#CiscoLiveAPJC

The bridge to possible

EVPN Deep Dive

with IOS-XR Configuration examples for Service Provider Metro and Data Center

Jiri Chaloupka – Principal Technical Marketing Engineer

BRKSPG-3731

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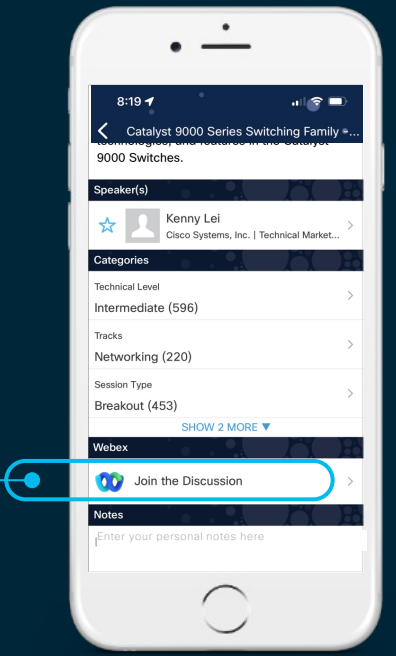

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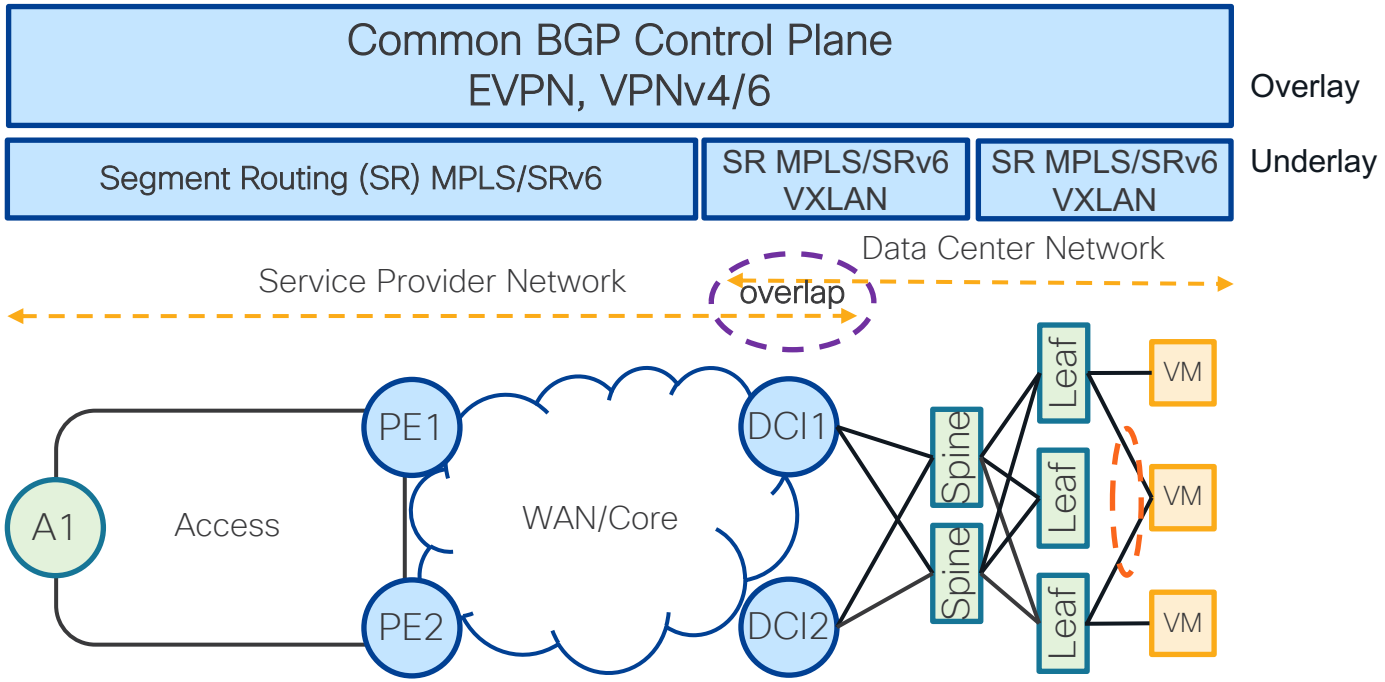
Why EVPN?

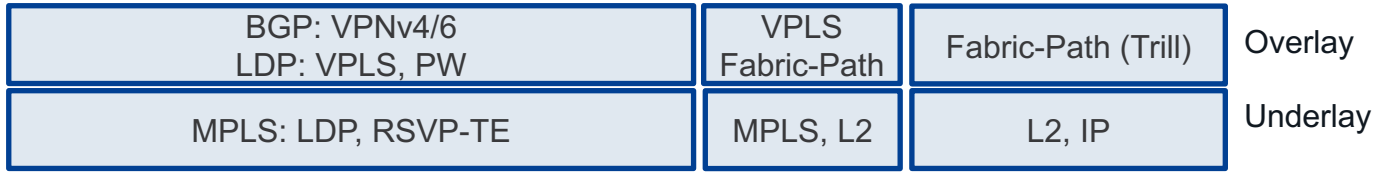
Industry Consensus

From Mac Bridging to Mac Routing

Evolution:



Legacy Solution:



EVPN Advantages:

Integrated Services

- Integrated Layer 2 and Layer 3 VPN services
- L3VPN-like principles and operational experience for scalability and control
- All-active Multi-homing & PE load-balancing (ECMP)

Network Efficiency

- Fast convergence (link, node, MAC moves)
- Control-Place (BGP) learning. PWs are no longer used.
- Optimized Broadcast, Unknown-unicast, Multicast traffic delivery

Service Flexibility

- Choice of MPLS, VxLAN or SRv6 data plane encapsulation
- Support existing and new services types (E-LAN, E-Line, E-TREE)
- Fully support IPv4 and IPv6 in the data plane and control plane

Investment Protection

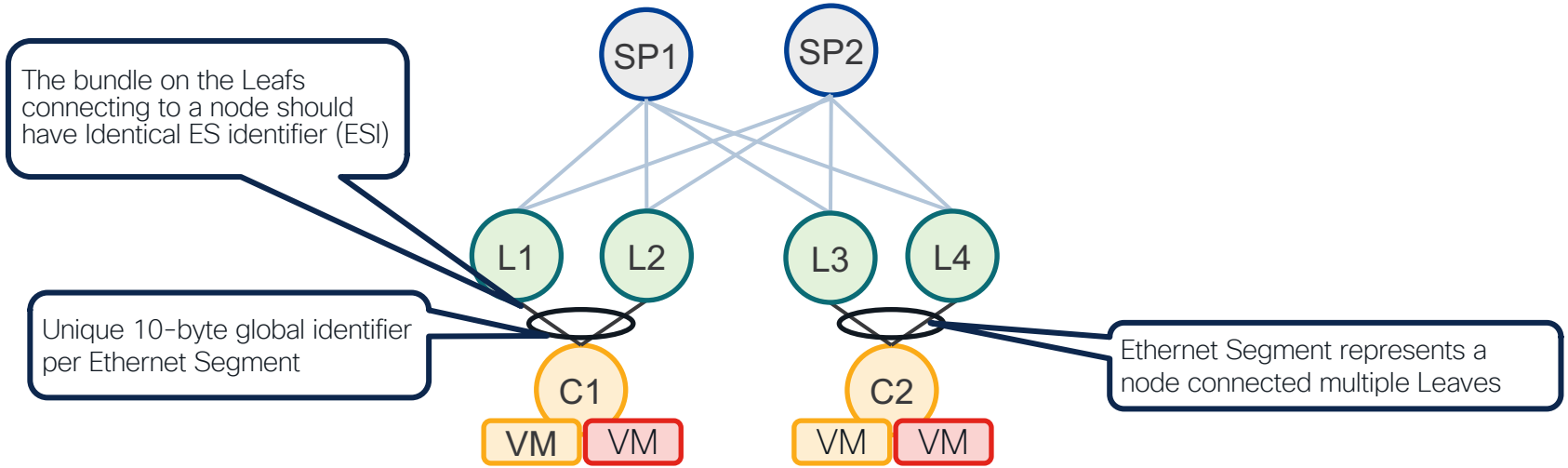
- Open-Standard and Multi-vendor support

Quick EVPN 101

cisco Live!

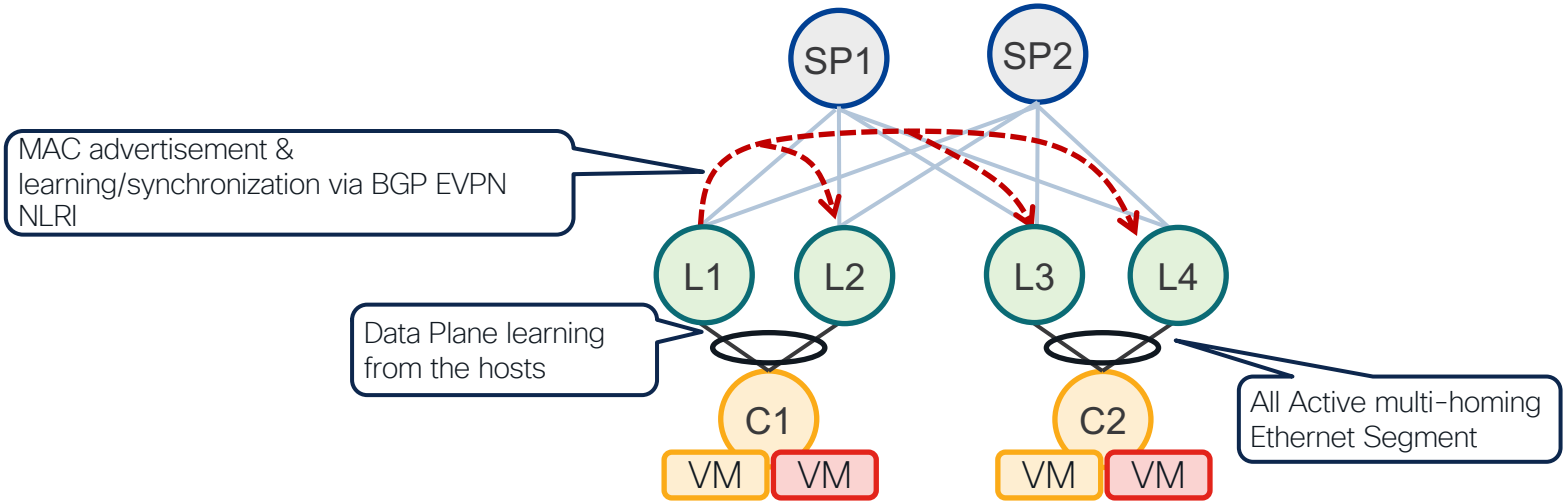
EVPN – Ethernet-Segment for Multi-Homing

L1 and L2 (L3 and L4) have to know if they multi-home same broadcast domain



EVPN – Ethernet VPN

MAC address advertisement and MAC address table synchronization



EVPN Configuration

CE has to receive same lacp system MAC

```
lacp system mac 3637.3637.3637

interface Bundle-Ether100
 l2transport
 !
!

evpn
 evi 100
  advertise-mac
 !
 interface Bundle-Ether100
  ethernet-segment
   identifier type 0 36.37.00.00.00.00.00.11.00
 !
!
```

