Simple VXLAN/EVPN Fabric Setup with Nexus Dashboard

Christian Capitan – Technical Solutions Engineer
Marc Belle-Isle – Technical Solutions Engineer

BRKDCN-2929

Webex App

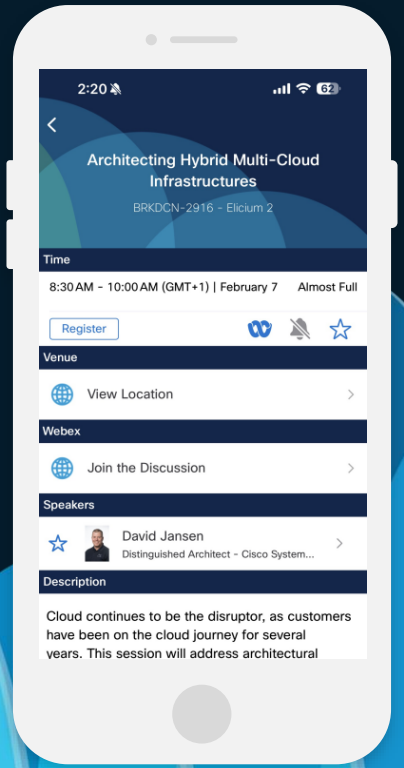
Questions?

Use the Webex app to chat with the speaker after the session

How

1. Find this session in the Cisco Events mobile app
2. Click “Join the Discussion”
3. Install the Webex app or go directly to the Webex space
4. Enter messages/questions in the Webex space

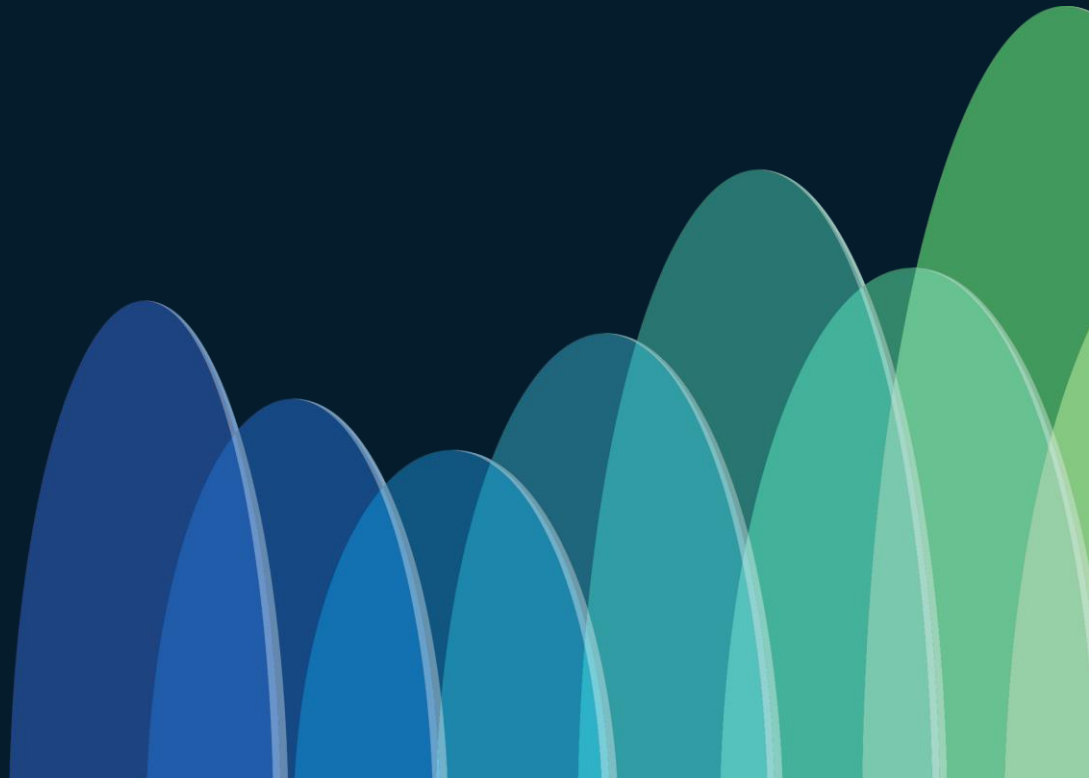
Webex spaces will be moderated by the speaker until February 28, 2025.



Agenda

- Introduction
  - EVPN VXLAN Design Fundamentals
  - Physical Connectivity and Logical Configuration
- Nexus Dashboard (ND)
  - Operations and Engineering Services Platform
  - Federation and One-View / Manage
- Nexus Dashboard Fabric Controller (NDFC)
  - NDFC Automation
  - NDFC Management
  - NDFC Visibility and Monitoring
  - NDFC Advanced Features

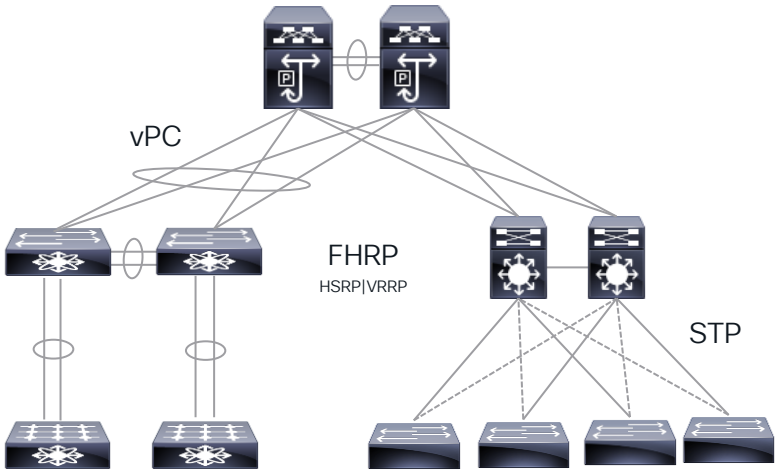
Introduction



Common Topologies

Three-Tier Hierarchical

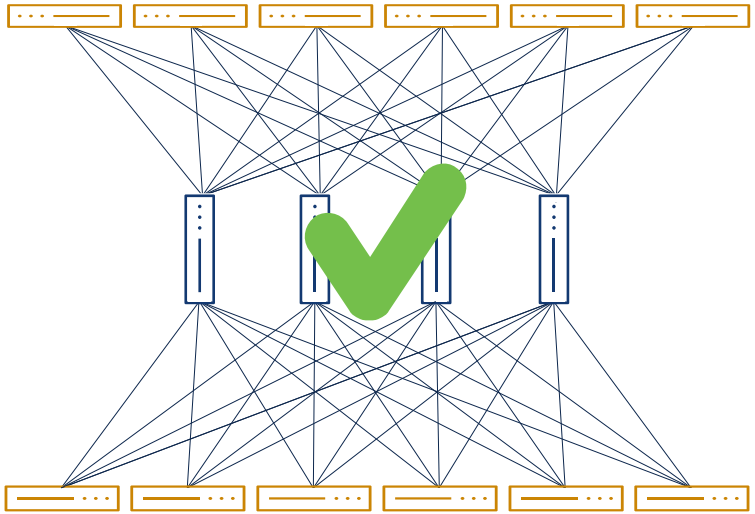
Inherent scale up topology building blocks
Requires multiple independent protocols configured in concert to be able to use all network links



"I always thought Ethernet forwarding with STP was a kludge, and the right solution was to do layer 3 forwarding..."
~Radia Perlman

Clos Fabric

Fully Interconnected 'fabric' with multiple design variations
Inherent modular scale out design (intra and inter-fabric)

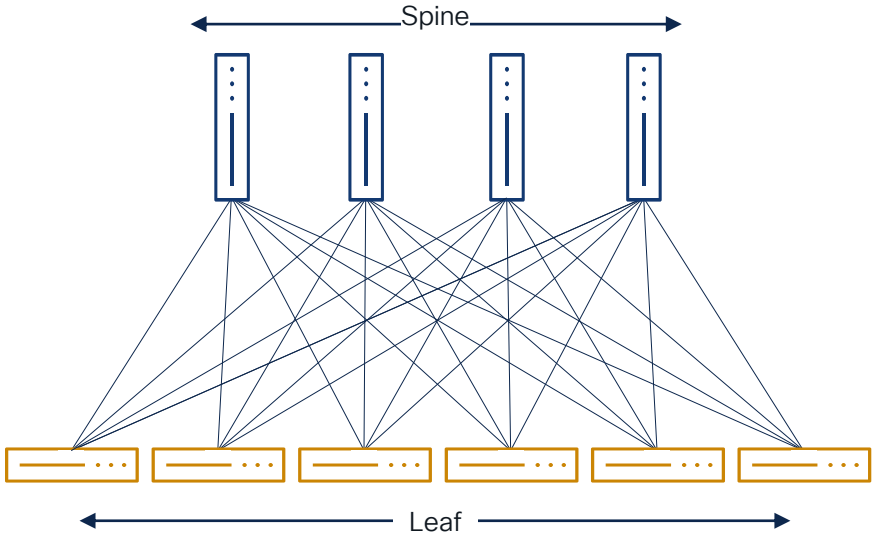


Clos Topology

A Leaf and Spine Topology

- Variations or Names of the same:
  - 2 Tier
  - Fat Tree
  - Folded Clos
  - 3 Stage Clos
  - Butterfly (5 Stage | PoD)

