

Simple Leaf Spine with a Touch of ToR

cisco Live !

Network Designs for the Modern Data Center

Richard Licon
Principle Technical Marketing Engineer

Session ID: BRKDCN-2667

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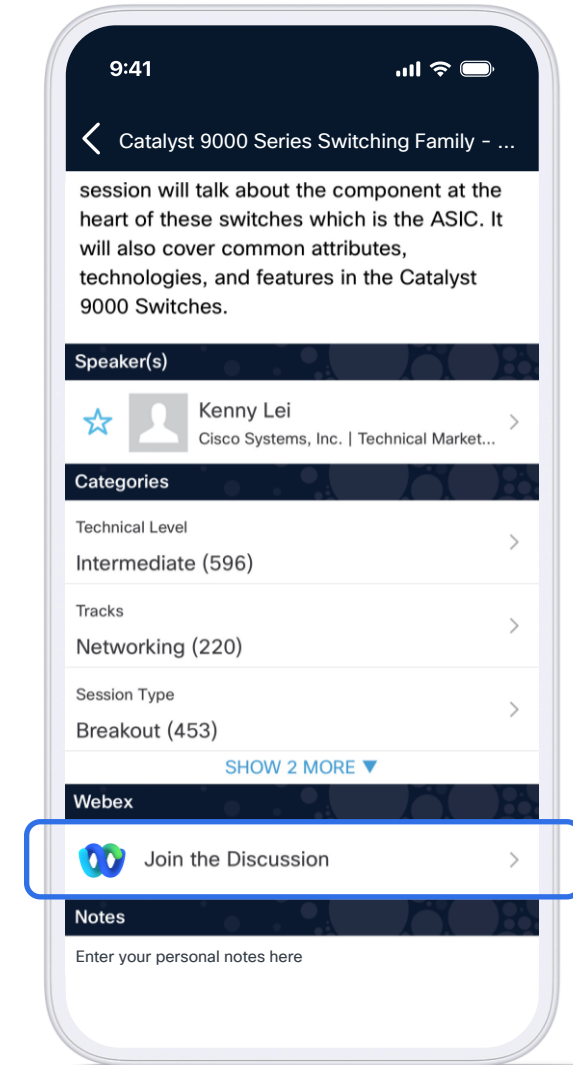
Questions?

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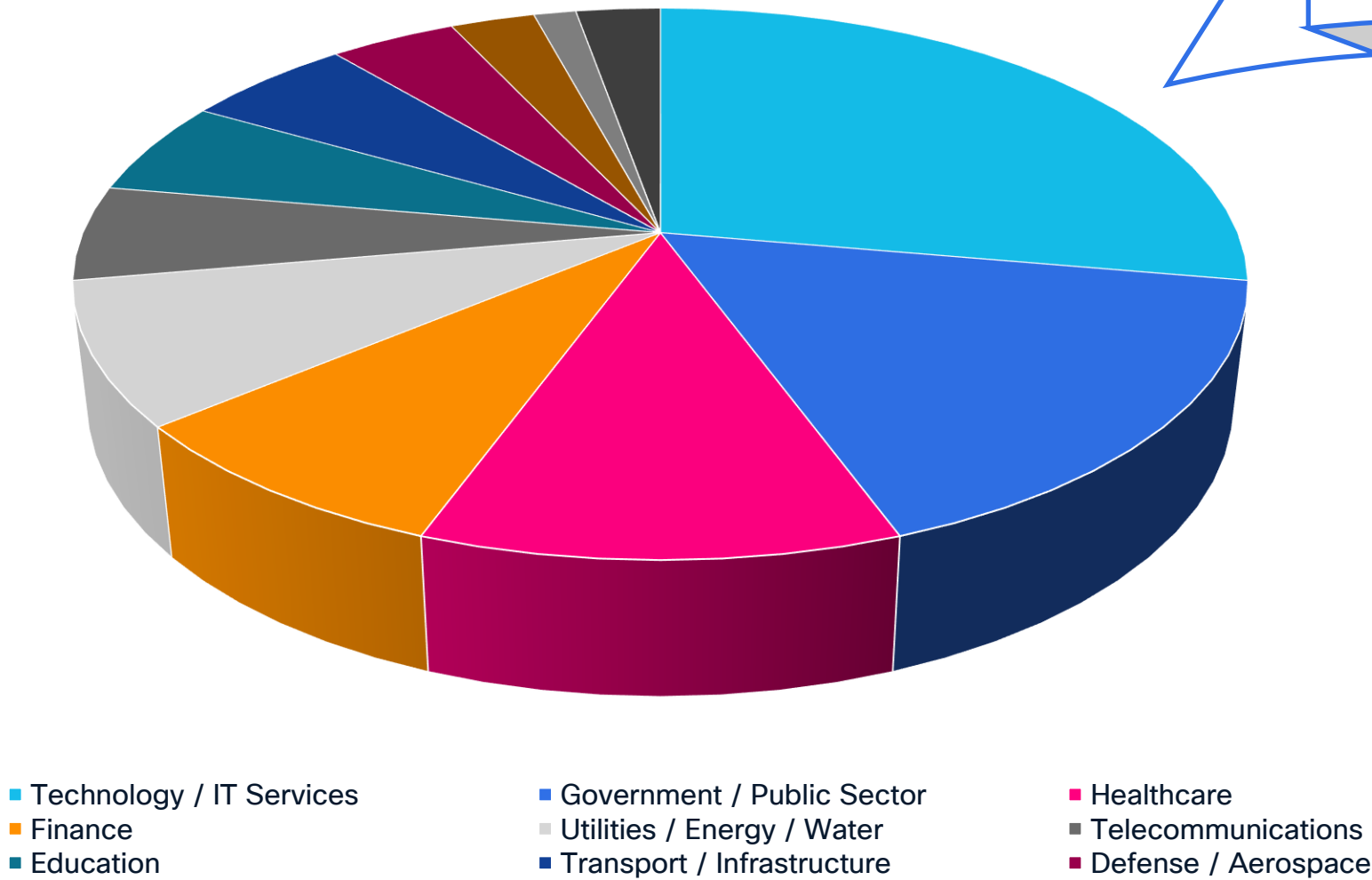


<https://cislive.ciscoevents.com/cislivebot/#BRKDCN-2667>

Attendee Distribution List (Verticals)



Simple Leaf Spine with
a Touch of ToR - BRKDCN-2667



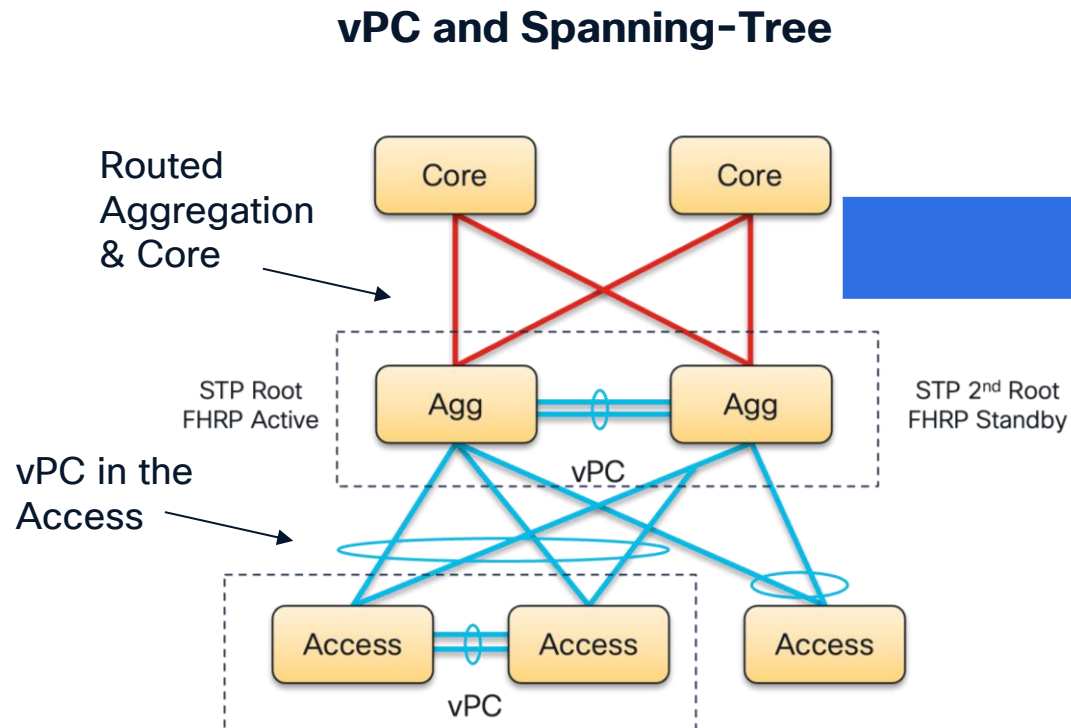
Agenda

- 01 Introduction
- 02 The Evolution of DC Network Designs
- 03 Leaf-Spine “Fat Tree” Network Topologies
- 04 Hardware Deployment Considerations
- 05 Fundamentals of VXLAN EVPN Design
- 06 Multi Fabric Designs – VXLAN Multi Site
- 07 Nexus VXLAN Fabric Security
- 08 Nexus VXLAN Fabric Operations
- 09 Conclusion

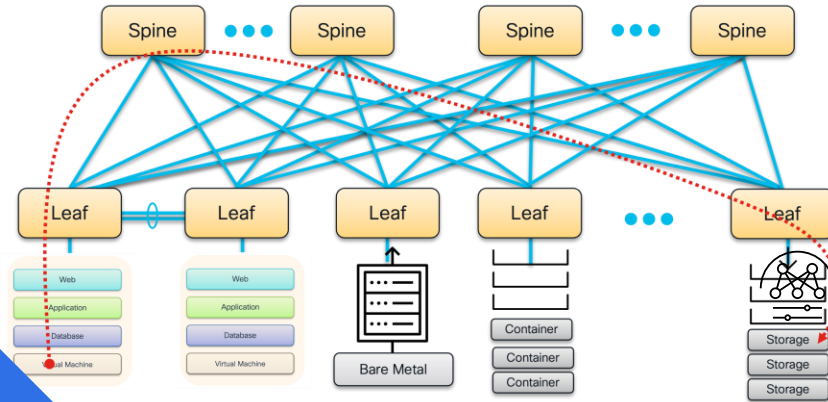
Introduction

Evolving Network Designs

Traditional 3-Tier DC Network Design

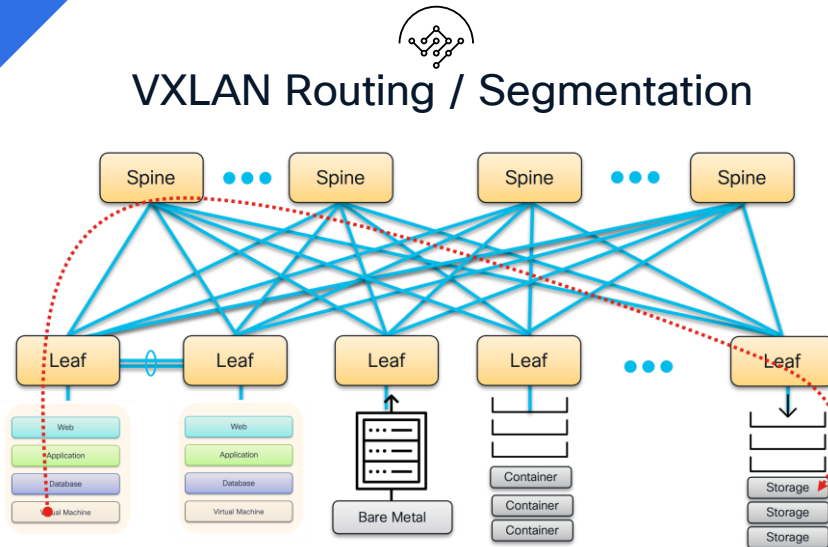


VXLAN Bridging/Routing Services



- VXLAN Flood & Learn
- VXLAN EVPN
- Separate Management Tools (e.g. Nexus Fabric Manager)

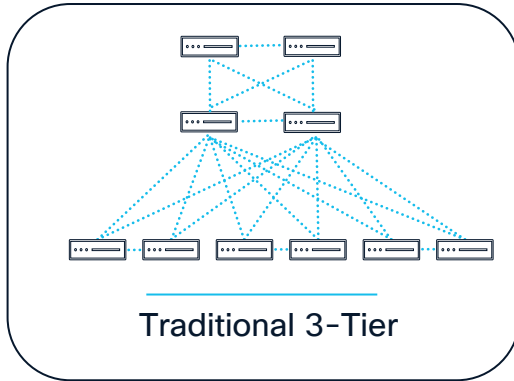
VXLAN Routing / Segmentation



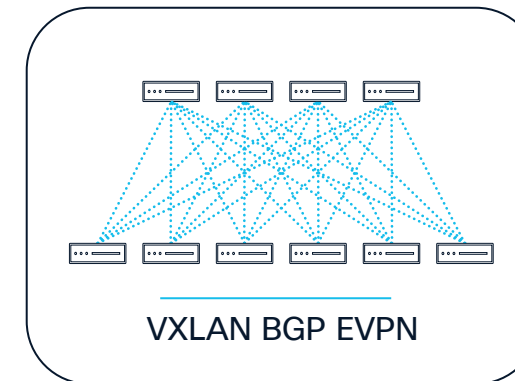
- VXLAN Routing
- Fabric Controller (NDFC)
- Automation
- Management
- Visibility
- Multi-Site
- Security (GPO)

The Evolution of DC Network Designs

Customer Use Cases for Data Center Fabrics



- ✓ Large broadcast/fault domains to support VM mobility
- ✓ Potential Suboptimal Forwarding
- ✓ Scale up behavior
- ✓ Relies on STP to ensure loop-free topology
- ✓ Disjointed Data Center Interconnect (DCI)

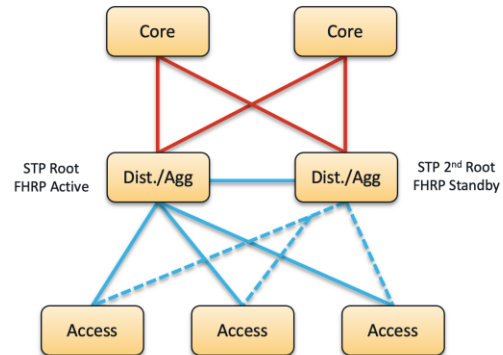


- ✓ Any workload anywhere across L3 boundaries
- ✓ Seamless VM Mobility (intra and inter-DC)
- ✓ Scale out behavior aligned to DC traffic patterns
- ✓ Leverages ECMP for optimal path over L3 network
- ✓ Next Gen Data Center Interconnect (DCI)

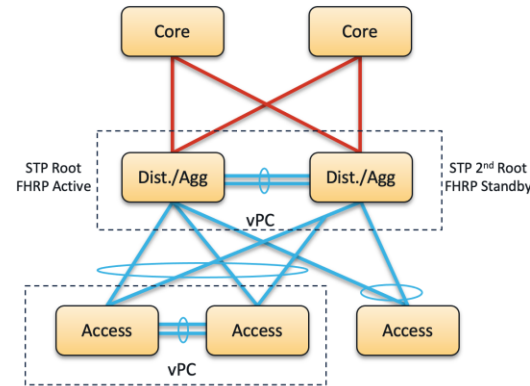
Data Center Network Challenges

Legacy Architectures

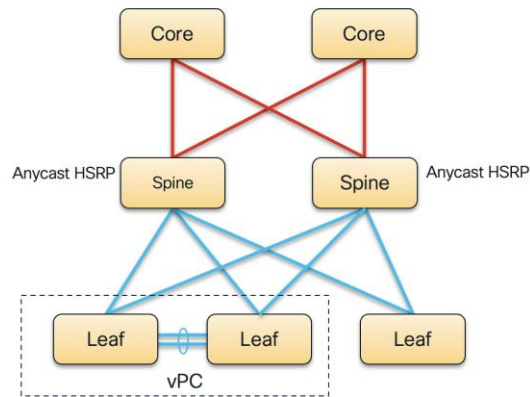
Classic Spanning-Tree



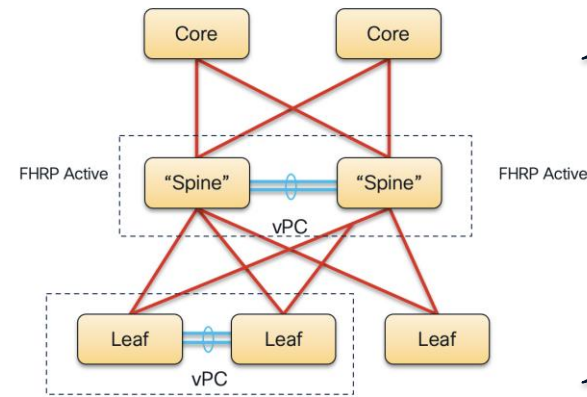
vPC and Spanning-Tree



FabricPath (MAC-in-MAC)



VXLAN Flood & Learn (MAC-in-IP)



Convergence Time:

STP high convergence time
TCN MAC Flush

Unused Links:

STP Redundant links in
blocked state

Rigid Network Services:

L4-L7 Services placed at
Distribution Layer

Suboptimal Forwarding:

Path defined by
Root Switch or FHRP Active

OpEx/CapEx:

Expensive to upgrade
Scale up with large Chassis

Limited Scale:

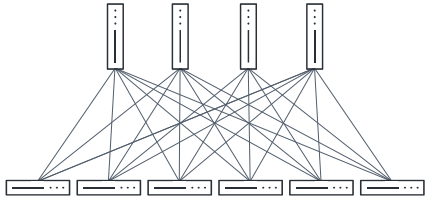
No Control Plane
Limited Workload Mobility

“Spine” = Not Really a Spine

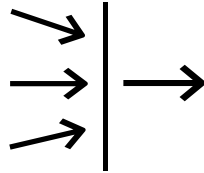
Leaf-Spine "Fat Tree" Network Topologies

Key Requirements

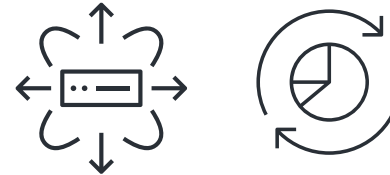
Topology
(Resiliency)



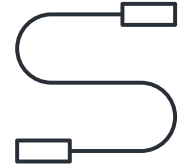
Bandwidth
(Oversubscription)



Platform Hardware
(Cost)



Optics
(Cabling)



Sustainability

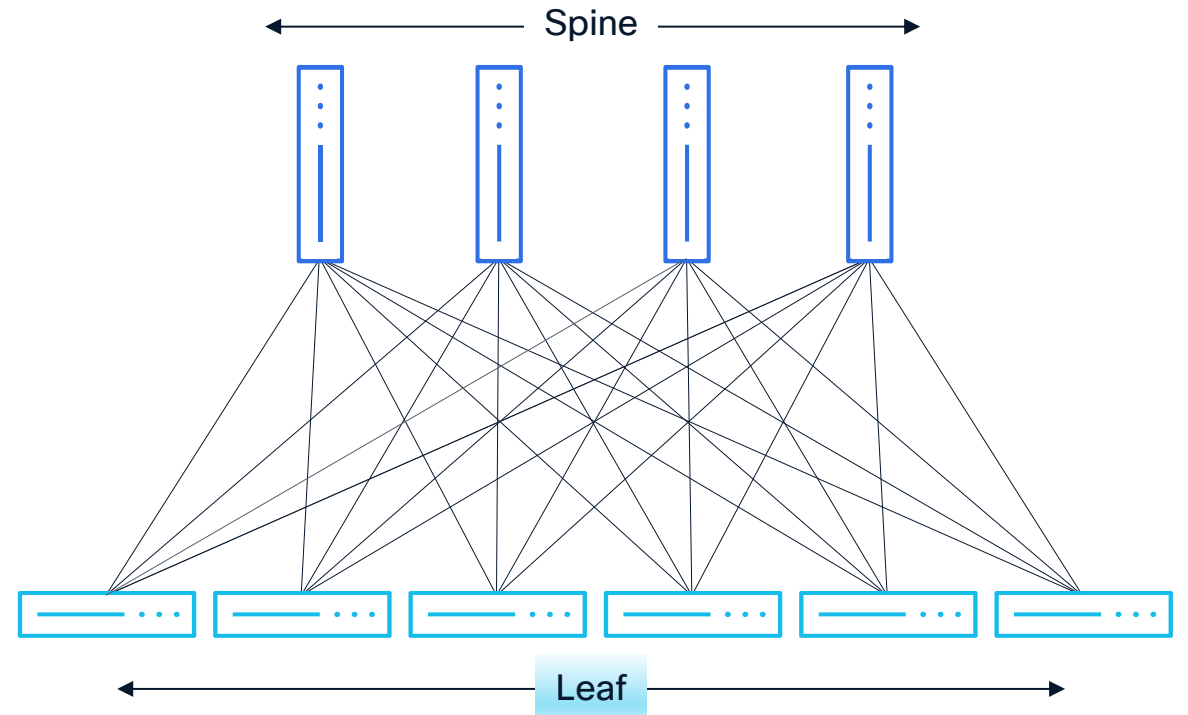


Define Requirements **Before** Designing Solution

Clos Topology

A Leaf and Spine Topology

- Variations and Names of the Same
 - 2-Tier
 - Fat Tree
 - Folded Clos
 - 3-Stage Clos
 - Butterfly (5-Stage | POD)

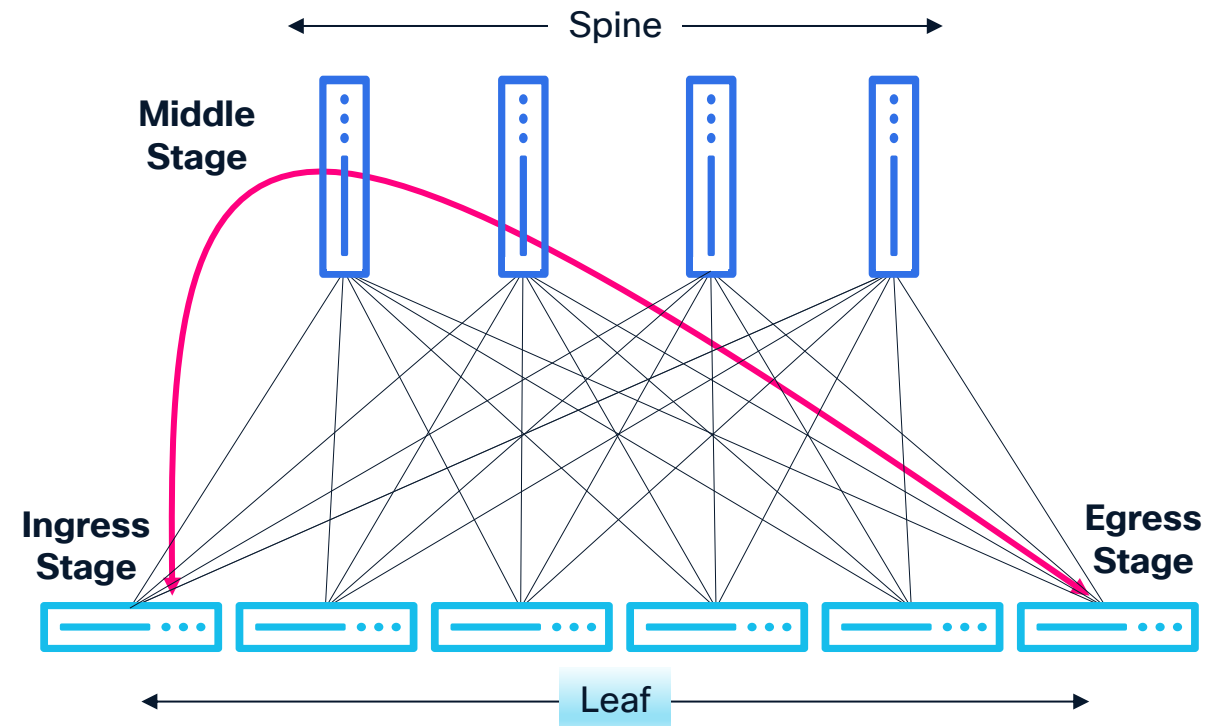


Clos Topology

A Leaf and Spine Topology

- 3 Stages
- 2 Tiers

Advantages

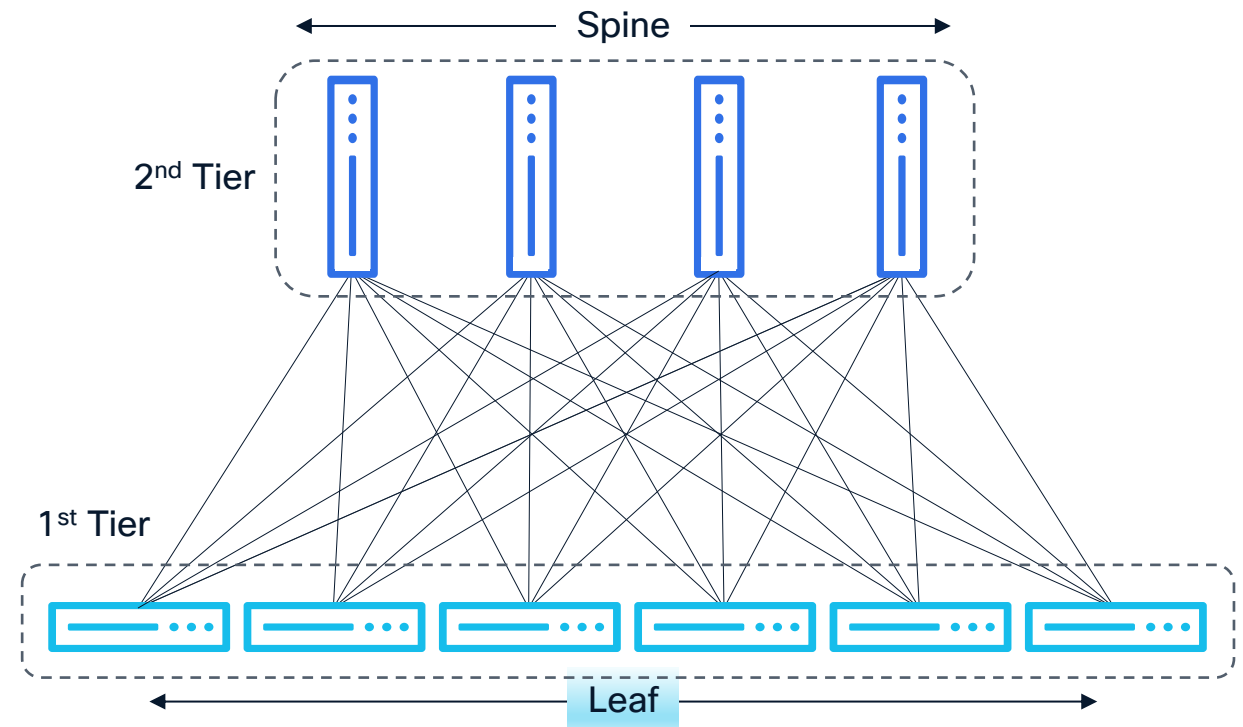


Clos Topology

A Leaf and Spine Topology

- 3 Stages
- 2 Tiers

Advantages

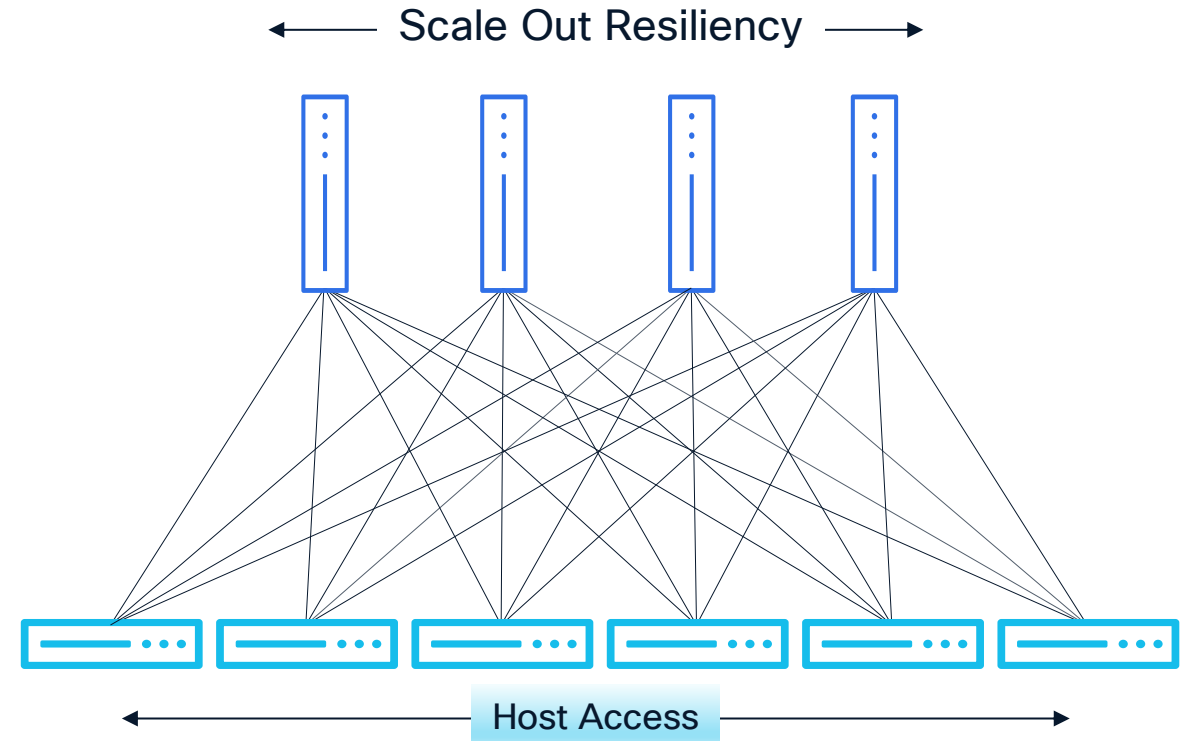


Clos Topology

Scale Out Architecture

- Adding Spines Results in:
 - Increased physical path redundancy
 - > Greater Resiliency
- Adding Leafs Results in:
 - Increased port capacity *without increasing oversubscription ratio(s)*
 - > More Access Ports

