The bridge to possible

Deployment of VXLAN EVPN Gateways with Cisco ACI for the Interconnection of Heterogeneous Data Center Fabrics

Max Ardica, Distinguished TME
@maxardica

Hall of Fame Elite Speaker

BRKDCN-2634

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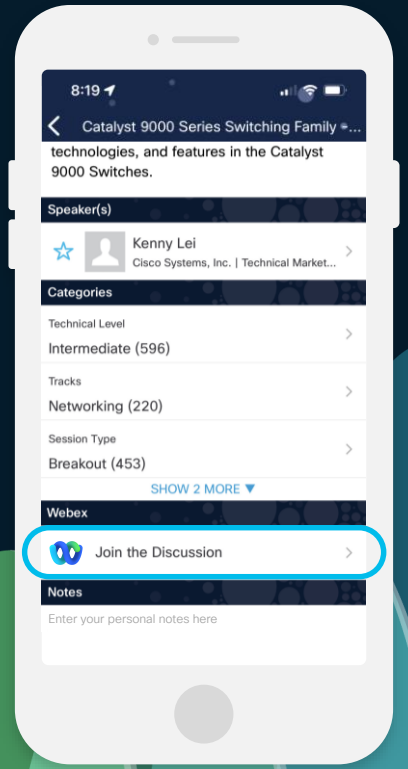


Agenda

- Introducing Cisco Nexus One Fabric Experience
- ACI Border Gateways (BGWs)
  - Introduction
  - Overview of Control-Plane and Data-Plane
  - Namespace Normalization
  - Workload Mobility across Domains
  - Policy Enforcement on ACI BGWs
- Secure Interconnection of Heterogeneous Fabrics

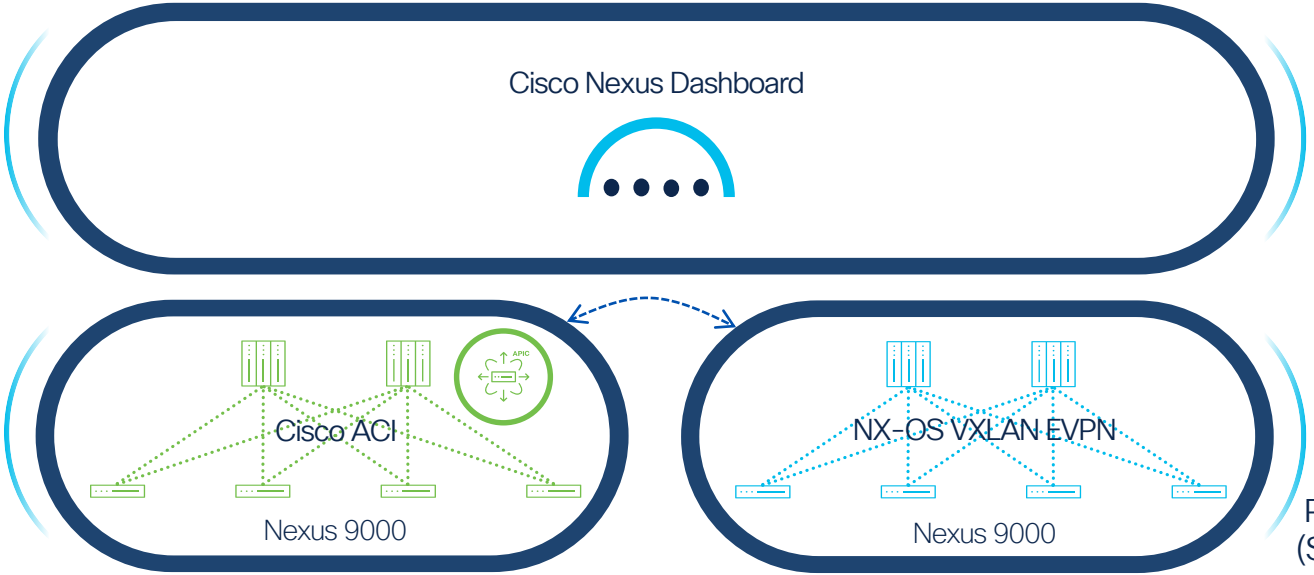
Introducing Cisco Nexus One Fabric Experience

Open networking Fabric Experience

Evolve multiple DCN fabrics into a single user experience to deliver consistent use cases

Nexus One Fabric Experience – Overview

3 Cisco Nexus Dashboard as single point of control and operations



1 ACI VXLAN EVPN Border Gateways

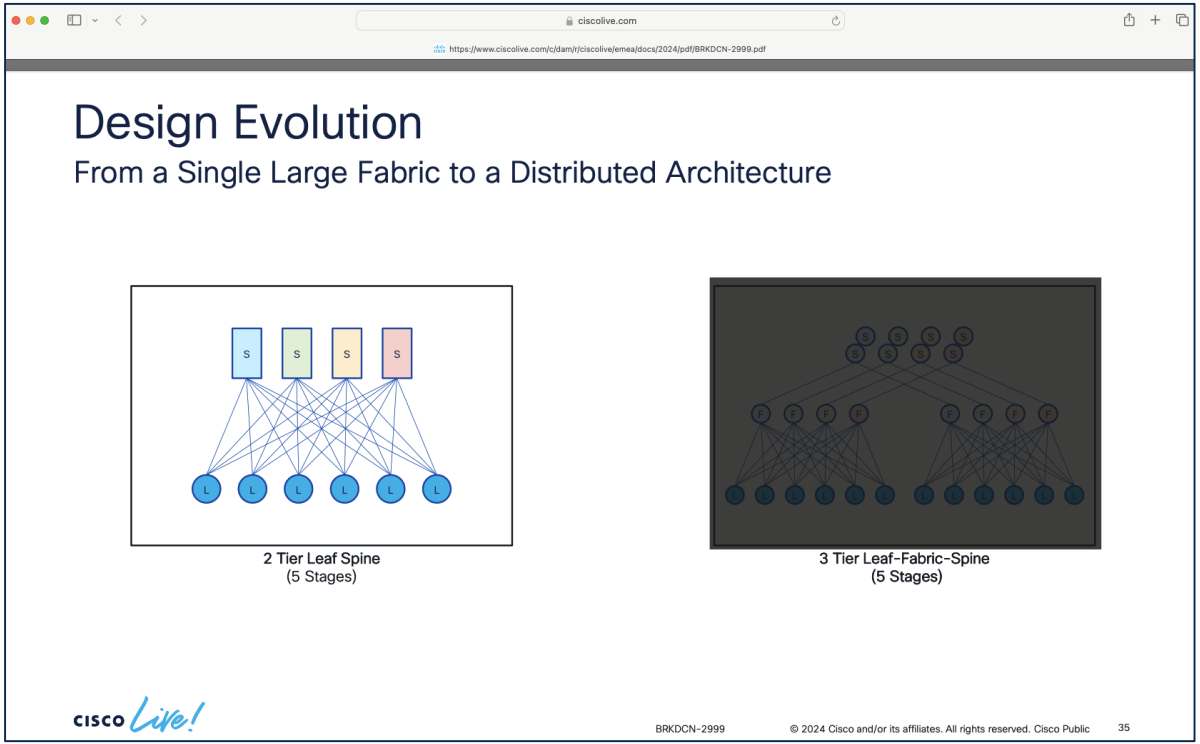
2 Policy in NX-OS (Security Groups)

Different fabric architectures | Same outcome with common experience

ACI Border Gateways
Introduction

DC Design Evolution

From a Single Large Fabric to a Distributed Architecture



For more information on DC Multi-Tier Design Evolution please refer to BRKDCN-2099

DC Design Evolution

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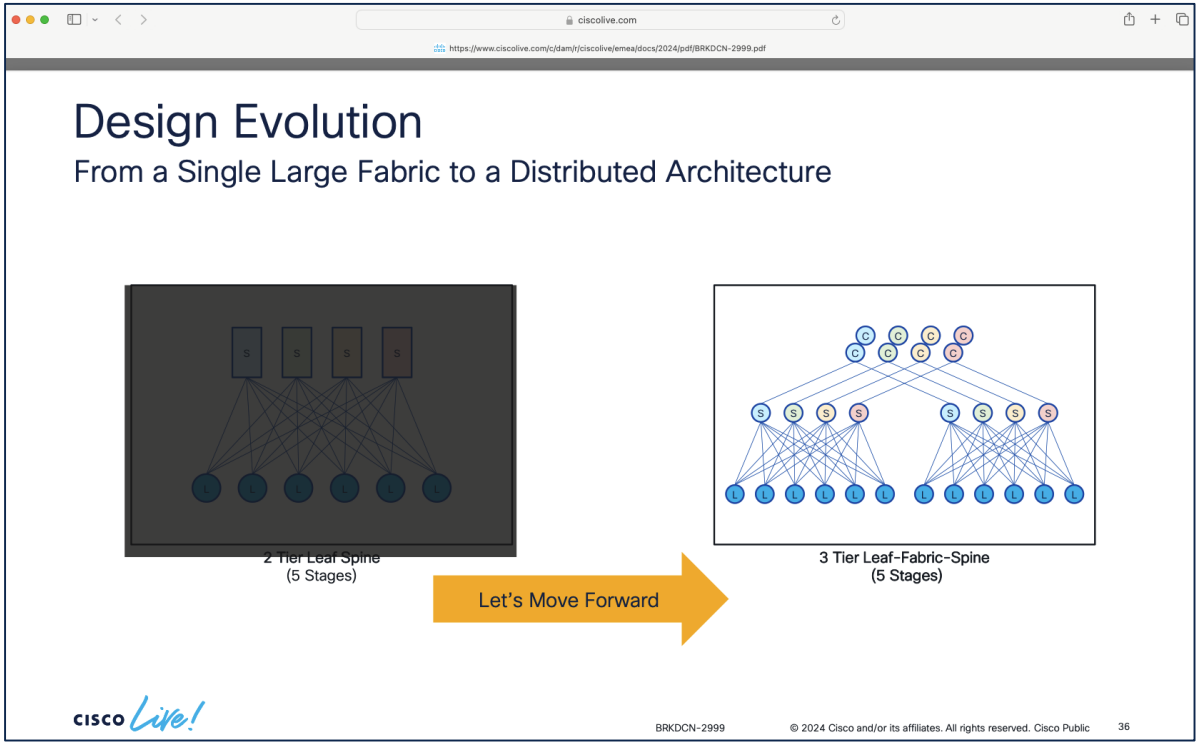

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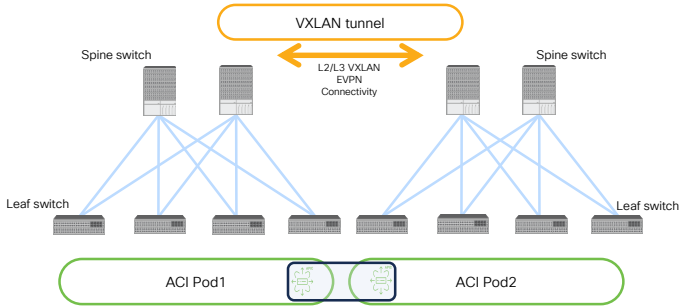
Building Distributed DC Architectures

