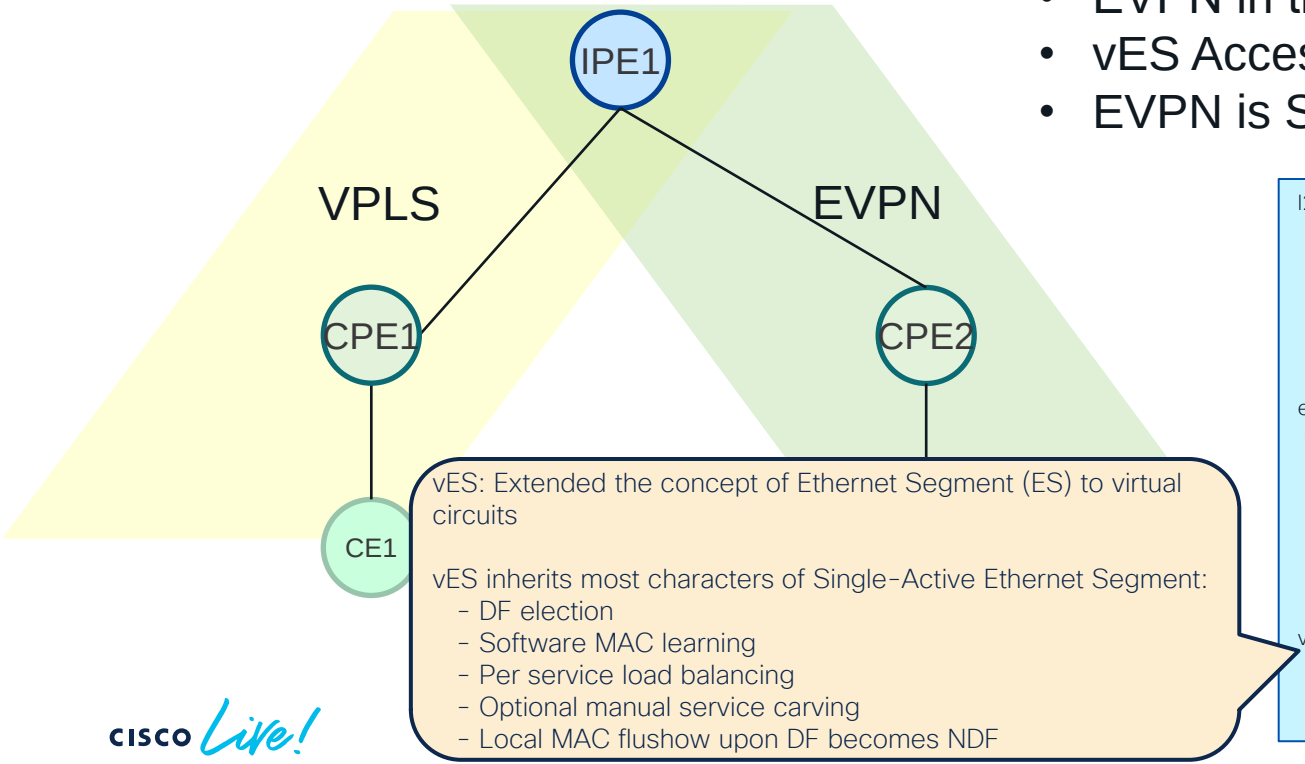
L2VPN & EVPN Interworking

Configure:

- VPLS on CPE1/IPE1
- EVPN on CPE2//IPE1

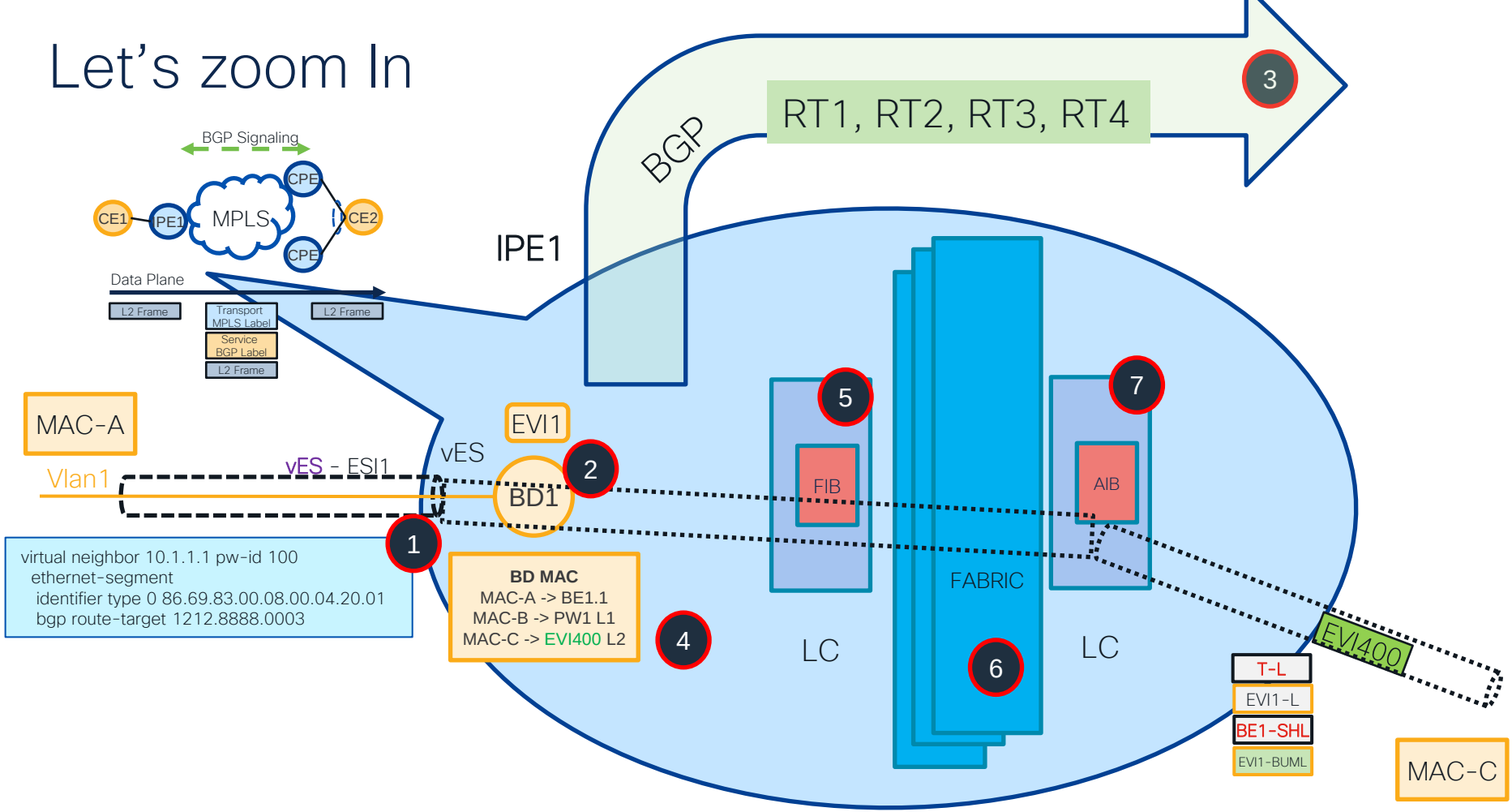
Specifics:

- EVPN in the “Core”
- vES Access PW (or Access VFI)
- EVPN is SHG1, vES VPLS is SHG0

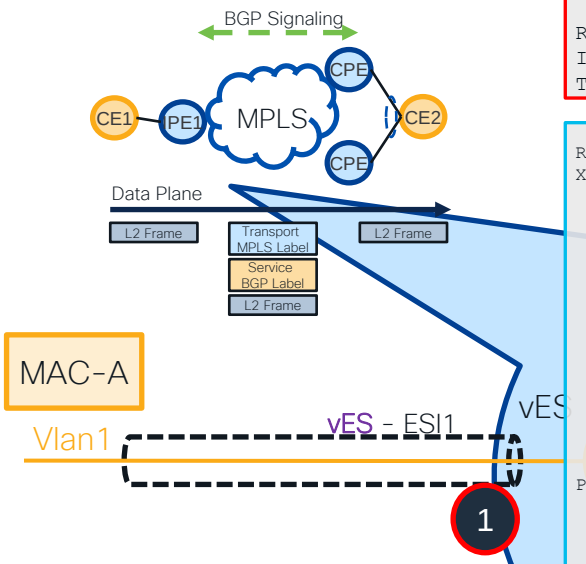



```
l2vpn
 bridge group vplstoevpn
  bridge-domain vplstoevpn
   neighbor 10.1.1.1 pw-id 100
    pw-class test
   !
   evi 100

evpn
 evi 100
  bgp
   route-target import 100:100
   route-target export 100:100
  !
  control-word-disable
  advertise-mac
  !
virtual neighbor 10.1.1.1 pw-id 100
  ethernet-segment
   identifier type 0 86.69.83.00.08.00.04.20.01
   bgp route-target 1212.8888.0003
```

Let's zoom In



1. L2 Ingress Interface




```
RP/0/RSP0/CPU0:IPE1#show ethernet tags TenGigE0/1/0/1.400
Interface                  St   MTU  Ly Outer            Inner            Xtra -,+
Te0/1/0/1.400              Up   1518 L2 .1Q:400          -                -    1 0
```

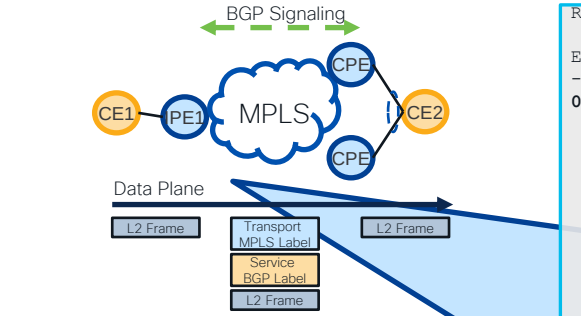
```
RP/0/RSP0/CPU0:IPE1#show l2vpn forwarding neighbor 1.1.1.1 pw-id 31 hardware egress det location <>
Xconnect id: 0xa000000b, Status: up
  Segment 1
    MPLS, Destination address: 1.1.1.1, pw-id: 31, status: Bound
    Pseudowire label: 24010
    Control word disabled
    Statistics:
      packets: received 2000 (unicast 1643), sent 4006
      bytes: received 228000 (unicast 187302), sent 464748
      MAC move: 0
      packets dropped: PLU 0, tail 0, out of order 0
      bytes dropped: PLU 0, tail 0, out of order 0
  Segment 2
    Bridge id: 1, Split horizon group id: 0
Platform PW context:
  Egress PW: VPLS, State: Bound
  XID: 0xa000000b, bridge: 1, MAC limit: 2000, l2vpn ldi index: 1, vc label: 24010,
  nr_ldi_hash: 0x7d, r_ldi_hash: 0xd3, lag_hash: 0x35, hash_ext: 0x48, SHG: None
    Flags: MAC Limit Port Level, EVPN Local Multi-home, vES spoke PW
    actns - last: Oct 15 23:49:53.1230, bind/unbind: May 21 12:50:41.2001
  Trident Layer Flags: None
  NP0
    Xconnect ID: 0xa000000b, NP: 0
      Type: Pseudowire (no control word)
      Flags: Learn enable, Type 5, VPLS, CP Learning
      VC label hash, nR-LDI Hash: 0x7d, R-LDI Hash: 0x1a, LAG Hash: 0x35,
      Hashow Ext: 0x48, VC output label: 0x05dca (24010), LDI: 0x0001, stats ptr: 0x00536c8c,
      ESI: 24025
      Bridge Domain ID: 1, Learn Key: 8, MAC Cntr ID: 0xec216c
```

XID, Bridge port and Label programmed.

SHG 0

Virtual Ethernet Segment

1. L2 Ingress Interface

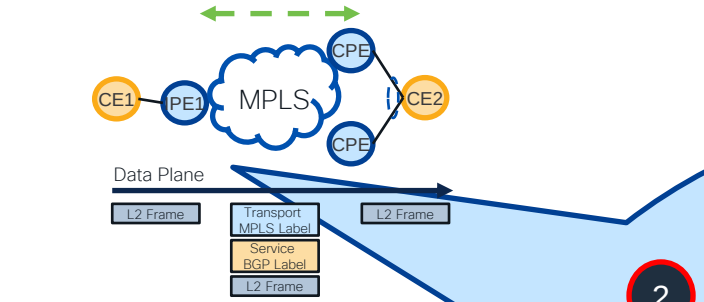


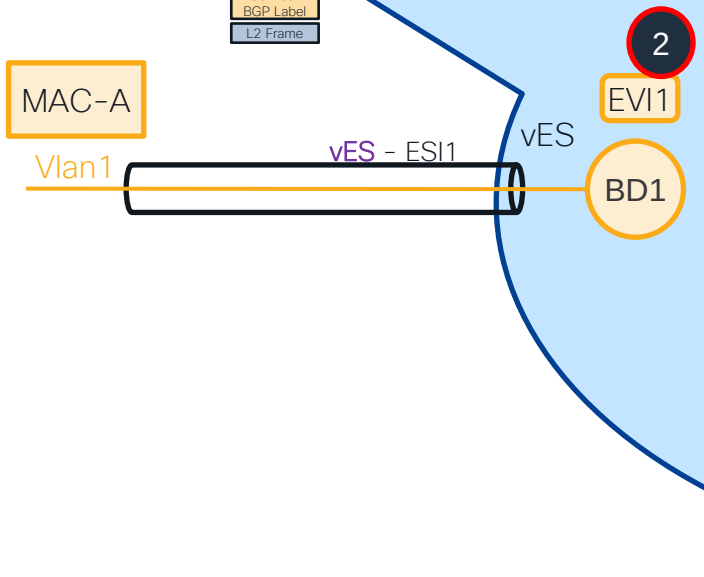

```
RP/0/RSP0/CPU0:IPE1#sh evpn ethernet-segment detail

Ethernet Segment Id      Interface                          Nexthops
------------------------ ---------------------------------- --------------------
0011.1111.1111.1111.1133 PW:1.1.1.1,31                      3.3.3.3
  ES to BGP Gates   : Ready
  ES to L2FIB Gates : Ready
  Virtual Access    :
     Name           : PW_1.1.1.1_31
     State          : Up
     Num PW Up      : 1
  ESI type          : 0
     Value          : 11.1111.1111.1111.1133
  ES Import RT      : 1111.1111.1111 (from ESI)
  Source MAC        : 0000.0000.0000 (N/A)
  Topology          :
     Operational    : SH
     Configured     : Single-active (AApS) (default)
  Service Carving   : Auto-selection
     Multicast      : Disabled
  Peering Details   :
     3.3.3.3 [MOD:P:00]

  Service Carving Results:
     Forwarders     : 1
     Elected        : 1
     Not Elected    : 0
  EVPN-VPWS Service Carving Results:
     Primary        : 0
     Backup         : 0
     Non-DF         : 0
  MAC Flushing mode : Invalid
  Peering timer     : 3 sec [not running]
  Recovery timer    : 30 sec [not running]
  Carving timer     : 0 sec [not running]
  Local SHG label   : 24007
  Remote SHG labels : 0
```