Advantages

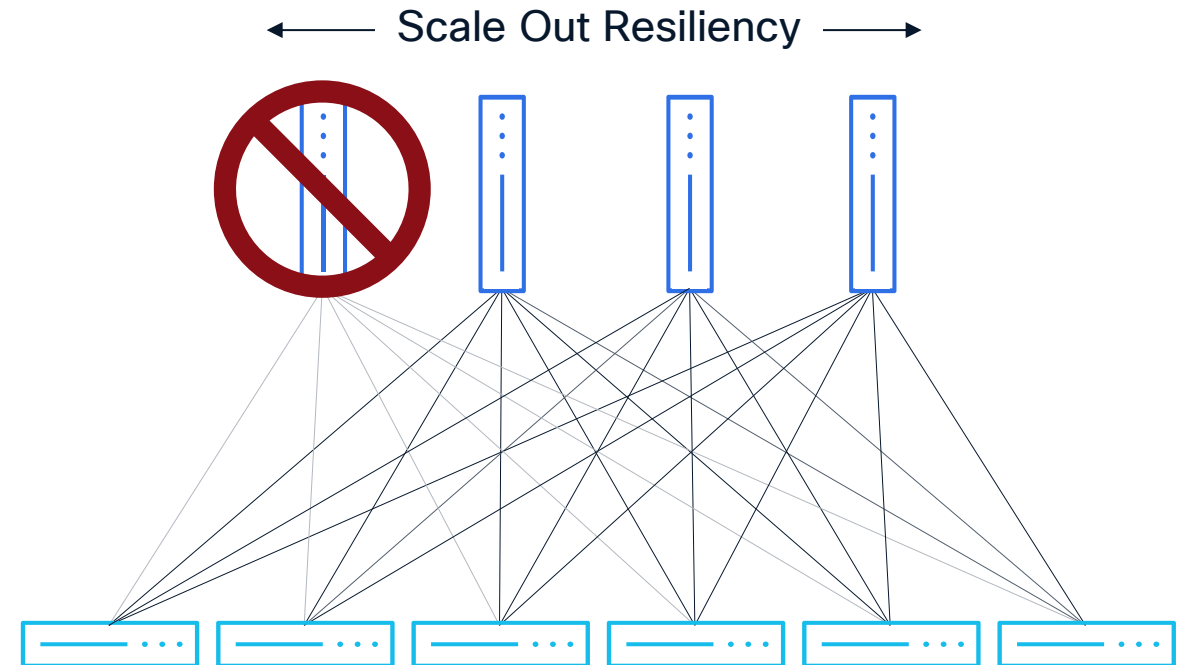


Clos Topology

N+1 Redundancy

- Resiliency increases when adding redundancy to the topology
- Single spine failure
 - 4 spines = 25% impact
 - 8 spines = 12.5% impact
 - 12 spines = 8.3% impact

Advantages



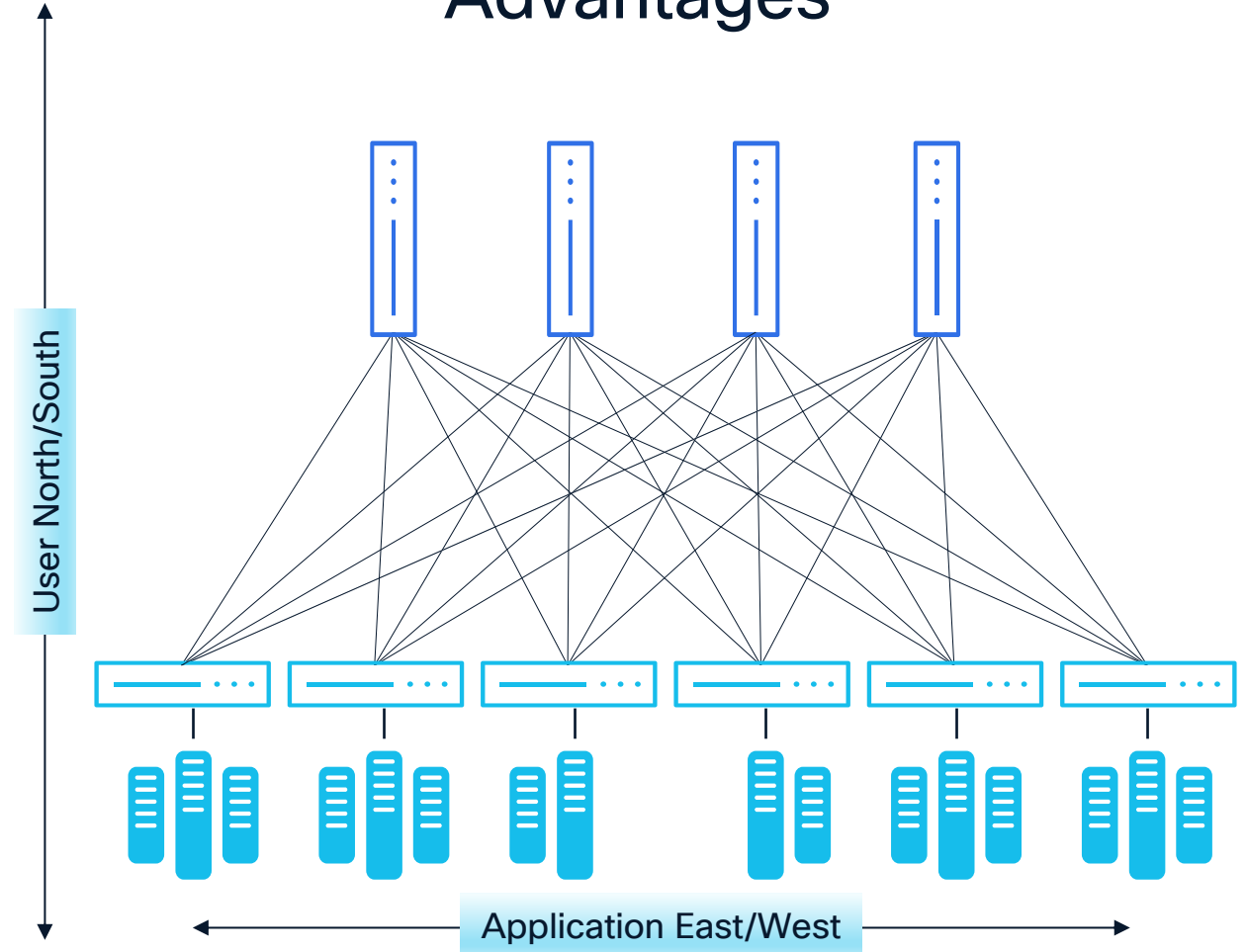
Clos Topology

Modern Application Needs

- Every (1) North South connection requires (8) East West connections
 - Application front end (user access)
 - Application back end (database, storage, etc.)



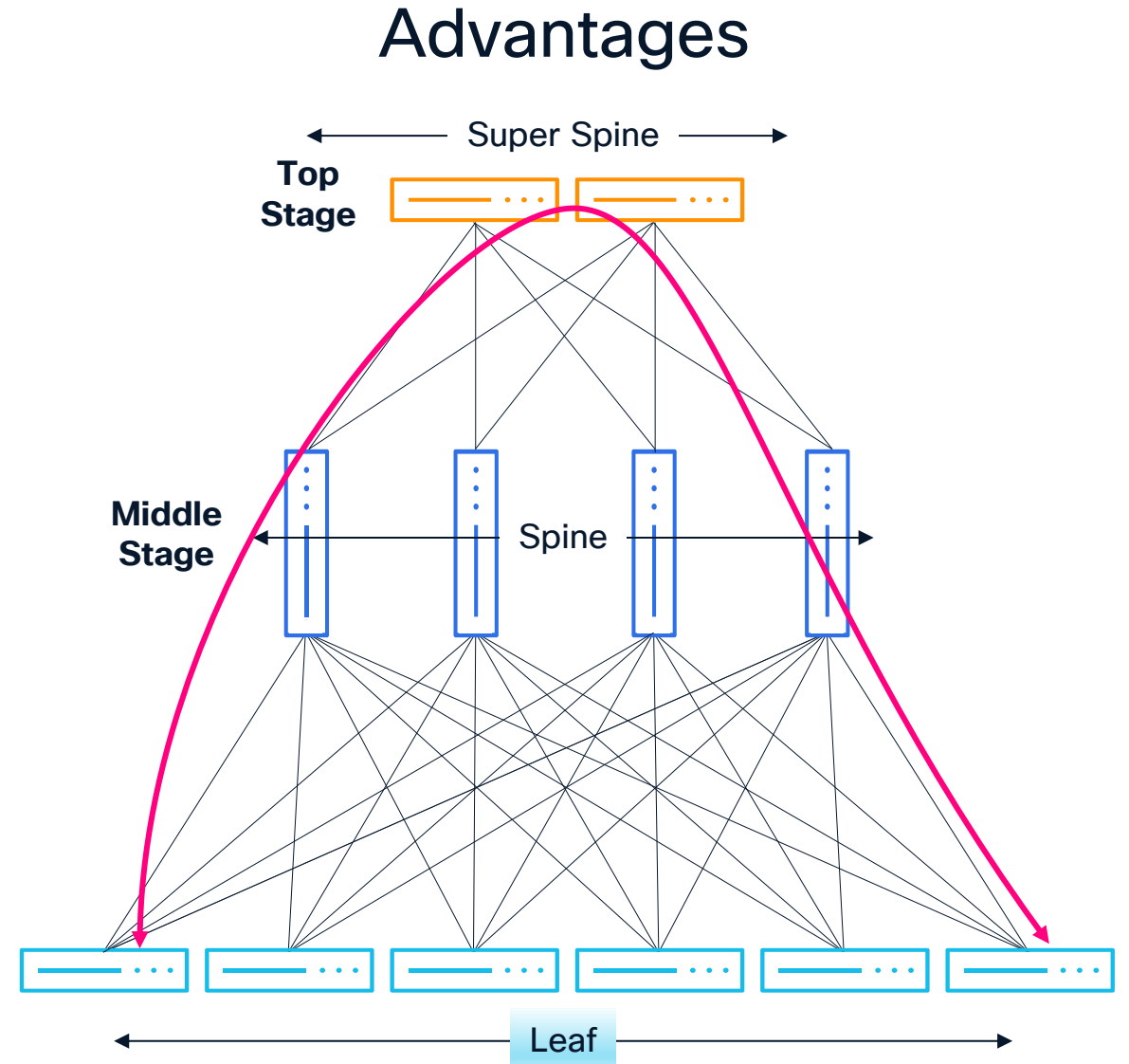
Advantages



Clos Topology

A Leaf and Spine Topology

- 5 Stages
- 3 Tiers

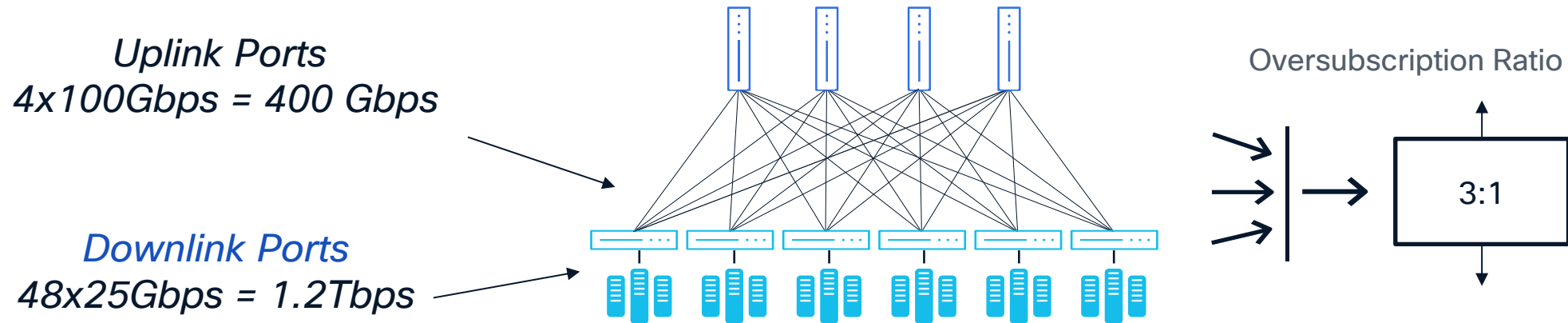


Oversubscription

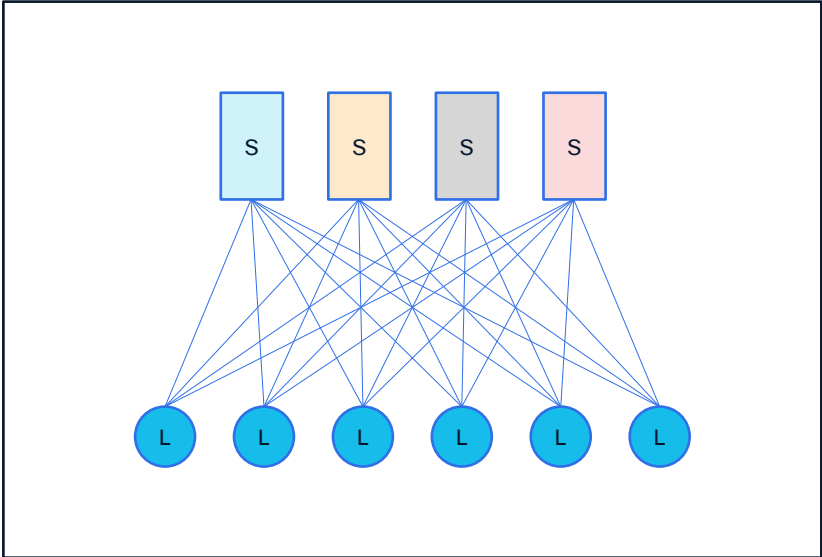
Oversubscription happens when an intermediate network device (switch) or link doesn't have enough capacity (bandwidth) to allow line rate communication between the two devices

Oversubscription Ratio

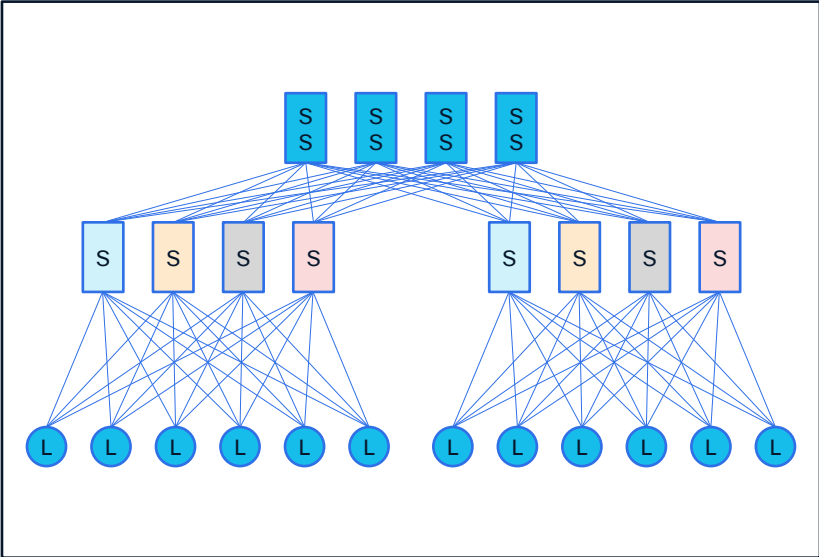
$$[\text{Number of Downlink Ports} * \text{Speed}] \div [\text{Number of Uplink to Spine} * \text{Speed}] : 1$$



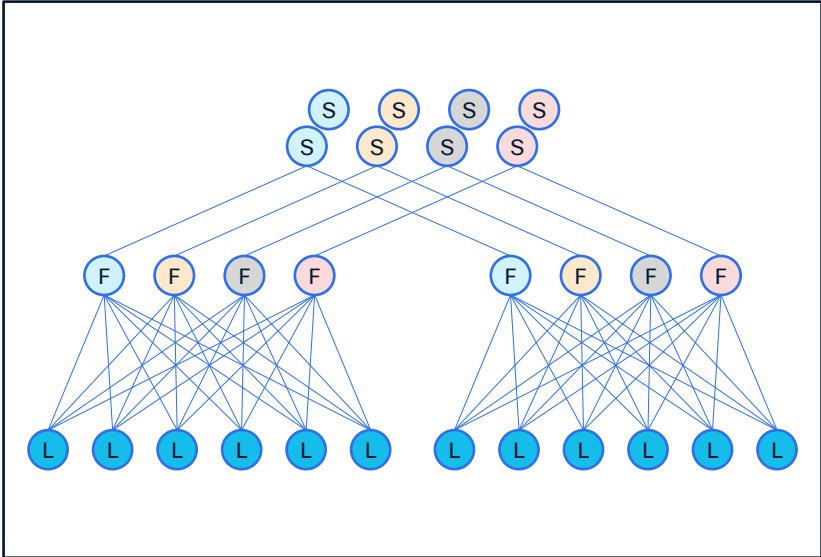
The Journey to Build Better and Further



2 Tier Leaf Spine



3 Tier Leaf-Spine-SuperSpine

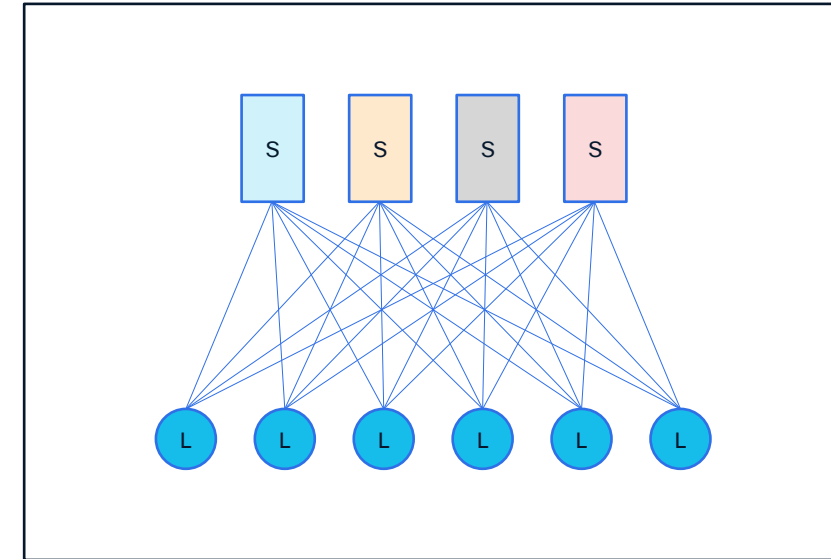


3 Tier Leaf-Fabric-Spine

Standard Design

2-Tier Leaf Spine

- A Perfectly Valid Way
- Tends to have “Finite Scale”
 - Maximum Chassis Capacity
 - Maximum Speed per Port
- Many Locations of Redundancy
 - Redundant Chassis Components
- Condensed Link and Bandwidth Presence
 - Aggregated within a Chassis



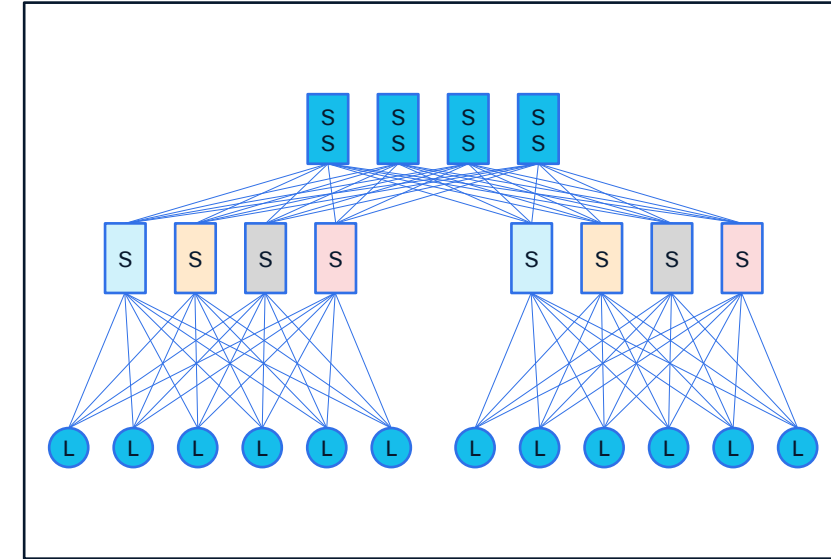
2 Tier Leaf Spine

- Use Modular Chassis at Spine
- Use Higher Density Linecards
- Use Higher Bandwidth per Port

Expanding Scale

3-Tier Multi Site

- Avoiding Scale-Up with Another Tier
- Distributed Link and Bandwidth Presence
 - Disaggregated Across Tiers
- Increases the “Finite Scale”
 - No Dependency on Chassis Capacity or Speed per Port
- Many Locations of Redundancy
 - Redundant Chassis Components
- Allows for Cost Optimization



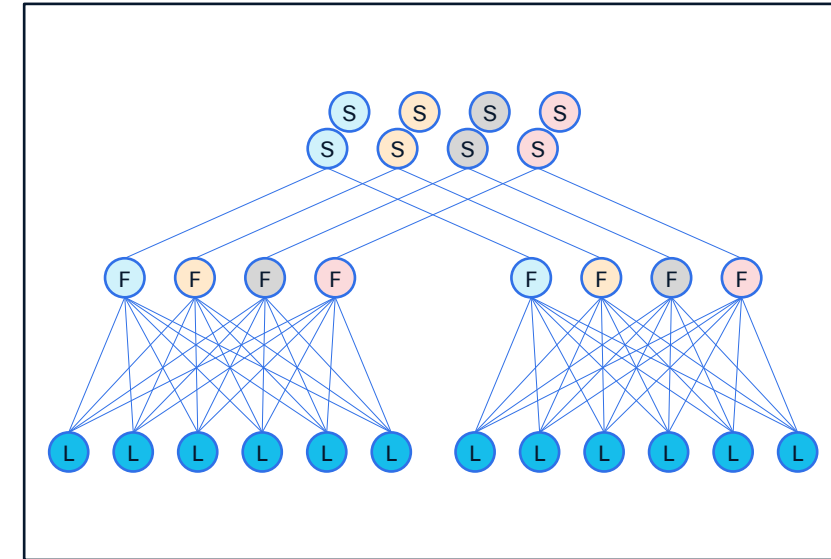
3 Tier Leaf-Spine-SuperSpine

- Scale-Out; Introduce a 3rd Tier
- Interconnect multiple 2 Tier “PODs”
- Use Modular or Fixed Spine & SuperSpine
- Use High Port Density
- Use High Bandwidth per Port

Increasing Resiliency

Multiplanar Architecture

- Increasing Scale-Out in All Tiers
- Reduce to the Max
 - Simple Design Principles
- Increases the “Finite Scale”
 - Scale as You Go
- Disaggregated Redundancy
- Flexible Link and Bandwidth Distribution
- Further Opportunity for Cost Optimization