Homogeneous Options

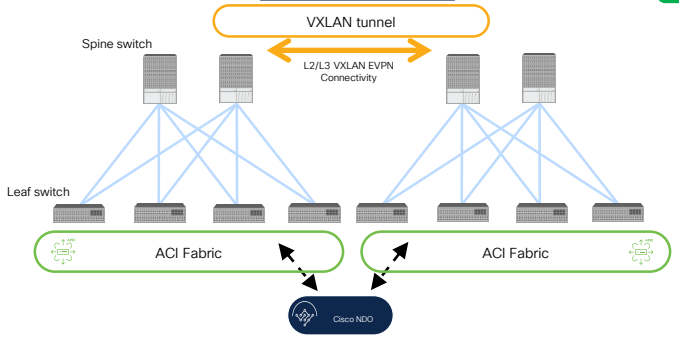
ACI Multi-Pod

Since 2017



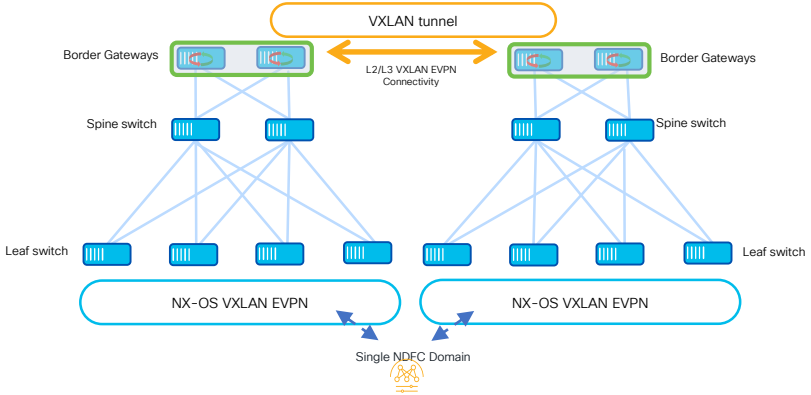
ACI Multi-Site

Since 2018



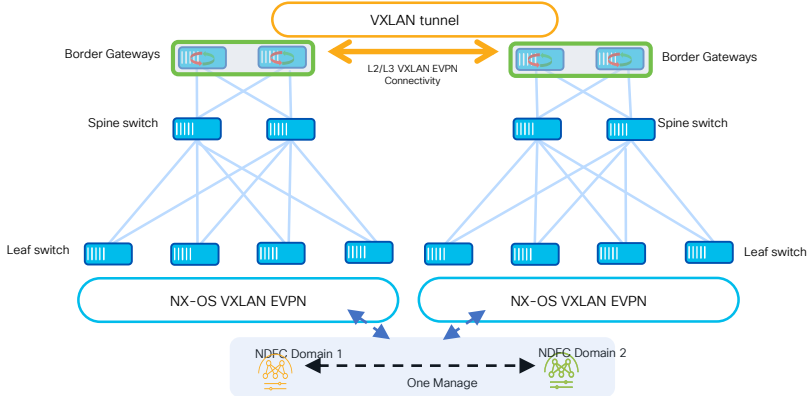
VXLAN EVPN Multi-Site

Since 2017



VXLAN EVPN Multi-Site

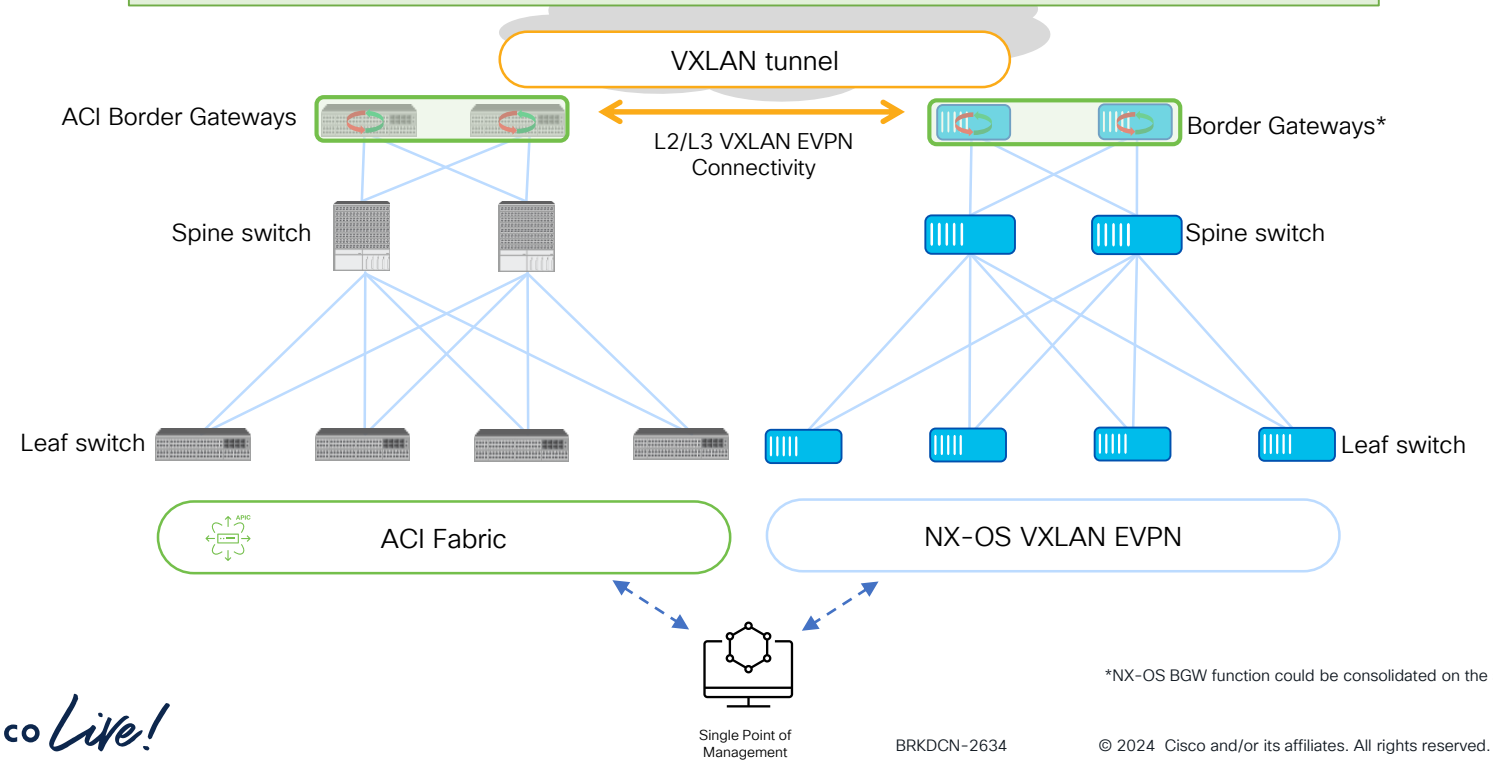
2HCY24



Heterogeneous Fabrics
Introducing ACI Border Gateways

ACI 6.1(x)

"Opening Up" L2/L3 Connectivity between ACI and VXLAN EVPN Fabrics



*NX-OS BGW function could be consolidated on the spines if desired

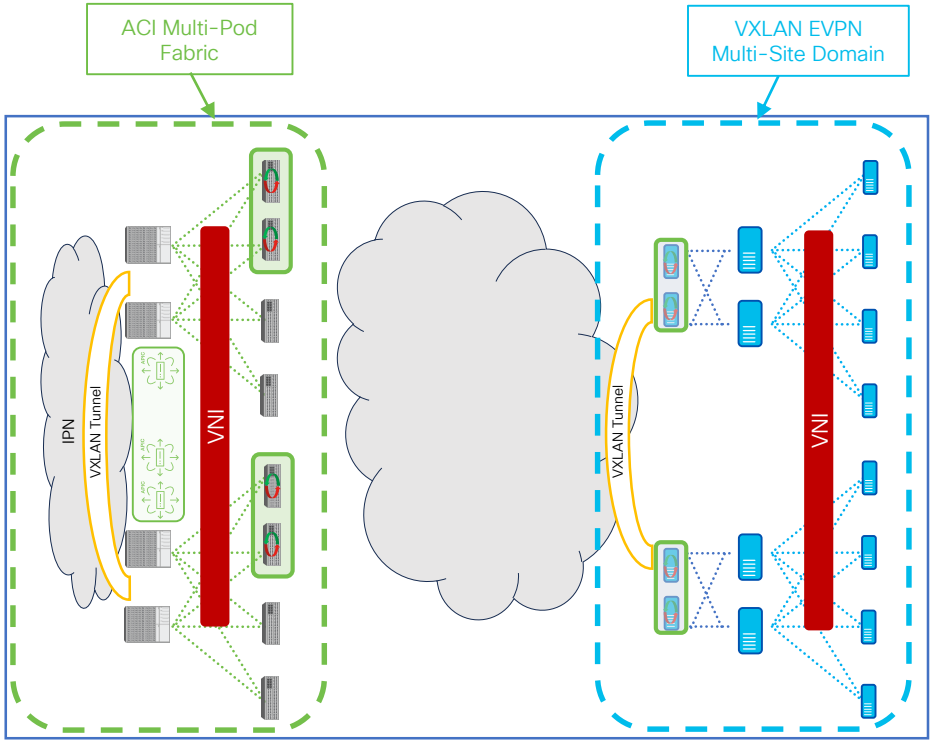
ACI Border Gateways
Deployment Considerations for 6.1(1) Release

ACI 6.1(1)

- Hardware support for ACI BGWs: Nexus 9000 FX2 and above
- Dedicated leaf nodes for Border Gateway functionality
  - Coexistence with Border Leaf functions (L3Outs) planned for a future release
- IGMP snooping and L3 Multicast traffic not supported across domains
  - L2 Multicast traffic forwarded as BUM
- Symmetric namespace between ACI and VXLAN EVPN domains
  - VNIs must be defined in the VXLAN EVPN domain to match the APIC assigned VNIDs
- “VRF unenforced” required on the ACI fabric for VRFs that need to be stretched
- Support for a single ACI fabric (can be Multi-Pod)

Heterogeneous Fabrics
ACI Multi-Pod Fabric Support

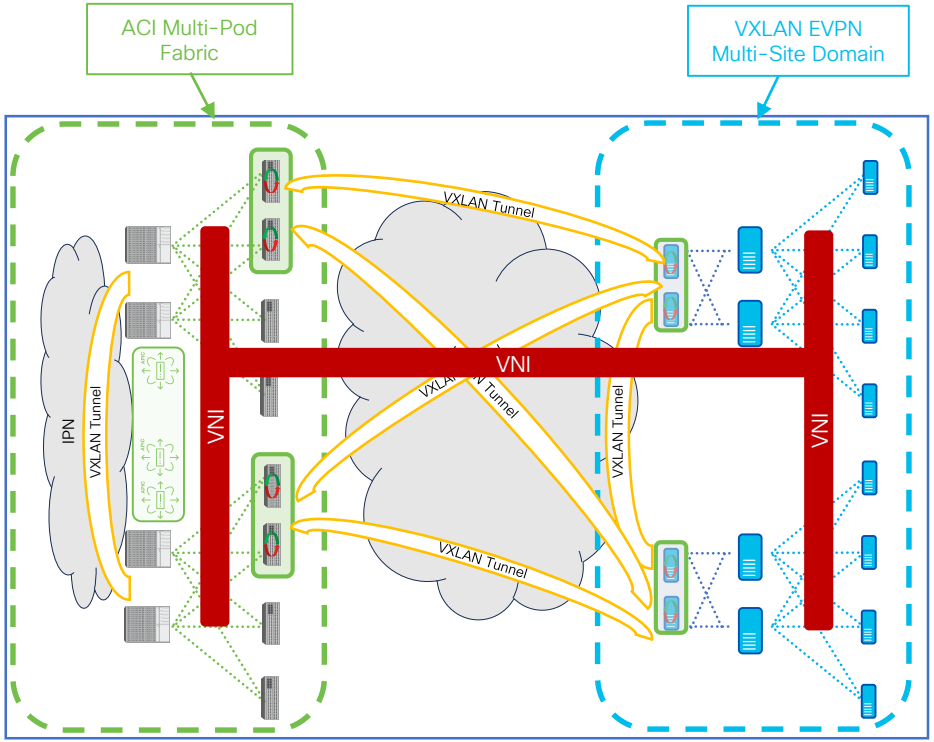
ACI 6.1(1)



- L2/L3 VXLAN connectivity between ACI Pods part of the same fabric achieved via the spine-to-spine data path (through the IPN)
  - No VXLAN EVPN connectivity between ACI BGWs of different ACI Pods
- Local instance of ACI BGWs mandatory in each Pod
- For each BD extended across domains, a specific ACI BGW is elected as DF (across all the BGWs in all the Pods)

Heterogeneous Fabrics
ACI Multi-Pod Fabric Support

ACI 6.1(1)



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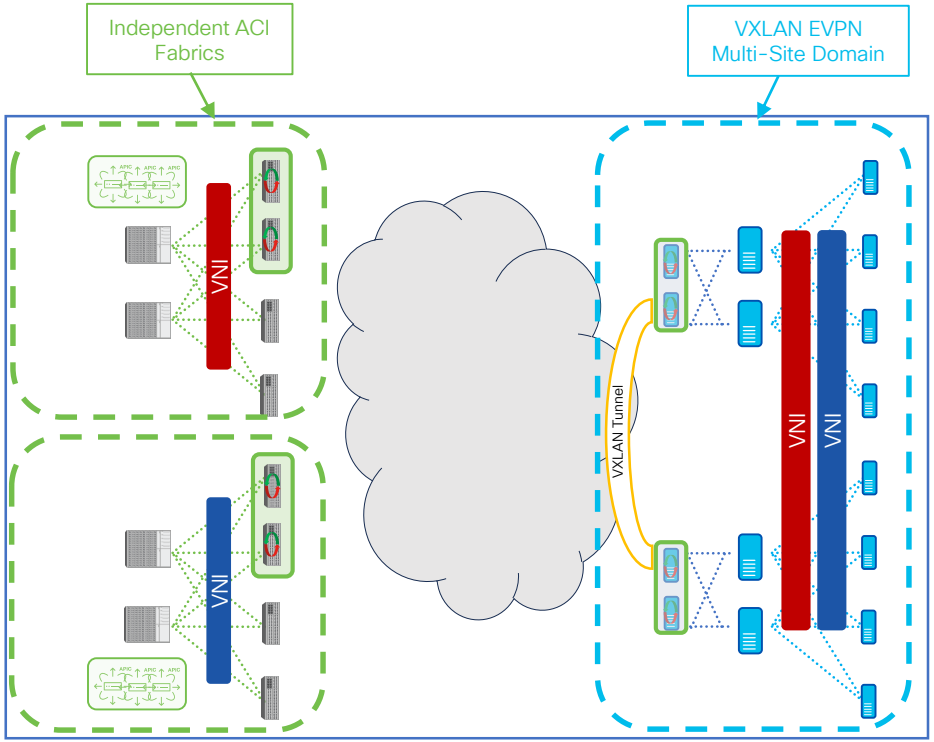
Heterogeneous Fabrics
Independent ACI Fabrics Support

Future



- Routed communications only via L3Out path possible between independent ACI fabrics
  - No VXLAN EVPN connectivity between ACI BGWs of different ACI Fabrics
- Different sets of VRFs/BDs can be extended between each ACI fabric and the VXLAN EVPN domain

Heterogeneous Fabrics
Independent ACI Fabrics Support

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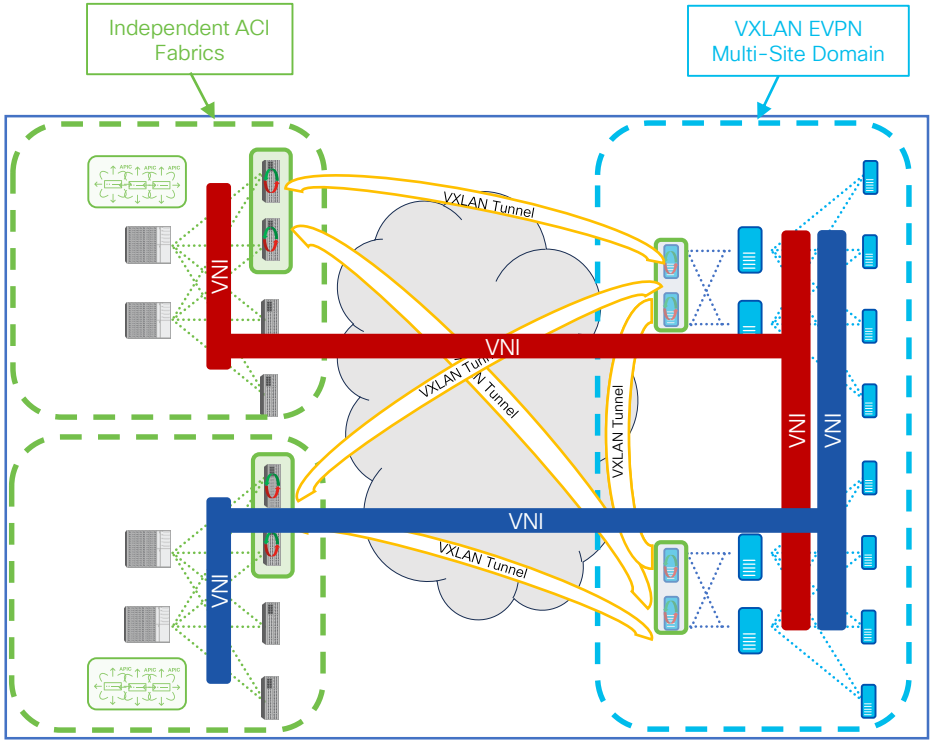