PW bound to ESI

2. Bridge Domain (Zoom In)

L2VPN

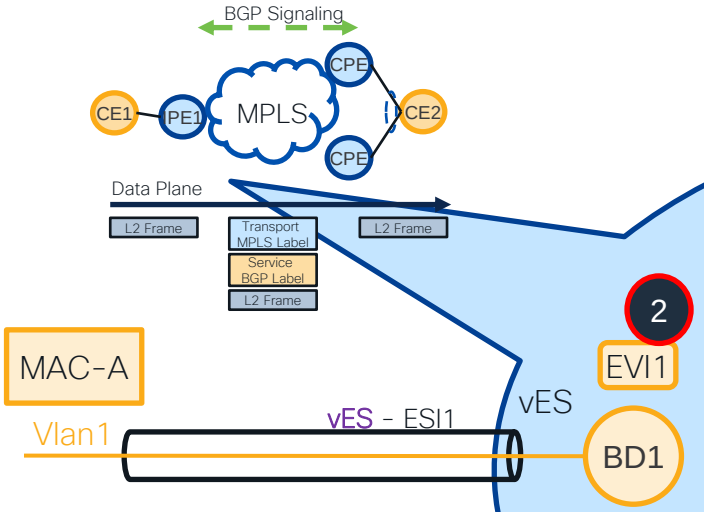





```
RP/0/RSP0/CPU0:IPE1#show l2vpn bridge-domain bd-name 3000 det
Bridge group: L2VPN, bridge-domain: 3000, id: 1, state: up, ShgId: 0, MSTi: 0
**SNIP**
 PW Status TLV in use
        MPLS          Local                          Remote
        ------------  ------------------------------ --------------------------
        Label         24009                          24010
        Group ID      0x1                            0x3
        Interface     Access PW                      Access PW
        MTU           1500                           1500
        Control word  disabled                       disabled
        PW type       Ethernet                       Ethernet
        VCCV CV type  0x2                            0x2
                      (LSP ping verification)        (LSP ping verification)
        VCCV CC type  0x6                            0x6
                      (router alert label)           (router alert label)
                      (TTL expiry)                   (TTL expiry)
        ------------  ------------------------------ --------------------------
```

```
RP/0/RSP0/CPU0:IPE1#show mpls forwarding labels 24009
Local  Outgoing    Prefix            Outgoing     Next Hop        Bytes
Label  Label       or ID             Interface                    Switched
------ ----------- ----------------- ------------ --------------- ------------
24009  Pop         PW(1.1.1.1:31)    BD=1         point2point     946820
```

2. Bridge Domain (Zoom In)



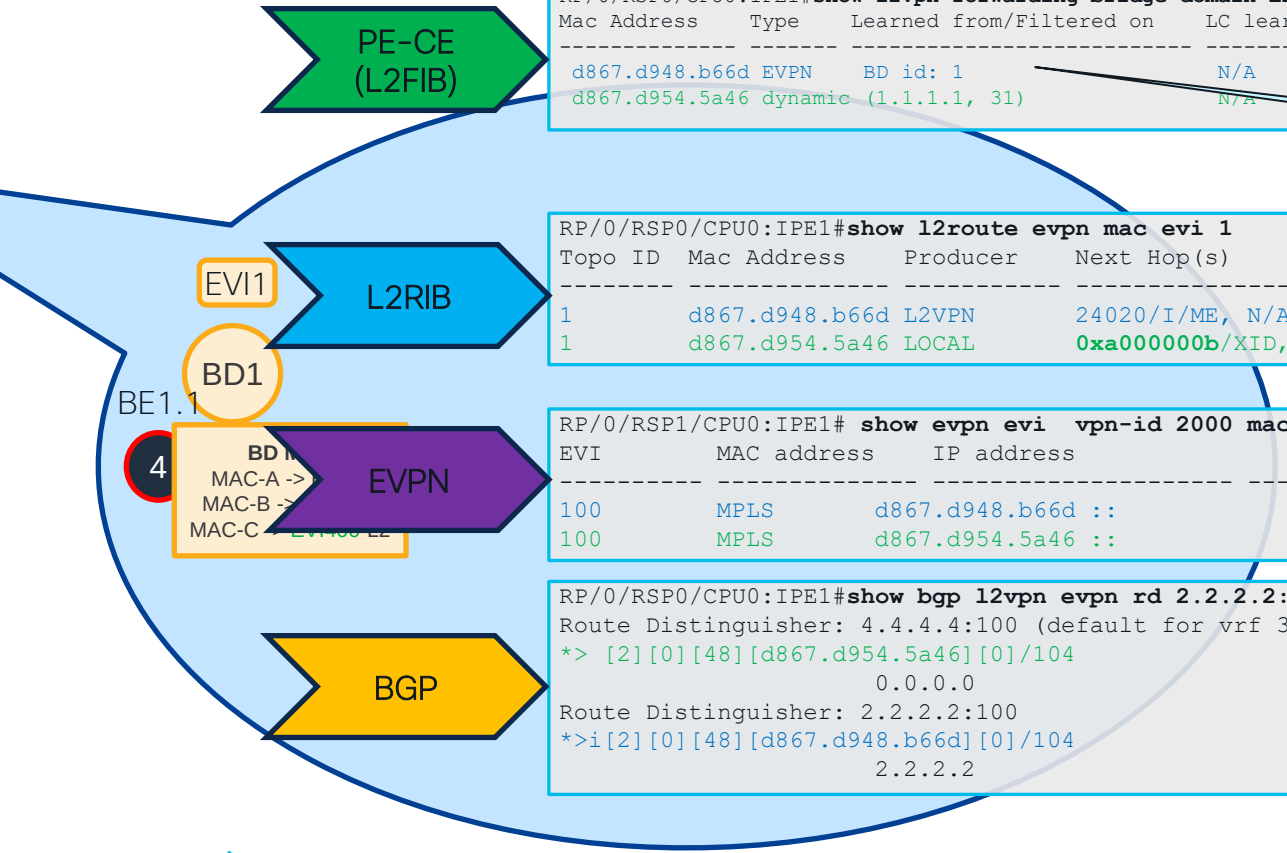

```
RP/0/RSP0/CPU0:IPE1#show l2vpn bridge-domain bd-name 3000
Sun Nov 21 12:16:05.108 EDT
Legend: pp = Partially Programmed.
Bridge group: L2VPN, bridge-domain: 3000, id: 1, state: up, ShgId: 0, MSTi: 0
  Aging: 300 s, MAC limit: 2000, Action: none, Notification: syslog
  Filter MAC addresses: 0
  ACs: 0 (0 up), VFIs: 0, PWs: 1 (1 up), PBBs: 0 (0 up), VNIs: 0 (0 up)
  List of EVPNs:
    EVPN, state: up
  List of ACs:
  List of Access PWs:
      Neighbor 1.1.1.1 pw-id 31, state: up, Static MAC addresses: 0
```

EVPN

```
RP/0/RSP0/CPU0:IPE1#show evpn evi vpn-id 100 nei
Sun Nov 21 12:22:16.545 EDT

VPN-ID     Encap  Neighbor IP
---------- ------ ---------------------------------------
100        MPLS   2.2.2.2
```

```
RP/0/RSP0/CPU0:IPE1#show evpn evi vpn-id 100 det
Sun Nov 21 12:34:41.432 EDT

VPN-ID     Encap      Bridge Domain                 Type
---------- ---------- ----------------------------- --------------------
100        MPLS       3000                          EVPN
   Stitching: Regular
   Unicast Label  : 24003
   Multicast Label: 24004
RD Auto  : (auto) 4.4.4.4:100
   RT Auto  : 100:100
   Route Targets in Use           Type
   ------------------------------ --------------------
   100:100                        Import
   100:100                        Export
```

4. L2VPN/EVPN : MAC Forwarding Tables




```
RP/0/RSP0/CPU0:IPE1#show l2vpn forwarding bridge-domain L2VPN:3000 mac-address loc 0/1/CPU0
Mac Address    Type    Learned from/Filtered on    LC learned Resync Age/Last Change Mapped to
-------------- ------- -------------------------- ---------- ---------------------- ---------
 d867.d948.b66d EVPN    BD id: 1                    N/A        N/A                    N/A
 d867.d954.5a46 dynamic (1.1.1.1, 31)               N/A        21 Nov 12:50:29        N/A
```

BD ID

```
RP/0/RSP0/CPU0:IPE1#show l2route evpn mac evi 1
Topo ID  Mac Address    Producer    Next Hop(s)
-------- -------------- ----------- ---------------------------------------
1        d867.d948.b66d L2VPN       24020/I/ME, N/A
1        d867.d954.5a46 LOCAL       0xa000000b/XID, N/A
```

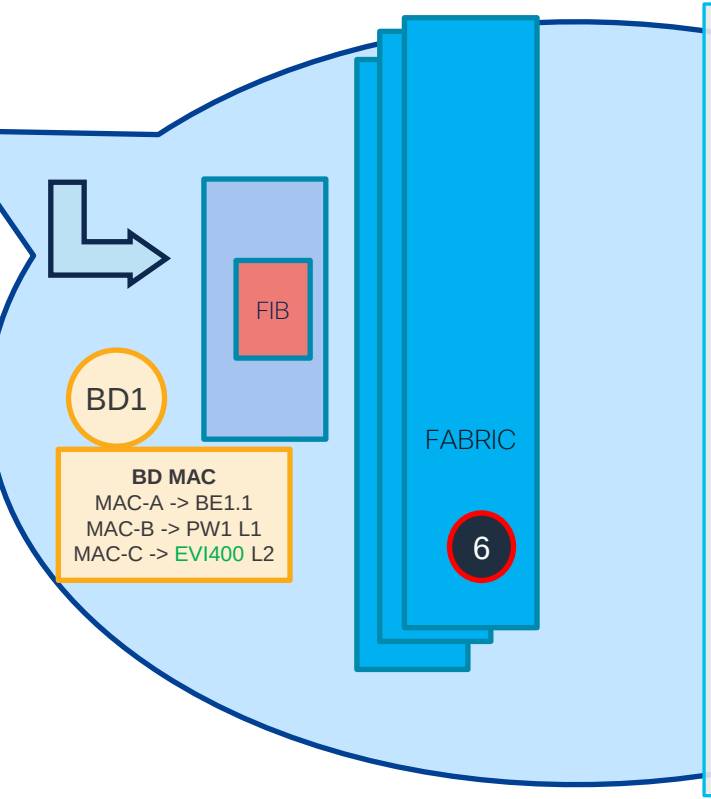
EVI ID

```
RP/0/RSP1/CPU0:IPE1# show evpn evi  vpn-id 2000 mac
EVI        MAC address    IP address                Nexthop                  Label
---------- -------------- ------------------------- -------------------------
100        MPLS       d867.d948.b66d ::             2.2.2.2                  24002
100        MPLS       d867.d954.5a46 ::             PW:1.1.1.1,31            24003
```

```
RP/0/RSP0/CPU0:IPE1#show bgp l2vpn evpn rd 2.2.2.2:100 route-type 2
Route Distinguisher: 4.4.4.4:100 (default for vrf 3000)
*> [2][0][48][d867.d954.5a46][0]/104
                    0.0.0.0                                0 i
Route Distinguisher: 2.2.2.2:100
*>i[2][0][48][d867.d948.b66d][0]/104
                    2.2.2.2                  100       0 i
```

