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What You Make Possible

TOMORROW starts here.

CISCO

Building Carrier Ethernet Services Using Cisco Ethernet Virtual Circuit Framework

BRKSPG-2204

Agenda

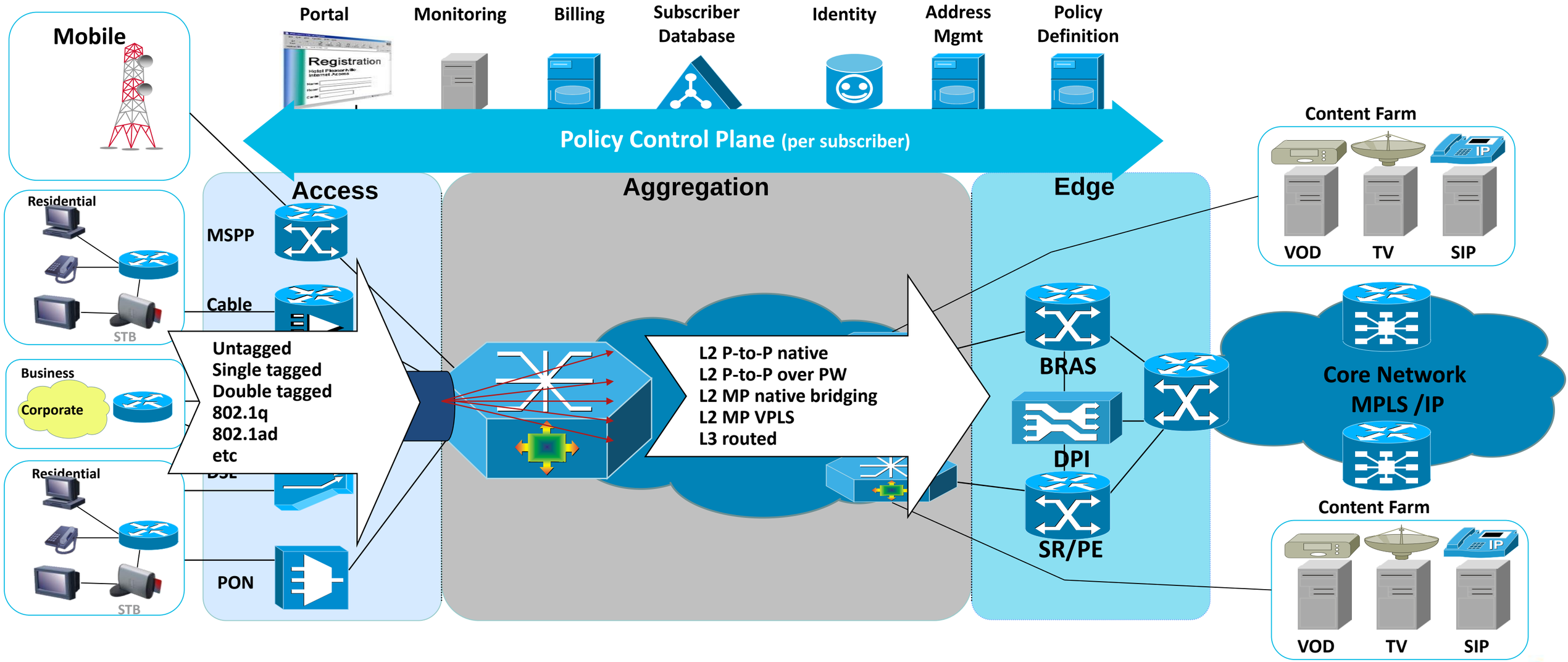
- Introduction
- Cisco EVC Fundamentals
- Operation and Packet Flow
- Dynamic Ethernet Service Activation (DESA)
- Deployment Use Cases—Residential / Business / DCI Services
- Platform Support
- Summary

Introduction

What is Cisco EVC Framework?

- Cisco Ethernet Virtual Circuit (EVC) is the next-generation cross-platform Carrier Ethernet Software Infrastructure
- Addresses Flexible Ethernet Edge requirements
- Supports service convergence over Ethernet
- Complies with MEF, IEEE, IETF standards

Flexible Ethernet Edge

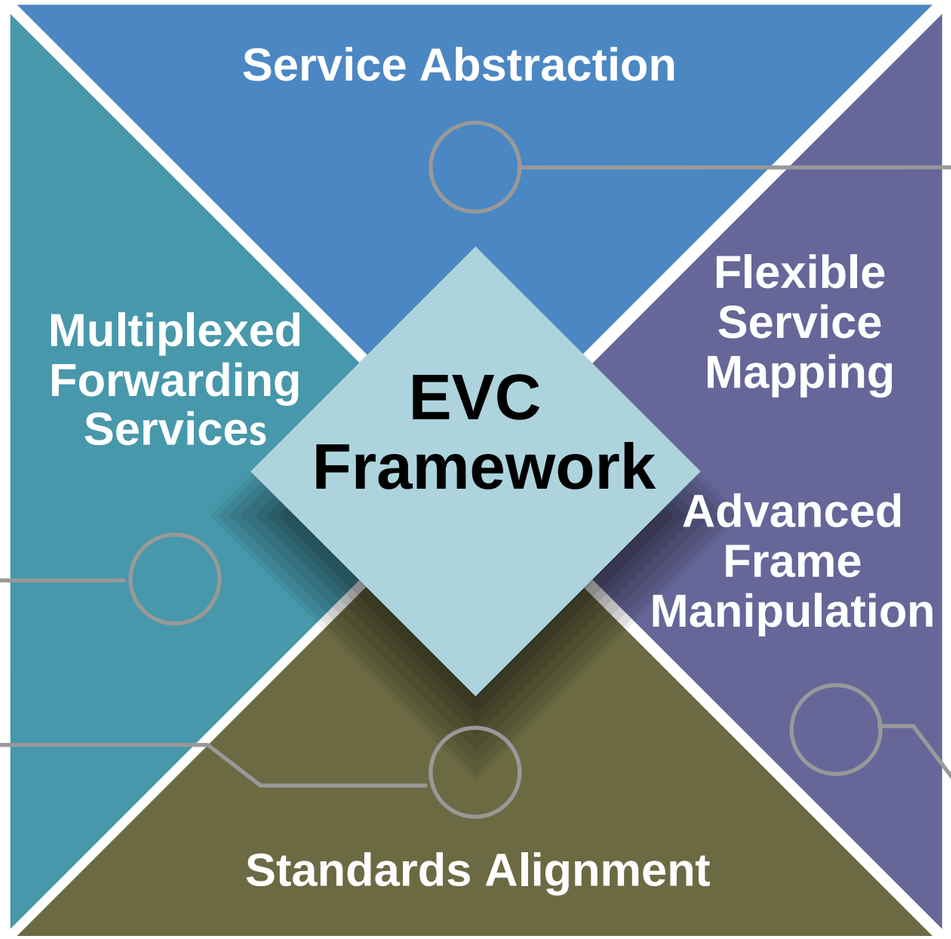


Introducing Cisco EVC Framework

Functional Highlights

Support mix of Layer 2 and Layer 3 services on same physical port

Concurrent support of different flavors of Layer 2 services: Pt-to-Pt and Mpt



Alignment with emerging standards:

- **MEF 6, 10.1, 11**
- **IEEE 802.1ad**
- **IEEE 802.1ah**

Ethernet Flow Points

- **Model Ethernet Service Layer**
- **Transport agnostic**

Flexible definition of service delimiters based on Ethernet header fields

Selective EVC Mapping

Advanced VLAN tag manipulation

Cisco EVC Fundamentals

Cisco EVC Building Blocks

Cisco EVC Uses the Following New Concepts:

- Ethernet Flow Point (EFP)

  Transport-agnostic abstraction of an Ethernet service on an interface

- Ethernet Virtual Circuit (EVC)

  Device local object (container) for network-wide service parameters

- Bridge Domain (BD)

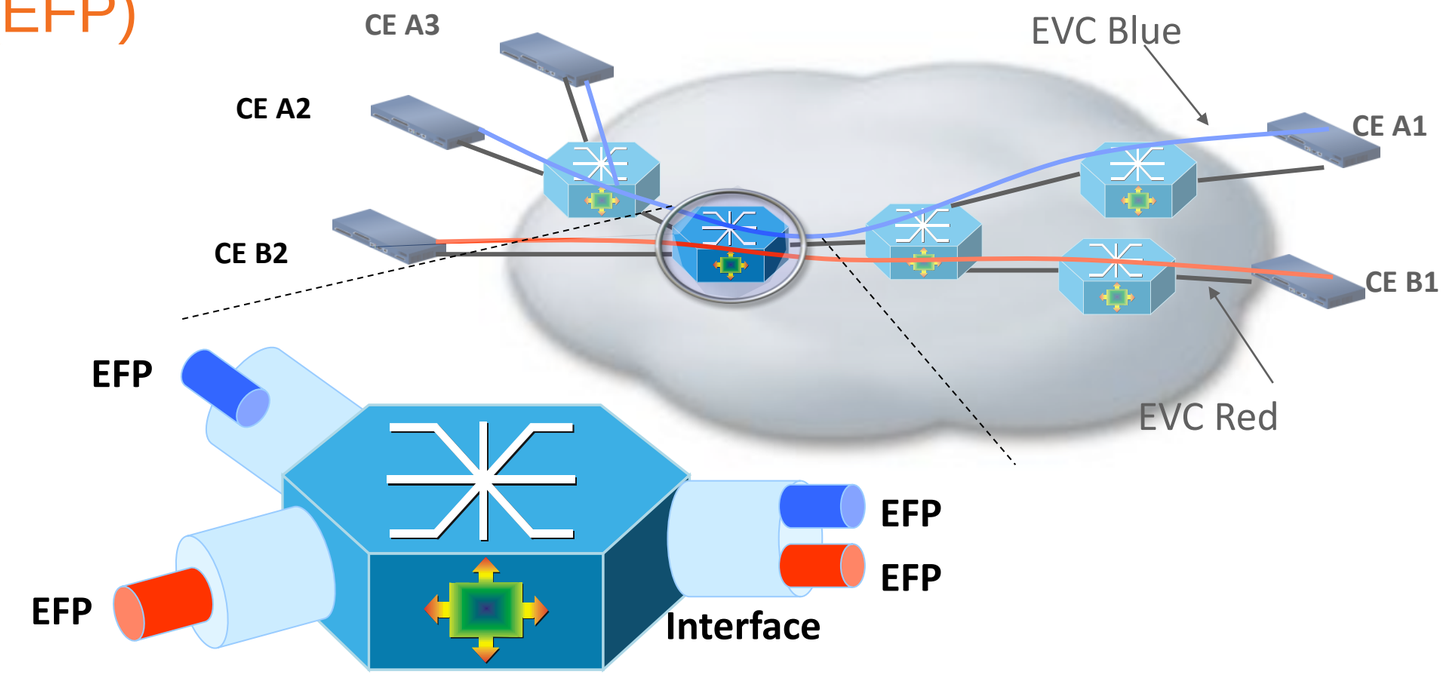
  Ethernet Broadcast Domain local to a device

- Bridge Domain Interface (BDI)

  – Logical Layer 3 interface associated with a BD to perform integrated routing and bridging

Cisco EVC Building Blocks

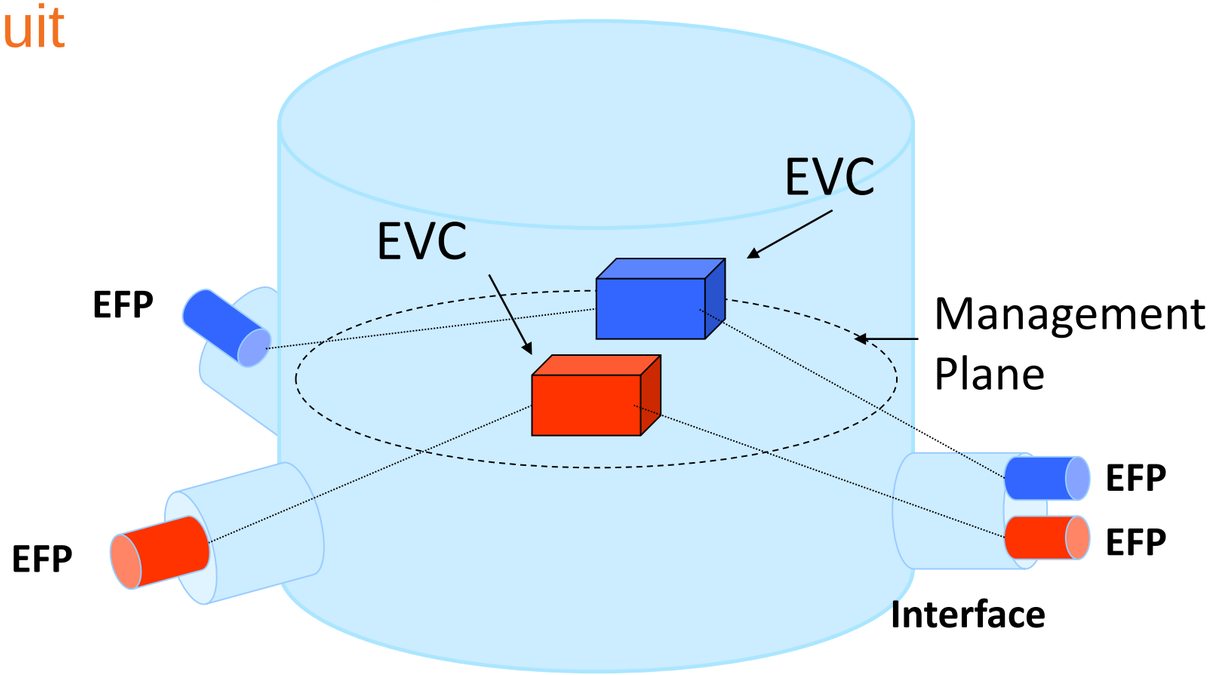
Ethernet Flow Point (EFP)



- Instance of a MEF EVC on a port
- Also defined as Service Instance
- Classify frames belonging to a particular Ethernet Service
- Apply features selectively to service frames
- Define forwarding actions and behavior

Cisco EVC Building Blocks

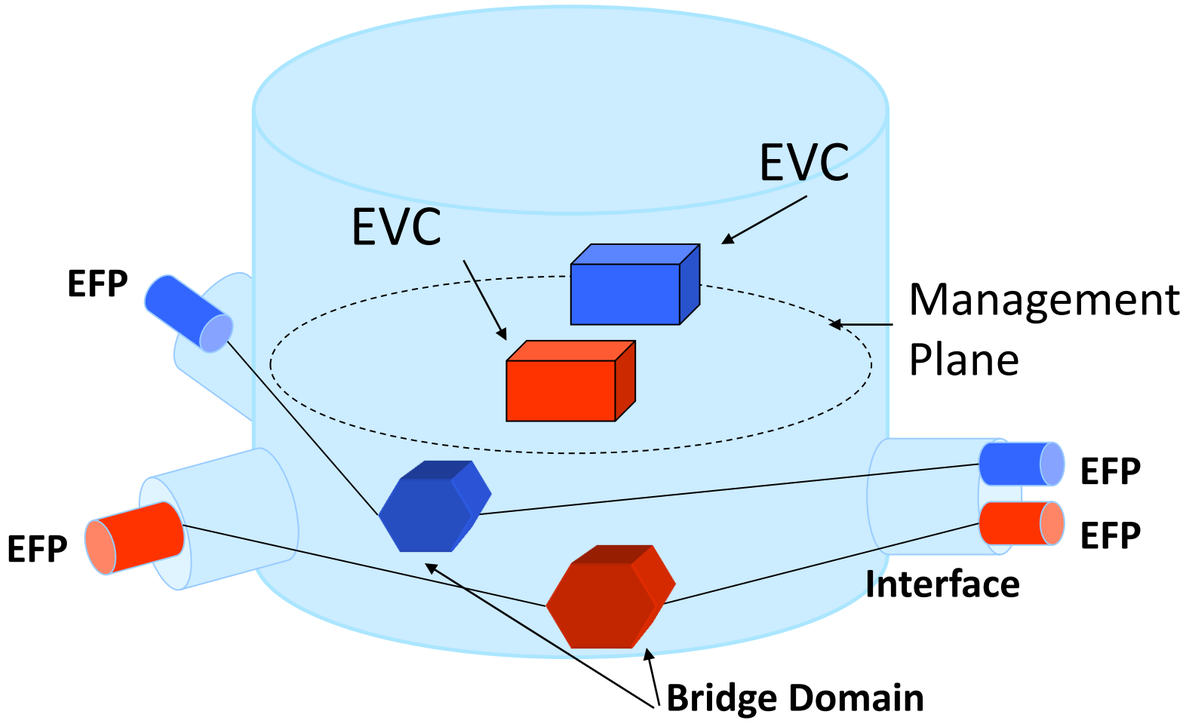
Ethernet Virtual Circuit



- Representation of a MEF EVC on the device
- Management Plane container
- Hosts global EVC attributes
- One-to-many mapping from EVC to EFPs

Cisco EVC Building Blocks

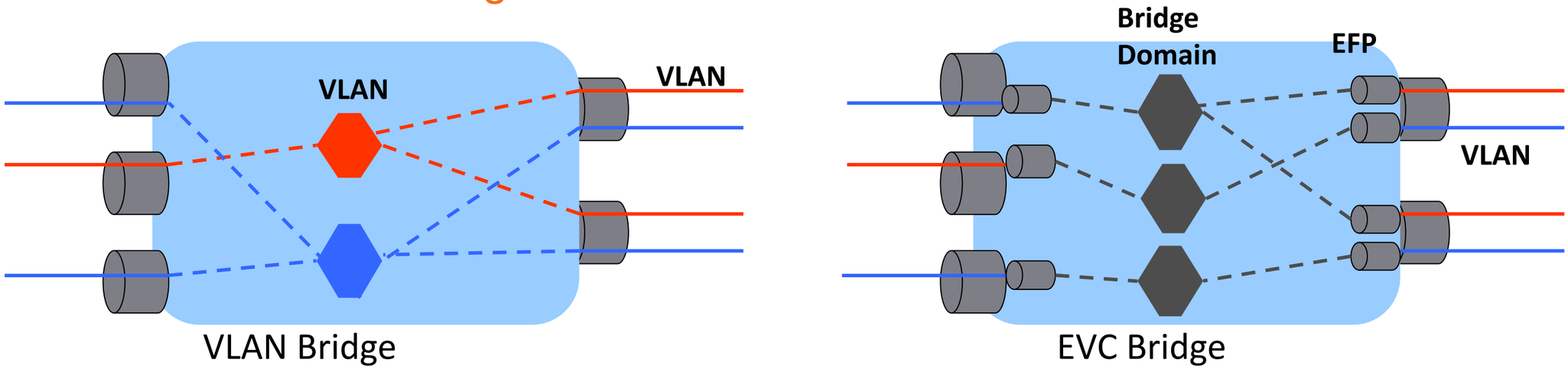
Bridge Domain



- Broadcast Domain internal to the device
- Allows decoupling broadcast domain from VLAN
- Per port VLAN significance
- One-to-many mapping from BD to EFPs