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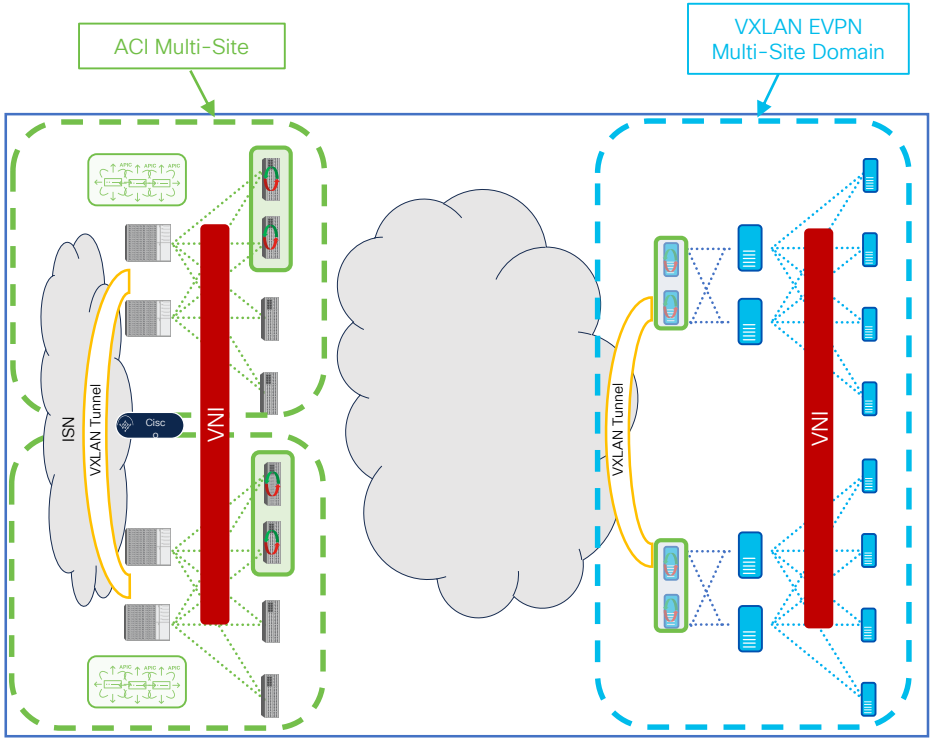
Heterogeneous Fabrics
ACI Multi-Site Support

Future



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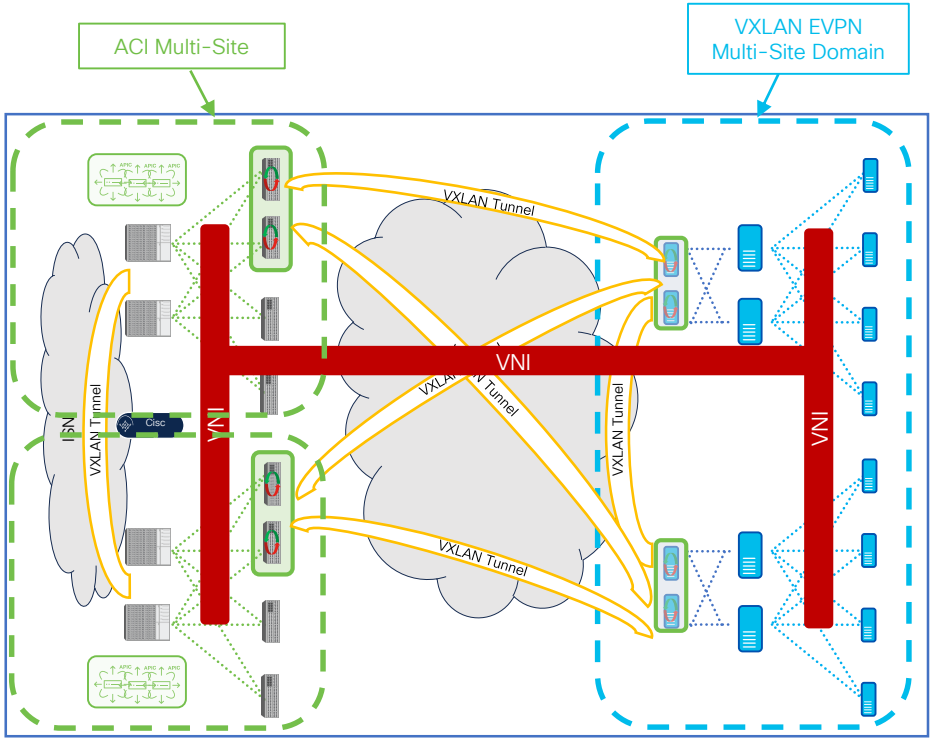
- NDO used for extending connectivity between ACI fabrics

Heterogeneous Fabrics
ACI Multi-Site Support

Future



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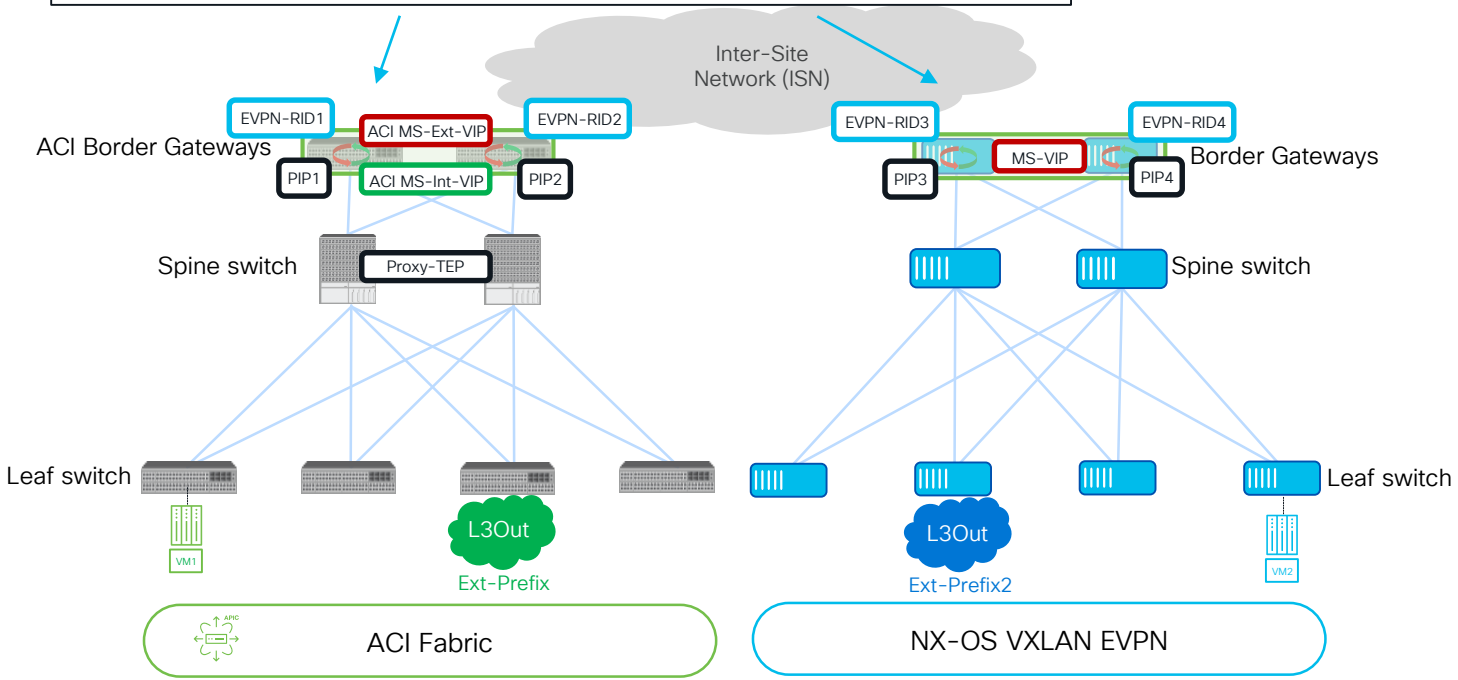
ACI Border Gateways

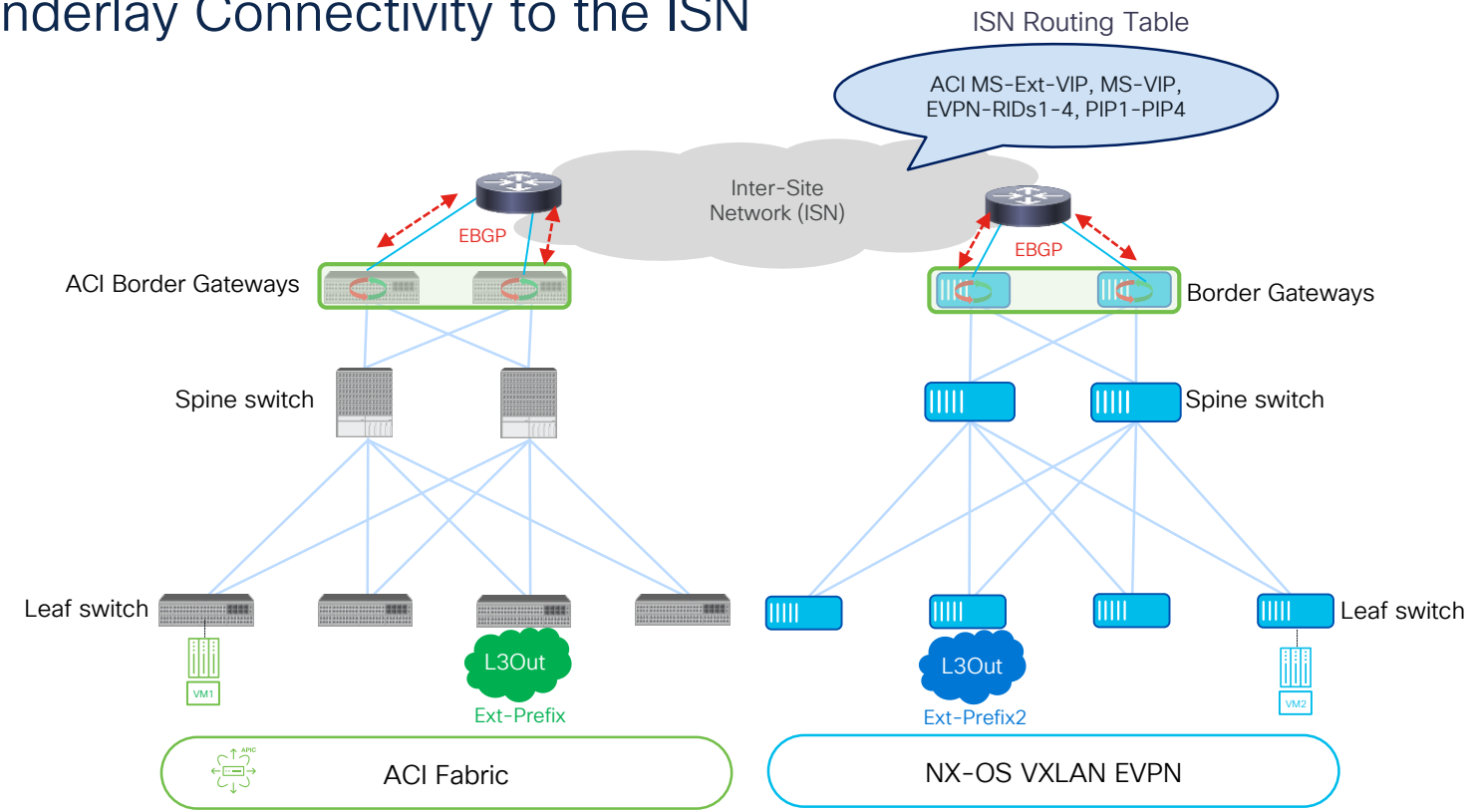
Overview of Control-Plane and Data-Plane

ACI Border Gateways
External and Internal Multi-Site VIP Addresses

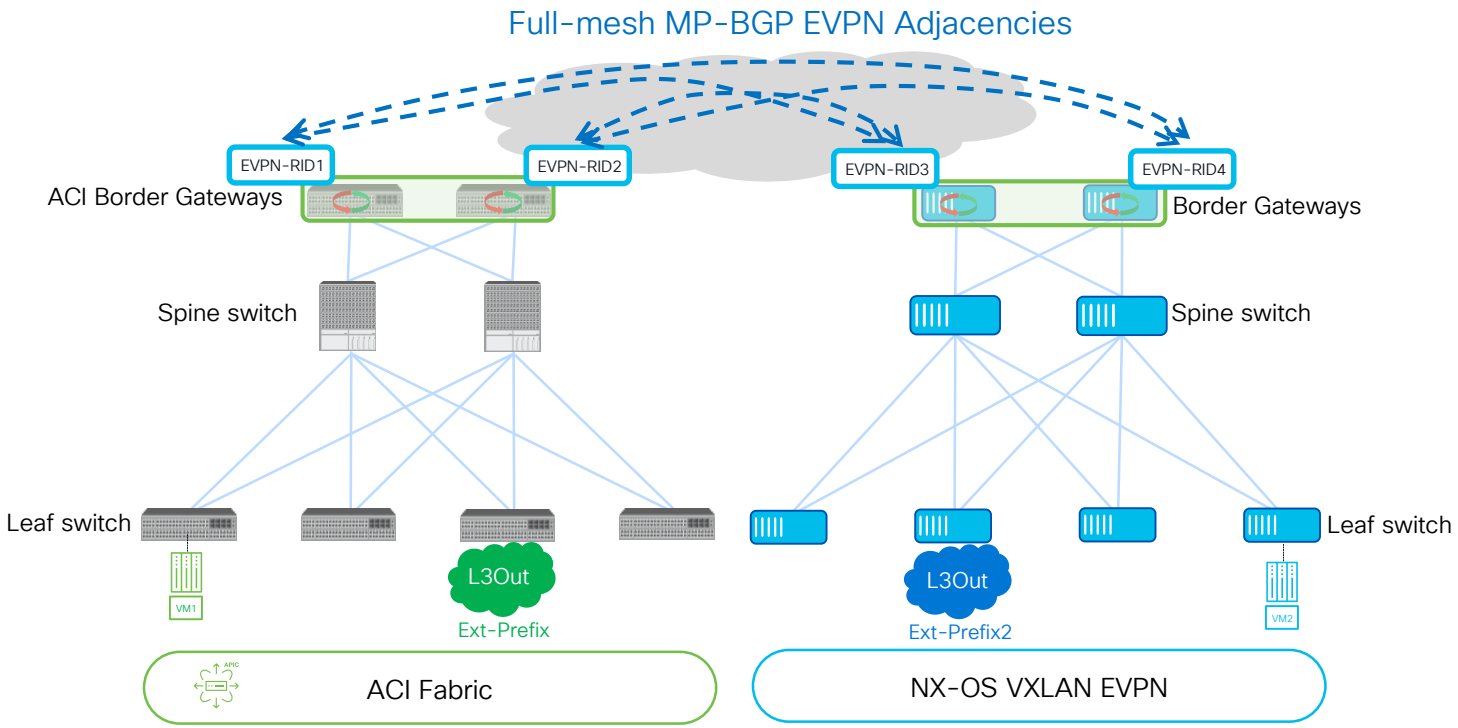
Handful of /32 prefixes that need to be exchanged across domains



