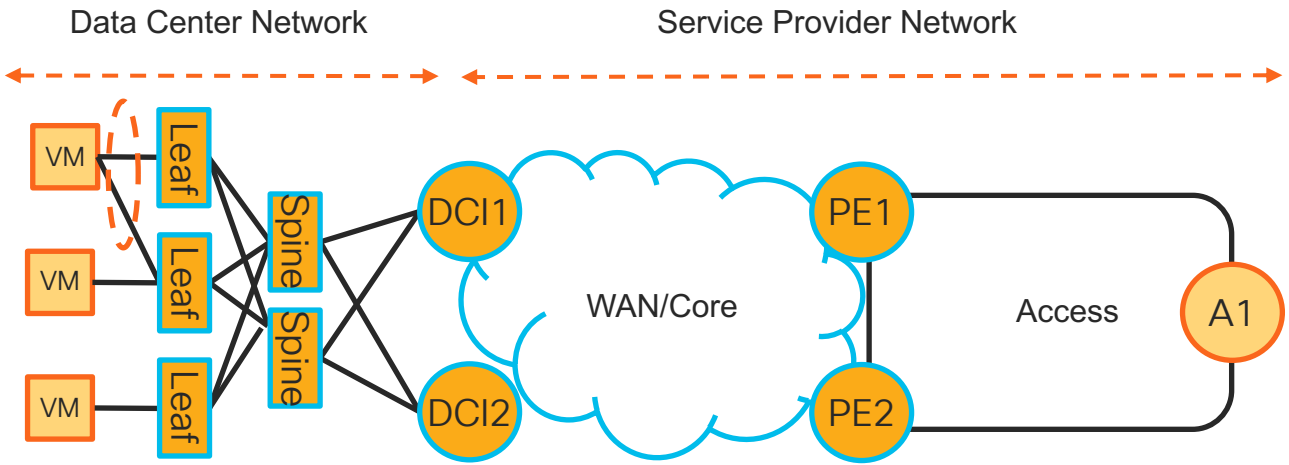
SP Transformation Summit 2018

Fecha
Lugar

Evolution:

Common EVPN Control Plane based on BGP: EVPN, PBB-EVPN, EVPN-VPWS — Overlay

IP, MPLS, VXLAN | **IP, MPLS (IGP/SR), MPLS-PBB** — Underlay

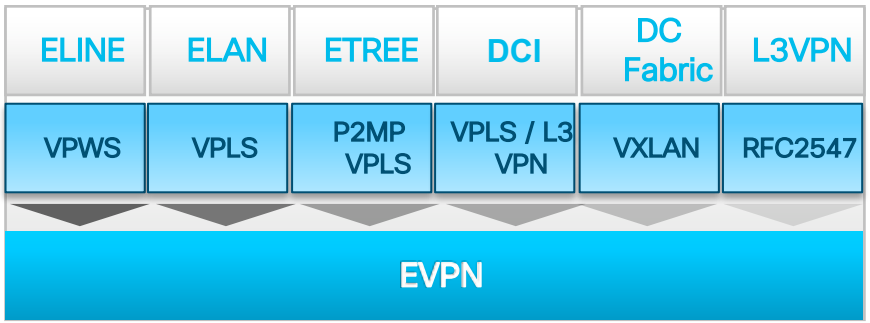


Existing Solution:

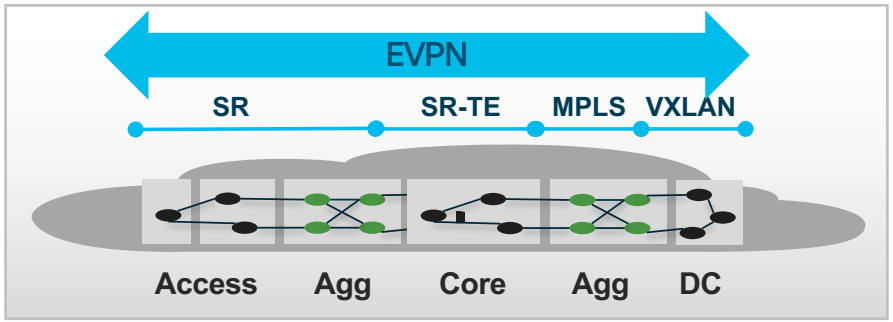
Trill, Fabric-Path	VPLS, OTV	L2/L3VPN (BGP,T-LDP) - VPLS, EoMPLS	Overlay
L2, STP, VLAN	IP, MPLS, L2	IP, IGP, MPLS (LDP), RSVP-TE, BGP-LU	Underlay

EVPN
Next generation network services

Single service for any application



E2E control and automation across domains



Optimized CapEx:
- Open Standards & Multi-vendor
- Active-Active multi-homing
- Enhanced load balancing

Reduced OpEx:
- Integrated L2 & L3 service, any application: faster time to market, certification
- E2E control and automation

Increased Customer Value
- Inter-domain SLA, faster convergence
- Better stability: no flood
- Granular policy control

What is EVPN?

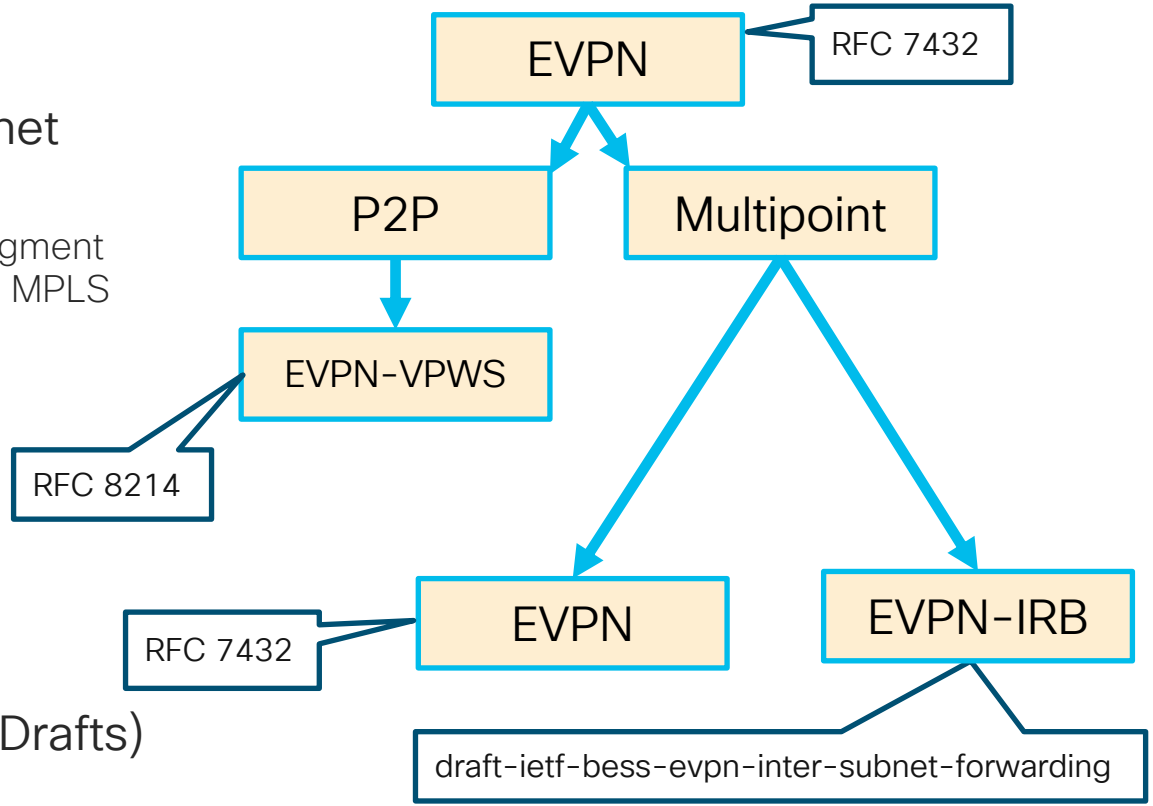
EVPN family introduces next generation solutions for Ethernet services

- BGP control-plane for Ethernet Segment and MAC distribution learning over MPLS and VXLAN data-plane
- Same principles and operational experience as in IP VPNs

No use of Pseudowires

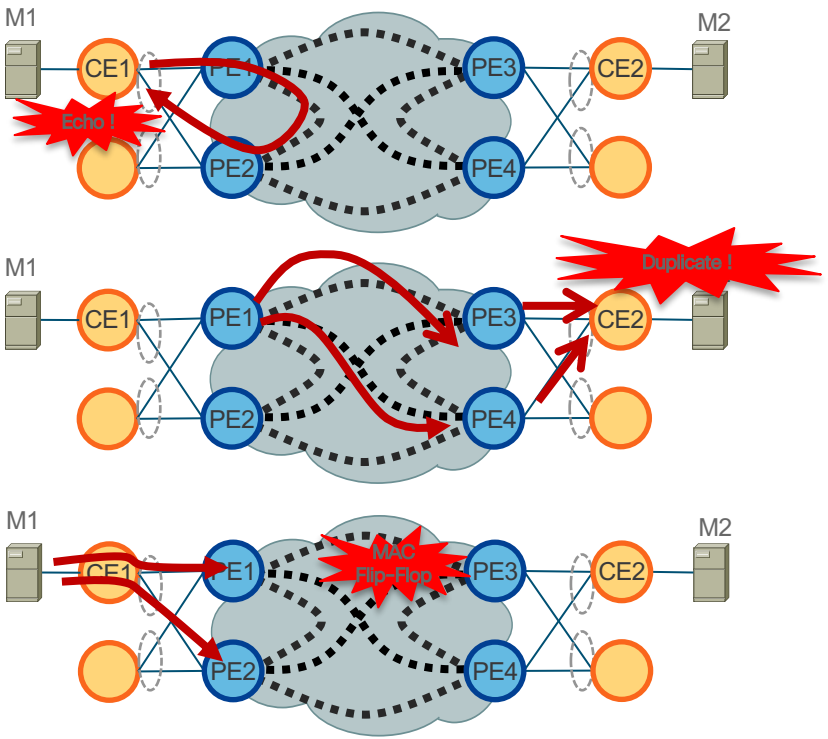
Multi-vendor solutions

Cisco leader in industry standardization efforts (RFCs/Drafts)



Why was EVPN needed in 2012?