Cisco EVC Building Blocks

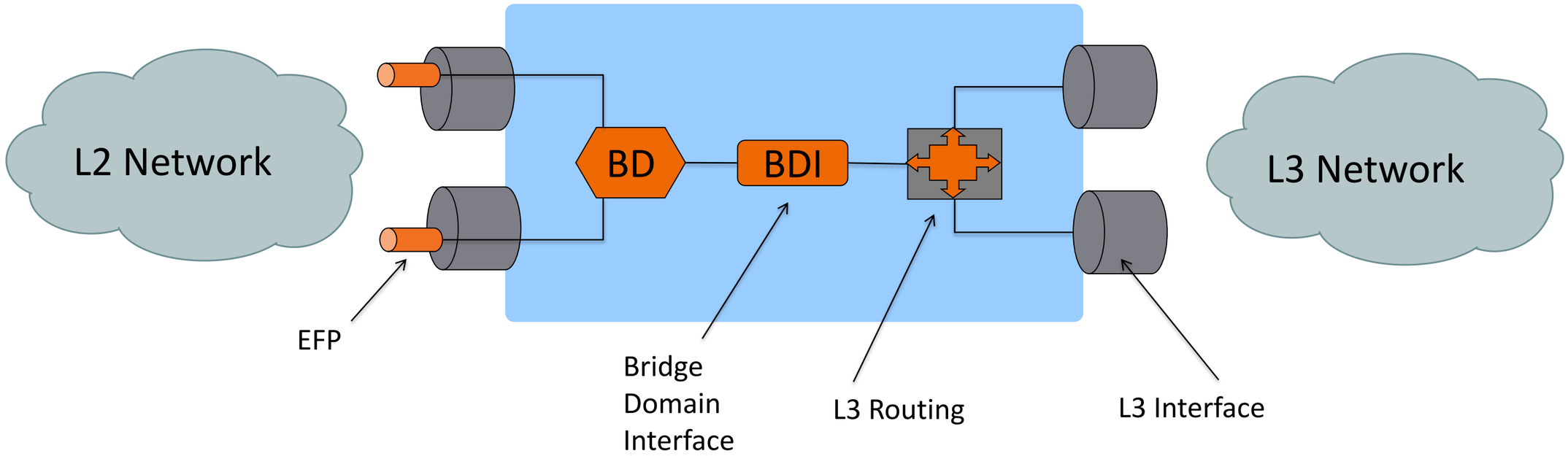
Bridge Domain vs. VLAN Bridge



- VLAN bridge has 1:1 mapping between VLAN and internal Broadcast Domain
  - VLAN has global per-device significance
- EVC bridge decouples VLAN from Broadcast Domain
  - VLAN treated as encapsulation on a wire
- VLAN on a wire mapped to internal Bridge Domain via EFPs
  - Net result: per-port VLAN significance

Cisco EVC Building Blocks

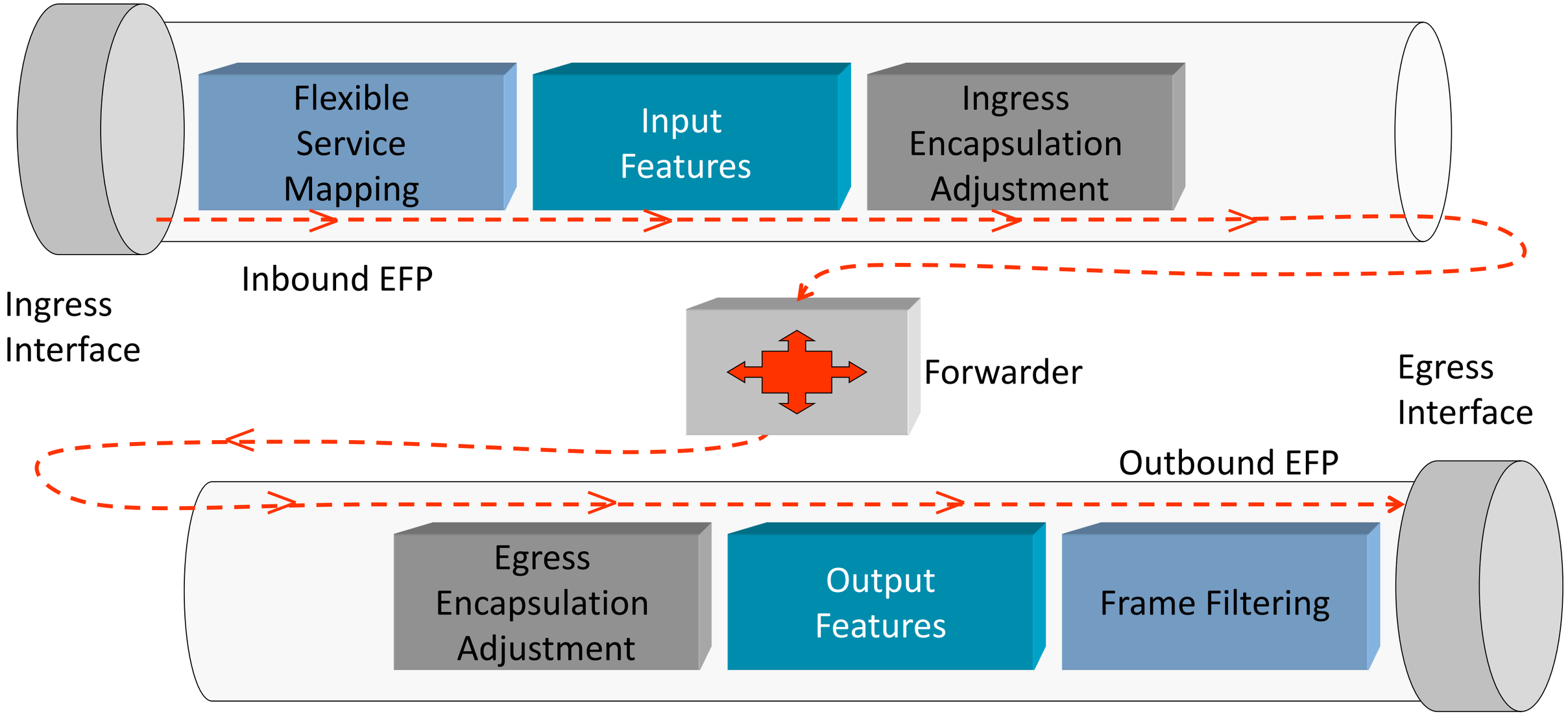
Bridge Domain Interface



- Logical Layer 3 (routed) port associated with a Bridge Domain
- Support termination of Ethernet traffic to IP / L3VPN (VRF aware)
- Only a single BDI per Bridge Domain is allowed
- Maintains Admin State (CLI) and Operational State (derived from BD)
  - If all EFPs in BD are Down or Admin-Down, then BDI operational state will be Down

Operation and Packet Flow

Packet Flow Pipeline



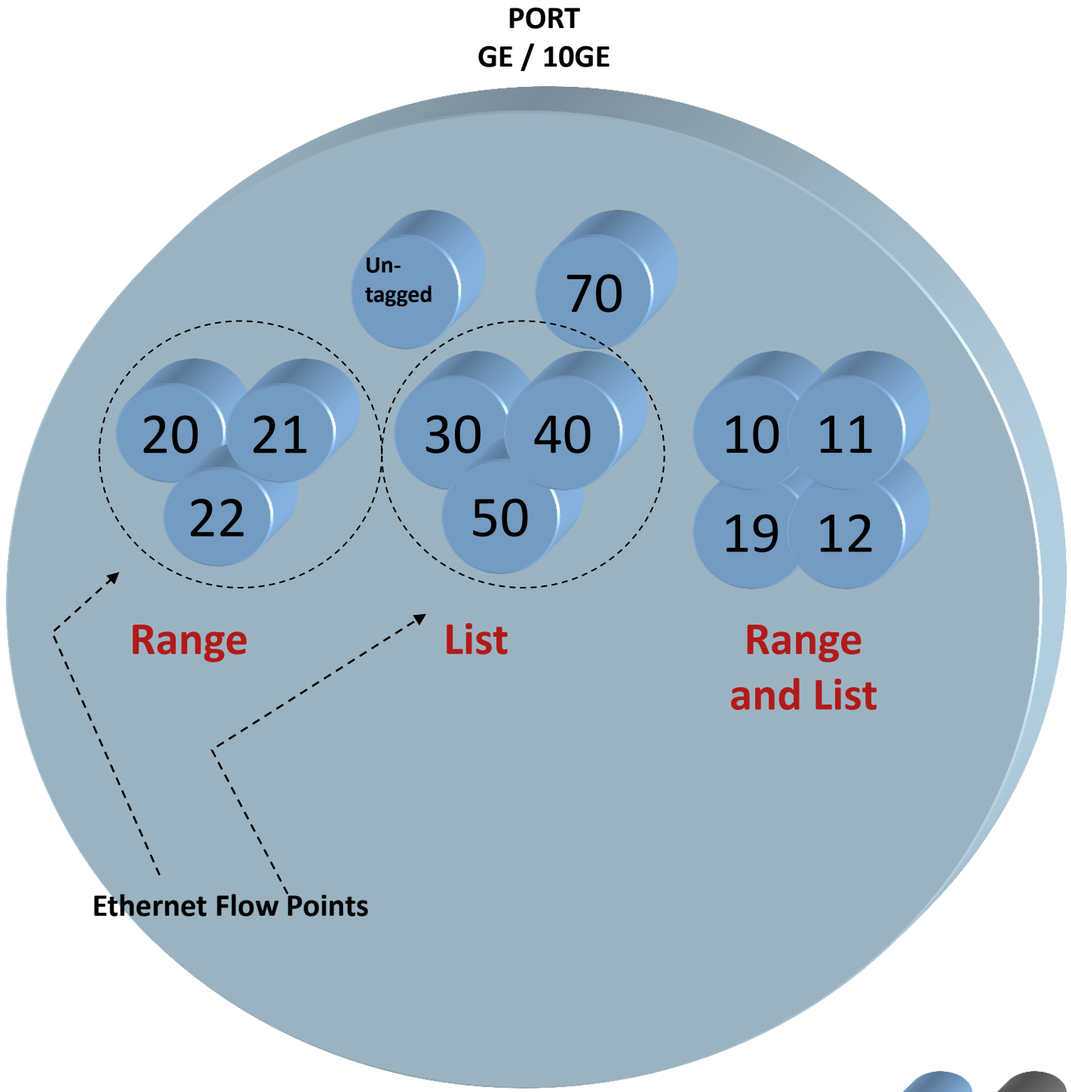
Operation and Packet Flow

Flexible Service Mapping

Flexible Service Mapping

Single Tagged VLAN Matching

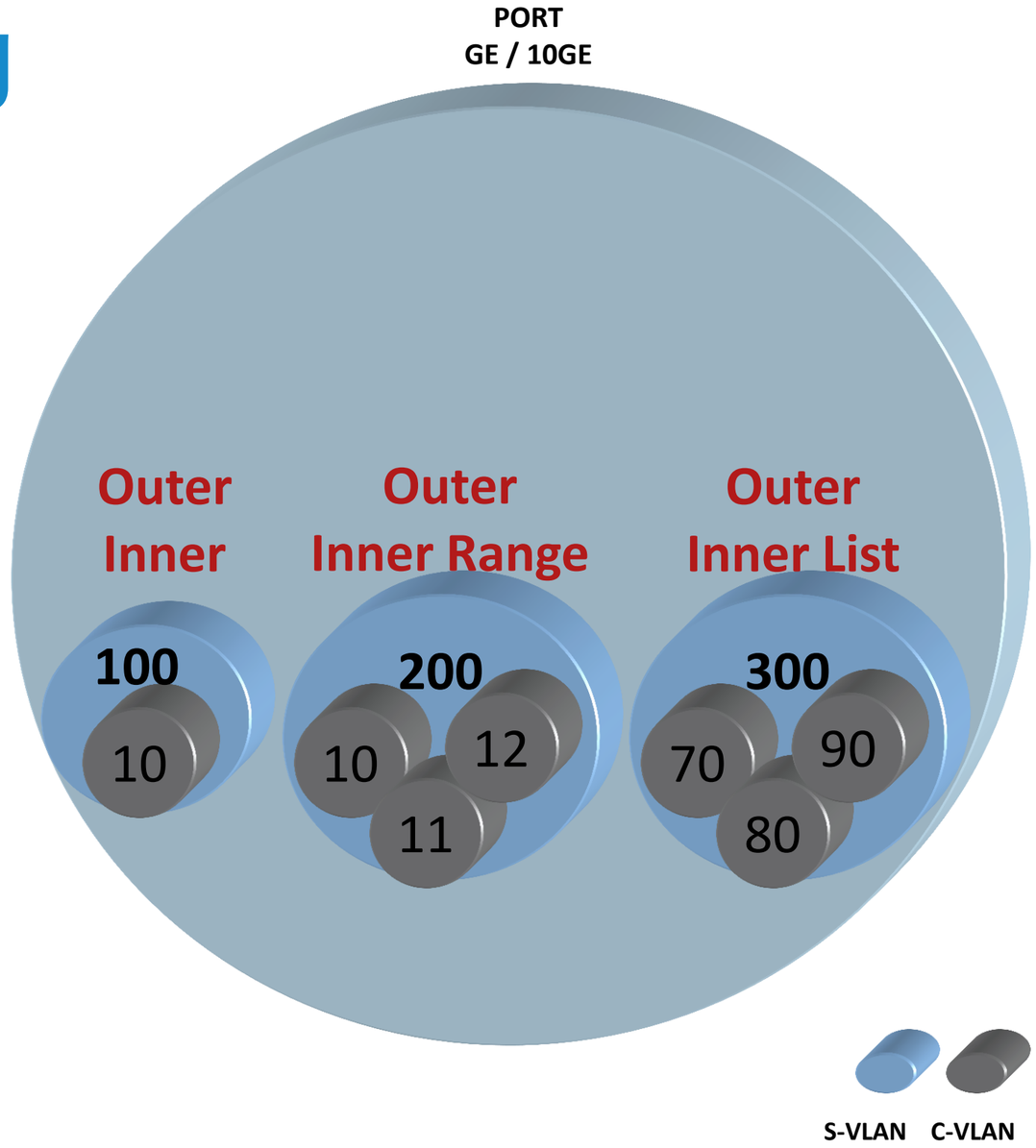
- Untagged traffic
- Single VLAN ID value
- Single VLAN ID Range (contiguous)
- Single VLAN ID List
- Single VLAN ID Range and List



Flexible Service Mapping

Double Tagged VLAN Matching

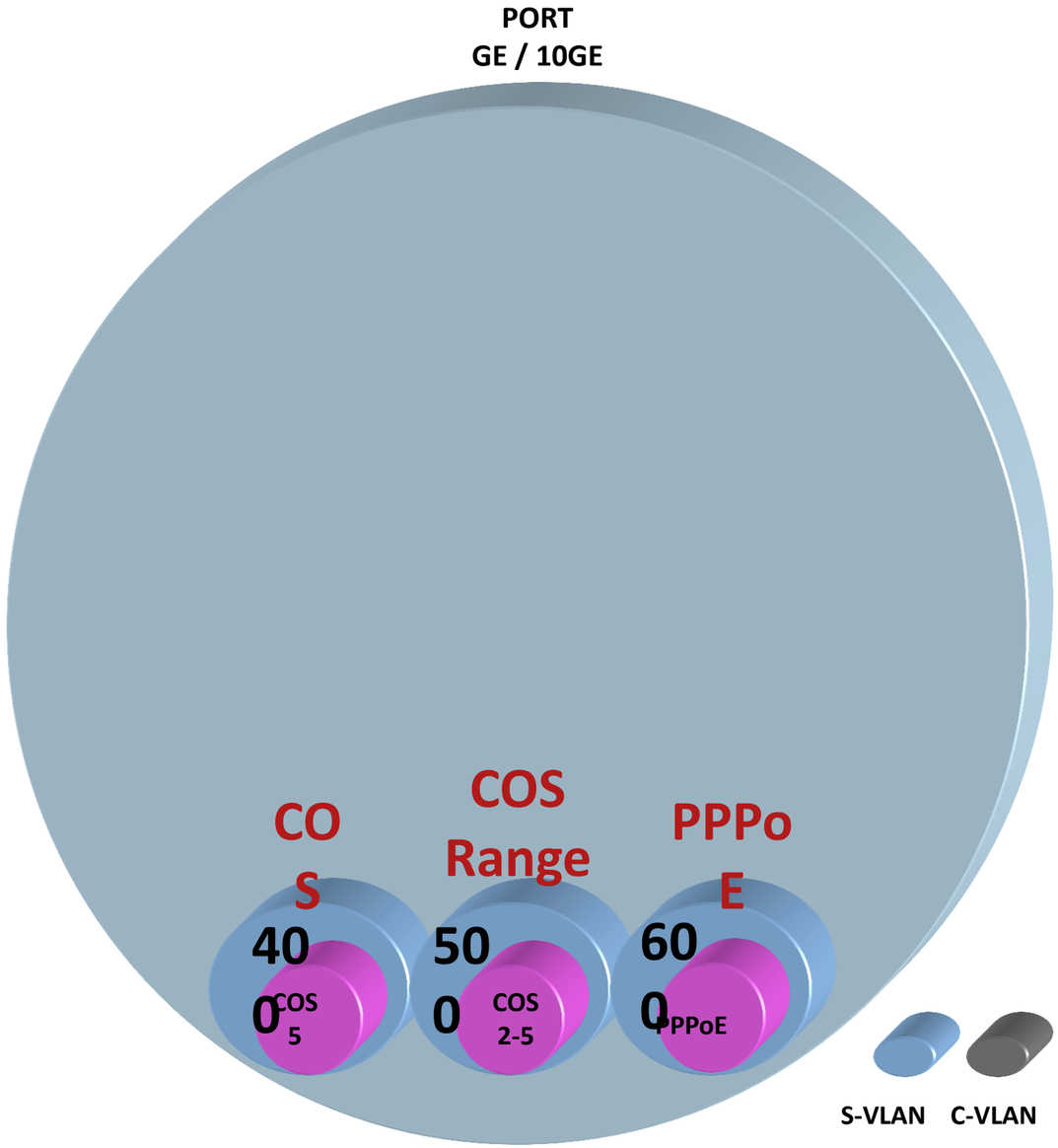
- Outer VLAN, Inner VLAN
- Outer VLAN and Range of Inner VLANs (contiguous)
- Outer VLAN and List of Inner VLANs
- Outer VLAN and Range and List of Inner VLANs



Flexible Service Mapping

Header Matching

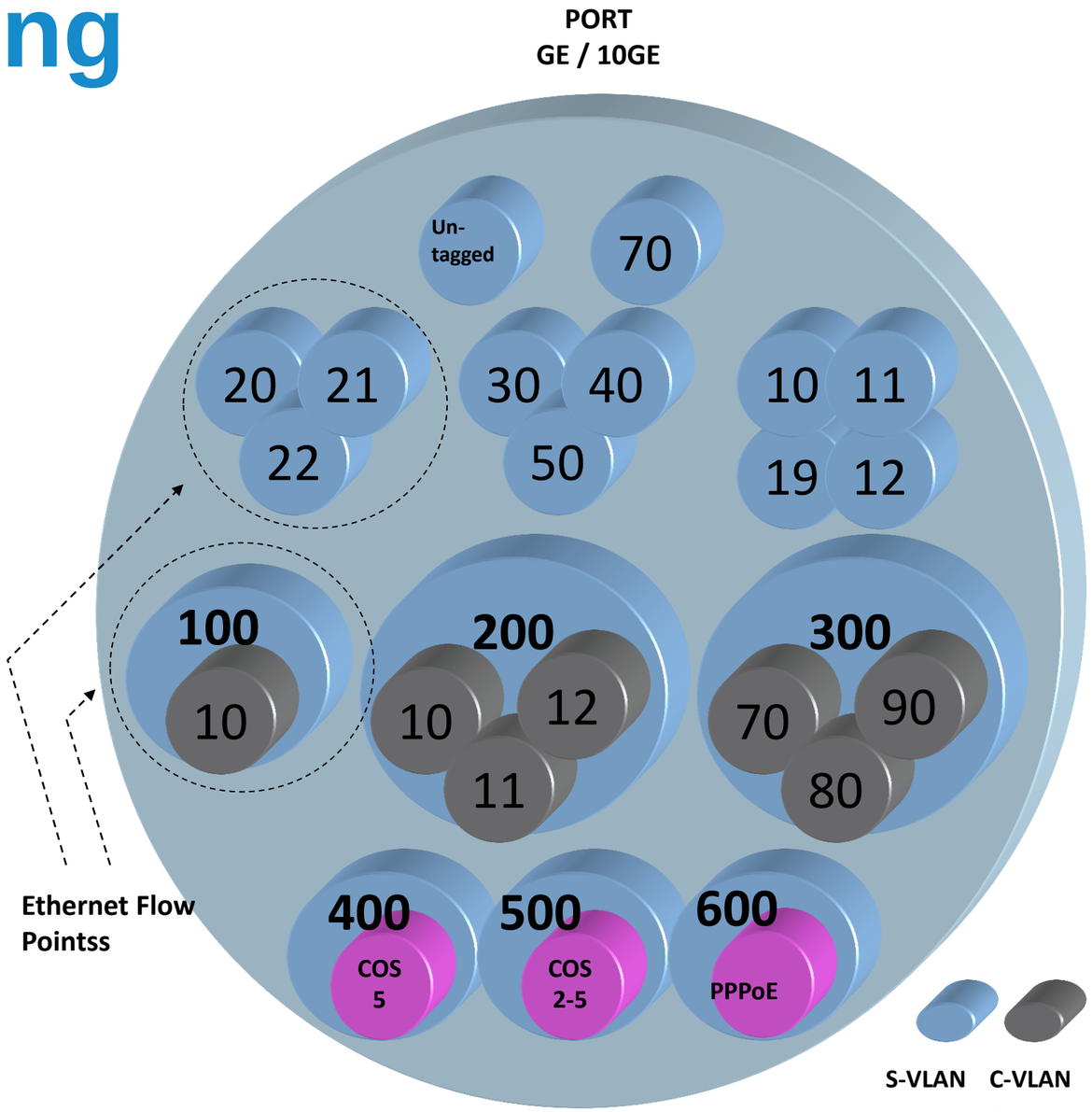
- Single VLAN, single 802.1p (COS) value
- Single VLAN, COS List/Range
- Outer VLAN, outer COS and Inner VLAN
- Outer VLAN, Inner VLAN and inner COS
- Single VLAN, Ethertype value (PPPoE, IPv4, IPv6)
- Outer VLAN, Inner VLAN and Ethertype value (PPPoE, IPv4, IPv6)