Per-NP data path counters

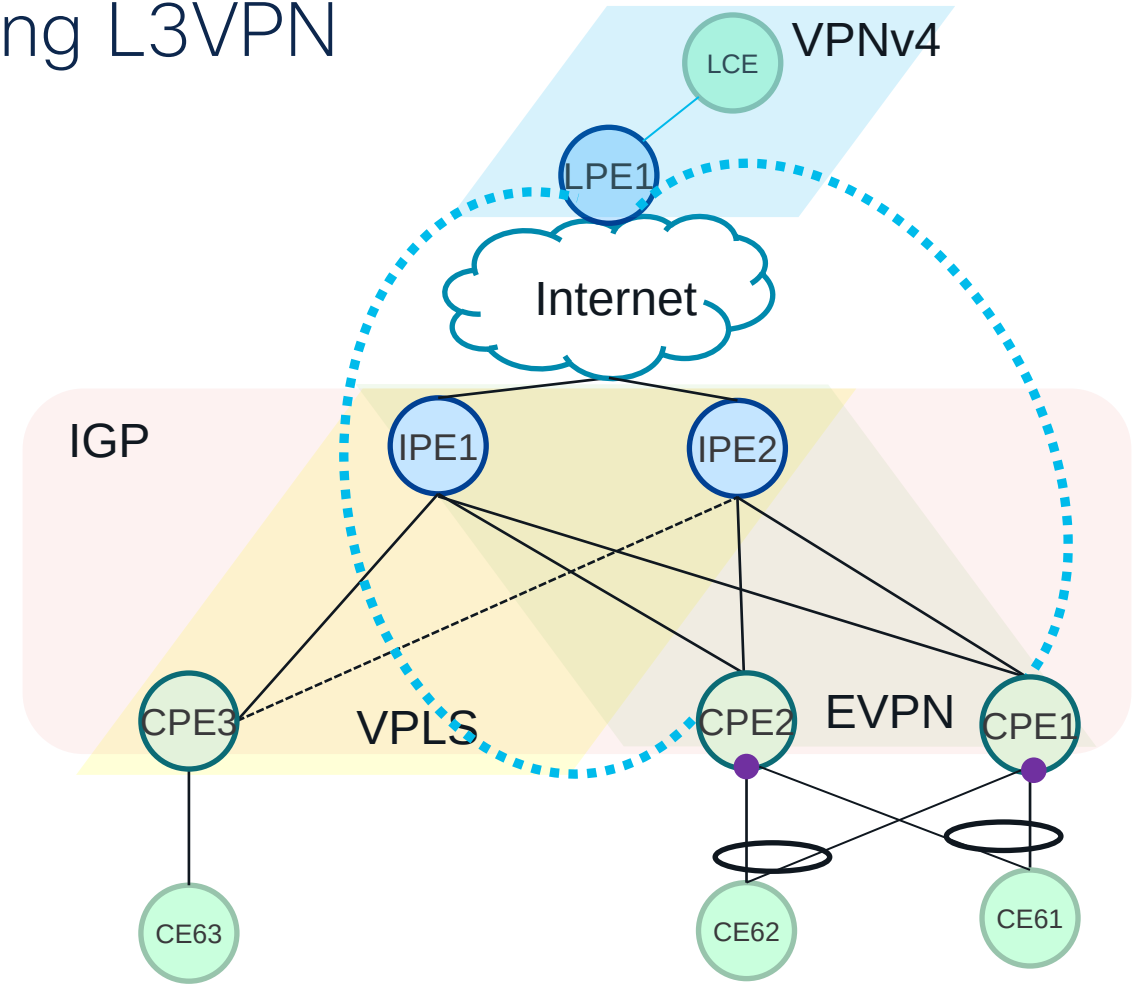
HIDDEN



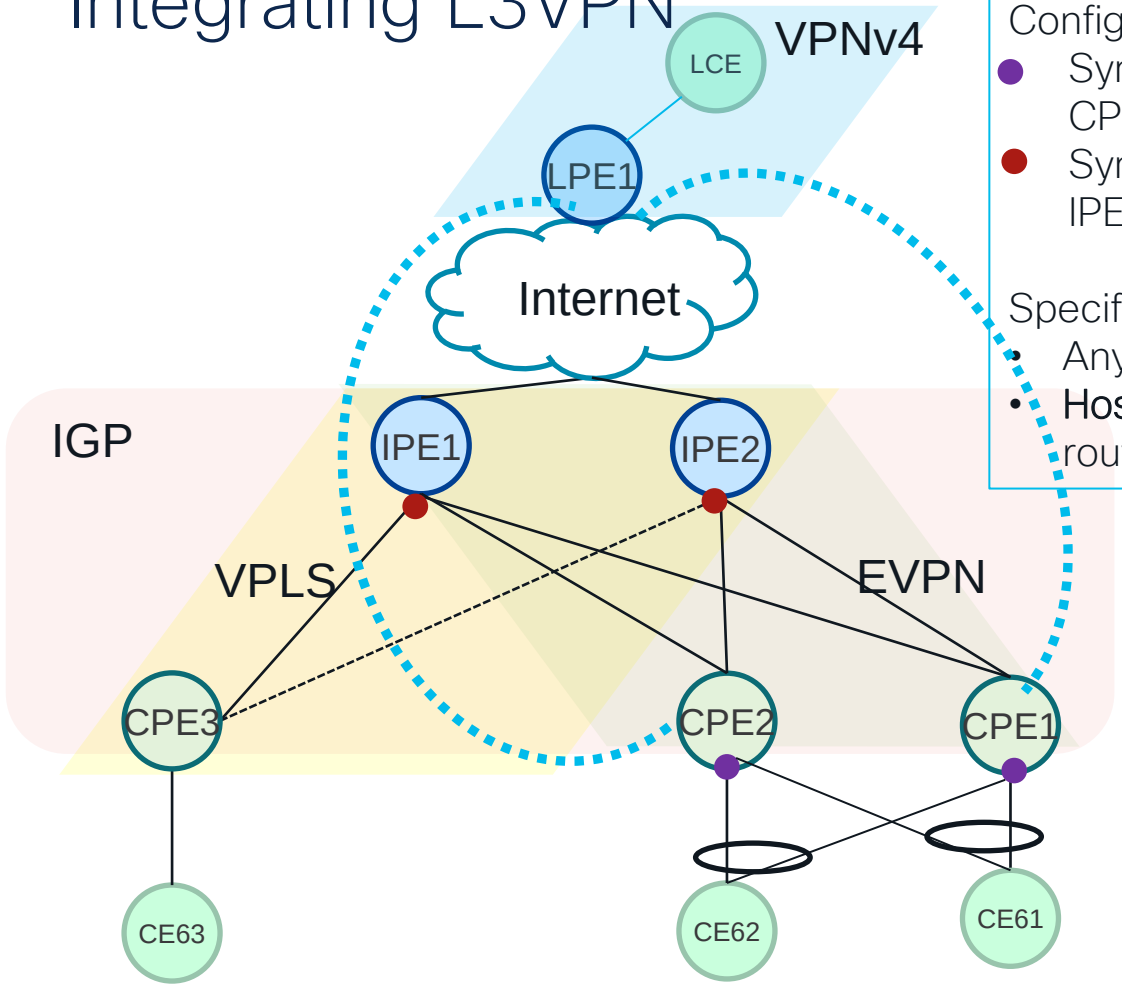

```
RP/0/RSP0/CPU0:IPE1#show controll np counters np0 loc 0/1/CPU0
Sun Nov 21 12:47:34.202 EDT

                Node: 0/1/CPU0:
----------------------------------------------------------------

Show global stats counters for NP0, revision v2

Last clearing of counters for this NP: 00:00:15

Read 31 non-zero NP counters:
Offset  Counter                                                FrameValue   Rate (pps)
--------------------------------------------------------------------------------------
   0  NULL_STAT_0                                                     12           1
  16  MDF_TX_LC_CPU                                                  118           8
  17  MDF_TX_WIRE                                                   2013         131
  21  MDF_TX_FABRIC                                                 2022         132
  33  PARSE_FAB_RECEIVE_CNT                                         2010         131
  37  PARSE_INTR_RECEIVE_CNT                                        7955         518
  45  PARSE_ENET_RECEIVE_CNT                                        2023         132
  53  PARSE_TOP_LOOP_RECEIVE_CNT                                    4000         260
  68  DBG_RSV_EP_L_RSV_ING_PUNT                                      139           9
  80  DBG_RSV_EP_L_RSV_PW_DISPOSE                                   2000         130
  81  DBG_RSV_EP_L_RSV_VPLS_PW_IMPOSE                               2000         130
 371  RSV_MAC_NOTIFY_SRC_NP_FILTER_SKIP                                1           0
 372  RSV_AGE_REFRESH_SEND_CNT                                         1           0
 524  MDF_PIPE_LPBK                                                 4000         260
```

EVPN/L3VPN Integration (IRB use case)

Integrating L3VPN



Integrating L3VPN



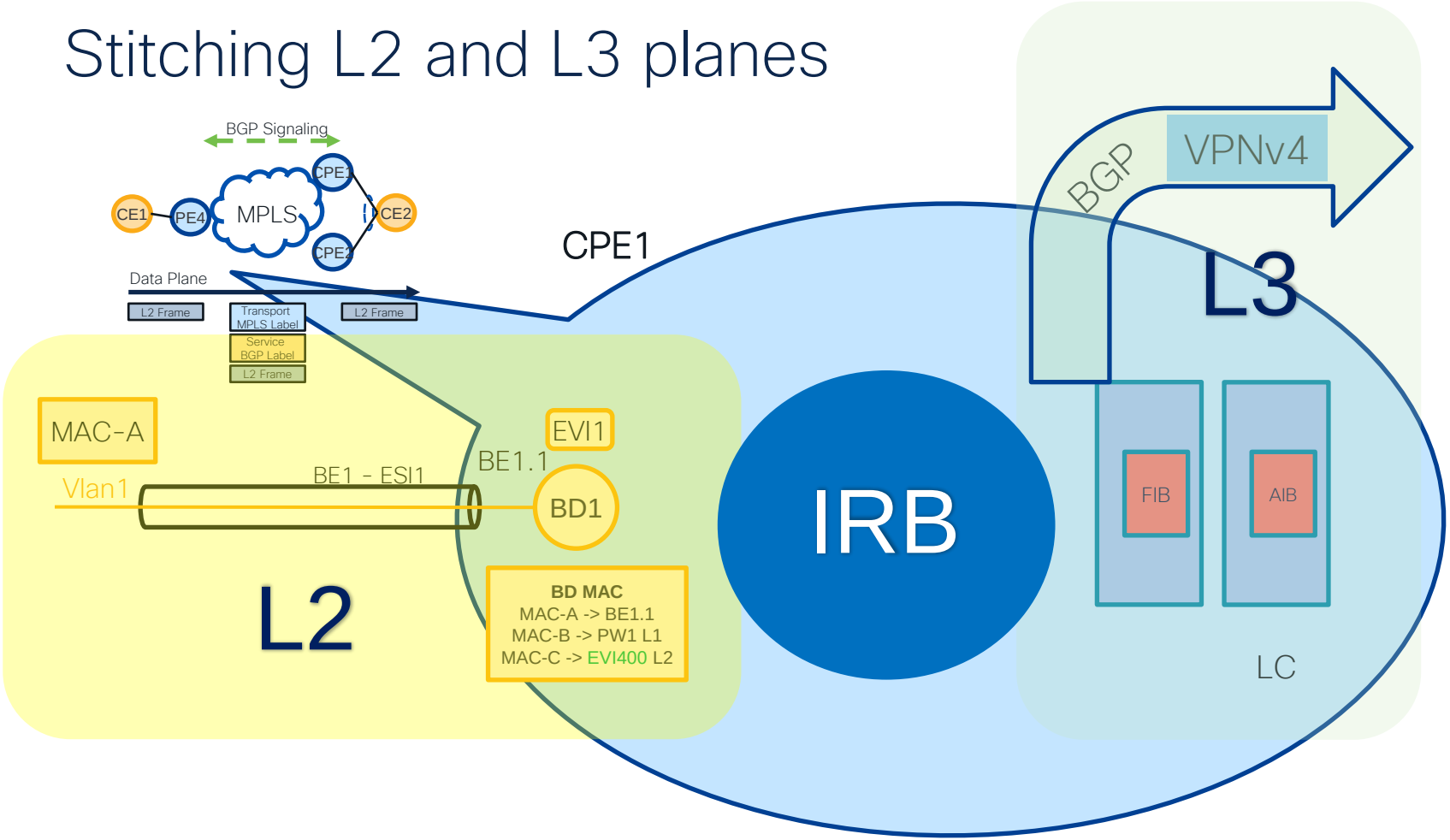
Configure:

- Symmetric Distributed Anycast IRB on CPE2/CPE1 to serve EVPN
- Symmetric Distributed Anycast IRB on IPE1/IPE2 to serve VPLS

Specifics:

- Anycast IRB
- **Host Routing** to add vpnv4 RT to EVPN routes

Stitching L2 and L3 planes



EVPN Configuration – IRB Distributed Gateway

```
cef adjacency route override rib

evpn
 evi 100
 bvi-couple-mode

vrf a
 address-family ipv4 unicast
 import route-target
  100:100
 export route-target
  100:100

interface BVI100
 host-routing
 vrf a
 ipv4 address 192.168.1.1 255.255.255.0
 mac-address 3637.3637.3637
!
router bgp 100
 address-family l2vpn evpn
  bgp implicit-import

 vrf a
  address-family ipv4 unicast
   redistribute connected
```

prefers adjacency /32 (ARP) route over RIB
IOS-XR 6.0+ AIB has the lowest priority by default (LSD>RIB>AIB)
After 7.3.1 – dynamically set

By default, BVI goes down if AC Down. We can make BVI EVPN aware to keep it up if EVI configured even when AC down.

MAC/IP RT2 into VPNv4

adds VPNv4 export RT to MAC-IP RT2. Router will import VPNv4 /32 route based on the presence of this RT.

Anycast Distributed IRB: Same IP and MAC IPE1/IPE2

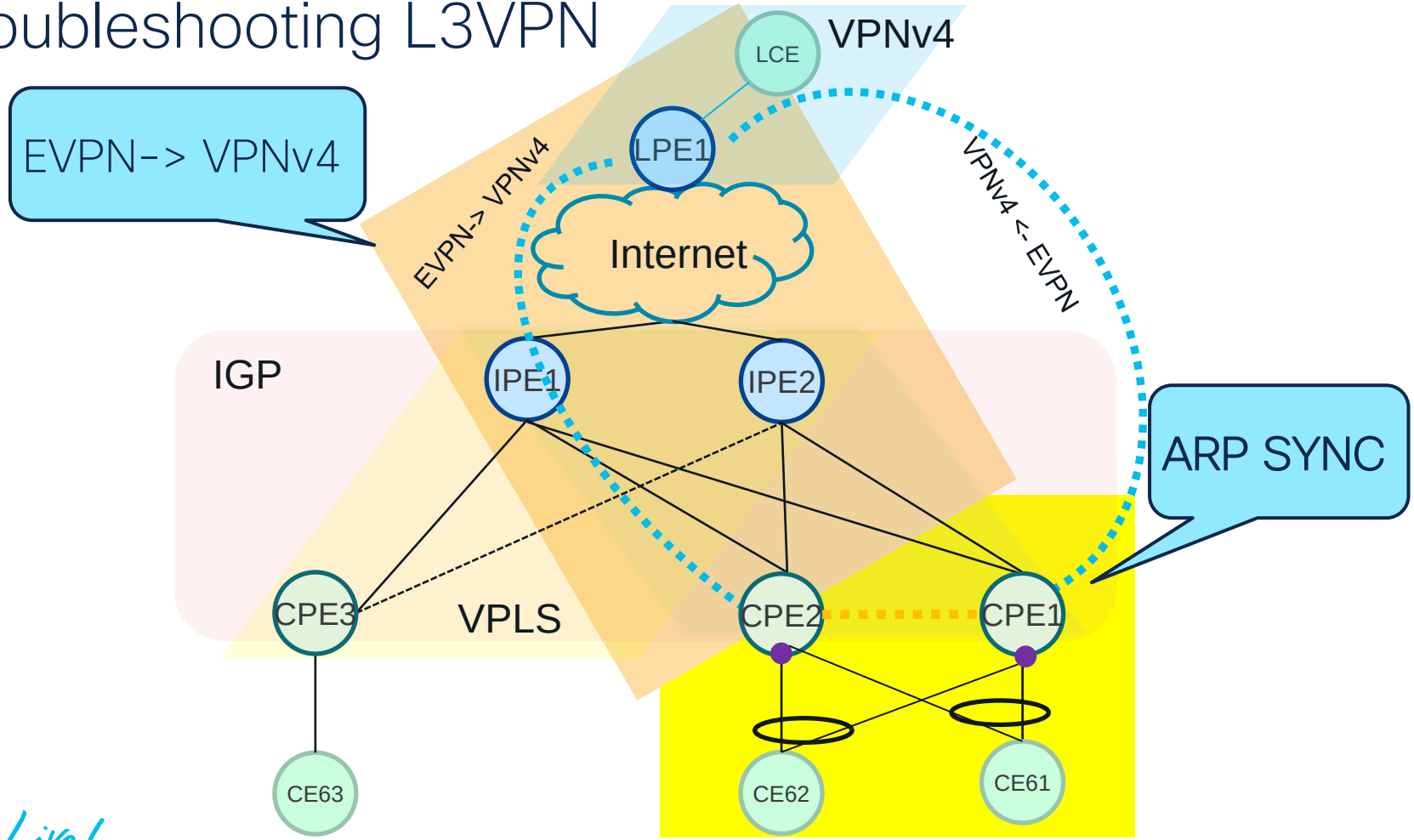
Import BVI routes to GRT/VRF based on EVPN RT

Generate L3VPN Label for EVPN route

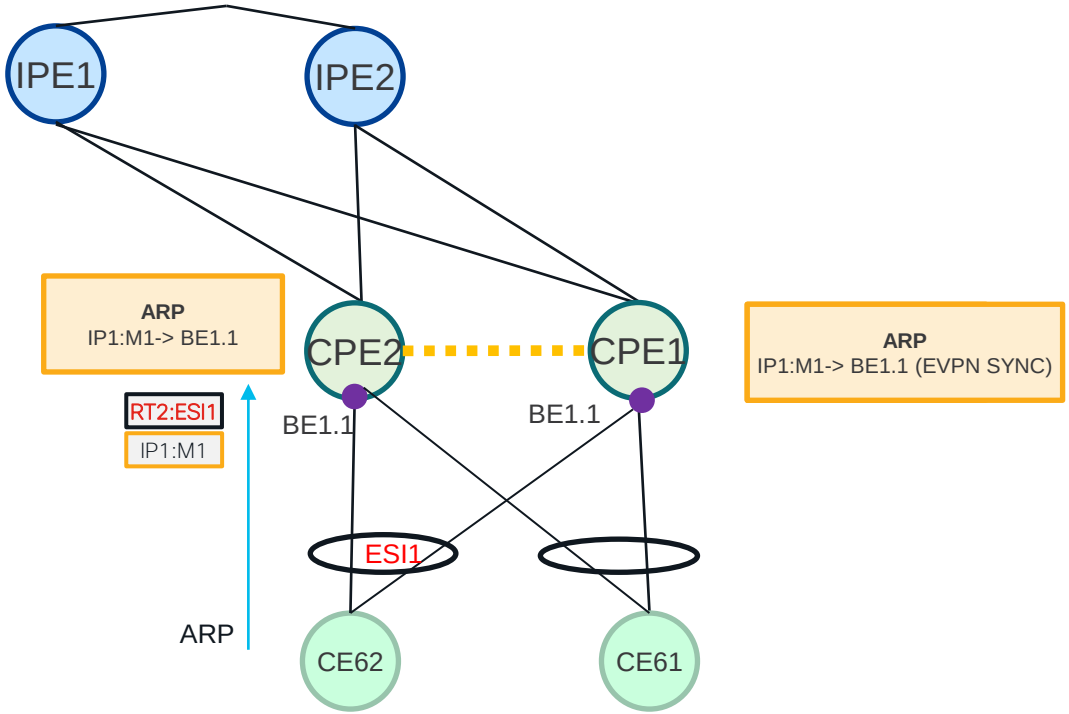
```
l2vpn
 bridge group 100
 bridge-domain 100
  interface Bundle-Ether100
  !
  evi 100
  !
 routed interface BVI100
   split-horizon group core
```