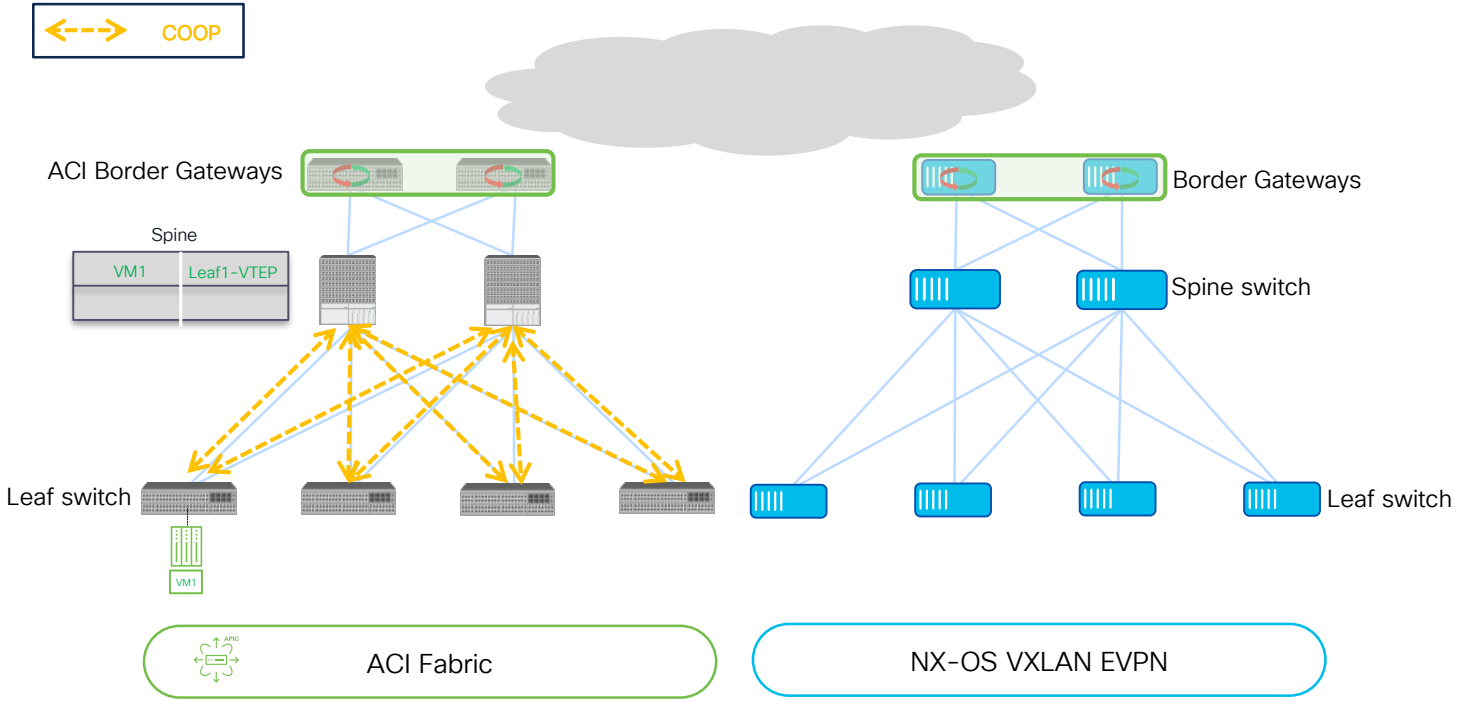
ACI Border Gateways
Underlay Connectivity to the ISN



ACI Border Gateways
Overlay EVPN Connectivity between BGWs



ACI Border Gateways
Control-Plane Overview



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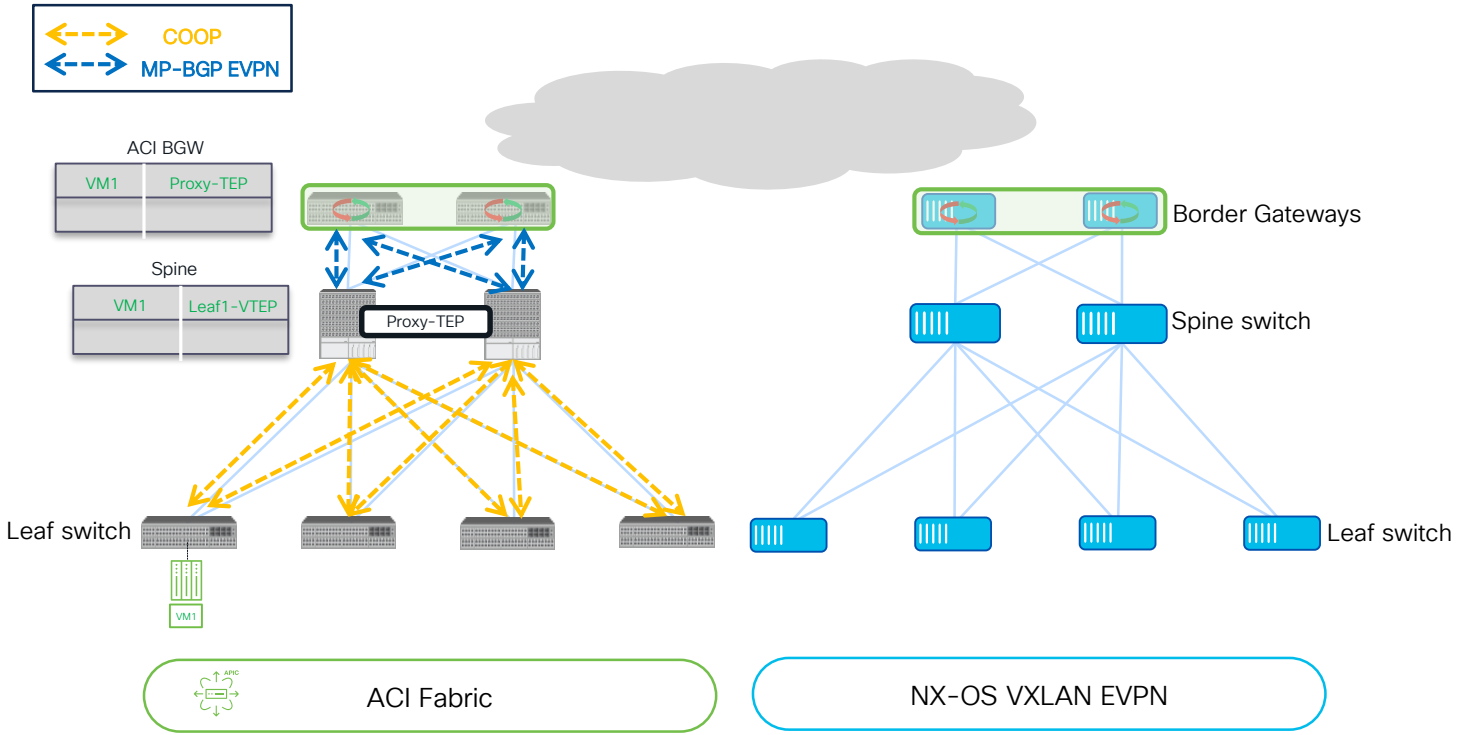

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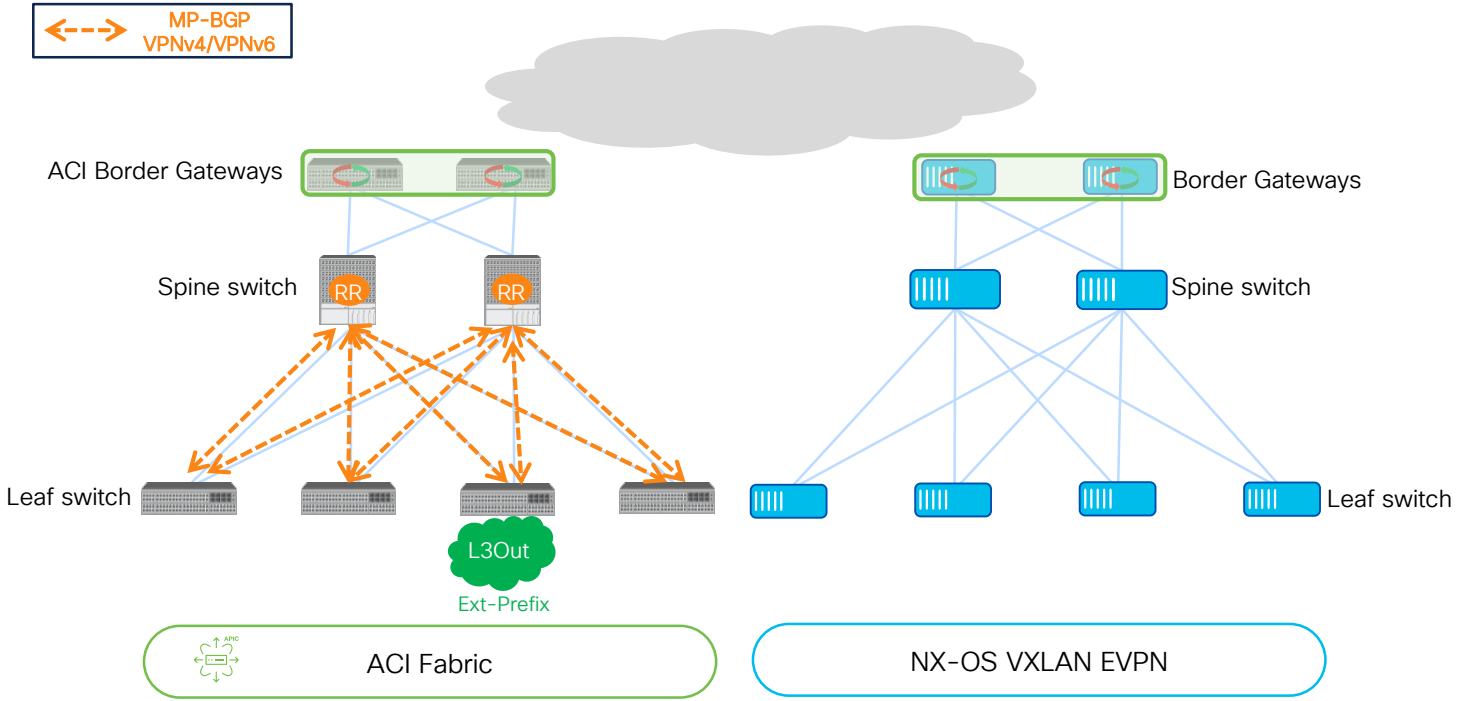

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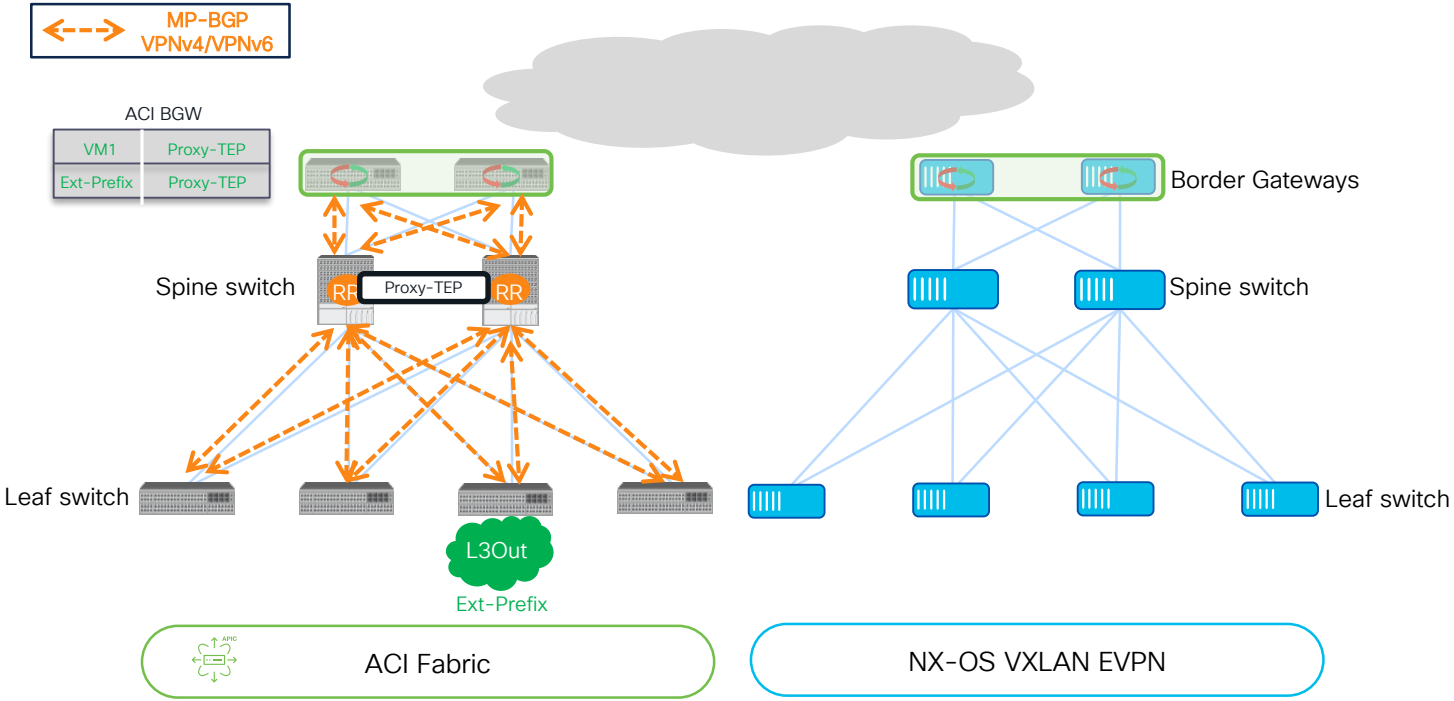