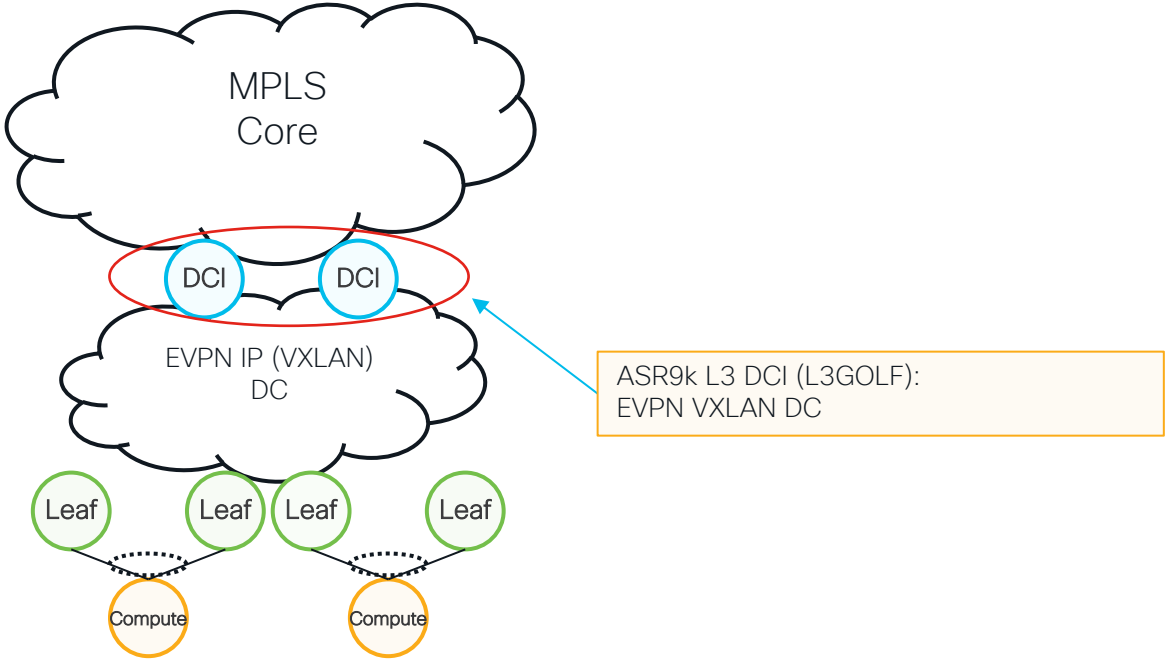
RT-2 MAC advertise

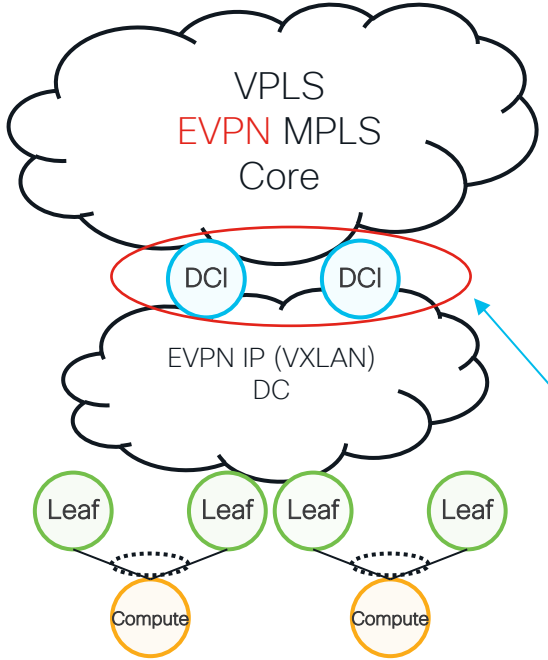
```
l2vpn
 bridge group 100
 bridge-domain 100
  interface Bundle-Ether100
  !
  evi 100
  !
 !
 !
!
```

EVPN Configuration – BGP

```
router bgp 1
 bgp router-id 3.3.3.36
 address-family l2vpn evpn
 !
 neighbor-group rr
 remote-as 1
 update-source Loopback0
 address-family l2vpn evpn
 !
 neighbor 3.3.3.103
 use neighbor-group rr
 !
 neighbor 3.3.3.104
 use neighbor-group rr
 !
!
```

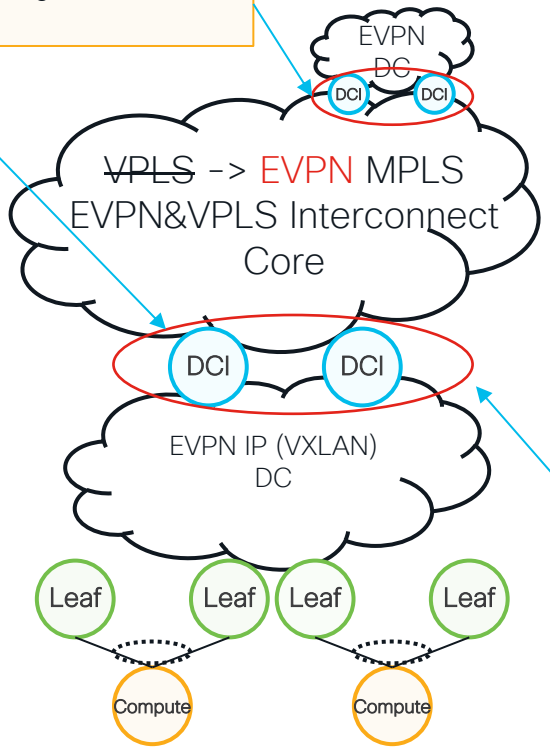
Once upon a time, around 2016...





ASR9k L3 DCI (L3GOLF):
EVPN VXLAN DC
ASR9k L2 DCI (L2GOLF):
EVPN VXLAN DC & EVPN MPLS Core
ASR9k L2 EVPN (ELAN)

ASR9k/NCS VPLS to EVPN Seamless Migration
ASR9k VPLS to EVPN Interconnect



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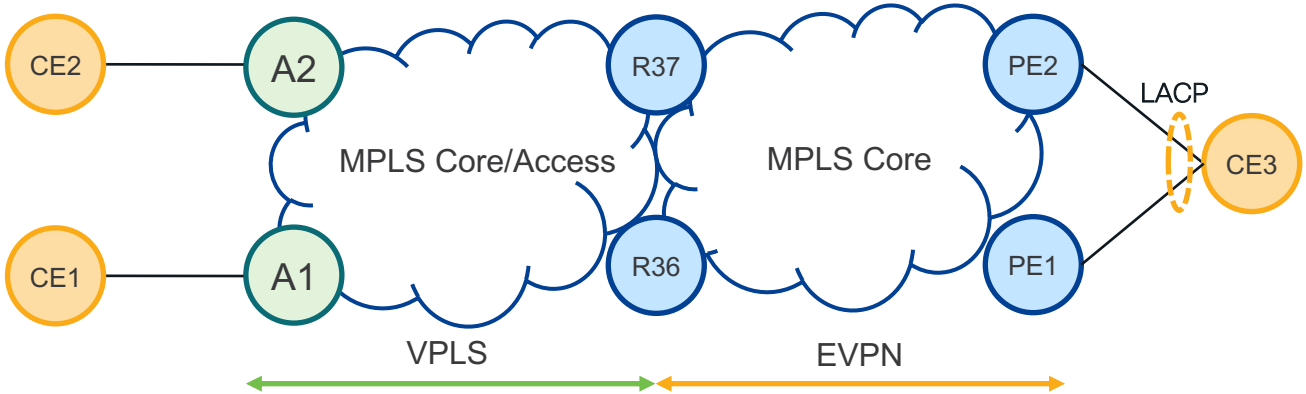
EVPN & VPLS Interconnect



R36/R37 Configuration

```
evpn
 evi 100
  advertise-mac
 !
 virtual vfi 1
  ethernet-segment
   identifier type 0 11.11.11.11.11.11.11.11.11
```

R36 Configuration

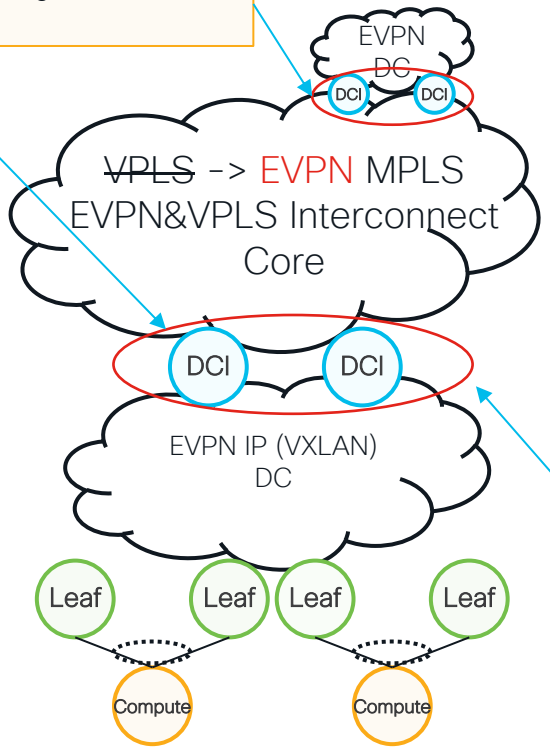
```
l2vpn
 bridge group 100
  bridge-domain 100
   access-vfi 1
    neighbor x.x.x.A1 pw-id 1
    !
    neighbor x.x.x.A2 pw-id 2
    !
   !
   evi 100
```

R37 Configuration

```
l2vpn
 bridge group 100
  bridge-domain 100
   access-vfi 1
    neighbor x.x.x.A1 pw-id 10
    !
    neighbor x.x.x.A2 pw-id 20
    !
   !
   evi 100
```

Virtual Ethernet Segment (vES)
- VPLS is Single-Active Access to EVPN

ASR9k/NCS VPLS to EVPN Seamless Migration
ASR9k VPLS to EVPN Interconnect



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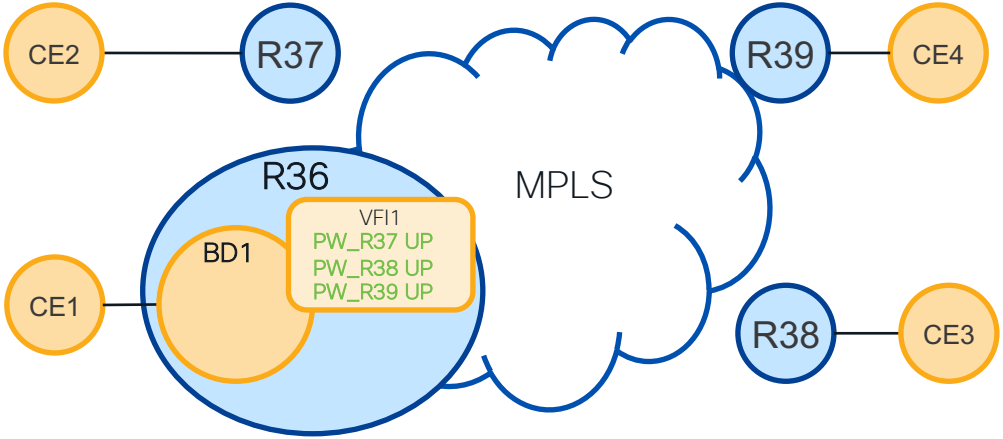
VPLS & EVPN Seamless Integration – Migration