Flexible Service Mapping

Comprehensive Matching Capabilities

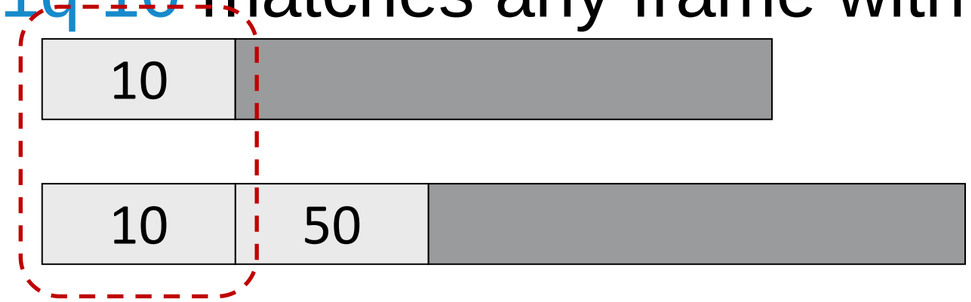
- EFP construct classifies L2 flows on Ethernet interfaces
- Single Tagged
- Double Tagged
- Header/Payload



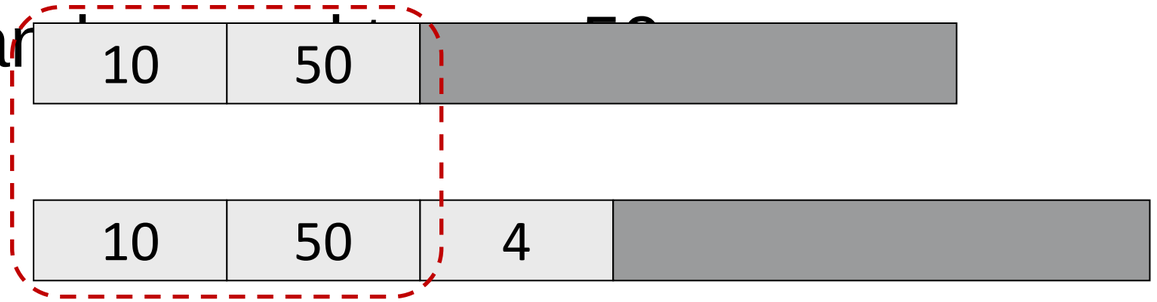
Flexible Service Mapping

Loose Match Classification Rule

- Cisco EVC follows a Loose Match classification model
- Unspecified fields are treated as wildcard
- encap dot1q 10 matches any frame with outer tag equal to 10



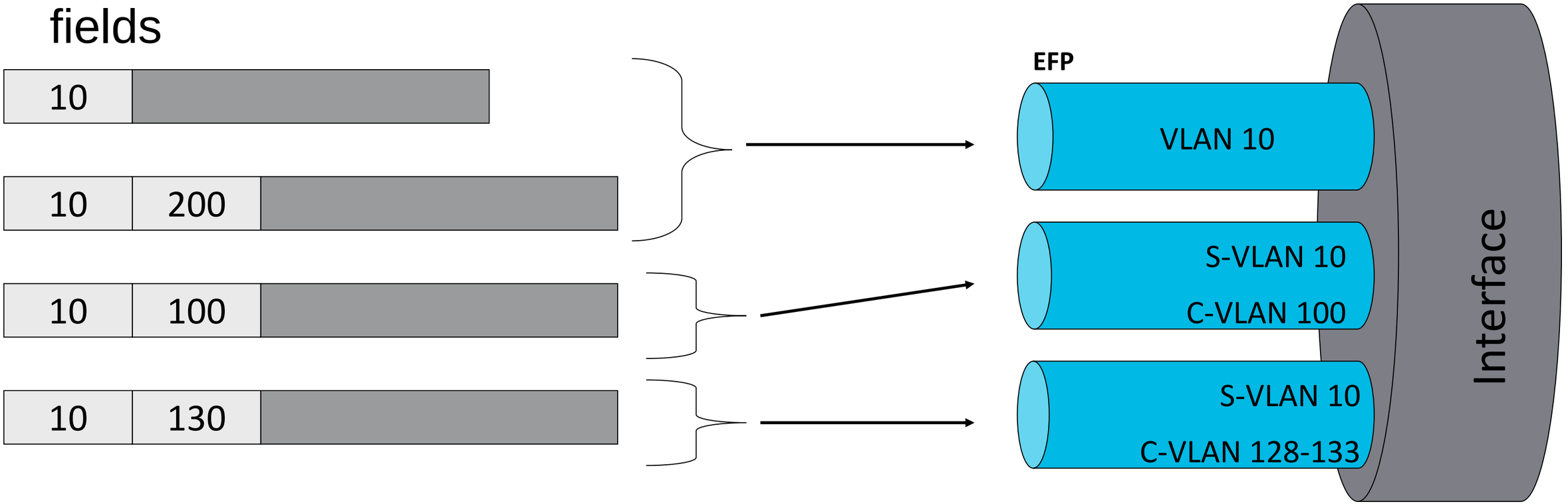
- encap dot1q 10 second-dot1q 50 matches any frame with outer-most tag as 10 ar



Flexible Service Mapping

Longest Match Classification Rule

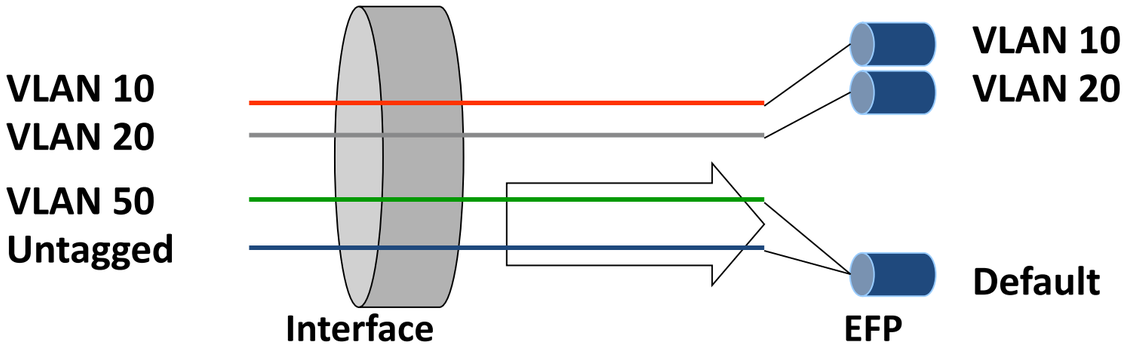
- Cisco EVC follows a Longest Match classification model
- Frames are mapped to EFP with longest matching set of classification fields



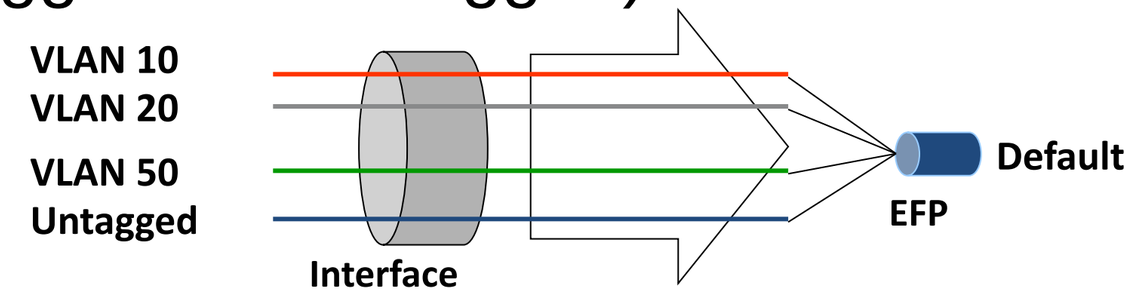
Flexible Service Mapping

EFP with ‘Default’ Encapsulation

- Matches all frames unmatched by any other EFP on a port



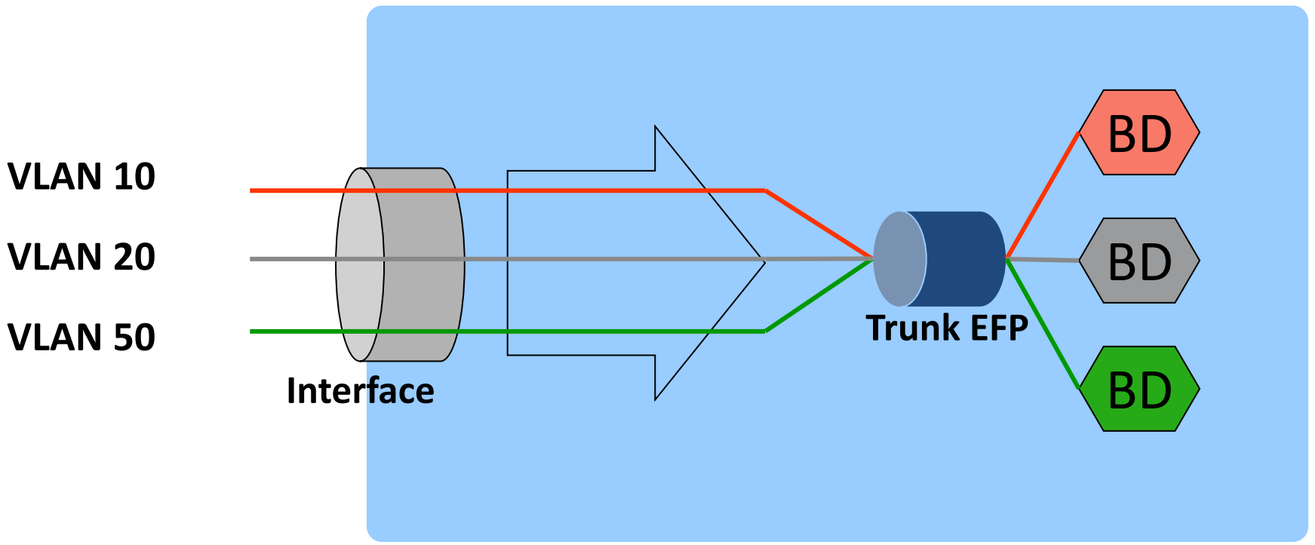
- If default EFP is the only one configured on a port, it matches all traffic on the port (tagged and untagged)



Flexible Service Mapping

Trunk EFP

- Matches a range and/or list of VLANs.
- Allocates **each VLAN** to a **unique bridge-domain**.
- Emulates ‘switchport mode trunk’ behavior.



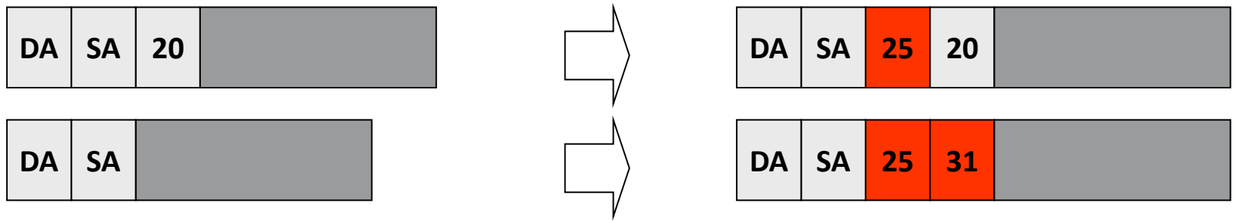
Operation and Packet Flow

Advanced Frame Manipulation

Advanced Frame Manipulation

PUSH Operations

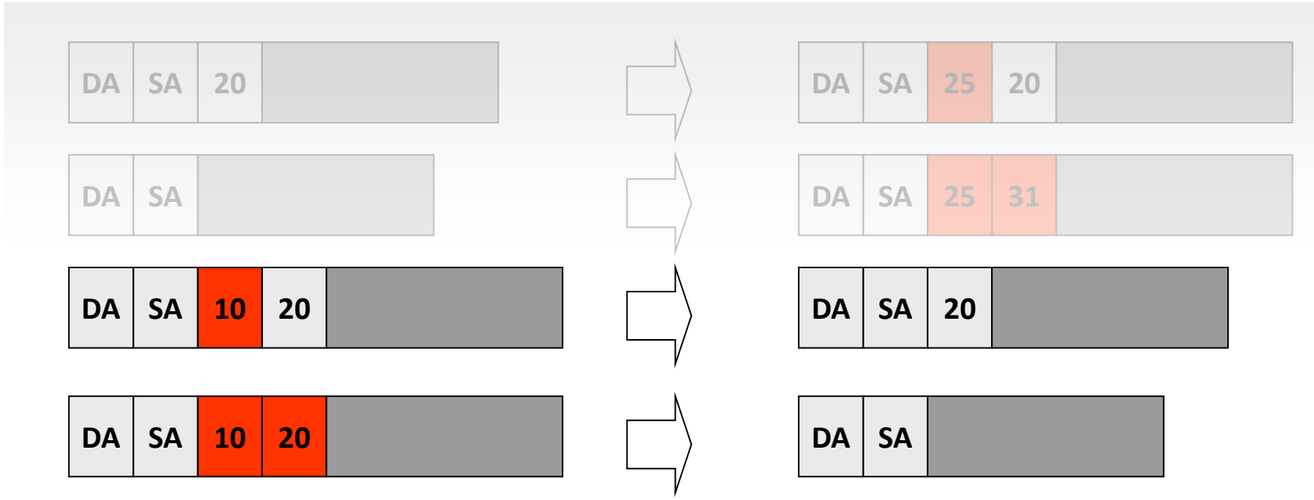
- Add one VLAN tag
- Add two VLAN tags



Advanced Frame Manipulation

POP Operations

- Remove one VLAN tag
- Remove two VLAN tags



Advanced Frame Manipulation

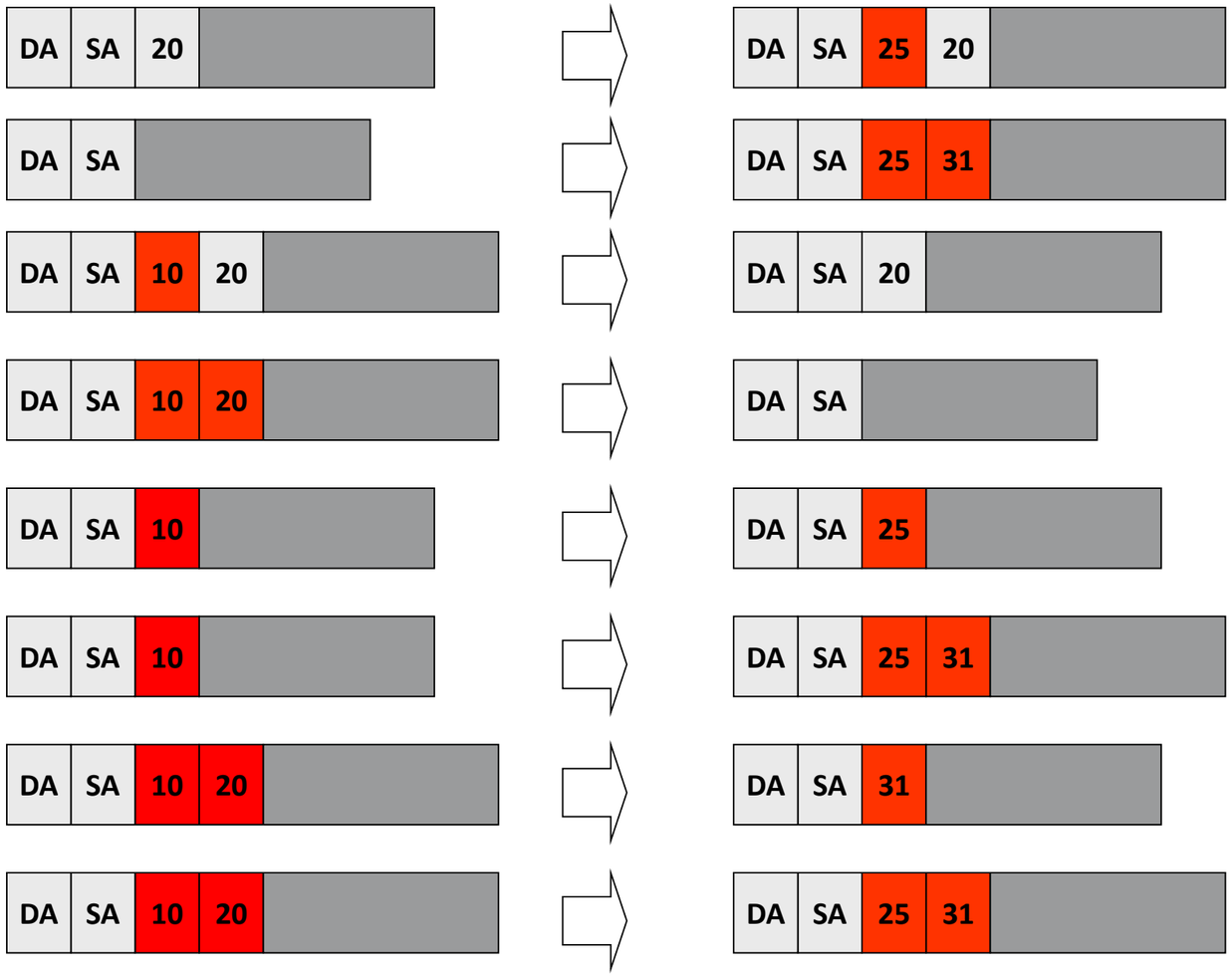
Translation Operations

- 1:1 VLAN Translation
- 1:2 VLAN Translation
- 2:1 VLAN Translation
- 2:2 VLAN Translation