- Existing VPLS solutions do not offer an All-Active per-flow redundancy
- Looping of Traffic Flooded from PE
- Duplicate Frames from Floods from the Core
- MAC Flip-Flopping over Pseudowire
  - E.g. Port-Channel Load-Balancing does not produce a consistent hash-value for a frame with the same source MAC (e.g. non MAC based Hash-Schemes)

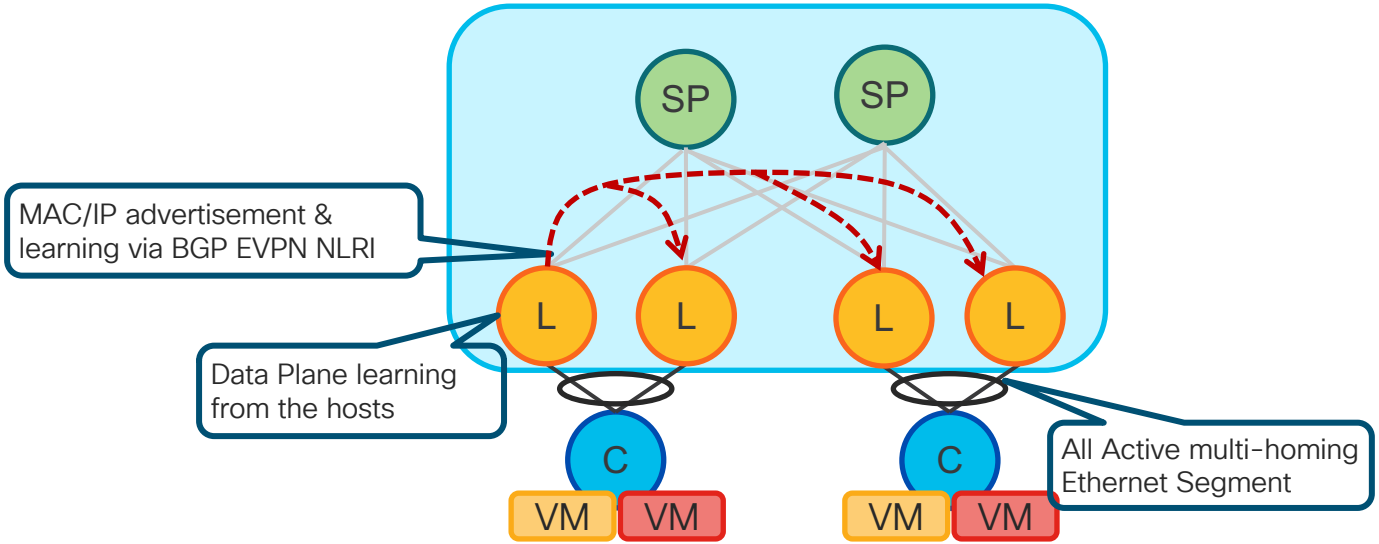


Why was EVPN needed in 2016?

- Network Operators have emerging needs in their network:
  - Cloud and Services virtualization (DC)
  - Data center interconnect operation (DCI)
  - Remove protocols and Network Simplification (ICCP, HSRP/VRRP)
  - Integrated of Layer 2 and Layer 3 VPN Services

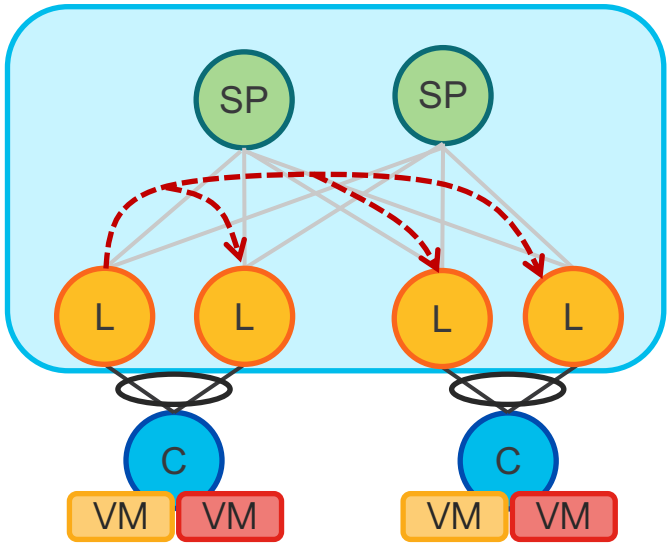
EVPN – Ethernet VPN

- Leafs run Multi-Protocol BGP to advertise & learn MAC/IP addresses over the Network Fabric
- MAC/IP addresses are advertised to rest of Leafs

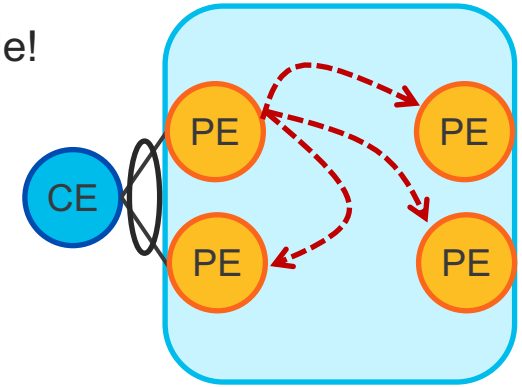


EVPN – Ethernet VPN

- Concepts are same!!! Pick your side!

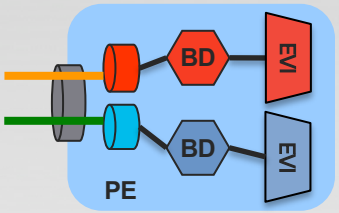


Pick your side!



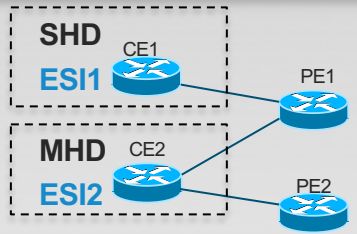
Concepts

EVPN Instance (EVI)



- **EVI identifies a VPN in the network**
- **Encompass one or more bridge-domains, depending on service interface type**
  - Port-based
  - VLAN-based (shown above)
  - VLAN-bundling

Ethernet Segment



- **Represents a 'site' connected to one or more PEs**
- **Uniquely identified by a 10-byte global Ethernet Segment Identifier (ESI)**
- **Could be a single device or an entire network**
  - Single-Homed Device (SHD)
  - Multi-Homed Device (MHD)
  - Single-Homed Network (SHN)
  - Multi-Homed Network (MHN)

BGP Routes

Route Types
[1] Ethernet Auto-Discovery (AD) Route
[2] MAC/IP Advertisement Route
[3] Inclusive Multicast Route
[4] Ethernet Segment Route
[5] IP Prefix Advertisement Route

- **New SAFI [70]**
- **Routes serve control plane purposes, including:**
  - MAC address reachability
  - MAC mass withdrawal
  - Split-Horizon label adv.
  - Aliasing
  - Multicast endpoint discovery
  - Redundancy group discovery
  - Designated forwarder election
  - IP address reachability
  - L2/L3 Integration

BGP Route Attributes

Extended Communities
ESI MPLS Label
ES-Import
MAC Mobility
Default Gateway
Encapsulation

- **New BGP extended communities defined**
- **Expand information carried in BGP routes, including:**
  - MAC address moves
  - Redundancy mode
  - MAC / IP bindings of a GW
  - Split-horizon label encoding
  - Data plane Encapsulation

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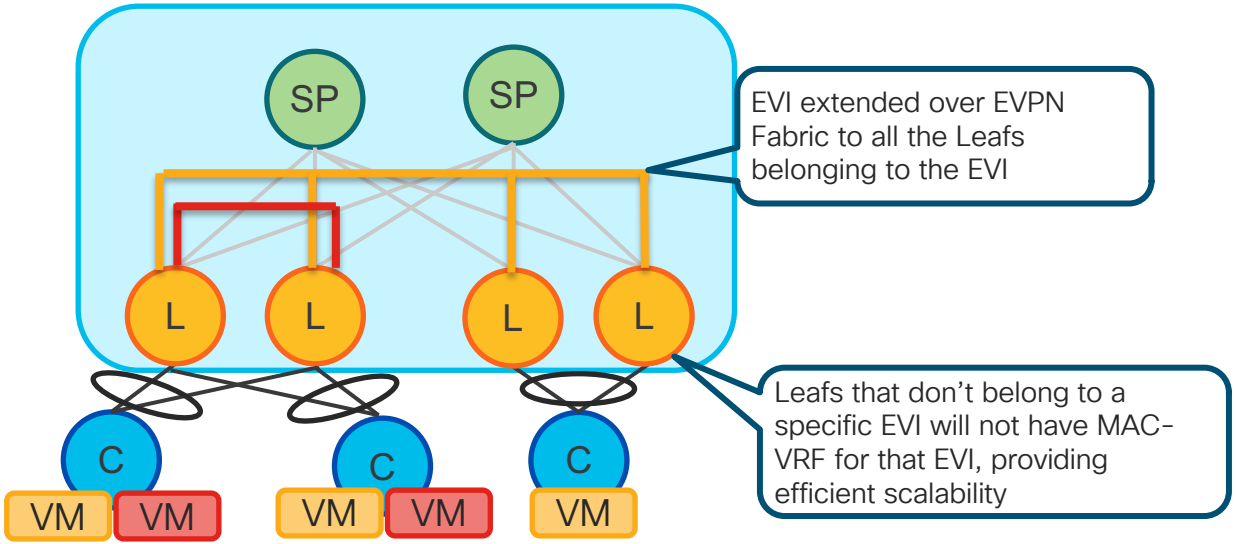
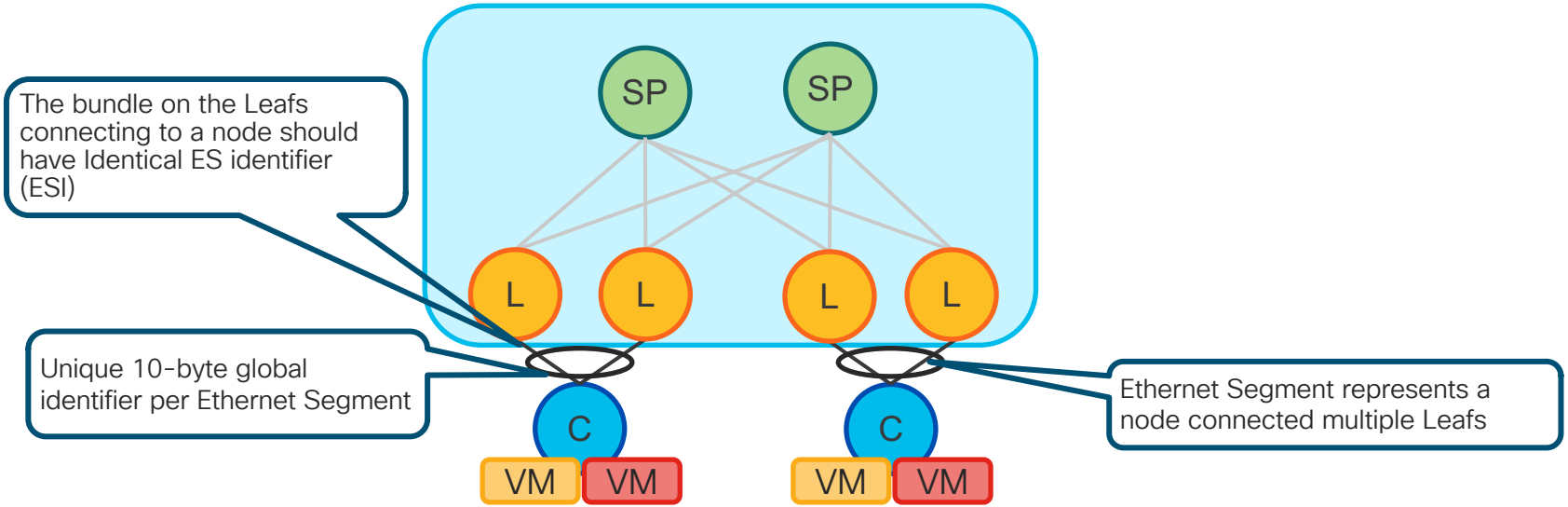
- MAC/IP addresses are advertised to rest of Leafs