3 Tier Leaf-Fabric-Spine

- To Infinity and Beyond

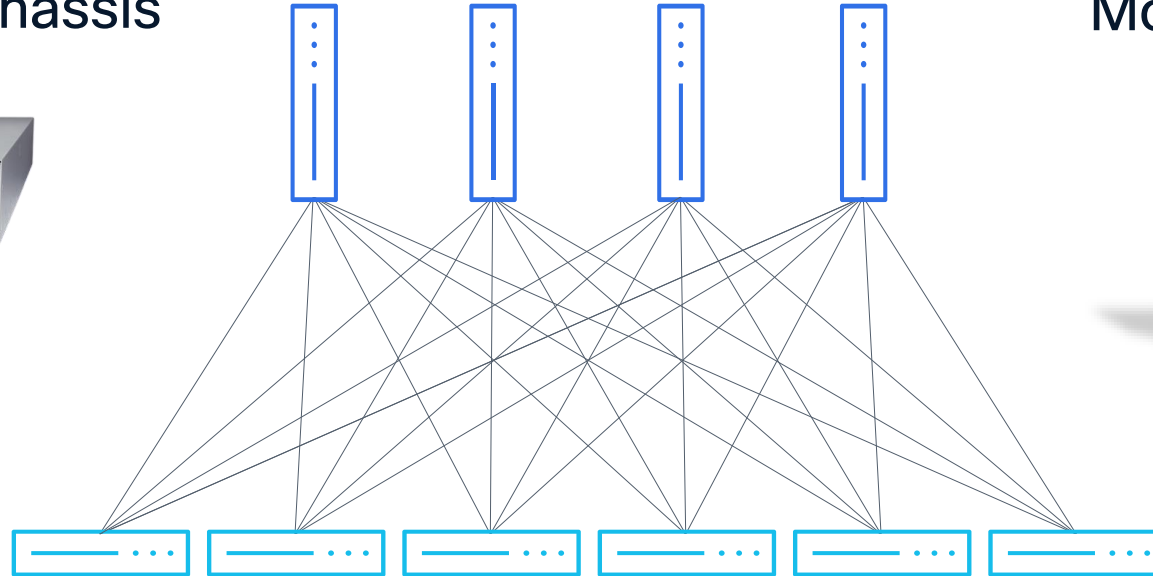
Hardware Deployment Considerations

Hardware Components

What should I use for **Spines**?
Modular or Fixed Chassis



What should I use for **Leafs**?
Modular or Fixed Chassis



Resiliency

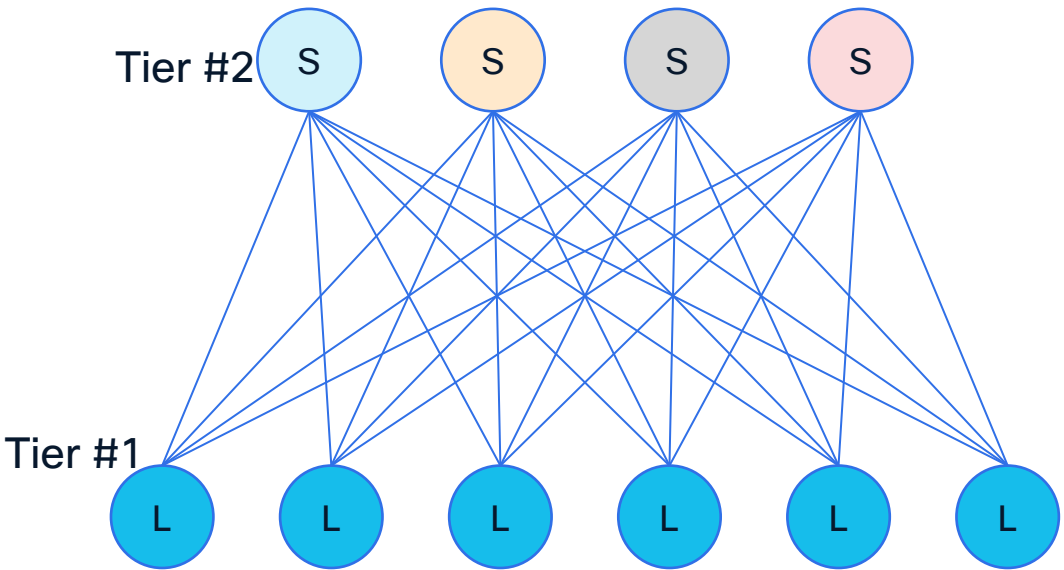
Oversubscription

Cost

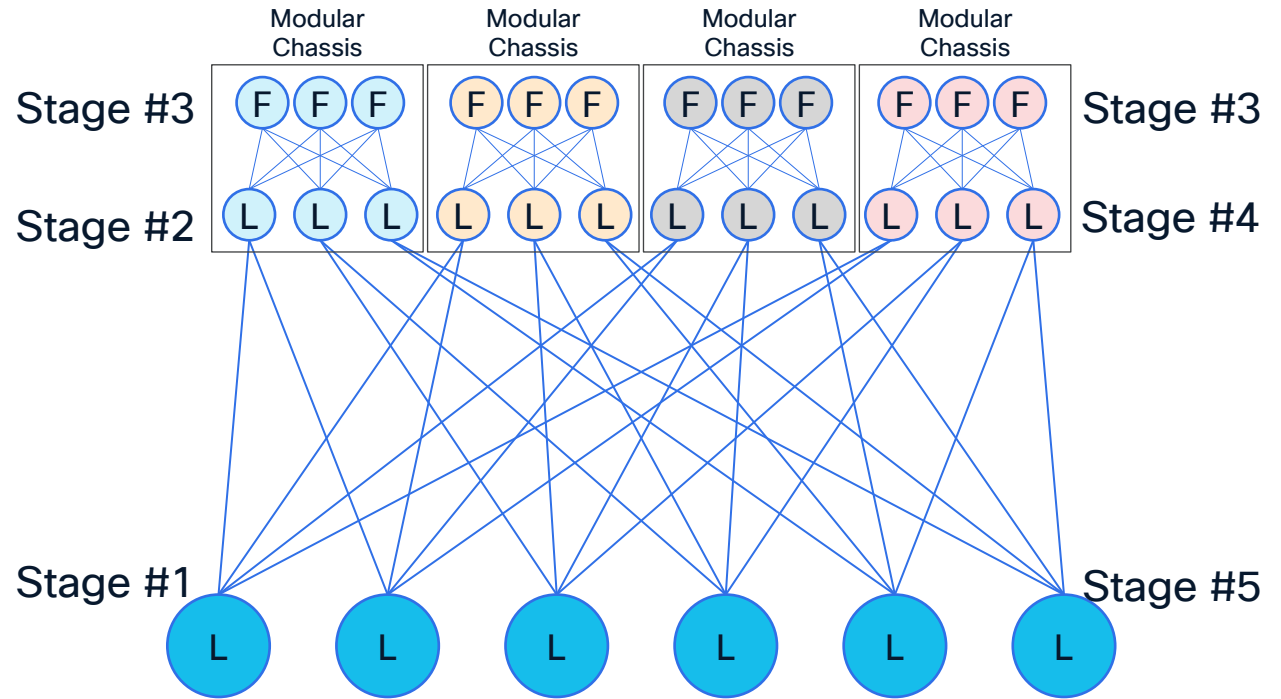
Cabling

Power

Attributes to Scale



What you think you Built
2 Tier Leaf and Spine Network (3 Stage)
Spine: Modular Chassis (4 Slot, 8, Slot, 16 Slot)
Leaf: Fixed Switch (single ASIC)



What you really Built
2 Tier Leaf and Spine Network (5 Stage)
Spine: Modular Chassis (4 Slot, 8, Slot, 16 Slot)
Leaf: Fixed Switch (single ASIC)

Optics

Direct Attach
Cables (**DAC**)
for Server
Connectivity

Active Optical
Cables (**AOC**)
for Server
Connectivity

Multimode
Fiber (MMF)
Optics for
Fiber Re-Use
<100m

Single Mode
Fiber (SMF)
Optics for **New
Deployment**
>100m

Cable Assembly

1:1 and Assembly Breakout

Individual Optics

1:1 and Panel Breakout

Resiliency

Oversubscription

Cost

Cabling

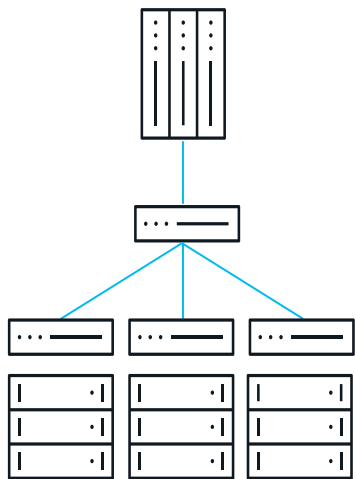
Power

Optics - Cable Management

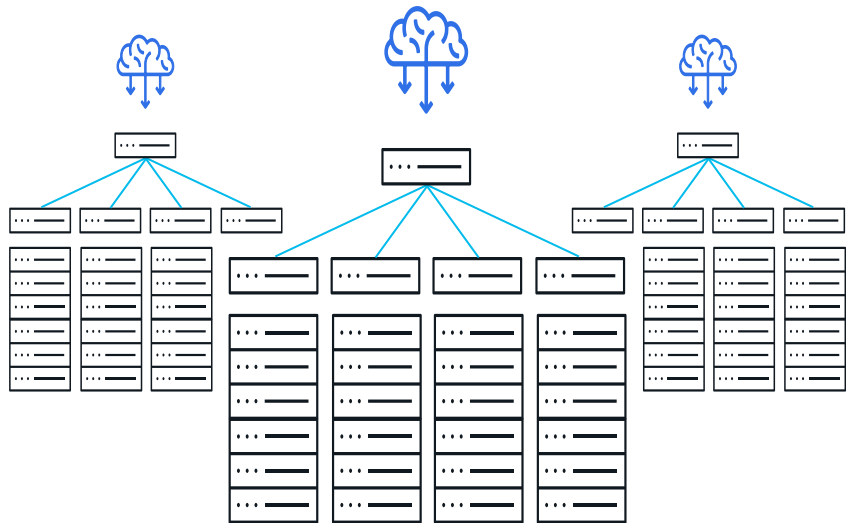


Optics – Panel Breakout

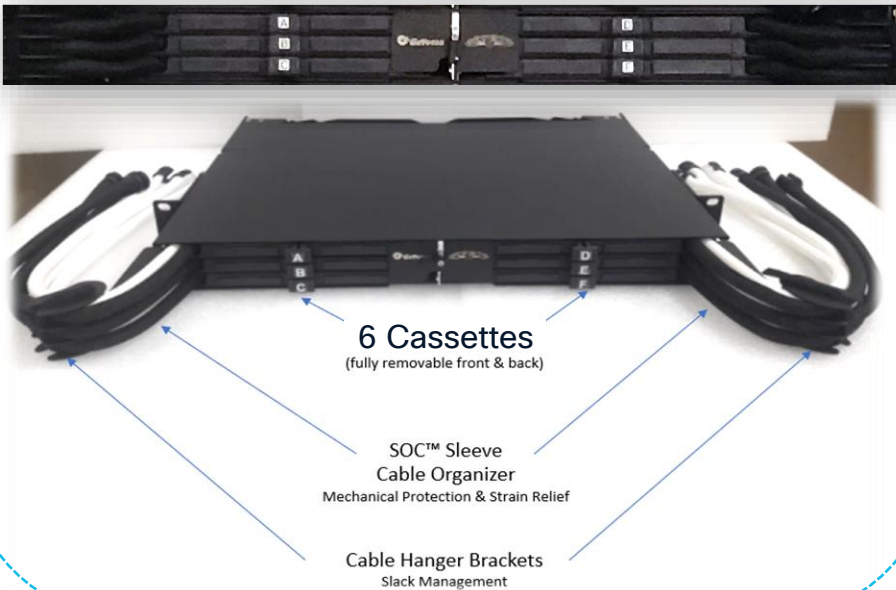
Multi-Tier Fabrics
Leaf | Spine | Super Spine



Large Scale AI/ML Clusters
IP Routed Fabric | Non-Oversubscribed

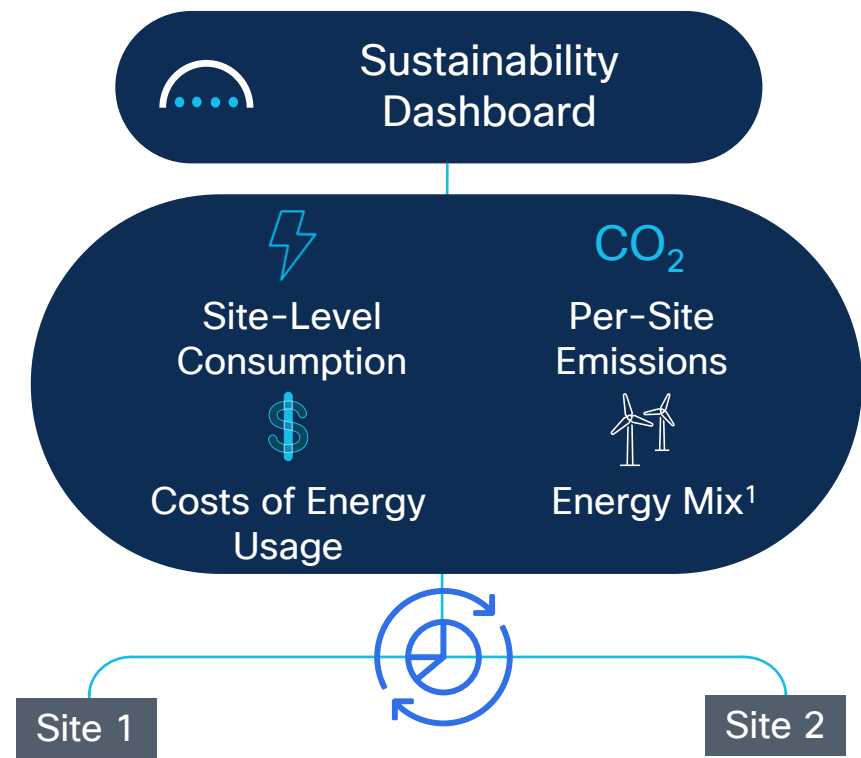


Cisco Patch Panel
400G MPO -> 4x 100G LC Breakout
72x 100G Ports Per Rack Unit
Available in 1RU / 2RU / 3RU

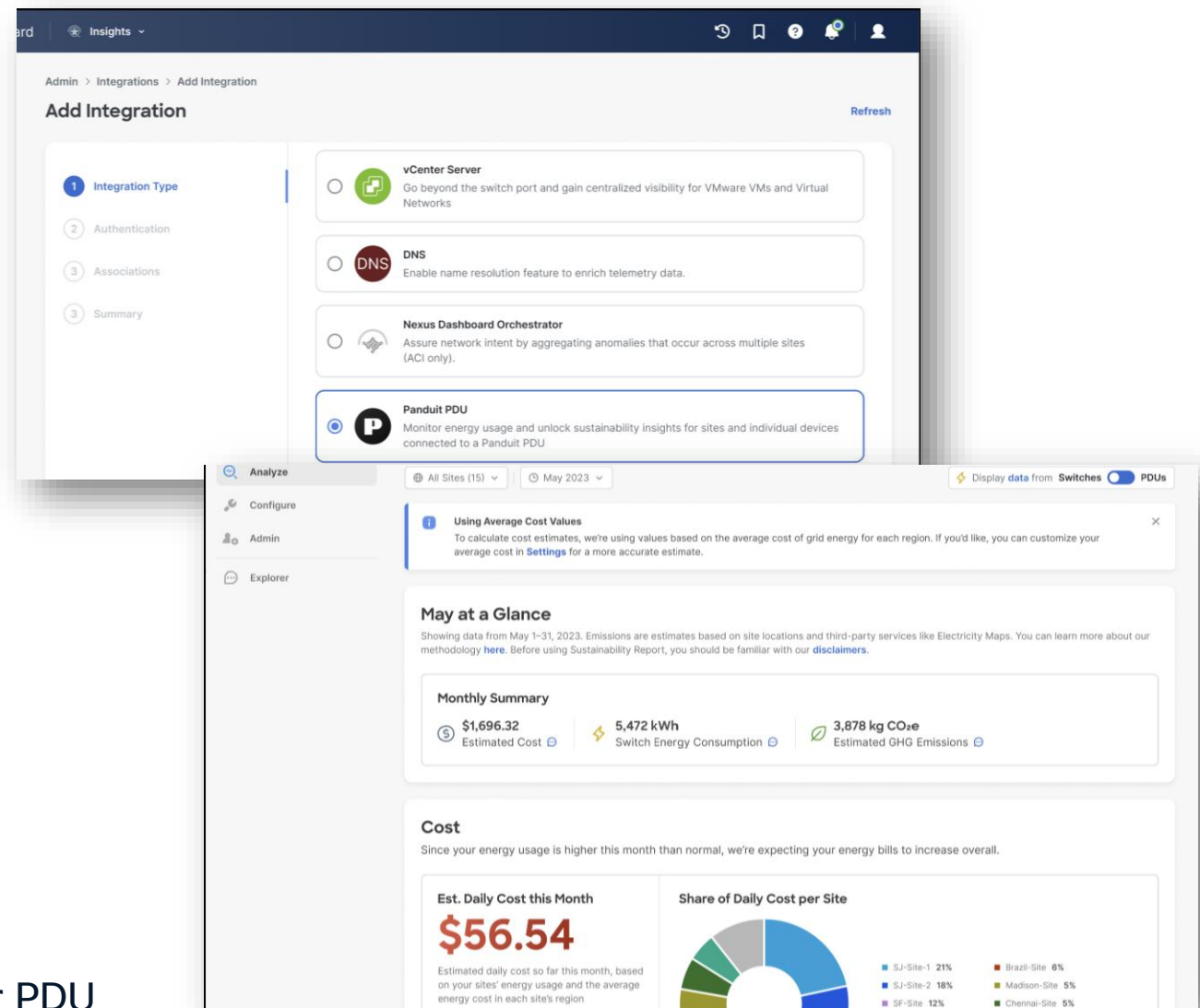


Resiliency	Oversubscription	Cost	Cabling	Power
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Sustainability

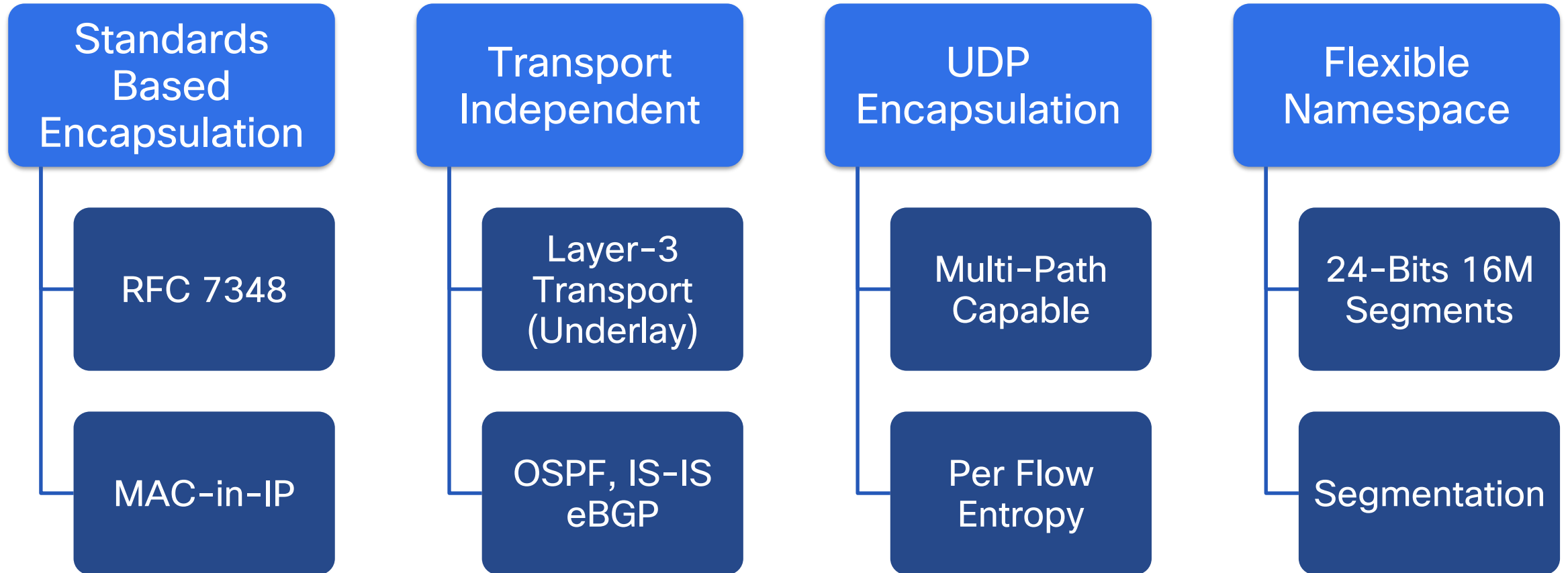


 **Key Sustainability Metrics**
Emissions, Carbon Footprint by Switch or PDU



Fundamentals of VXLAN EVPN Design

What is VXLAN?



EVPN in the Data Center

IETF/RFC Draft for Control and Data Plane

Control-
Plane

EVPN MP-BGP RFC 7432

Data-
Plane

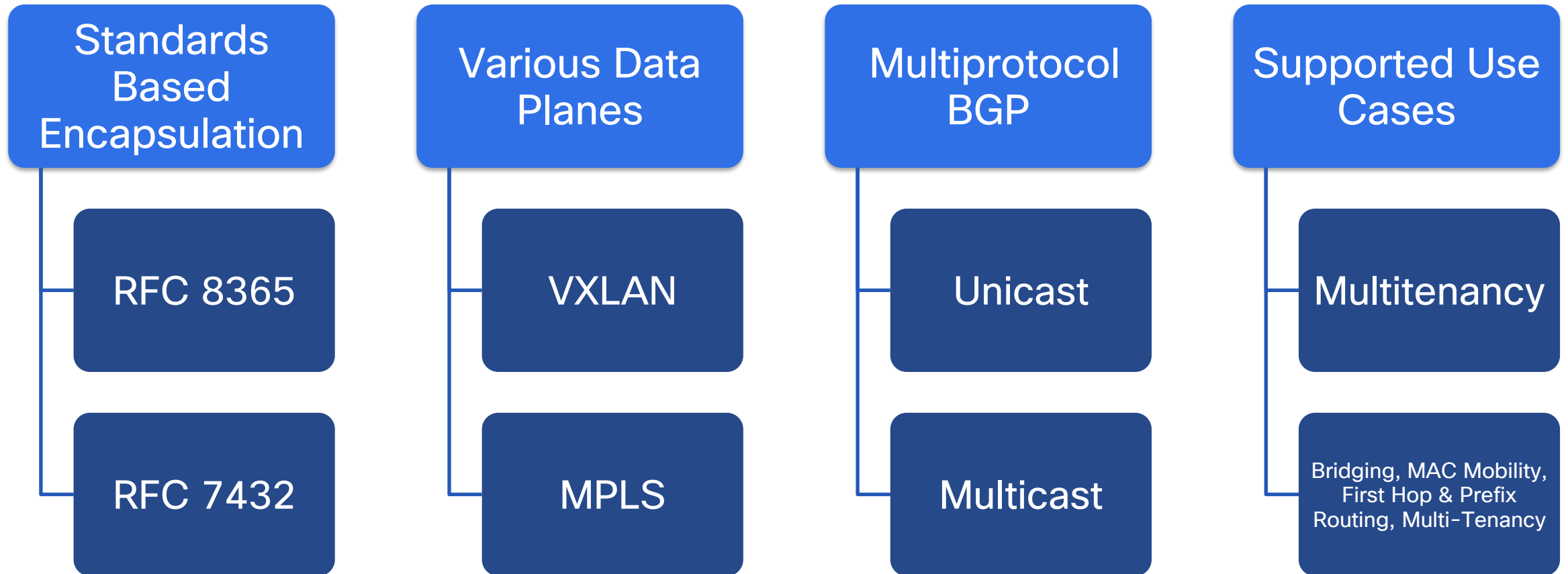
Multiprotocol Label Switching
(MPLS)
draft-ietf-l2vpn-evpn

Provider Backbone Bridges
(PBB)
draft-ietf-l2vpn-pbb-evpn

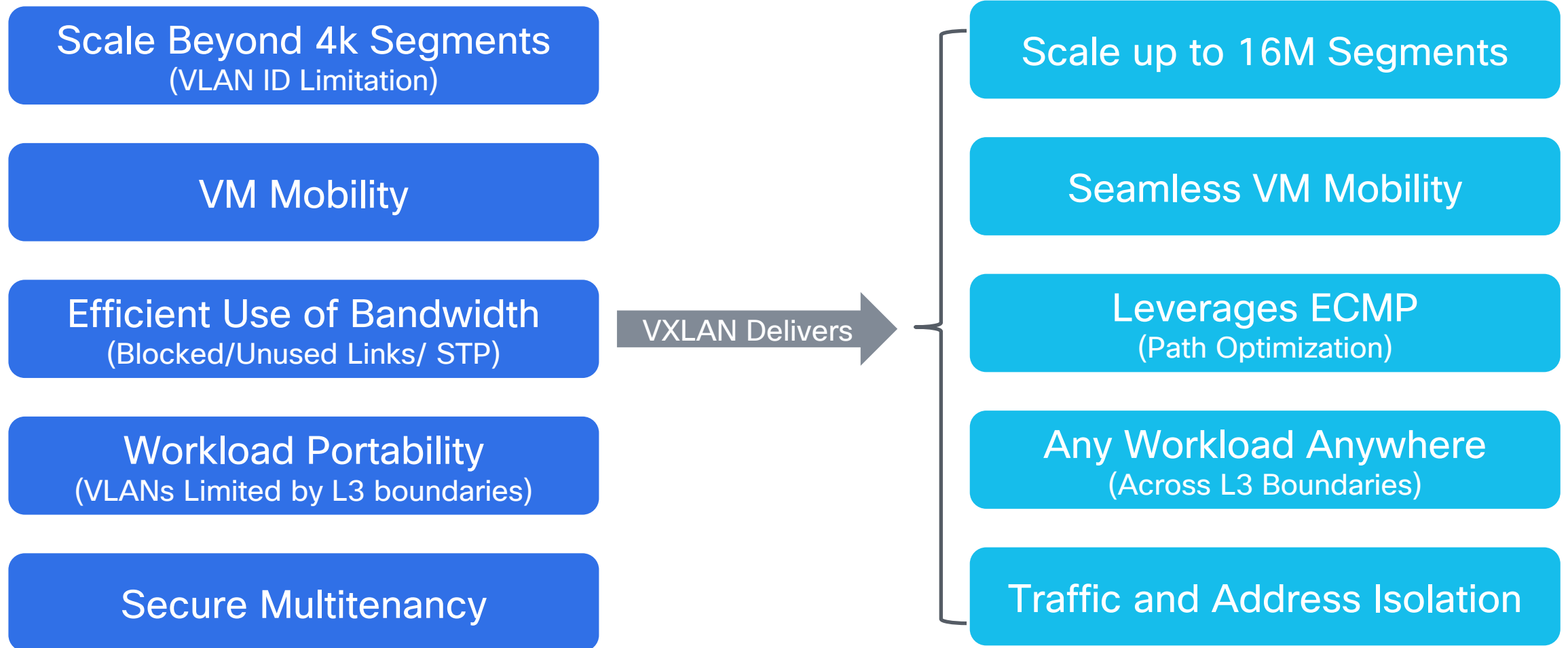
Network Virtualization Overlay
(NVO)
draft-ietf-bess-evpn-overlay

- EVPN over NVO Tunnels (i.e., VXLAN) for Data Center Fabric Encapsulations
- Provides Layer-2 and Layer-3 Overlays over IP Networks

What is EVPN?



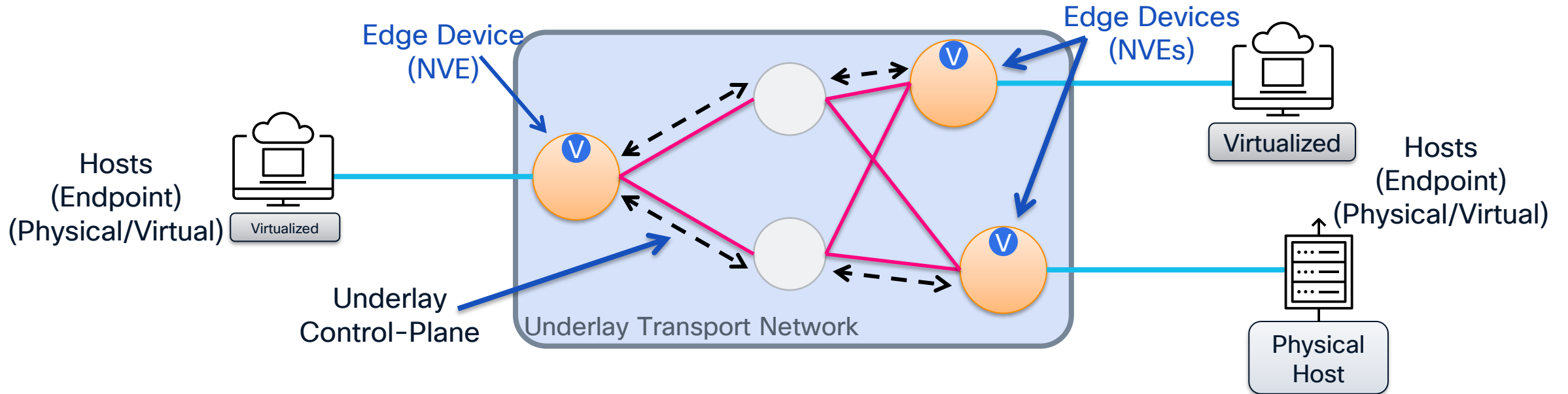
Why VXLAN – How Did We Get Here?