Put EVI and BVI in different SHG for Distributed GW

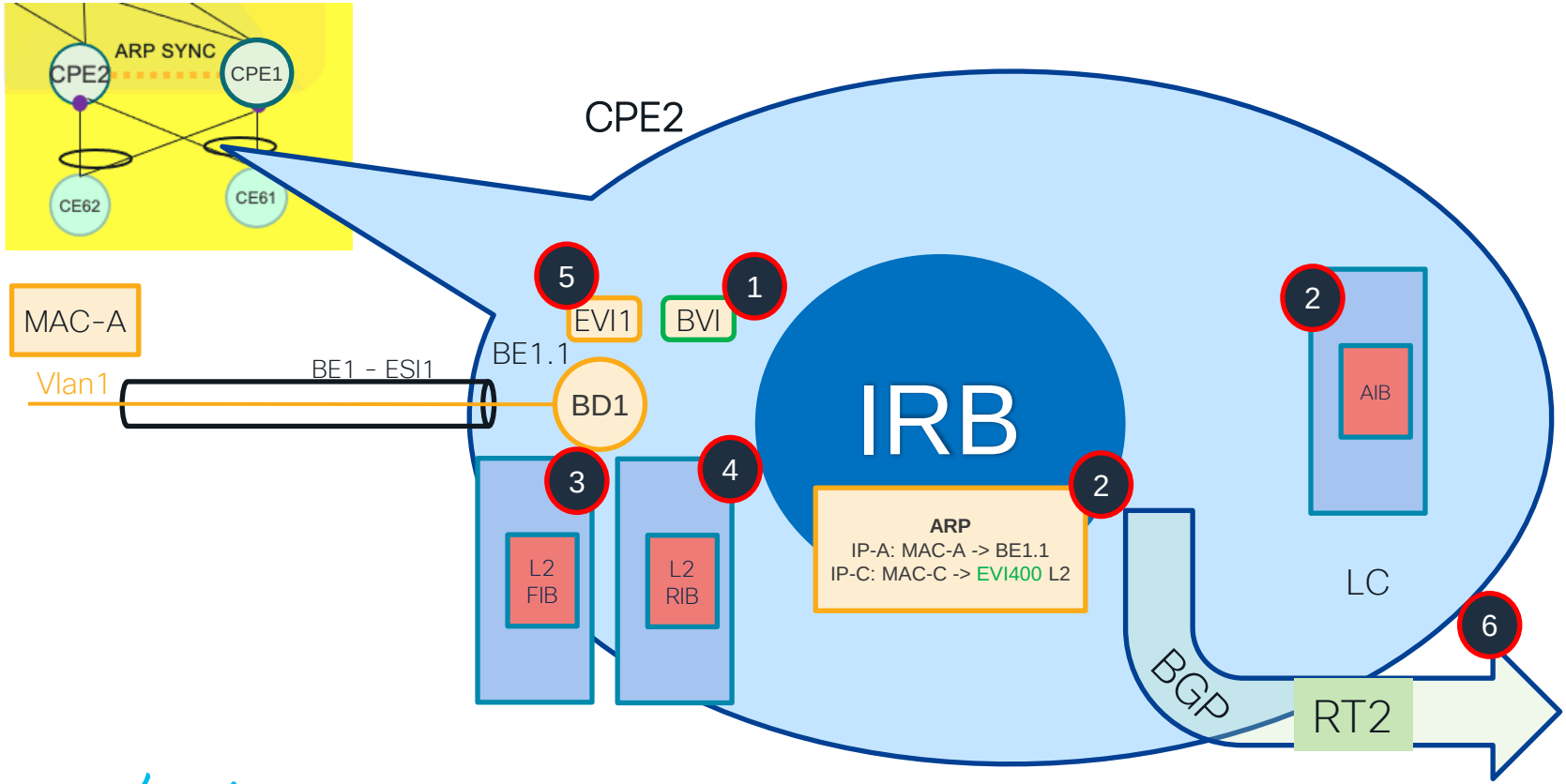
Troubleshooting L3VPN



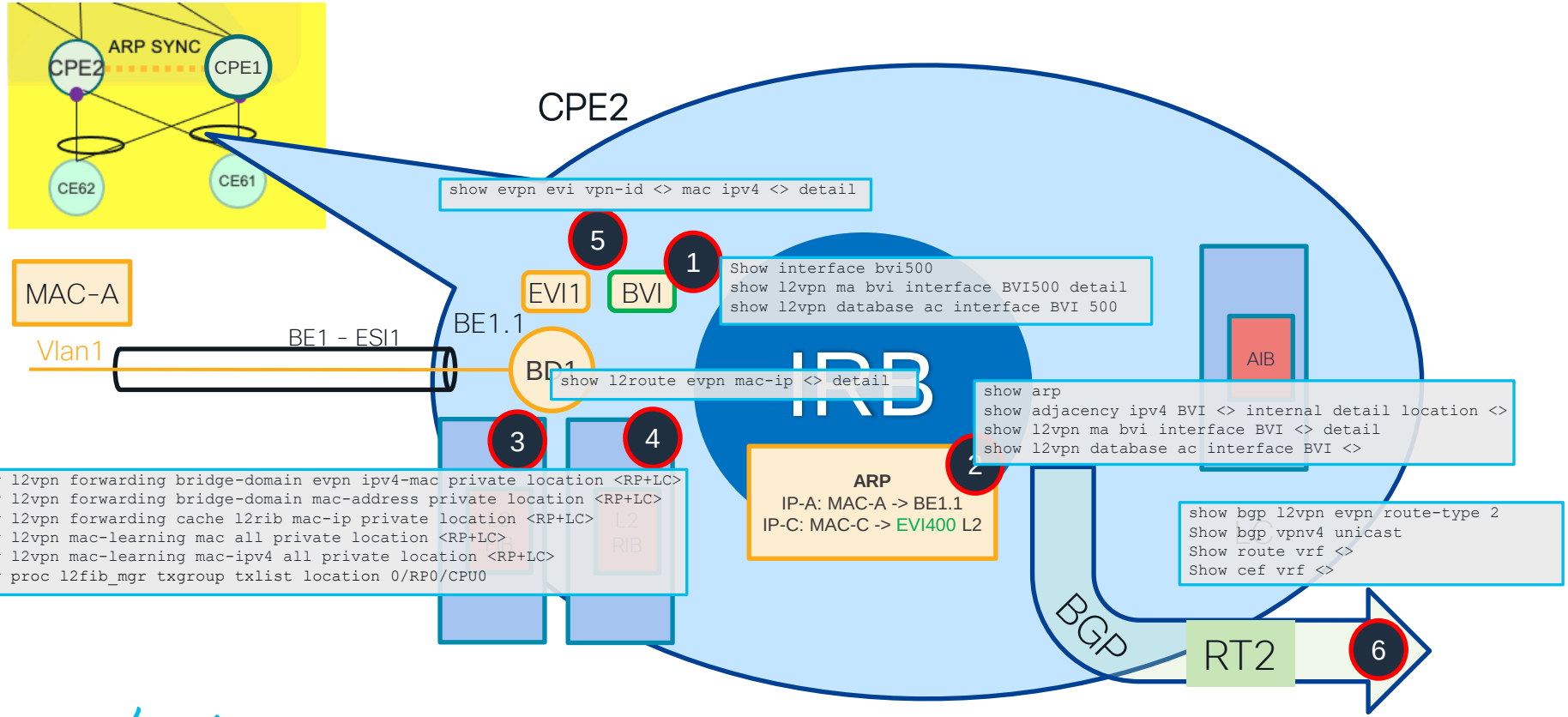
ARP SYNC



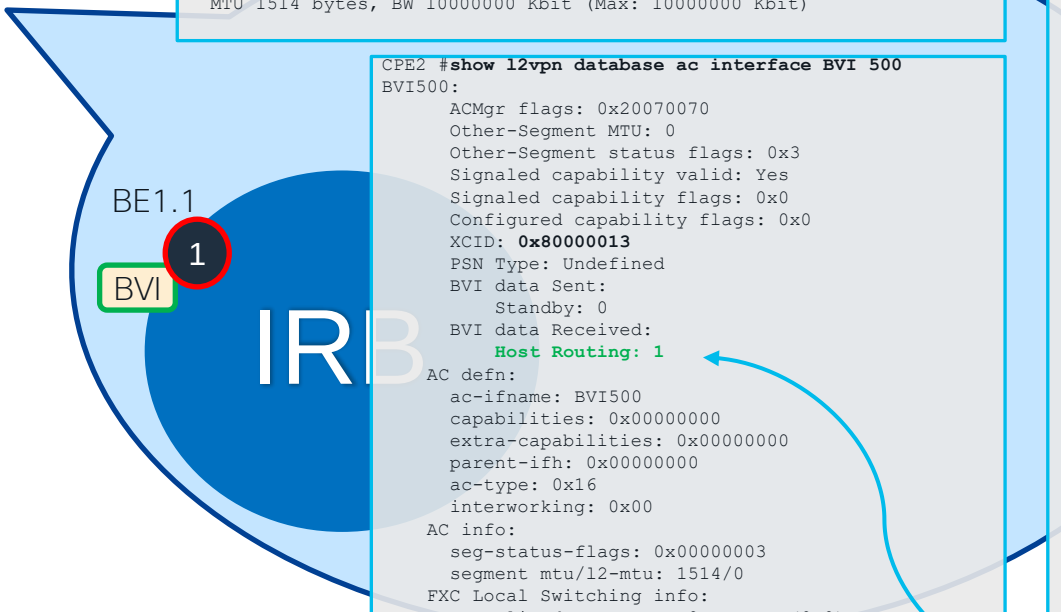
EVPN ARP Sync



EVPN ARP Sync



1. Verifying BVI

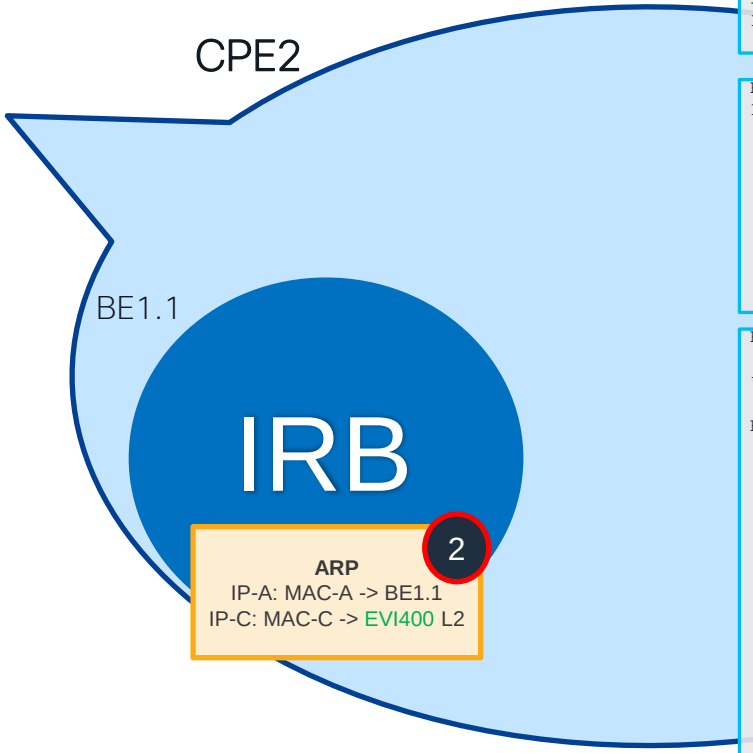



```
RP/0/RSP0/CPU0:CPE2#show interfaces bvi500
Fri Nov 18 20:22:26.878 EDT
BVI500 is up, line protocol is up
  Interface state transitions: 1
  Hardware is Bridge-Group Virtual Interface, address is 000a.000a.000a
  Internet address is 10.1.1.100/24
  MTU 1514 bytes, BW 10000000 Kbit (Max: 10000000 Kbit)
```

```
CPE2 #show l2vpn database ac interface BVI 500
BVI500:
      ACMgr flags: 0x20070070
      Other-Segment MTU: 0
      Other-Segment status flags: 0x3
      Signaled capability valid: Yes
      Signaled capability flags: 0x0
      Configured capability flags: 0x0
      XCID: 0x80000013
      PSN Type: Undefined
      BVI data Sent:
          Standby: 0
      BVI data Received:
          Host Routing: 1
    AC defn:
      ac-ifname: BVI500
      capabilities: 0x00000000
      extra-capabilities: 0x00000000
      parent-ifh: 0x00000000
      ac-type: 0x16
      interworking: 0x00
    AC info:
      seg-status-flags: 0x00000003
      segment mtu/l2-mtu: 1514/0
    FXC Local Switching info:
      normalised VLAN tag: 0        (0x0)
      VLAN Aware PWID: 0
      local switched AC XCID: 0x0
      EAD state: Invalid
```

```
RP/0/RSP0/CPU0: CPE2 #show l2vpn ma bvi interface BVI500 detail
Interface: BVI500    Interface State: Up, Admin state: Up
  Interface handle 0x160
  MTU:  1514
  BW:   10000000 Kbit
  Interface MAC addresses (2 addresses):
      Config: 000a.000a.000a
      EMA   : 18ef.63e4.107a
  Opaque flags: 0xb
  Flags: 0x3c
    Valid  : IFH, MTU, MAC, BW
  MA trace history [Num events: 18]
  ------------------------------------------------------
  Time                 Event                    Value      Sticky Many
  ====                 =====                    ==========  ======  ====
  Nov 15 10:51:43.104 IDB Set Opaque Data       0x8        No      No
  Nov 15 10:51:43.104 IDB Add                   0x2        No      No
  Nov 15 10:51:43.104 IDB Set Mac               0x20       No      No
  Nov 15 10:51:43.104 IDB Set MTU               0x5ea      No      No
  Nov 15 10:51:43.104 IDB Set Bandwith          0x989680   No      No
  Nov 15 10:51:43.104 IM Publishow Mac            0xa00      No      No
  Nov 15 10:51:43.104 IDB Set flag              0x3c       No      No
  Nov 15 10:51:43.104 IM Publishow Mac            0xc0000a00 No      No
  Nov 15 10:51:43.104 IM Replication/Upd        0          No      No
  Nov 15 10:51:43.104 IDB Set Admin State       0          No      No
  Nov 15 10:51:43.104 IDB Set State             0x1        No      No
  Nov 15 10:51:43.872 IDB Replay                0x1        No      No
  Nov 15 10:51:43.872 IM Publishow Mac            0x80000a00 No      No
  Nov 15 10:51:43.872 IDB Set flag              0x3e       No      No

  CLIENT MA trace history [Num events: 6]
  ------------------------------------------------------
  Time                 Event                    Value      Sticky Many
  ====                 =====                    ==========  ======  ====
  Nov 15 10:51:43.104 IM Notify Up              0x10       No      No
  Nov 15 10:51:43.872 Standby                   0xc        No      No
  Nov 15 10:54:46.656 Attrib Update to L2VPN    0x8        No      No
  Nov 16 19:56:40.832 Attrib Update to L2VPN    0x200000   No      No

  BVI IDB client data
  -------------------
  IDB Handle  : 0x1510ba84
  Host-routing: Enabled
```

2. Verifying ARP




```
RP/0/RSP0/CPU0: CPE2#show arp vrf IRB1
Fri Nov 18 19:33:18.872 EDT

------------------------------------------------------------------------------
0/0/CPU0
------------------------------------------------------------------------------
Address         Age        Hardware Addr   State      Type  Interface
10.1.1.1        01:40:07   d867.d948.b66d  Dynamic    ARPA  BVI500
10.1.1.100      -          000a.000a.000a  Interface  ARPA  BVI500
```

```
RP/0/RSP0/CPU0: CPE2#show cef vrf IRB1 10.1.1.1 location 0/0/CPU0
10.1.1.1/32, version 0, out-of-resource, internal 0x1120001 0x0 (ptr 0x8bf7bf74)
[1], 0x0 (0x8bde9998), 0x0 (0x0)
 Updated Nov 16 19:52:57.359
 local adjacency 10.1.1.1
 Prefix Len 32, traffic index 0, Adjacency-prefix, precedence n/a, priority 15
   via 10.1.1.1/32, BVI500, 4 dependencies, weight 0, class 0 [flags 0x0]
    path-idx 0 NHID 0x0 [0x8d4eb3d8 0x0]
    next hop
    local adjacency
```

Cef adjacency override rib

```
RP/0/RSP0/CPU0: CPE2#show adjacency ipv4 BVI 500 internal detail loc 0/0/CPU0

***SNIP***

BVI500, 10.1.1.1 (ipv4)
        Version: 58, references: 3, transient lock: 0
        Encapsulation information (14 bytes) d867d948b66d000a000a000a0800
        MTU: 1500
        Adjacency pointer is: 0x7cf65068
        Platform adjacency pointer is: 0x7c6bdc70
        Last updated: Nov 16 19:52:56.299
        Adjacency producer: arp (prod_id: 9)
        Flags: incomplete adj,
                (Base-flag: 0x1, Entry-flag: 0x0)
        Netio idb pointer not cached
        Cached interface type: 78
        Adjacency references:
                bfd_agent (JID 127, PID 188537), 0 reference
                l2fib_mgr (JID 262, PID 520331), 1 reference
                fib_mgr (JID 188, PID 188528), 1 reference
                aib (JID 114, PID 188520), 1 reference
```