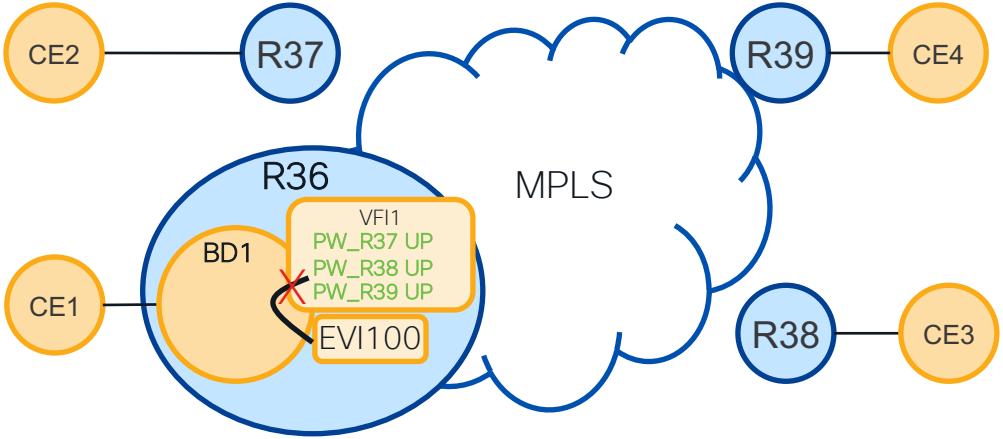



```
l2vpn
 bridge group 100
  bridge-domain 100
   vfi 1
    neighbor x.x.x.37 pw-id 37
    !
    neighbor x.x.x.38 pw-id 38
    !
    neighbor x.x.x.39 pw-id 39
    !
   !
```

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

VPLS & EVPN Seamless Integration – Migration




```
l2vpn
 bridge group 100
  bridge-domain 100
   vfi 1
    neighbor x.x.x.37 pw-id 37
    !
    neighbor x.x.x.38 pw-id 38
    !
    neighbor x.x.x.39 pw-id 39
    !
   evi 100
   !
```

VFI1 is by default in Split Horizon Group 1

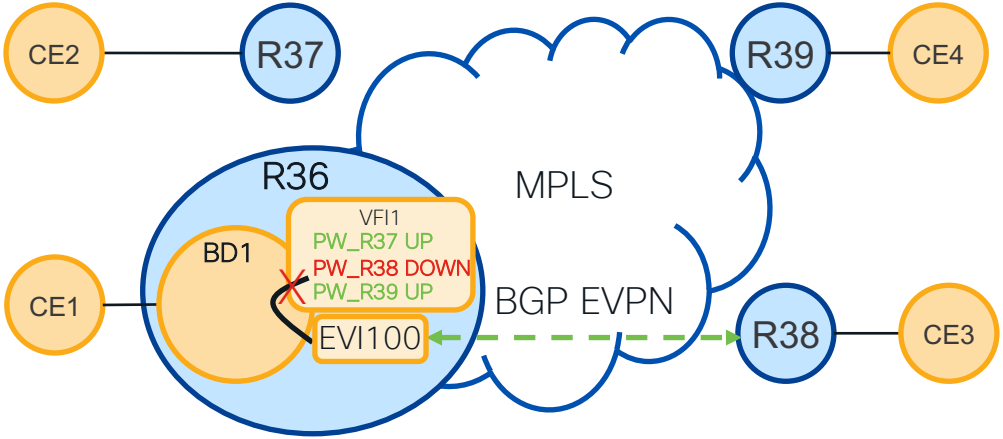
- SHG1 protects loops in MPLS Core
- Full Mesh of pseudowires(PW) is required

for Any-to-Any forwarding

EVI100 is also by default in Split Horizon Group 1

- R36 doesn't forward data between VFI1 and EVI100

VPLS & EVPN Seamless Integration – Migration




```
l2vpn
 bridge group 100
  bridge-domain 100
   vfi 1
    neighbor x.x.x.37 pw-id 37
    !
    neighbor x.x.x.38 pw-id 38
    !
    neighbor x.x.x.39 pw-id 39
    !
   evi 100
   !
```

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

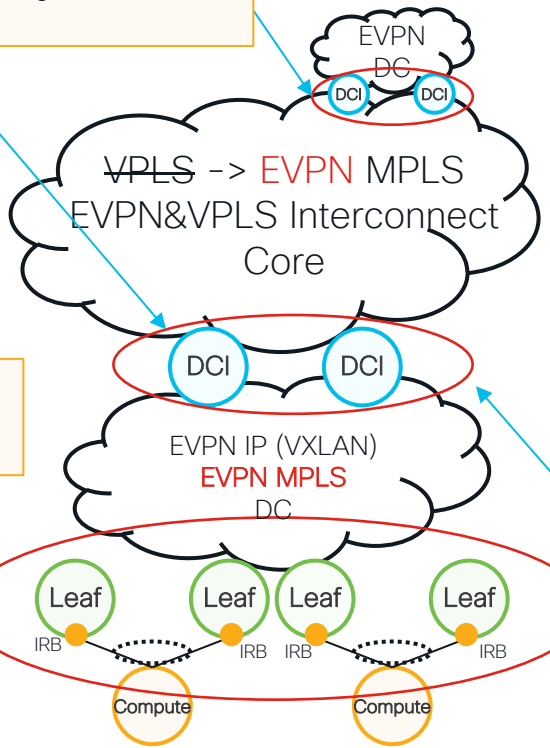
EVI1 is also by default in Split Horizon Group 1

- R36 doesn't forward data between VFI1 and EVI100

R36&R38 run BGP EVPN

- PW_R38 goes DOWN
- Data Forwarding between R36 and R38 via EVI100

ASR9k/NCS VPLS to EVPN Seamless Migration
ASR9k VPLS to EVPN Interconnect



ASR9k/NCS L2 EVPN (ELAN)
All-Active Multihoming
ASR9k/NCS EVPN Distributed Anycast GW

ASR9k L3 DCI (L3GOLF):
EVPN VXLAN DC
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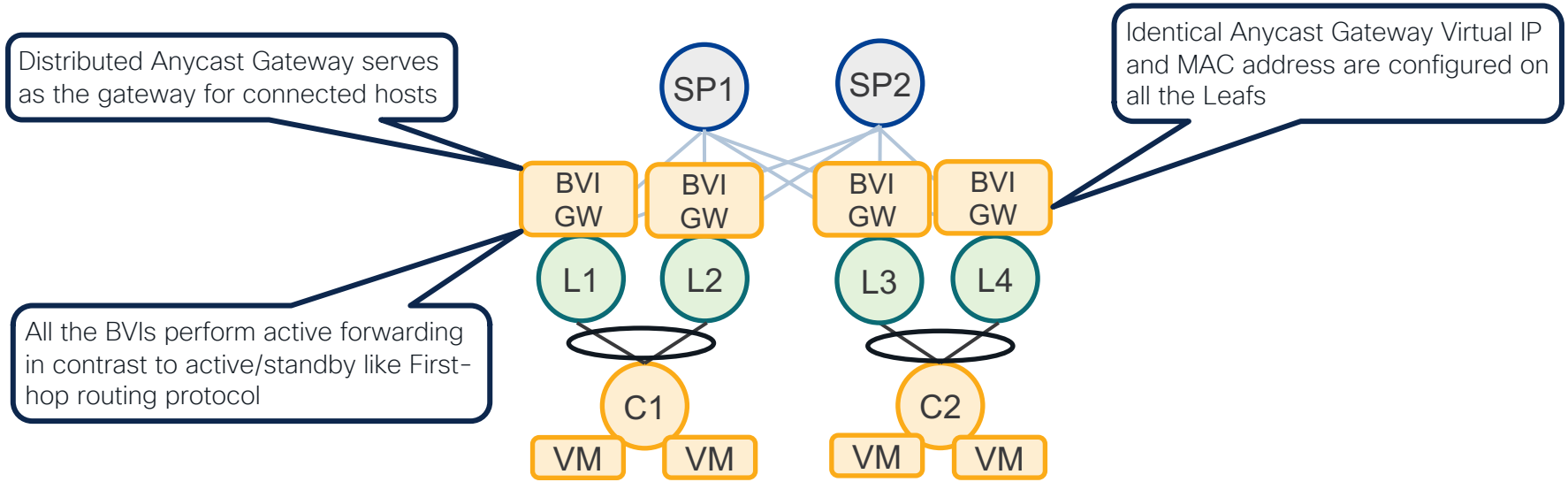
ASR9k L2 EVPN (ELAN)

EVPN – Distributed Symmetric Anycast Gateway



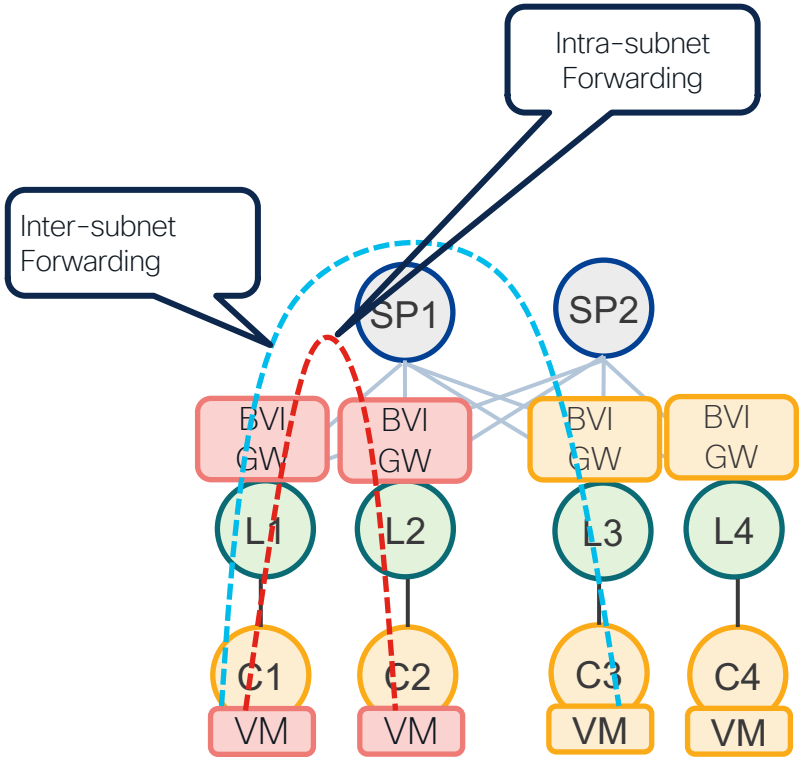
EVPN Configuration – IRB

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

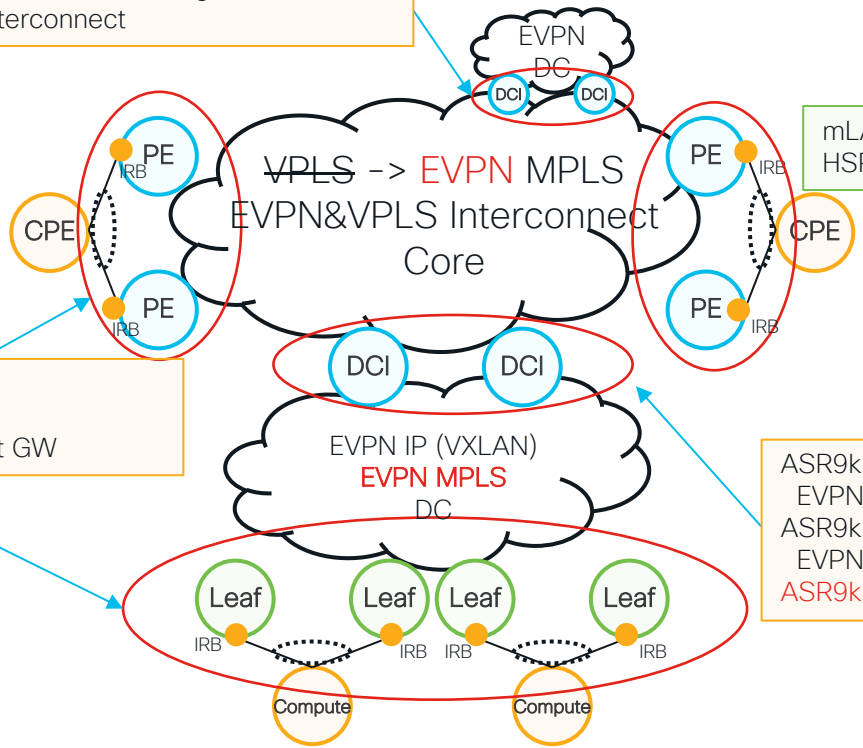
MAC/IP RT2

Anycast Distributed IRB: Same IP and MAC
R36,R37

EVPN – IRB in Network Fabric



ASR9k/NCS VPLS to EVPN Seamless Migration
ASR9k VPLS to EVPN Interconnect



mLACP/Cluster Replacement
HSRP/VRRP Replacement Phase 1 (IRB)