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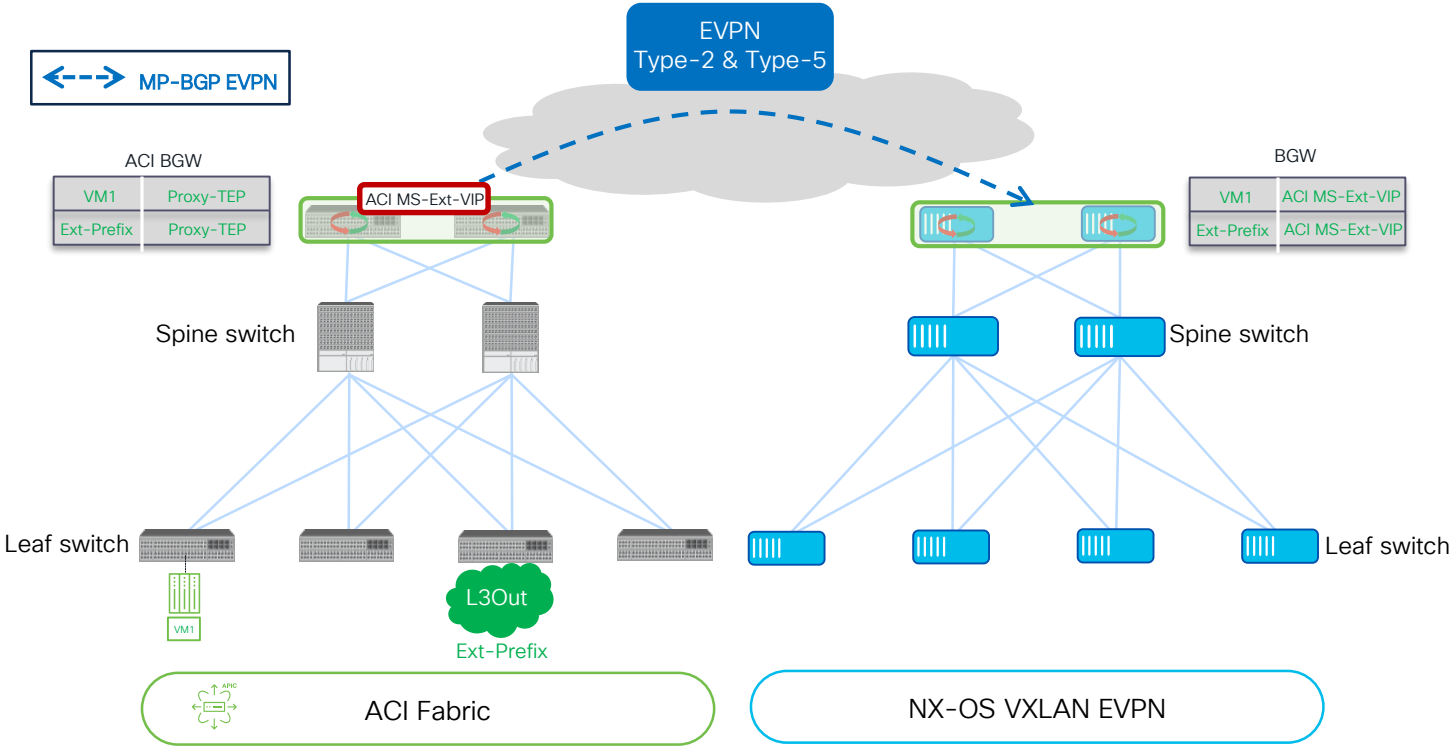

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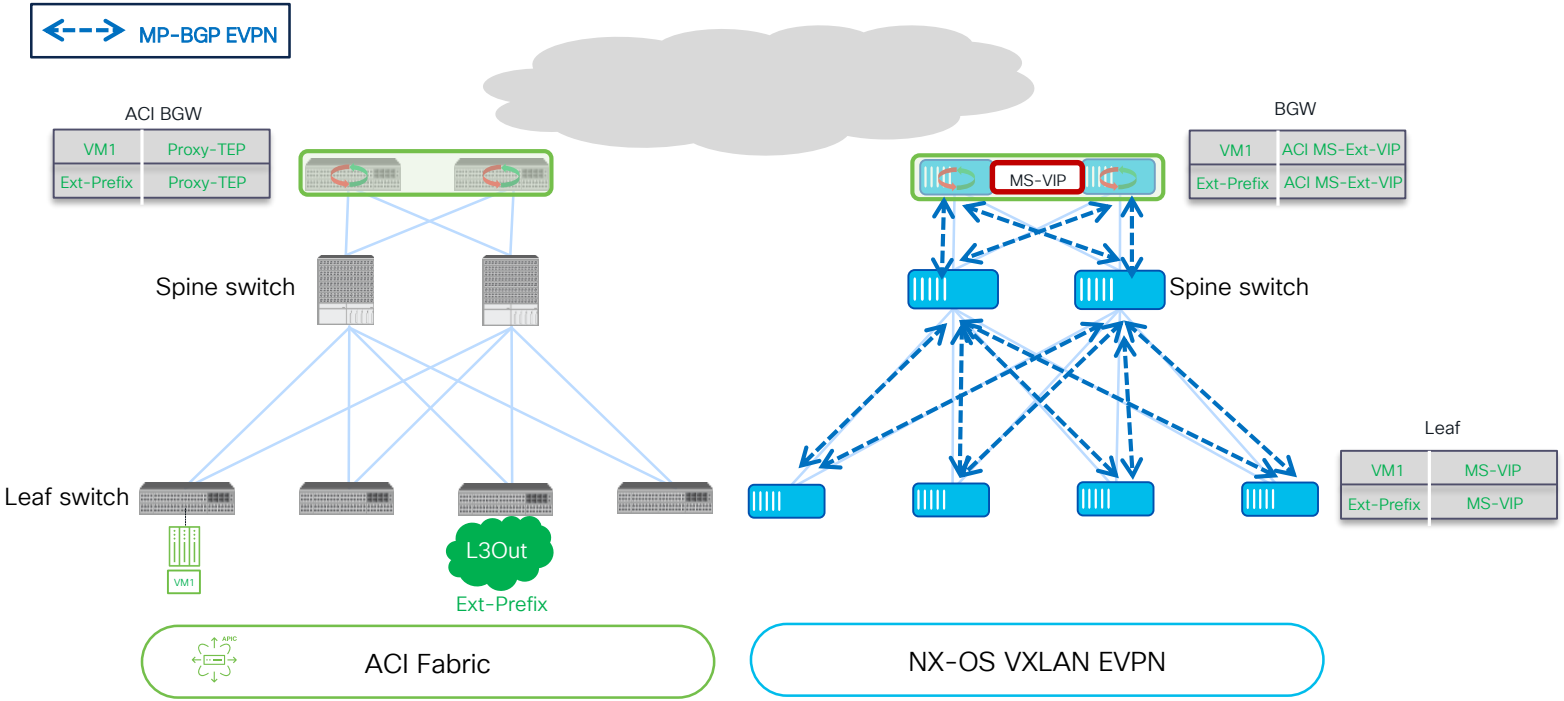

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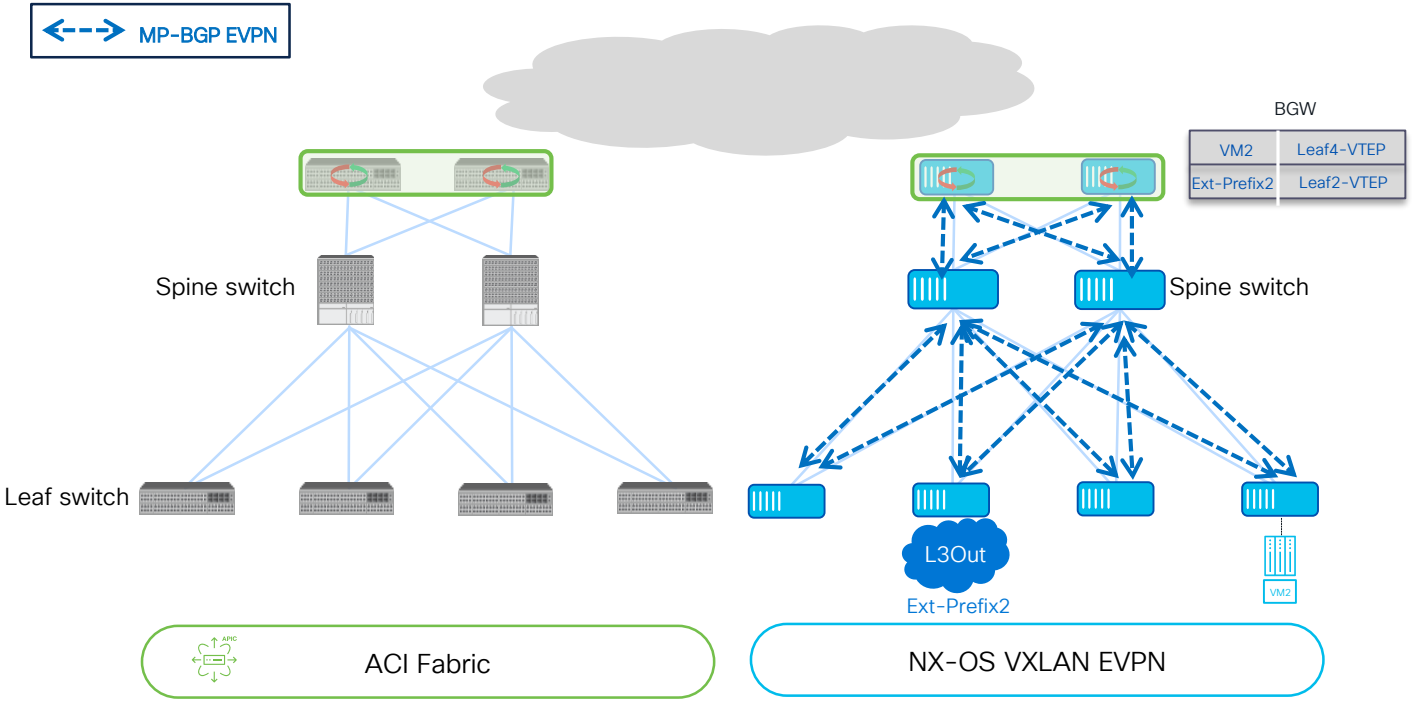

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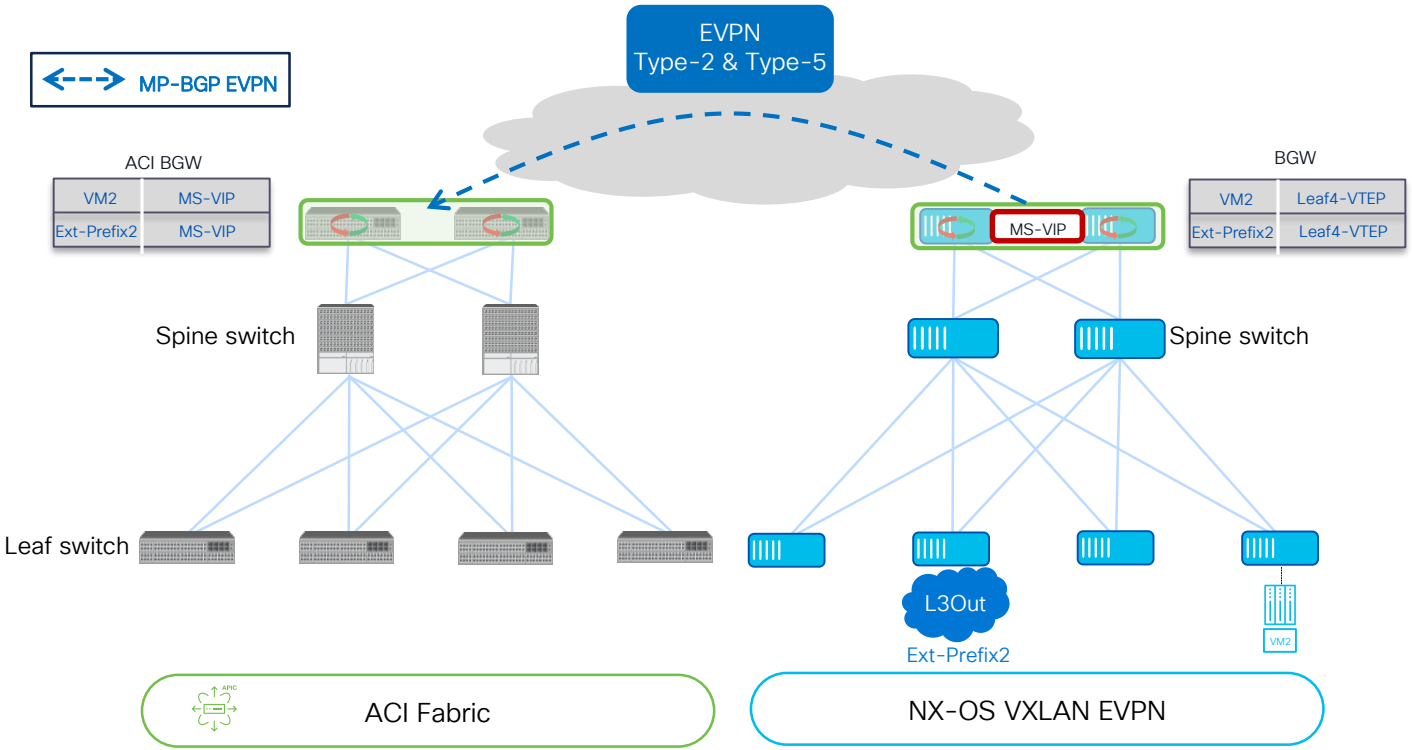