2. Verifying ARP

CPE2/CPE1

```
RP/0/RSP0/CPU0: CPE2 #show route vrf IRB1 10.1.1.1

Routing entry for 10.1.1.1/32
  Known via "bgp 100", distance 200, metric 0, type internal
  Installed Nov 16 21:51:02.650 for 1d22h
  Routing Descriptor Blocks
    1.1.1.1, from 4.4.4.4
      Nexthop in Vrf: "default", Table: "default", IPv4 Unicast
      Route metric is 0
```

```
RP/0/RSP0/CPU0: CPE2 #show arp vrf IRB1
Fri Nov 18 20:23:05.121 UTC

---------------------------------------------------------------------------
0/0/CPU0
---------------------------------------------------------------------------
Address         Age       Hardware Addr   State     Type  Interface
10.1.1.1        -         d867.d948.b66d  Interface ARPA  BVI500
10.1.1.100      -         000a.000a.000a  Interface ARPA  BVI500
```

```
RP/0/RSP0/CPU0: CPE1#show arp vrf IRB1
Fri Nov 18 20:23:05.121 UTC

---------------------------------------------------------------------------
0/2/CPU0
---------------------------------------------------------------------------
Address         Age       Hardware Addr   State     Type  Interface
10.1.1.1        -         d867.d948.b66d  EVPN_SYNC ARPA  BVI500
10.1.1.100      -         000a.000a.000a  Interface ARPA  BVI500
```

```
RP/0/RSP0/CPU0: CPE2 #show cef vrf IRB1 10.1.1.1 location 0/0/CPU0
10.1.1.1/32, version 0, out-of-resource, internal 0x1120001 0x0 (ptr 0x8bf7bf74)
[1], 0x0 (0x8bde9998), 0x0 (0x0)
 Updated Nov 16 19:52:57.359
 local adjacency 10.1.1.1
 Prefix Len 32, traffic index 0, Adjacency-prefix, precedence n/a, priority 15
   via 10.1.1.1/32, BVI500, 4 dependencies, weight 0, class 0 [flags 0x0]
    path-idx 0 NHID 0x0 [0x8d4eb3d8 0x0]
    next hop
    local adjacency
```

cef adjacency override rib

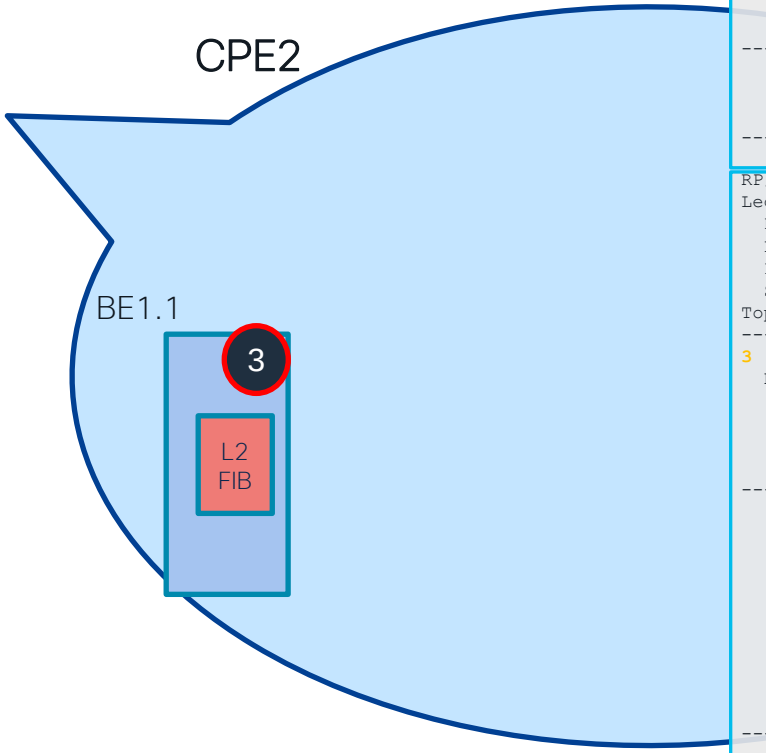
IRB

2

ARP
IP-A: MAC-A -> BE1.1
IP-C: MAC-C -> EVI400 L2

```
RP/0/RSP0/CPU0:IPE1show adjacency ipv4 BVI 500 internal detail loc 0/0/CPU0

***SNIP***

BVI500, 10.1.1.1 (ipv4)
        Version: 58, references: 3, transient lock: 0
        Encapsulation information (14 bytes) d867d948b66d000a000a000a0800
        MTU: 1500
        Adjacency pointer is: 0x7cf65068
        Platform adjacency pointer is: 0x7c6bdc70
        Last updated: Nov 16 19:52:56.299
        Adjacency producer: arp (prod_id: 9)
        Flags: incomplete adj,
                (Base-flag: 0x1, Entry-flag: 0x0)
        Netio idb pointer not cached
        Cached interface type: 78
        Adjacency references:
                bfd_agent (JID 127, PID 188537), 0 reference
                l2fib_mgr (JID 262, PID 520331), 1 reference
                fib_mgr (JID 188, PID 188528), 1 reference
                aib (JID 114, PID 188520), 1 reference
```

3. Verifying L2FIB

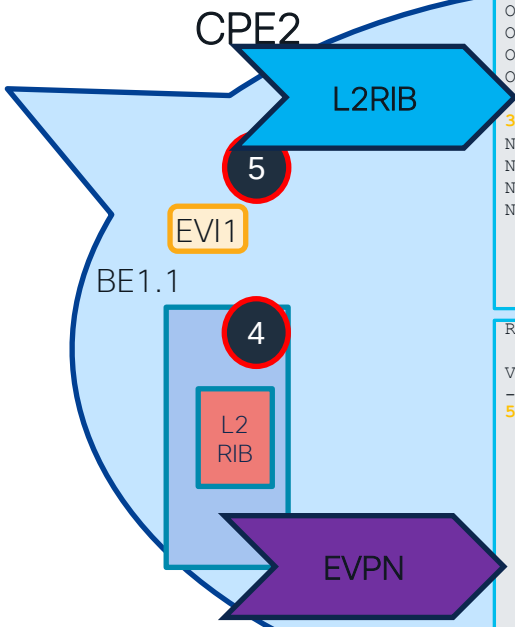



```
RP/0/RSP0/CPU0: CPE2 #show l2vpn mac-learning mac-ipv4 all private location 0/0/CPU0
Topo ID   Producer       Next Hop(s)       Mac Address       IP Address
-------   --------       -----------       --------------    ----------
3         0/0/CPU0       BV500             d867.d948.b66d    10.1.1.1

   Object: MAC MGR ENTRY
   Base info: version=0xaabbcc30, flags=0x100, type=34, reserved=0, address=0x8d686a08
   Event Trace History [Total events: 1]
------------------------------------------------------------------------------
     Time                 Event                Flags
     ====                 =====                =====
     Nov 16 19:52:57.365 Create                0x100        -  -
------------------------------------------------------------------------------
```

```
RP/0/RSP0/CPU0: CPE2 #show l2vpn forwarding bridge-domain evpn ipv4-mac private location 0/0/CPU0
Legend:
  D - Delete pending
  L - Local route
  P - Probe pending
  S - Sync pending
Topology MAC Address    IP Address                                Flags
-------- -------------- ----------------------------------------- -----
3        d867.d948.b66d 10.1.1.1                                   L
  BP IFH: 0x722, XID: 0xffffffff

   Object: EVPN IP4MAC
   Base info: version=0xaabbcc32, flags=0x2010, type=36, reserved=0, address=0x8d686880
   Event Trace History [Total events: 8]
------------------------------------------------------------------------------
     Time                 Event                Flags
     ====                 =====                =====
     Nov 18 17:53:12.815 Modify                0xa410       -  -
     Nov 18 17:53:12.815 End of list           0xa410       -  -
     Nov 18 17:53:12.815 PD modify             0x2410       -  -
     Nov 18 17:53:12.815 Modify                0x2010       -  -
     Nov 18 19:48:07.919 Modify                0xa410       -  -
     Nov 18 19:48:07.919 End of list           0xa410       -  -
     Nov 18 19:48:07.919 PD modify             0x2410       -  -
     Nov 18 19:48:07.919 Modify                0x2010       -  -
------------------------------------------------------------------------------
```

Learnt MAC+IP Locally

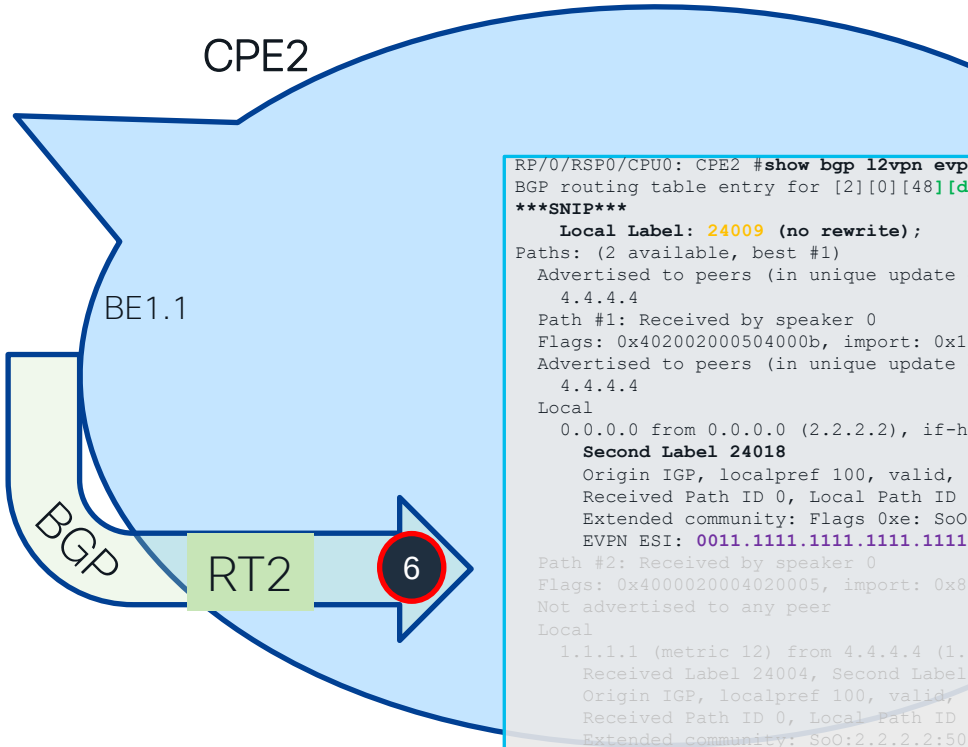
4-5. Verifying L2RIB/EVPN




```
RP/0/RSP0/CPU0: CPE2 #show l2route evpn mac-ip all det

Topo ID  Mac Address    IP Address      Producer    Next Hop(s)                              Seq No   Flags
Opaque Data Type        Opaque Data Len
Opaque Data Value
Opaque NH Type          Opaque NH Len
Opaque NH Value
-------- -------------- --------------- ----------- ---------------------------------------- -------- -----
3        d867.d948.b66d 10.1.1.1        LOCAL       Bundle-Ether1.500, N/A                   0        BL
N/A                     N/A
N/A
N/A                     N/A
N/A
    Last Update: Wed Nov 30 08:36:26.475 EDT
```

```
RP/0/RSP0/CPU0: CPE2 #show evpn evi vpn-id 500 mac ipv4 10.1.1.1 det

VPN-ID     Encap      MAC address    IP address                               Nexthop              Label
---------- ---------- -------------- ---------------------------------------- -------------------- -----------
500        MPLS       d867.d948.b66d 10.1.1.1                                 Bundle-Ether1.500    24009
   Ethernet Tag                          : 0
   Multi-paths Resolved                  : False
   Multi-paths Internal label            : 0
   Local Static                          : No
   Remote Static                         : No
   Local Ethernet Segment                : 0011.1111.1111.1111.1111
   Remote Ethernet Segment               : N/A
   Local Sequence Number                 : 0
   Remote Sequence Number                : N/A
   Local Encapsulation                   : MPLS
   Remote Encapsulation                  : N/A
   Local E-Tree                          : Root
   Remote E-Tree                         : Root
   Remote matching E-Tree RT             : No
   Local AC-ID                           : 0x1f4
   Remote AC-ID                          : 0x1f4
```

6. Verifying BGP RT2



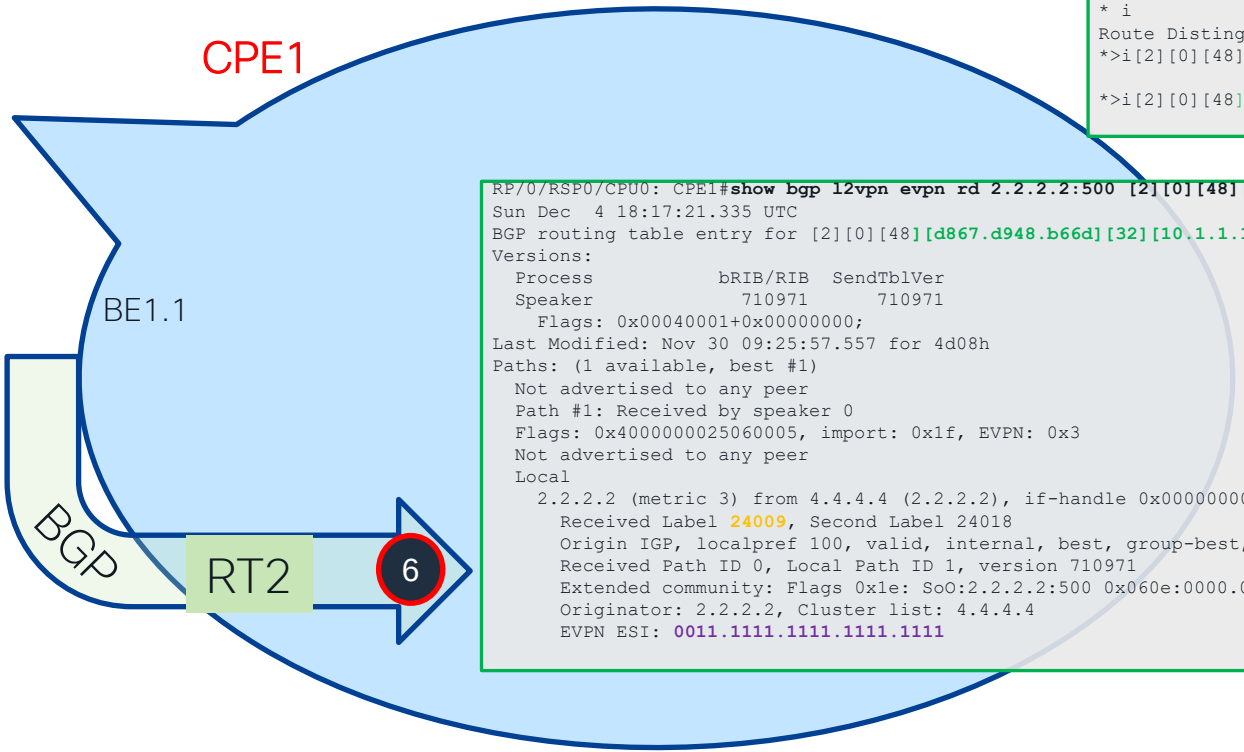

```
RP/0/RSP0/CPU0: CPE2 #show bgp l2vpn evpn route-type 2

Route Distinguisher: 1.1.1.1:500
*>i[2][0][48][d867.d948.b66d][0]/104
                       1.1.1.1                 100      0 i
*>i[2][0][48][d867.d948.b66d][32][10.1.1.1]/136
                       1.1.1.1                 100      0 i
Route Distinguisher: 2.2.2.2:500 (default for vrf IRB1)
*> [2][0][48][d867.d948.b66d][0]/104
                       0.0.0.0                           0 i
* i                    1.1.1.1                 100      0 i
*> [2][0][48][d867.d948.b66d][32][10.1.1.1]/136
                       0.0.0.0                           0 i
* i                    1.1.1.1                 100      0 i
```

```
RP/0/RSP0/CPU0: CPE2 #show bgp l2vpn evpn rd 2.2.2.2:500 [2][0][48][d867.d948.b66d][32][10.1.1.1]/136 detail
BGP routing table entry for [2][0][48][d867.d948.b66d][32][10.1.1.1]/136, Route Distinguisher: 2.2.2.2:500
***SNIP***
    Local Label: 24009 (no rewrite);
Paths: (2 available, best #1)
  Advertised to peers (in unique update groups):
    4.4.4.4
  Path #1: Received by speaker 0
  Flags: 0x4020020005040000b, import: 0x1f, EVPN: 0x1b
  Advertised to peers (in unique update groups):
    4.4.4.4
  Local
    0.0.0.0 from 0.0.0.0 (2.2.2.2), if-handle 0x00000000
      Second Label 24018
      Origin IGP, localpref 100, valid, redistributed, best, group-best, import-candidate, rib-install
      Received Path ID 0, Local Path ID 1, version 51
      Extended community: Flags 0xe: SoO:2.2.2.2:500 0x060e:0000.0000.01f4 RT:111:400995 RT:8888:300
      EVPN ESI: 0011.1111.1111.1111.1111
  Path #2: Received by speaker 0
  Flags: 0x4000020004020005, import: 0x80, EVPN: 0x3
  Not advertised to any peer
  Local
    1.1.1.1 (metric 12) from 4.4.4.4 (1.1.1.1), if-handle 0x00000000
      Received Label 24004, Second Label 24018
      Origin IGP, localpref 100, valid, internal, import-candidate, imported, rib-install
      Received Path ID 0, Local Path ID 0, version 0
      Extended community: SoO:2.2.2.2:500 0x060e:0000.0000.01f4 RT:111:400995 RT:8888:300
      Originator: 1.1.1.1, Cluster list: 4.4.4.4
      EVPN ESI: 0011.1111.1111.1111.1111
      Source AFI: L2VPN EVPN, Source VRF: default, Source Route Distinguisher: 1.1.1.1:500
```

```
evi 500
 bgp
  route-target import 111:400995
  route-target export 111:400995
```