ASR9k/NCS L2 EVPN (ELAN)
All-Active Multihoming
ASR9k/NCS EVPN Distributed Anycast GW

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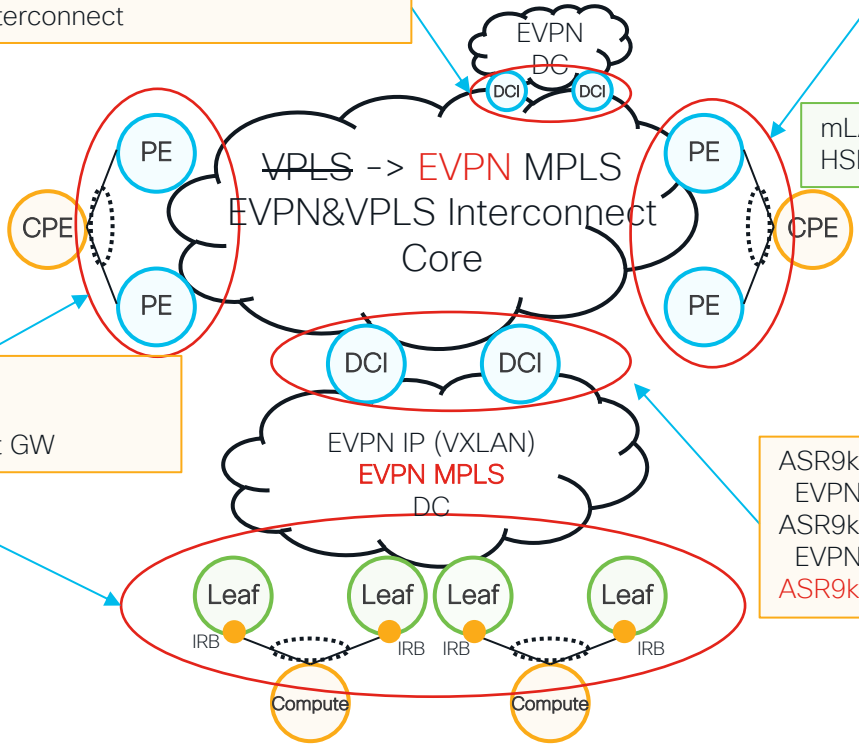
ASR9k/NCS VPLS to EVPN Seamless Migration
ASR9k VPLS to EVPN Interconnect

ASR9k/NCS EVPN-VPWS
All-Active Multihoming

mLACP/Cluster Replacement
HSRP/VRRP Replacement Phase 1 (IRB)



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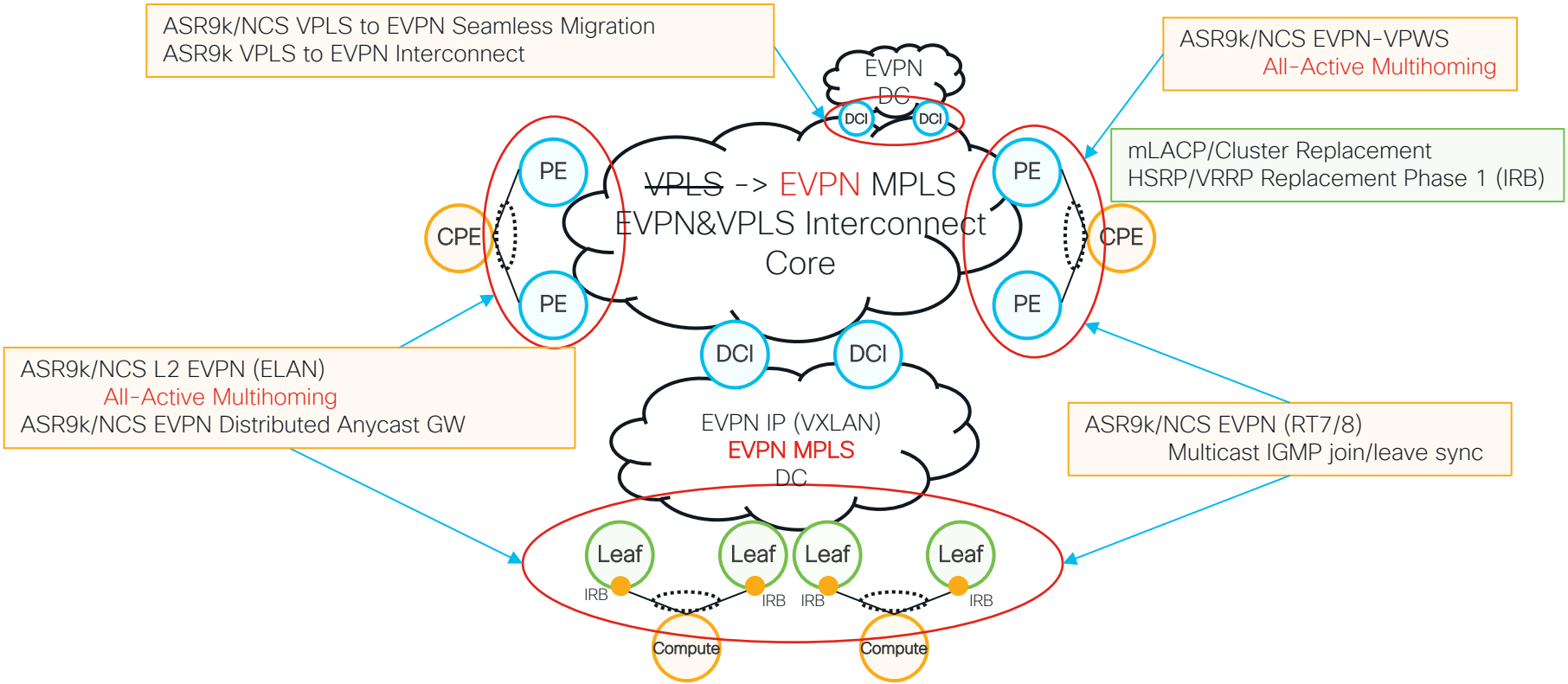
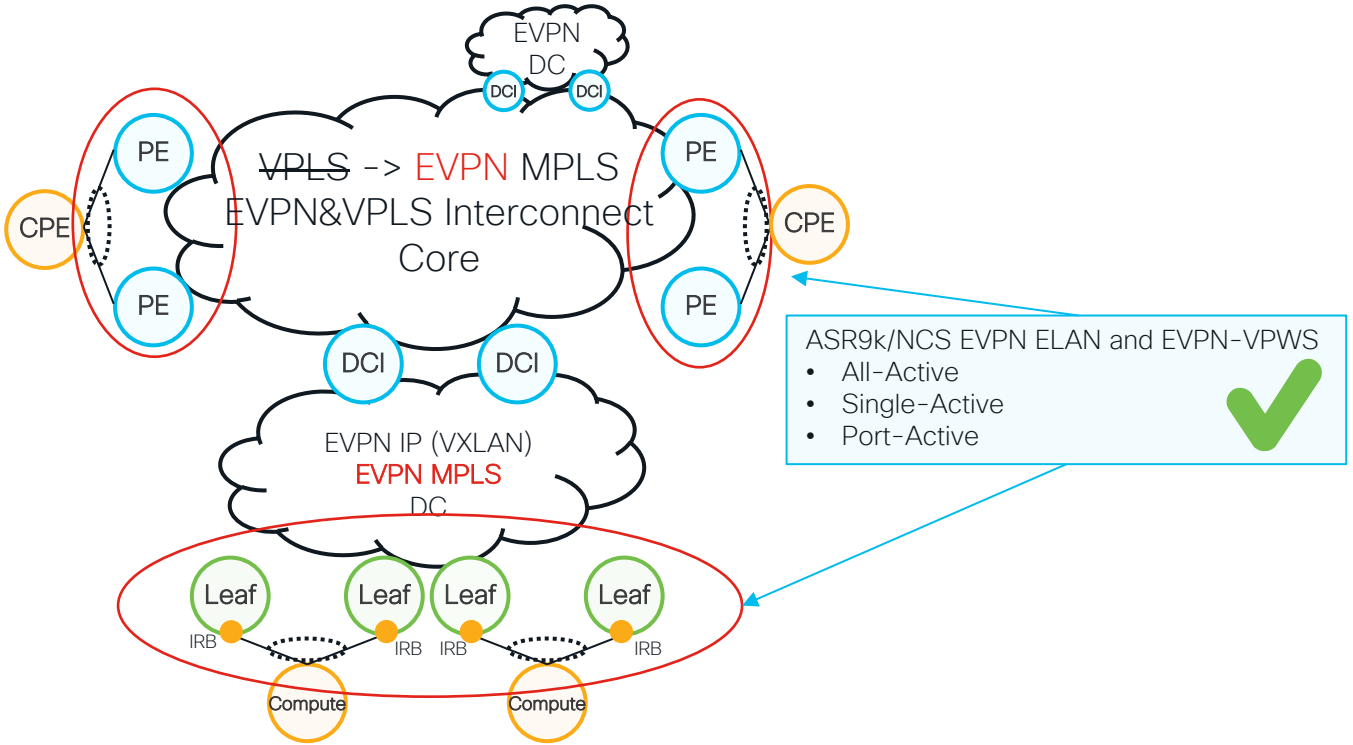
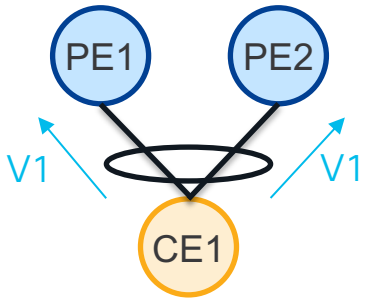


Service Overlay in CY2020



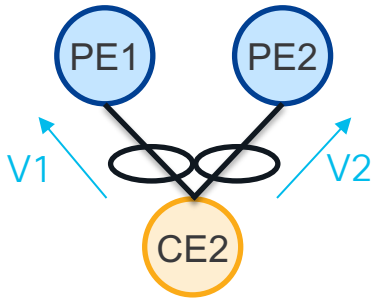
EVPN - Load-Balancing Modes

All-Active (per flow)



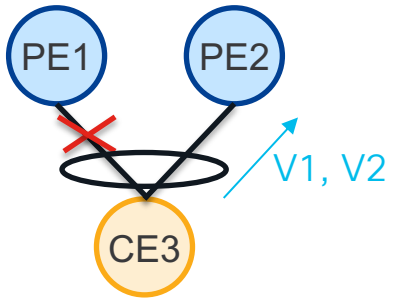
Single LAG at the CE
VLAN goes to both PE
Traffic hashed per flow
Benefits: Bandwidth, Convergence

Single-Active (per VLAN)