Underlay Taxonomy

- Edge Devices host the VTEP
- Responsible for the encapsulation and decapsulation of the VXLAN Header

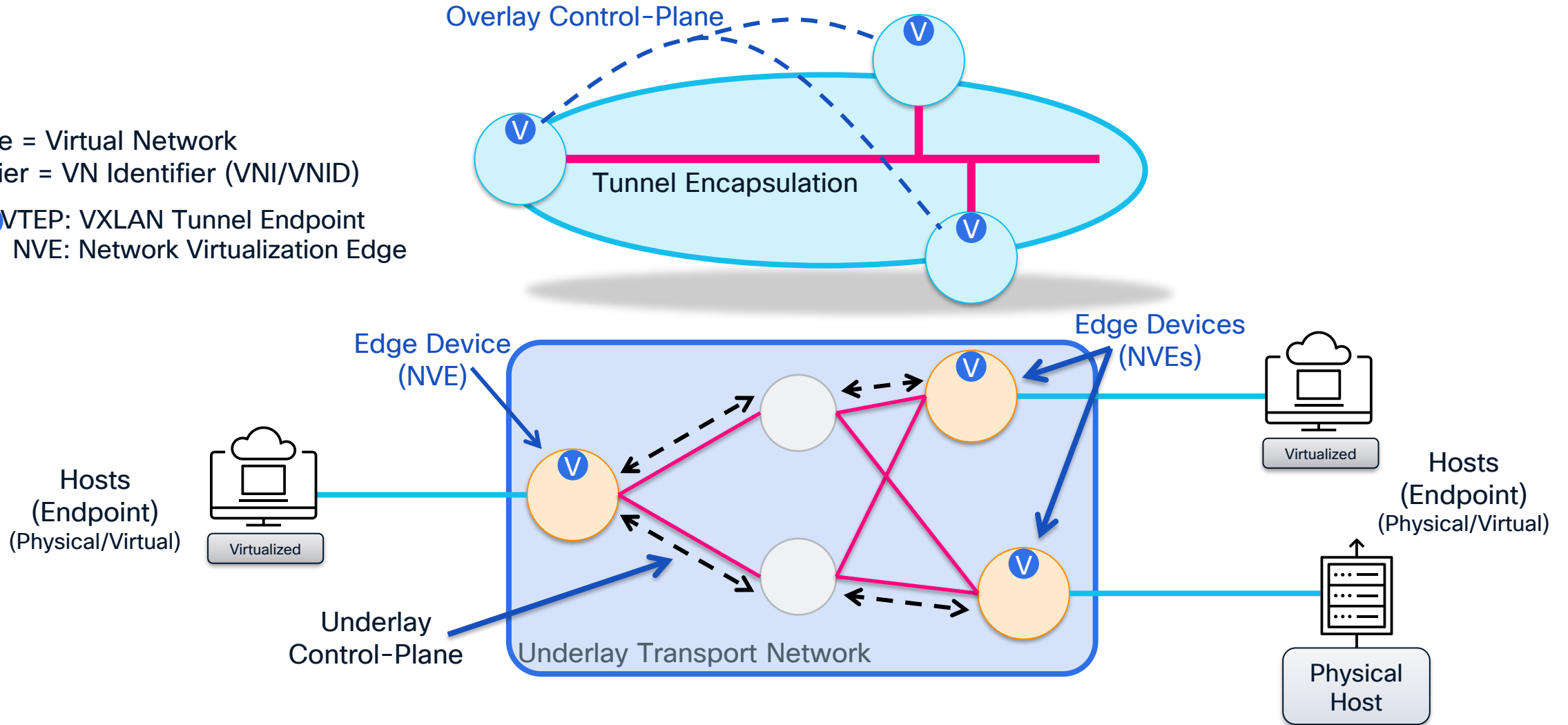
V VTEP: VXLAN Tunnel Endpoint
NVE: Network Virtualization Edge



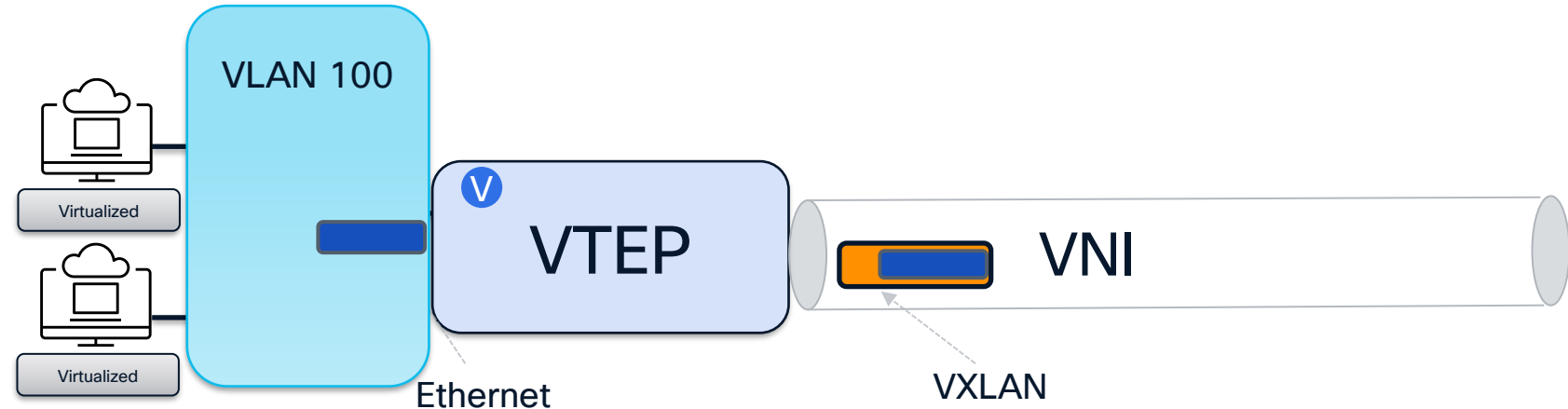
Overlay Taxonomy

Service = Virtual Network
Identifier = VN Identifier (VNI/VNID)

V VTEP: VXLAN Tunnel Endpoint
NVE: Network Virtualization Edge

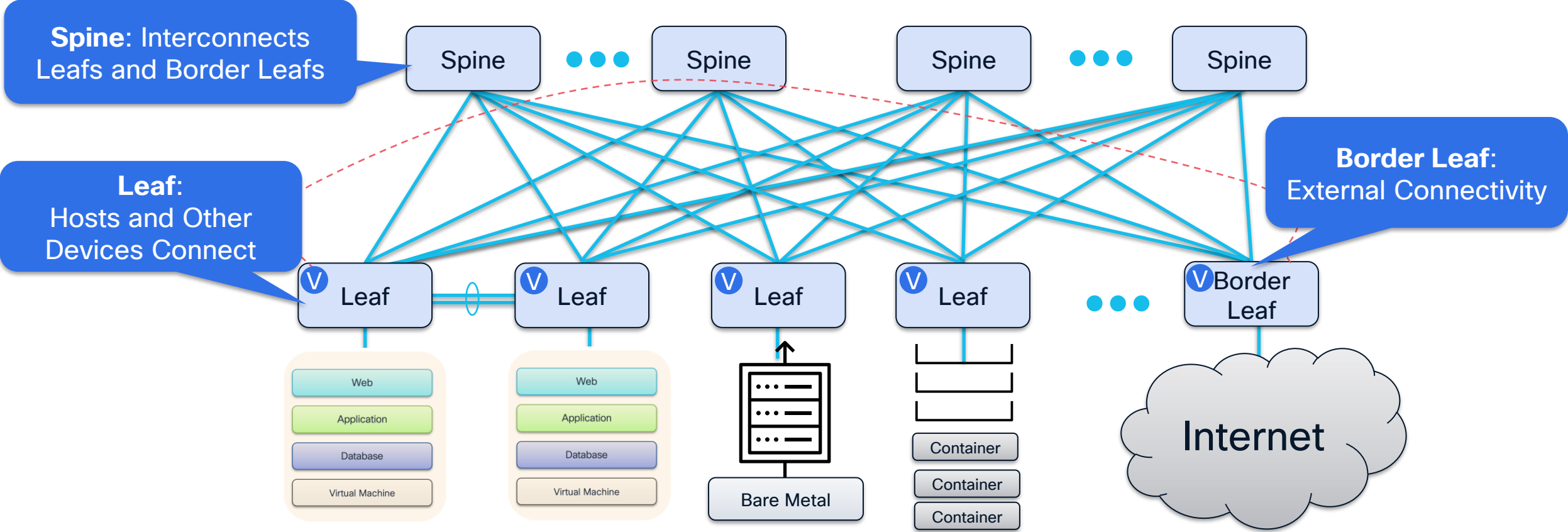


VXLAN (or Virtual) Tunnel Endpoint – VTEP



- VXLAN Tunnel Endpoint – Network Virtualization Edge
- Each VTEP is uniquely identified by an IP Address
- VTEP Discovers or learns remote VTEPs, and end hosts attached to them
- VTEP bridges when forwarding packets within the same VNI and Routes for Inter-VNI traffic

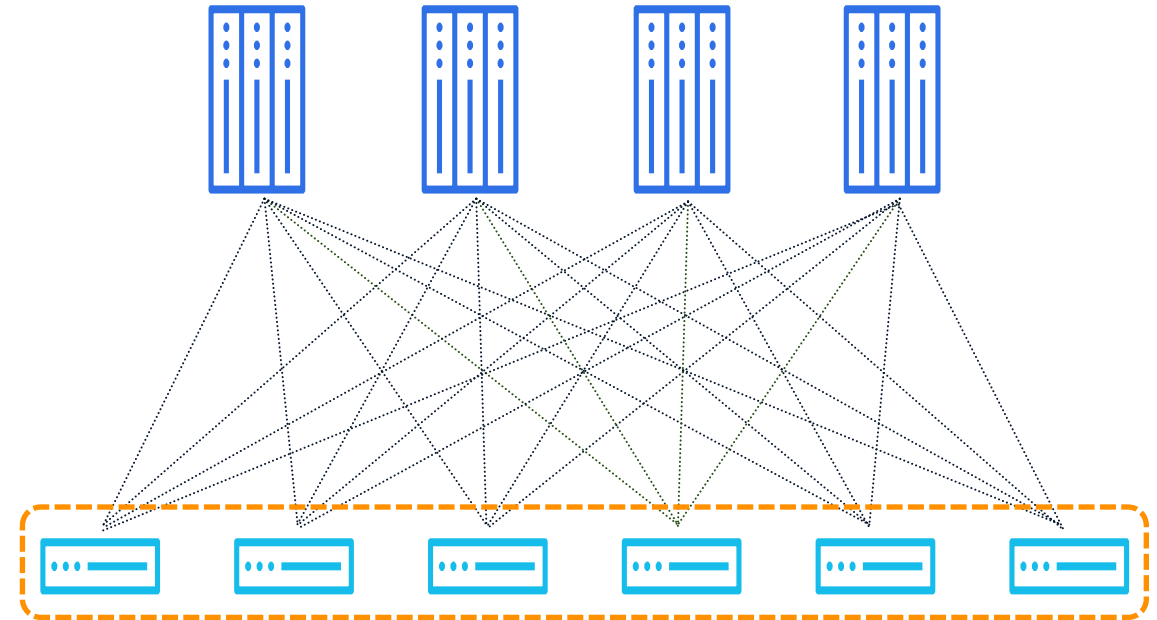
VTEP Device Roles



Components of VXLAN EVPN

Functions of Leaf

- Forms Routing Protocol adjacencies for underlay with Spines (OSPF, IS-IS, BGP)
- MP-BGP L2VPN EVPN neighborships with spines to exchange routes
- Performs VXLAN encapsulation and decapsulation
- Default Gateway Services for hosts using Distributed Anycast Gateway
- BUM replication/processing
- **Connect to Non-VXLAN segments using VRF-Lite extension (Typically done on Border Leaf)**

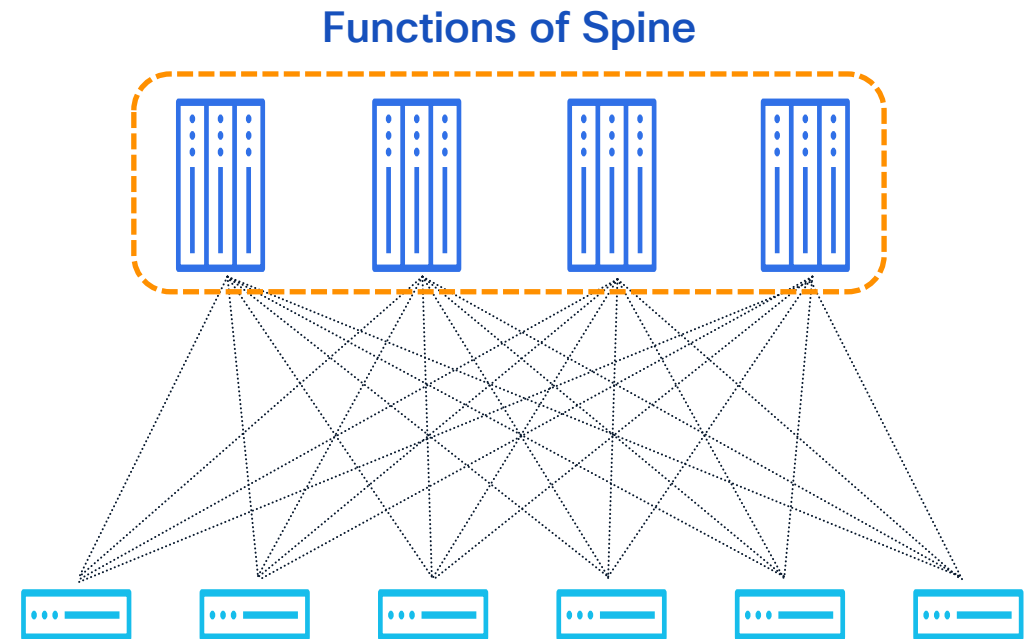


Functions of Leaf

Components of VXLAN EVPN

Functions of Spine

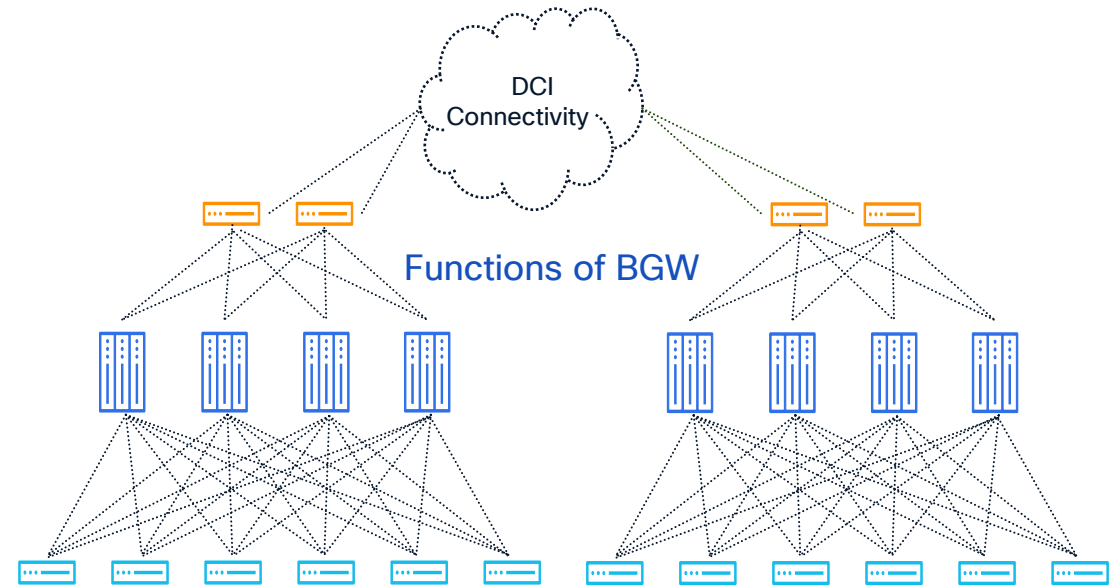
- Forms Routing Protocol adjacencies for underlay with Leaf (OSPF, IS-IS, BGP)
- MP-BGP L2VPN EVPN neighborships with Leaf switches to exchange routes
- Route Reflector for iBGP deployments
- PIM Anycast RP
- **Do NOT typically do VXLAN encapsulation and decapsulation (unless it is a border spine or border gateway spine)**



Components of VXLAN EVPN

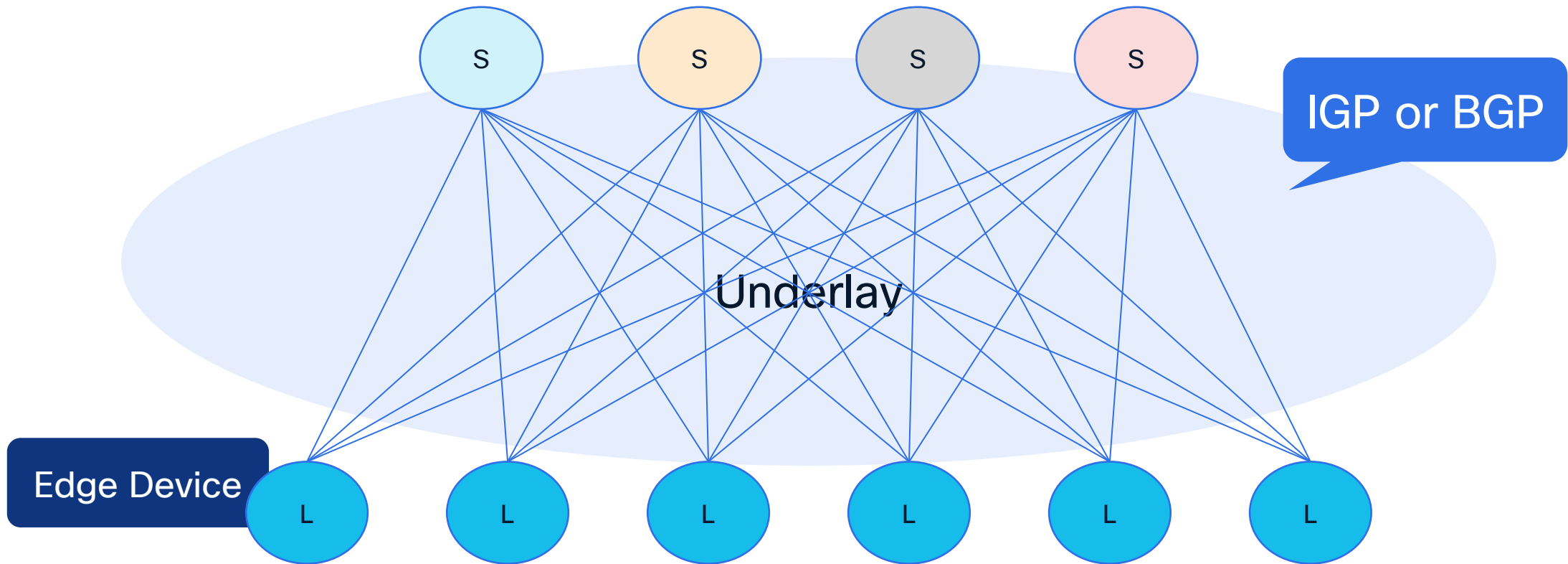
Functions of Border Gateway (BGW)

- Gateway (GW) to stitch multiple VXLAN BGP EVPN domains
- Provides Control- and Data-Plane separation
- Extends Layer-2 and Layer-3 with Control
- Allows to Scale beyond any Fabric Scale
- Facilitates Multi-DC and Multi-Pod Use-Cases
- More than just a Data Center Interconnect (DCI)