The Standard



Fun Fact

Invented – Edwin Erwin 1938

Formalized – Charles Clos 1952

Honorable Mention – Almon Strowger 1888

Clos Topology

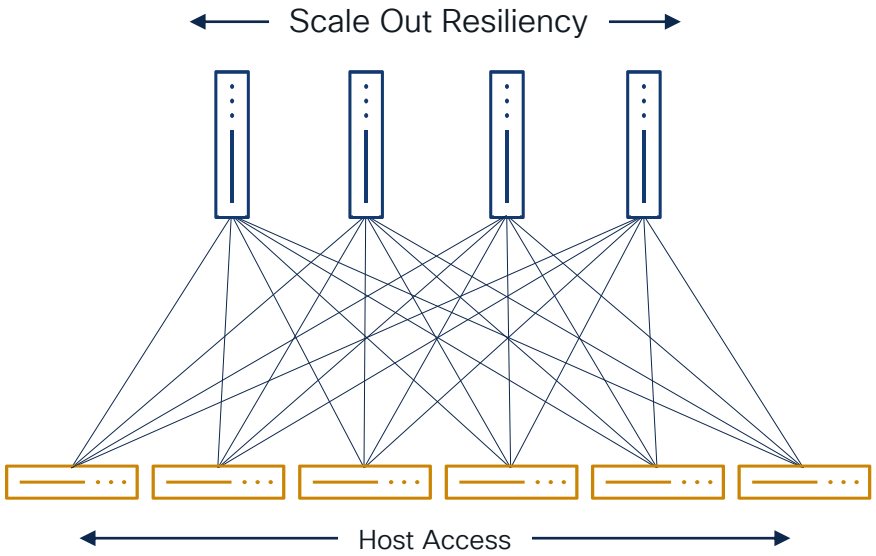
Scale Out Architecture

- Adding Spines results in:
  - Increased physical path redundancy

    -> Greater Resiliency
  - Increased leaf count *without increasing oversubscription ratio(s)*

    -> More Access Ports

Advantages



Clos Topology – VXLAN EVPN Logical Configuration

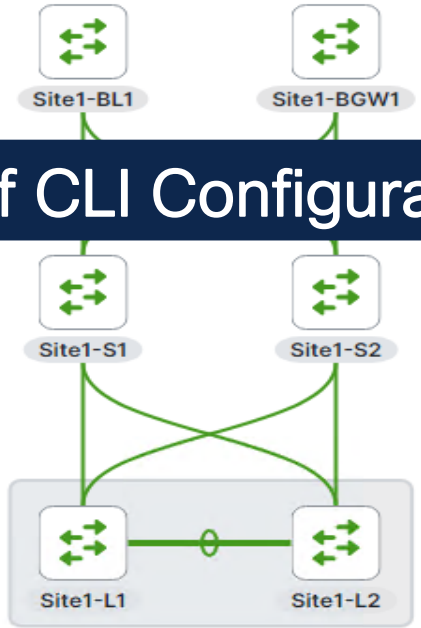
```
Site1-L1# show vrf all
VRF-Name                           VRF-ID State   Reason
bluevrf                             4 Up      --
default                             1 Up      --
management                          2 Up      --
```

```
Site1-L1# show nve vni
Interface VNI      Multicast-group   State Mode Type [BD/VRF]      Flags
--------- -------- ----------------- ----- ---- ------------------ -----
nve1      30000    239.1.1.1         Up    CP   L2 [2300]
nve1      30001    239.1.1.1         Up    CP   L2 [2301]
nve1      50000    n/a               Up    CP   L3 [bluevrf]
```

BGW

Spine

Leaf



1000's of CLI Configuration Lines

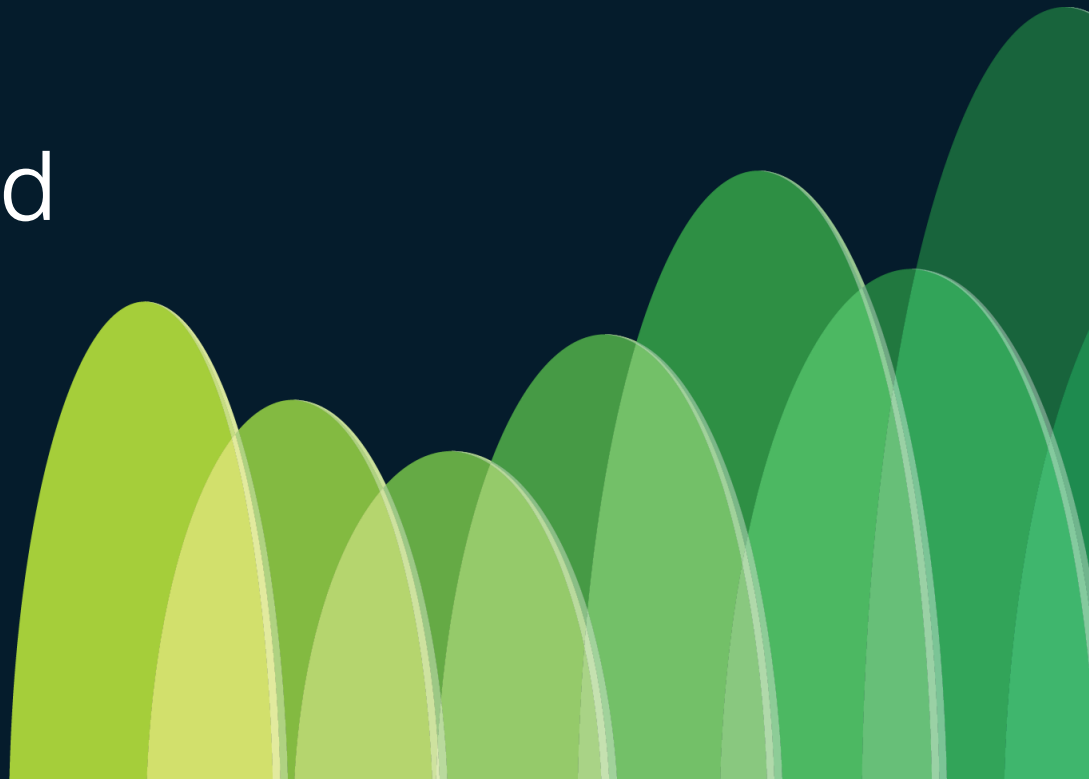
```
Site1-BGW1# show run | count
435
```

```
Site1-S1# show run | count
443
```

```
Site1-L1# show run | count
593
```

cisco Live!

Nexus Dashboard Platform (v3.2.1)



cisco Live!

Cisco Nexus Dashboard

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

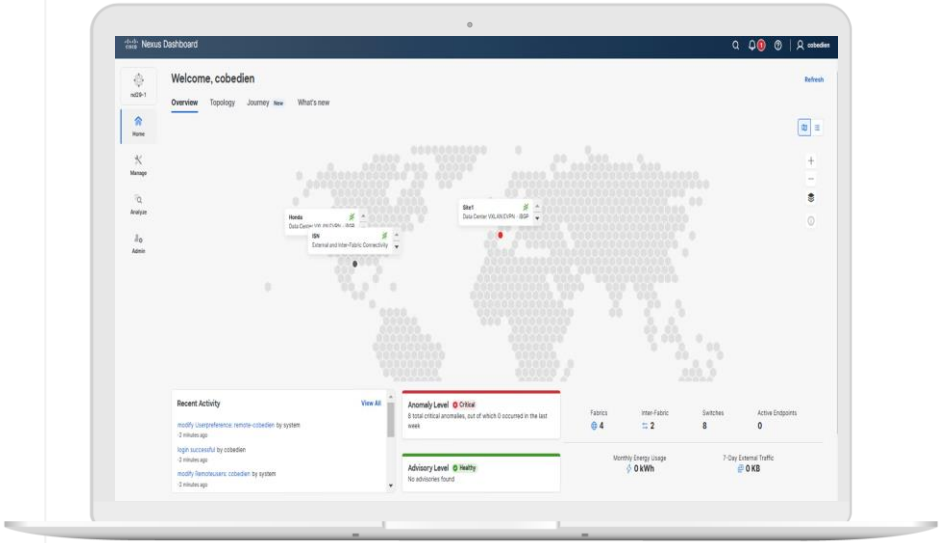
Cisco Nexus Dashboard

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

Platform Specifications

Physical Form Factor (pND)

UCS C220 M6 *(Node-L4)*	
Memory	256GB
CPU	1x 2.8GHz AMD
Hard Disk	4x2.4TB (9.6TB)
NVMe	1.6TB
SSD	960GB
PSU	1050W | 1600W

Virtual Form Factor (vND)

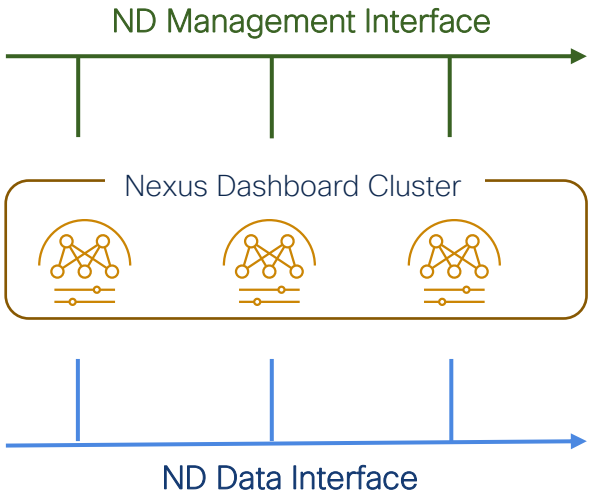
Virtual Appliance *(App Node)*	
Memory	64GB
CPU	16 vCPUs
Disk	550G SSD