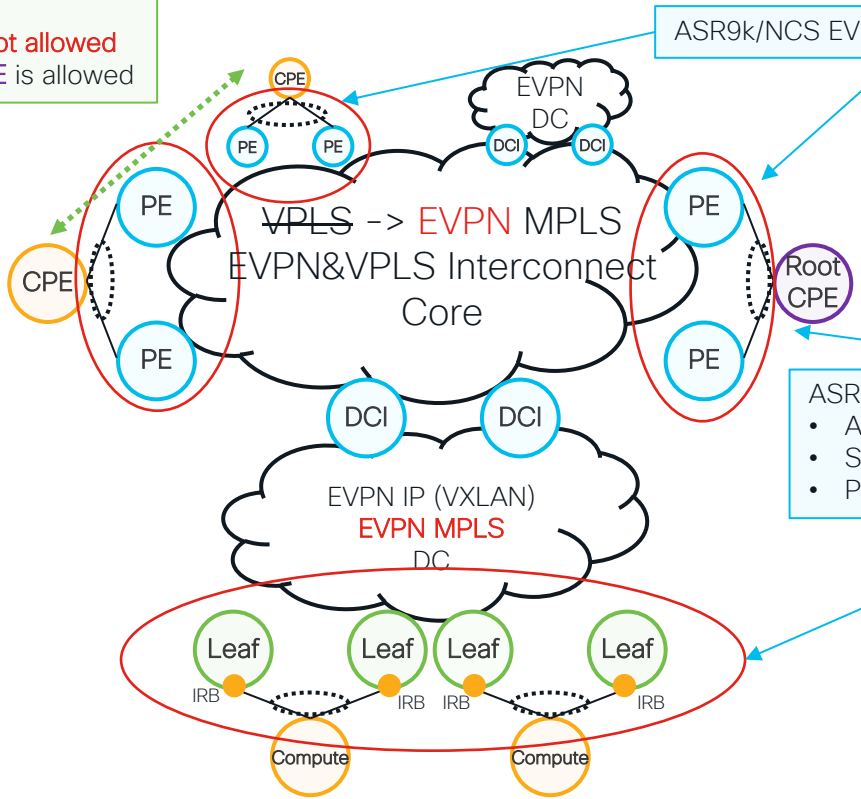
Multiple LAGs at the CE
VLAN active on single PE
Traffic hashed per VLAN
Benefits: Billing, Policing

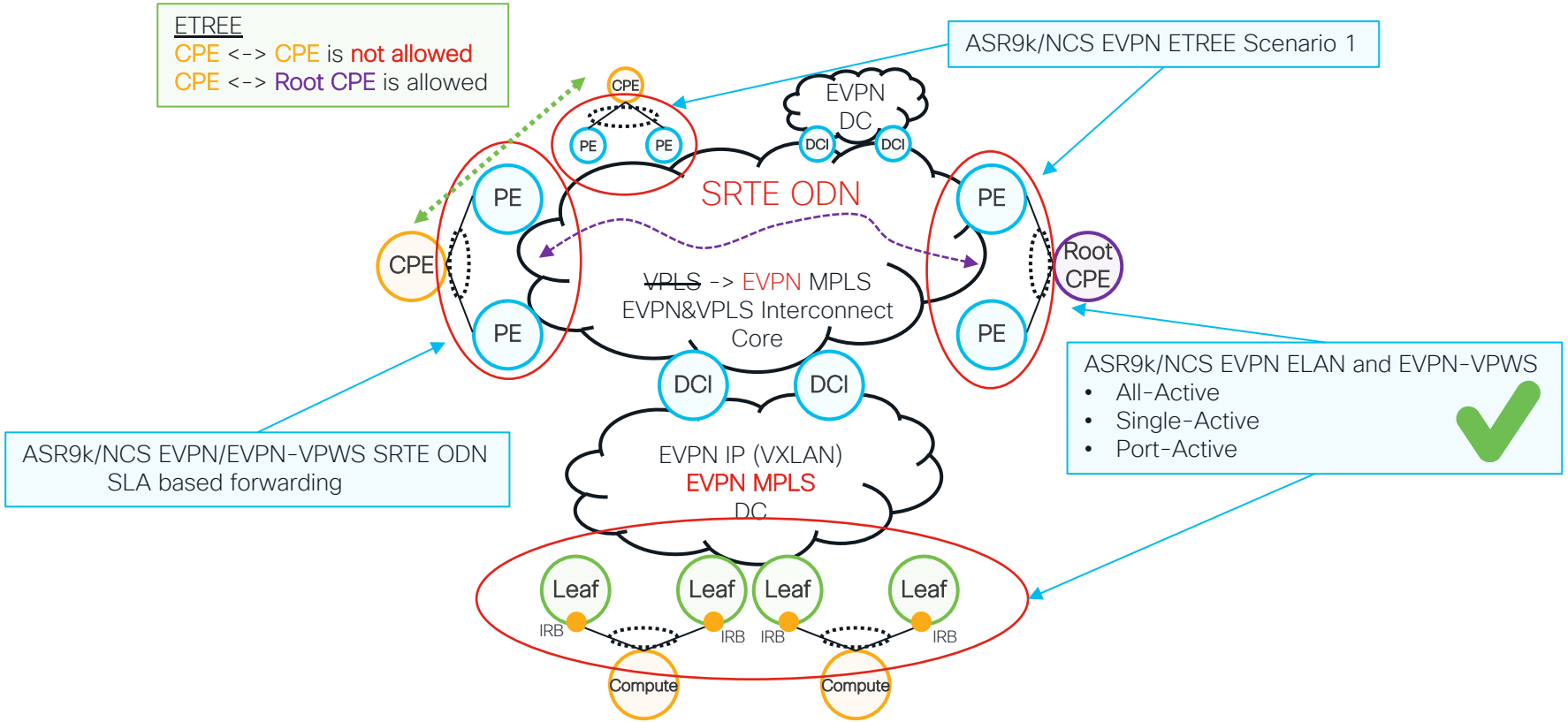
Port-Active (per port)

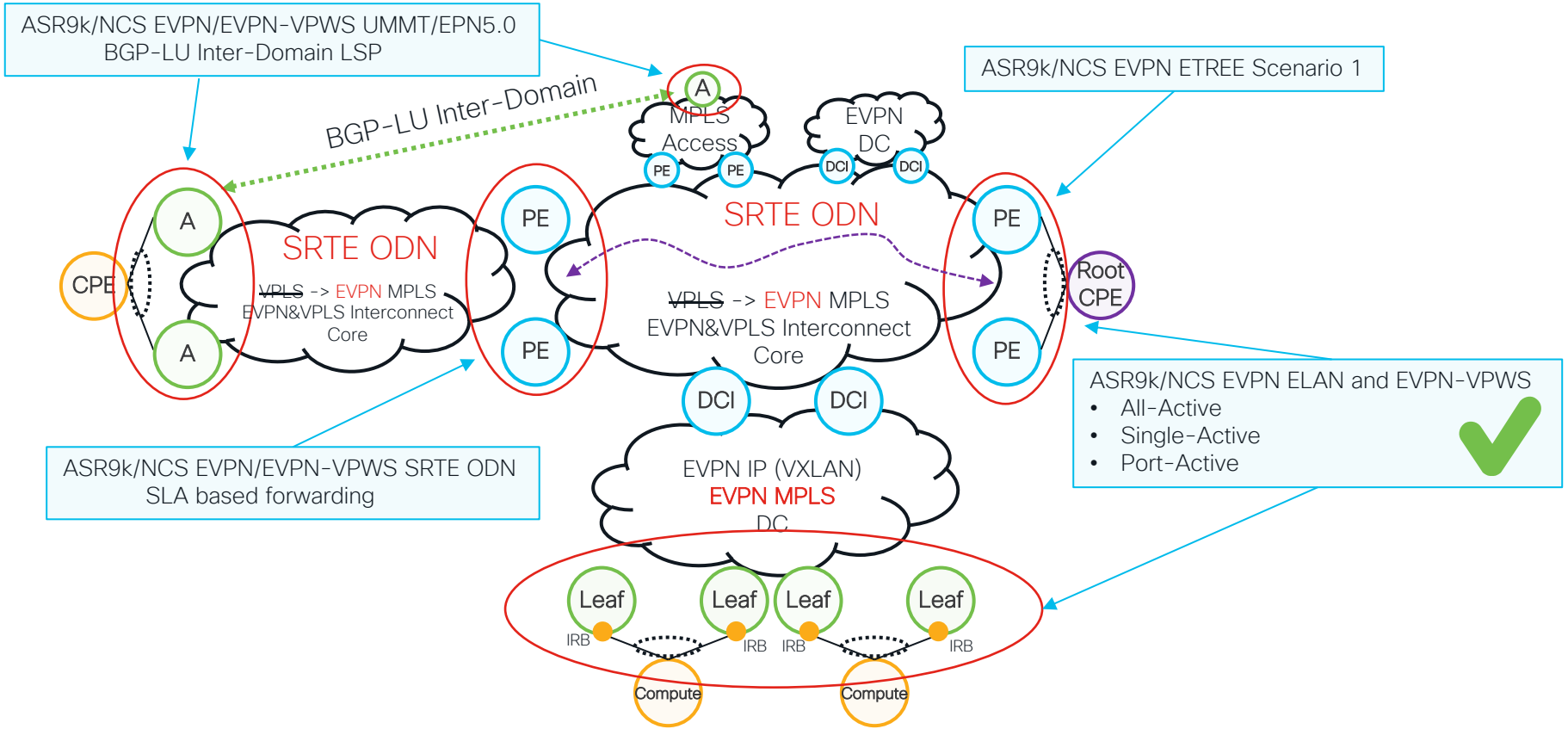


Single LAGs at the CE
Port active on single PE
Traffic hashed per port
Benefits: Protocol Simplification