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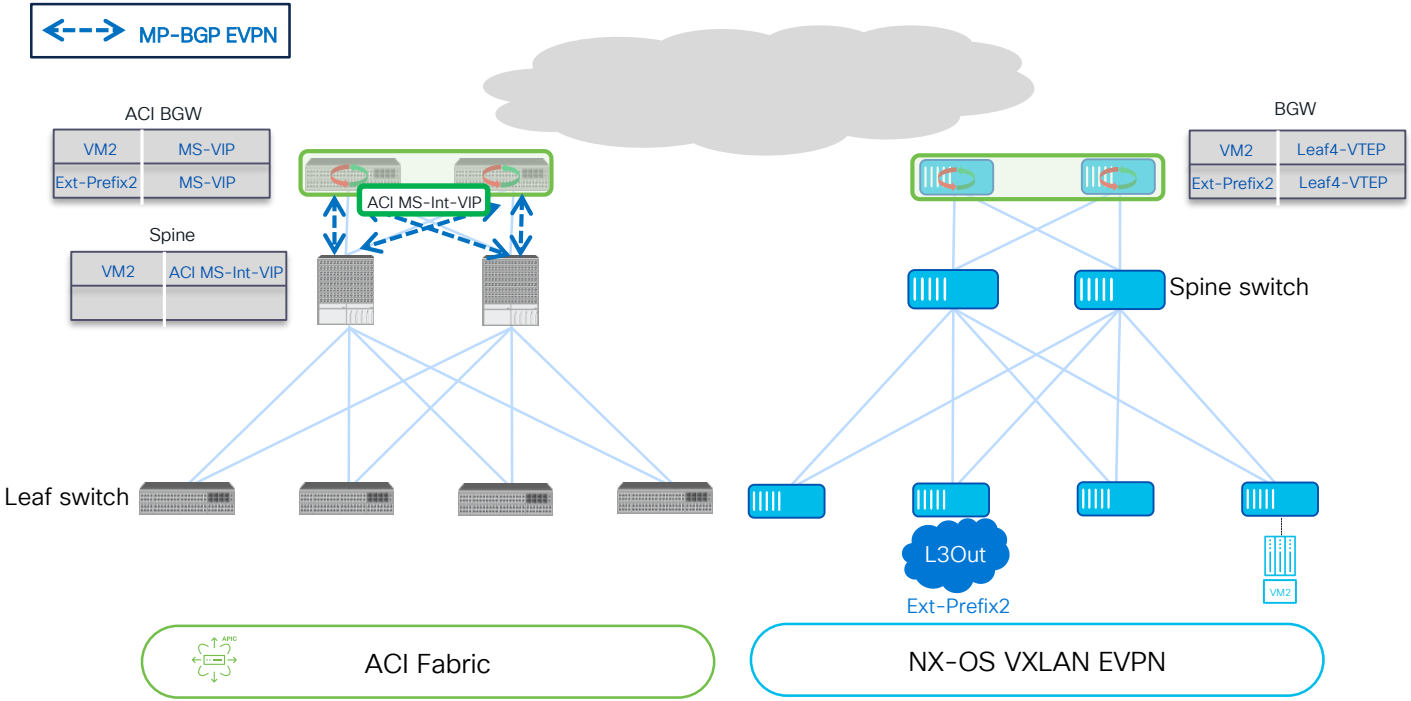
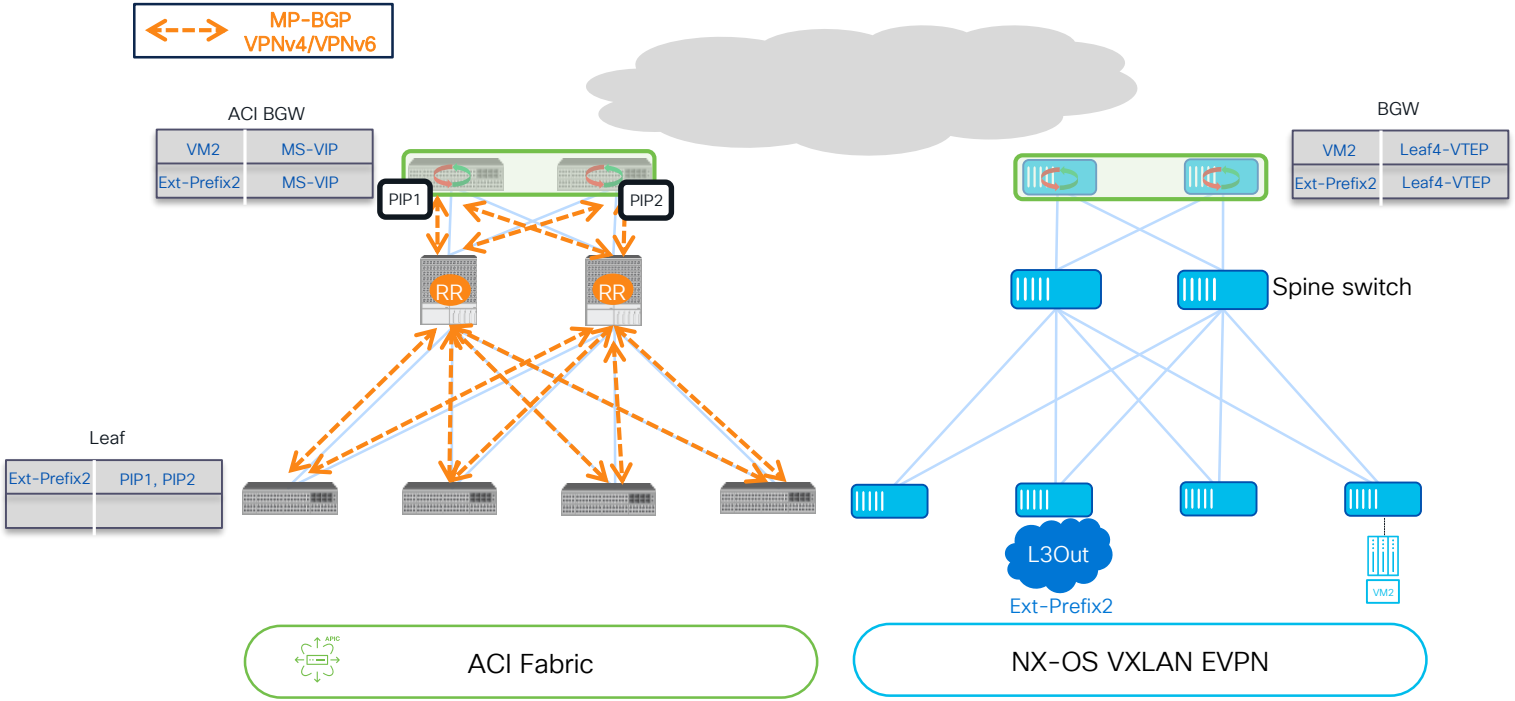
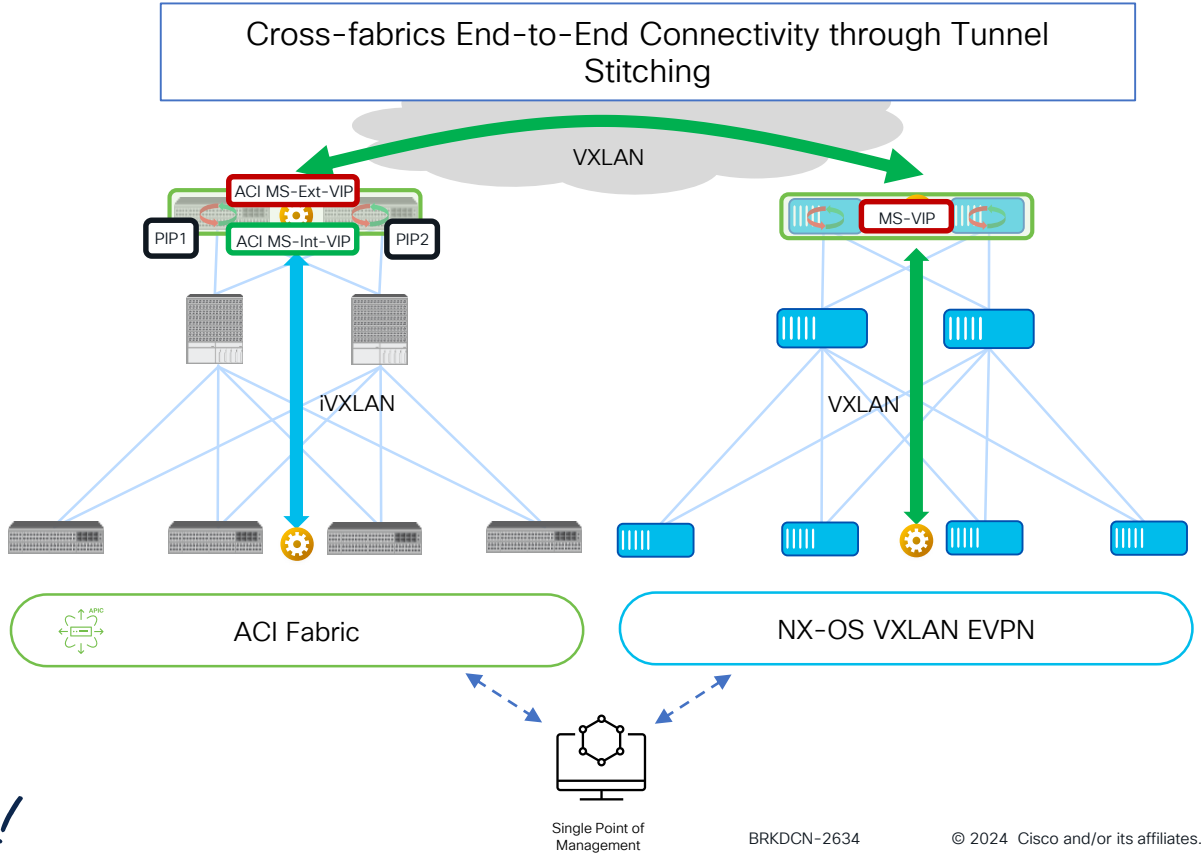


ACI Border Gateways
Control-Plane Overview



ACI Border Gateways
Data-Plane Overview

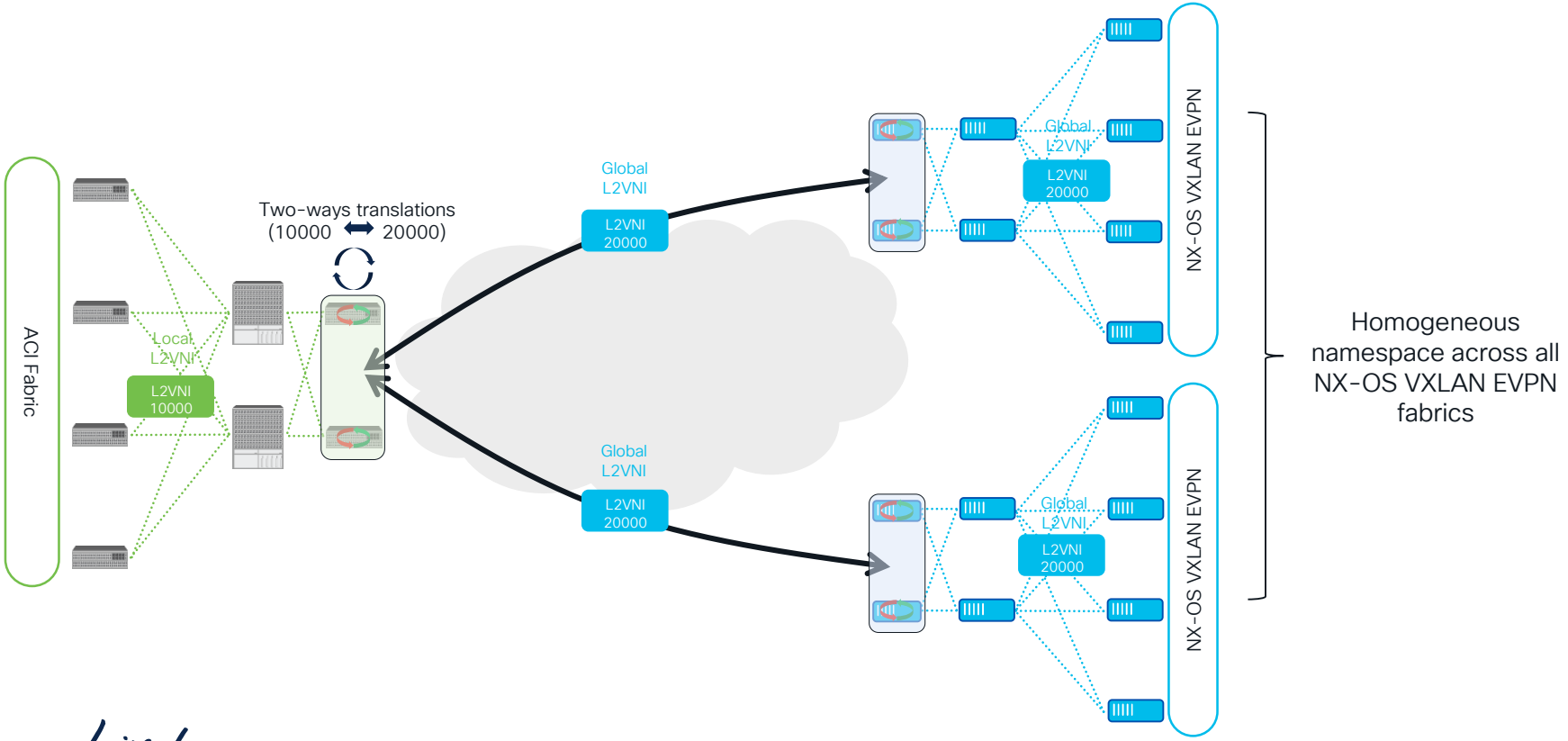


ACI Border Gateways
Namespace Normalization

ACI Border Gateways

Namespace Normalization for Stretched BDs

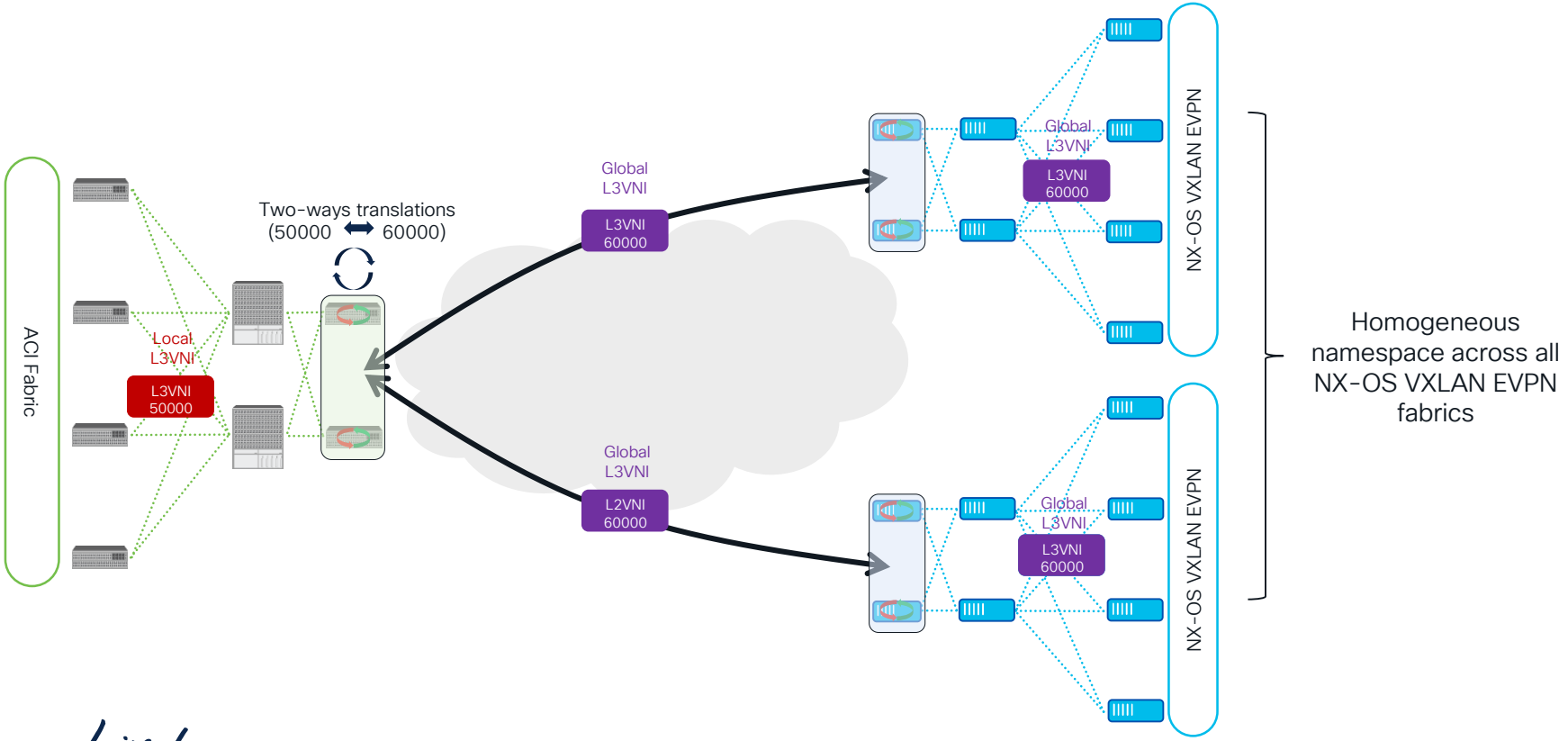
ACI 6.1(x)