For the latest information check the specific scalability guide

Nexus Dashboard Sizing and Capacity Planning

Cisco Nexus Dashboard

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



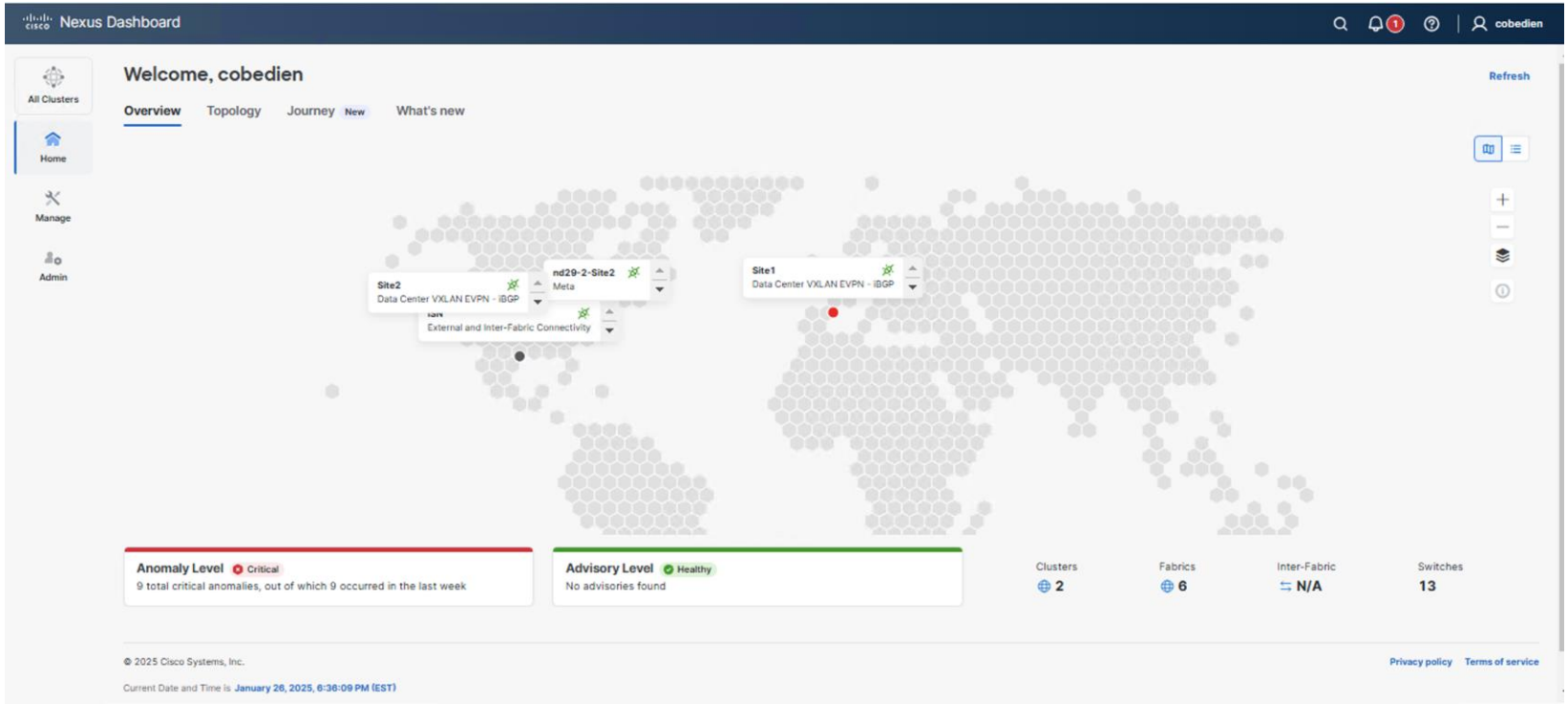
Nexus Dashboard Management Interface

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

The Nexus Dashboard Data Interface

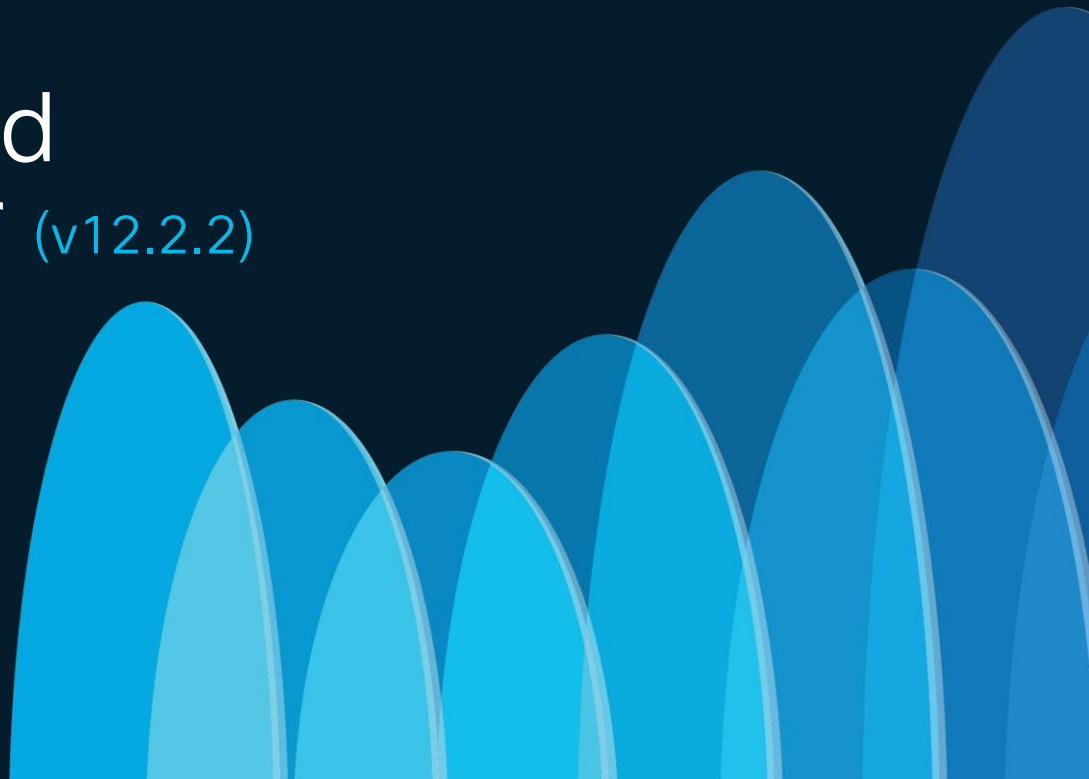
Connects and provides IP reachability to the physical data center network infrastructure, via In-Band or Mgmt0 (OOB)

Cisco Nexus Dashboard



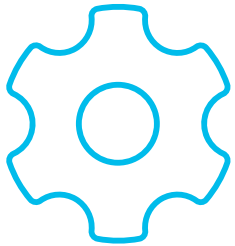
One-Manage View for Multi-Clusters

Nexus Dashboard Fabric Controller (v12.2.2)



cisco Live!

Nexus Dashboard Fabric Controller

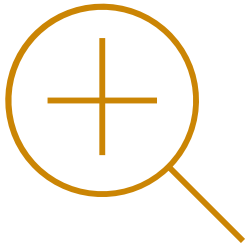


Automation

Accelerate provisioning and simplify deployments

Management

In depth Management and control for all network deployments



Visibility

Get Centralized Visibility and Monitoring views

Nexus Dashboard Fabric Controller

One-Manage / Federation For Multi-Cluster Deployment

Single sign-on for clusters

(With remote authentication)

Single dashboard

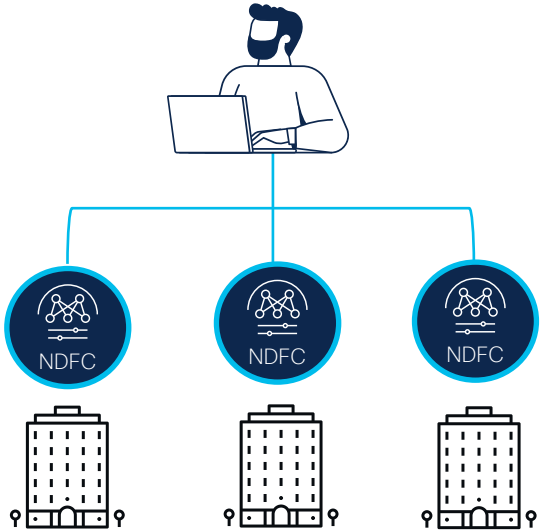
Including a summary of fabrics, switch details, etc.

VXLAN EVPN Fabric

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

4 Maximum clusters in a federation

Based on 12.2(2) scale



Distributed NDFC Data Centers

Benefits

Scale Out NDFC Deployments	DCI Control Between DC and NDFC (Multi-Fabric)	DCI Connectivity Health, Tunnel Path and Statistics

Nexus Dashboard Fabric Controller

Scale Numbers (v12.2.2)

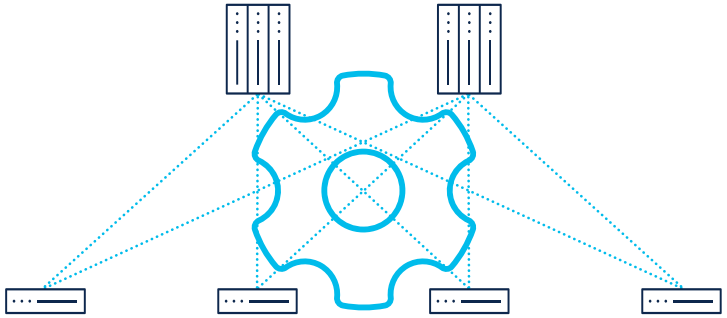
Deployment Type	Verified Limit	One Manage (4 Clusters)
1-Node vND (app node)	50 Switches	200 Switches
3-Node vND (app node)	100 Switches	400 Switches
5-Node vND (app node)	400 Switches	1600 Switches
1-Node pND	50 Switches	200 Switches
3-Node pND	500 Switches	2000 Switches

For the latest information check the specific scalability guide

Verified Scalability Guild for Cisco NDFC, Release 12.2.2

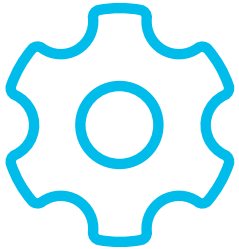
NDFC Automation

(Engineering)



Cisco Nexus Dashboard

Nexus Dashboard Fabric Controller

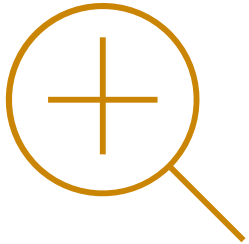


Automation

Accelerate provisioning and simplify deployments

Management

In depth Management and control for all network deployments



Visibility

Get Centralized Visibility and Monitoring views

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

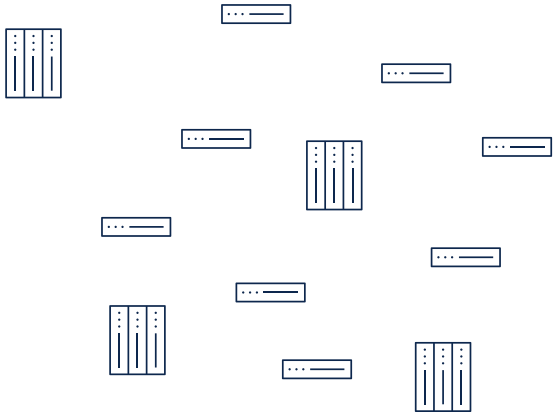
NDFC Day-0

VXLAN EVPN Underlay

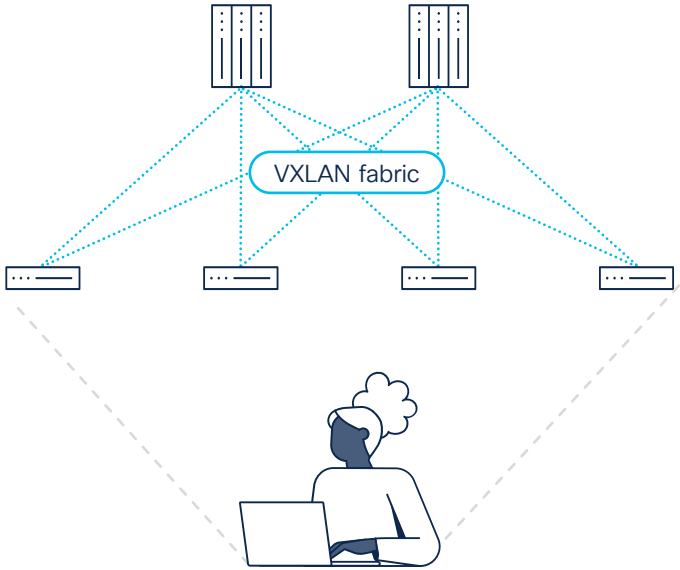
cisco Live!