EVI: An EVPN instance extends Layer 2 between the Leafs

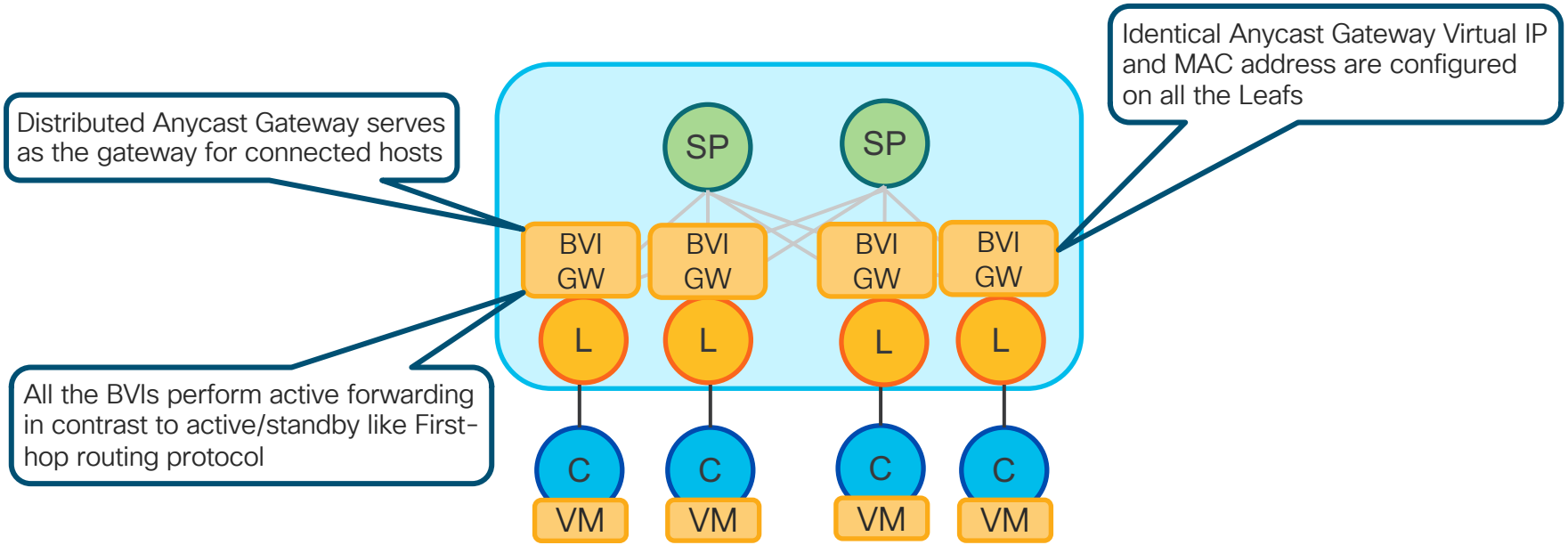
EVPN – Ethernet-Segment for Multi-Homing



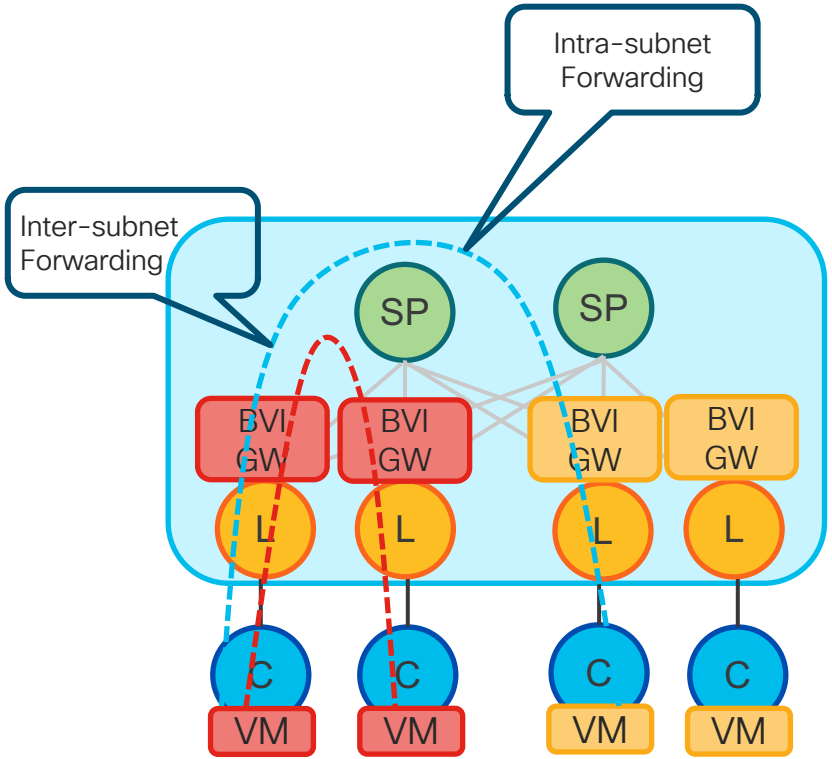
EVPN – Distributed Anycast Gateway

Purpose:

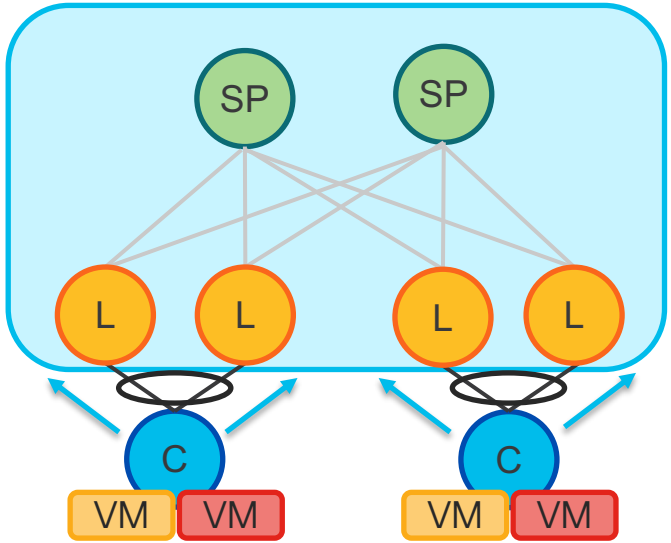
Optimal intra and inter-subnet connectivity with seamless workload mobility



Distributed Anycast Gateway



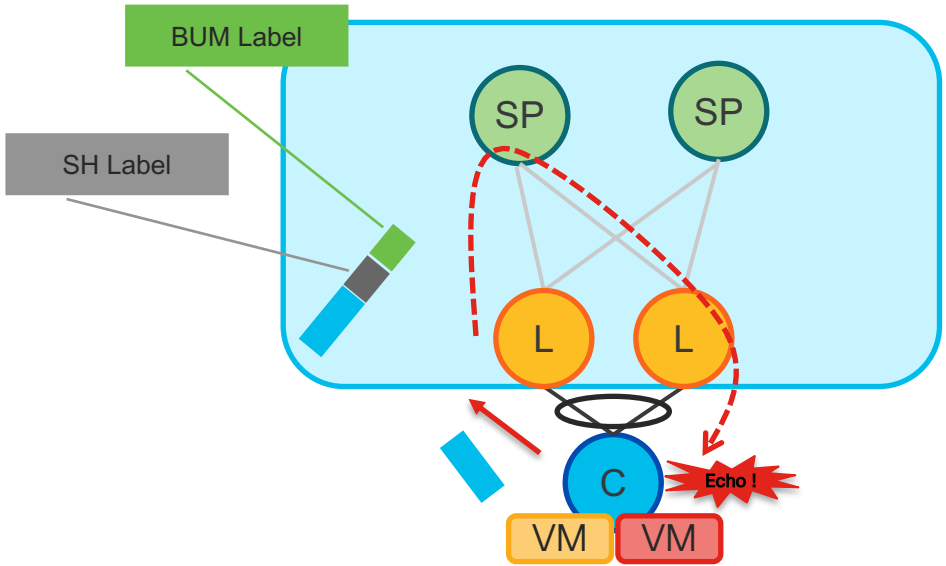
EVPN – All-Active Load balancing



- No dedicated cross link between leafs required
- EVPN based service carving for load balancing of BUM traffic forwarding
- Mass withdraw for faster convergence
- Per-flow load-balancing across both active links

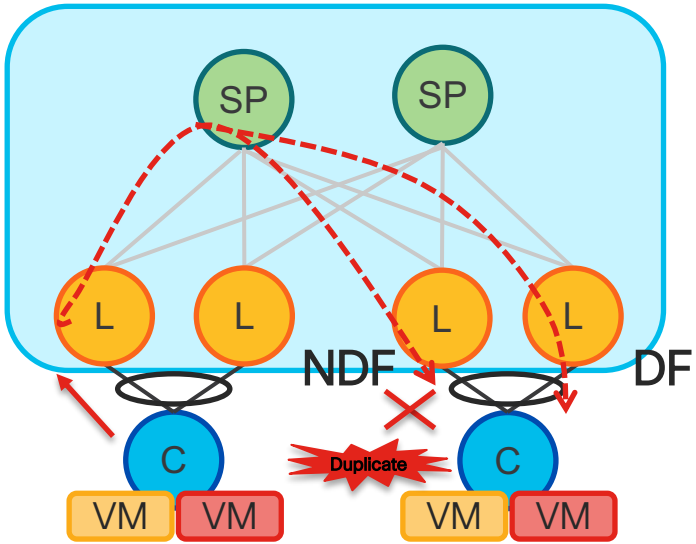
EVPN – Split Horizon

Challenge:
How to prevent flooded traffic from echoing back to a multi-homed Ethernet Segment?