Advanced Frame Manipulation

VLAN Tag Manipulation

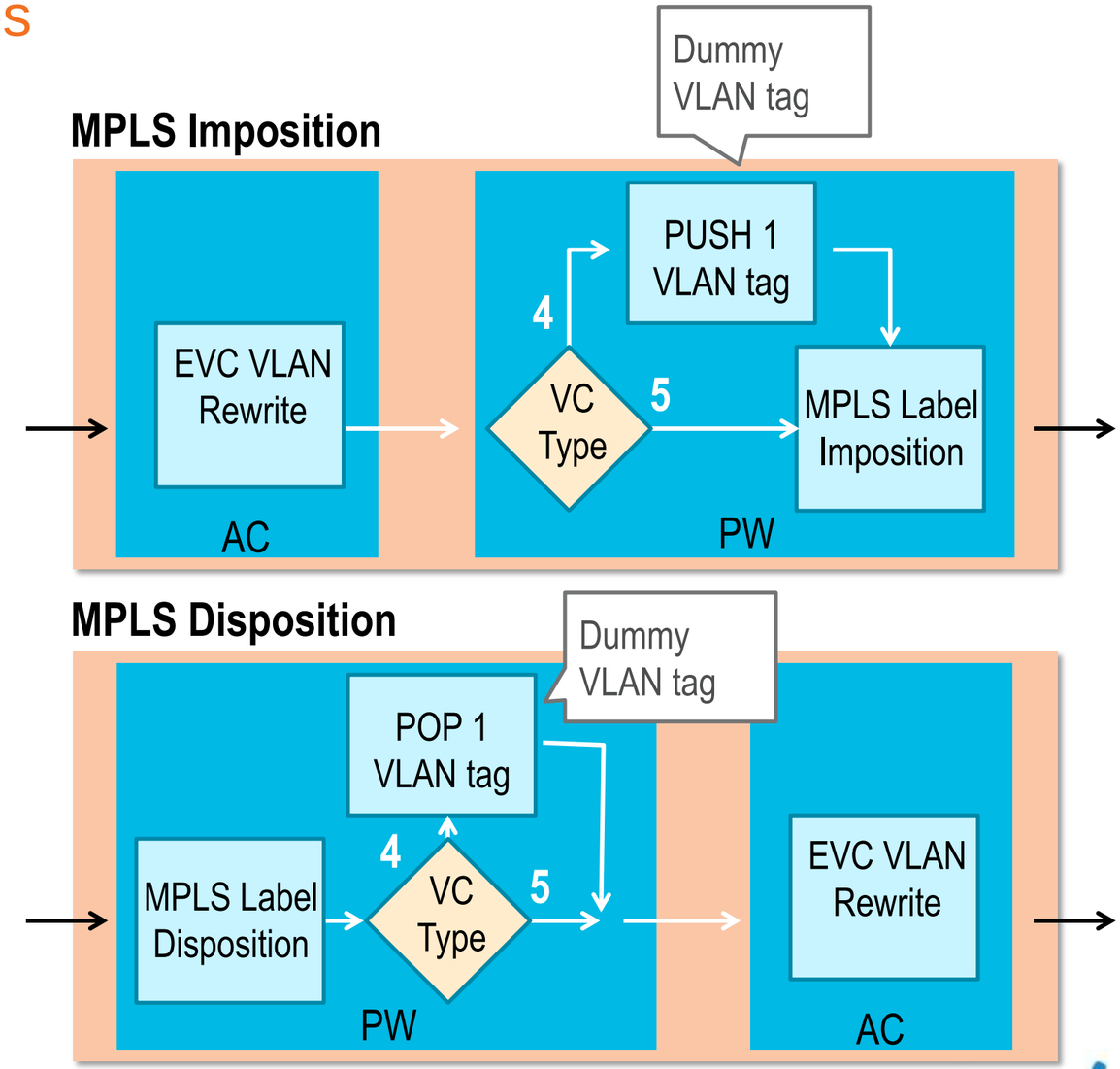
- PUSH operations
- POP operations
- TRANSLATION operations



Encapsulation Adjustment Considerations

EoMPLS PW VC Type and EVC VLAN Rewrites

- VLAN tags can be added, removed or translated prior to VC label imposition or after disposition
  - Any VLAN tag(s), if retained, will appear as payload to the VC
- VC label imposition and service delimiting tag are independent from EVC VLAN tag operations
  - Dummy VLAN tag – RFC 4448 (sec 4.4.1)
- VC service-delimiting VLAN-ID is removed before passing packet to Attachment Circuit processing



Operation and Packet Flow

Multiplexed Forwarding Services

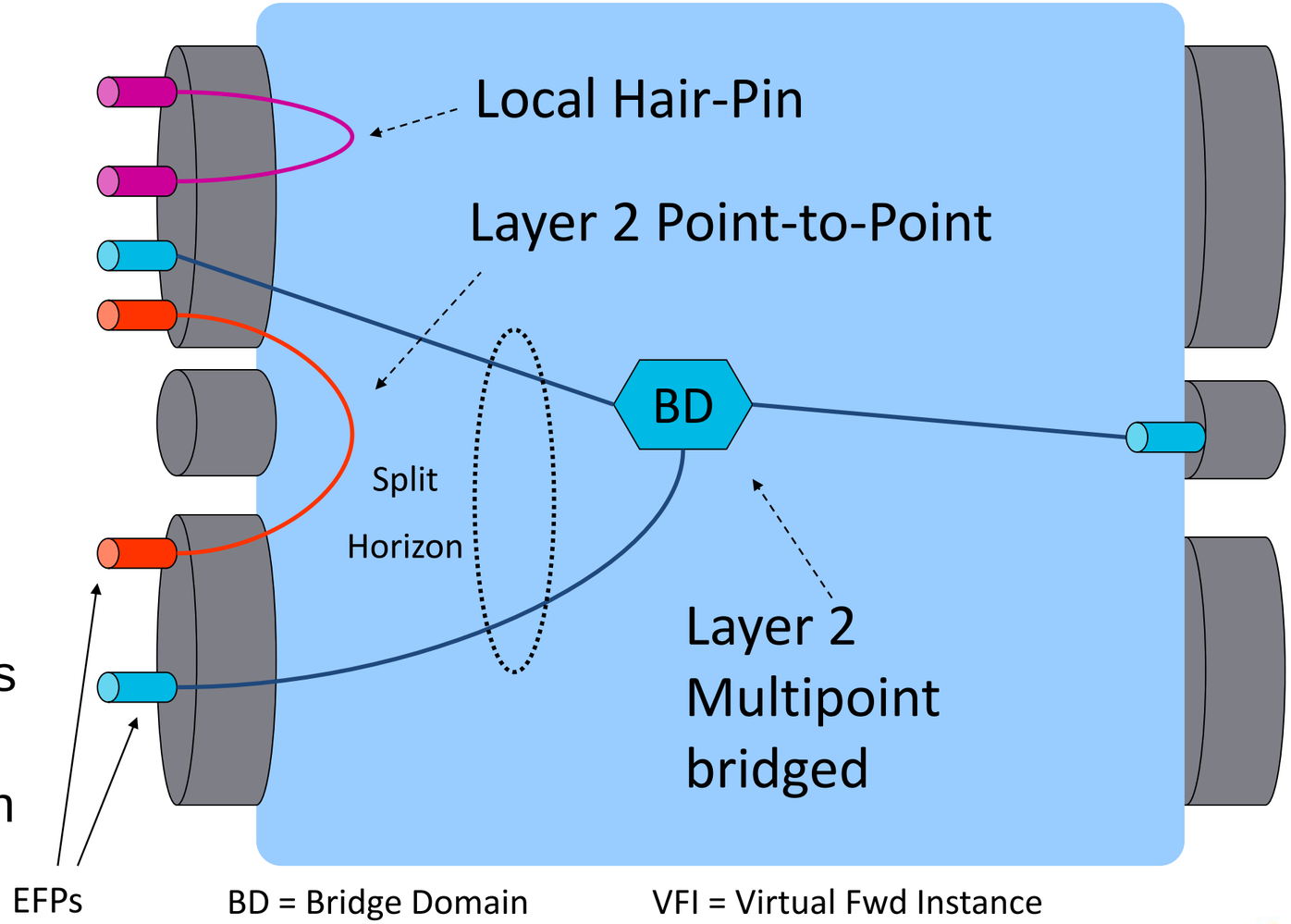
Multiplexed Forwarding Services

- Cisco EVC supports flexible access VLAN to forwarding service mapping
  - 1-to-1 access VLAN to a service
  - Same port, multiple access VLANs to a service
  - Multiple ports, multiple access VLANs to a service
- Forwarding services include:
  - L2 point-to-point local connect
  - L2 point-to-point xconnect
  - L2 multipoint bridging
  - L2 multipoint VPLS
  - L2 point-to-multipoint bridging
  - L3 termination

Multiplexed Forwarding Services

Local and Bridged P2P and MP Forwarding Services

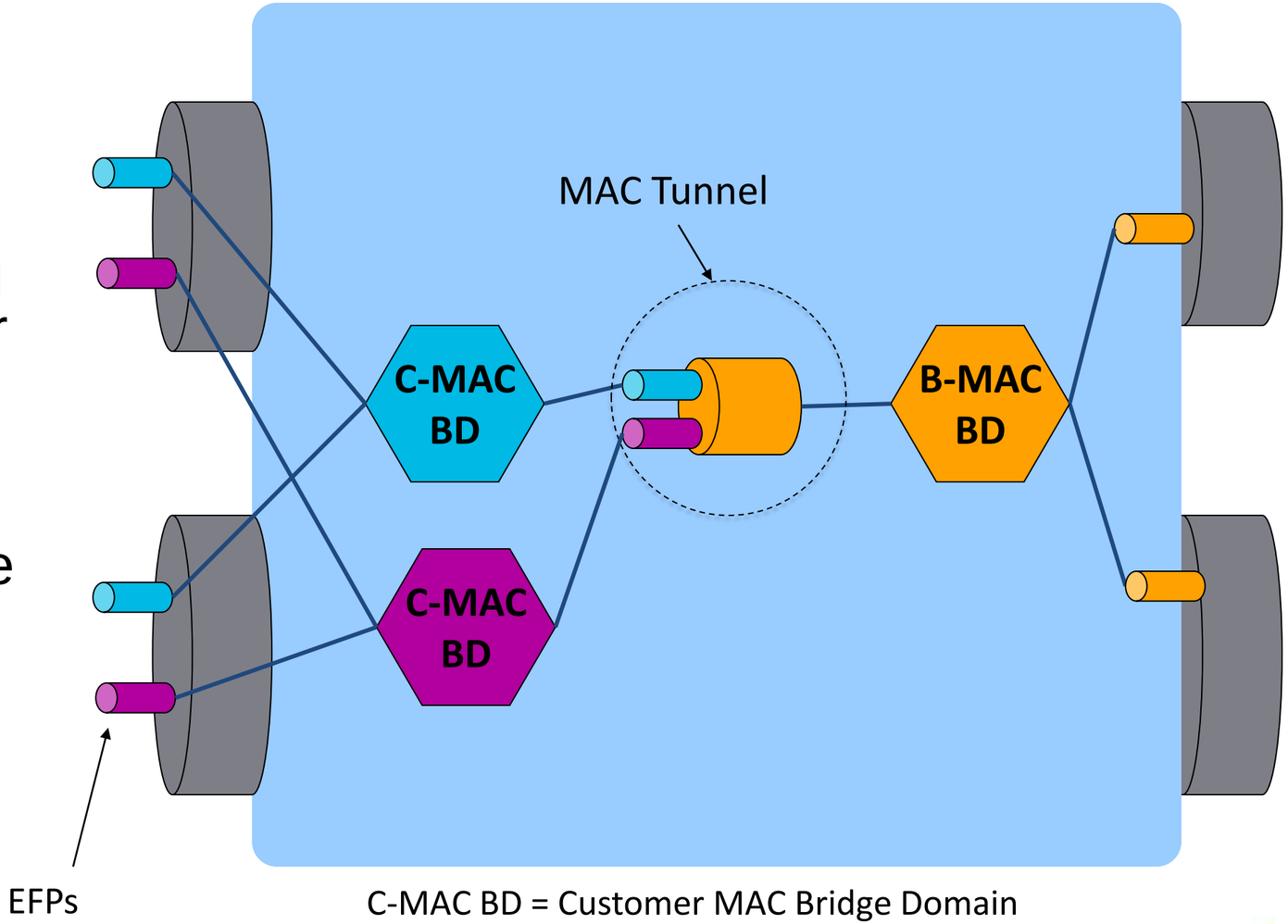
- Layer 2 P2P local services
  - –No MAC learning
  - –Two EFPs on same interface (hair-pin)
  - –Two EFPs on different interfaces
- Layer 2 MP bridged services
  - –MAC based forwarding and learning
  - –Local VLAN significance
  - –Bridge Domain (BD)—different access VLANs in the same broadcast domain
  - –Split-horizon—prevent communication between EFPs



Multiplexed Forwarding Services

Provider Backbone Bridging (PBB) Forwarding Services

- PBB Forwarding Services
  - MAC Tunnelling per IEEE Std. 802.1ah
  - C-MAC BD performs MAC learning and forwarding based on Customer MAC Addresses (1:1 mapping between C-MAC BD & I-SID)
  - B-MAC BD performs MAC learning and forwarding based on Backbone MAC Addresses
  - MAC Tunnel performs PBB encapsulation/de-capsulation (I-SID, B-VLAN, Backbone Addresses Header)

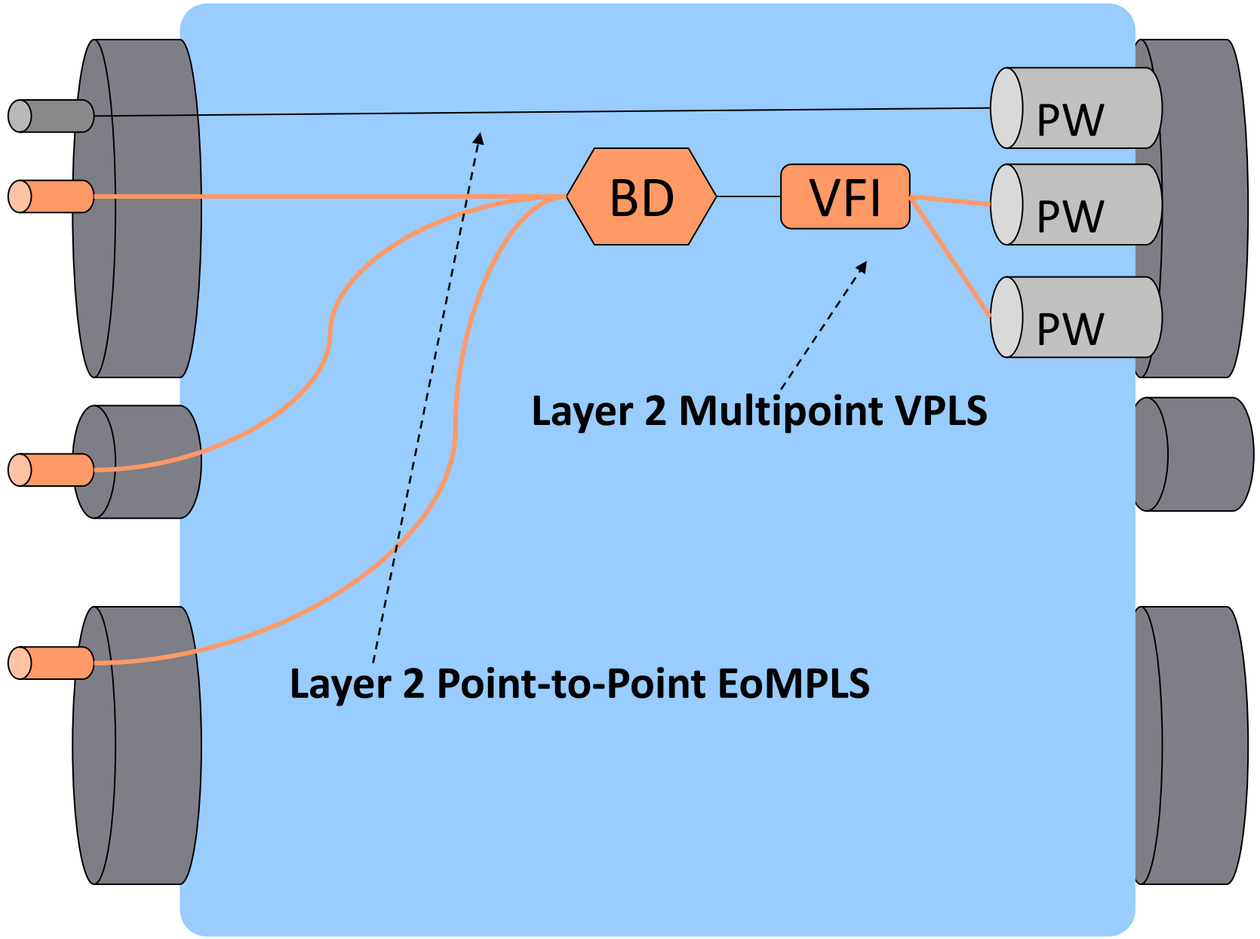


C-MAC BD = Customer MAC Bridge Domain
B-MAC BD = Backbone MAC Bridge Domain

Multiplexed Forwarding Services

MPLS-Based P2P and MP Forwarding Services

- Layer 2 P2P services using Ethernet over MPLS
  - EFP to EoMPLS PW
- Layer 2 MP services using VPLS
  - Extends ethernet multipoint bridging over a full mesh of PWs
  - Split horizon support over attachment circuits (configurable) and PWs

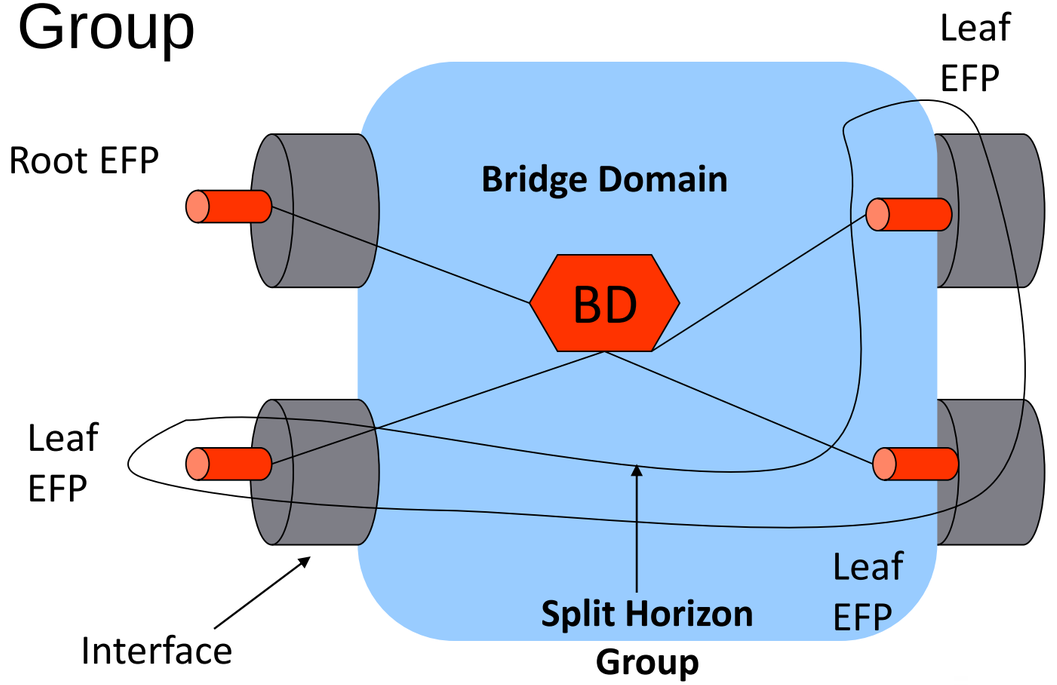


BD = Bridge Domain
PW = Pseudowire
VFI = Virtual Fwd Instance
SVI = Switch Virtual Instance

Multiplexed Forwarding Services

Rooted-Multipoint Forwarding Services (E-TREE)