Provision a New Fabric in Minutes

Un-provisioned switches



NDFC
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?

NDFC Fabric Controller Mode	Build VXLAN fabric in few minutes	Templates already embed best practices	IP addresses, overlay pool, routing profiles, replication attributes –all taken care by NDFC

Step 1
Create

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

Step 2
Discover

Import switches with POAP or Day-0 config

Define switch Roles (Border, Leaf, Spine, etc)

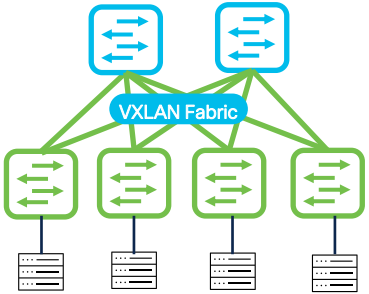
[Optional] Create vPC pairs

Step 3
Recalculate and Deploy

Generates config based on intent

Preview side by side diffs

Cisco Best Practice Implemented



Fast, automated process

Data Center VXLAN EVPN – Day-0 Underlay

Step 1 – Create

Zero Touch Deployment

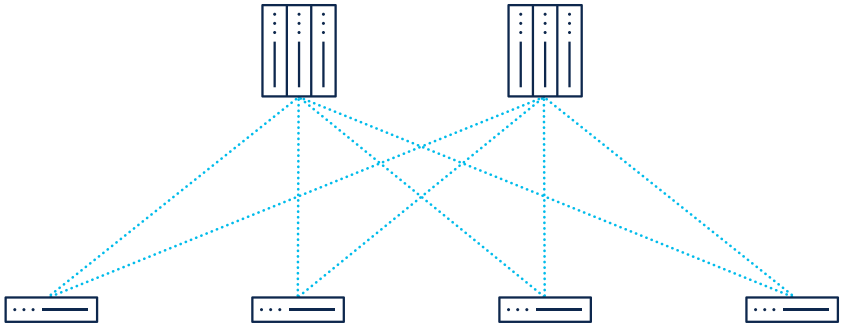
POAP – Power On Auto Provisioning

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

Data Center VXLAN EVPN – Day-0 Underlay

Enable POAP

Bootstrapping

Pre-Provision

Step 2 – Discover

NDFC Switch Role Example

Different Roles for Border Gateway (BGW)

Border Gateway

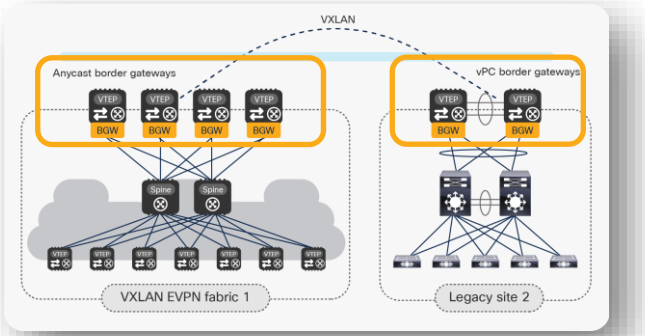
Layer 3 based Anycast BGW deployed at the Leaf Layer

vPC Border Gateway

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

Border Gateway Spine

Layer 3 based Anycast BGW deployed at the Spine Layer

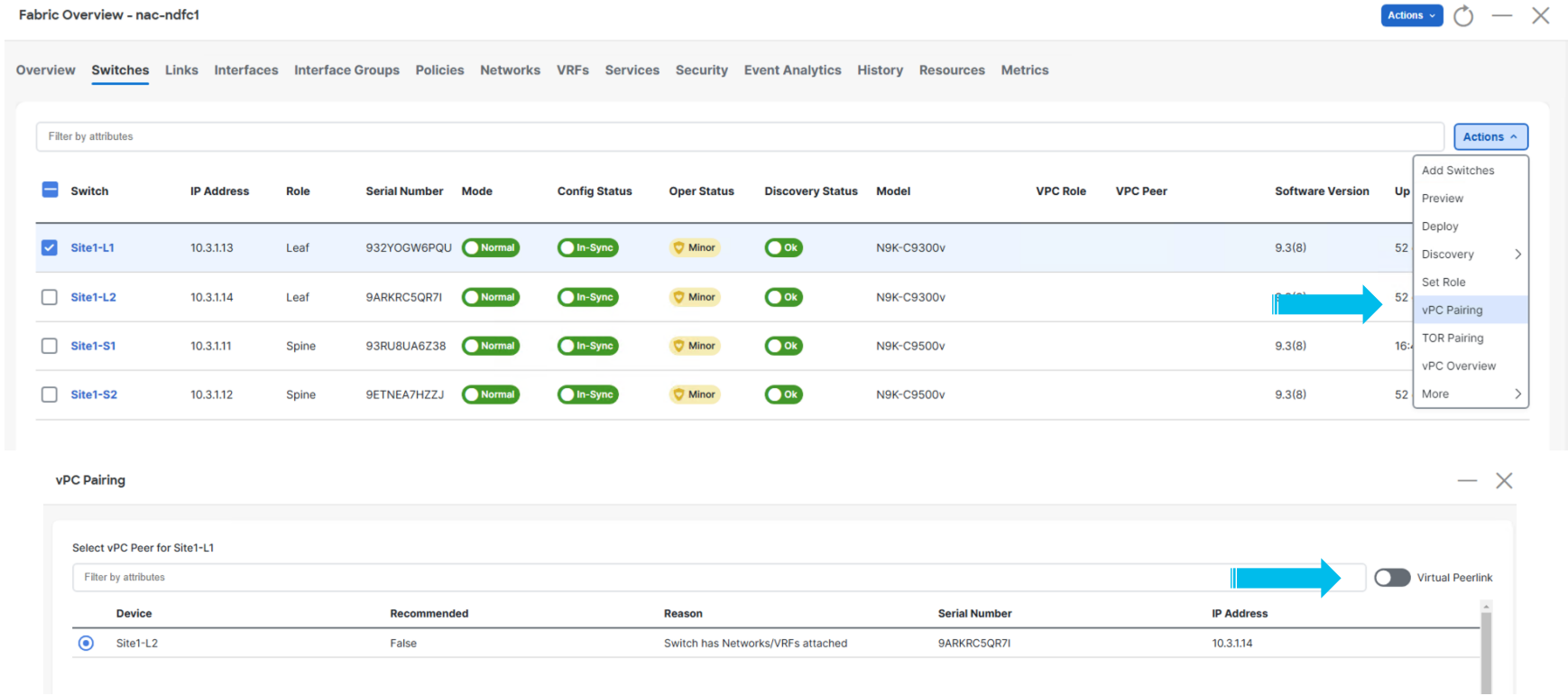


- Spine
- Leaf
- Border
- Border Spine
- **Border Gateway (current)**
- **Border Gateway Spine**
- Super Spine
- Border Super Spine
- **Border Gateway Super Spine**