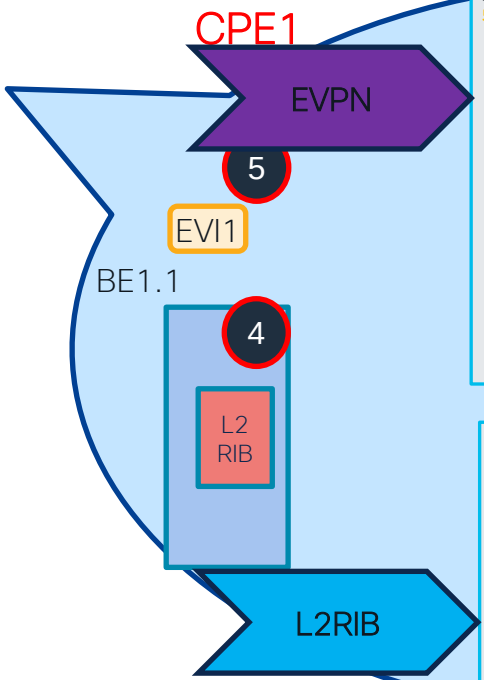
6. Verifying BGP RT2 on a peer

```
RP/0/RSP0/CPU0: CPE1#show bgp l2vpn evpn route-type 2

Route Distinguisher: 1.1.1.1:500 (default for vrf IRB1)
*> [2][0][48][d867.d948.b66d][0]/104
                        0.0.0.0                                0 i
* i                      2.2.2.2                  100           0 i
*> [2][0][48][d867.d948.b66d][32][10.1.1.1]/136
                        0.0.0.0                                0 i
* i                      2.2.2.2                  100           0 i
Route Distinguisher: 2.2.2.2:500
*>i[2][0][48][d867.d948.b66d][0]/104
                        2.2.2.2                  100           0 i
*>i[2][0][48][d867.d948.b66d][32][10.1.1.1]/136
                        2.2.2.2                  100           0 i
```




```
RP/0/RSP0/CPU0: CPE1#show bgp l2vpn evpn rd 2.2.2.2:500 [2][0][48][d867.d948.b66d][32][10.1.1.1]/136 det
Sun Dec  4 18:17:21.335 UTC
BGP routing table entry for [2][0][48][d867.d948.b66d][32][10.1.1.1]/136, Route Distinguisher: 2.2.2.2:500
Versions:
  Process           bRIB/RIB  SendTblVer
  Speaker             710971      710971
    Flags: 0x00040001+0x00000000;
Last Modified: Nov 30 09:25:57.557 for 4d08h
Paths: (1 available, best #1)
  Not advertised to any peer
  Path #1: Received by speaker 0
  Flags: 0x4000000025060005, import: 0x1f, EVPN: 0x3
  Not advertised to any peer
  Local
    2.2.2.2 (metric 3) from 4.4.4.4 (2.2.2.2), if-handle 0x00000000
      Received Label 24009, Second Label 24018
      Origin IGP, localpref 100, valid, internal, best, group-best, import-candidate, not-in-vrf
      Received Path ID 0, Local Path ID 1, version 710971
      Extended community: Flags 0x1e: SoO:2.2.2.2:500 0x060e:0000.0000.01f4 RT:111:400995 RT:8888:300
      Originator: 2.2.2.2, Cluster list: 4.4.4.4
      EVPN ESI: 0011.1111.1111.1111.1111
```

4-5. Verifying L2RIB/EVPN on a peer




```
RP/0/RSP0/CPU0: CPE1#show evpn evi vpn-id 500 mac ipv4 10.1.1.1 det

VPN-ID     Encap      MAC address    IP address                              Nexthop                 Label
---------- ---------- -------------- --------------------------------------- --------------------------------------
500        MPLS       d867.d948.b66d 10.1.1.1                                2.2.2.2                 24009
   Ethernet Tag                          : 0
   Multi-paths Resolved                  : True
   Multi-paths Internal label            : 24010
   Local Static                          : No
   Remote Static                         : No
   Local Ethernet Segment                : N/A
   Remote Ethernet Segment               : 0011.1111.1111.1111.1111
   Local Sequence Number                 : N/A
   Remote Sequence Number                : 0
   Local Encapsulation                   : N/A
   Remote Encapsulation                  : MPLS
   Local E-Tree                          : Root
   Remote E-Tree                         : Root
   Remote matching E-Tree RT             : No
   Local AC-ID                           : 0x1f4
   Remote AC-ID                          : 0x1f4
```

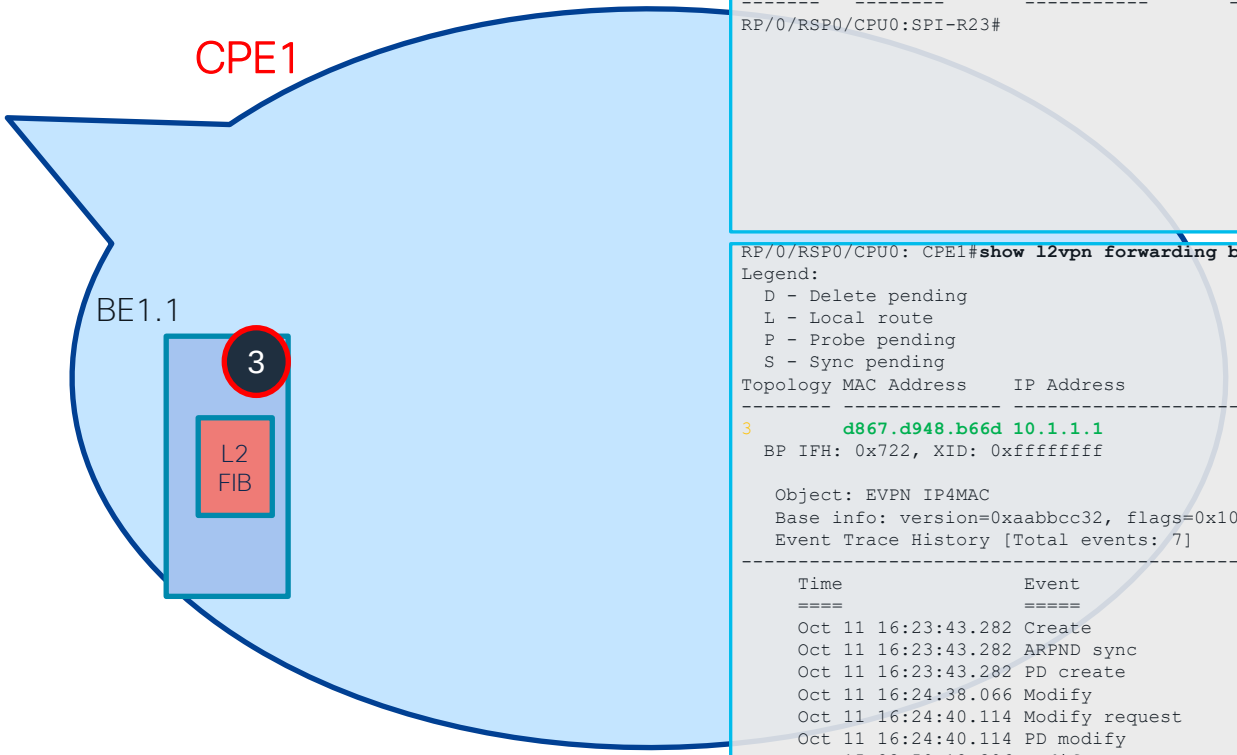
Peer's IP instead of "Local"

```
RP/0/RSP0/CPU0: CPE1#show l2route evpn mac-ip all det

Topo ID  Mac Address    IP Address      Producer     Next Hop(s)                              Seq No   Flags
Opaque Data Type        Opaque Data Len
Opaque Data Value
Opaque NH Type          Opaque NH Len
Opaque NH Value
-------- -------------- --------------- ----------- ---------------------------------------- -------- --------
3        d867.d948.b66d 10.1.1.1        L2VPN       Bundle-Ether1.500, N/A                   0        BS
0                       12
0x06000000 0x09000080 0x00000000
N/A                     N/A
N/A
    Last Update: Wed Nov 30 09:26:01.192 UTC
```

Attaching to Local AC

Sync Instead of "L"

3. Verifying L2FIB on a peer



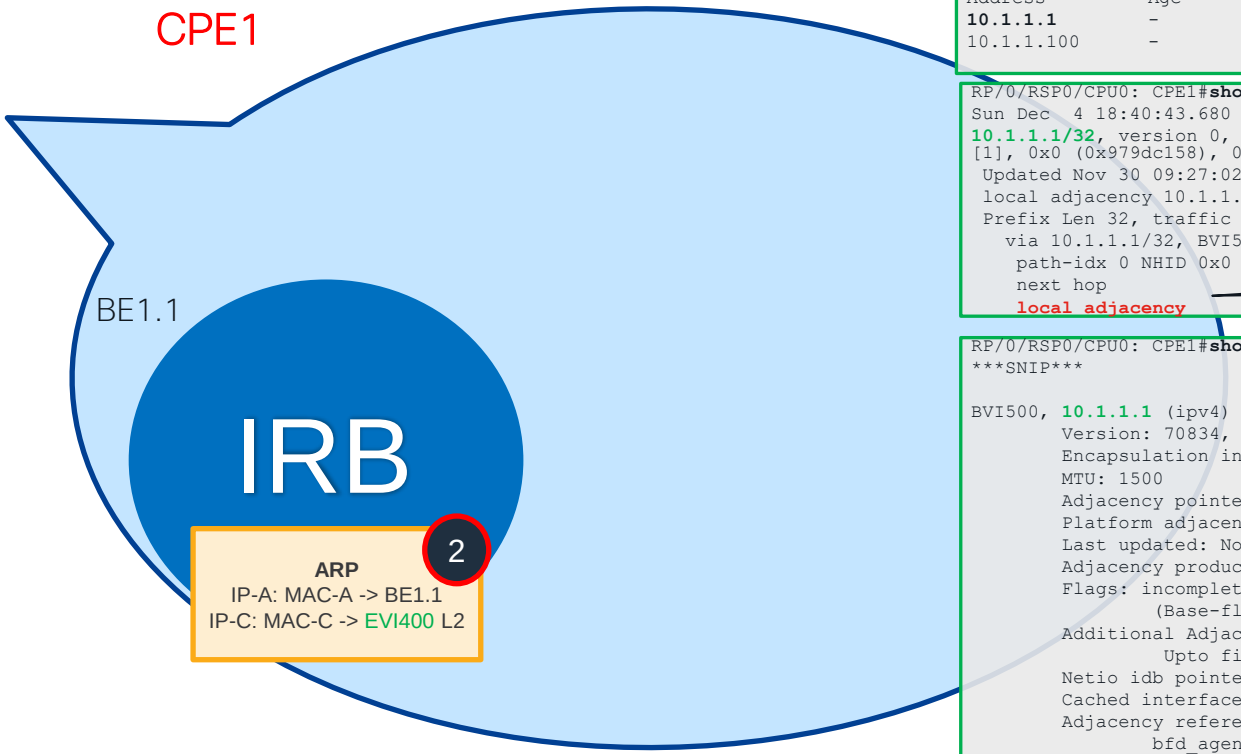

```
RP/0/RSP0/CPU0: CPE1#show l2vpn mac-learning mac-ipv4 all private location 0/0/CPU0
Sun Dec  4 18:37:47.422 UTC
Topo ID   Producer       Next Hop(s)       Mac Address       IP Address
-------   --------       -----------       --------------    ----------
RP/0/RSP0/CPU0:SPI-R23#
```

Empty because no ARP learning occurred on this node

```
RP/0/RSP0/CPU0: CPE1#show l2vpn forwarding bridge-domain evpn ipv4-mac private location 0/0/CPU0
Legend:
  D - Delete pending
  L - Local route
  P - Probe pending
  S - Sync pending
Topology MAC Address    IP Address                                Flags
-------- -------------- ----------------------------------------- -----
3        d867.d948.b66d 10.1.1.1
  BP IFH: 0x722, XID: 0xffffffff

   Object: EVPN IP4MAC
   Base info: version=0xaabbcc32, flags=0x10, type=36, reserved=0, address=0x990691d0
   Event Trace History [Total events: 7]
------------------------------------------------------------------------------------
     Time                Event               Flags
     ====                =====               =====
     Oct 11 16:23:43.282 Create              0x4100       -  -
     Oct 11 16:23:43.282 ARPND sync          0x4110       -  -
     Oct 11 16:23:43.282 PD create           0x110        -  -
     Oct 11 16:24:38.066 Modify              0x10         M  -
     Oct 11 16:24:40.114 Modify request      0x413        -  -
     Oct 11 16:24:40.114 PD modify           0x410        -  -
     Oct 15 23:59:12.306 Modify              0x10         M  -
------------------------------------------------------------------------------------
```

Missing “L” flag

2. Verifying ARP on a peer



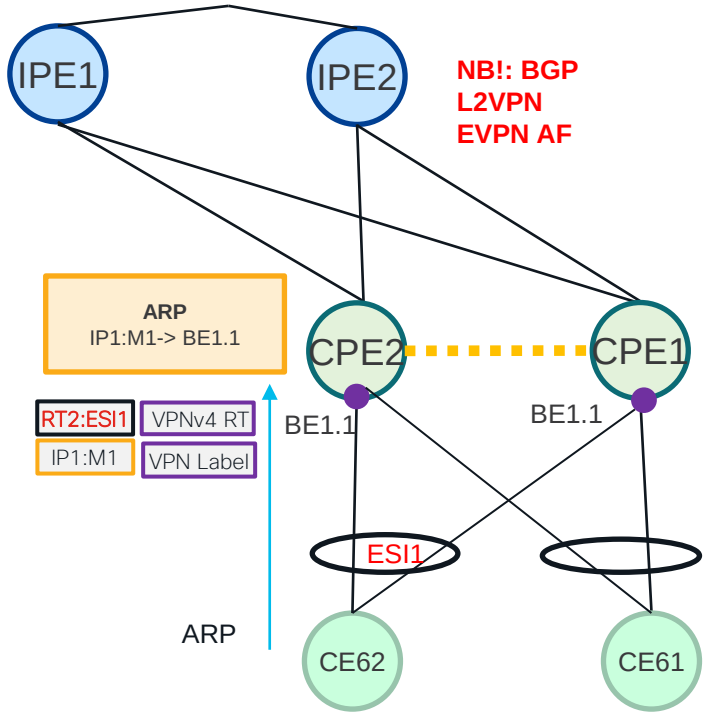

```
RP/0/RSP0/CPU0: CPE1#show arp vrf IRB1
Fri Nov 18 20:23:05.121 UTC

------------------------------------------------------------------------------
0/2/CPU0
------------------------------------------------------------------------------
Address         Age        Hardware Addr   State      Type  Interface
10.1.1.1        -          d867.d948.b66d  EVPN_SYNC  ARPA  BVI500
10.1.1.100      -          000a.000a.000a  Interface  ARPA  BVI500
```

```
RP/0/RSP0/CPU0: CPE1#show cef vrf IRB1 10.1.1.1 location 0/0/CPU0
Sun Dec  4 18:40:43.680 UTC
10.1.1.1/32, version 0, out-of-resource, internal 0x1120001 0x0 (ptr 0x990d2f84)
[1], 0x0 (0x979dc158), 0x0 (0x0)
 Updated Nov 30 09:27:02.706
 local adjacency 10.1.1.1
 Prefix Len 32, traffic index 0, Adjacency-prefix, precedence n/a, priority 15
   via 10.1.1.1/32, BVI500, 4 dependencies, weight 0, class 0 [flags 0x0]
    path-idx 0 NHID 0x0 [0x990d3124 0x0]
    next hop
    local adjacency
```

cef adjacency override rib

```
RP/0/RSP0/CPU0: CPE1#show adjacency ipv4 BVI 500 internal detail loc 0/0/CPU0
***SNIP***

BVI500, 10.1.1.1 (ipv4)
        Version: 70834, references: 2, transient lock: 0
        Encapsulation information (14 bytes) d867d948b66d000a000a000a0800
        MTU: 1500
        Adjacency pointer is: 0x8f735e98
        Platform adjacency pointer is: 0x8eafca90
        Last updated: Nov 16 22:40:02.672
        Adjacency producer: arp (prod_id: 12)
        Flags: incomplete adj,
                (Base-flag: 0x1, Entry-flag: 0x0)
        Additional Adjacency Information (4 bytes long),
                 Upto first 4 bytes (in hex): 00000001
        Netio idb pointer not cached
        Cached interface type: 78
        Adjacency references:
                bfd_agent (JID 126, PID 184442), 0 reference
                fib_mgr (JID 193, PID 184435), 1 reference
                l2fib_mgr (JID 266, PID 516239), 0 reference
                aib (JID 113, PID 184427), 1 reference
```