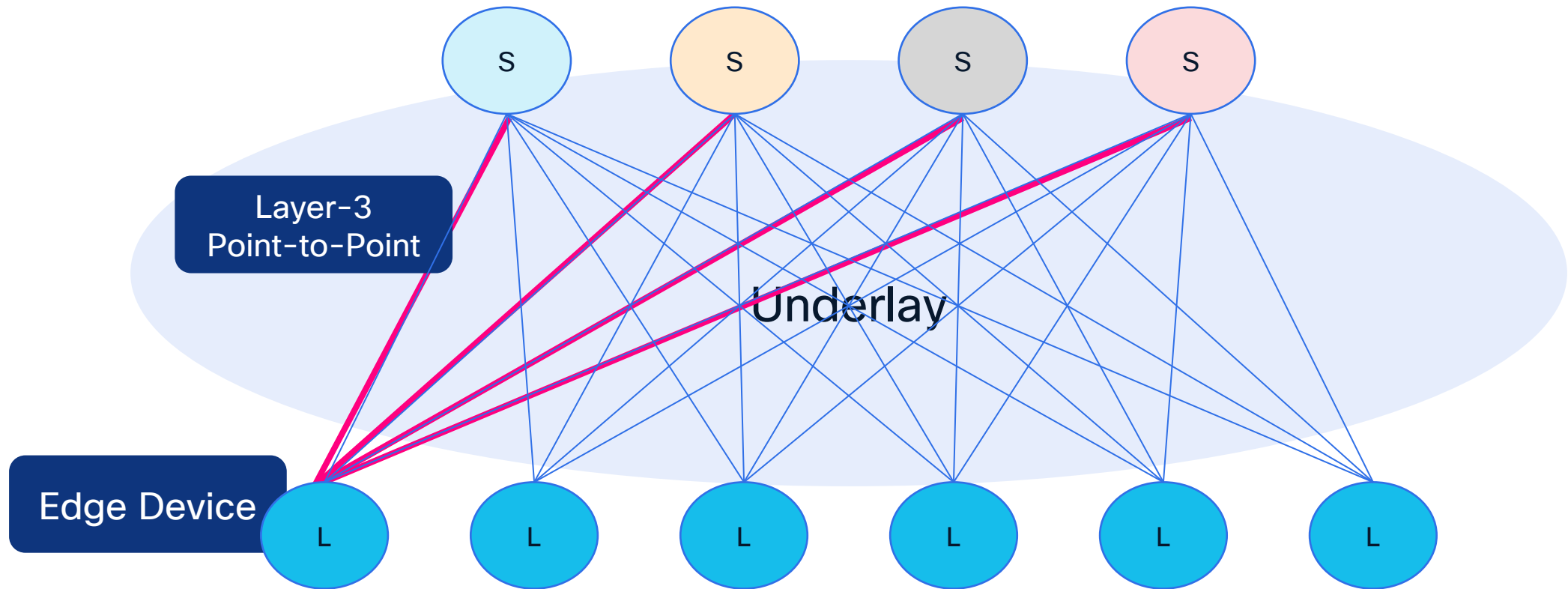
VXLAN: The Building Blocks

Underlay



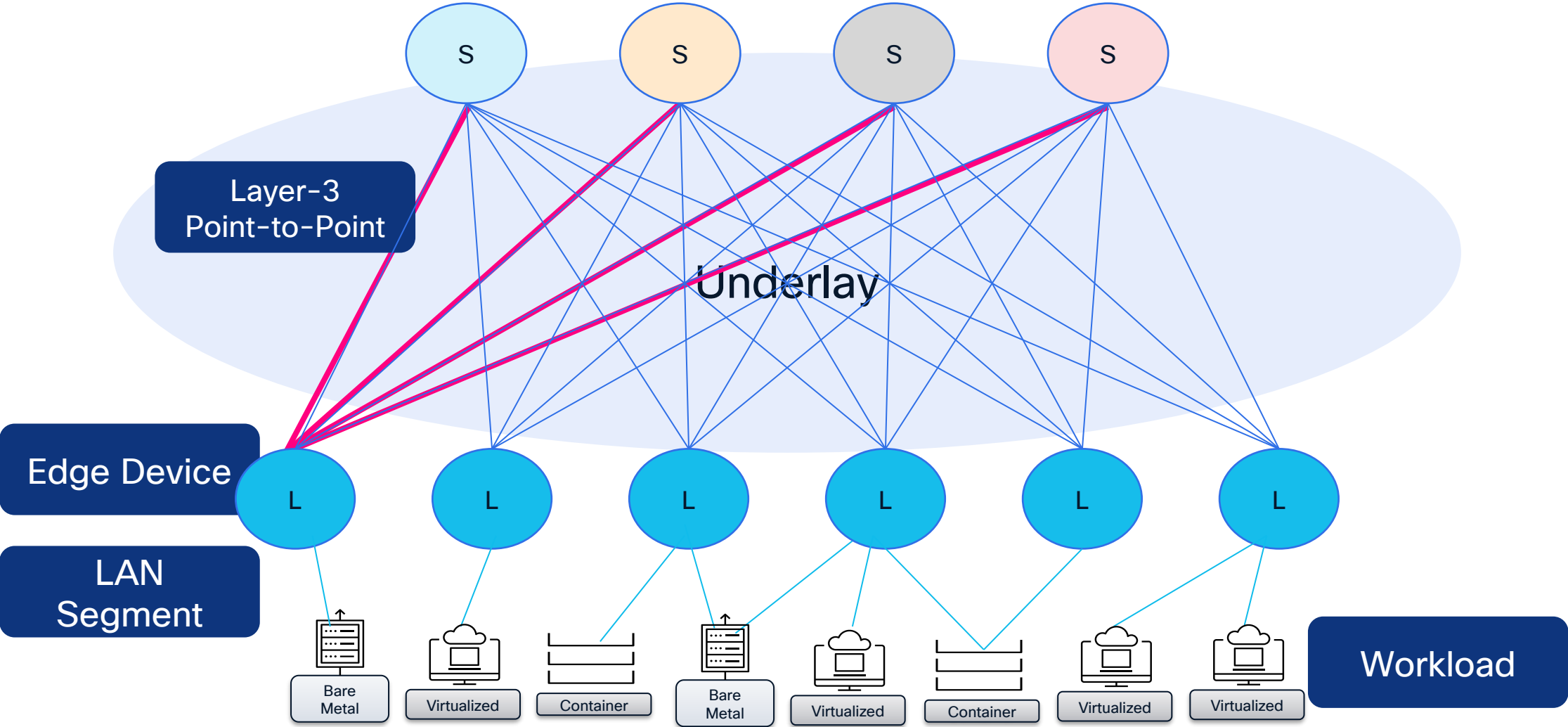
VXLAN: The Building Blocks

Underlay



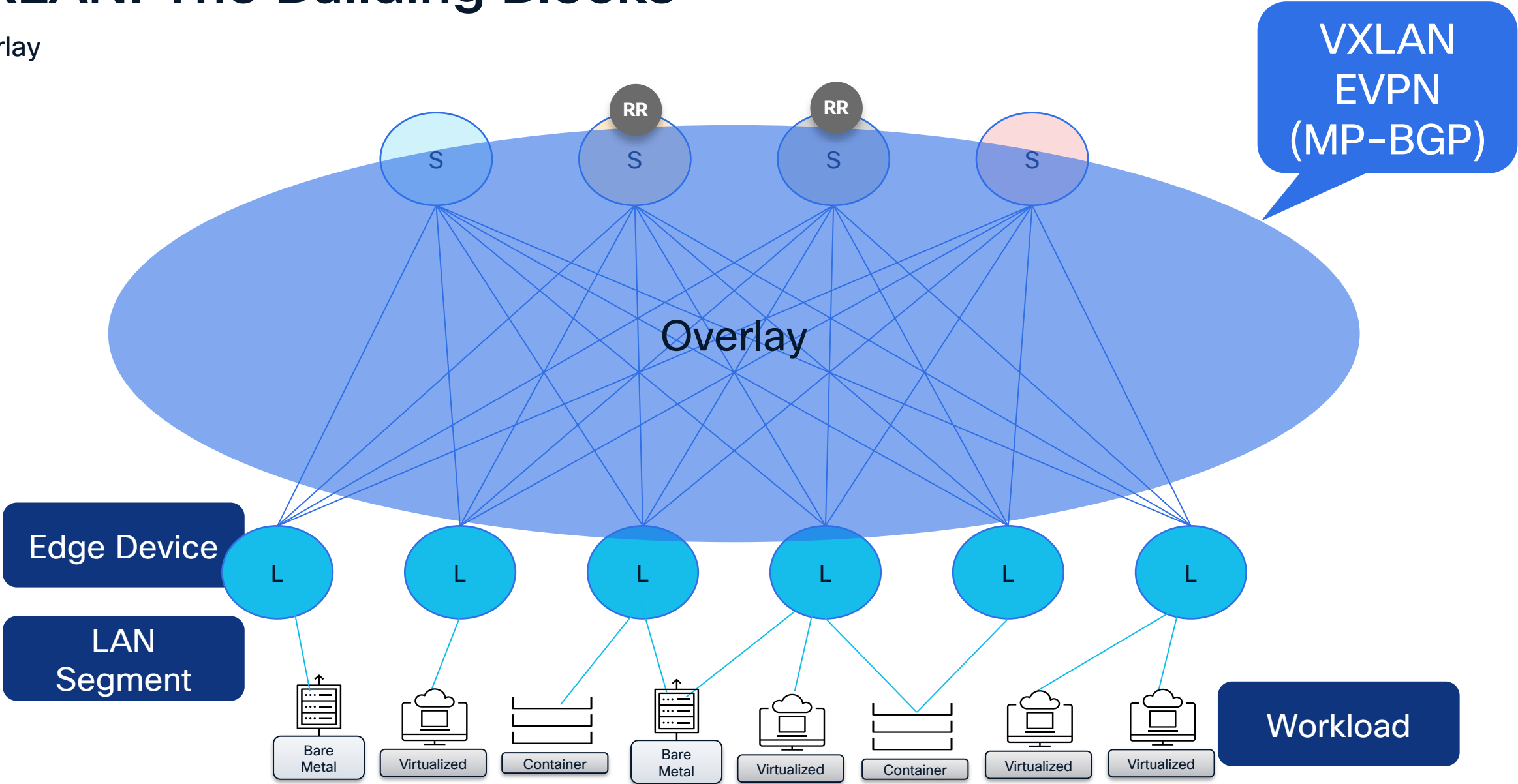
VXLAN: The Building Blocks

Underlay



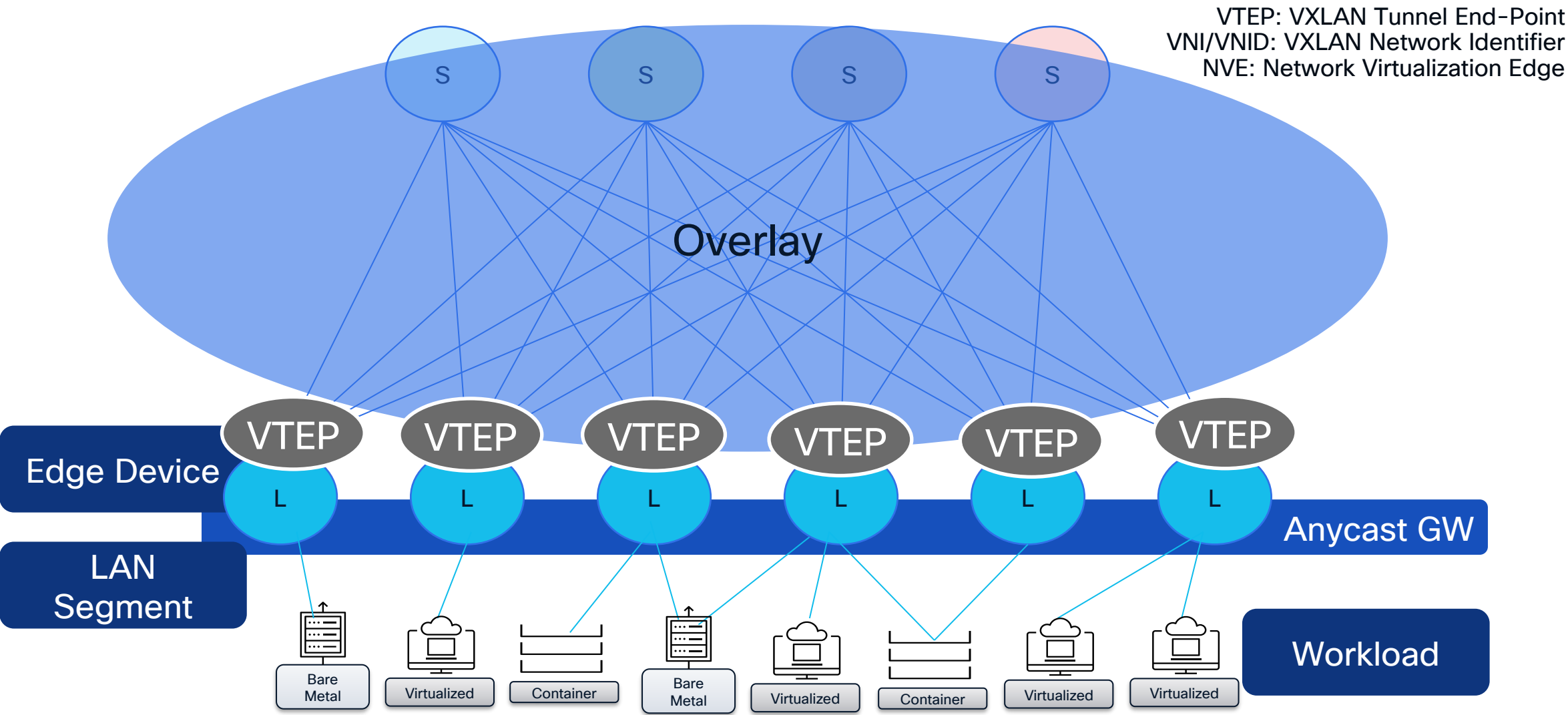
VXLAN: The Building Blocks

Overlay



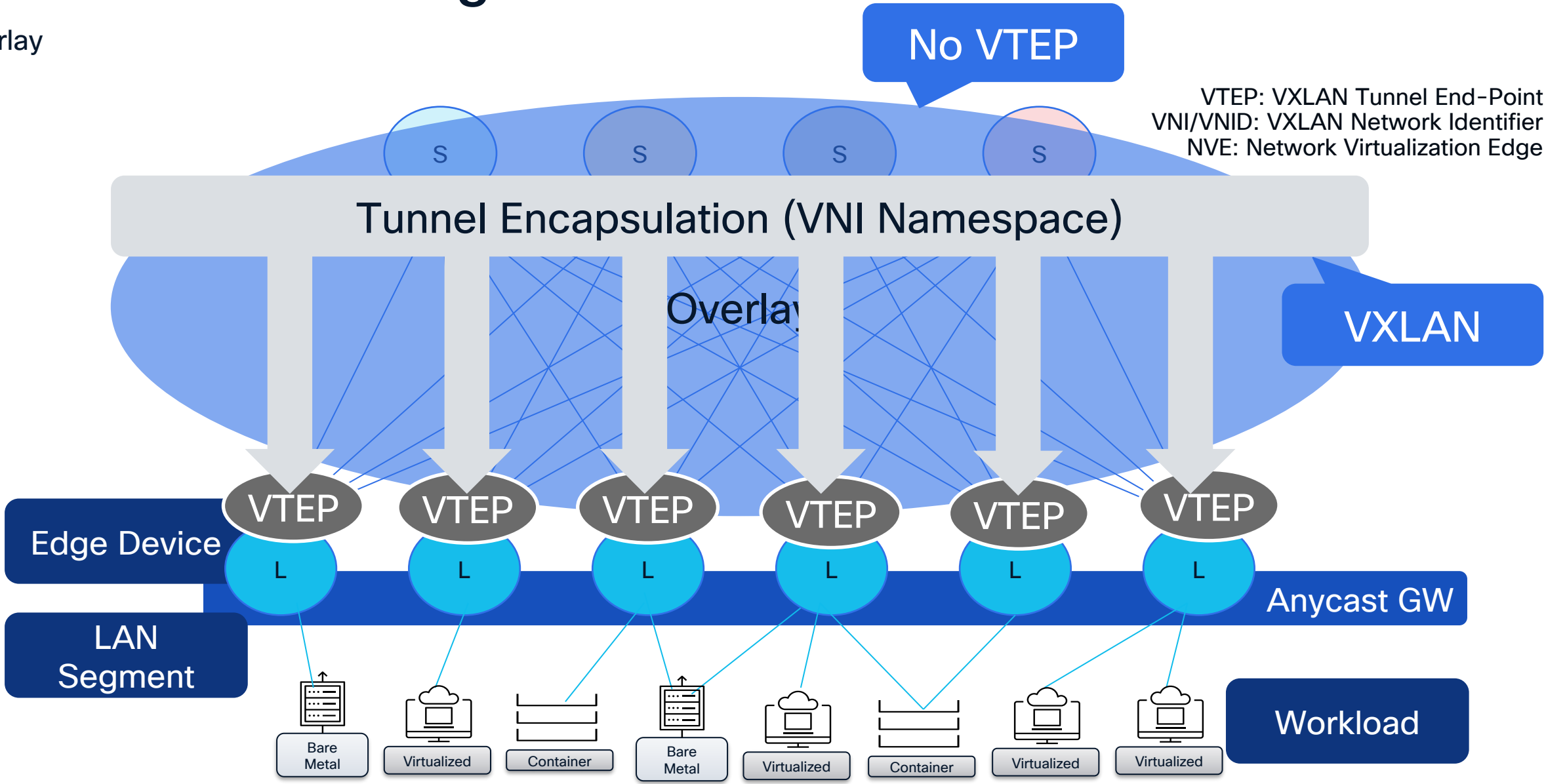
VXLAN: The Building Blocks

Overlay



VXLAN: The Building Blocks

Overlay

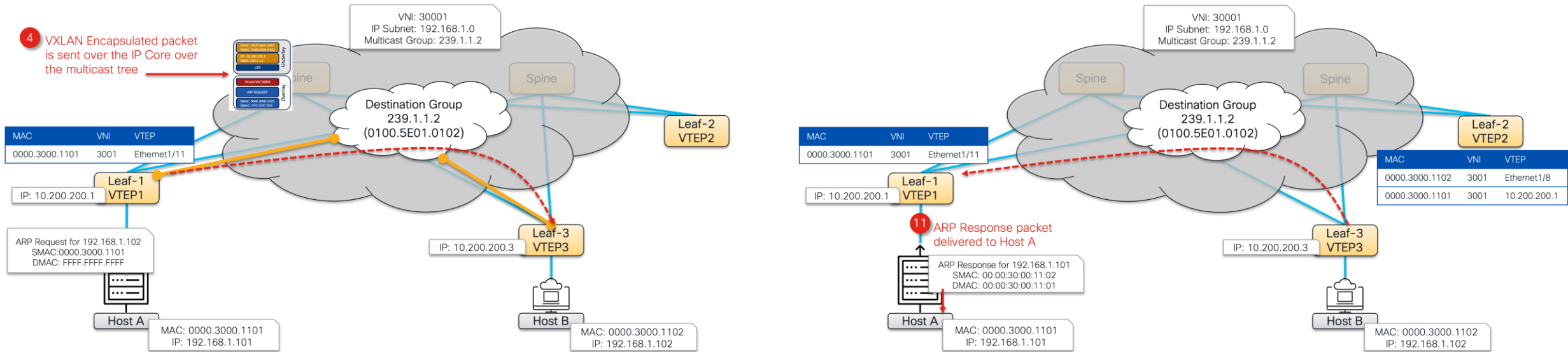


VTEP: VXLAN Tunnel End-Point
VNI/VNID: VXLAN Network Identifier
NVE: Network Virtualization Edge

VXLAN Flood & Learn Mechanism

Multicast Based – PIM

Multidestination Traffic is “Flooded” over the VXLAN Tunnel between VTEPs to “Learn” about the Host MAC addresses located behind the VTEPs so subsequent communication is delivered via Unicast

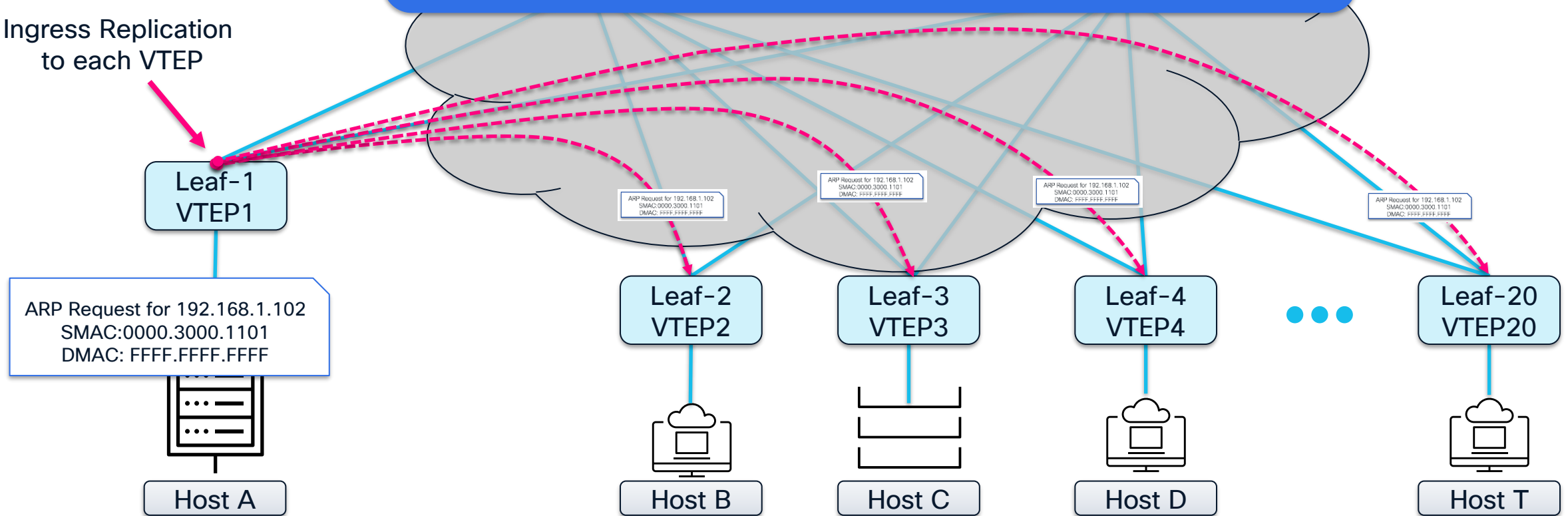


VXLAN Flood & Learn Mechanism

Unicast Based – Ingress Replication or Head-End Replication

- One unicast replica per remote VTEP
- Increases traffic load throughout the network
- Example: 10MB of BUM traffic for 20 remote VTEPs = 200MB of BUM traffic

Ingress Replication
to each VTEP



BGP EVPN *Route Types – RFC 7432

For your reference 

RFC/Draft	Route Type	Description	
RFC 7432	1	Ethernet Auto-Discovery EAD Route	BGP Based Multi-Homing Mass Withdrawal/Aliasing
	2	MAC/IP Advertisement Route	L2 VNI MAC or MAC-IP from L2 MAC Learning or ARP
	3	Inclusive Multicast Ethernet Tag Route	Dynamic Peer Discovery for EVPN Ingress Replication
	4	Ethernet Segment Route	BGP Based Multi-Homing BUM DF Election/Split-Horizon
draft-ietf-bess-evpn-prefix-advertisement	5	IP Prefix Route	IETF Draft, Advertise IP Prefixes

MP-BGP VPN Terminology

VPN Address Family

A Multi-Protocol BGP Extension to
Distribute VPN Routes

Virtual Routing & Forwarding (VRF)

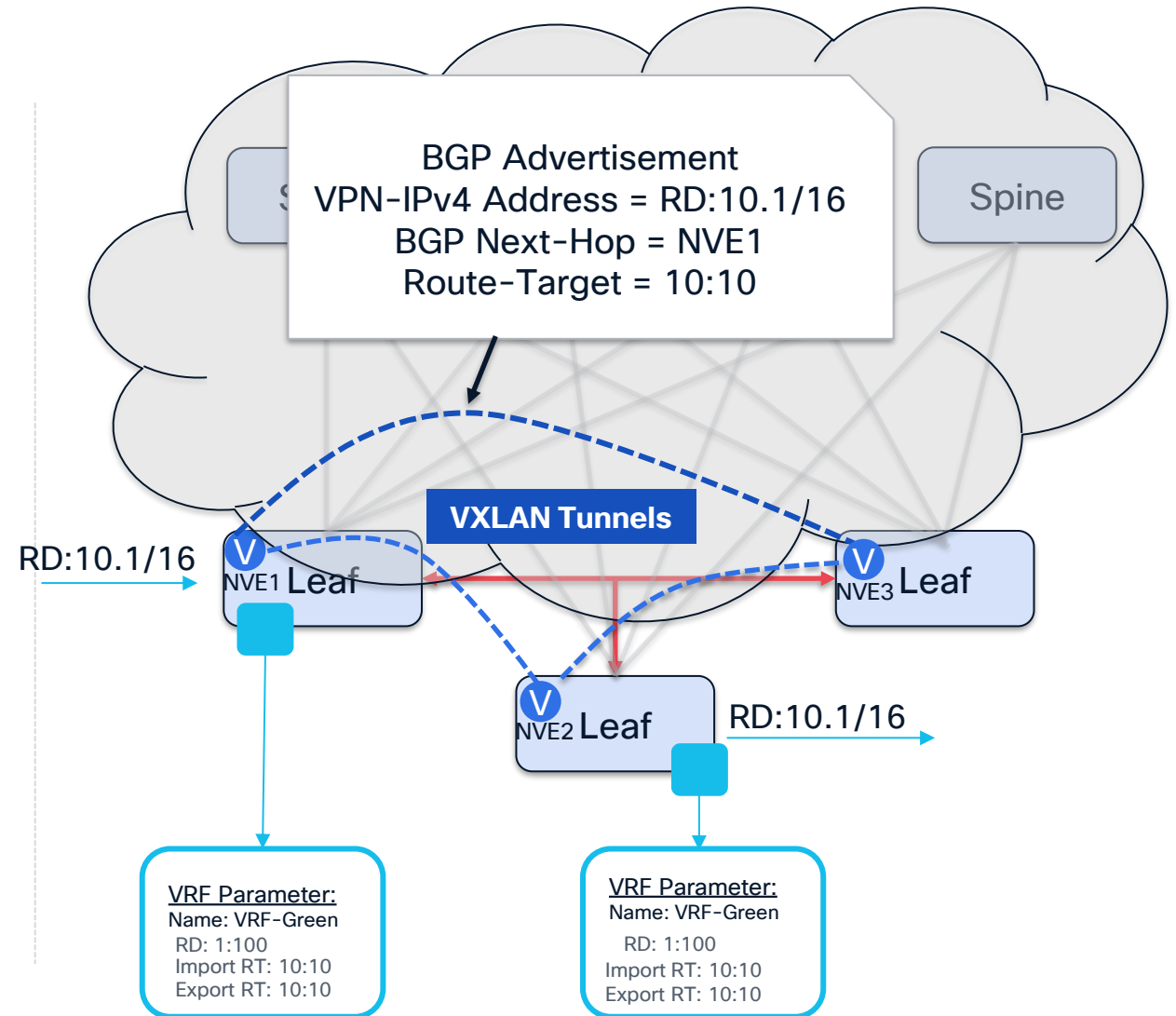
Overlay MAC or IP Routes are stored in
dedicated VRF tables (MAC or IP VRF)

Route Distinguisher (RD)

8-byte Field, VRF Parameter
Value to make the MAC or IP Routes unique
(RD + VPN prefix)

Route Target (RT)

8-byte Field, VRF Parameter
Value for the Import/Export Rules of
VPN Routes (MAC or IP) into the VRF



EVPN in the Data Center

MP-BGP for EVPN

- MP-BGP is the routing protocol for EVPN
- Multi-tenancy construct using VRF (Virtual Route & Forwarding)
 - Route Distinguisher, and Route Targets
- New Address Family “l2vpn evpn” for distributing EVPN Routes
- EVPN Routes = [MAC] + [IP]
- iBGP or eBGP Support

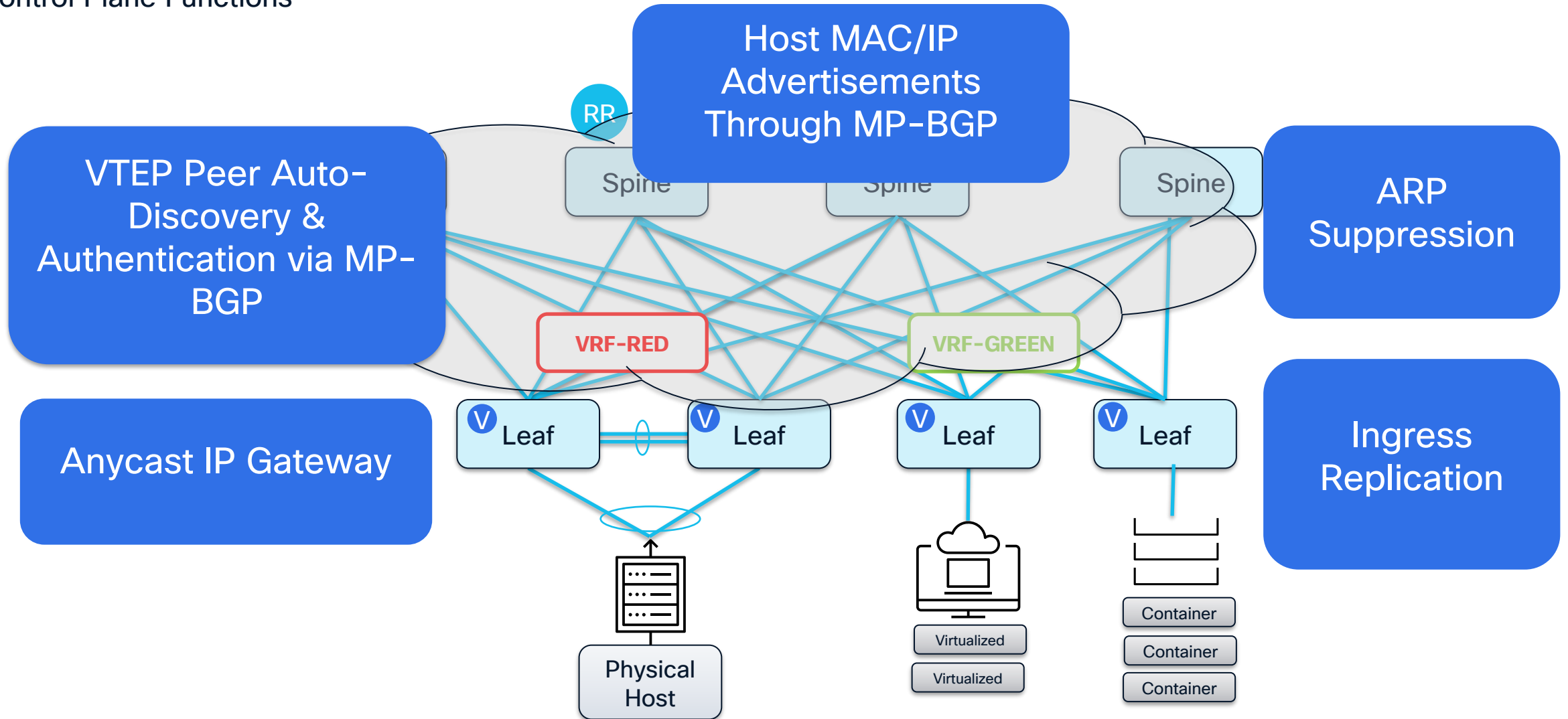
```
vrf context myvrf_50000
vni 50000
rd auto
address-family ipv4 unicast
route-target both auto
route-target both auto evpn
```

```
evpn
vni 30000 12
rd auto
route-target import auto
route-target export auto
```

```
router bgp 65101
router-id 10.2.0.1
neighbor 10.2.0.3
remote-as 65101
update-source loopback0
address-family l2vpn evpn
vrf myvrf_50000
address-family ipv4 unicast
advertise l2vpn evpn
```

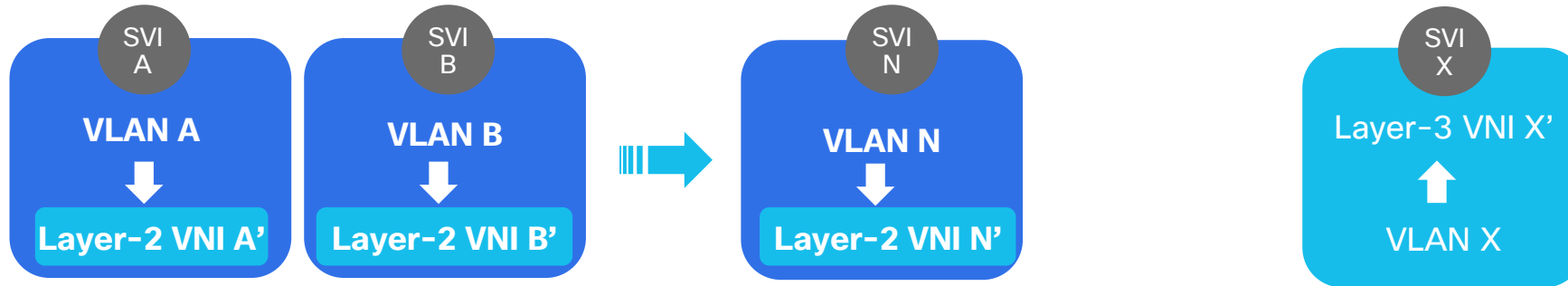
EVPN in the Data Center

Control Plane Functions



Logical Construct of Multi-Tenant VXLAN EVPN

Tenant A (VRF A)