Data Center VXLAN EVPN – Day-0 Underlay

Step 3 – Recalculate and Deploy

Virtual Port Channel (vPC) NDFC

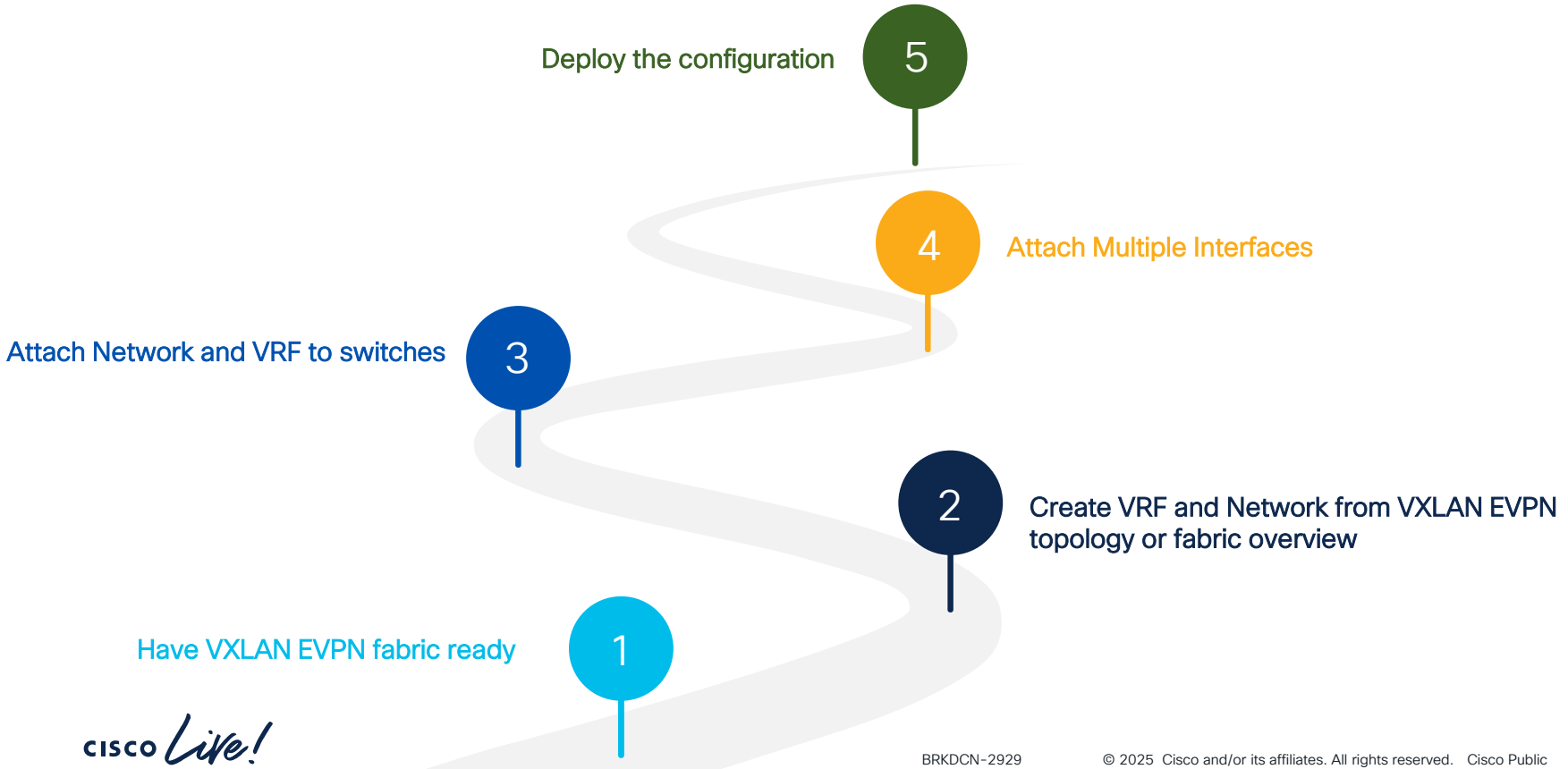


NDFC Day-1

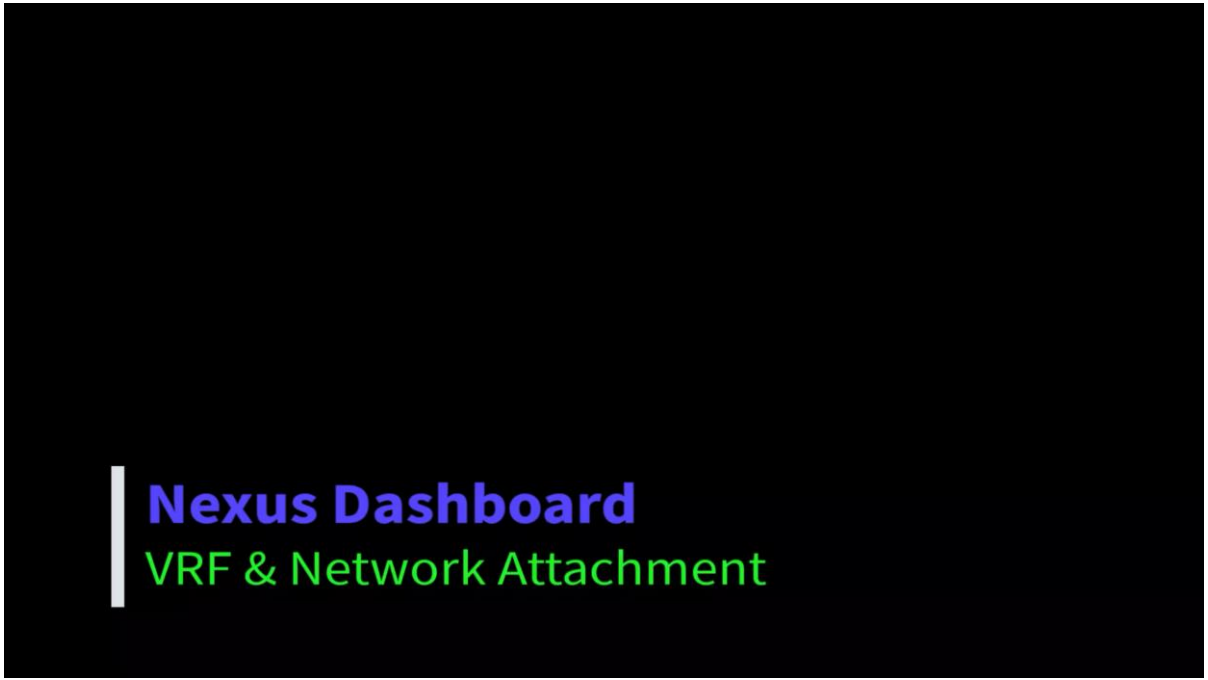
VXLAN EVPN Overlay

cisco Live!

Data Center VXLAN EVPN – Day-1 Overlay

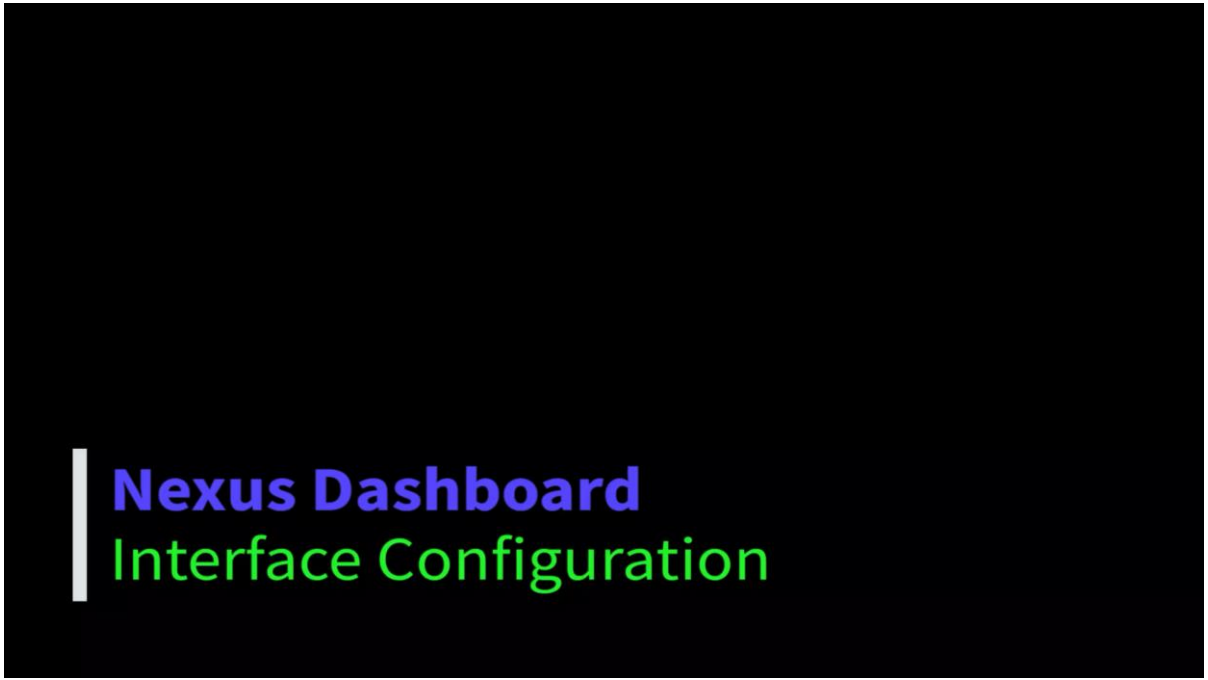


Data Center VXLAN EVPN – Day-1 Overlay



Create VRF and Network

Data Center VXLAN EVPN – Day-1 Overlay



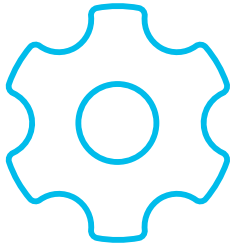
Attach Interface

NDFC Management

(Operations)

Cisco Nexus Dashboard

Nexus Dashboard Fabric Controller

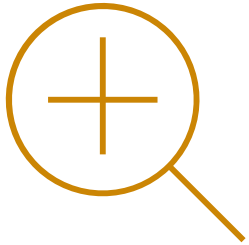


Automation

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

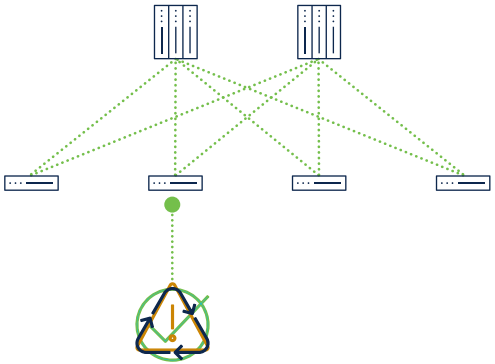
Reliability	Compliance	Secure

Configuration Compliance

Ensure fabric consistency

Continuously monitors if configuration is compliant with user intent

Error detection, flag drifts for remediation



Benefits

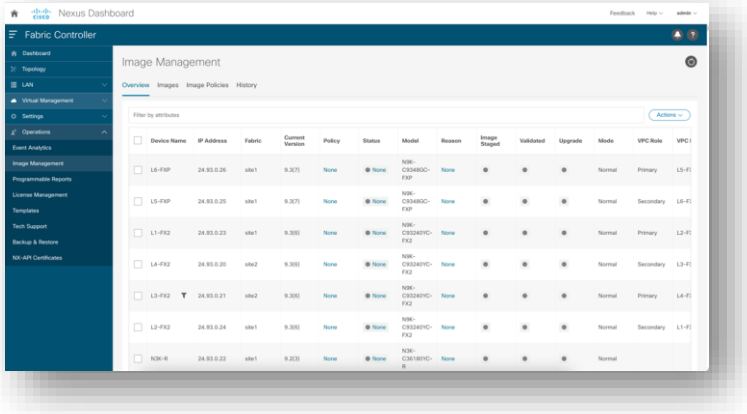
Fabric Reliability and Visibility

Operations Confidence

Streamlined Image and Patch Management

Maintenance mode

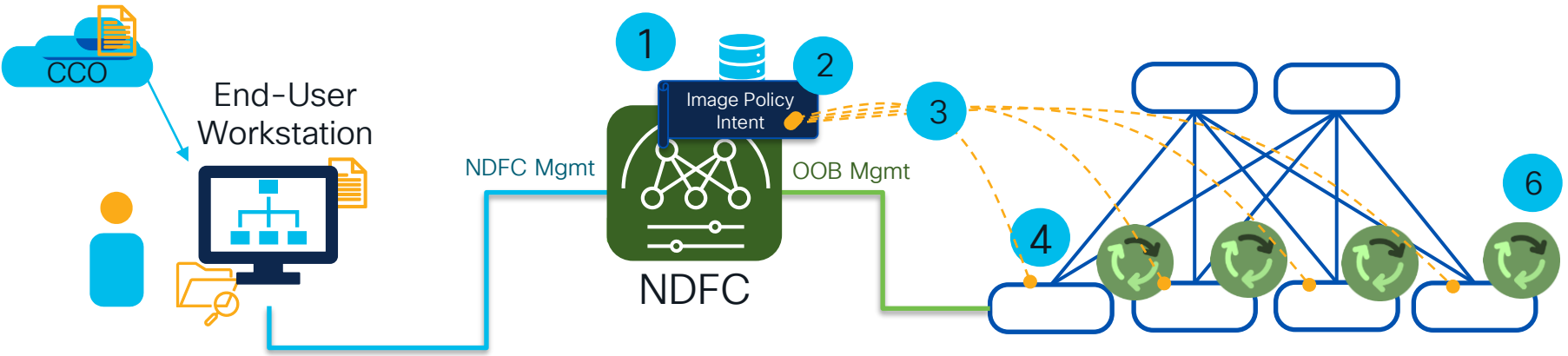
- Guided workflows
- Image upgrades, EPLD upgrades and downgrades, SMU