ETREE
CPE <-> CPE is not allowed
CPE <-> Root CPE is allowed

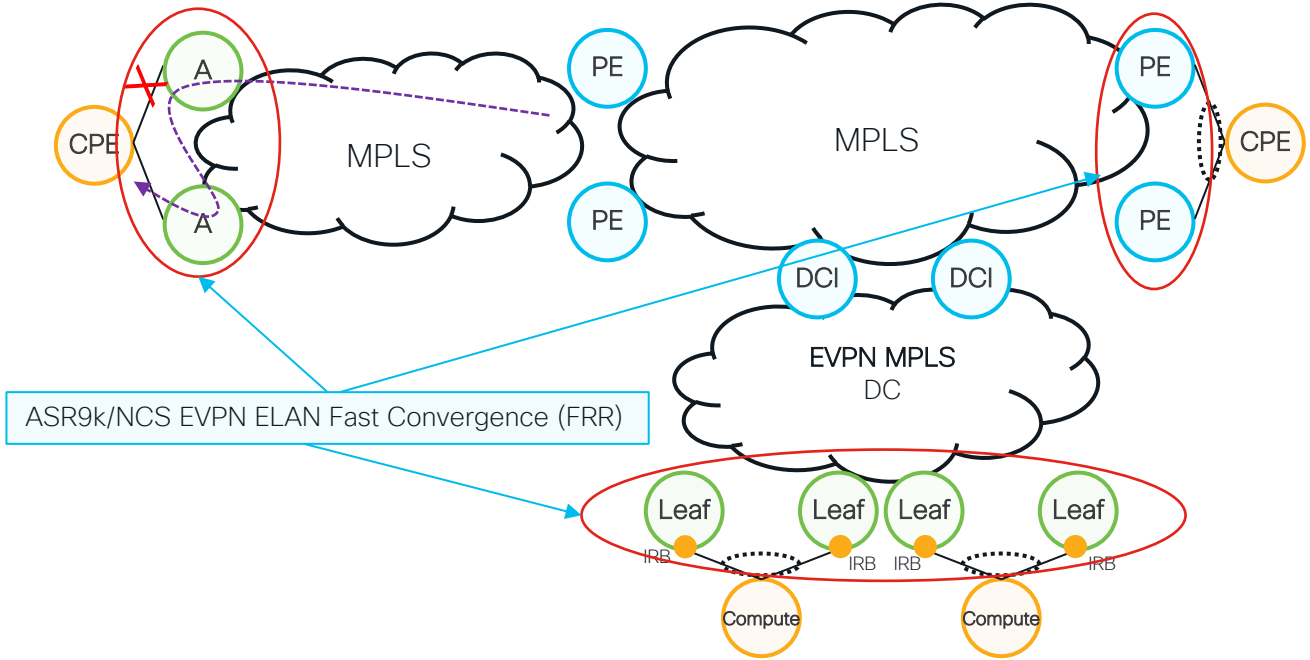






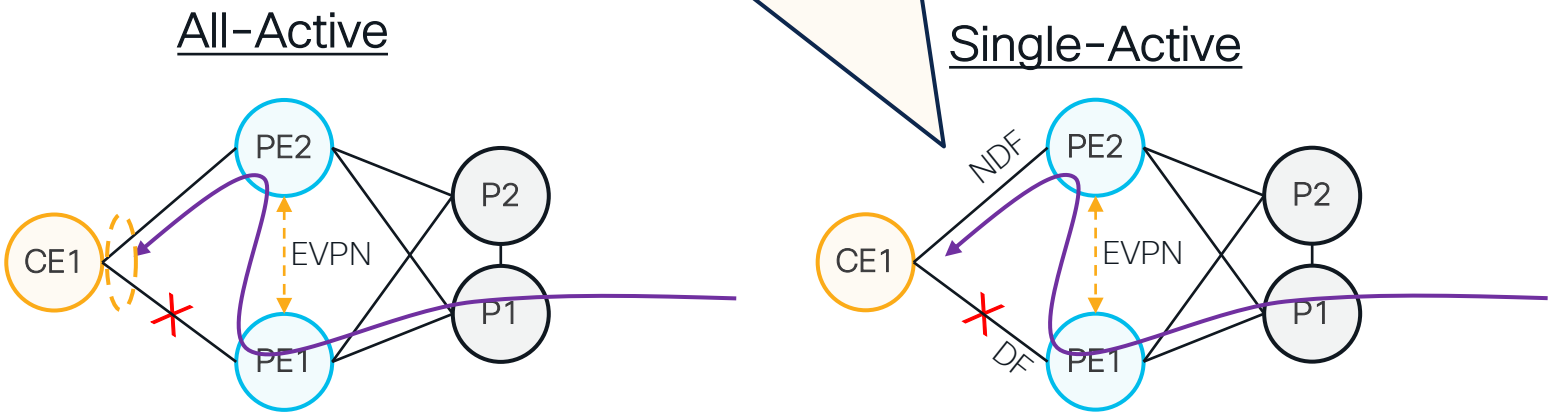
Service Overlay in CY2021

EVPN Fast Reroute
draft-burdet-bess-evpn-fast-reroute

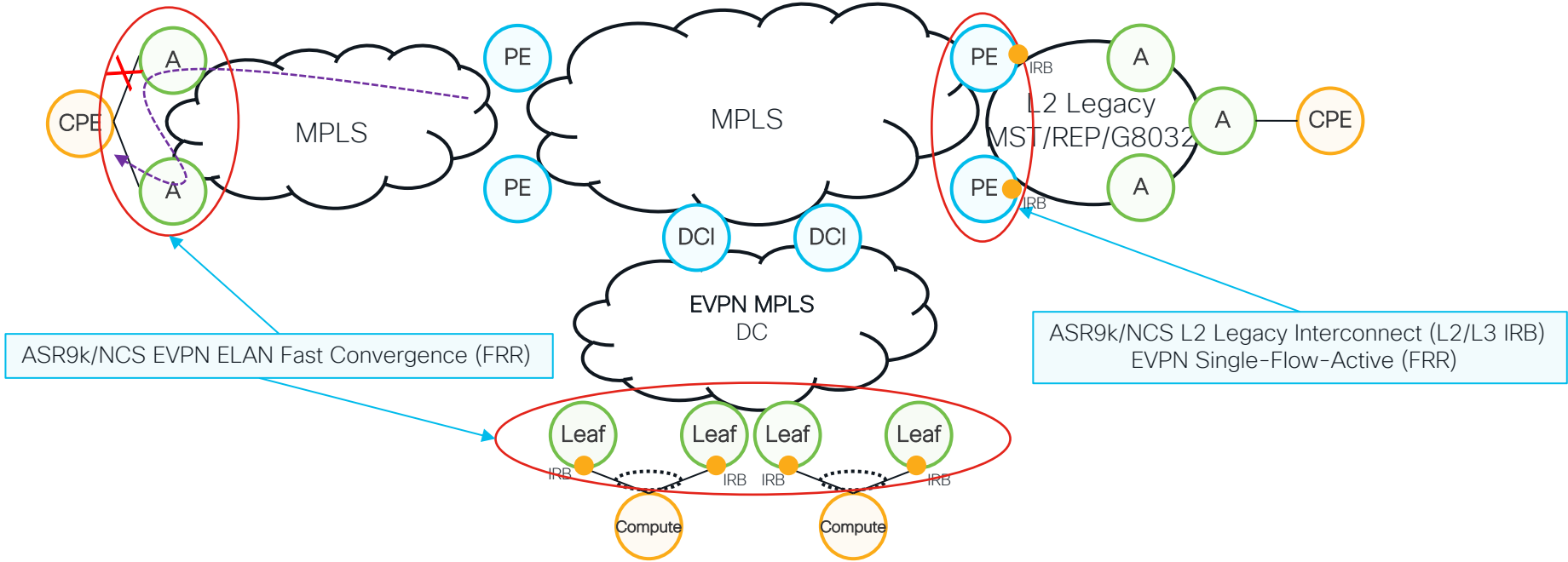


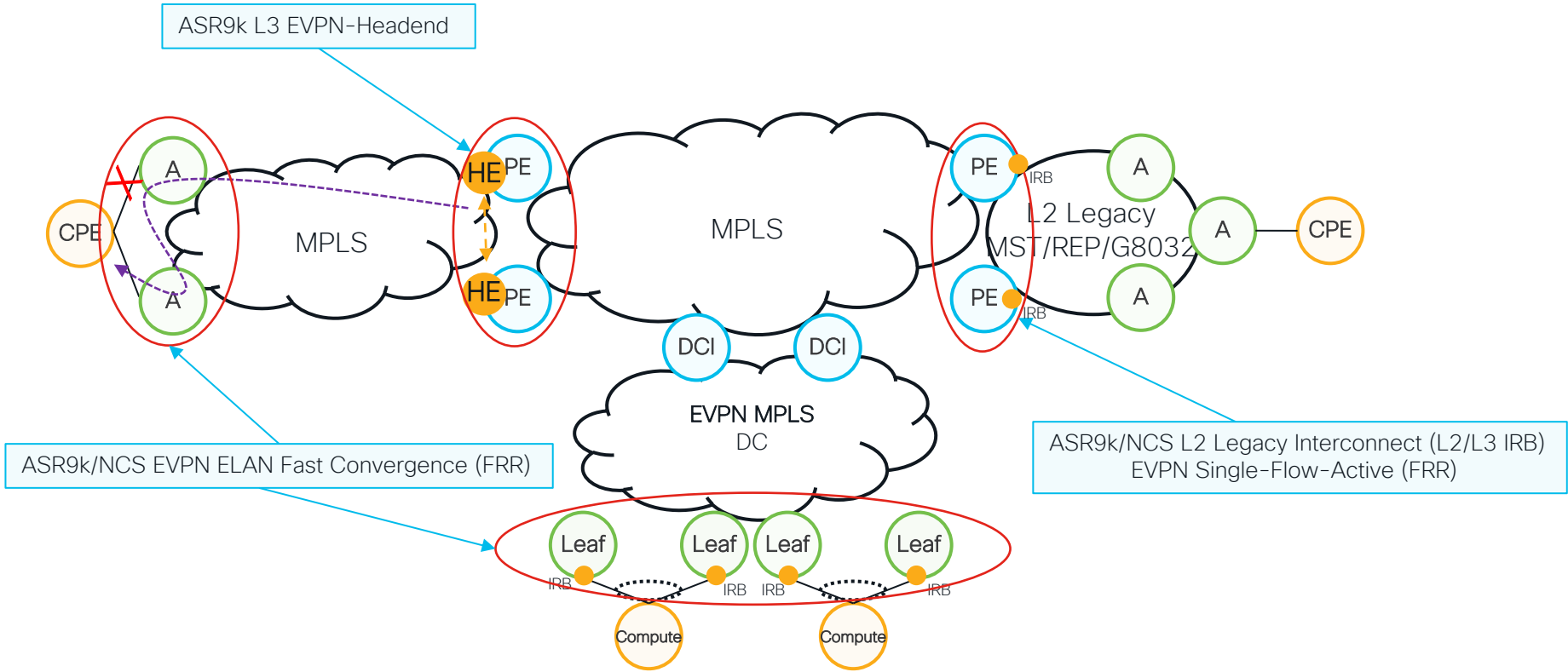
Fast Convergence (EVPN FRR Data Plane) – Edge

- Single-Active NDF filter traffic in both directions
- Re-Directed traffic will be re-directed back to PE1 (L3 Loop) or dropped
- Solution is to bypass NDF => Only redirected packet can bypass NDF!
  - Extra FRR label is used to bypass NDF
  - FRR Label is used for both All-Active and Single-Active access