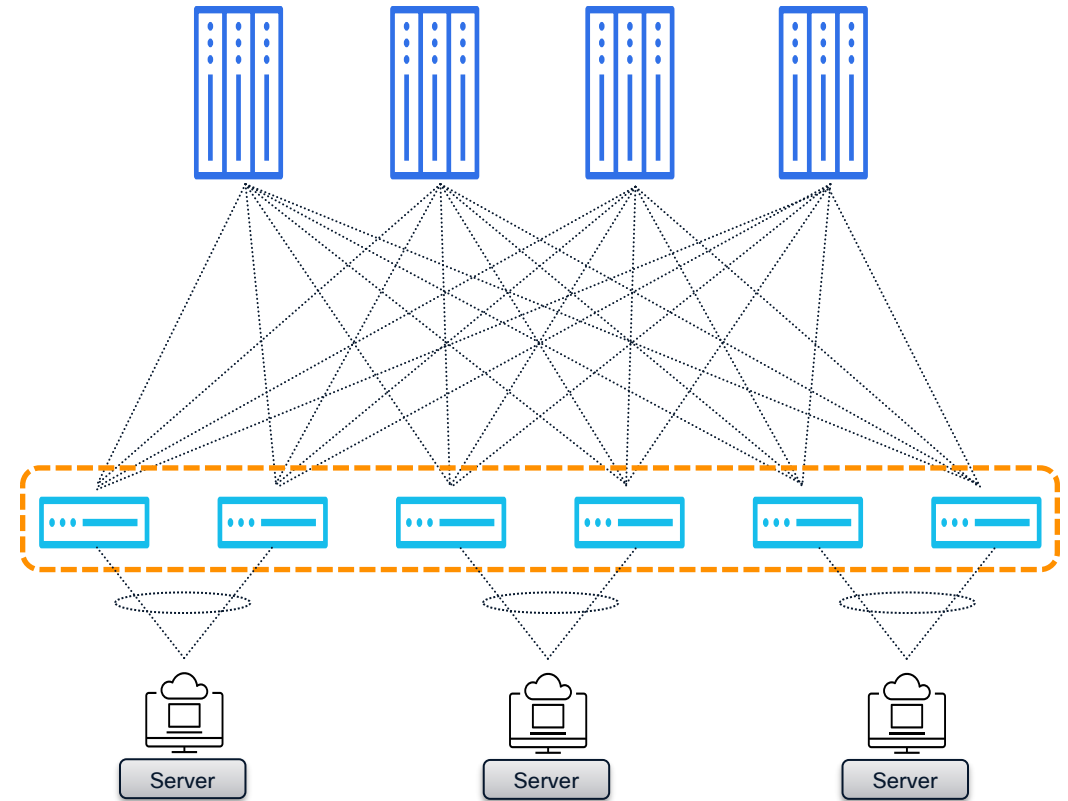
- One VLAN maps to one Layer-2 VNI per Layer-2 segment
- A Tenant can have multiple VLANs, therefore multiple Layer-2 VNIs
- Traffic within one Layer-2 VNI is bridged
- Traffic between Layer-2 VNI's is routed

- 1 Layer-3 VNI per Tenant (VRF) for routing
- VNI X' is used for routed packets

Host Connectivity in VXLAN Fabric

Virtual Port Channel (VPC)

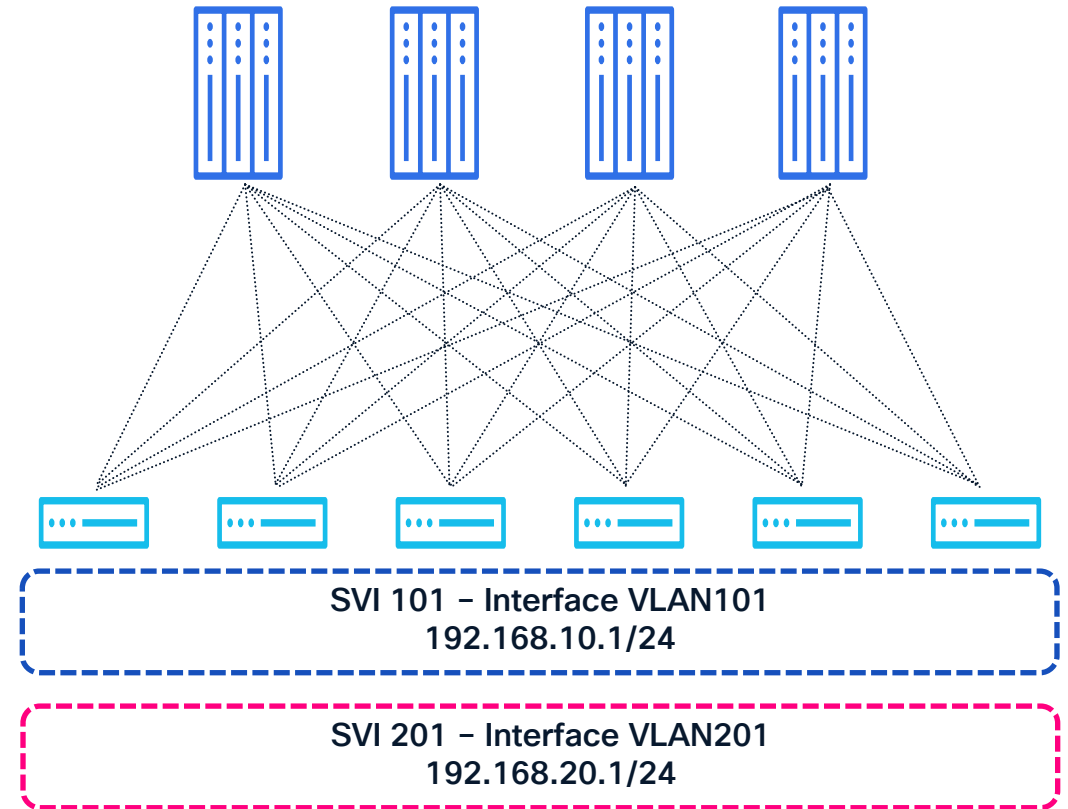
- Virtual Port Channel
 - Multi Chassis Link Aggregation
 - Layer-2 Multihoming
- Host Side Connectivity
 - Dual Connect Hosts Using Port Channels
- Fabric Side Connectivity
 - Individual VTEPs
 - Uses a Common Anycast VTEP
 - Seen as Remote VTEP from Remote Nodes
- VPC is Lone Multihoming Technology Supported by NDFC
- Standards Based ESI Support Coming in NX-OS 10.6(1)
- Physical Peer-Link is Optional, starting from NX-OS 9.2(3) Switches can be Configured with VPC Fabric Peering



First Hop Routing in VXLAN Fabric

Distributed Anycast Gateway (DAG)

- Distributed First Hop routing on Edge Device
 - All Edge Device Share Same Gateway IP, MAC Address
 - Pervasive Gateway Approach
- Gateway is Always Active
 - No First Hop Redundancy Protocol for Hello or State Exchange
- Associated to a Unique MAC address to Facilitate Host Mobility
- DAG is close to the End-Hosts, hair-pinning in the fabric is almost eliminated
- It scales out with the fabric, new switches will be configured with the DAG automatically, if required
- Distributed and Smaller State
 - Only Local Endpoints ARP Entries



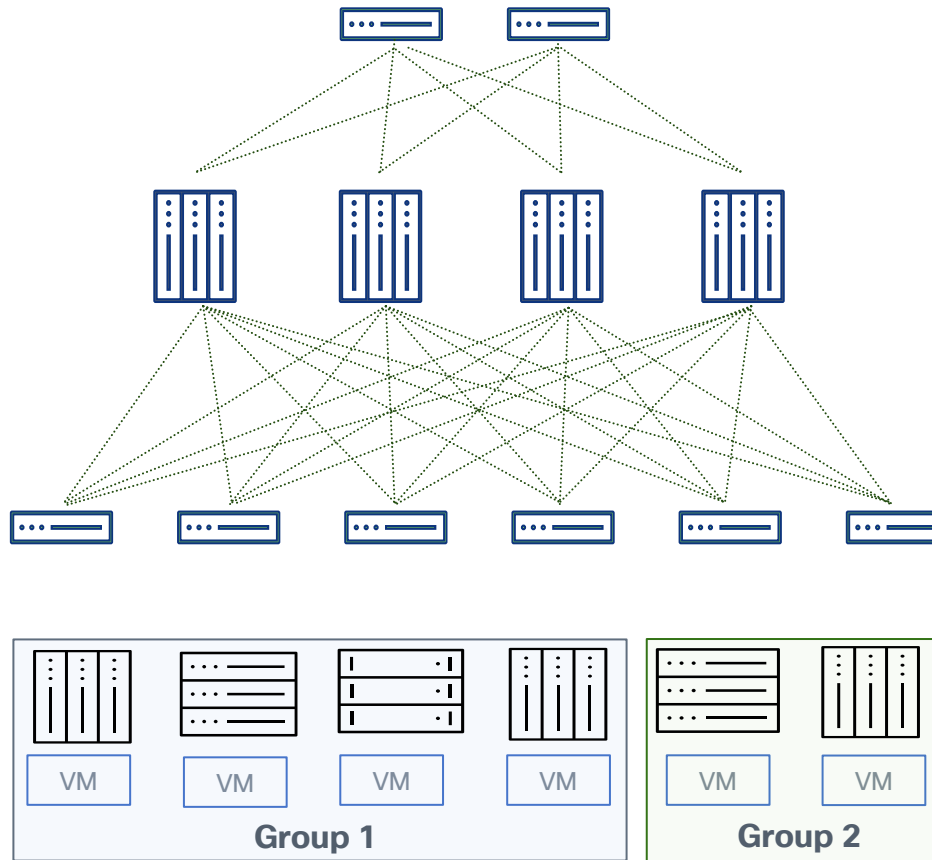
Design Building Blocks for VXLAN Fabrics

BGW

Spine

Leaf

Security



Border Gateways

- Dedicated or Shared Devices
- External Connectivity (WAN)
- East-West DCI Connectivity

Spines

- Fabric Bandwidth (i.e. 400G)
- High Availability (# of Spines)
- Scalability (Super Spines)

Leafs

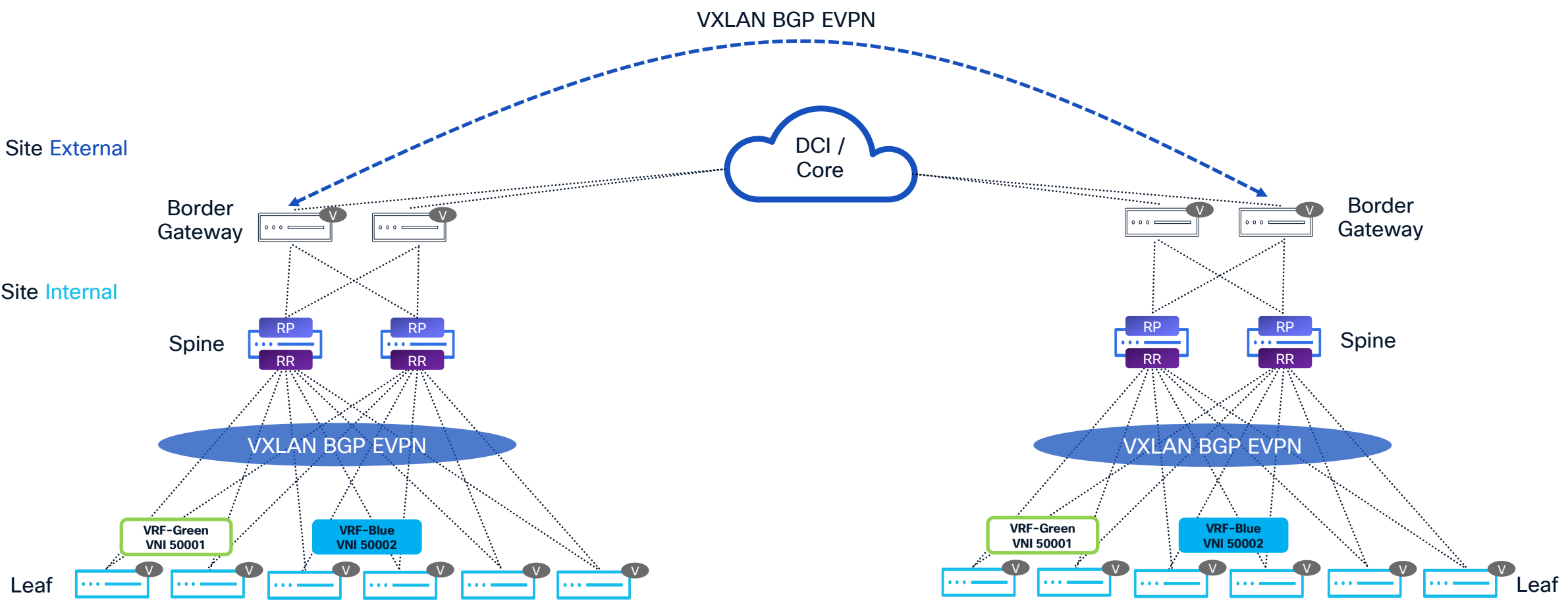
- Fabric Capacity (# of Ports)
- Fabric Connectivity (i.e. 25G)
- Host Redundancy (VPC/ESI)

Security

- Network Segmentation (GPO)
- Device Segmentation (FW)
- Host Segmentation (Agent/DPU)

Multi Fabric Designs – VXLAN Multi Site

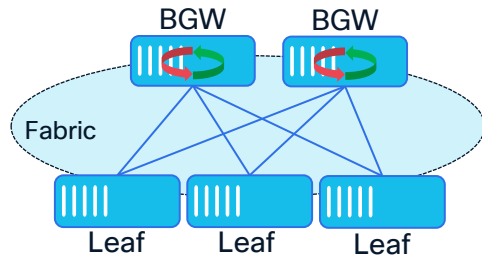
Connecting Multiple VXLAN EVPN Sites



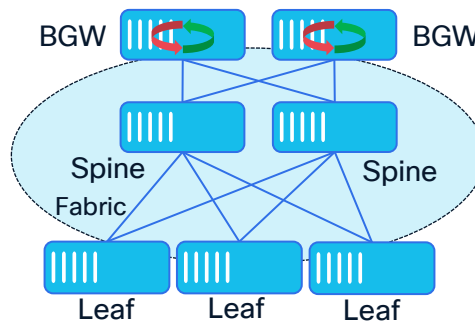
Border Gateways

Deployment Considerations

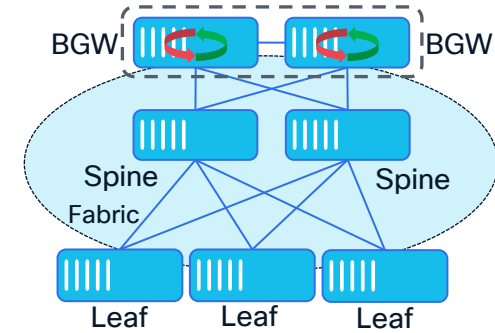
Shared Anycast Border Gateway



Dedicated Anycast Border Gateway

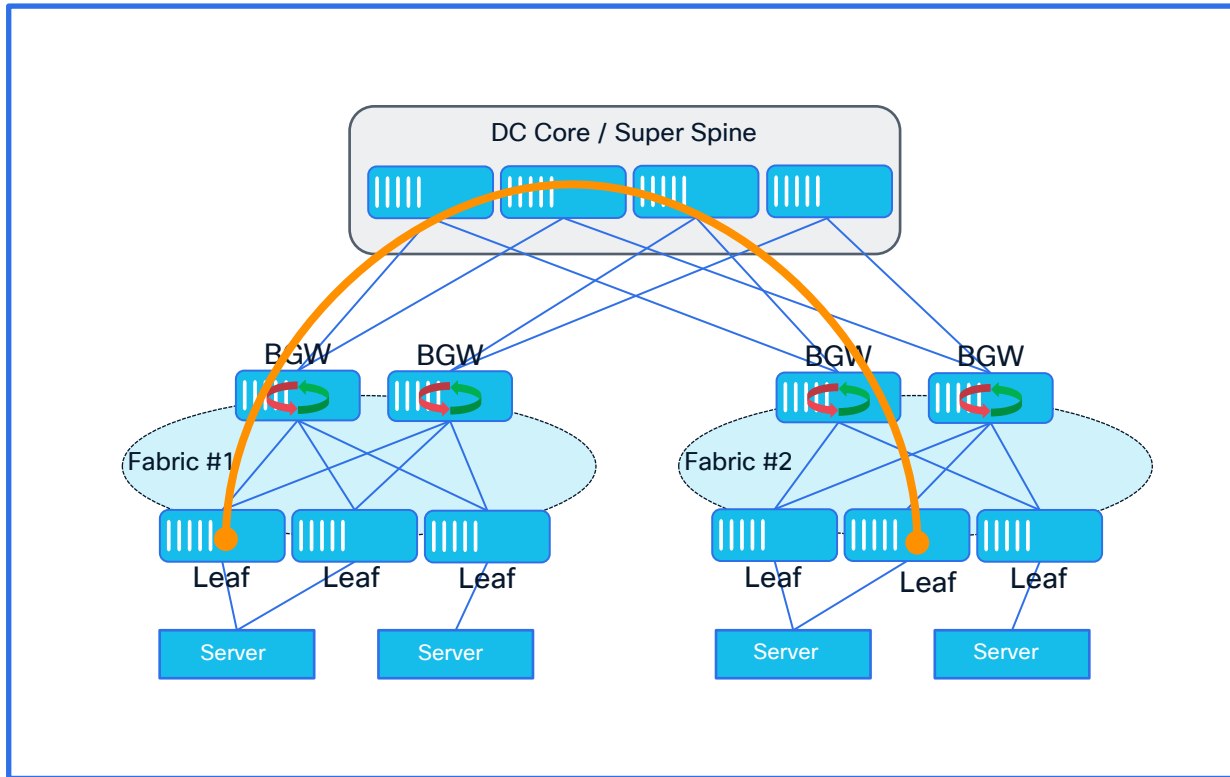


Dedicated vPC Border Gateway



- Border Gateways used for two main functions:
 - Interconnecting each site to the Inter-Site network (for East-West traffic flows)
 - Connecting each site to the external Layer 3 domain (for North-South traffic flows)
- Possible deployment models:
 - Anycast Border Gateways
 - vPC Border Gateways – The only supported method to connect end-hosts at the BGW level
- BGW function enablement in the VXLAN EVPN fabric:
 - BGW is a logical role dictated by features and configurations. Devices can either be placed at the leaf or spine level

Use Case #1 - Compartmentalization



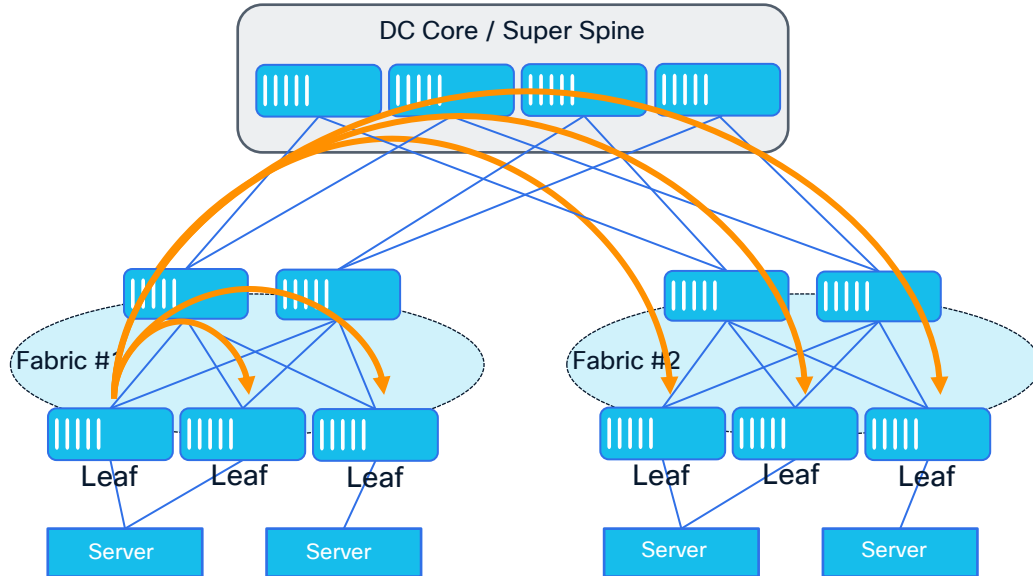
- Multiple Fabrics, single Data Center
 - Single or Multiple Data Halls
 - Within a Geographic Locations
- Control at BGW (Border Gateway)
 - Allows Layer-2 and Layer-3 Extension
 - VNIs are selectively advertised
 - Allows Traffic Control (BUM*)
 - Optimizes BUM* Replication

*BUM - Broadcast, Unknown Unicast, Multicast

BUM Optimization

Use Case #1 Compartmentalization

Single Fabric BUM with Ingress Replication

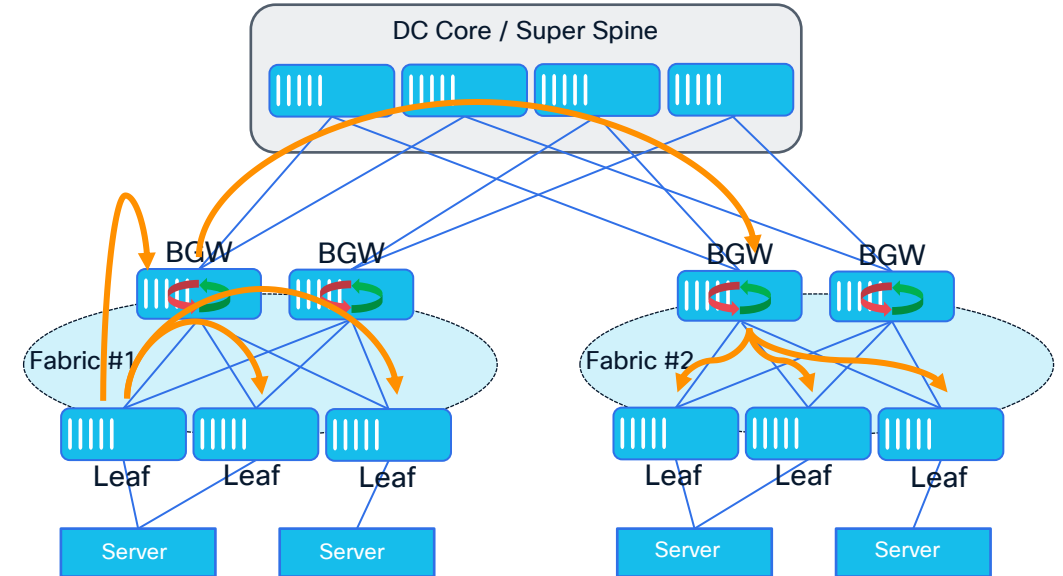


Single BUM Packet, 5x Replicated

3 Replication over DC Core / Super Spine (Between)

2 Replication for Fabric #1 (Local)

Multi-Site BUM with Ingress Replication



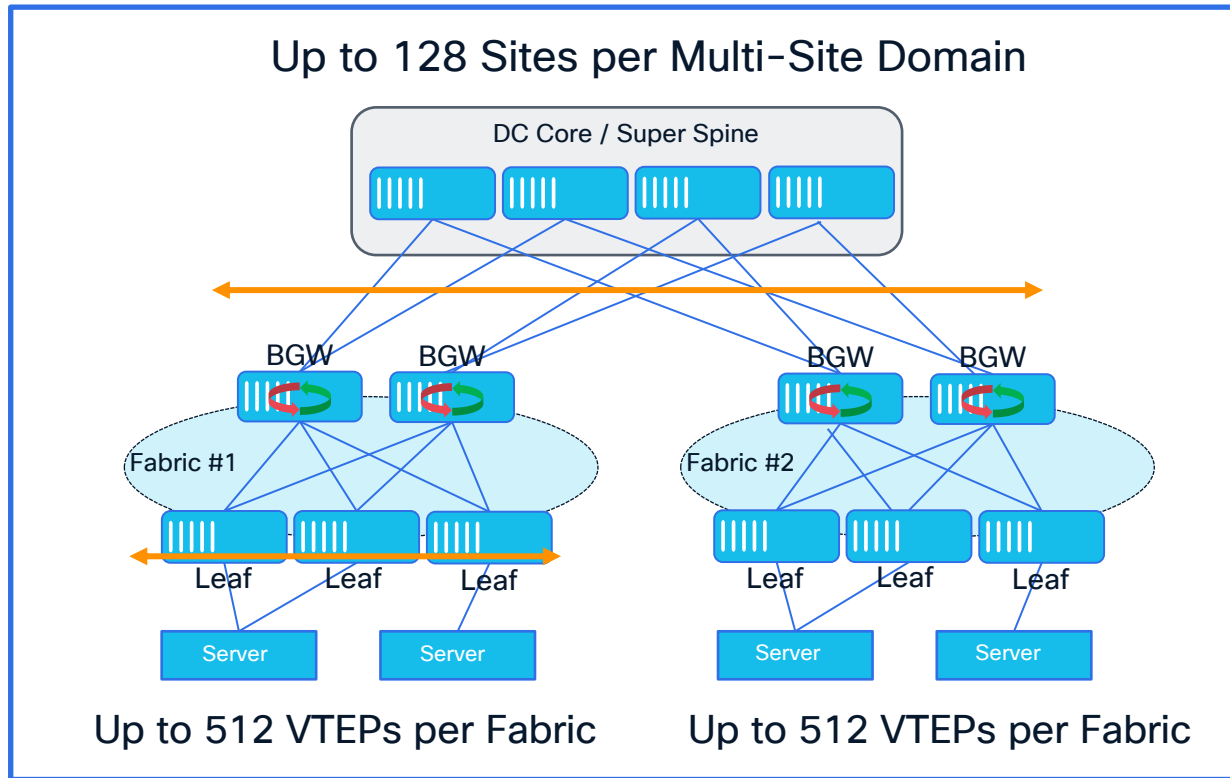
Single BUM Packet, 3x Replicated

1 Replication over DC Core / Super Spine (Between)

3 Replication for Fabric #1 (Local)

3 Replication for Fabric #2 (Local)

Use Case #2 – Building Scalable Networks



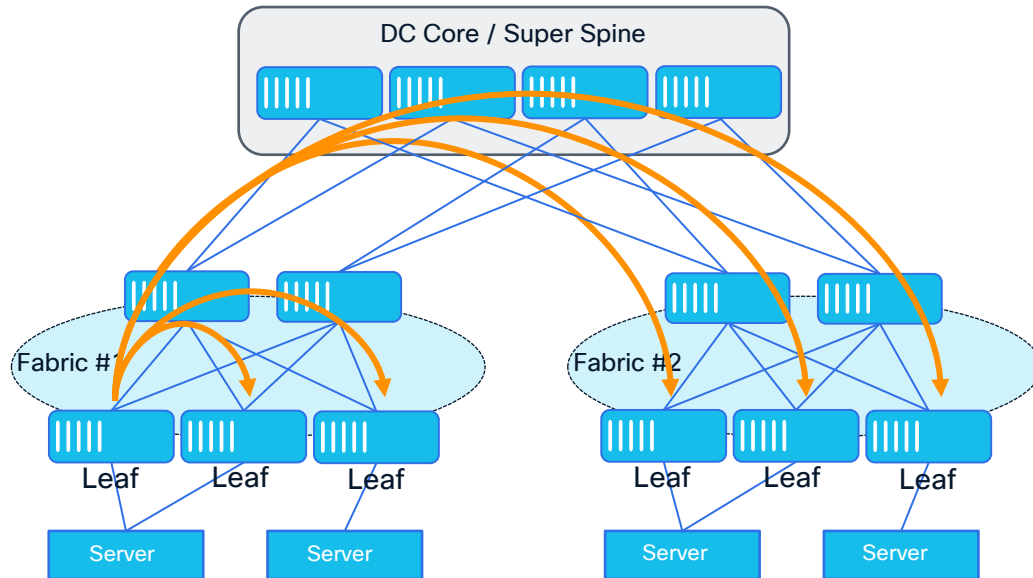
- Multiple Fabrics , single or multiple Data Center
 - Single or Multiple Data Halls
 - Within or between Geographic Locations
- Control at BGW (Border Gateway)
 - Reduces Remote VTEP Count
 - Expands VTEP scale
- Scale through Hierarchy
 - Multiply VTEP with Sites