Benefits

Simplified	Intuitive	Customizable

Image Management Workflow



Discover the switches into Nexus Dashboard Fabric Controller.

1	2	3	4	5	6
Upload Images	Create the Image Policy	Attach the Image Policy	Stage the Images	Validate non-disruptive upgrade	Upgrade the switches

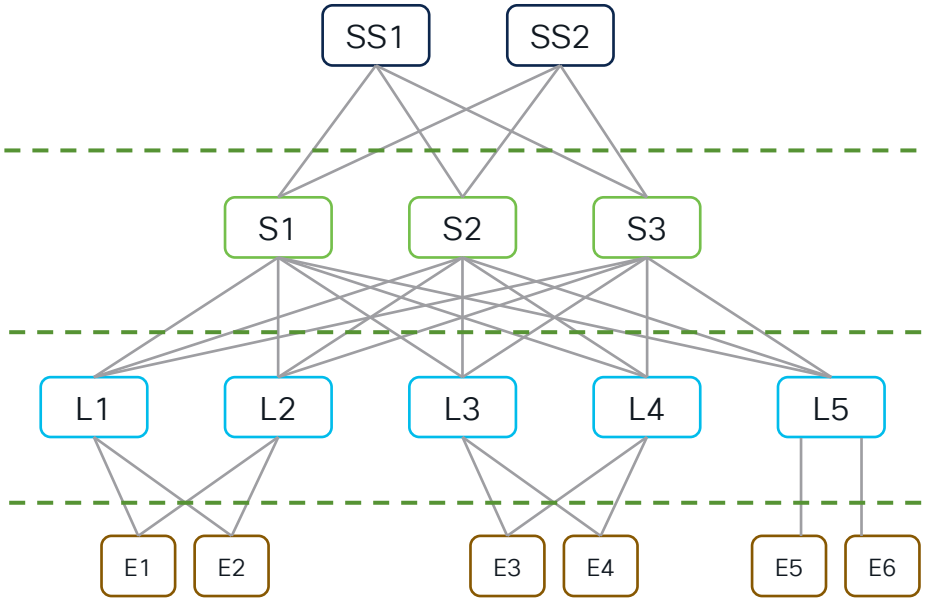
Fabric Image Policy Management

Image Policy

Fabric Image Management

Image Management

Hitless Upgrade Models



Platform Options		Recommended Upgrade Options
Modular	Fixed	✓ GIR/maintenance mode ✓ SMU (Patch)
Modular	Fixed	✓ GIR/maintenance mode ✓ SMU (Patch)
	Fixed	✓ GIR/maintenance mode ✓ SMU (Patch) ✓ ISSU

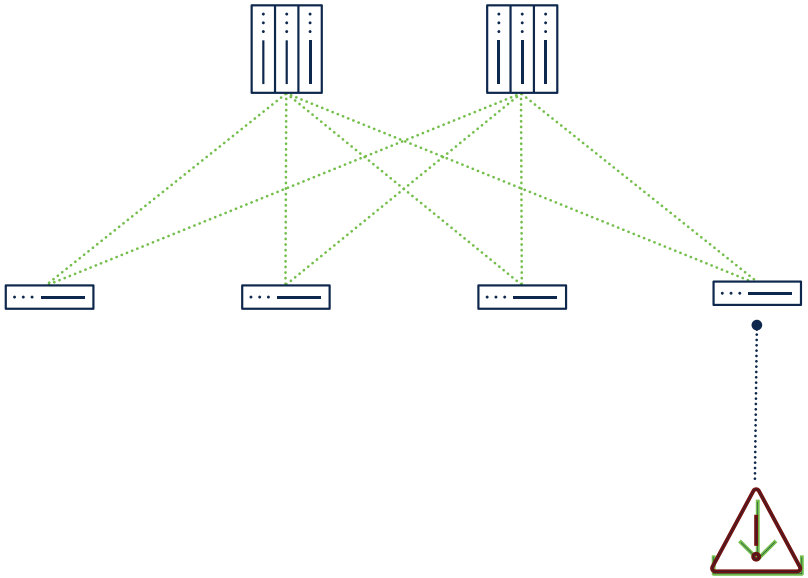
GIR, SMU support on all Nexus

ISSU/Enhanced ISSU on NX-OS fixed switches

Image upgrade automation from Controller

https://blogs.cisco.com/datacenter/ensuring-continuous-network-operations-with-cisco-nexus-hitless-upgrades

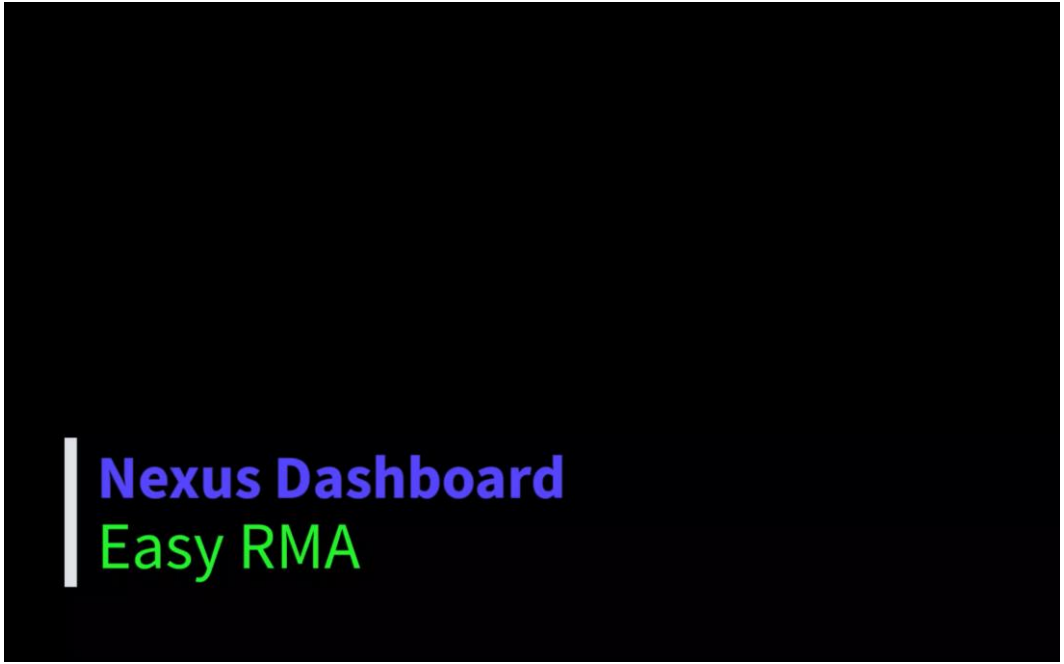
RMA Replacement



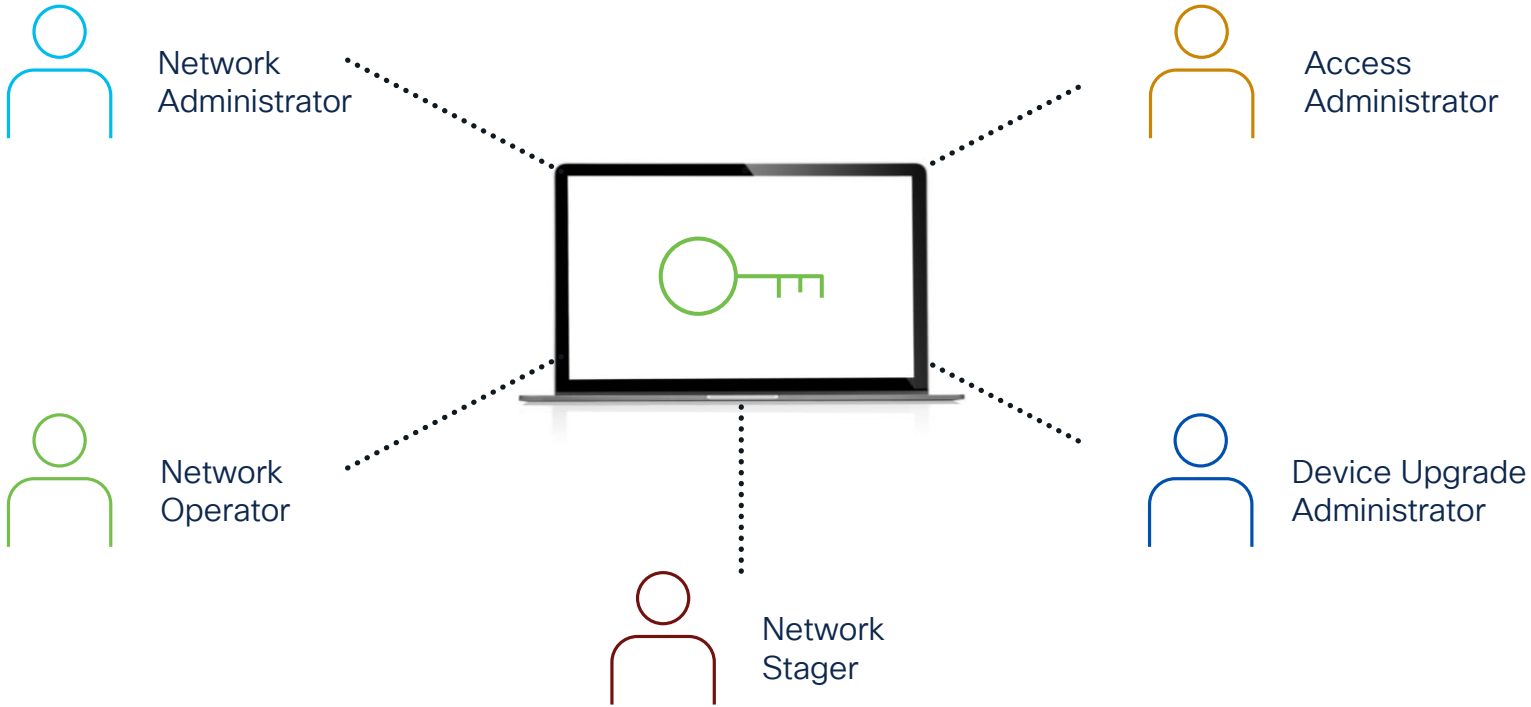
RMA for Defective Switch is Required

Easily Perform RMAs from NDFC UI

RMA Workflow Demo



Role-Based Access Control (RBAC)