ACI Border Gateways

Namespace Normalization for Stretched VRFs

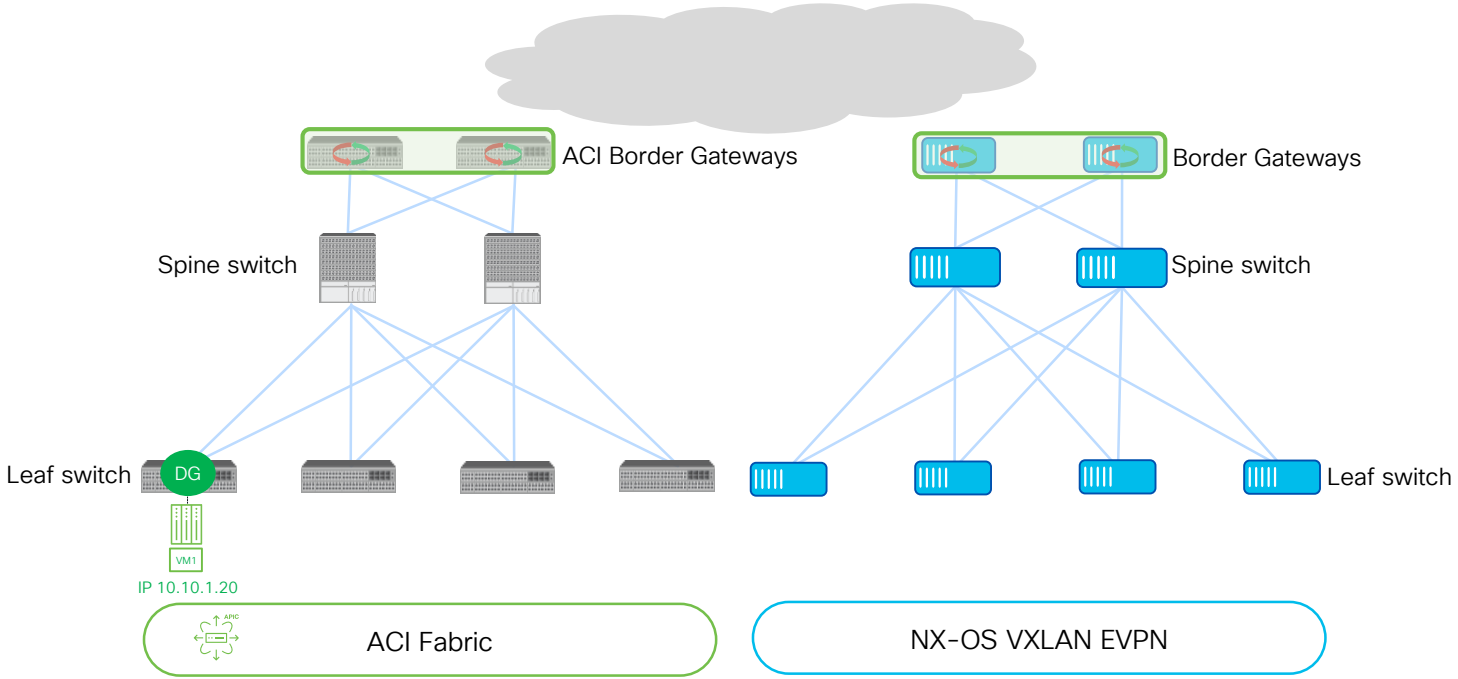
ACI 6.1(x)



ACI Border Gateways

Workload Mobility across Domains

Workload Mobility
Configure a Consistent vMAC/VIP



Workload Mobility
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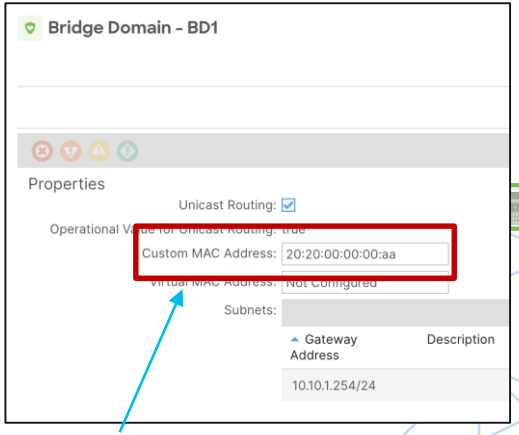
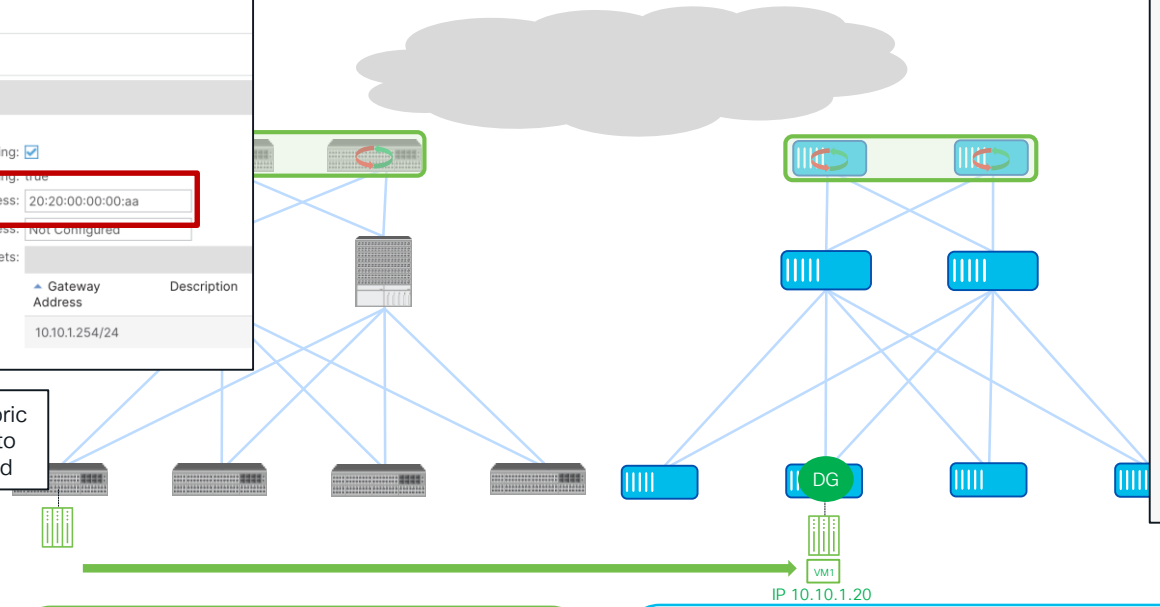
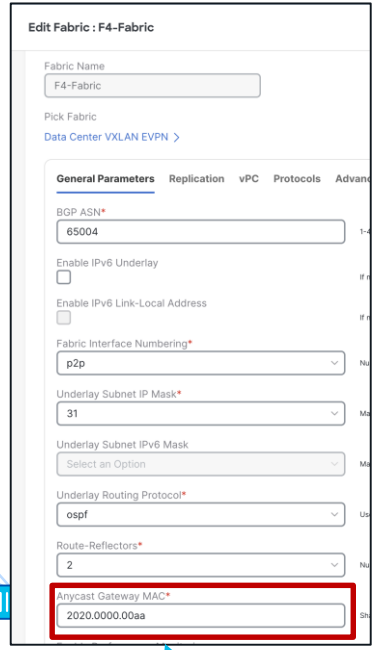


Matching VXLAN EVPN fabric vMAC must be assigned to the BDs that are stretched





ACI Fabric

NX-OS VXLAN EVPN

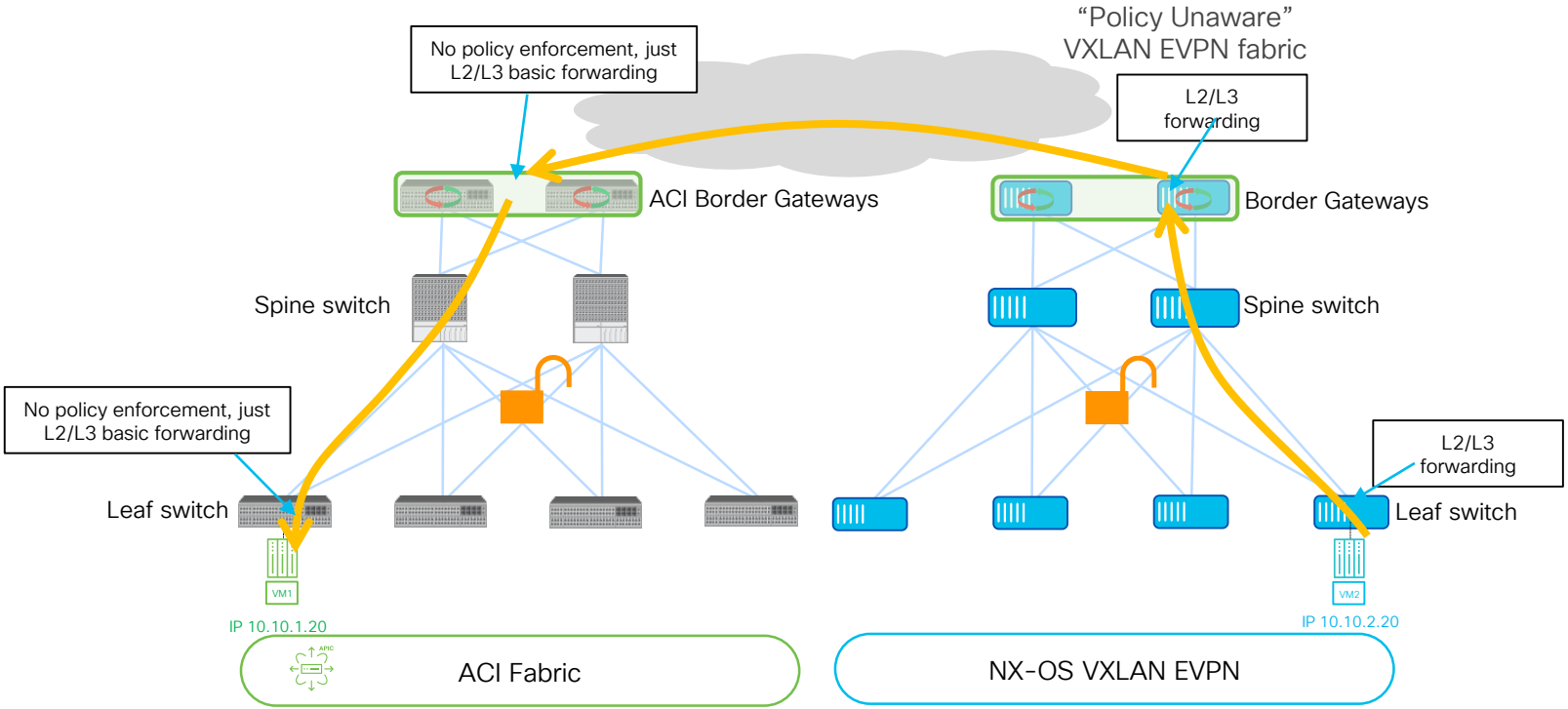
Same vMAC assigned to all Networks in a VXLAN EVPN fabric

ACI Border Gateways

Policy Enforcement on ACI BGWs

Heterogeneous Fabrics
VRF Unenforced in ACI 6.1(1) Release

ACI 6.1(1)



Heterogeneous Fabrics
Policy Enforcement on ACI BGWs

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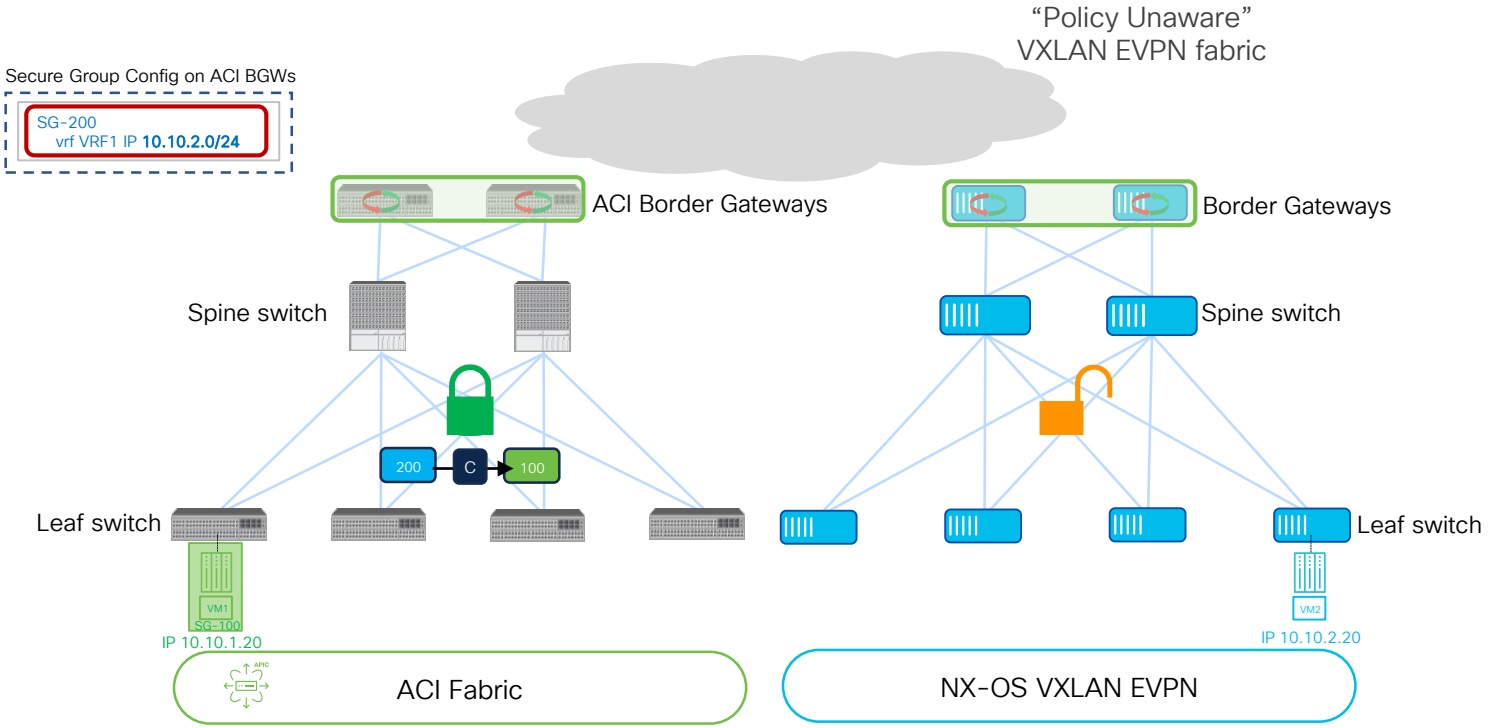