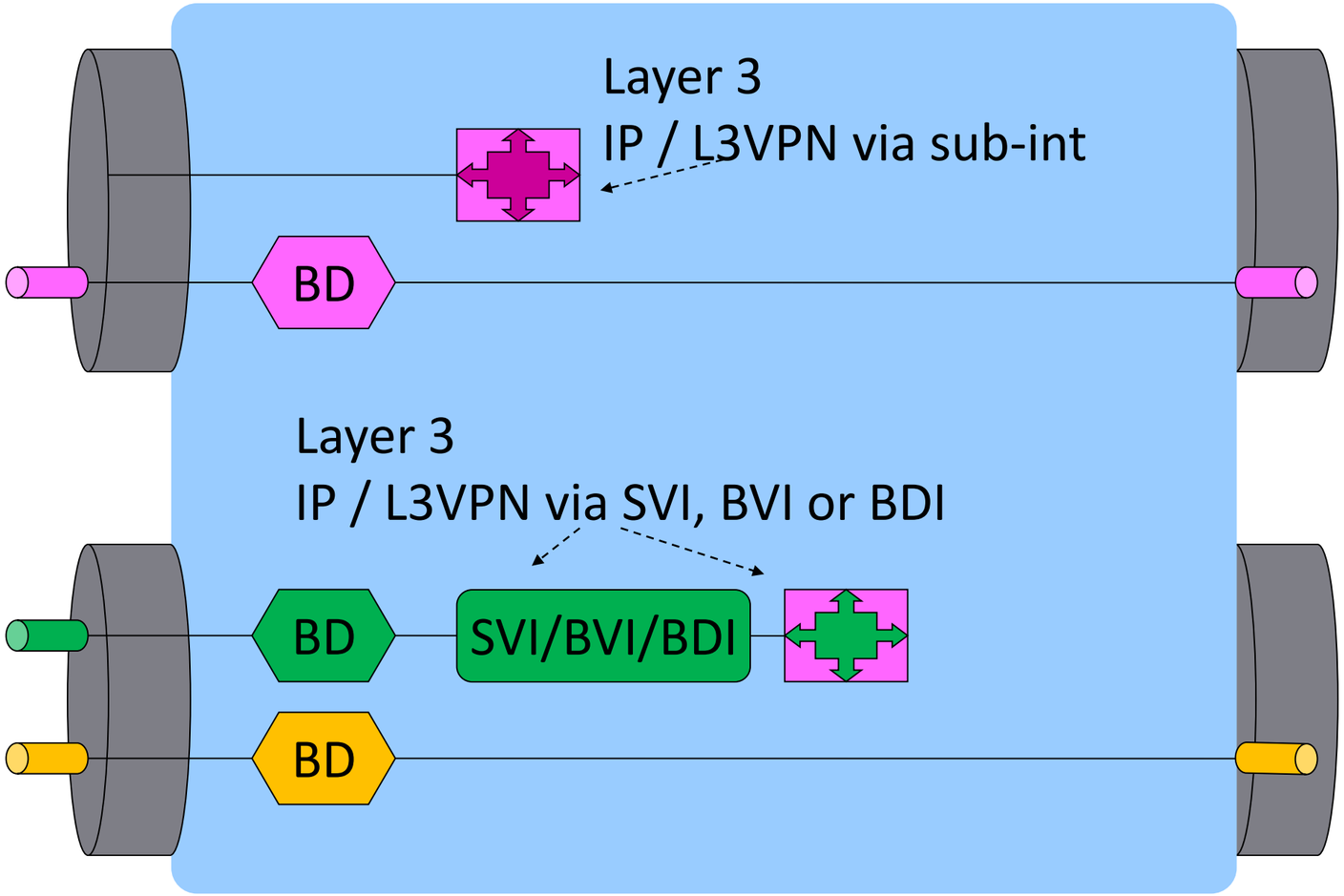
- BD with Split Horizon Group can be used to implement rooted-multipoint forwarding service:
  - Place all Leaf EFPs in Split Horizon Group
  - Keep Root EFP outside the Split Horizon Group
- Net effect:
  - Bidirectional connectivity between Root and all Leaf EFPs
  - Leaf EFPs cannot communicate to each other



Multiplexed Forwarding Services

Layer 3 Forwarding Services

- Co-existence with Routed sub-interfaces
- Layer 3 termination through SVI/BVI/BDI interface
- Layer 3 termination through Routed sub-interfaces

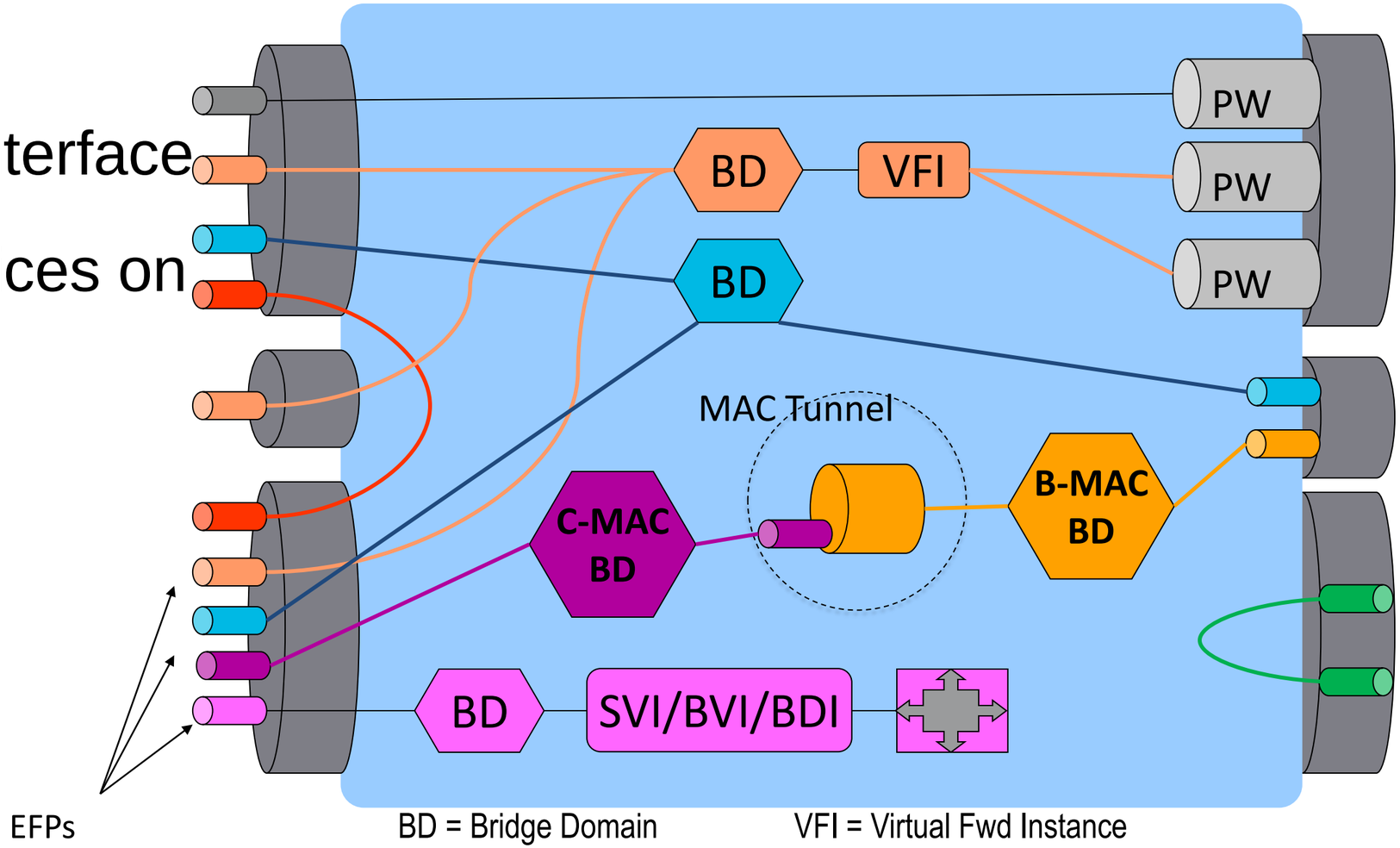


BD = Bridge Domain
PW = Pseudowire
BDI = Bridge Domain Interface
VFI = Virtual Fwd Instance
SVI = Switch Virtual Instance
BVI = Bridge Virtual Interface

Multiplexed Forwarding Services

Putting It All Together

- Multiplexed Service Interface
- Mix of L2 and L3 services on same port
- Different types of L2 services
  - Point-to-Point
  - Multipoint



BD = Bridge Domain
VFI = Virtual Fwd Instance
PW = Pseudowire
SVI = Switch Virtual Instance
BDI = Bridge Domain Interface
BVI = Bridge Virtual Interface
C-MAC BD = Customer MAC Bridge Domain
B-MAC BD = Backbone MAC Bridge Domain

Operation and Packet Flow

Features

Service-Instance/Bridge Domain Features

Security Features

Bridging Control

- MAC Address Limiting on EVC Bridge Domain
- MAC Security on EFP
- Storm Control on Ports with EVCs

Access Control

- L2 MAC ACL on EFP
- L3 ACL on EFP
- L4 ACL on EFP

Address Spoofing / Masquerading

- IP Source Guard for EFP
- DHCP snooping with Option-82 on EFP
- Dynamic ARP Inspection (DAI)

Service-Instance/Bridge Domain Features

Resiliency Features

Link Redundancy

- EVC “static” Etherchannel
- EVC “LACP” Etherchannel
- EVC Etherchannel Manual Load Balancing
- EVC and FlexLink (backup interface) integration

Device Multi-homing

- Multi-Chassis LACP (mLACP)
- ICCP Multi-chassis VLAN Redundancy (Pseudo mLACP, a.k.a mLACP Active/Active)
- Pseudowire Redundancy

Network Multi-homing

- MST on EVC Bridge Domain
- G.8032 Ethernet Ring Protection (ERP)
- Resilient Ethernet Protocol (REP) on EVC
- MST/PVST Access Gateway

Service-Instance/Bridge Domain Features

OAM Features

Service OAM

Fault Management	Performance Management	Link OAM
• IEEE 802.1ag (CFM) on EFP with Bridge Domain • CFM on EFP with Xconnect • CFM on L2 VFI • E-LMI (MEF16) • CFM to Ethernet LMI (E-LMI) Interworking • PW OAM to E-LMI Interworking • Link OAM to CFM Interworking	• IP SLA (IOS) / Ethernet SLA (IOS-XR) • ITU-T Y.1731 Performance Management	• 802.3ah Link OAM • UDLD on EFP

Service-Instance/Bridge Domain Features

Miscellaneous and Instrumentation Features

Miscellaneous

- IGMP Snooping
- Custom ether-type on EFP
- Static unicast / multicast MAC on EFP and VFI PW
- SPAN on EVC

Instrumentation

- IF-MIB (extensions to support EFPs)
- CISCO-EVC-MIB
- CISCO-BRIDGE-DOMAIN-MIB

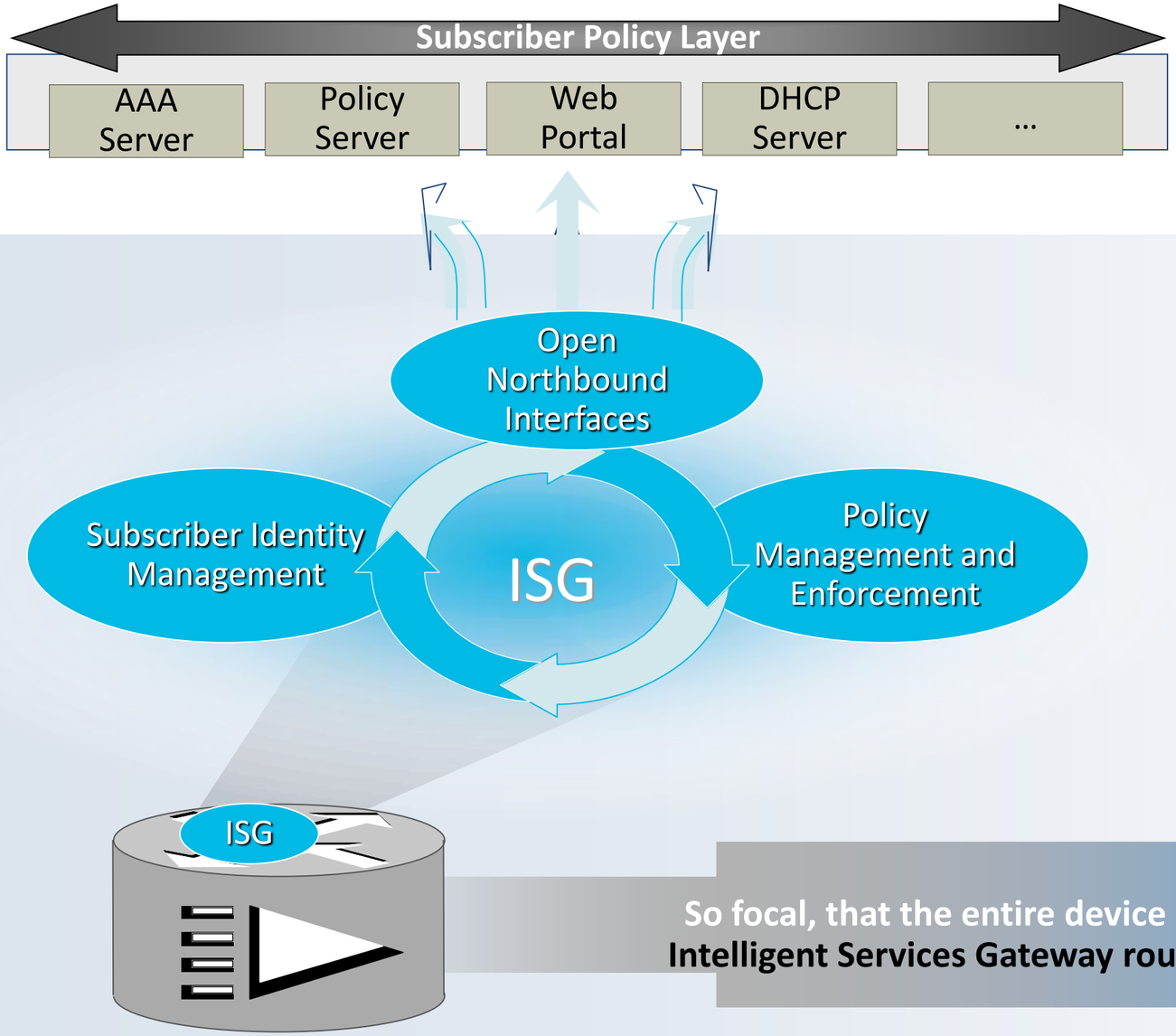
Dynamic Ethernet Service Activation (DESA)

What is DESA?

- Ethernet infrastructure with programmatic interface
- Intelligent Service Management engine
- Power of dynamic subscriber management from ISG to automate provisioning of Ethernet Services
- Automated, customised Ethernet service provisioning infrastructure that saves OPEX

What is ISG?

Cisco Intelligent Services Gateway (ISG) is a licensed feature set on Cisco IOS that provides Session Management and Policy Management services to a variety of access networks



- Subscriber Identification
- Subscriber Authentication
- Subscriber Services Determination and Enforcement
- Dynamic Service update

So focal, that the entire device is often referred as an: Intelligent Services Gateway router or simply "The ISG"

ISG Session Types

- Based on Subscriber Access Protocol
- Sessions Supported:

Dynamically Created Sessions:

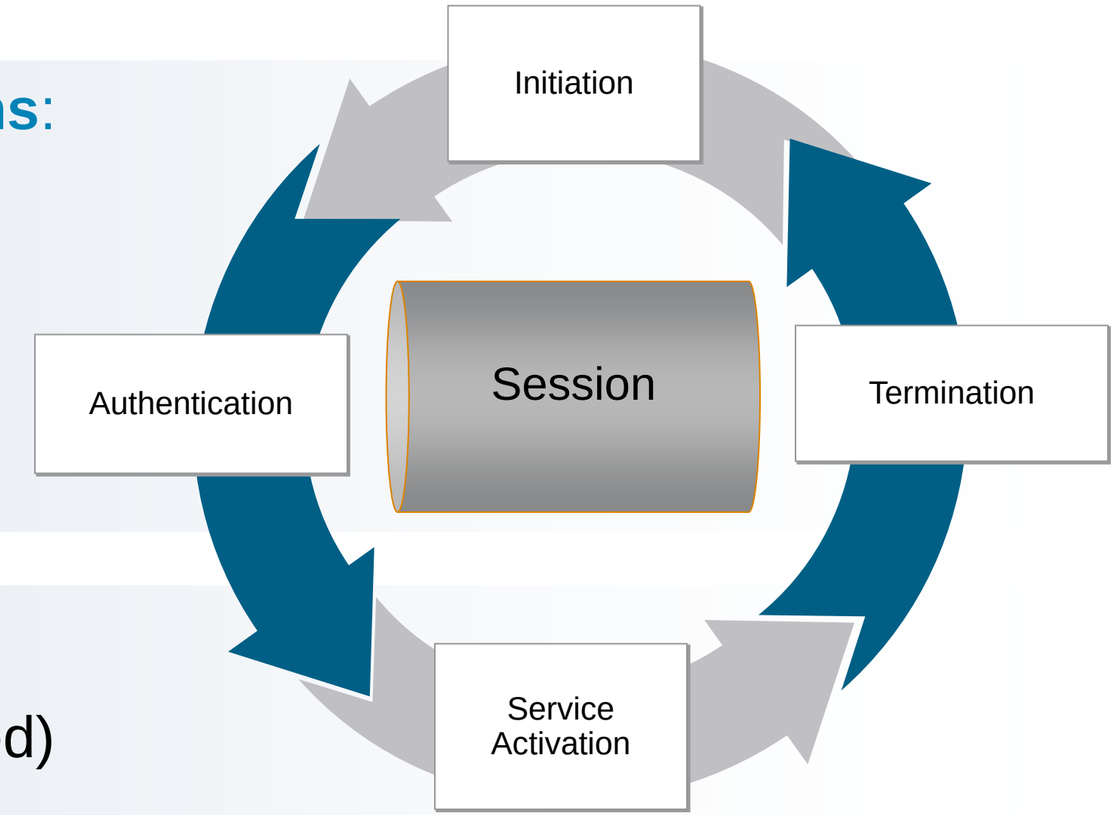
PPP sessions

IP sessions

IP “Subnet” sessions

NEW with DESA

Ethernet sessions



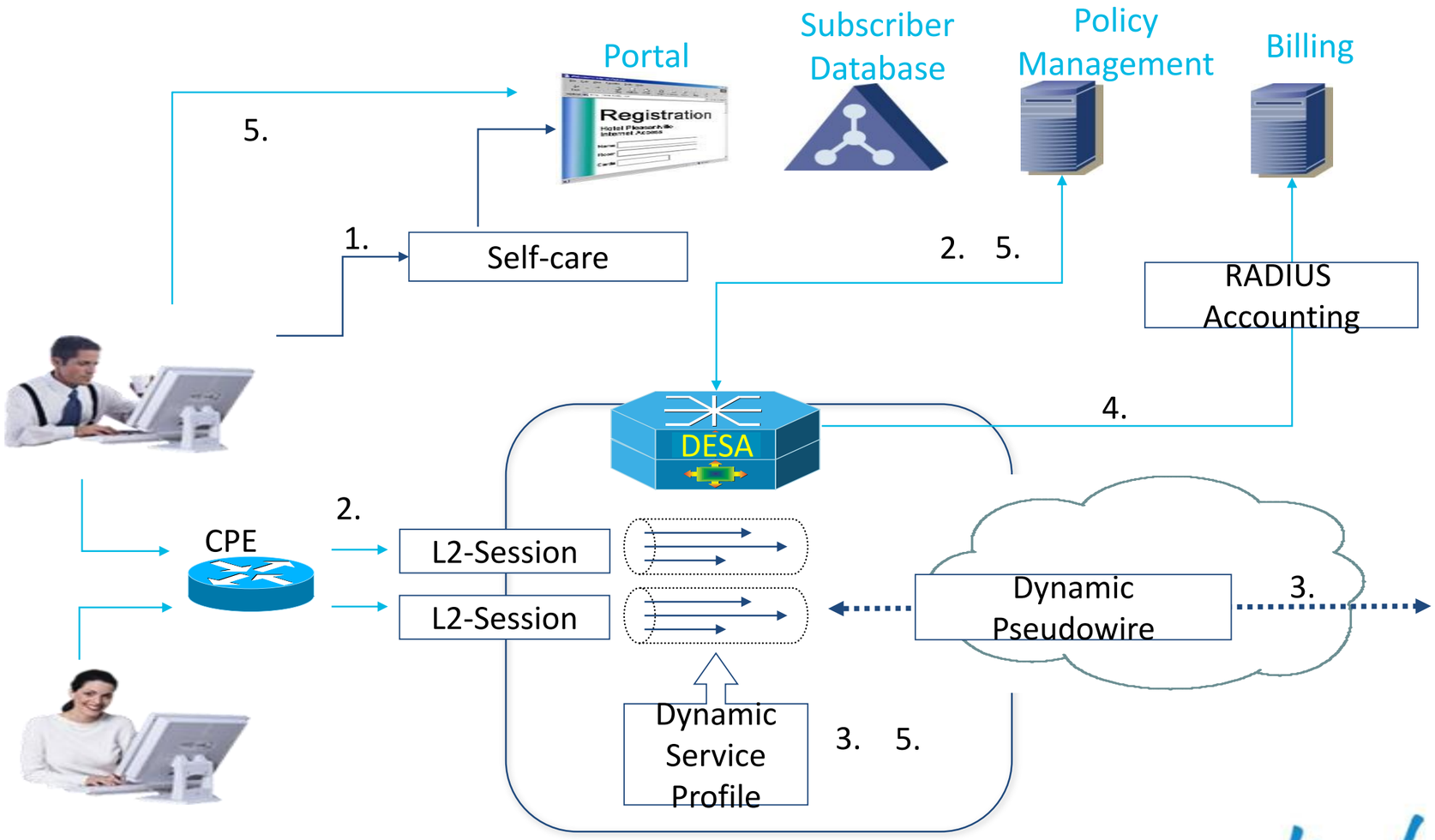
Statically Created Sessions:

Interface sessions (IP-based)

Ethernet sessions

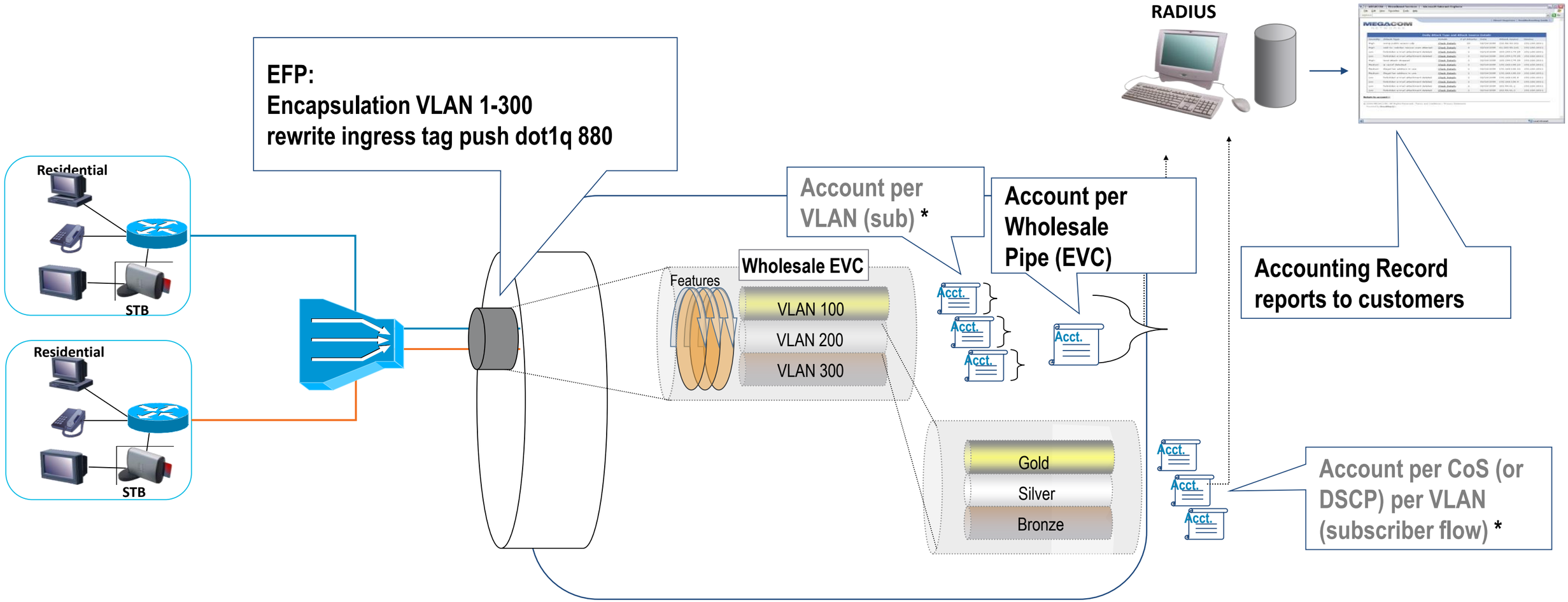
SMB—Service Activation Example

1. Customer orders L2 service at portal
   - –CPE is shipped to customer
   - –Customer plugs in CPE
2. First L2-traffic triggers RADIUS request to activate services
3. L2 Service profile applied (ACLs, QOS, Pseudowire, etc.)
4. Activates billing and inventory functions
5. Customer changes profile dynamically on-demand



Ethernet Accounting

Wholesale Use Case



(*) Per-Flow accounting planned for future phases

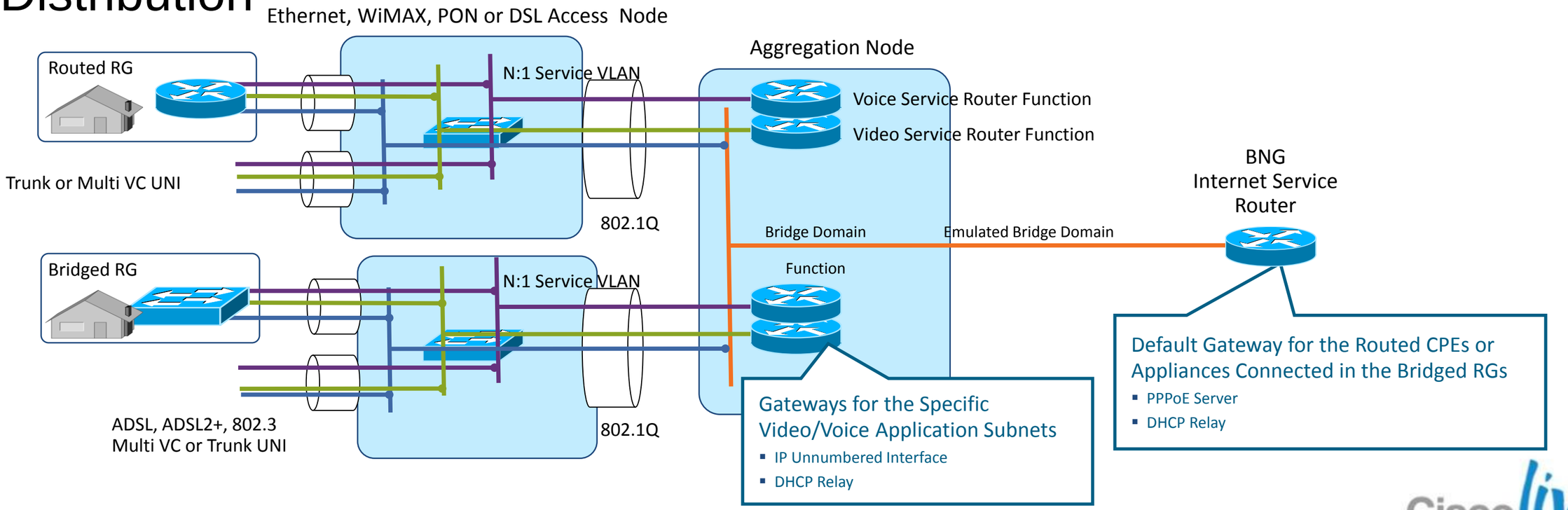
Deployment Use Cases

Residential Access Model Implementation

Trunk UNI, N:1 Service VLAN

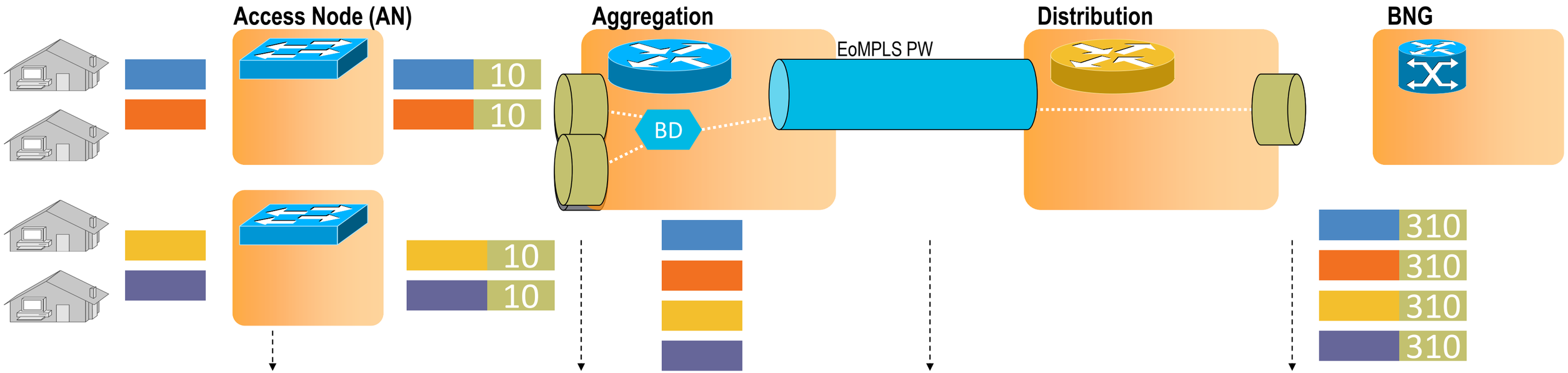
Residential Service Connectivity Overview

- Split Horizon Forwarding, locally significant VLAN ids combined into a per service ‘Bridge Domains’ (N:1)
- Video routed (unnumbered) in Aggregation, other transported to Distribution



Residential Service Use Case

Trunk UNI, N:1 Data Service VLAN (PW Per AGG Node)



Access Node assigns a single VLAN for Data service (e.g. 10). This vlan is shared for all subscribers (N:1)

DATA EFP

Ingress direction:

- Match traffic from AN based on single VID (e.g. 10)
- POP the service vlan
- Send traffic to DATA bridge domain (BD)

Egress direction:

- PUSH service vlan (e.g. 10) on traffic received from DATA BD

Single EoMPLS PW carries traffic from all ANs in a given AGG node

DATA EFP

Egress direction:

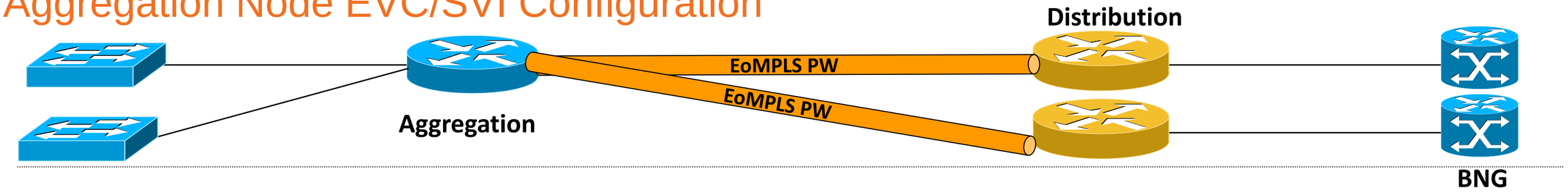
- PUSH vlan representing AGG node (e.g. 310) on traffic received from PW

Ingress direction:

- Match traffic from BNG based on AGG VID (e.g. 310)
- POP AGG vlan
- Send traffic to PW

Trunk UNI - Single Attached Access Node

Aggregation Node EVC/SVI Configuration



- One common bridge domain for HSI (VLAN 310)
- Per Access Node SVI for video (VLAN 311 and VLAN 312)
- Active/Active example using VPLS

Aggregation EVC

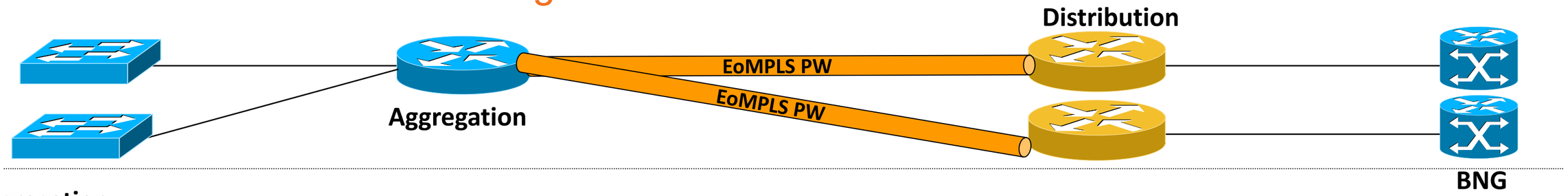
```
interface GigabitEthernet4/0/4
 service instance 1 ethernet
  encapsulation dot1q 10
  rewrite ingress tag pop 1 symmetric
  bridge-domain 310 split-horizon
 !
 service instance 2 ethernet
  encapsulation dot1q 11
  rewrite ingress tag pop 1 symmetric
  bridge-domain 311 split-horizon
!
interface GigabitEthernet4/0/5
 service instance 1 ethernet
  encapsulation dot1q 10
  rewrite ingress tag pop 1 symmetric
  bridge-domain 310 split-horizon
 !
 service instance 2 ethernet
  encapsulation dot1q 11
  rewrite ingress tag pop 1 symmetric
  bridge-domain 312 split-horizon
```

Aggregation SVI

```
vlan 310
vlan 311
vlan 312
!
interface Loopback1
 ip address 130.173.1.1 255.255.255.255
!
interface Vlan310
 xconnect vfi v310
!
interface Vlan311
 ip dhcp relay information trusted
 ip unnumbered Loopback1
 ip helper-address 10.20.61.3
 ip pim sparse-mode
!
interface Vlan312
 ip dhcp relay information trusted
 ip unnumbered Loopback1
 ip helper-address 10.20.61.3
 ip pim sparse-mode
```

Trunk UNI - Single Attached Access Node

Distribution Node/VPLS Configuration



Aggregation

```
vlan 310
!
pseudowire-class F1701
 encapsulation mpls
 preferred-path interface Tunnel1
!
pseudowire-class F1601
 encapsulation mpls
 preferred-path interface Tunnel3
!
l2 vfi v310 manual
 vpn id 310
 neighbor 10.30.30.16 pw-class F1601 no-split-horizon
 neighbor 10.30.30.17 pw-class F1701 no-split-horizon
!
interface Loopback0
 ip address 10.30.30.172 255.255.255.255
!
interface Vlan310
 xconnect vfi v310
```

Distribution #1

```
interface Loopback0
 ip address 10.30.30.16 255.255.255.255
!
interface GigabitEthernet3/0/3
 service instance 310 ethernet
  encapsulation dot1q 310
  rewrite ingress tag pop 1 symmetric
  xconnect 10.30.30.173 310 pw-class F1703
```

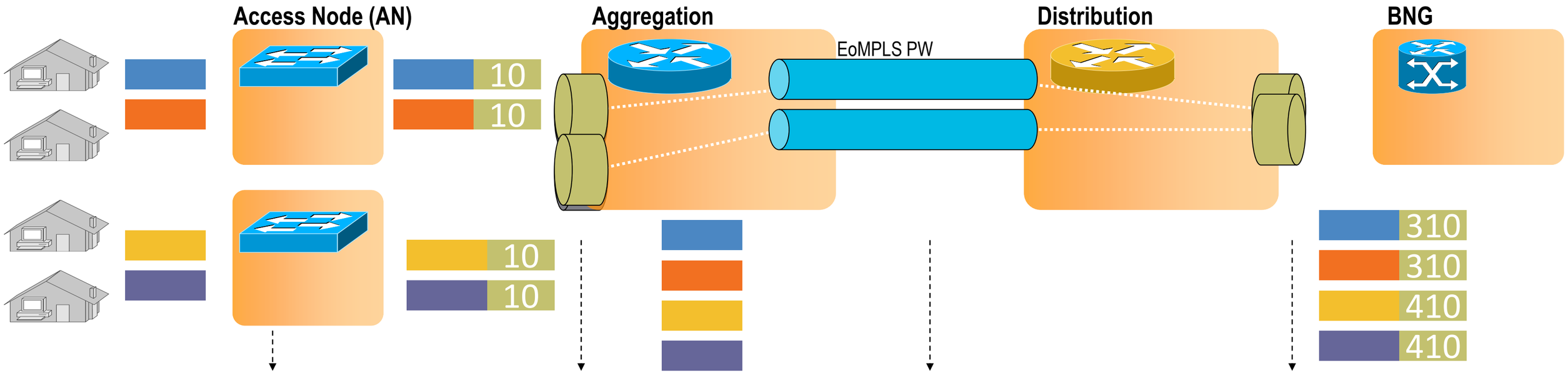
Distribution #2

```
interface Loopback0
 ip address 10.30.30.17 255.255.255.255
!
interface GigabitEthernet3/0/3
 service instance 310 ethernet
  encapsulation dot1q 310
  rewrite ingress tag pop 1 symmetric
  xconnect 10.30.30.173 310 pw-class F1703
```

(*) These configurations reflect only the VPLS CLI required for HSI transport toward the redundant BNGs on the Aggregation Node; for complete Aggregation Node configuration, please refer to the previous slide

Residential Service Use Case

Trunk UNI, N:1 Data Service VLAN (PW Per Access Node)



AN assigns a single VLAN for Data service (e.g. 10). This vlan is shared for all subscribers (N:1)

DATA EFP

Ingress direction:

- Match traffic from AN based on single VID (e.g. 10)
- POP the service vlan
- Send traffic to PW

Egress direction:

- PUSH service vlan (e.g. 10) on traffic received from PW

Single EoMPLS PW carries traffic from all subscribers in a given AN

DATA EFP

Egress direction:

- PUSH vlan representing AN (e.g. 310, 410) on traffic received from PW

Ingress direction:

- Match traffic from BNG based on AN VID (e.g. 310, 410)
- POP AN vlan
- Send traffic to PW

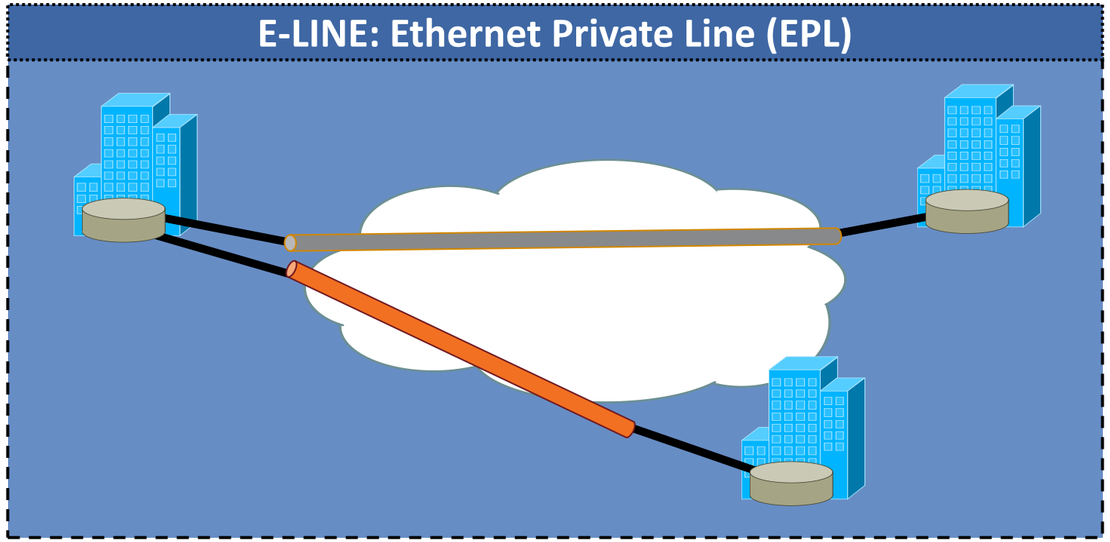
Deployment Use Cases

Business Services Implementation

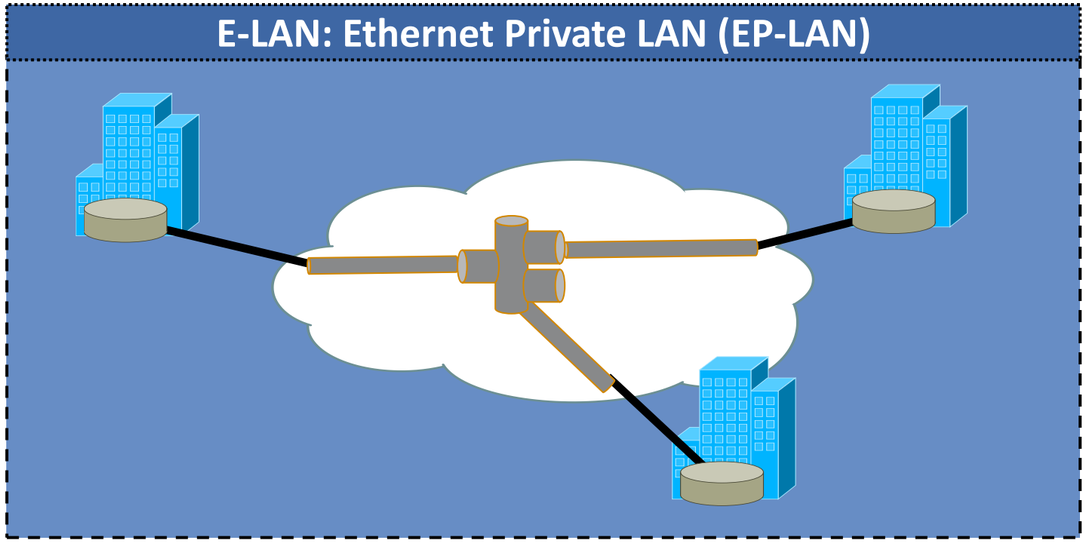
Carrier Ethernet Business Services

MEF Service Visualisation

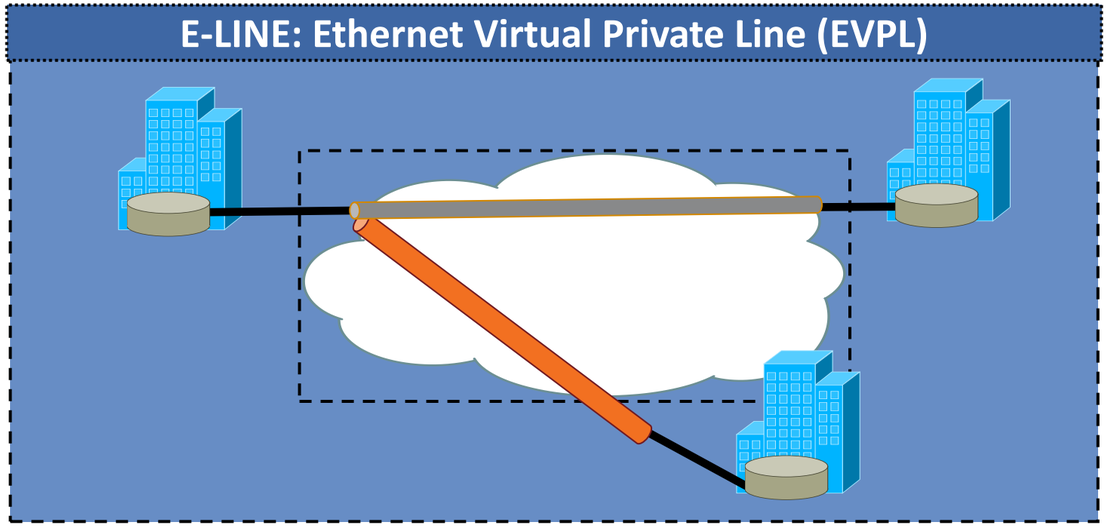
E-LINE: Ethernet Private Line (EPL)