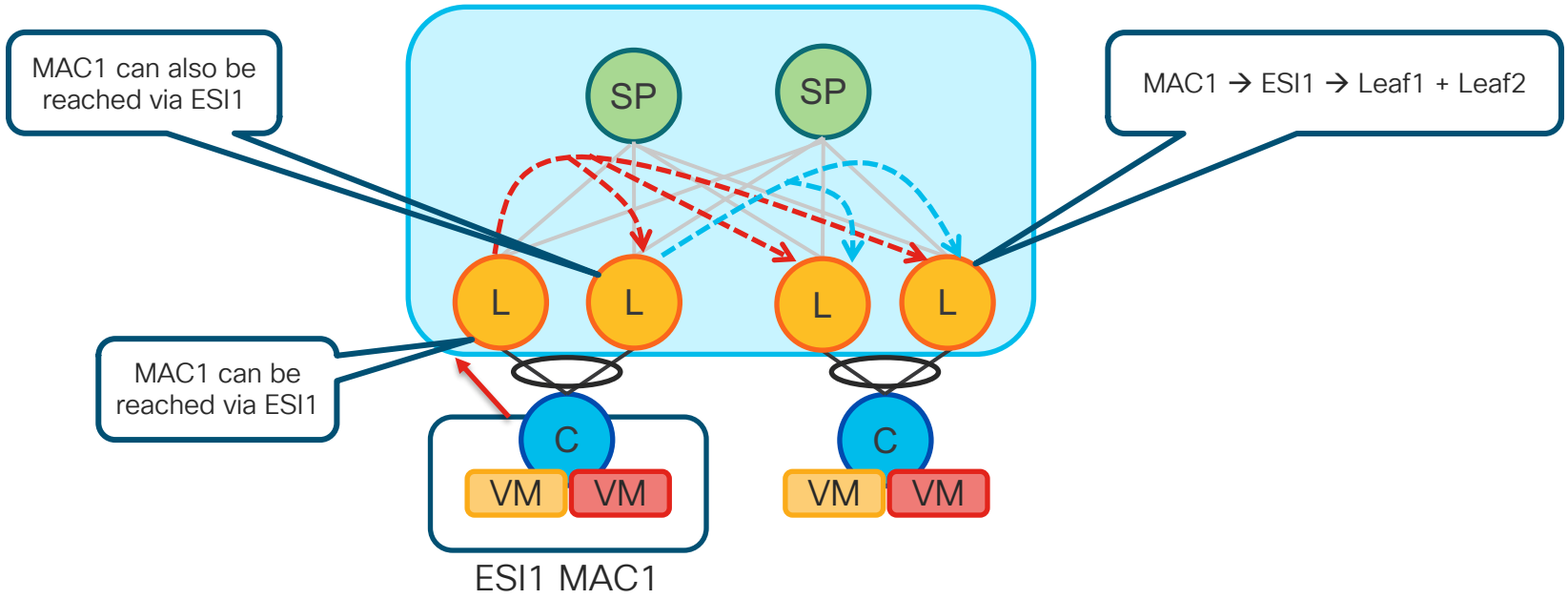
EVPN – Designated Forwarder (DF)

Challenge:
How to prevent duplicate copies of flooded traffic from being delivered to a multi-homed Ethernet Segment?



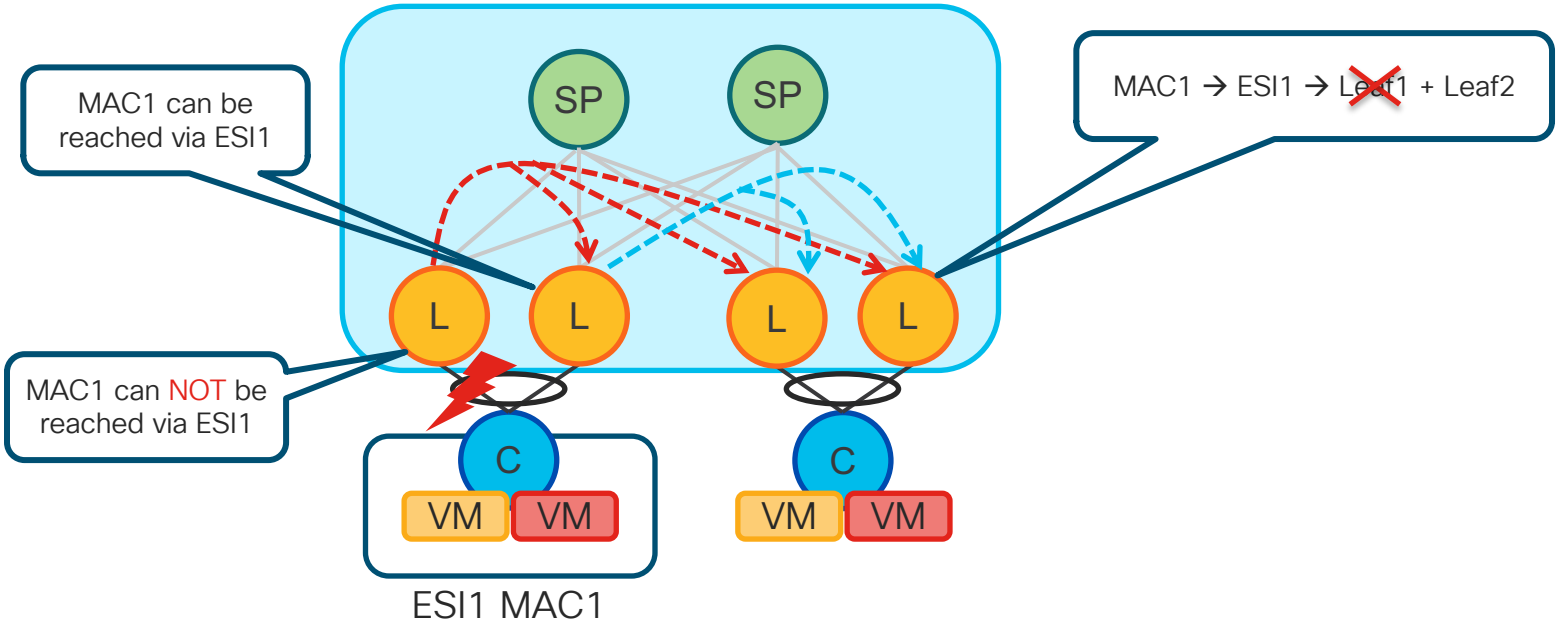
EVPN – Aliasing

Challenge:
How to load-balance traffic towards a multi-homed device across multiple Leafs when MAC addresses are learnt by only a single Leaf?



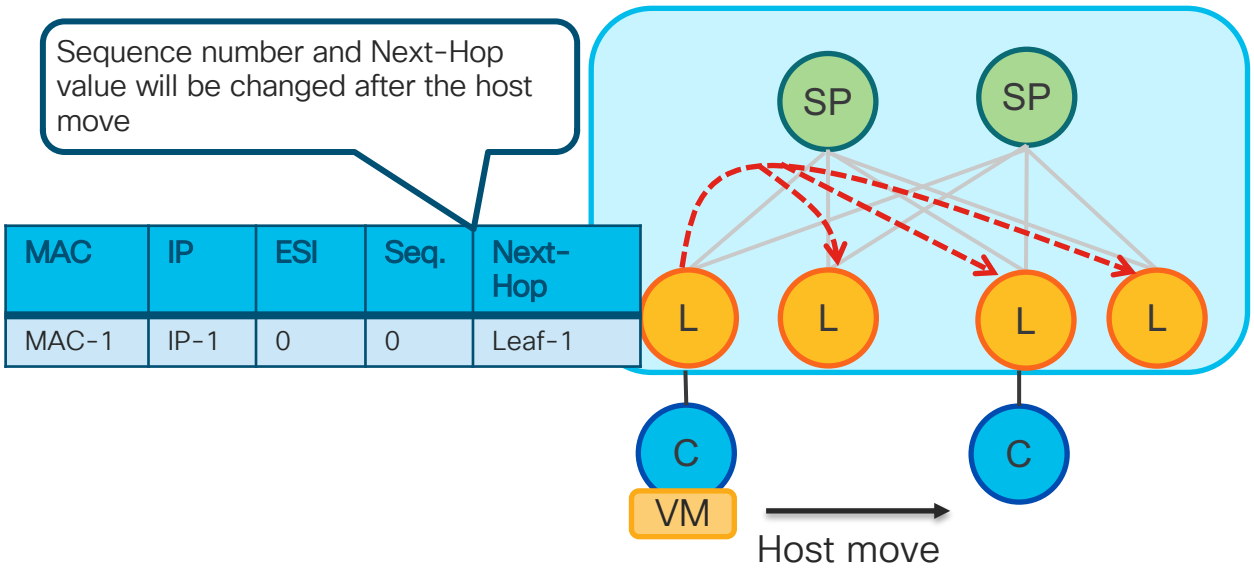
EVPN – MAC Mass-Withdraw

Challenge:
How to inform other Leafs of a failure affecting many MAC addresses quickly while the control-plane re-converges?

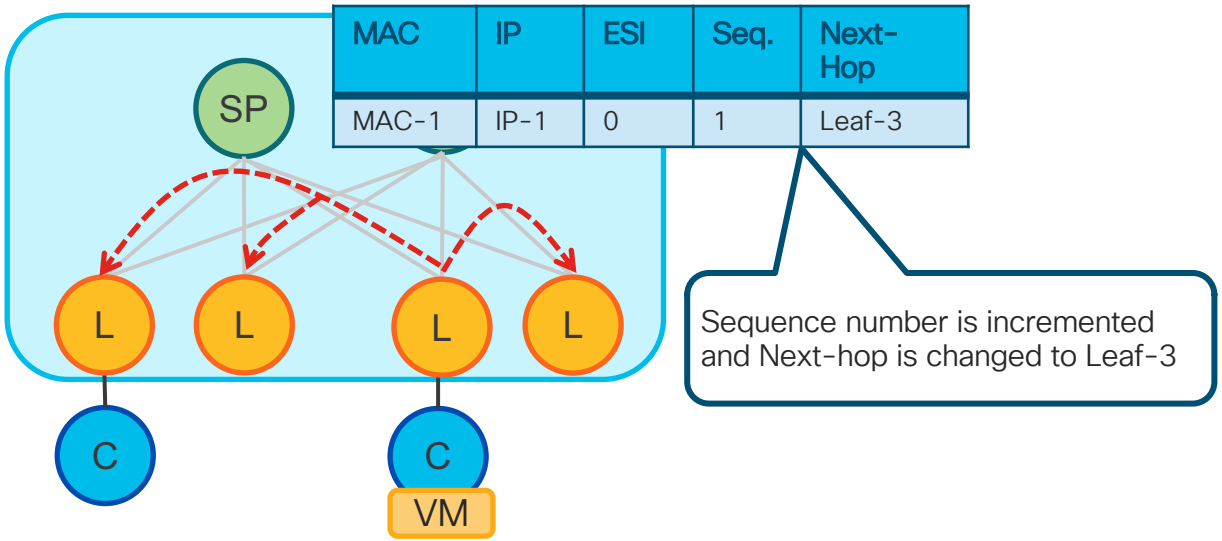


EVPN – MAC Mobility (1/2)

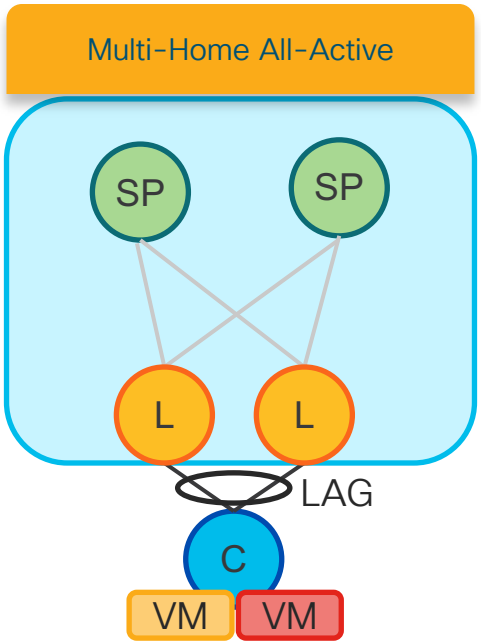
Challenge:
How to detect the correct location of MAC after the movement of host from one Ethernet Segment to another also called “MAC move”?