64000+ VTEP to extend Layer-2 or/and Layer-3 segments

VTEP Scalability

Use Case #2 Building Scalable Networks

Single Fabric (or Multi-Pod)

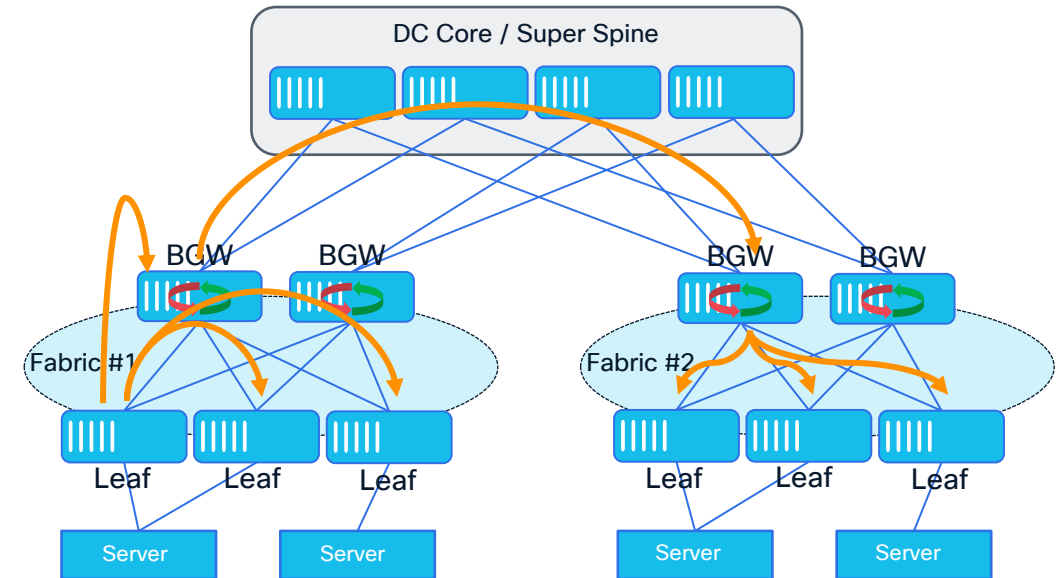


Leaf #1 sees every VTEP, 5 VTEP Peer

3 VTEP Peer for Fabric #2 (Between)

2 VTEP Peer for Fabric #1 (Local)

Multiple Fabric with Multi-Site

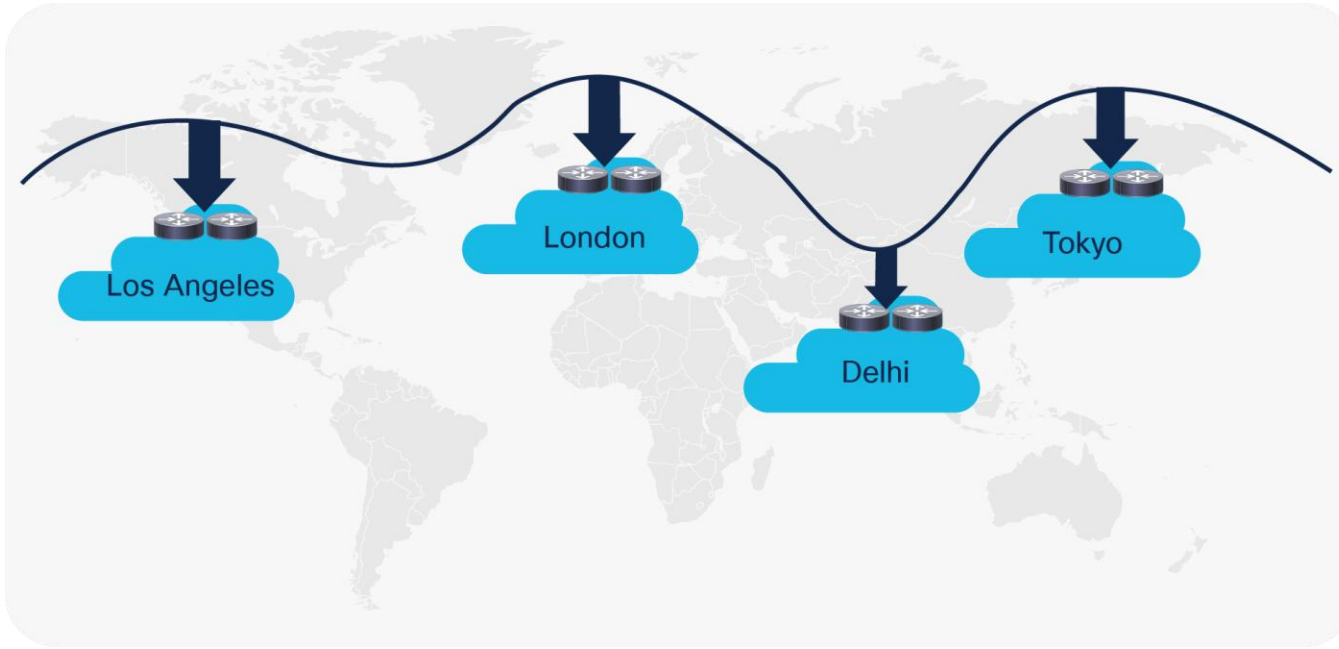


Leaf #1 sees only local VTEP, 3 VTEP Peer

1 VTEP Peer for Exit, BGW (Between)

2 VTEP Peer for Fabric #1 (Local)

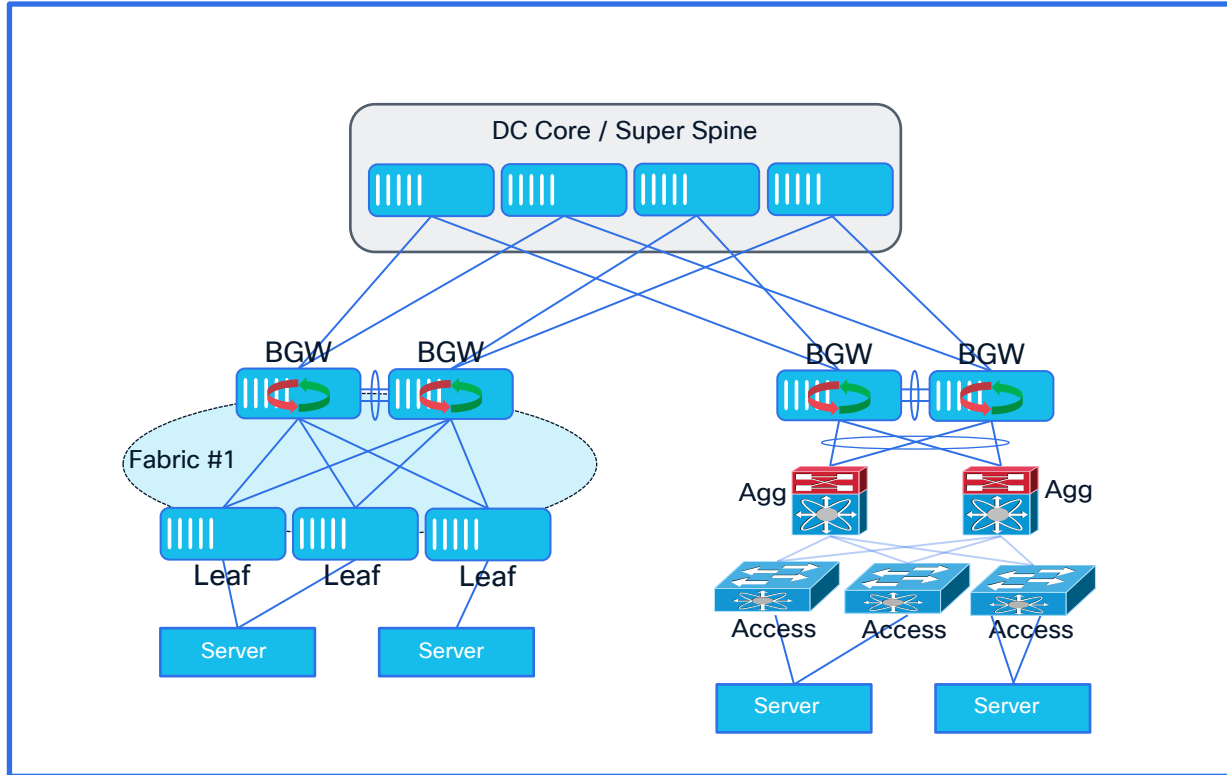
Use Case #3 – Data Center Interconnect (DCI)



- Multiple Fabrics, Geographically Dispersed
- Classic DCI Use Case
 - Allows Extension of Layer-2
 - Allows Extension of Layer-3
 - Allows Traffic Control (BUM)
 - Defines VNI allocation and stitching
 - Optimizes BUM* Replication

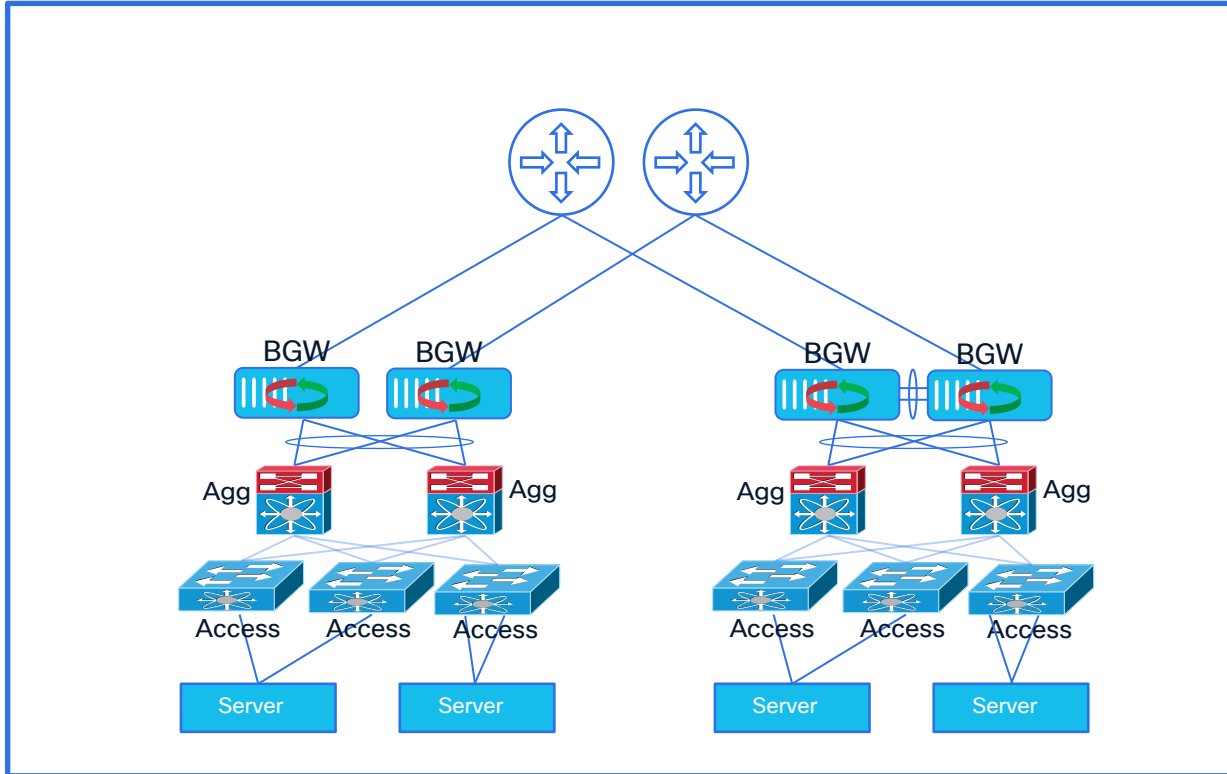
Works Within a Geographic Location – Works Between Geographic Locations

Use Case #4 – Integration with Legacy Networks



- Integrating Fabrics with Legacy Networks
 - BGW Frontends Legacy Network
 - BGW Frontends New Network
- Host Mobility and Migration
 - Provides Distributed Default Gateway
 - Allows Layer-2 Extension where needed
- Benefits from all Multi-Site functions
 - Layer-2, Layer-3 Multicast and Unicast VPNs between different Networks for Migration or Co-Existence
- Distributed Anycast Gateway and/or HSRP coexistence

Use Case #5 – Next-Gen DCI



- vPC Border Gateways used to provide a modern DCI architecture to two or more traditional fabrics
- Endpoint Default Gateways can be deployed on the vPC BGWs to provide the anycast functionality
- Single technology for a secure L2 and L3 extension

Multi Site Architecture Summary

#1

Border Gateway (BGW)

- A Gateway (GW) to stitch multiple VXLAN BGP EVPN domains
- Provides Control- and Data-Plane separation
- Extends Layer-2 and Layer-3 with Control
- Allows to Scale beyond any Fabric Scale
- Facilitates Multi-DC and Multi-Pod Use-Cases
- More than just a Data Center Interconnect (DCI)

#2

VXLAN BGP EVPN Multi-Site

- A Simple add or drop-in
- First introduced in September 2017 – proven and deployed
- A Solution combining EVPN DCI Overlay (RFC9014) and IPVPN-EVPN interworking (draft-ietf-evpn-ipvpn)
- Provides Layer-2 and Layer-3 extension
- Wide Hardware Support
- Flexible Deployment Option – Not just for VXLAN Fabrics

Nexus VXLAN Fabric Security

Security for Open and Programmable Fabric



Secured Traffic

- VXLAN IP First-Hop-Security FHS 10.4(1)F
- Multi-Site Storm Control
- Private VLANs 10.2(3)F
- Hardware Line-rate encryption (MACSec)
- Multi-hop VTEP encryption (CloudSec)
- Group Policy Option 10.4(3)F



Visibility and Proactive Threat Response

- Netflow w/ Stealthwatch
- Nexus Dashboard- Proactive Advisories
- GNMI Streaming Telemetry



Secured Services

- RADSec (RFC 6614)
- Secure NTP
- RADIUS over DTLS (10.4.3)



Security Compliance

- FIPS
- Common Criteria
- NDcPP
- UC-APL

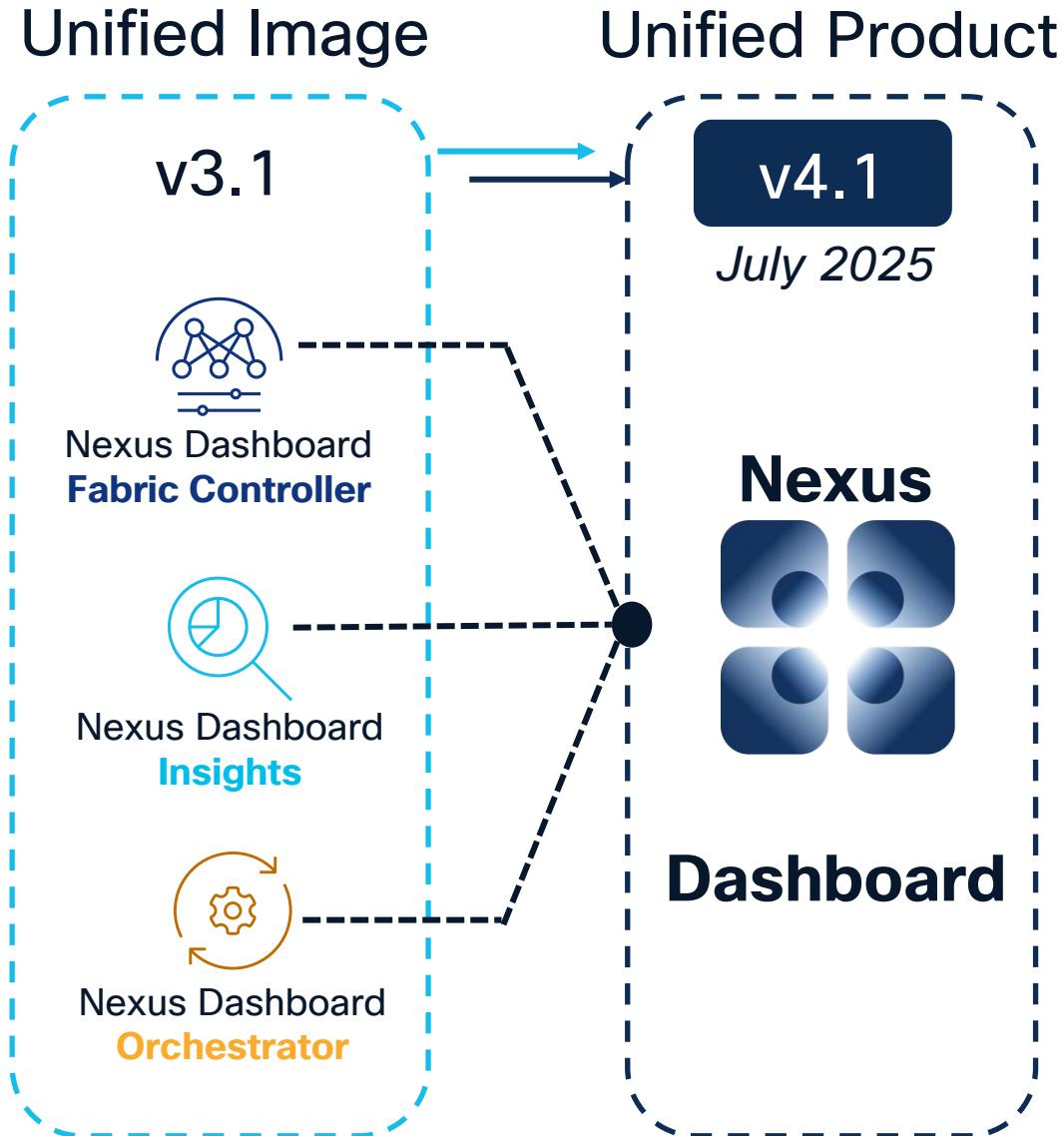
Nexus VXLAN Fabric Operations

Cisco Nexus Dashboard – Product Unification

Unified Image



- Single Image Installation
- All Services pre-installed (NDO/NDI/NDFC)
- Service versions bound to ND version



Unified Product

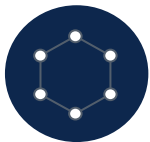


- Single image installation
- Services merged into base OS
- Services == ND Capabilities
 - Automation [Controller]
 - Telemetry
 - Orchestration

Cisco Nexus Dashboard Vision



Your **key** to a simple operational experience
Unify data center network architectures
Accelerate business innovation, minimize risk
Unleash the power of AI for networking
Reactive, proactive and **predictive** insights
Leverage **open** protocols and standards



Provision

Once, deploy anywhere

Built-In automation |
Infra-as-code



Secure

One source of truth

Segmentation |
Zero-Trust



Manage

One logical network

Visibility |
Maintenance



Analyze

Identify, troubleshoot,
and fix faster

Tools | Reports |
Prediction

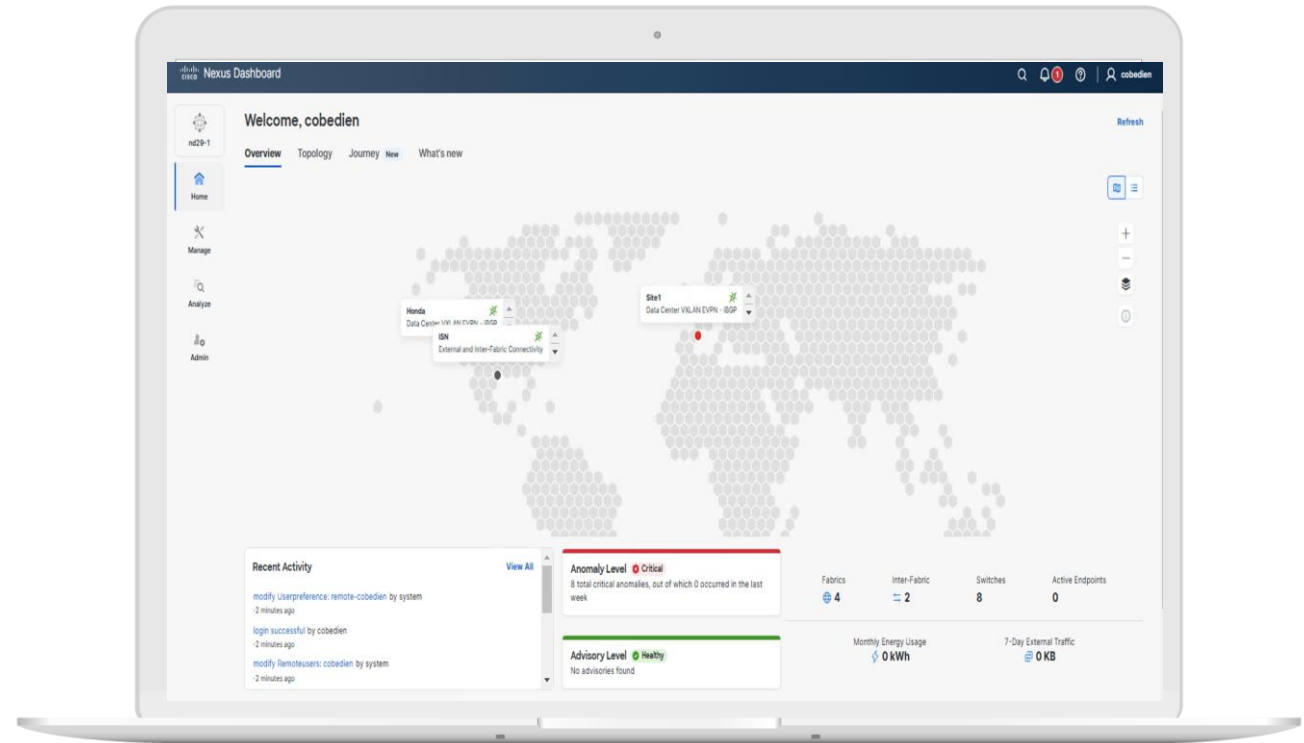
Cisco Nexus Dashboard Architecture

Microservices Architecture

Both Virtual and Physical ND Supported

One Manage | Multi-Cluster Support

3-Node Active-Active High Availability



Benefits

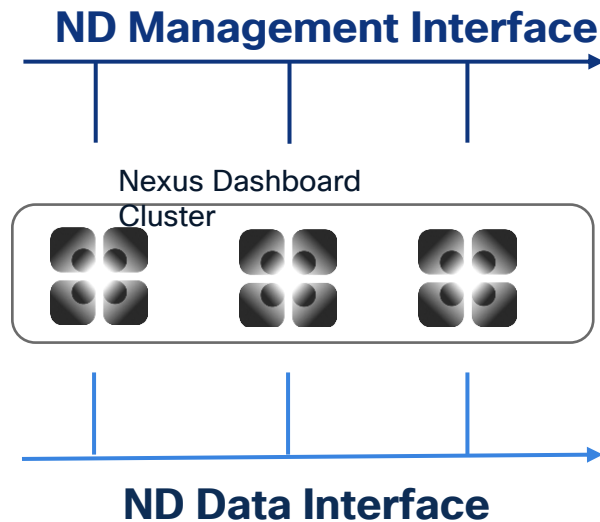
Flexibility and Scalability

Highly Customizable

Single Vantage Point

Cisco Nexus Dashboard Clustering

Each Nexus Dashboard Node in a cluster has two interfaces, each in a *different* subnet



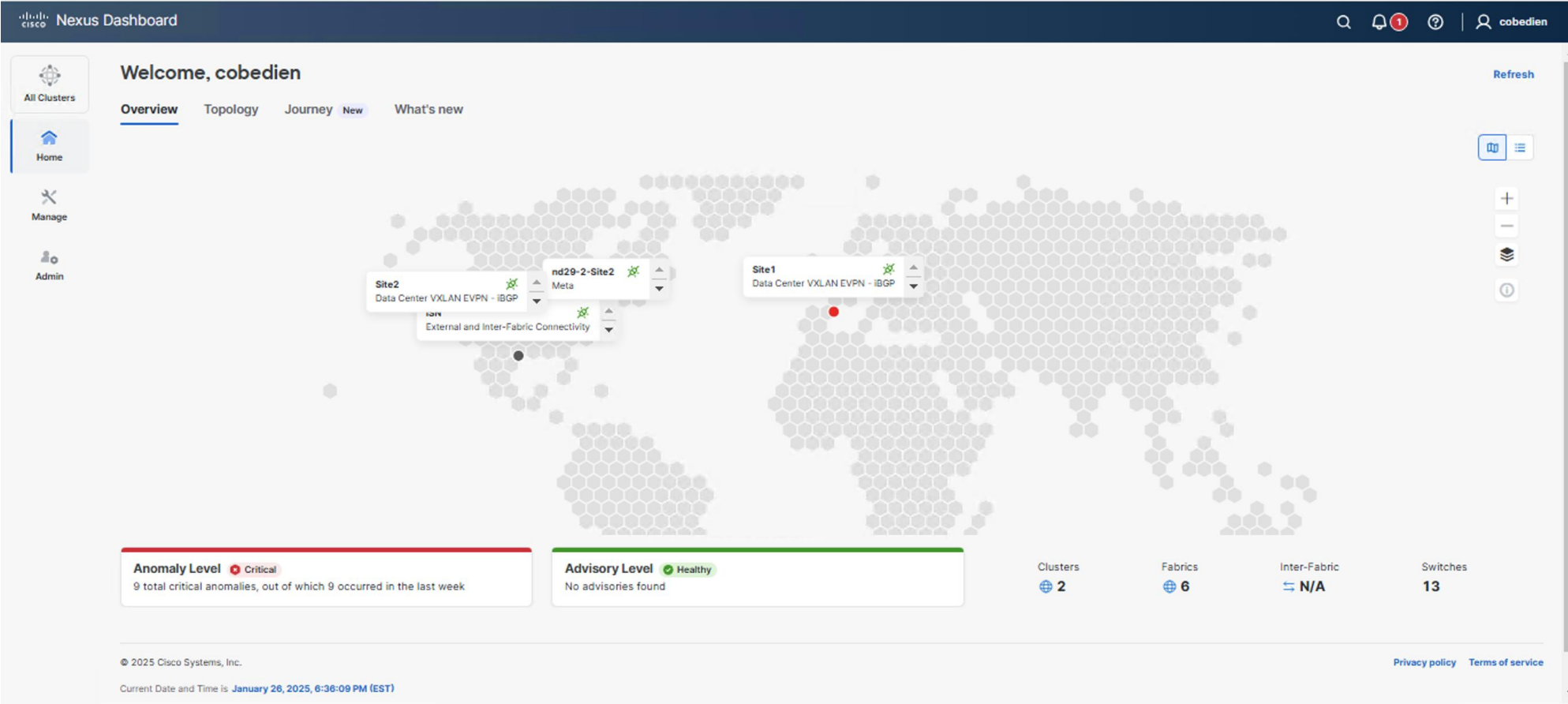
Nexus Dashboard Management Interface

Connects to the management network, and it provides web/API access to the Nexus Dashboard cluster

The Nexus Dashboard Data Interface

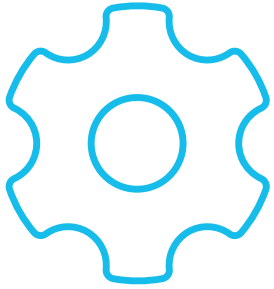
Connects and provides IP reachability to the physical data center network infrastructure, via In-Band or Mgmt0 (OOB)

Cisco Nexus Dashboard One-Manage



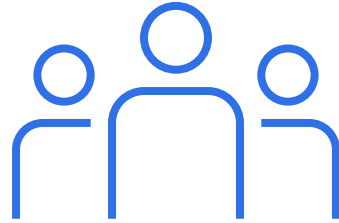
One-Manage View for Multi-Clusters

Cisco Nexus Dashboard Three Pillars



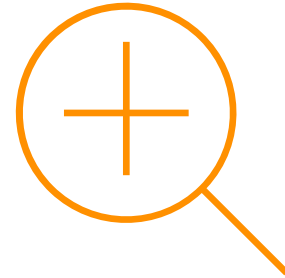
Automation

Accelerate provisioning
and simplify deployments



Management

In depth Management
and control for all
network deployments



Visibility

Get Centralized Visibility
and Monitoring views

Cisco Nexus Dashboard

One-Mange / Federation for Multi-Cluster Deployments



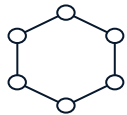
Single sign-on for clusters

(With remote authentication)



Single dashboard

Including a summary of fabrics, switch details, etc.