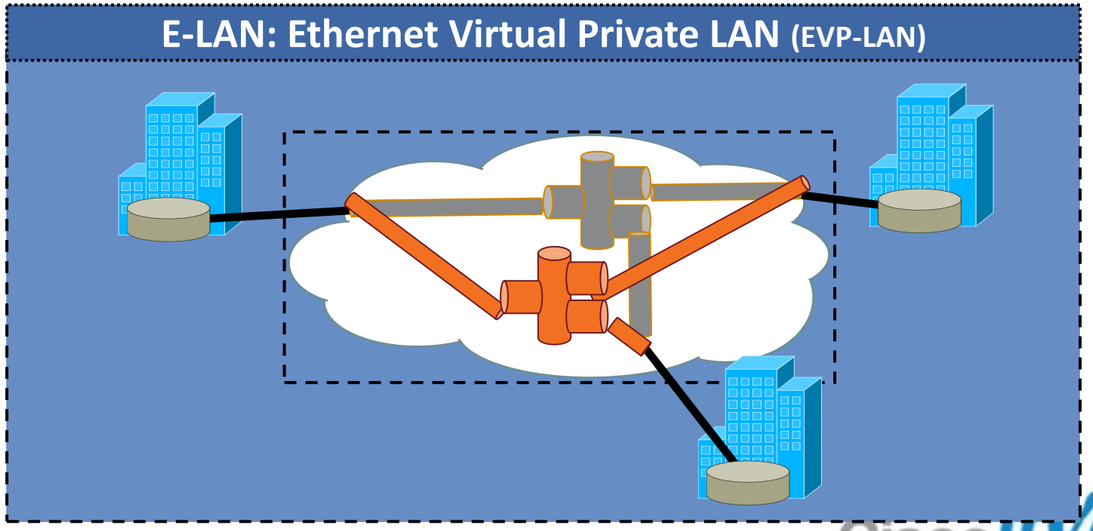
E-LAN: Ethernet Private LAN (EP-LAN)



E-LINE: Ethernet Virtual Private Line (EVPL)



E-LAN: Ethernet Virtual Private LAN (EVP-LAN)



Deployment Use Cases

Business use cases presented in the section:

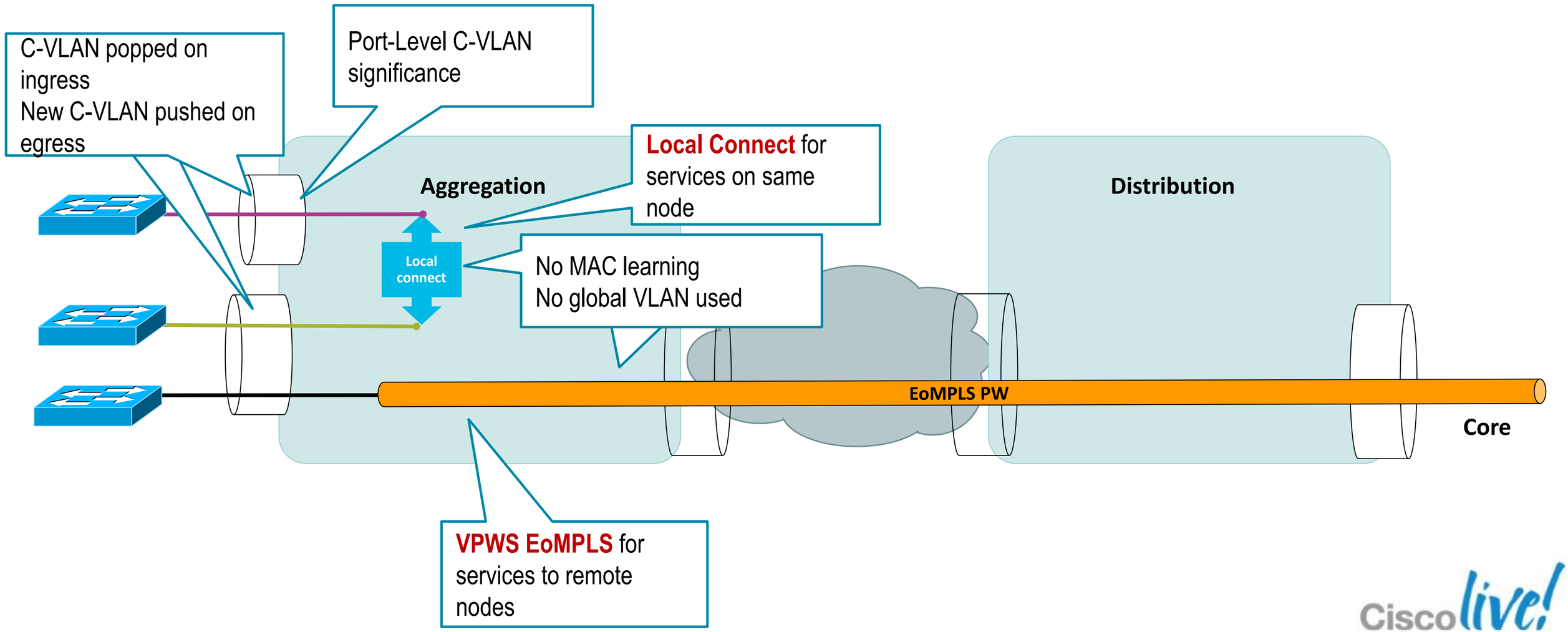
Service Type	Service
E-LINE	Ethernet Virtual Private Line
E-LINE	Ethernet Private Line
E-LAN	Ethernet Virtual Private LAN
E-LAN	Ethernet Private LAN

Deployment Use Cases

Business Services – Point2Point (EVPL & EPL)

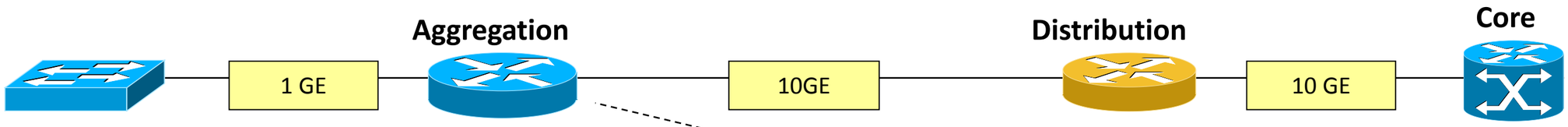
Ethernet Virtual Private Line (EVPL)

Logical View



Ethernet Virtual Private Line (EVPL)

Sample Configurations



EVPL Service Between Aggregations *

```
interface GigabitEthernet3/0/15
 no cdp enable
 service instance 100 ethernet
  encapsulation dot1q 2593
  rewrite ingress tag pop 1 symmetric
  xconnect 10.40.40.26 11111 pw-class AS40


pseudowire-class AS40
 encapsulation mpls
 preferred-path interface Tunnel1040
```

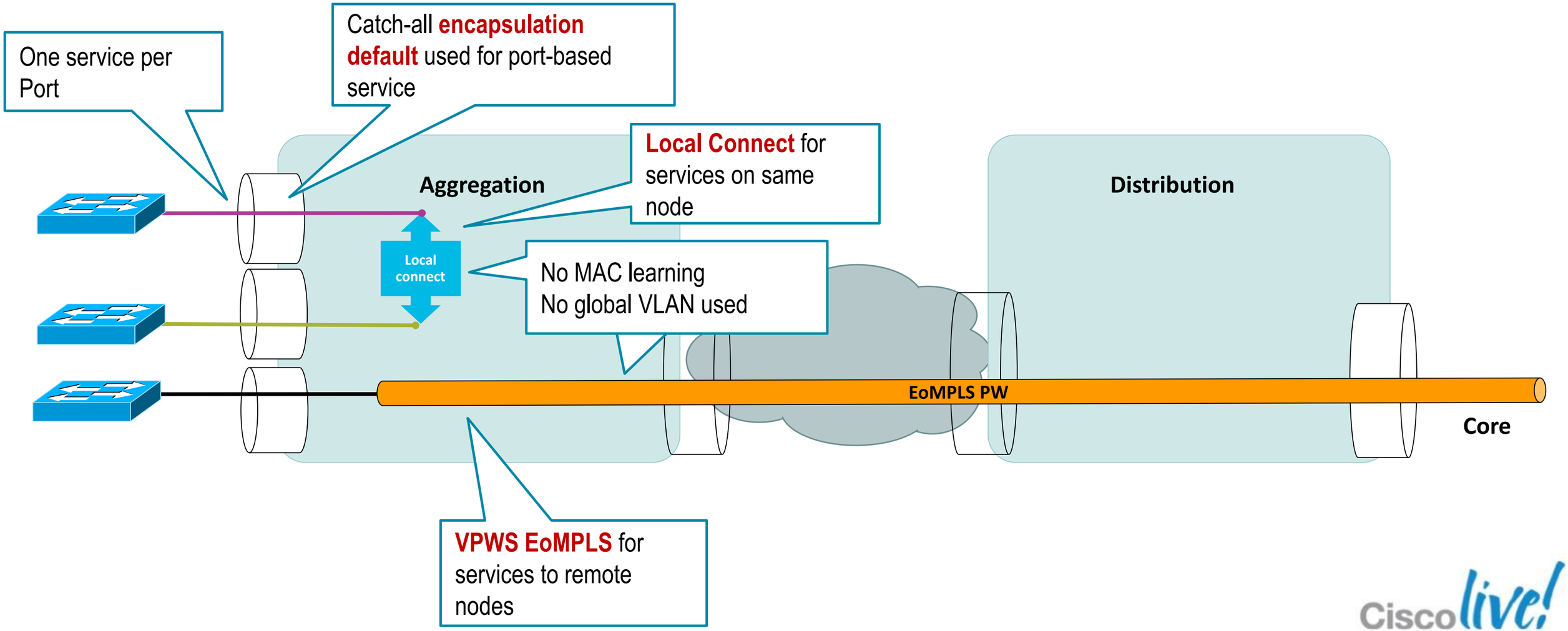
EVPL Service on Same Aggregation

```
interface GigabitEthernet3/0/15
 mls qos trust cos
 no cdp enable
 service instance 100 ethernet
  encapsulation dot1q 2595
  rewrite ingress tag pop 1 symmetric

interface GigabitEthernet3/0/16
 mls qos trust cos
 no cdp enable
 service instance 200 ethernet
  encapsulation dot1q 2595
  rewrite ingress tag pop 1 symmetric

connect EVPL_local GigabitEthernet3/0/15 100
GigabitEthernet3/0/16 200
```

(*) Configuration sample for remote EVPL reflects only one end of the connection

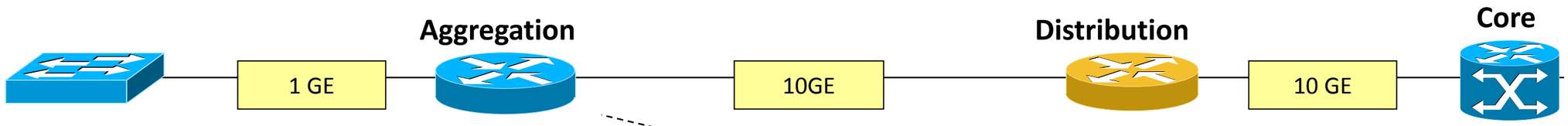
Ethernet Private Line (EPL)

Logical View



Ethernet Private Line (EPL)

Sample Configurations



EPL Service Between Aggregations *

```
interface GigabitEthernet3/0/4
 description Sample EPL
 mtu 9216
 no cdp enable
 service instance 30 ethernet
  encapsulation default
  xconnect 10.40.40.26 1111 pw-class AS40

pseudowire-class AS40
 encapsulation mpls
 preferred-path interface Tunnel1040
```

EPL Service on Same Aggregation

```
interface GigabitEthernet3/0/11
 mtu 9216
 no cdp enable
 service instance 100 ethernet
  encapsulation default

interface GigabitEthernet3/0/12
 mtu 9216
 no cdp enable
 service instance 200 ethernet
  encapsulation default

connect EPL-sample GigabitEthernet3/0/11 100
GigabitEthernet3/0/12 200
```

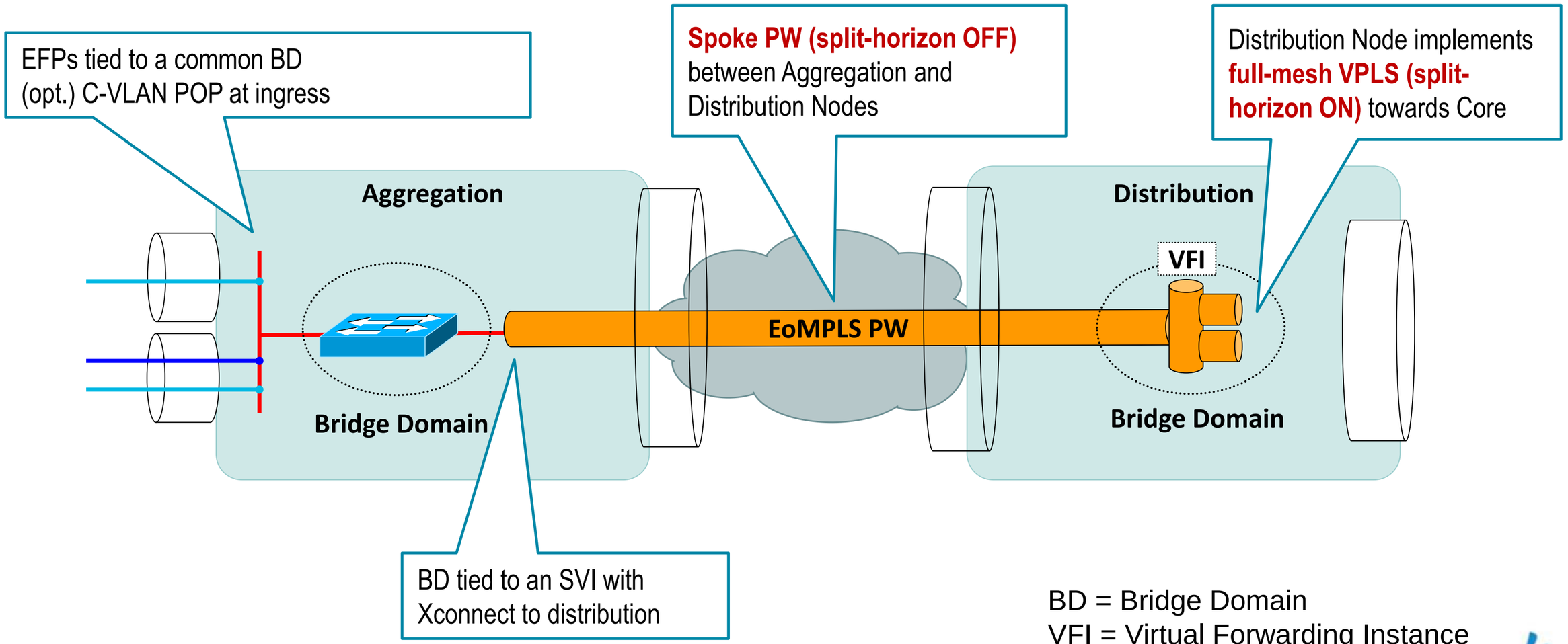
(*) Configuration sample for remote EPL reflects only one end of the connection

Deployment Use Cases

Business Services – Multipoint (EVP-LAN & EP-LAN)

Ethernet Virtual Private LAN (EVP-LAN)

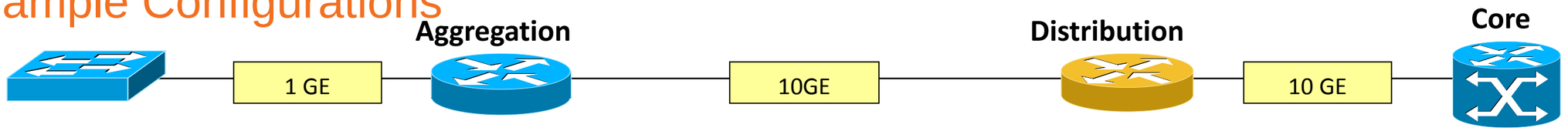
Logical View



BD = Bridge Domain
VFI = Virtual Forwarding Instance

Ethernet Virtual Private LAN (EVP-LAN)

Sample Configurations



Aggregation Node

```
interface GigabitEthernet3/0/15
 mtu 9216
 service instance 100 ethernet
  encapsulation dot1q 2504
  rewrite ingress tag pop 1 symmetric
  bridge-domain 2511

interface GigabitEthernet3/0/16
 mtu 9216
 service instance 200 ethernet
  encapsulation dot1q 2514
  rewrite ingress tag pop 1 symmetric
  bridge-domain 2511

interface Vlan2511
 mtu 9216
 xconnect 10.10.10.25 1111 pw-class F2501

pseudowire-class F2501
 encapsulation mpls
 preferred-path interface Tunnel11
```