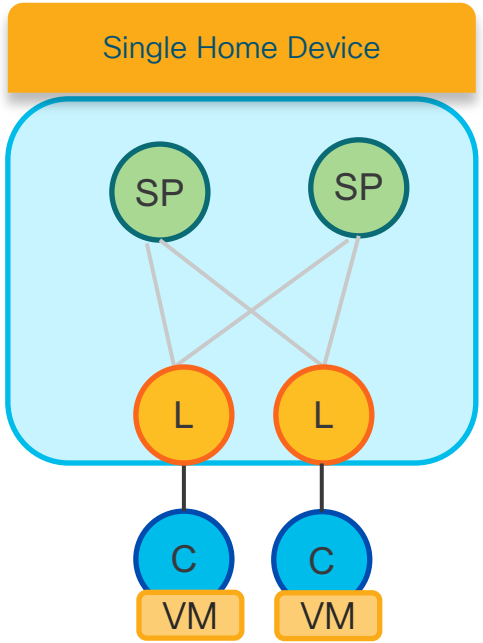
EVPN – MAC Mobility (2/2)



EVPN – Host Connectivity Options



- Identical ESI on Leafs
- DF election per EVI/ESI

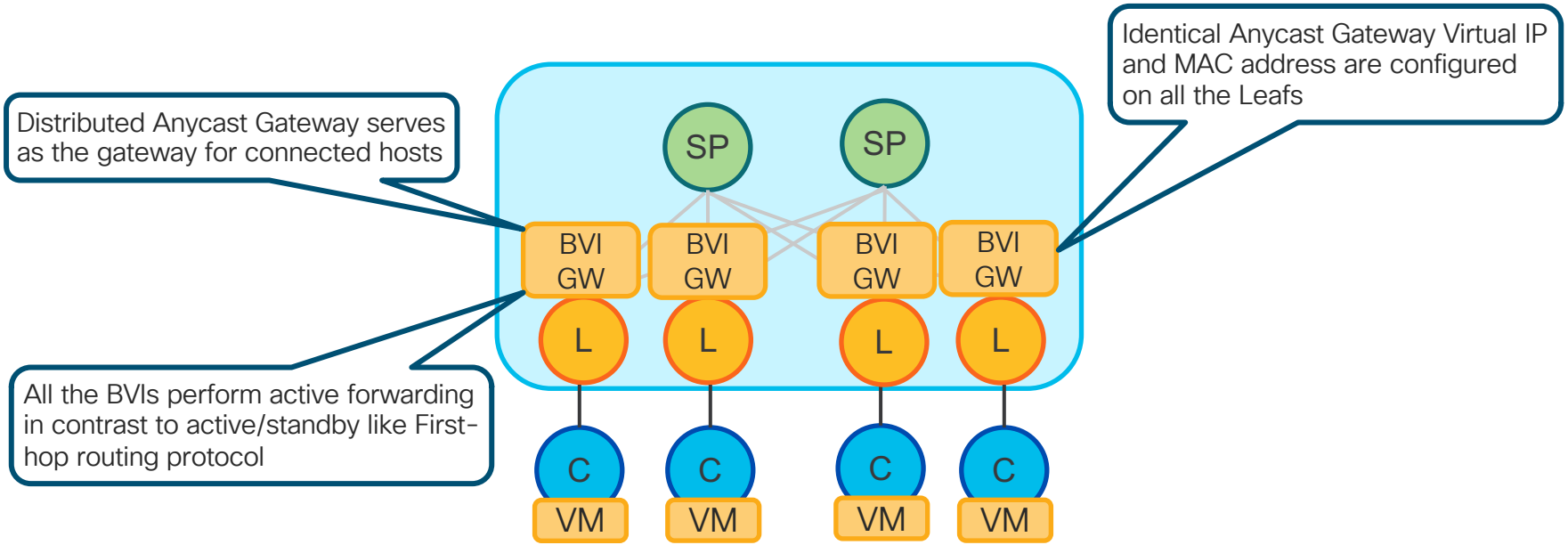


- Ethernet Segment Identifier (ESI) ‘0’
- No DF election

EVPN – Distributed Anycast Gateway

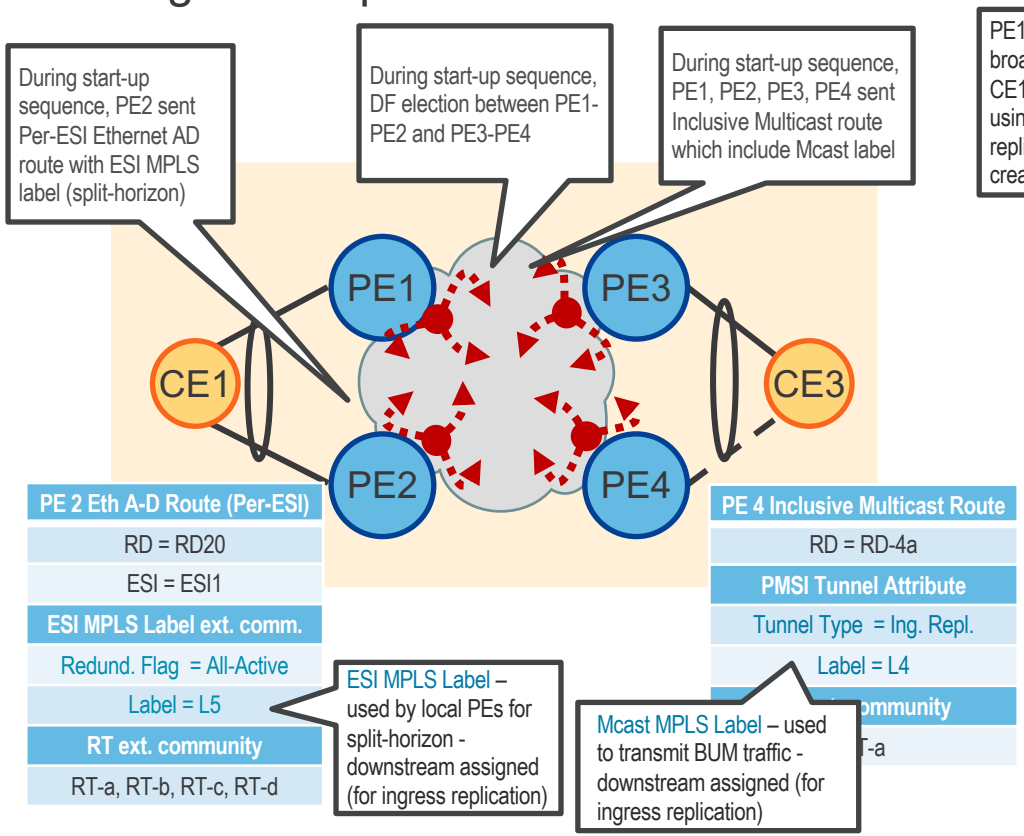
Purpose:

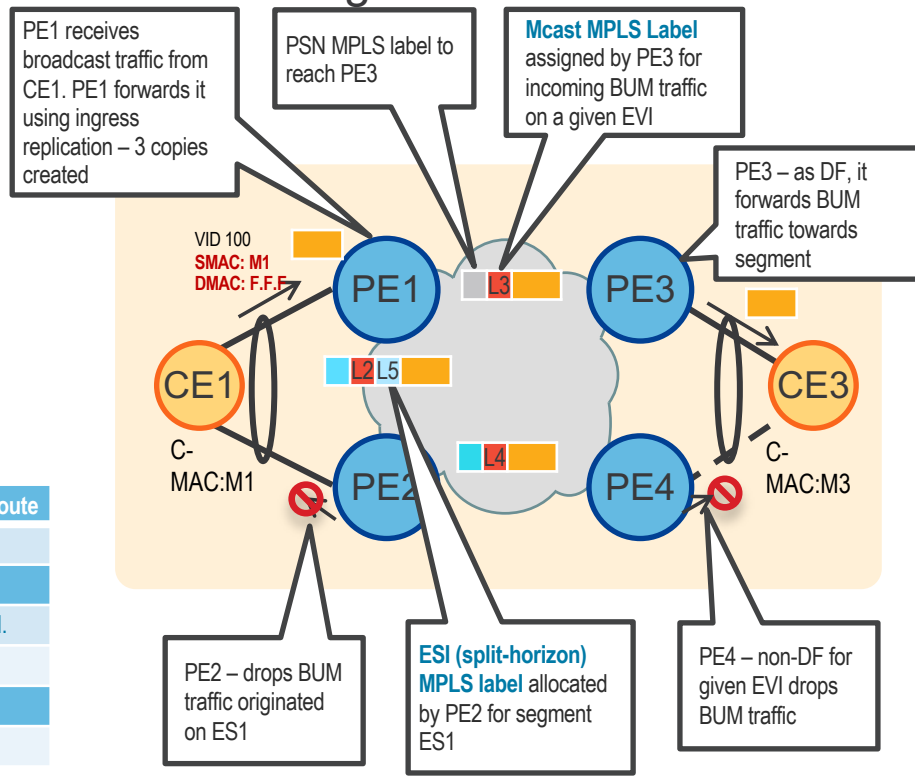
Optimal intra and inter-subnet connectivity with seamless workload mobility



EVPN - Life of a Packet

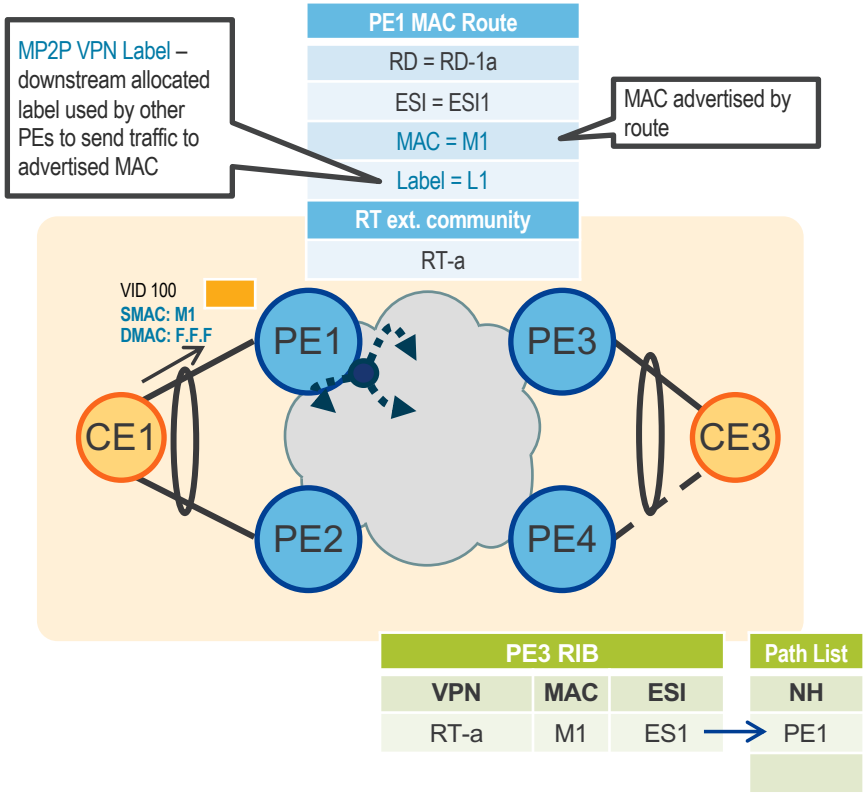
- Ingress Replication – Multi-destination Traffic Forwarding