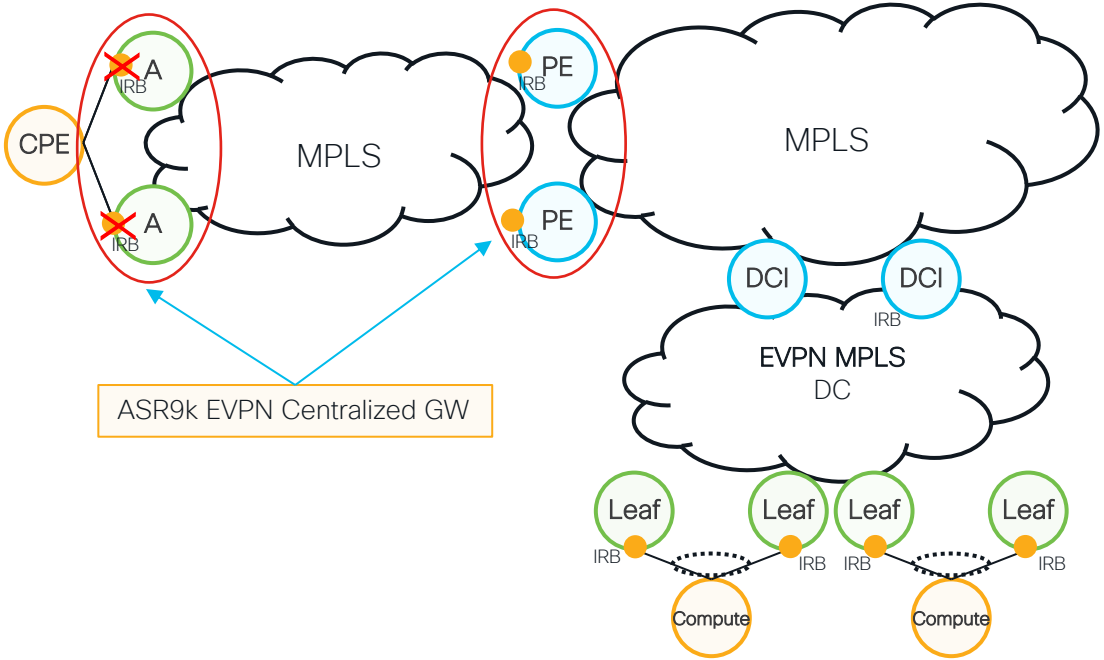


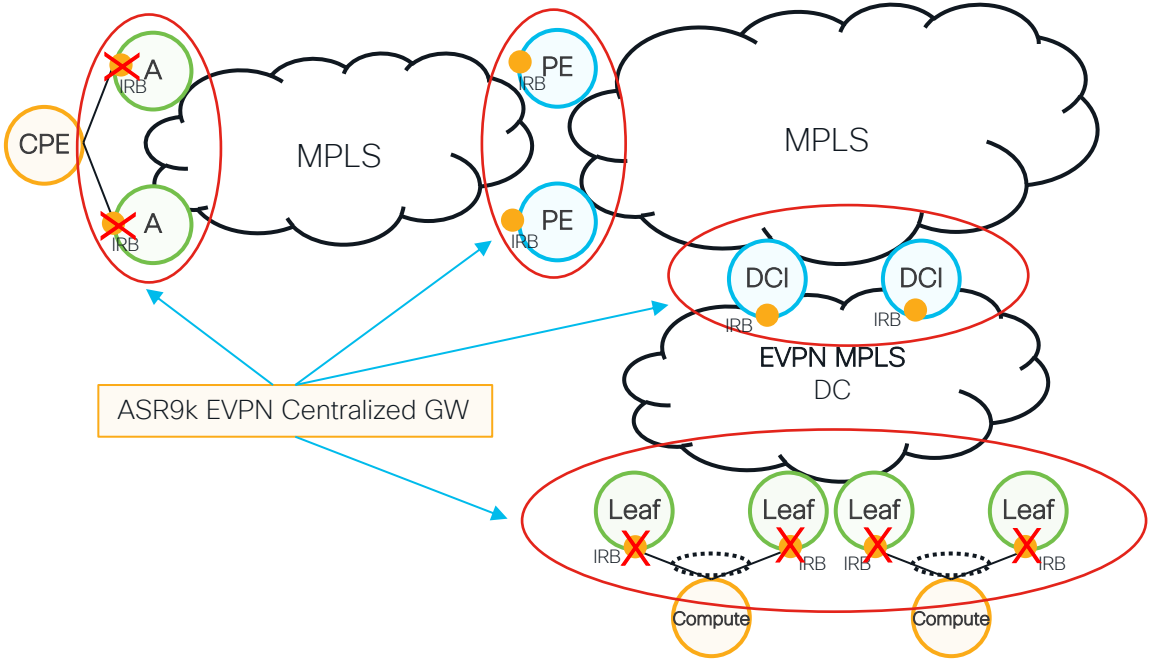
EVPN Single Flow Active
draft-brissette-bess-evpn-l2gw-proto