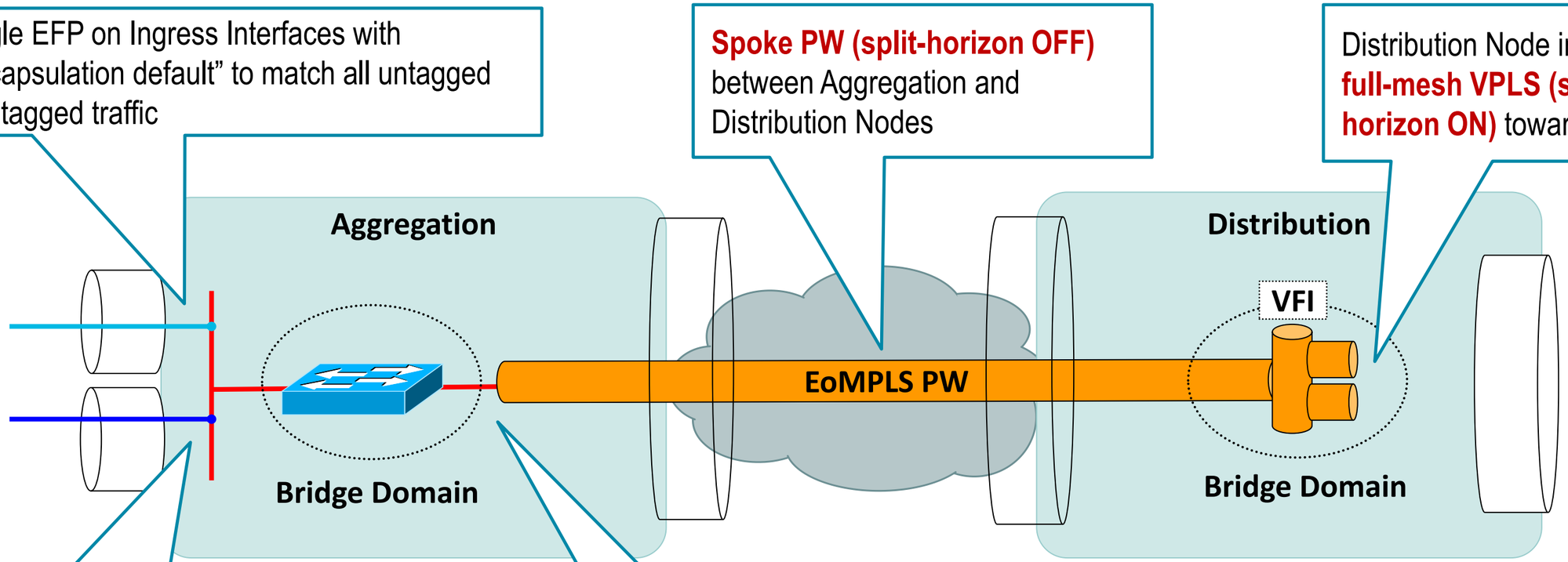
Distribution Node *

```
l2 vfi EVPLAN-sample manual
 vpn id 1111
!Neighbor aggregation node
 neighbor 10.10.10.26 pw-class F2601 no-split-
 horizon
!Neighbor Distribution node
 neighbor 10.10.10.24 pw-class F2401
!Remote Distribution node
 neighbor 10.40.40.63 encapsulation mpls

interface Vlan2511
 mtu 9216
 xconnect vfi EVPLAN-sample

pseudowire-class F2401
 encapsulation mpls
 preferred-path interface Tunnel11
pseudowire-class F2601
 encapsulation mpls
 preferred-path interface Tunnel13
```

(*) Distribution SVI will stay up even if not associated to a EFP

Ethernet Private LAN (EP-LAN)

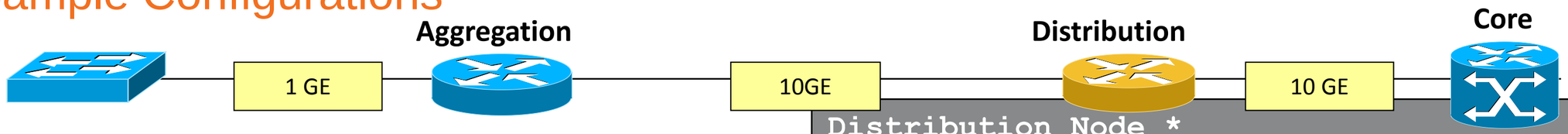
Logical View



BD = Bridge Domain
VFI = Virtual Forwarding Instance

Ethernet Private LAN (EP-LAN)

Sample Configurations



Aggregation Node

```
interface GigabitEthernet4/0/2
 mtu 9216
 no cdp enable
 service instance 200 ethernet
  encapsulation default
  l2protocol forward
  bridge-domain 2711

interface Vlan2711
 mtu 9216
 xconnect 10.10.10.25 1111 pw-class F2501

pseudowire-class F2501
 encapsulation mpls
 preferred-path interface Tunnel11
```

Distribution Node *

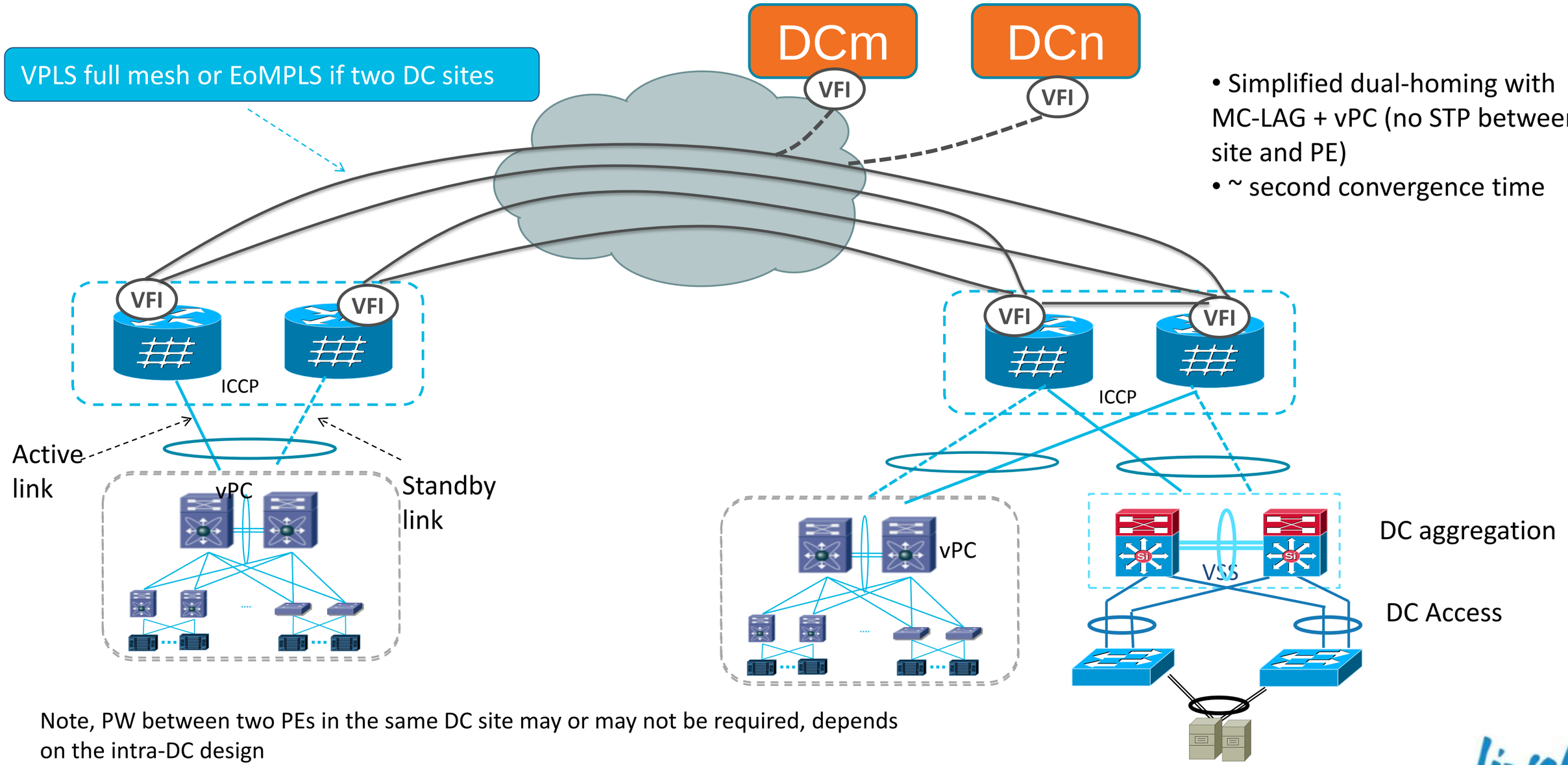
```
l2 vfi EPLAN-sample manual
 vpn id 1111
  !Neighbor aggregation node
 neighbor 10.10.10.26 pw-class F2601 no-split-
  horizon
  !Neighbor Distribution node
 neighbor 10.10.10.24 pw-class F2401
  !Remote Distribution node
 neighbor 10.40.40.63 encapsulation mpls

interface Vlan2711
 mtu 9216
 xconnect vfi EPLAN-sample

pseudowire-class F2401
 encapsulation mpls
 preferred-path interface Tunnel11
pseudowire-class F2601
 encapsulation mpls
 preferred-path interface Tunnel13
```

(*) Distribution SVI will stay up even if not associated to a EFP

Deployment Use Cases

Data Centre Interconnect

Data Centre Interconnect with MC-LAG + vPC and VPLS

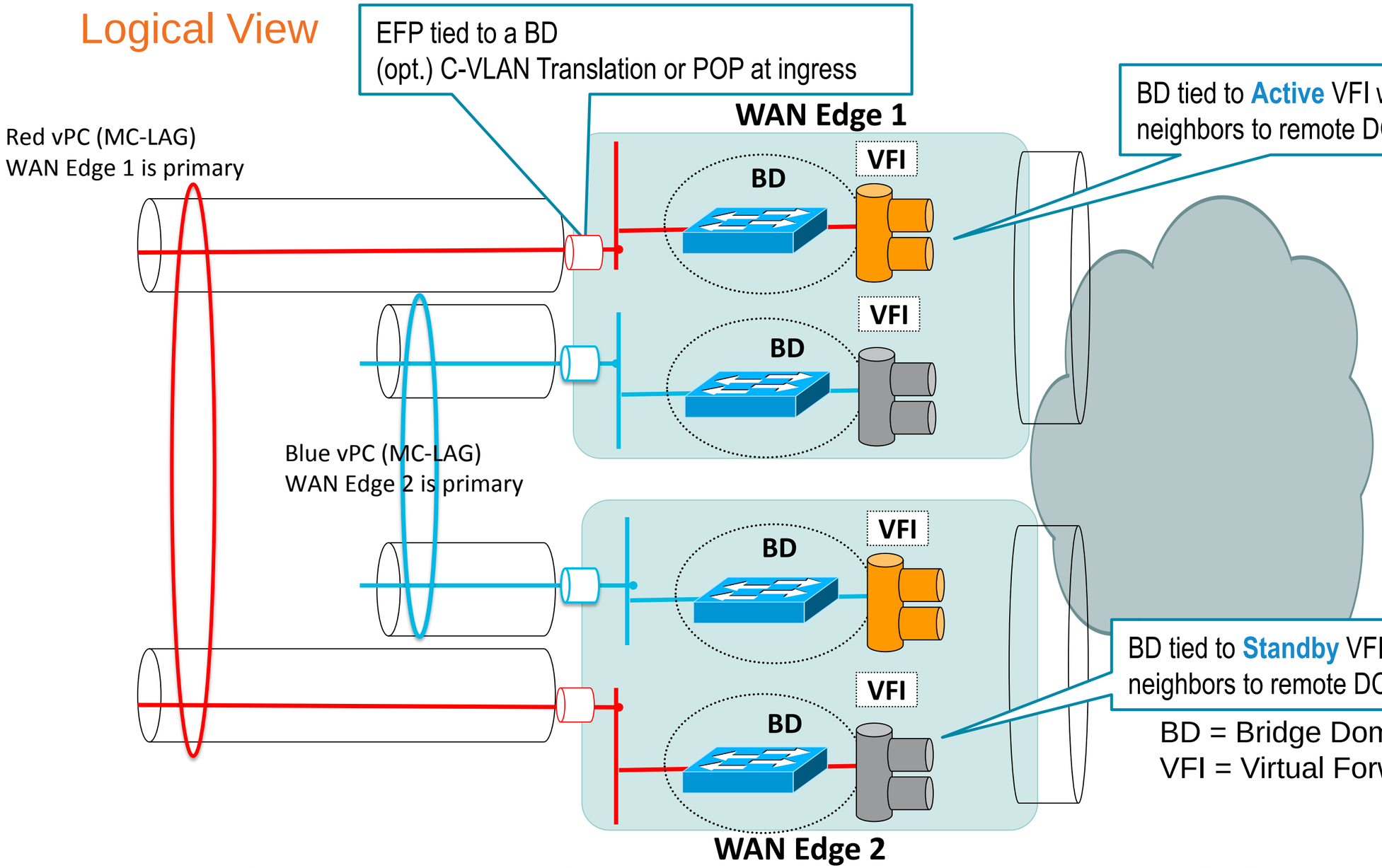


- Simplified dual-homing with MC-LAG + vPC (no STP between site and PE)
- ~ second convergence time

Note, PW between two PEs in the same DC site may or may not be required, depends on the intra-DC design

Data Centre Interconnect with MC-LAG + vPC and VPLS

Logical View

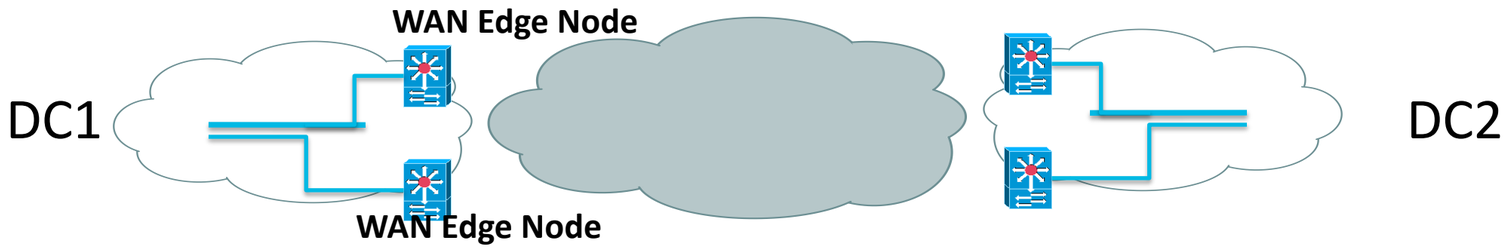


Per-VLAN load balancing: For better load balancing over two PE WAN links, configure 2 MC-LAG bundles and evenly distribute the VLANs across two bundles (static configuration).

BD = Bridge Domain
VFI = Virtual Forwarding Instance

Data Centre Interconnect with VPLS

Sample Configuration



DC 1 WAN Edge Node

```
interface bundle-ethernet1.1 l2transport ← VLAN range 1
 encapsulation dot1q 1-250 ← VLAN Bundling

interface bundle-ethernet2.2 l2transport ← VLAN range 2
  encapsulation dot1q 251-500 ← VLAN Bundling

L2vpn
 bridge group  DCI
 bridge-domain DCI1
   interface bundle-ethernet1.1
   vfi DCI1
    neighbor 2.2.2.2 pw-id 1
    neighbor 3.3.3.3 pw-id 1

 bridge-domain DCI2
   interface bundle-ethernet2.2
   vfi DCI2
    neighbor 2.2.2.2 pw-id 2
     neighbor 3.3.3.3 pw-id 2
```

- One VFI to aggregate multiple VLANs.
- Enhanced VPLS VFI scale.
- Reduced Configuration.

Note: Only EVC specific configuration shown.

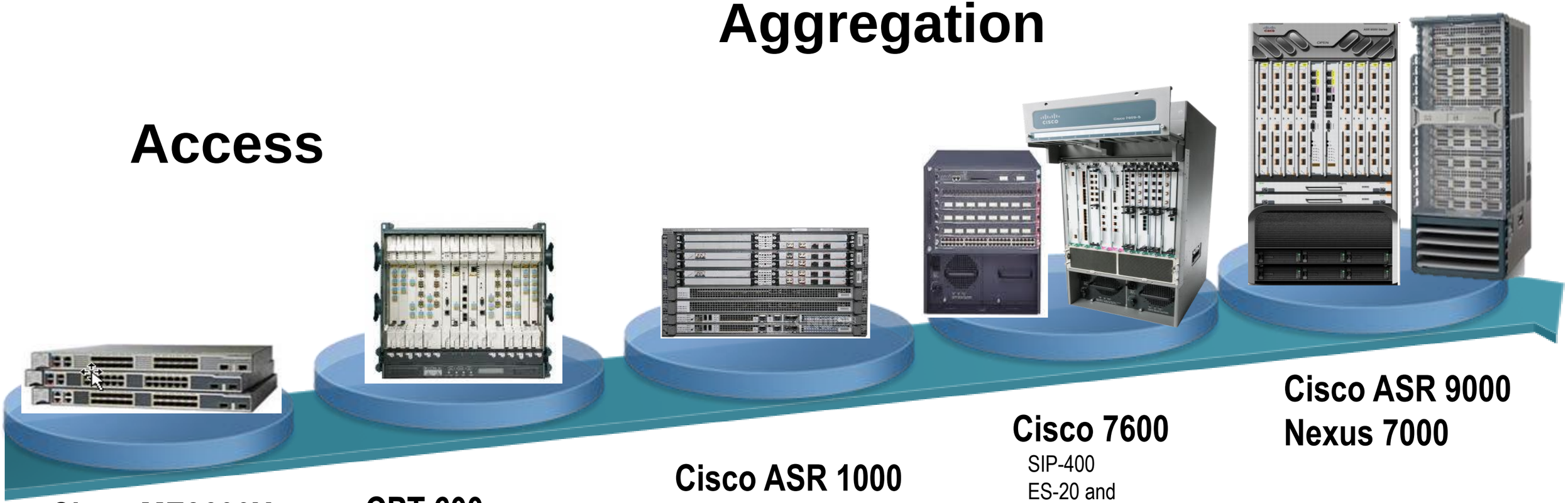
Platform Support

Cisco EVC Framework

Platform Support

Aggregation

Access



Cisco ME3600X
Cisco ME3800X
ASR 901
ASR 903

CPT 600
CPT 50
Cisco ONS 15454
ML-MR linecard

Cisco ASR 1000

Cisco 7600
SIP-400
ES-20 and
ES+ linecards
Catalyst 6500
Supervisor 2T

Cisco ASR 9000
Nexus 7000

Summary

Cisco EVC Framework

- Introduction
- Cisco EVC Fundamentals
- Operation and Packet Flow
- Dynamic Ethernet Service Activation (DESA)
- Deployment Use Cases—Residential / Business / DCI Services
- Platform Support
- Summary

Cisco EVC Framework

Key Takeaways

- Next-generation cross-platform Carrier Ethernet Software Infrastructure
- Addresses Flexible Ethernet Edge requirements
- Flexible Service Mapping
- Advanced Frame Manipulation
- Service Multiplexing

For More Information

- Cisco 7600 – Ethernet Services + (ES+) Configuration Guide—Layer 2 Features
- Cisco 7600 – Ethernet Services (ES) Configuration Guide—Layer 2 Features
- Cisco 7600 – SPA Interface Processor-400 (SIP-400) Configuration Guide
- Cisco ASR 9000 Series Aggregation Services Router L2VPN and Ethernet Services Configuration Guide
- Cisco ME 3600X / ME 3800X – Configuring Ethernet Virtual Connections (EVCs)

For More Information (Cont.)

- Cisco ASR 1000 – Carrier Ethernet Configuration Guide, Cisco IOS XE Release 3S
- Cisco ONS 15454 – Configuring Ethernet Virtual Circuits and QoS on the ML-MR-10 Card
- Dynamic Ethernet Service Activation Configuration Guide
- Cisco Carrier Packet Transport
- Cisco ASR 903 Aggregation Services Router Configuration Guide
- Cisco ASR 901 Aggregation Services Router Configuration Guide

Acronyms

Acronym	
ACL	Access Control List
AN	Access Node
BD	Bridge Domain
BRAS	Broadband Access Server
CE	Customer Equipment (Edge)
C-VLAN / CE-VLAN	Customer VLAN
CoS	Class of Service
E-LAN	Ethernet LAN service (multipoint)
E-Line	Ethernet Line service (point-to-point)
E-Tree	Ethernet Tree service (rooted multipoint)
EFP	Ethernet Flow Point
EoMPLS	Ethernet over MPLS
EPL	Ethernet Private Line
EVC	Ethernet Virtual Connection
EVPL	Ethernet Virtual Private Line
IEEE	Institute of Electrical and Electronics Engineers
IETF	Internet Engineering Task Force

Acronym	
IPoETV	TV on IP over Ethernet
IPTV	Television over IP
MEF	Metro Ethernet Forum
MEN	Metro Ethernet Network
MPLS	Multi-protocol Label Switching
OAM	Operations, Administration and Maintenance
PBB	Provider Backbone Bridging
PE	Provider Edge device
PW	Pseudowire
Q-in-Q	VLAN tunnelling using two 802.1Q tags
QoS	Quality of Service
SVI	Switch Virtual Interface (interface vlan)
S-VLAN	Service VLAN (Provider VLAN)
UNI	User to Network Interface
VLAN	Virtual LAN
VoD	Video on Demand
VoIP	Voice over IP
VPLS	Virtual Private LAN Service

Q & A

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