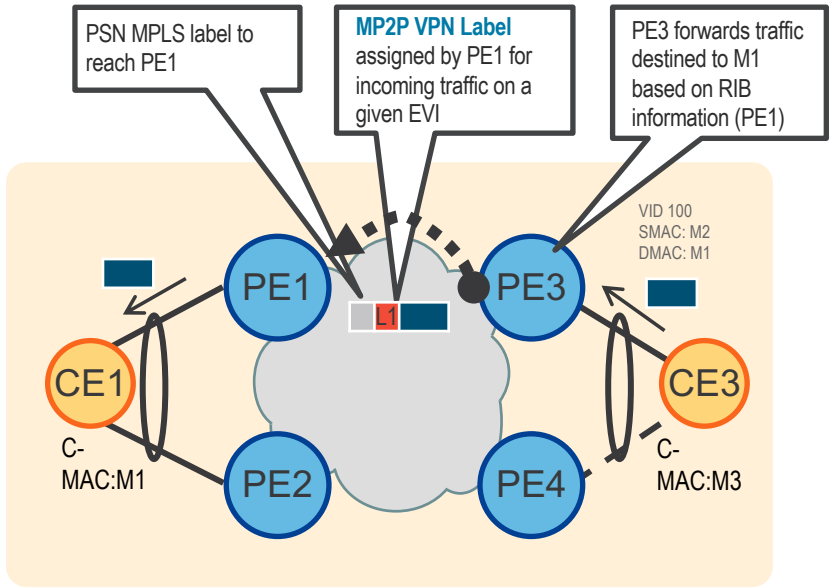




EVPN Life of a Packet

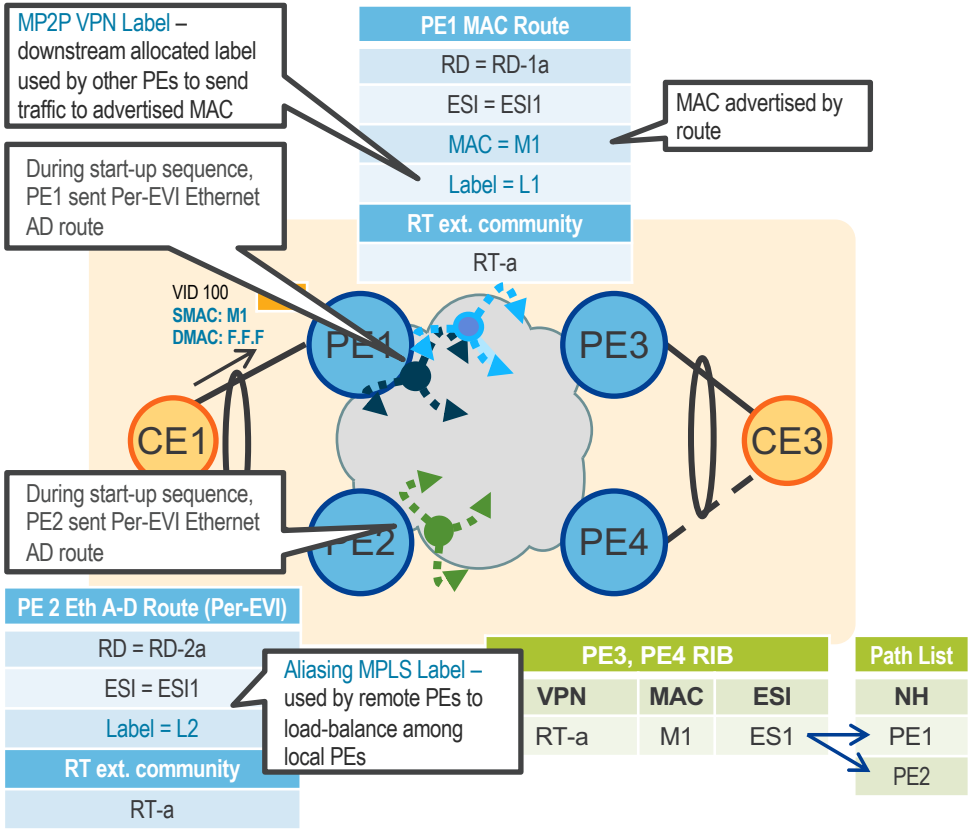
- Unicast Traffic Forwarding

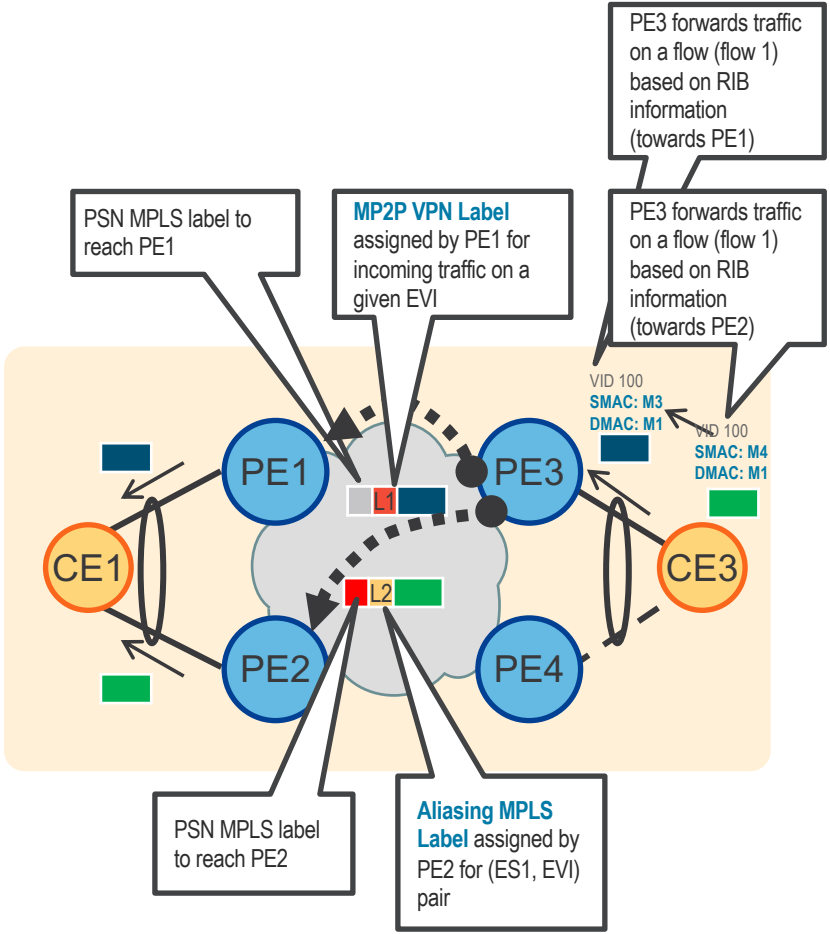




Life of a Packet

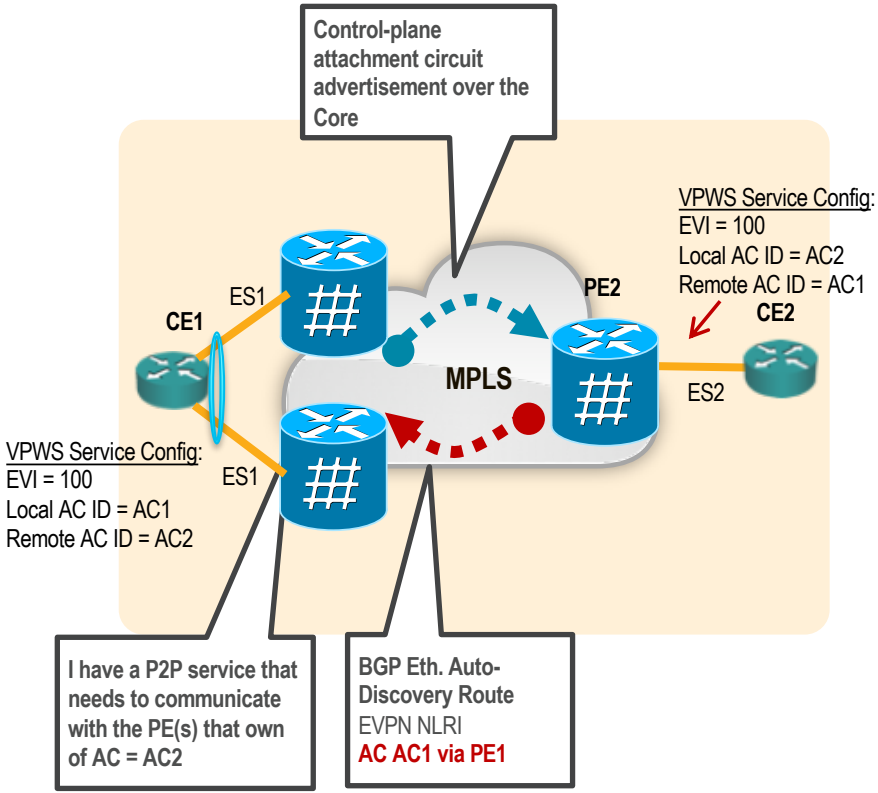
- Unicast Forwarding and Aliasing



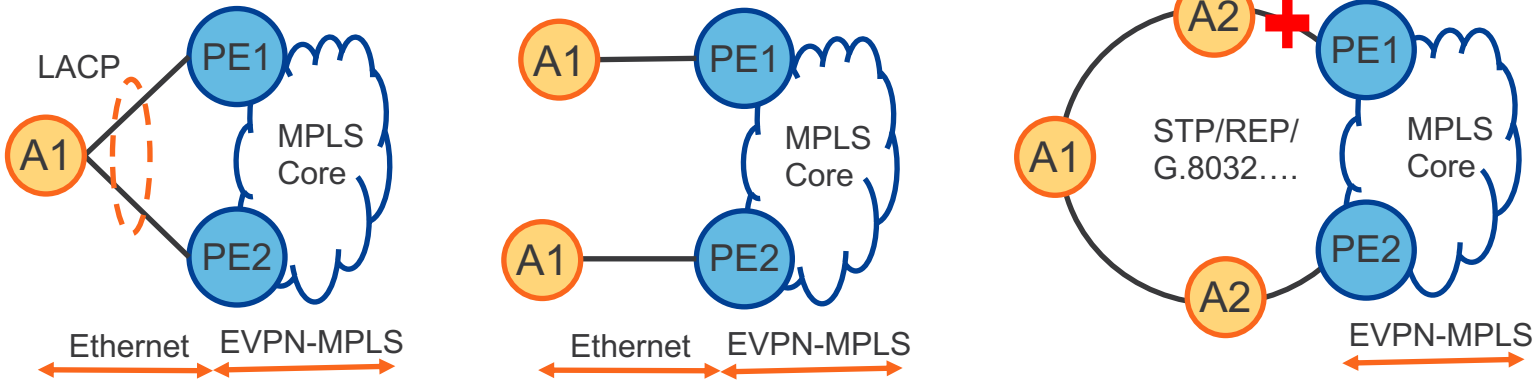


EVPN VPWS

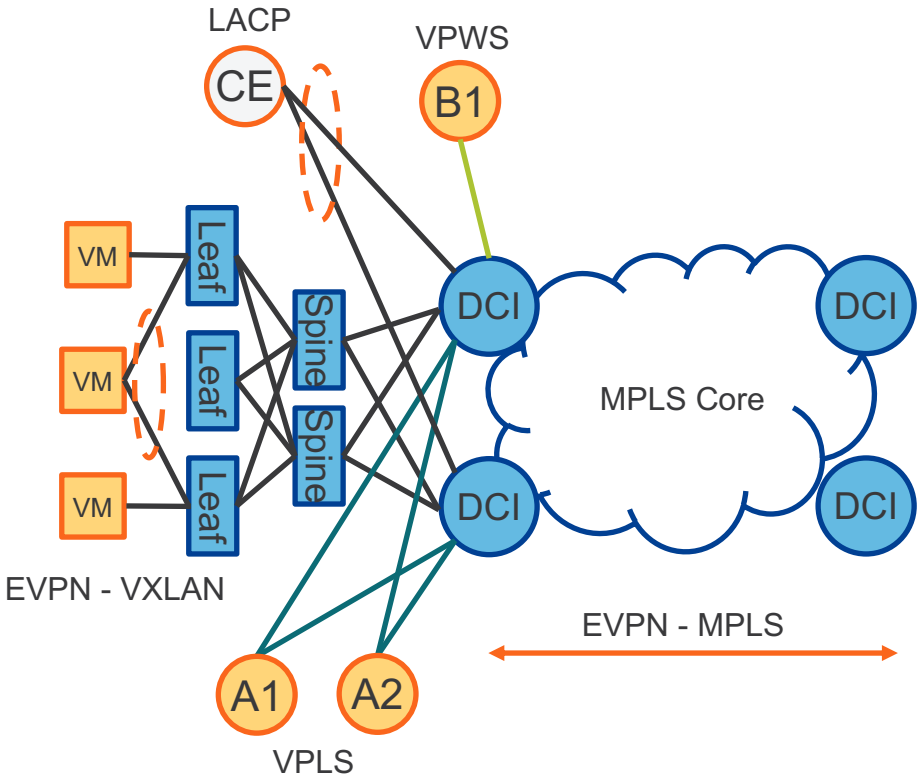
- Benefits of EVPN applied to point-to-point services
  - No signaling of PWs. Instead signals MP2P LSPs instead (ala L3VPN)