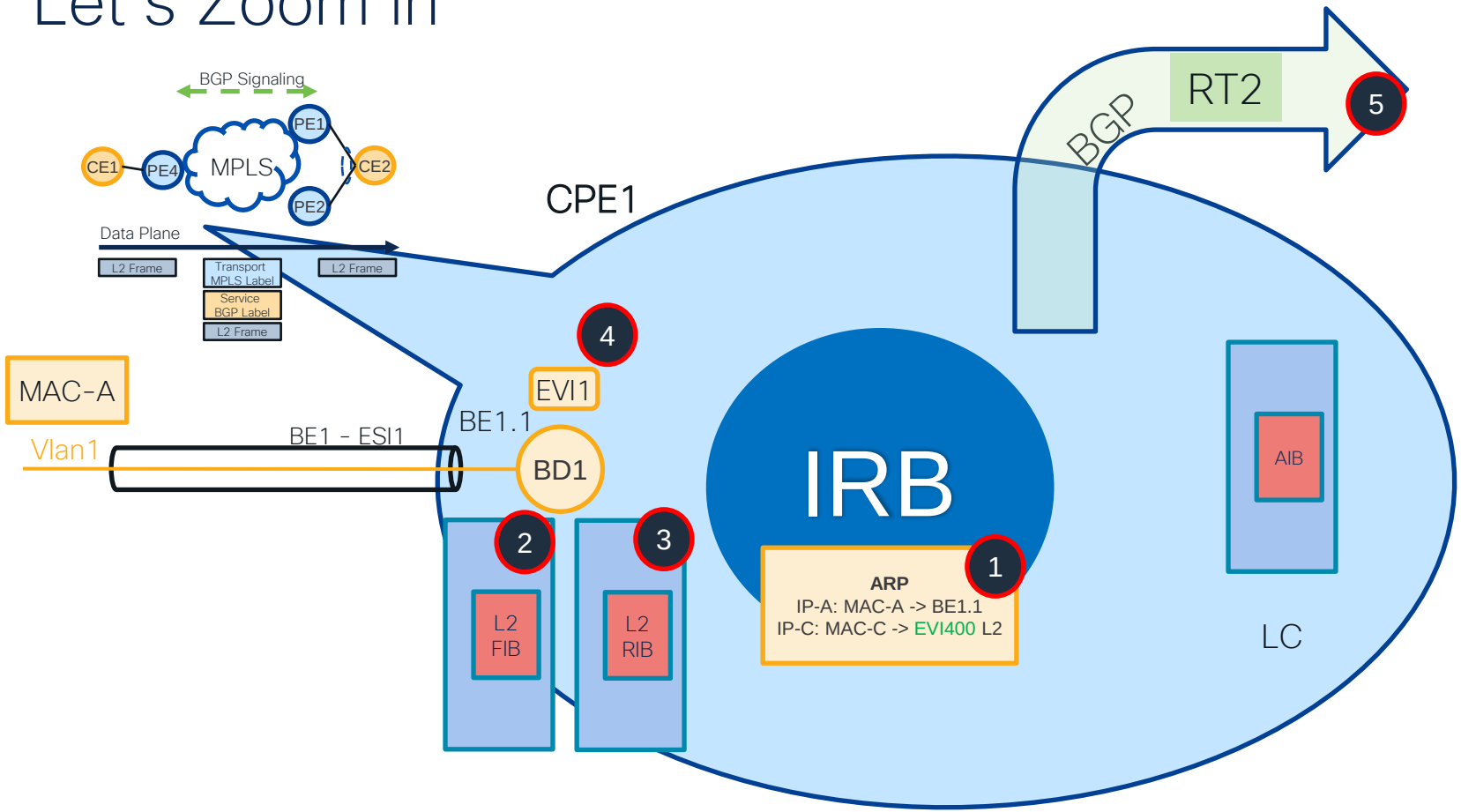
Integrating with L3VPN (host-routing)



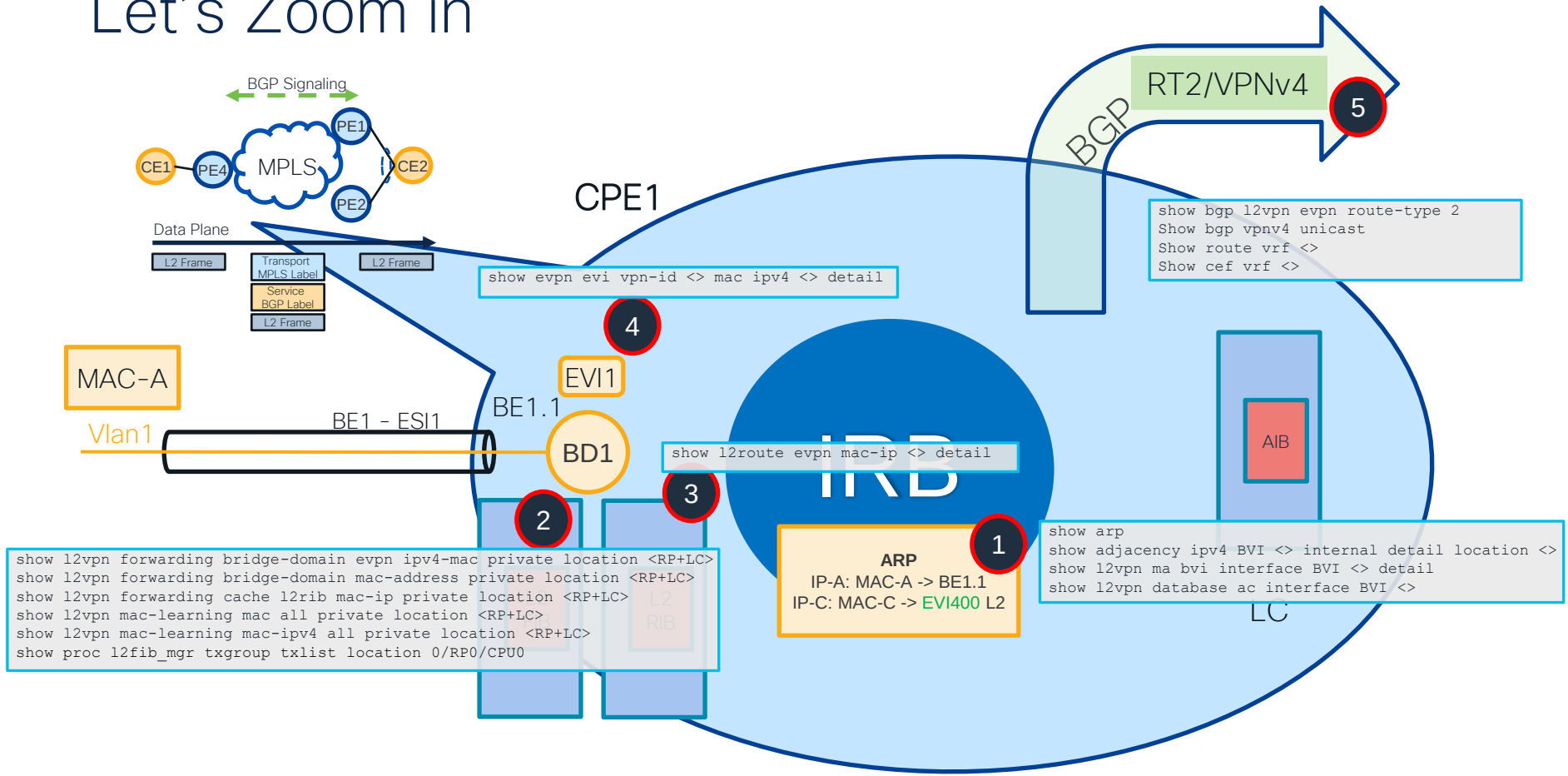

```
interface BVI100
 host-routing
 vrf IRB1
 ipv4 address 192.168.1.1 255.255.255.0
 mac-address 3637.3637.3637
!
```

```
router bgp 100
 vrf IRB1
  address-family ipv4 unicast
   redistribute connected
```

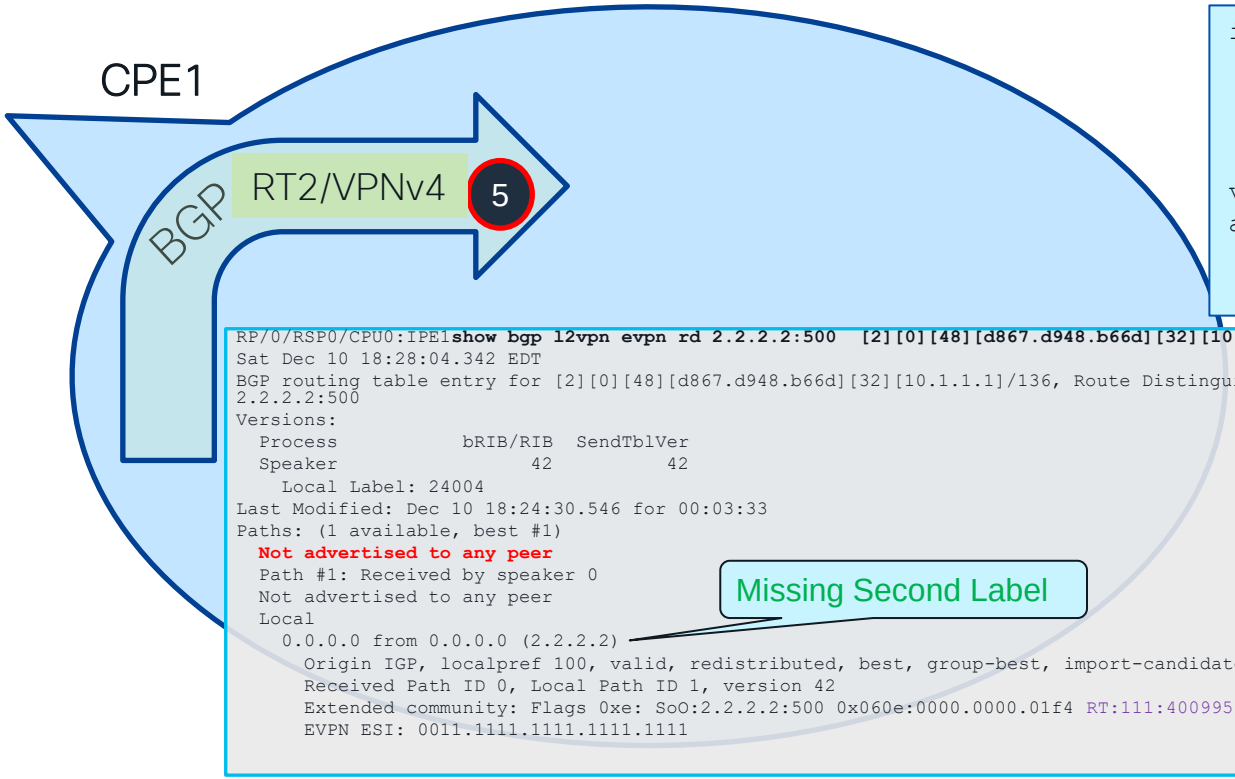
Let's Zoom in



Let's Zoom in



What can go wrong?




```
RP/0/RSP0/CPU0:IPE1show bgp l2vpn evpn rd 2.2.2.2:500  [2][0][48][d867.d948.b66d][32][10.1.1.1]/136
Sat Dec 10 18:28:04.342 EDT
BGP routing table entry for [2][0][48][d867.d948.b66d][32][10.1.1.1]/136, Route Distinguisher:
2.2.2.2:500
Versions:
  Process           bRIB/RIB  SendTblVer
  Speaker                 42          42
    Local Label: 24004
Last Modified: Dec 10 18:24:30.546 for 00:03:33
Paths: (1 available, best #1)
  Not advertised to any peer
  Path #1: Received by speaker 0
  Not advertised to any peer
  Local
    0.0.0.0 from 0.0.0.0 (2.2.2.2)
      Origin IGP, localpref 100, valid, redistributed, best, group-best, import-candidate, rib-install
      Received Path ID 0, Local Path ID 1, version 42
      Extended community: Flags 0xe: SoO:2.2.2.2:500 0x060e:0000.0000.01f4 RT:111:400995
      EVPN ESI: 0011.1111.1111.1111.1111
```

Missing Second Label

```
 evi 500
  bgp
   route-target import 111:400995
   route-target export 111:400995
```

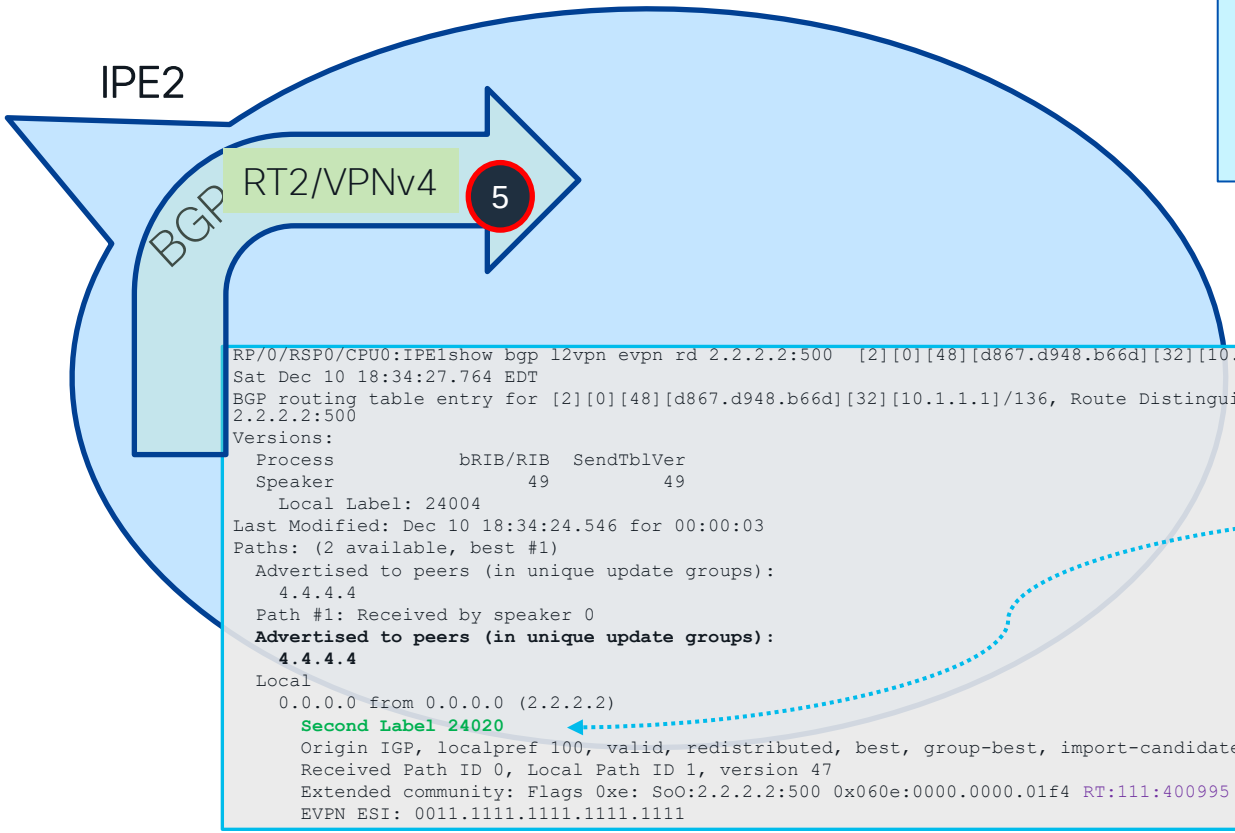
```
interface BVI100
 vrf IRB1
 ipv4 address 192.168.1.1 255.255.255.0
 mac-address 3637.363[illegible]3637

vrf IRB1
allow-imported-vpn
  export route-target
   8888:300
```