Heterogeneous Fabrics
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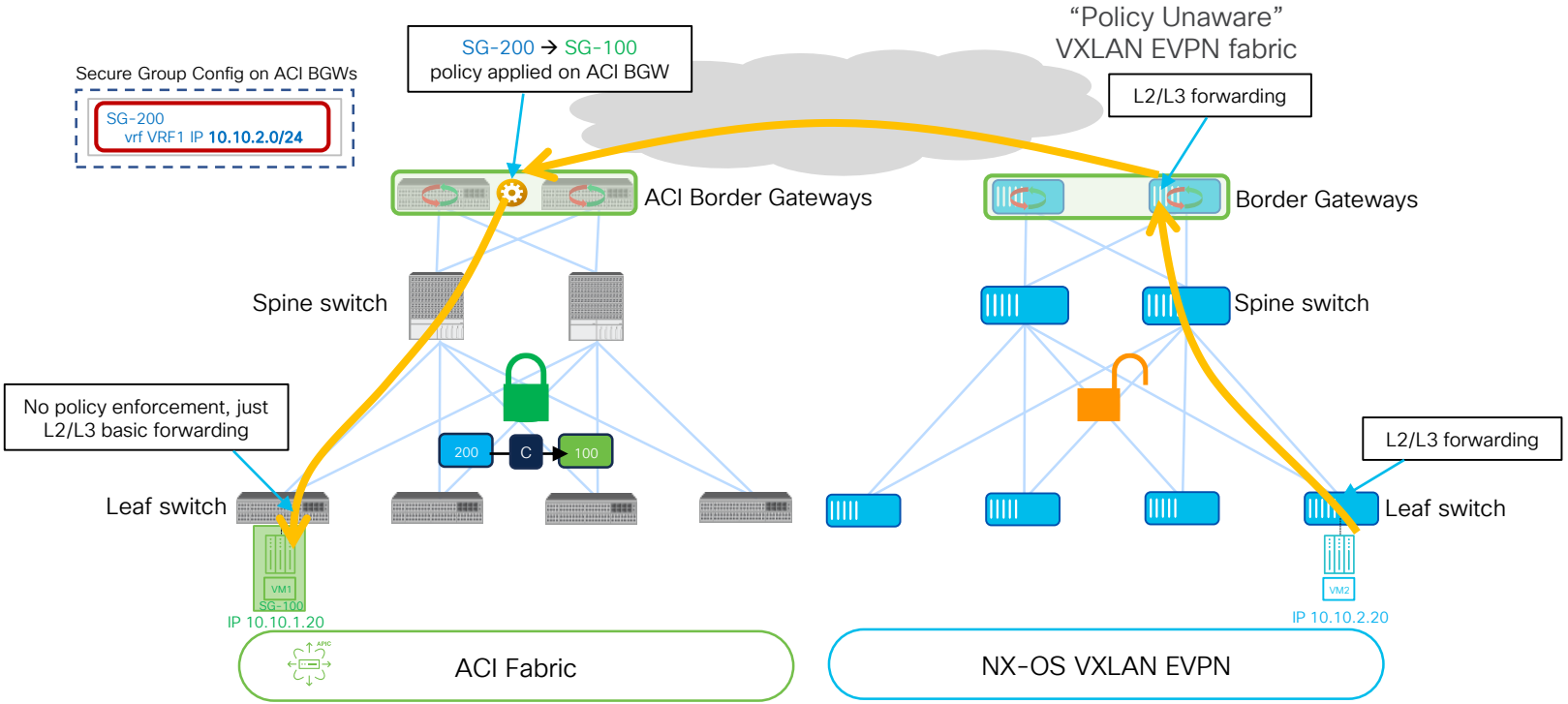
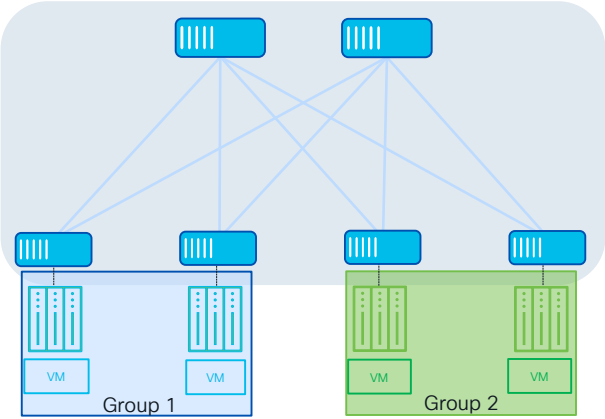


Secure Interconnection of Heterogeneous Fabrics

NX-OS 10.4(3)F

VXLAN GPO with NX-OS



NX-OS VXLAN EVPN

VXLAN GPO with NX-OS

- Group Policy Object carried in standard VXLAN header
- Decoupling network connectivity and security

Grouping

- Classify endpoints to create security groups
- Based on IP, VLAN, VM attributes, etc. across VRFs

Policy enforcement

- Create contracts/SGACLs between security groups
- Possible actions: permit, deny, redirect (service chaining)

Automation

- Automate using NDFC or Open APIs

Benefits

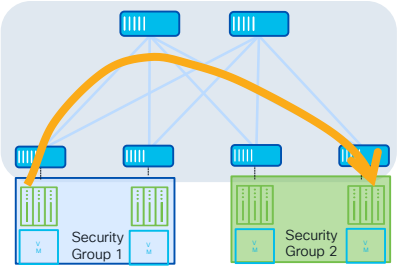
Segment East-West traffic | Flexible security isolation | Reduce attack surface | Automate your way

VXLAN GPO with NX-OS
Main Use Cases

For More Information on VXLAN GPO with NX-OS
BRKDCN-2629 & BRKDCN-2633

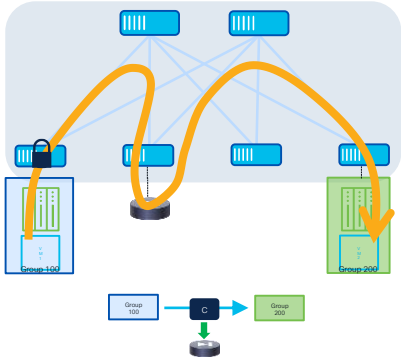
Creation of Security Zones

- VXLAN GPO allows to define policies for enforcing security policies (SGACLs) between security groups (SGs)
- SGACLs are a simpler, more flexible and more scalable policy enforcement mechanism compared to traditional ACLs
- Provides better control over the flow of network traffic (both east-west and north-south)



Service Chaining

- VXLAN GPO can be used to insert network services into a packet flow based on specific policy criteria
- Service chaining steers flows through the appropriate network services functions (such as firewalls, load balancers, or intrusion detection systems)



VXLAN GPO with NX-OS

Cisco GPO Data Plane and Control Plane Functionalities

Data Plane
(draft-smith-vxlan-group-policy)

```
Internet Engineering Task Force                                M. Smith
Internet-Draft                                     Cisco Systems, Inc.
Intended status: Informational                              L. Kreeger
Expires: April 25, 2019                                     Arrcus, Inc.
                                                        October 22, 2018

                    VXLAN Group Policy Option
                 draft-smith-vxlan-group-policy-05

Abstract

   This document defines a backward compatible extension to Virtual
   eXtensible Local Area Network (VXLAN) that allows a Tenant System
   Interface (TSI) Group Identifier to be carried for the purposes of
   policy enforcement.
```

+

Control Plane
(draft-wlin-bess-group-policy-id-extended-community)

```
bess                                                           W. Lin
Internet-Draft                                     Juniper Networks
Intended status: Standards Track                            J. Drake
Expires: 22 April 2024                                   Individual
                                                             D. Rao
                                                        Cisco Systems
                                                     20 October 2023

              Group Policy ID BGP Extended Community
        draft-wlin-bess-group-policy-id-extended-community-03

Abstract

   Group Based Policy can be used to achieve micro or macro segmentation
   of user traffic.  For Group Based Policy, a Group Policy ID, also
   known as Group Policy Tag, is used to represent a logical group that
   shares the same policy and access privilege.  This specification
   defines a new BGP extended community that can be used to propagate
   Group Policy ID through a BGP route advertisement in the control
   plane.  This is to facilitate policy enforcement at the ingress node
   when the optimization of network bandwidth is desired.
```

Data Plane and Control Plane
(draft-lrss-bess-evpn-group-policy)

```
BESS WorkGroup                                                 W. Lin
Internet-Draft                                                Juniper
Intended status: Standards Track                               D. Rao
Expires: 5 September 2024                                   A. Sajassi
                                                              M. Smith
                                                                 Cisco
                                                            L. Kreeger
                                                                Arrcus
                                                          4 March 2024

                         EVPN Group Policy
                 draft-lrss-bess-evpn-group-policy-00

Abstract

   Group Based Policy can be used to achieve micro or macro segmentation
   of user traffic.  For Group Based Policy, a Group Policy ID, also
   known as Group Policy Tag, is used to represent a logical group that
   shares the same policy and access privilege.  This document defines a
   backward compatible extension to Virtual eXtensible Local Area
   Network (VXLAN) that allows a Group Policy ID to be carried for the
   purposes of policy enforcement at the egress Network Virtualization
   Edge (NVE).  It also defines a new BGP Extended Community that can be
   used to propagate Group Policy ID through a BGP route advertisement
   in the control plane.  This is to facilitate policy enforcement at
   the ingress NVE when feasible.
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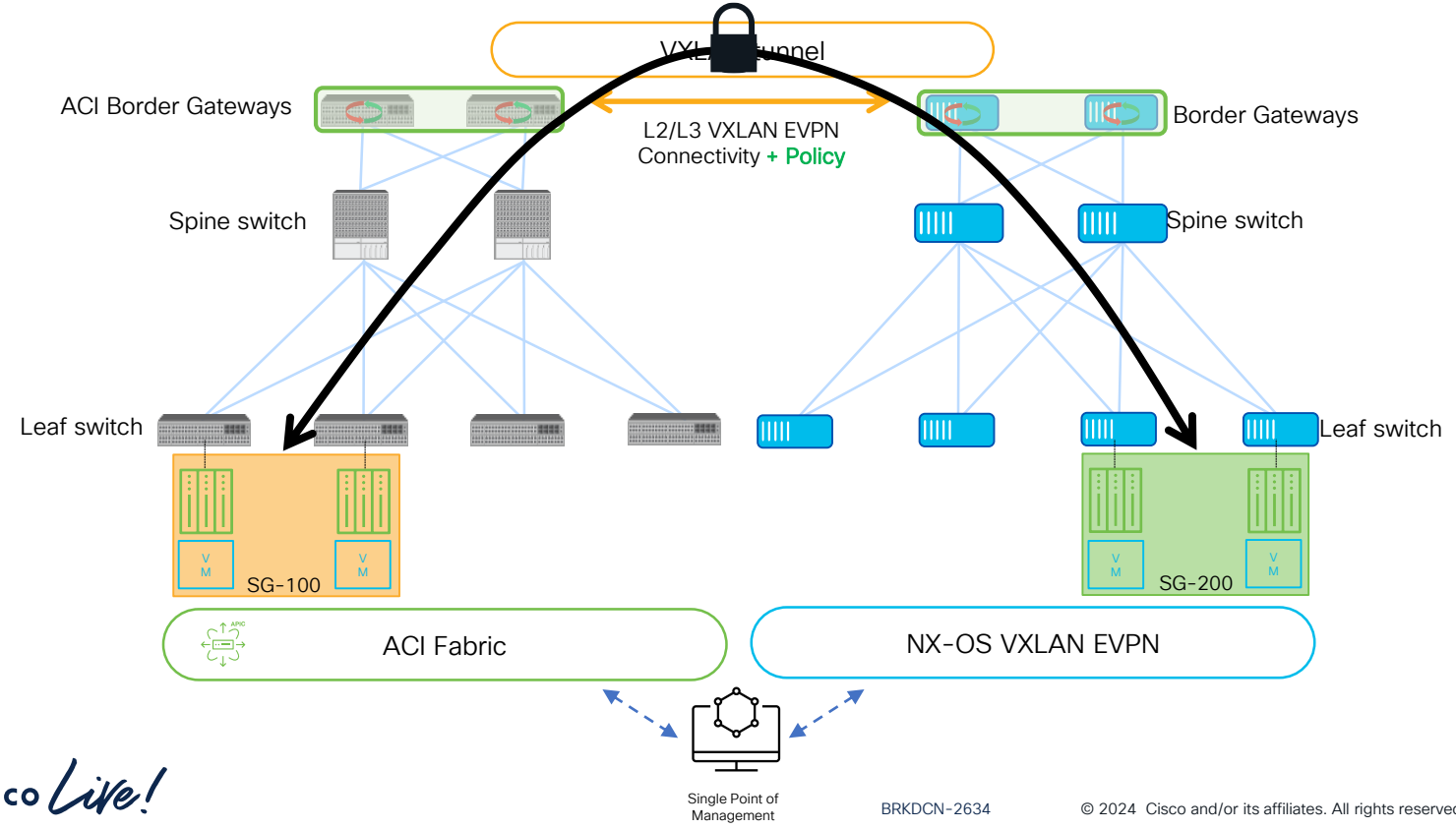
Heterogeneous Fabrics
Policy Enforcement End-to-End

Future



Conclusions

Conclusions

- Building distributed infrastructures is key to the deployment of resilient and scalable designs
- Cisco One Fabric Experience aims to seamlessly interconnect and operate a mix of heterogeneous fabrics (ACI and VXLAN EVPN)
- The three main pillars to realize the One Fabric Experience vision are:
  1. BGW function for ACI fabrics
  2. Security policies in VXLAN EVPN fabrics (GPO)
  3. Introduction of centralized management and operation platforms for heterogeneous fabric on Nexus Dashboard

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