  - All-active CE multi-homing (per-flow LB)
  - Single-active CE multi-homing (per-service LB)
- Relies on a sub-set of EVPN routes to advertise Ethernet Segment and AC reachability
  - PE discovery & signaling via a single protocol – BGP
  - Per-EVI Ethernet Auto-Discovery route
  - Handles double-sided provisioning with remote PE auto-discovery



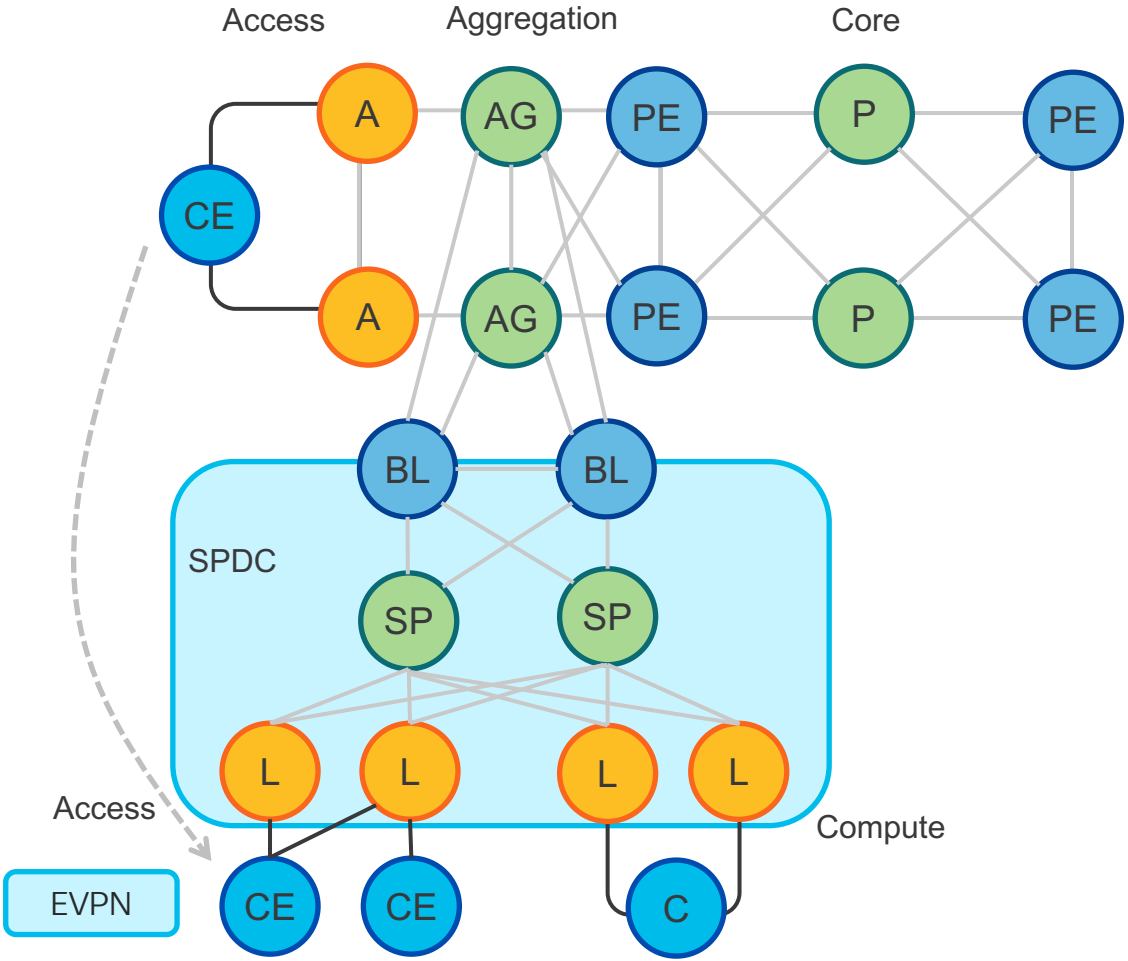
EVPN Ethernet access
Single/Dual Homed Solution, Legacy L2 access