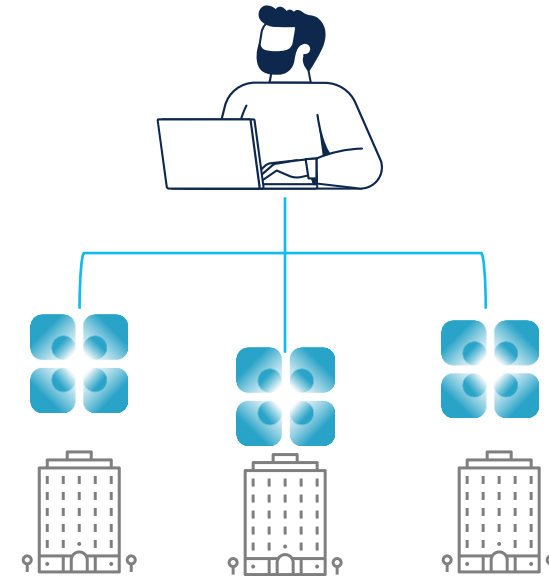
VXLAN EVPN Fabric

- Unified view and automation workflows for Multi-Fabric deployments
- Federation of MSDs
- L2/L3 Network stretch

10

Maximum clusters in a federation

Based on 4.1 scale (*Increased from 4 in v3.2*)



Distributed Data Centers

Benefits

Scale Out Deployments

DCI Control Between DC
and ND (Multi-Fabric)

DCI Connectivity Health,
Tunnel Path and Statistics

Automation

Accelerate Provisioning From Days to Minutes

Day 0 - VXLAN EVPN Underlay Configuration

Define fabric settings (Underlay/Overlay), AS#, Replication Mode, IGP, IP Pools

Import Switches and Define Roles

Calculate and Deploy

Day 1 - VXLAN EVPN Overlay Configuration

VRF and Network Configuration and Attach

Interface Policy and Attach

Calculate and Deployment

Benefits

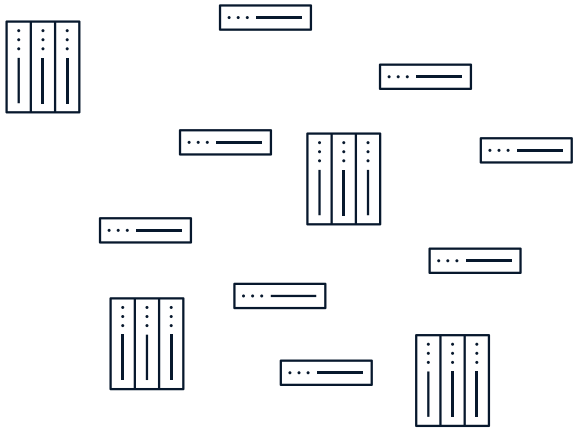
Simplify Fabric
Deployments

Developer Agility

VXLAN EVPN Multi-Site

Provision New Fabric in Minutes

Un-provisioned switches

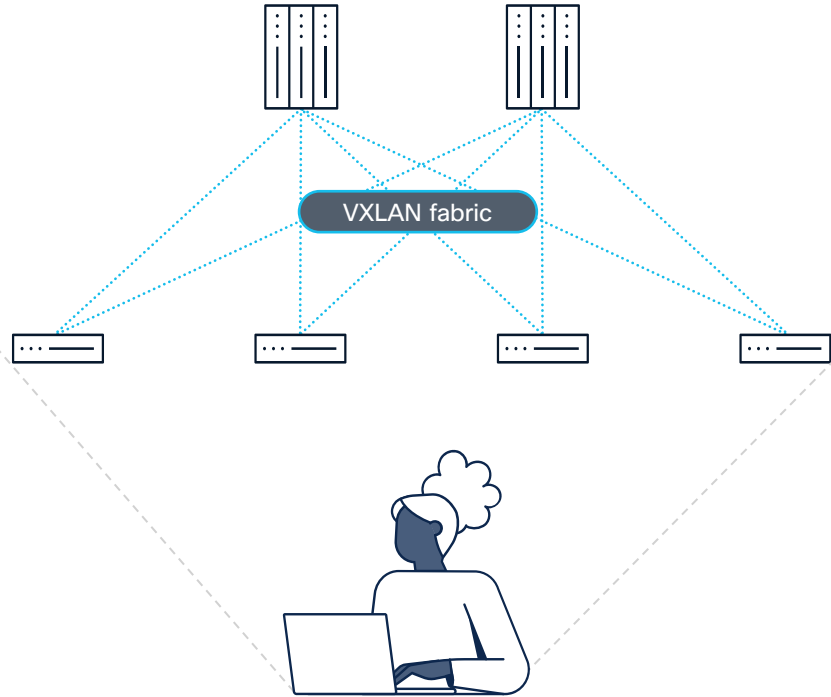


Fabric Builder



Cisco Best Practice
Configuration Built-In

Support for Both Greenfield
and Brownfield Deployments



Benefits

Accelerate Fabric
Deployments

Automated Consistency

Minimize Risk

Data Center VXLAN EVPN – Day-0 Underlay

Not on VXLAN EVPN Today?



Nexus Dashboard
Automation



Build VXLAN fabric
in few minutes



Templates already
embed best practices



IP addresses, overlay pool,
routing profiles, replication
attributes –all taken
care by ND

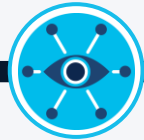
Step 2 Discover

Import switches with POAP or Day-0 config
Define switch Roles (Border, Leaf, Spine, etc)
[Optional] Create vPC pairs



Step 1 Create

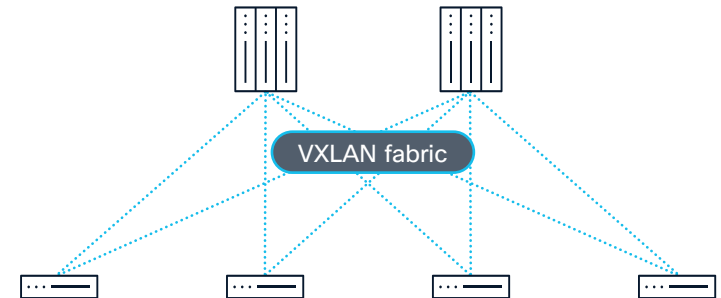
Define fabric settings (Underlay, Overlay) –
AS#, Replication Mode, IGP, IP Pools, etc.



Step 3 Recalculate and Deploy

Generates config based on intent
Preview side by side diffs

Cisco Best Practice Implemented



Fast, automated process



Zero Touch Deployment

POAP – Power On Auto Provisioning



Flexible bootstrap and management via in-band (front-panel port) or out of band port

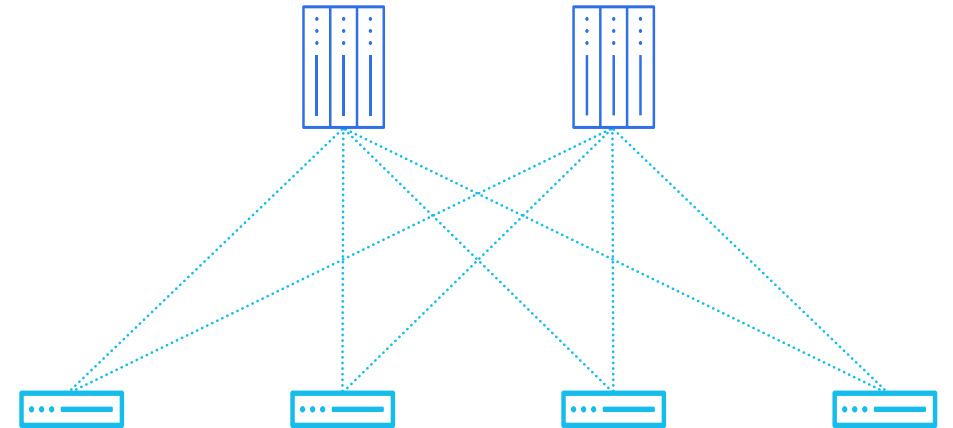


Supports VXLAN EVPN, classic LAN fabrics



Convenient connectivity options for all device roles: leaf, spine, border leaf, border spine

Inband or OOB Connectivity



Benefit

Zero Touch Fabric Onboarding and Management

Fabric Switch Role Example

Different Roles for Border Gateway (BGW)

vPC Border Gateway

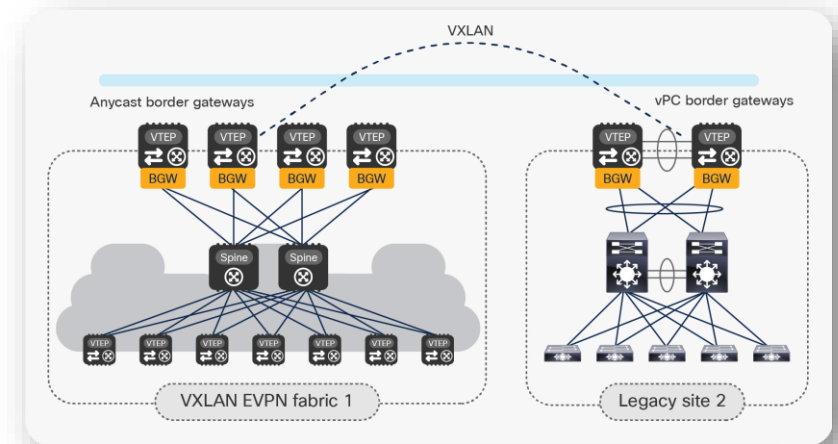
Used to locally dual-attach Layer 2 networks or Endpoints
Allows Distributed Anycast Gateway (DAG)

Border Gateway

Layer 3 based Anycast BGW deployed at the Leaf Layer

Border Gateway Spine

Layer 3 based Anycast BGW deployed at the Spine Layer



Select Role

Spine

Leaf (current)

Border

Border Spine

Border Gateway

Border Gateway Spine

Super Spine

Border Super Spine

Border Gateway Super Spine

ToR

Virtual Port Channel (vPC)

nd

Home

Manage

Analyze

Admin

Nexus Dashboard

Site1-Greenfield

RefreshView in topologyActions

OverviewInventoryConnectivitySegmentation and securityConfiguration PoliciesAnomaliesAdvisoriesIntegrationsHistory

SwitchesvPC PairsOther Devices

Filter by attributes

Actions

☐	Name	Anomaly Level	IP Address	Model	Configuration Sync Status	Role	Serial Number	Discovery Status	Advisory Level	vPC Role	vPC Peer	
☐	Site1-BGW1	Minor	198.18.4.106	N9K-C9300v	Out Of Sync	Border Gateway	9WI7FS9YW2Y	Ok	Healthy			
☐	Site1-BL1	Minor	198.18.4.103	N9K-C9300v	Out Of Sync	Border	9J2I4VEVXV7	Ok	Healthy			
☒	Site1-L1	Minor	198.18.4.101	N9K-C9300v	Out Of Sync	Leaf	9H3NIVJ0I8O	Ok	Healthy	Secondary	Site1-L2	
☐	Site1-L2	Minor	198.18.4.102	N9K-C9300v	Out Of Sync	Leaf	9XPIFKSI4N7	Ok	Healthy	Primary	Site1-L1	

Add Switches

Configuration

Discovery

Set Role

vPC Pairing

TOR Pairing

vPC Overview

Maintenance

Delete Switch(es)

vPC Pairing

Select vPC Peer for Site1-L1

Filter by attributes

Device

Recommended

Reason

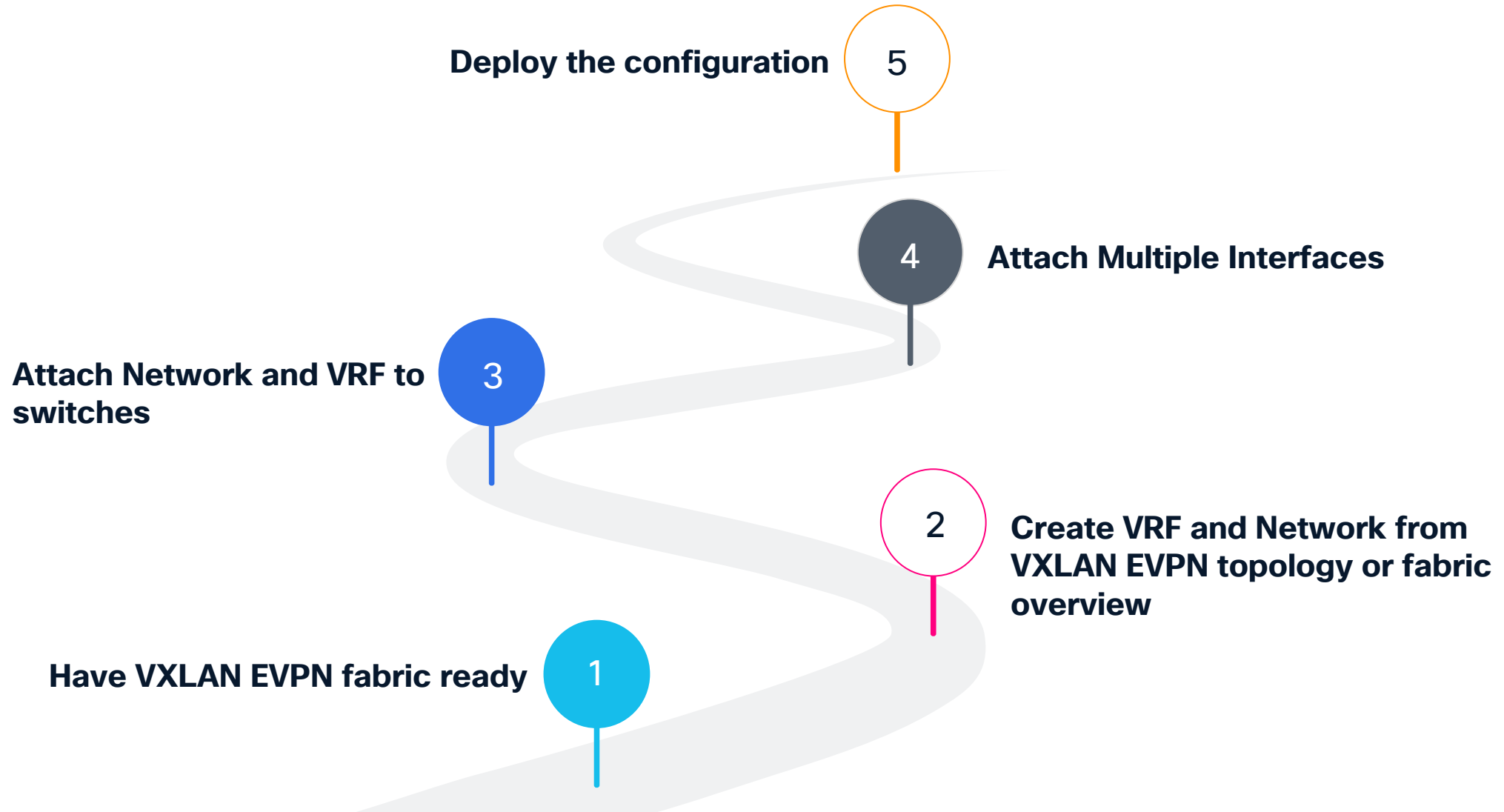
Serial Number

IP Address

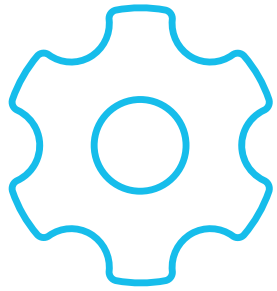
☒ Site1-L2	False	Switch has Networks/VRFs attached	9ARKRC5QR7I	10.3.1.14
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Virtual Peerlink

Data Center VXLAN EVPN – Day-1 Overlay

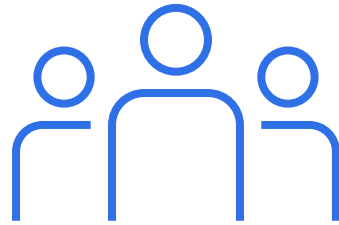


Cisco Nexus Dashboard



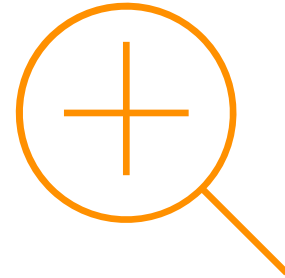
Automation

Accelerate provisioning
and simplify deployments



Management

In depth Management
and control for all
network deployments



Visibility

Get Centralized Visibility
and Monitoring views

Management



Single Point of Management for Data Center Operations

Configuration Compliance

Image and Patch Management

Fabric Backup and Restore

Hardware Replacement / RMA

Role Based Access Control (RBAC) and Change Control

Management for non-Nexus platforms

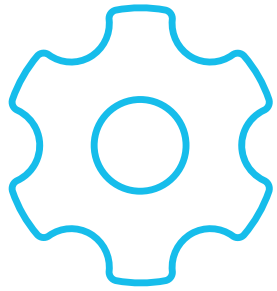
Benefits

Reliability

Compliance

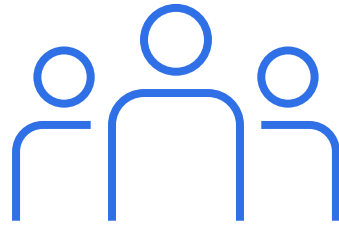
Secure

Cisco Nexus Dashboard



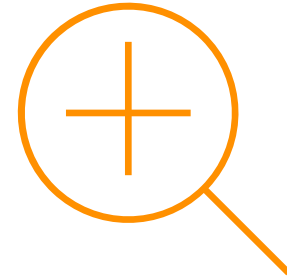
Automation

Accelerate provisioning
and simplify deployments



Management

In depth Management
and control for all
network deployments



Visibility

Get Centralized Visibility
and Monitoring views

Visibility and Monitoring



Comprehensive Monitoring

Enhanced Topology Views

Compute and Endpoint Visibility

OAM support with NDFC

Detailed Inventory, Health, Resource Consumption Information on Devices

End-to-End Visibility, Monitoring and Troubleshooting

Integrate with Day 2 Operations

Benefits

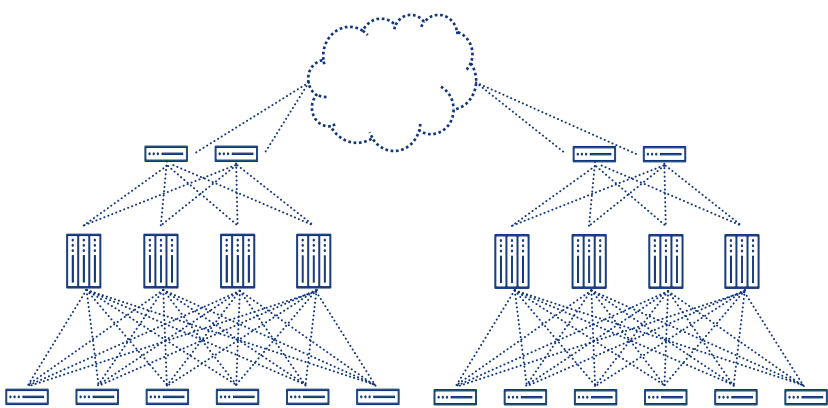
Reliability

Compliance

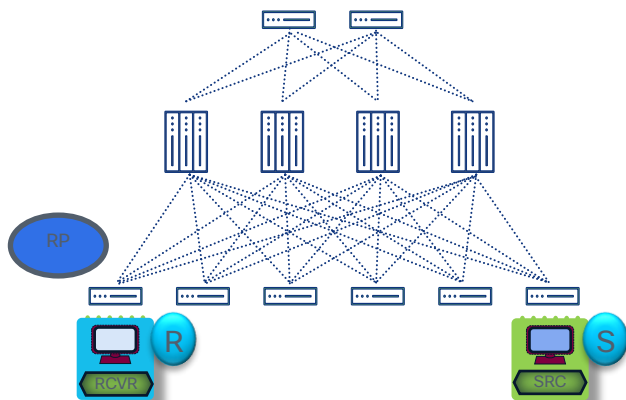
Secure

Advanced Features Support Pt 1

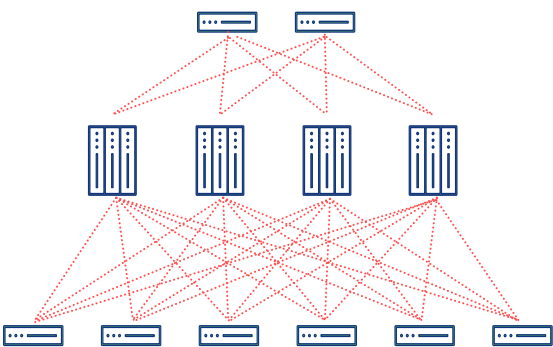
Muti-Site



Multicast



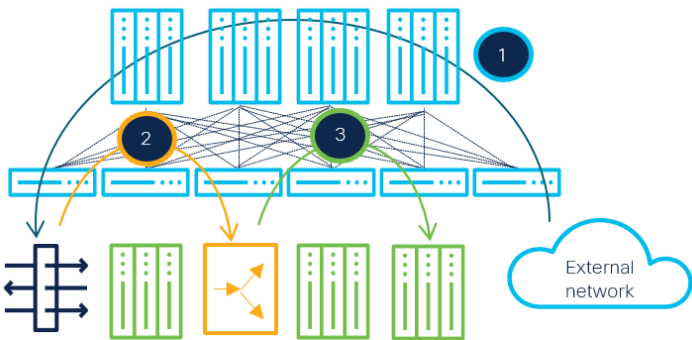
MacSec



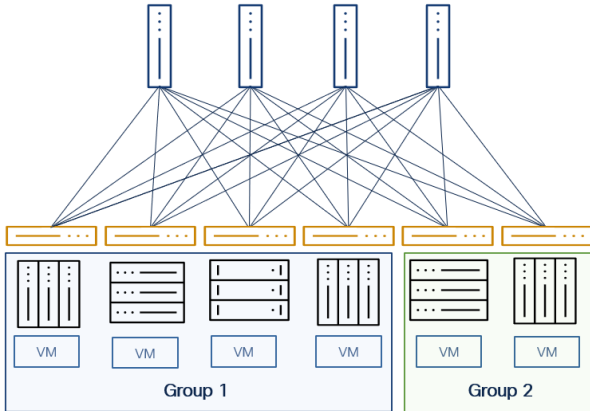
1000's of CLI Configuration Lines

Advanced Features Support Pt 2

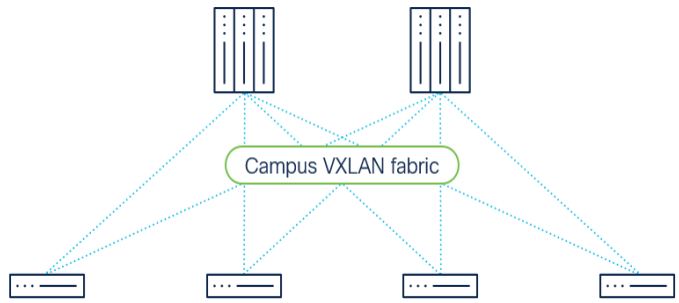
L4-7 Service Insertion 



Segmentation / GPO 



Campus VXLAN EVPN

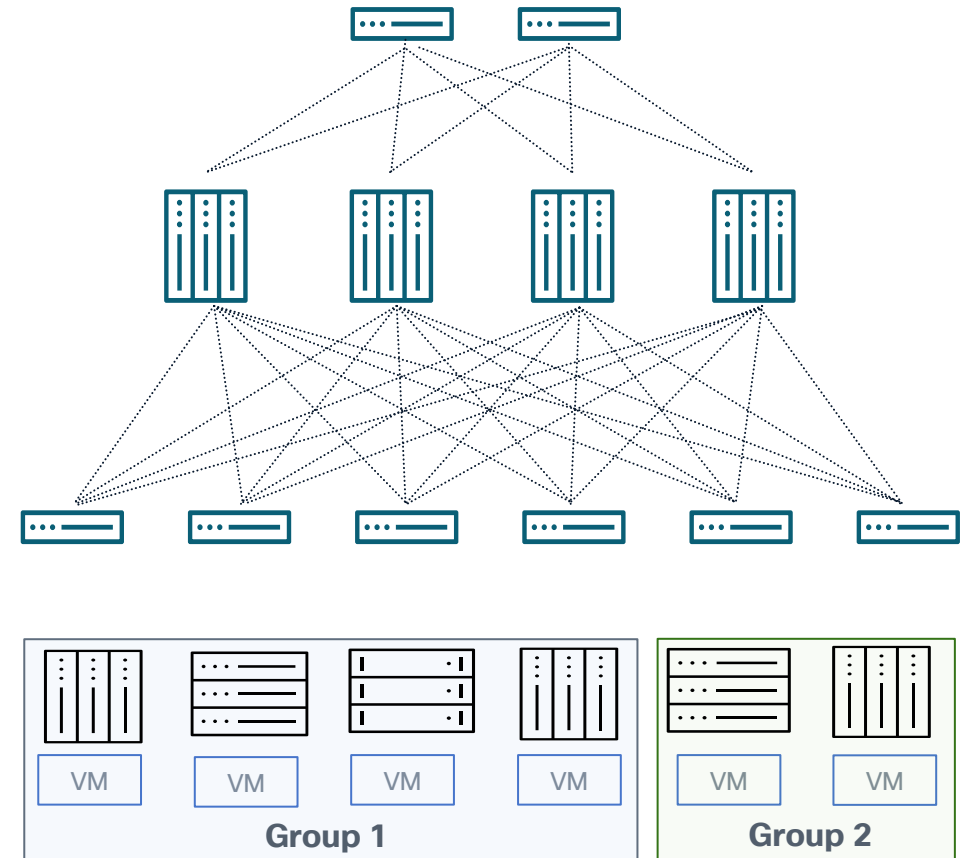


1000's of CLI Configuration Lines

Conclusion

Conclusion

- Requirements for Designing a Data Center Fabric Continue to Evolve
- Important Factors for Consideration Include:
 - Scalability
 - Performance
 - Oversubscription
 - Economics
 - Sustainability
- Build Modern Data Center Fabrics to Support:
 - Network Simplicity
 - Repeatability
 - Distributed Architectures (Minimize Failure Domains)
 - Better & Faster Troubleshooting
 - Automation and Lifecycle Management



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