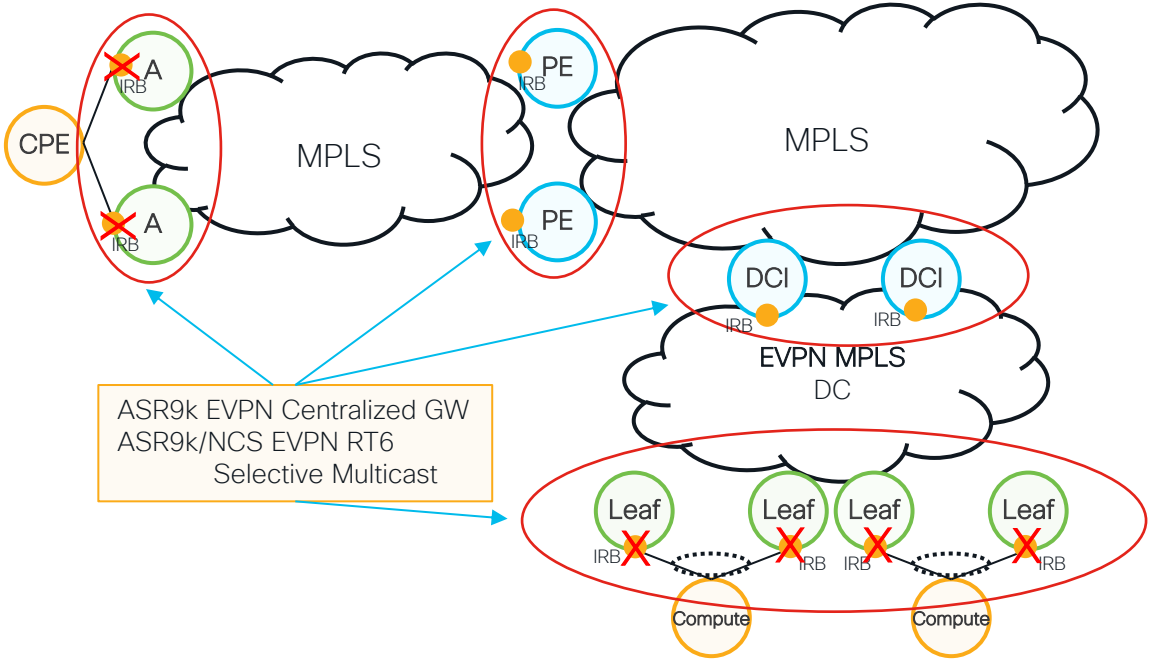


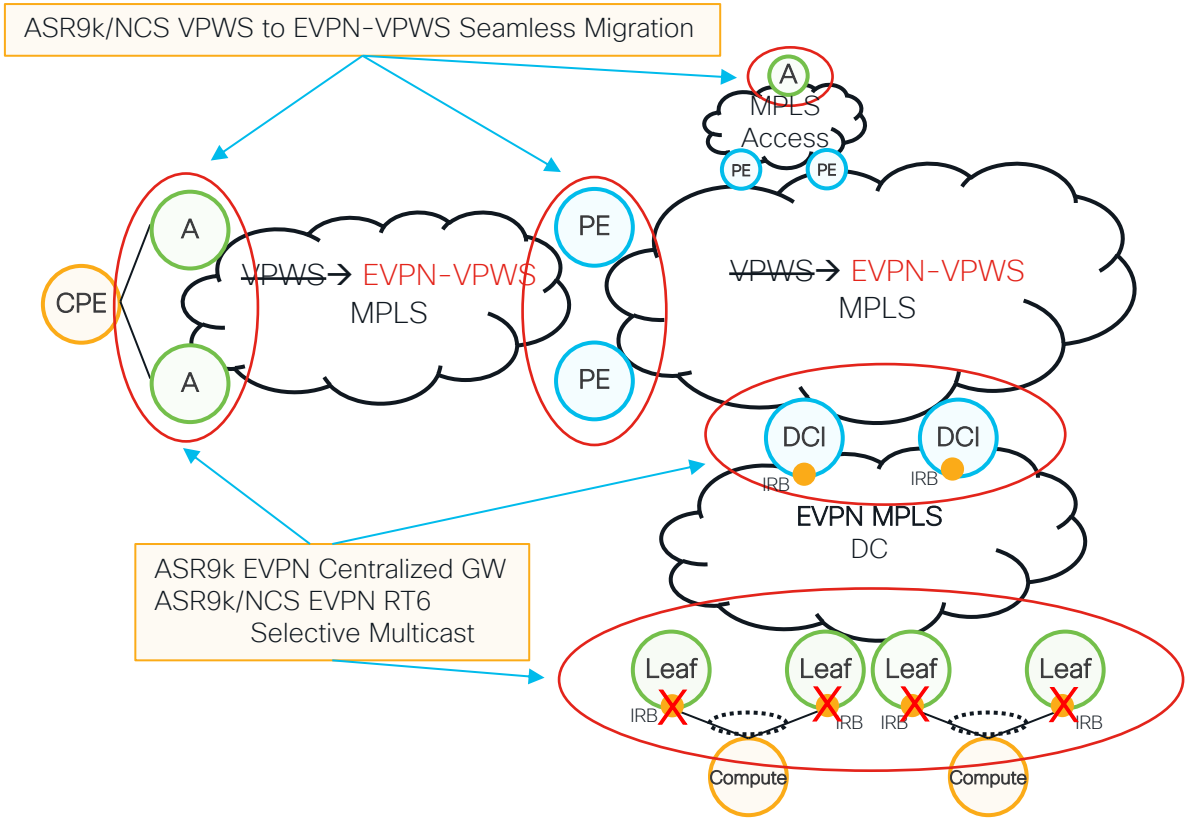


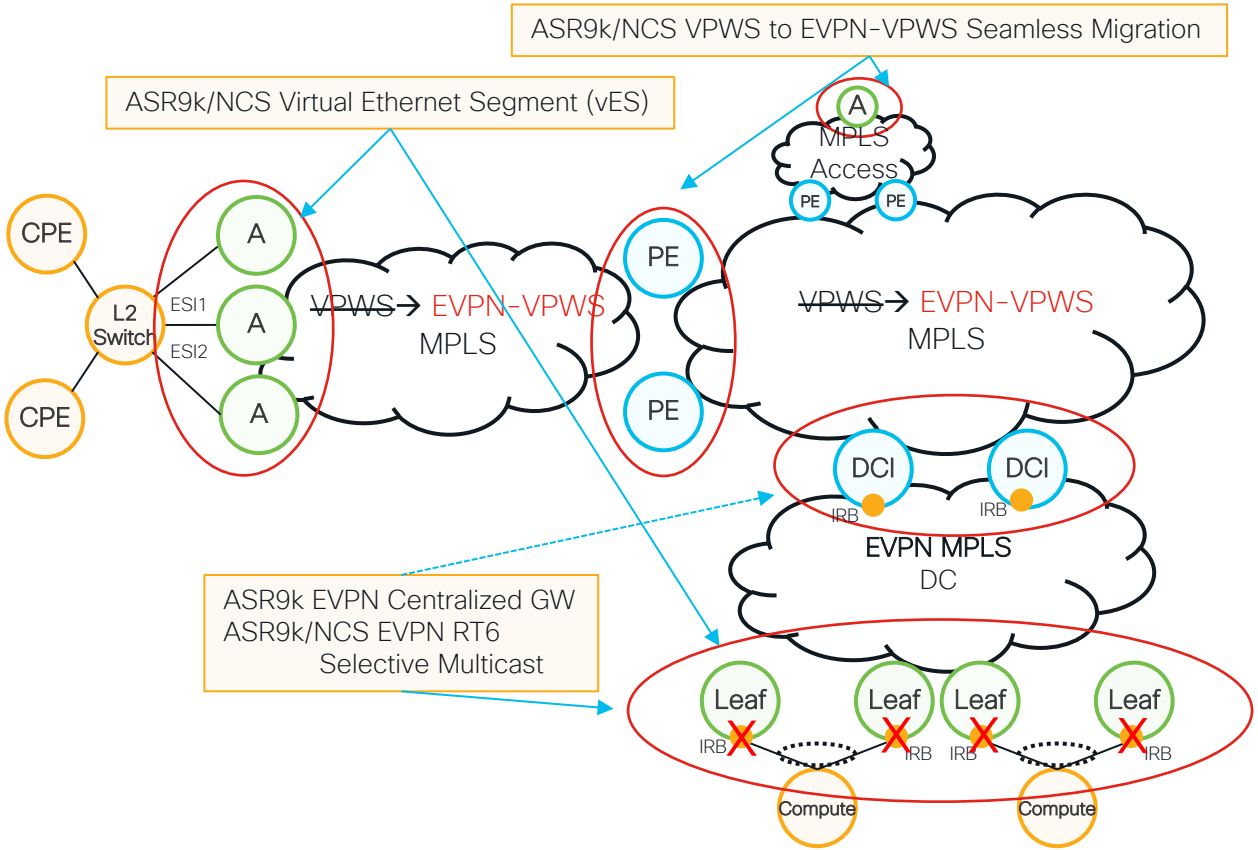
Service Overlay in CY2022

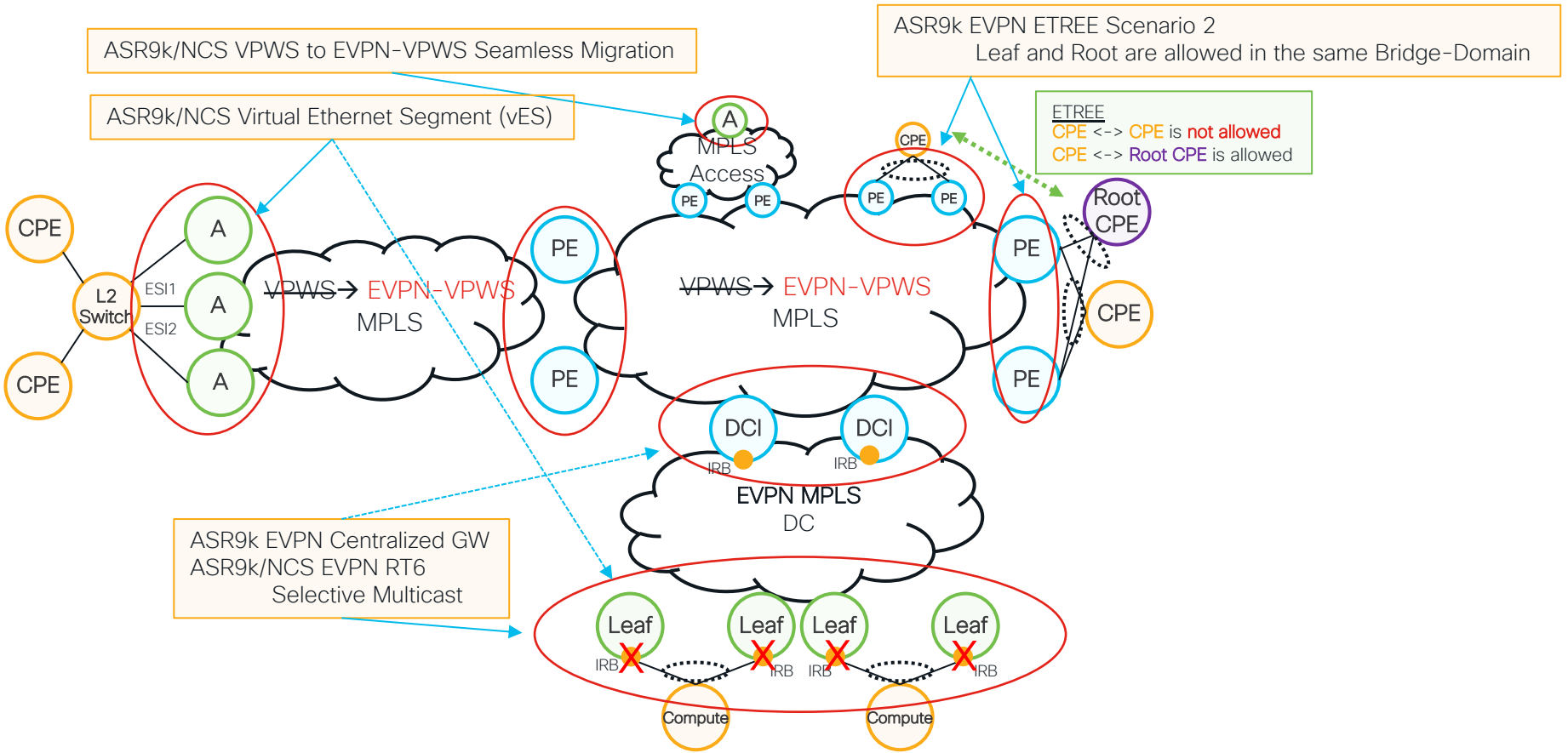


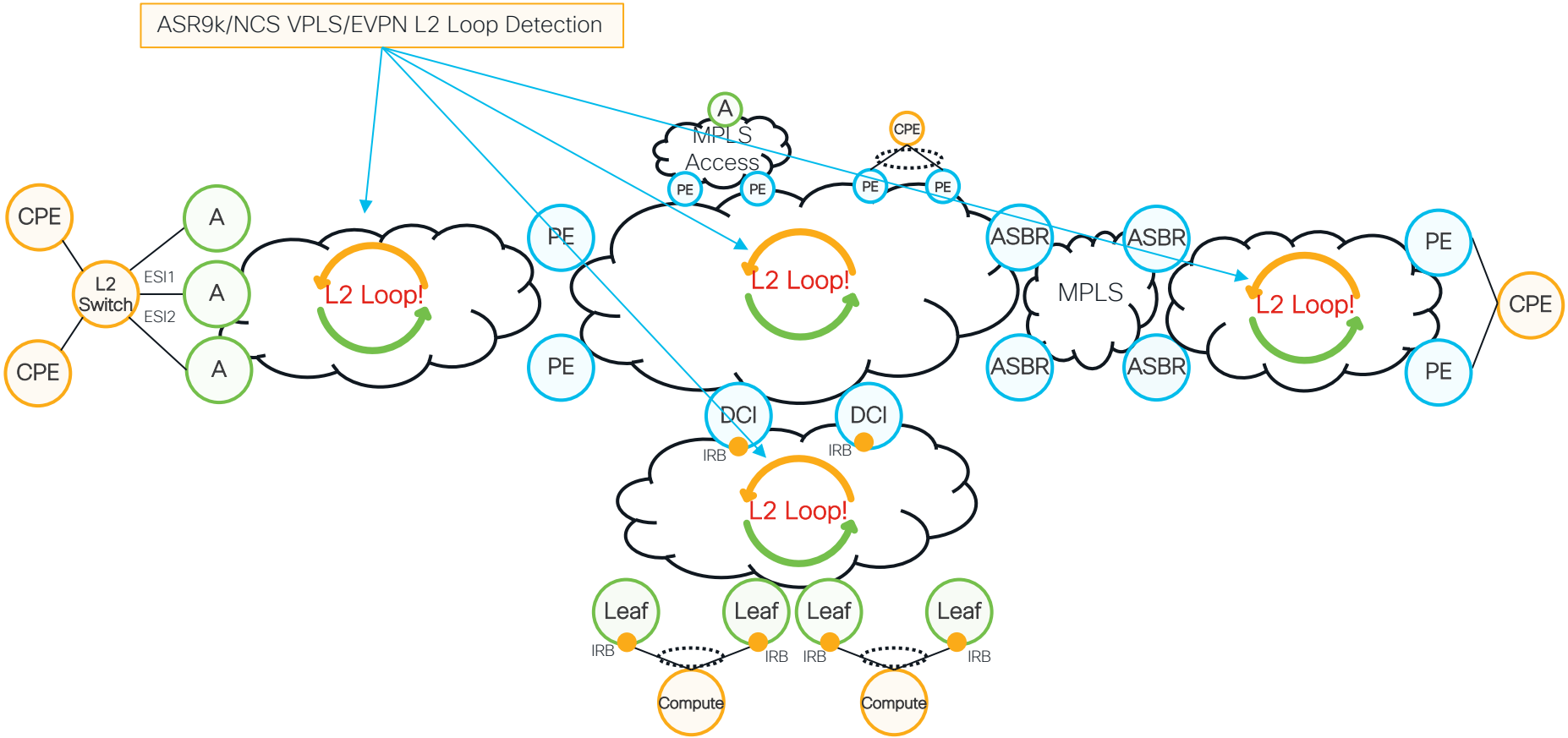




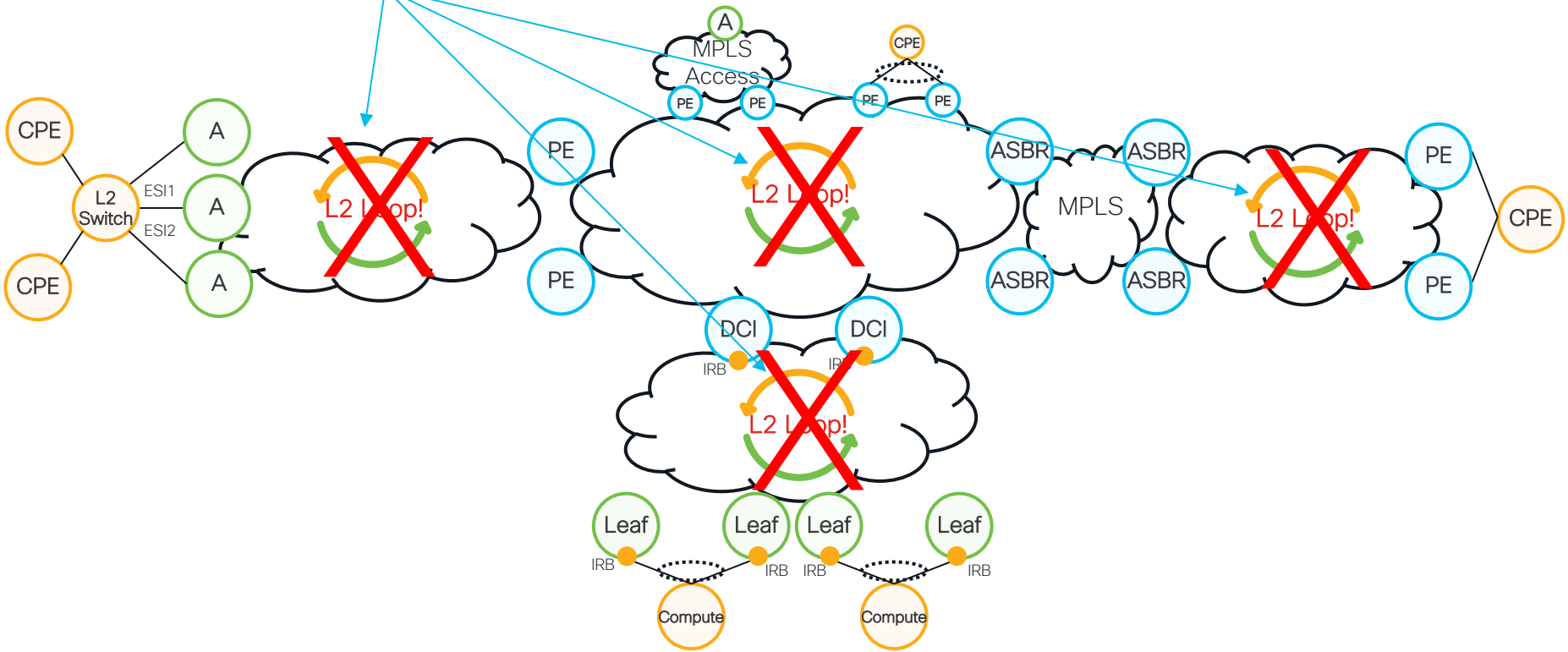








ASR9k/NCS VPLS/EVPN L2 Loop Detection
ASR9k/NCS VPLS/EVPN L2 Loop Protection



EVPN - Stay Up-To-Date

- https://e-vpn.io/
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