Increase Efficiency and Productivity with Granular Roles Orchestrated from Nexus Dashboard

Backup and Restore Workflows

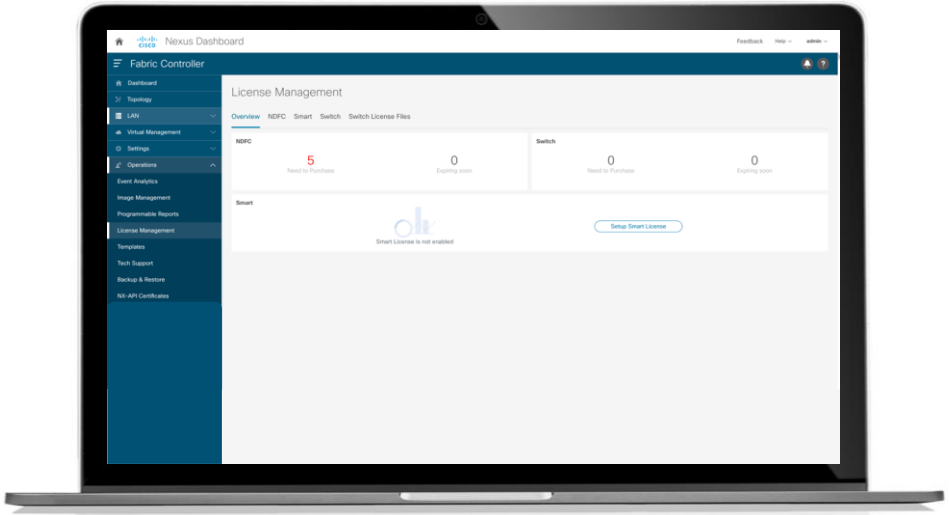
Backup

Restore

Managing Failure and Recovery

License Management

NDFC offers unified license management for NX-OS and MDS deployments



Easily activate and configure Smart Licensing from NDFC UI

Benefits

Easily License your Devices	Monitor License Usage	Ensure Compliance

Management for Non-Nexus Platforms

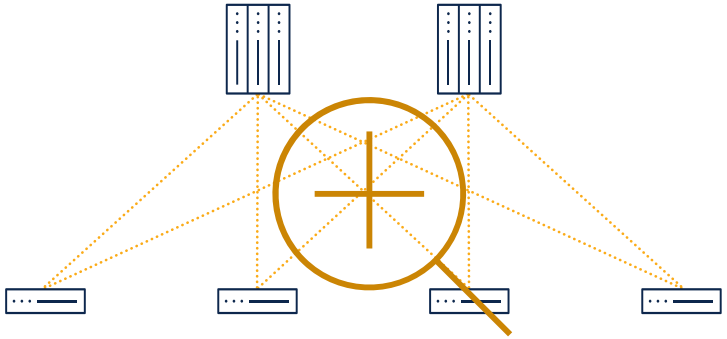
Configuration management for Cisco IOS-XR devices

VXLAN EVPN management for Cisco IOS-XE Catalyst devices

Discovery and basic monitoring for third-party devices

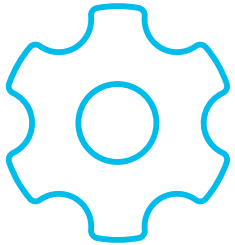
ARISTA

NDFC Visibility and Monitoring



Cisco Nexus Dashboard

Nexus Dashboard Fabric Controller



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

Get 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

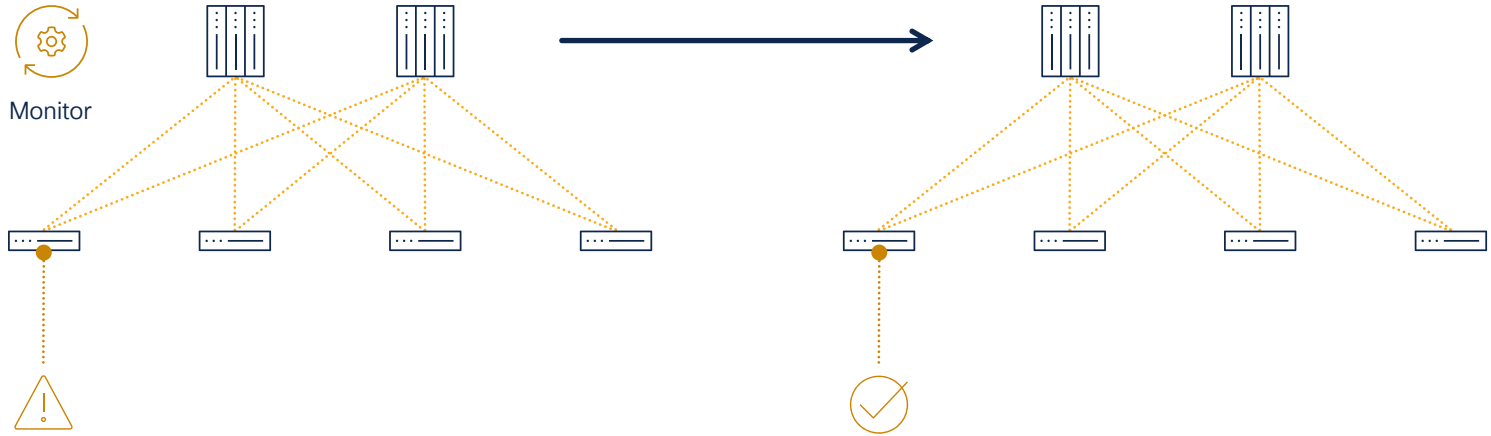
Integrate with Day 2 Operations

Benefits

Intuitive	Deep Visibility	Enhanced Monitoring

Operations, Administration and Maintenance

NDFC supports OAM for VXLAN, external, and classic LAN fabrics

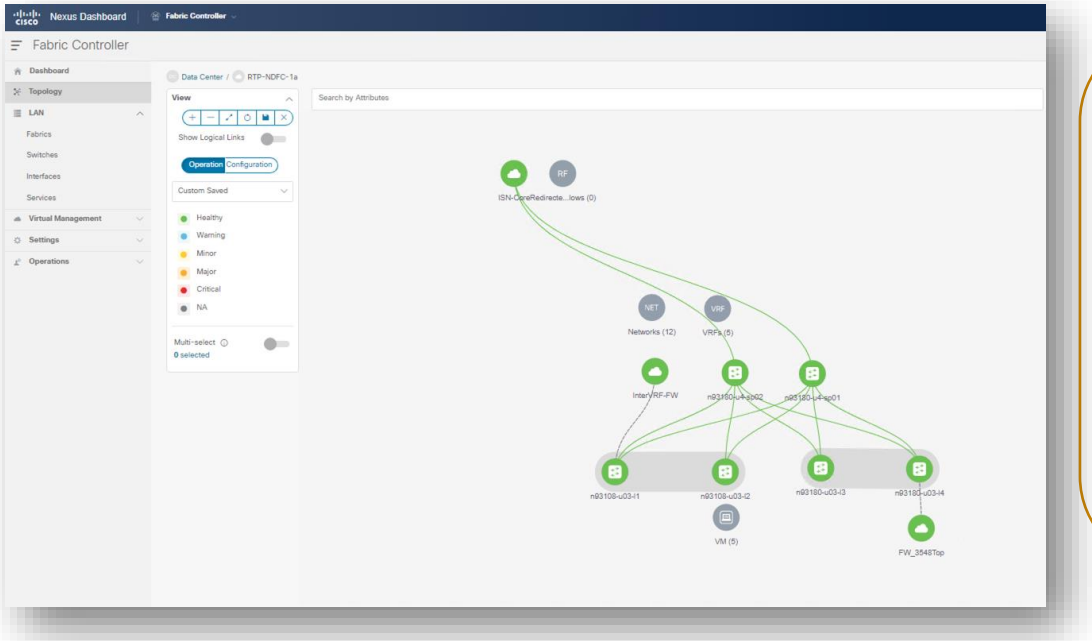


Benefits

Enhance Management

Monitoring and Troubleshooting Capabilities

Visualize Multiple Fabrics with Topology Views



- Drill-down into a single fabric and detect anomalies
- In-context fabric, switch, end-point details
- Inventory View (Switches, ports, endpoints)
- Zoom in/Zoom out and Search in a fabric
- Multi-Pod & Multi-Fabric overlay visibility (ND 4.0)
- Security and Segmentation view (future)