Missing host-routing

```
router bgp 100
 vrf IRB1
  address-family ipv4 unicast
```

Missing redistribute-connected

5. Verifying BGP



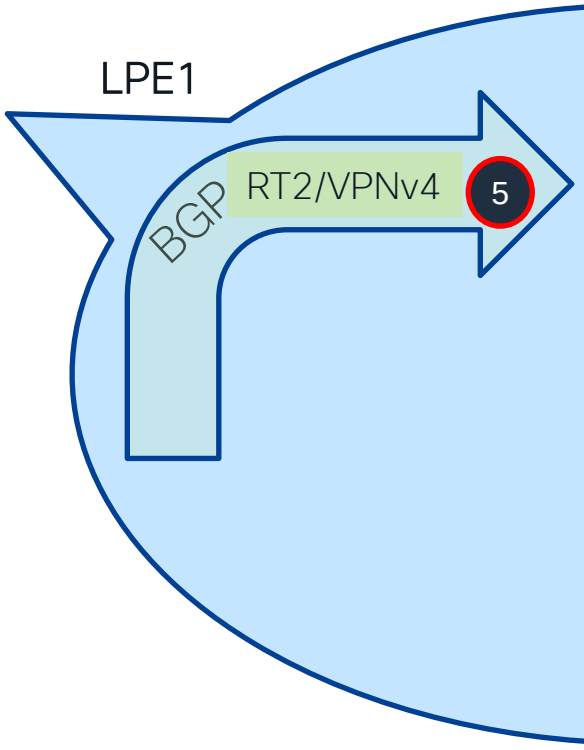

```
interface BVI100
 host-routing
 vrf IRB1
 ipv4 address 192.168.1.1 255.255.255.0
 mac-address 3637.3637.3637

vrf IRB1
allow-imported-vpn
  export route-target
    8888:300
```

```
evi 500
 bgp
  route-target import 111:400995
  route-target export 111:400995
```

```
RP/0/RSP0/CPU0:IPE1show bgp l2vpn evpn rd 2.2.2.2:500  [2][0][48][d867.d948.b66d][32][10.1.1.1]/136
Sat Dec 10 18:34:27.764 EDT
BGP routing table entry for [2][0][48][d867.d948.b66d][32][10.1.1.1]/136, Route Distinguisher:
2.2.2.2:500
Versions:
  Process           bRIB/RIB  SendTblVer
  Speaker                 49          49
    Local Label: 24004
Last Modified: Dec 10 18:34:24.546 for 00:00:03
Paths: (2 available, best #1)
  Advertised to peers (in unique update groups):
    4.4.4.4
  Path #1: Received by speaker 0
  Advertised to peers (in unique update groups):
    4.4.4.4
  Local
    0.0.0.0 from 0.0.0.0 (2.2.2.2)
      Second Label 24020
      Origin IGP, localpref 100, valid, redistributed, best, group-best, import-candidate, rib-install
      Received Path ID 0, Local Path ID 1, version 47
      Extended community: Flags 0xe: SoO:2.2.2.2:500 0x060e:0000.0000.01f4 RT:111:400995 RT:8888:300
      EVPN ESI: 0011.1111.1111.1111.1111
```

```
router bgp 100
 vrf IRB1
  address-family ipv4 unicast
   redistribute connected
```

5. Verifying BGP on Remote L3VPN PE



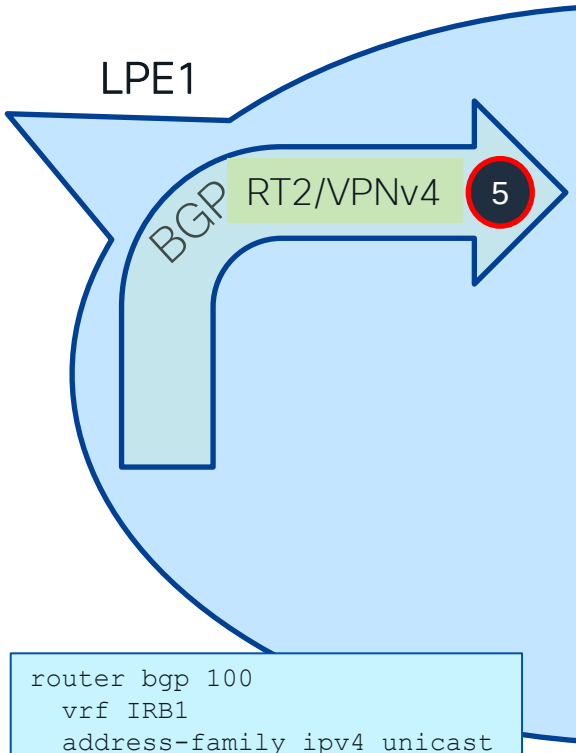

```
RP/0/RSP0/CPU0:LPE1#show bgp l2vpn evpn rd 2.2.2.2:500 [2][0][48][d867.d948.b66d][32][10.1.1.1]/136
2.2.2.2 (metric 12) from 4.4.4.4 (2.2.2.2)
      Received Label 24004, Second Label 24017
      Extended community: Flags 0x1e: SoO:2.2.2.2:500 0x060e:0000.0000.01f4 RT:111:400995 RT:8888:300

RP/0/RSP0/CPU0:LPE1#show bgp l2vpn evpn rd 1.1.1.1:500 [2][0][48][d867.d948.b66d][32][10.1.1.1]/136
1.1.1.1 (metric 12) from 4.4.4.4 (1.1.1.1)
      Received Label 24004, Second Label 24018
      Extended community: Flags 0x1e: SoO:2.2.2.2:500 0x060e:0000.0000.01f4 RT:111:400995 RT:8888:300
```

```
RP/0/RSP0/CPU0:R41#show bgp vrf IRB1 10.1.1.1
Paths: (2 available, best #1)
  Path #1: Received by speaker 0
  Not advertised to any peer
  Local
    1.1.1.1 (metric 12) from 4.4.4.4 (1.1.1.1)
      Received Label 24018
      Origin IGP, localpref 100, valid, internal, best, group-best, import-candidate, imported
      Received Path ID 0, Local Path ID 1, version 33353
      Extended community: SoO:2.2.2.2:500 0x060e:0000.0000.01f4 RT:111:400995 RT:8888:300
      mac: d8:67:d9:48:b6:6d
      Originator: 1.1.1.1, Cluster list: 4.4.4.4
      Source AFI: L2VPN EVPN, Source VRF: default, Source Route Distinguisher: 1.1.1.1:500
  Path #2: Received by speaker 0
  Not advertised to any peer
  Local
    2.2.2.2 (metric 12) from 4.4.4.4 (2.2.2.2)
      Received Label 24017
      Origin IGP, localpref 100, valid, internal, import-candidate, imported
      Received Path ID 0, Local Path ID 0, version 0
      Extended community: SoO:2.2.2.2:500 0x060e:0000.0000.01f4 RT:111:400995 RT:8888:300
      mac: d8:67:d9:48:b6:6d
      Originator: 2.2.2.2, Cluster list: 4.4.4.4
      Source AFI: L2VPN EVPN, Source VRF: default, Source Route Distinguisher: 2.2.2.2:500
```

```
RP/0/RSP0/CPU0:LPE1#show route vrf IRB1

B    10.1.1.1/32 [200/0] via 2.2.2.2 (nexthop in vrf default), 00:06:11
```

Why only one peer?

5. Verifying BGP on Remote L3VPN PE




```
RP/0/RSP0/CPU0:LPE1#show bgp l2vpn evpn rd 2.2.2.2:500 [2][0][48][d867.d948.b66d][32][10.1.1.1]/136
2.2.2.2 (metric 12) from 4.4.4.4 (2.2.2.2)
      Received Label 24004, Second Label 24017
      Extended community: Flags 0x1e: SoO:2.2.2.2:500 0x060e:0000.0000.01f4 RT:111:400995 RT:8888:300

RP/0/RSP0/CPU0:R41#show bgp l2vpn evpn rd 1.1.1.1:500 [2][0][48][d867.d948.b66d][32][10.1.1.1]/136
1.1.1.1 (metric 12) from 4.4.4.4 (1.1.1.1)
      Received Label 24004, Second Label 24018
      Extended community: Flags 0x1e: SoO:2.2.2.2:500 0x060e:0000.0000.01f4 RT:111:400995 RT:8888:300
```

```
RP/0/RSP0/CPU0:LPE1#show bgp vrf IRB1 10.1.1.1
Paths: (2 available, best #1)
  Path #1: Received by speaker 0
  Not advertised to any peer
  Local
    1.1.1.1 (metric 12) from 4.4.4.4 (1.1.1.1)
      Received Label 24018
      Origin IGP, localpref 100, valid, internal, best, group-best, multipath, import-candidate, imported
      Received Path ID 0, Local Path ID 1, version 33353
      Extended community: SoO:2.2.2.2:500 0x060e:0000.0000.01f4 RT:111:400995 RT:8888:300
      mac: d8:67:d9:48:b6:6d
      Originator: 1.1.1.1, Cluster list: 4.4.4.4
      Source AFI: L2VPN EVPN, Source VRF: default, Source Route Distinguisher: 1.1.1.1:500
  Path #2: Received by speaker 0
  Not advertised to any peer
  Local
    2.2.2.2 (metric 12) from 4.4.4.4 (2.2.2.2)
      Received Label 24017
      Origin IGP, localpref 100, valid, internal, multipath, import-candidate, imported
      Received Path ID 0, Local Path ID 0, version 0
      Extended community: SoO:2.2.2.2:500 0x060e:0000.0000.01f4 RT:111:400995 RT:8888:300
      mac: d8:67:d9:48:b6:6d
      Originator: 2.2.2.2, Cluster list: 4.4.4.4
      Source AFI: L2VPN EVPN, Source VRF: default, Source Route Distinguisher: 2.2.2.2:500
```

Multipath now

```
router bgp 100
  vrf IRB1
  address-family ipv4 unicast
   maximum-paths eibgp 2
```

```
RP/0/RSP0/CPU0:LPE1#show route vrf IRB1

B    10.1.1.1/32 [200/0] via 1.1.1.1 (nexthop in vrf default), 00:05:52
                 [200/0] via 2.2.2.2 (nexthop in vrf default), 00:05:52
```

Show Commands

show evpn summary
show evpn ethernet-segment
show evpn ethernet-segment detail
show evpn evi
show evpn evi detail
show evpn evi mac <> detail
show evpn evi vpn-id <>
show evpn evi vpn-id <> detail
show evpn evi vpn-id <> mac
show evpn evi vpn-id <> mac detail
show evpn evi vpn-id <> inclusive-multicast
show evpn evi vpn-id <> inclusive-multicast detail
show l2route topology
show l2route evpn mac evi 2 det
show l2vpn forwarding protection main-interface location <>
show l2vpn forwarding protection main-interface detail location <>
show l2vpn forwarding protection main-interface private location <>
show l2vpn forwarding bridge-domain evpn inclusive-multicast detail location <>
show l2vpn bridge-domain bd-name <> detail
show l2vpn forwarding bridge-domain <>:<> mac-address location <>
show l2vpn forwarding bridge-domain <>:<> mac-address location <>
show l2vpn bridge-domain bd-name <> detail
show l2vpn bridge-domain bd-name <> details
show bgp l2vpn evpn
show bgp l2vpn evpn bridge-domain <> labels
show mpls forwarding labels XXXX
Show arp
Show adjacency

Show Tech

Show tech l2vpn

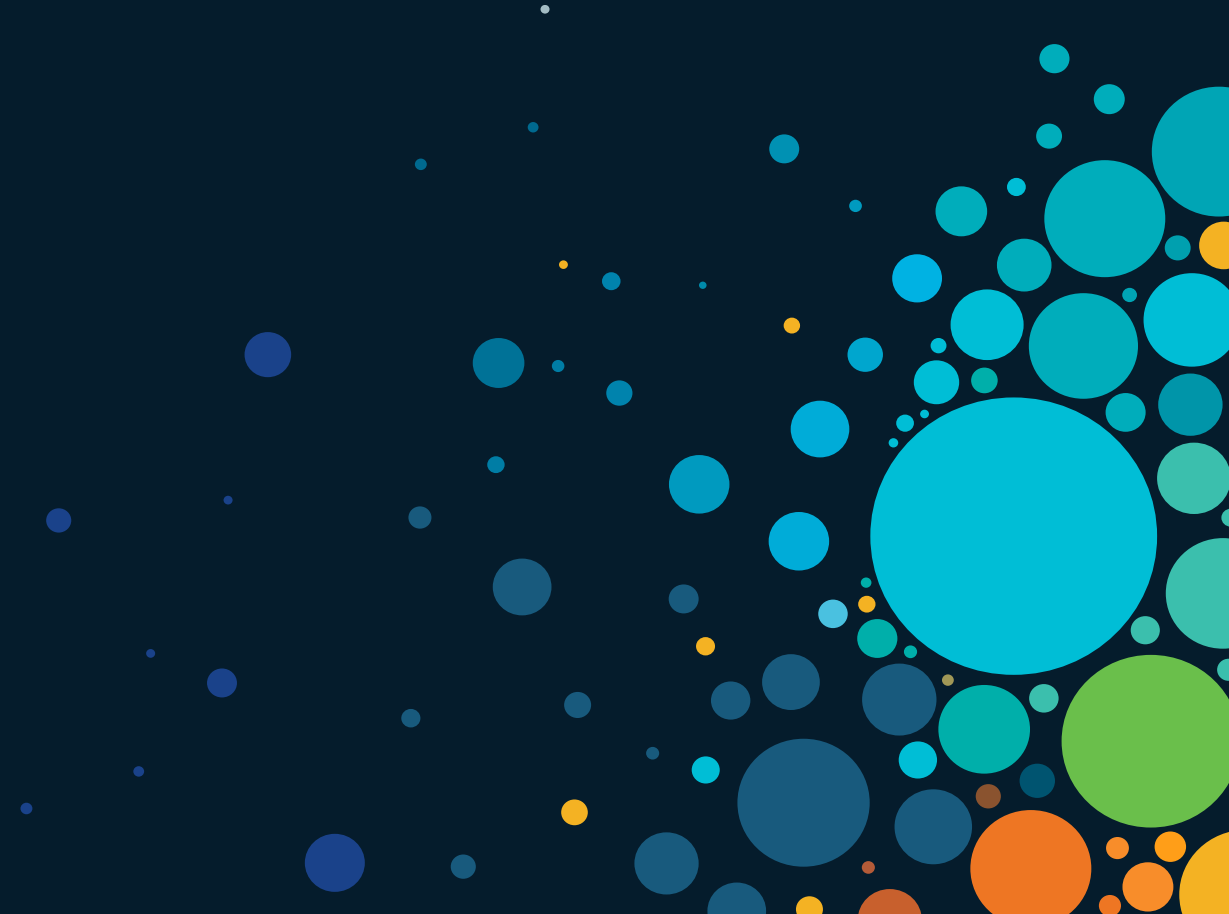
Show tech l2vpn platform

Show tech l2rib

Show tech evpn

Show tech routing bgp

Summary



EVPN vs L2VPN vs L3VPN

- EVPN can be integrated into L2VPN/L3VPN
  - During transition L2VPN and EVPN can co-exist
  - EVPN co-exists with L3VPN over IRB
- EVPN Troubleshooting:
  - Adds new steps/approaches/CLI
  - Good if segmented into logical blocks
- Businesses are migrating to EVPN

Thus, we are ready to migrate!

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- Complete a minimum of 4 session surveys and the Overall Conference survey (open from Thursday) to receive your Cisco Live t-shirt.

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ALL IN