EVPN Seamless integration
VPLS, VPWS, Ethernet



Service Provider Network



Conceptually

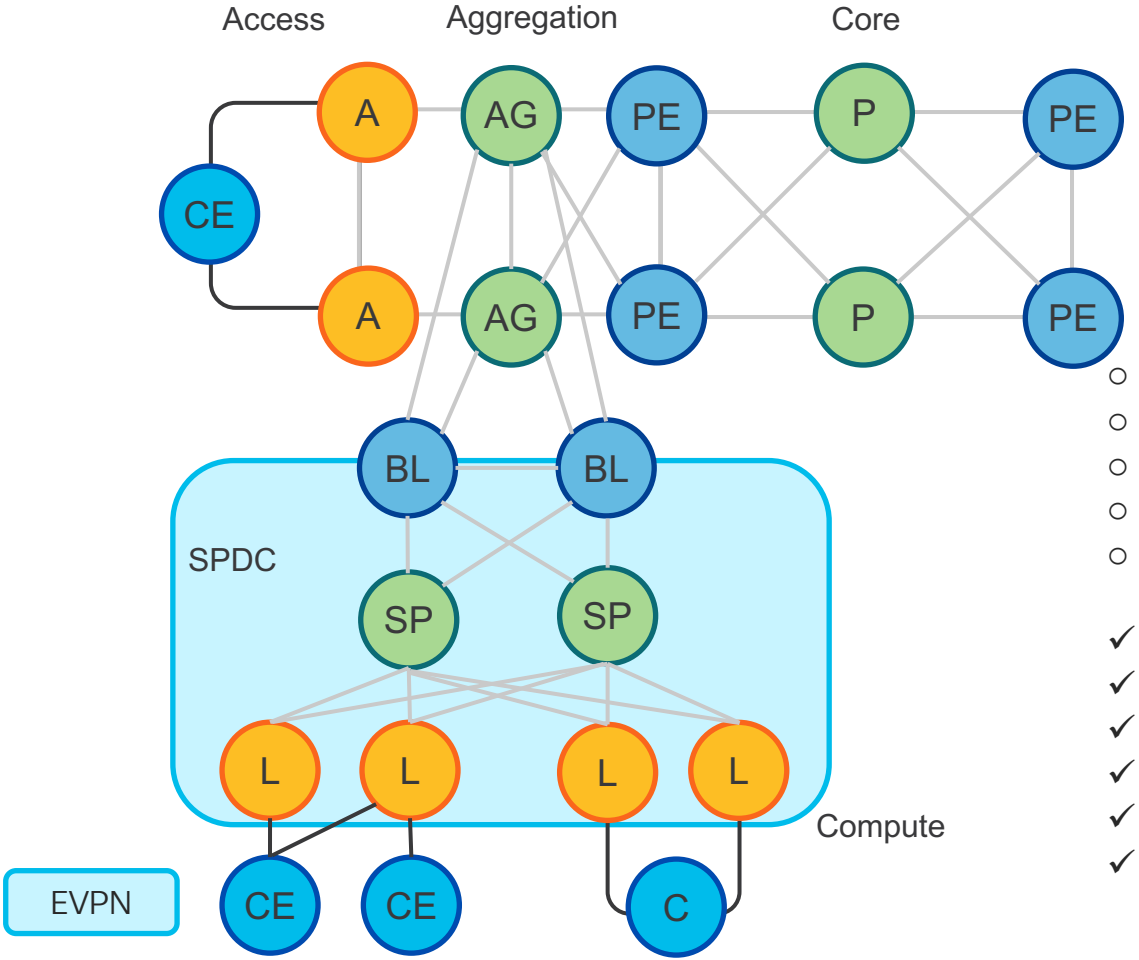
PE = BL

AG = SP

A = L

CE = C

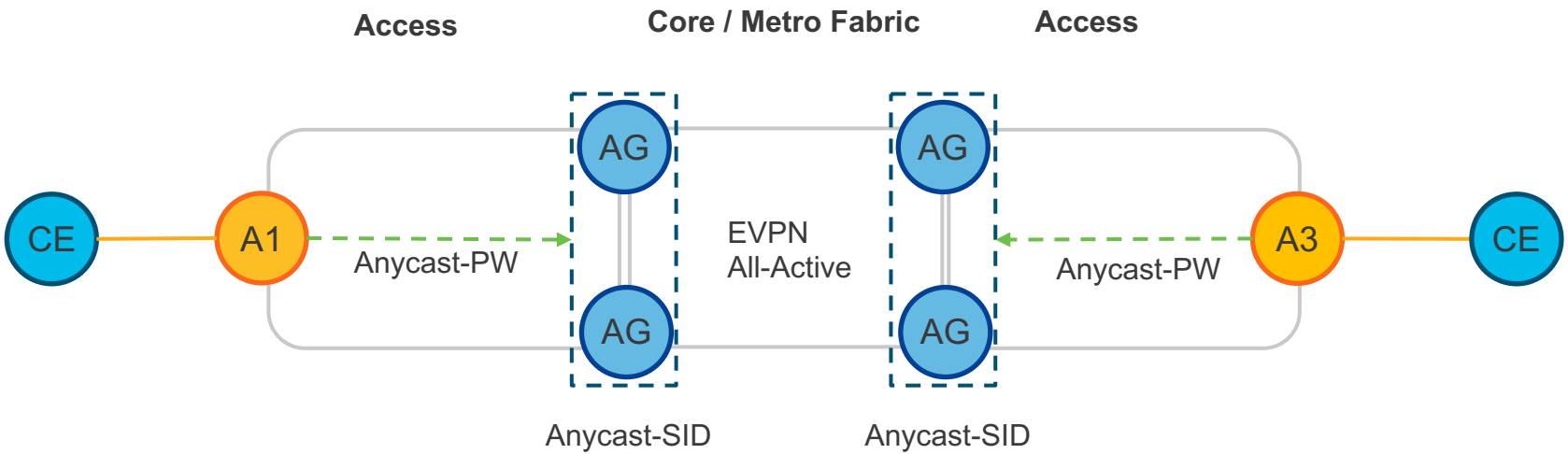
Service Provider Network



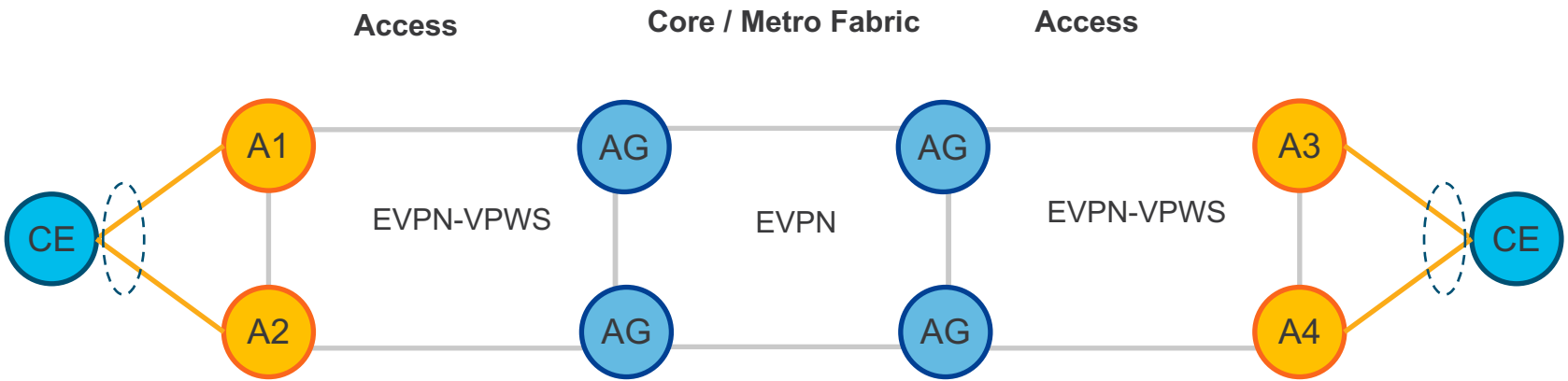
- Distributed Anycast Gateway EVPN-IRB
- All-active Multi-Homing
- EVPN symmetric IRB
- EVPN L2 for east-west traffic
- EVPN L3 for north-south traffic

- ✓ Seamless mobility
- ✓ Optimal forwarding (east-west & north-south)
- ✓ All-active multi-homing load-balancing
- ✓ Allow virtualization of appliances
- ✓ EVPN multi-services (E-LAN, E-LINE, IRB)
- ✓ Optimal bandwidth utilization

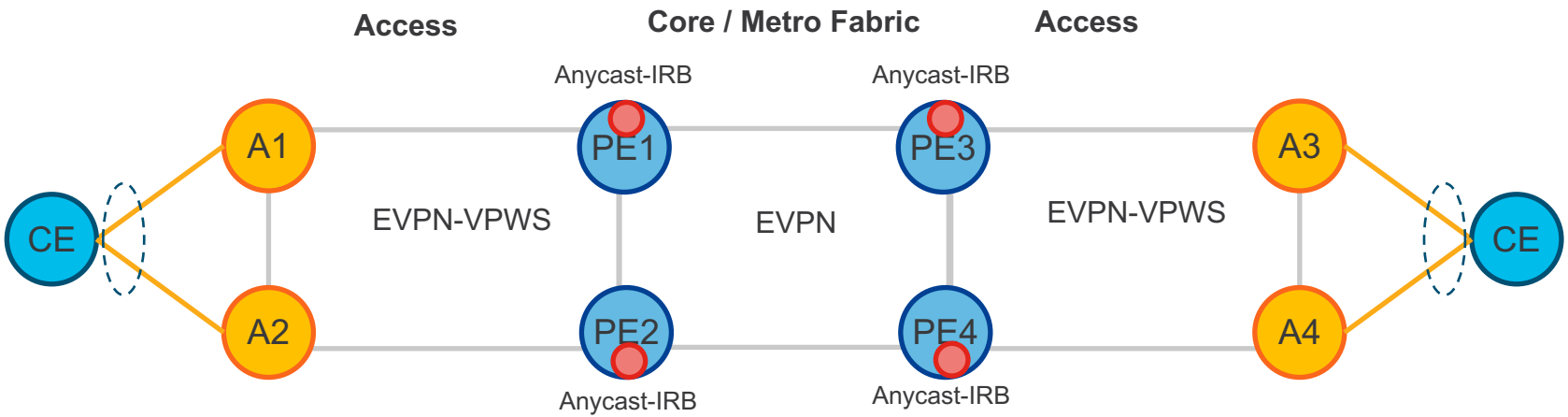
EVPN – Anycast-PW



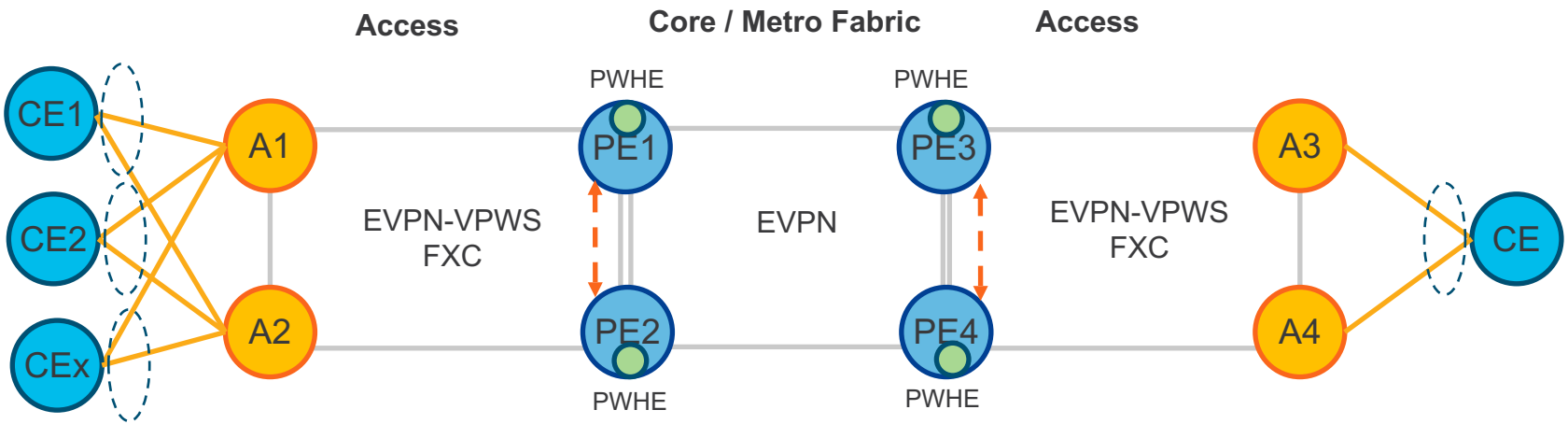
EVPN – access VPWS



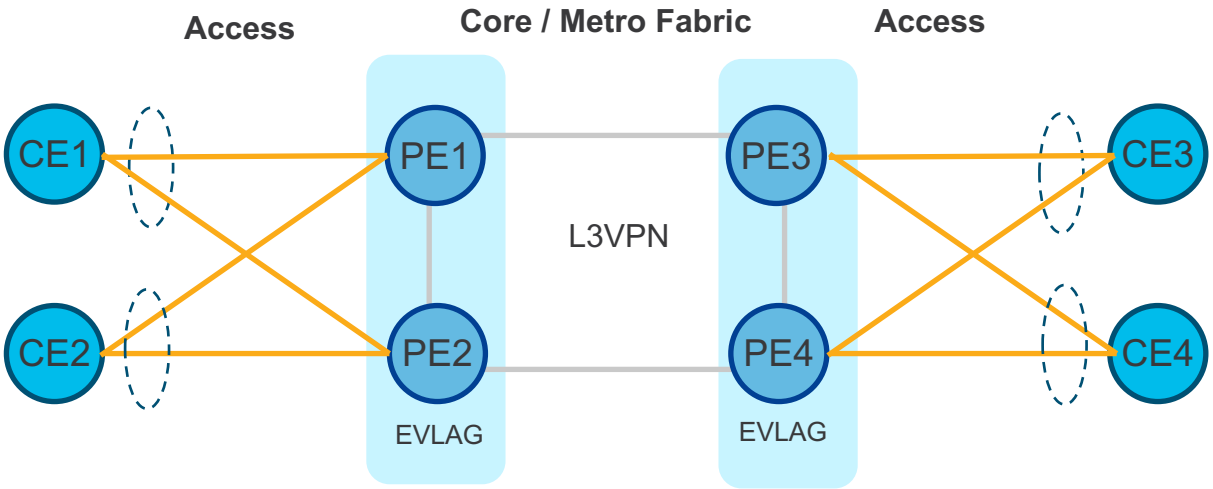
EVPN – IRB with access VPWS



EVPN – PWHE with access VPWS



EVPN – L3 Multi-Homing using EVLAG



EVPN

EVPN Advantages:

Integrated Services

- Integrated Layer 2 and Layer 3 VPN services
- L3VPN-like principals and operational experience for scalability and control

Network Efficiency

- All-active Multi-homing & PE load-balancing (ECMP)
- 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)
- Peer PE auto-discovery. Redundancy group auto-sensing

Investment Protection

- Fully support IPv4 and IPv6 in the data plane and control plane
- Open-Standard and Multi-vendor support

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¡Gracias por su participación!

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