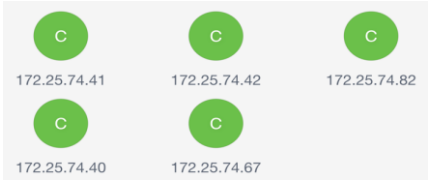
Benefit

Dynamic and Intuitive, Superior App Experience

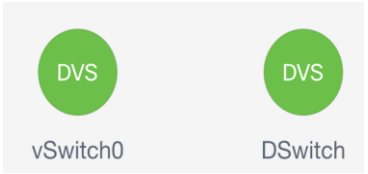
VMM Visibility

vCenter Instance

Visualise the virtual infrastructure at different layer



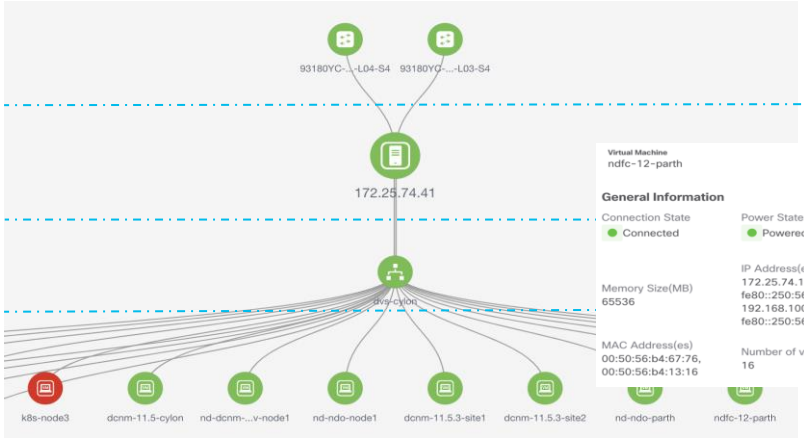
Hosts

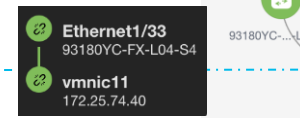


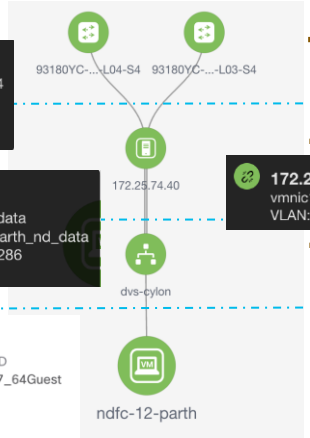
DVS

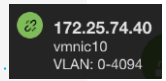
VM

Display connectivity details









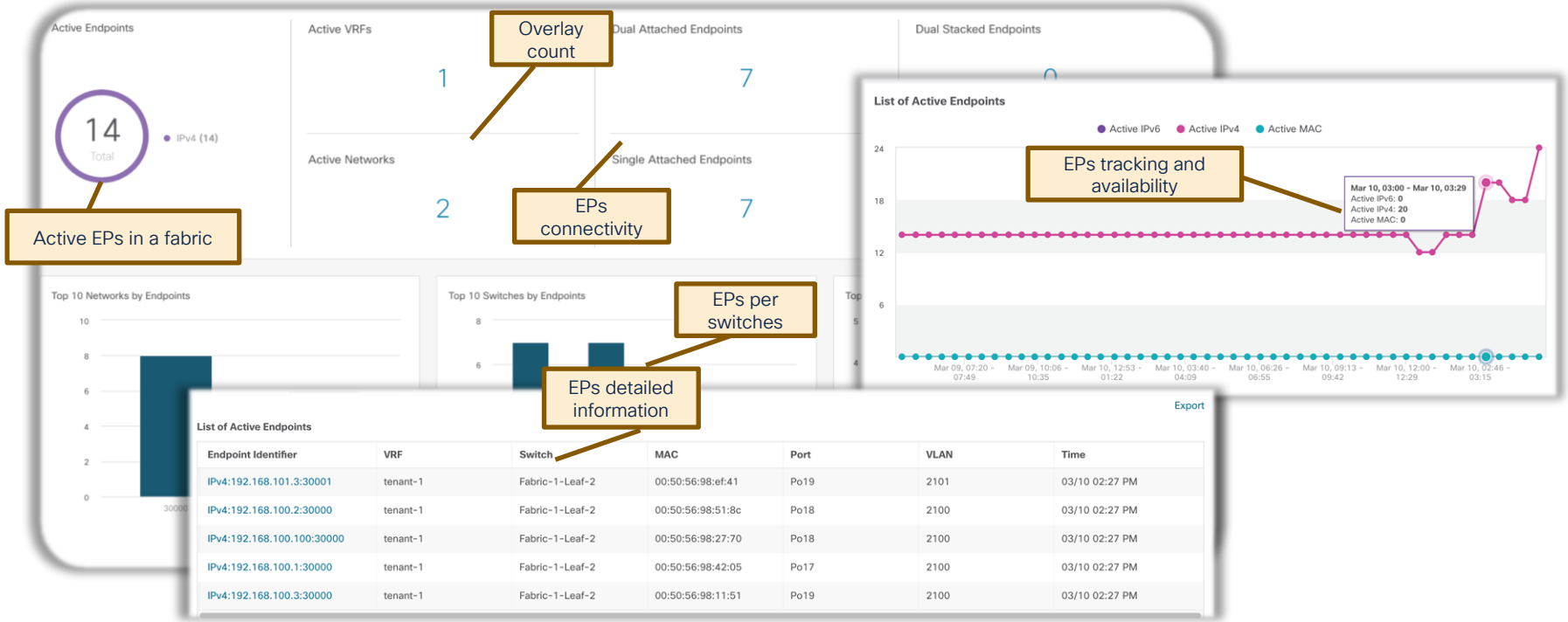
Leaf nodes

Physical Host

DVS

Virtual Machines

Endpoint Locator and Visualizer



Benefit

Almost Real-Time Data on Active Endpoints

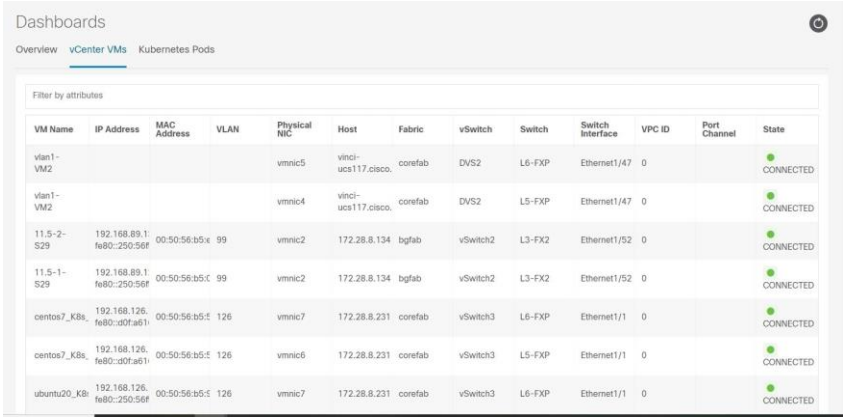
Single Pane of glass for all EP Visualization

Endpoint Life and History

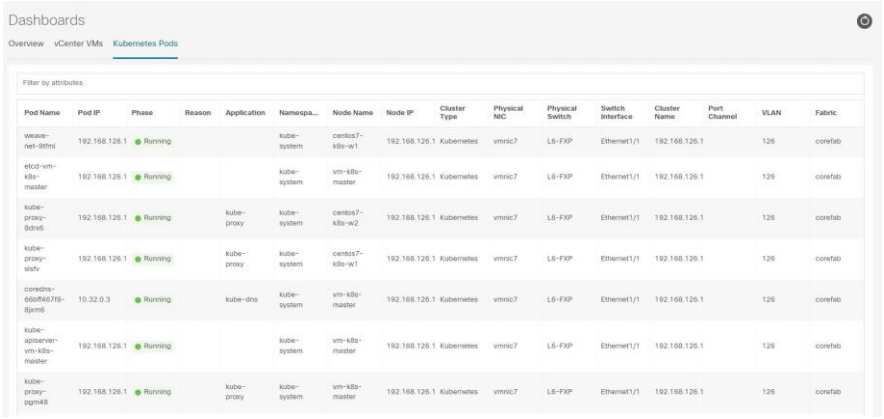
Active VRFs and Networks

Enhanced Endpoint Capabilities

Viewing vCenter VMs

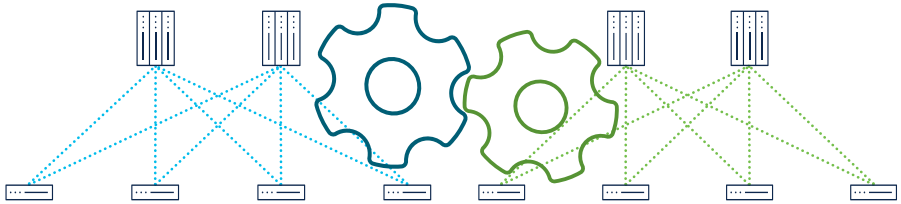


Viewing Kubernetes Pods



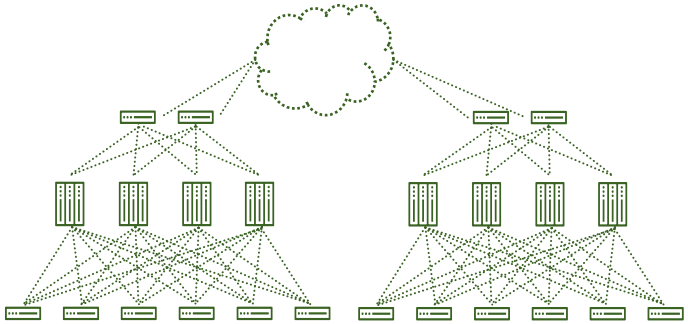
NDFC Provides Superior Visibility to the End Points

NDFC Advanced Features

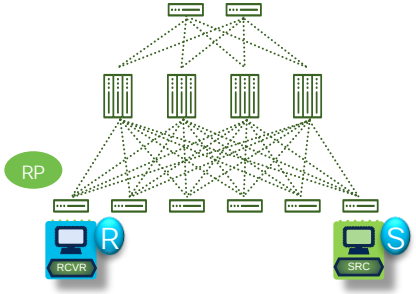


Advanced NDFC Features

Muti-Site



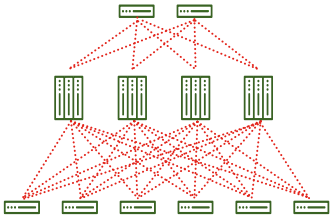
Multicast



RCVR-21
224.10.10.10
10.20.20.1

SRC-10
224.10.10.10
10.10.10.100

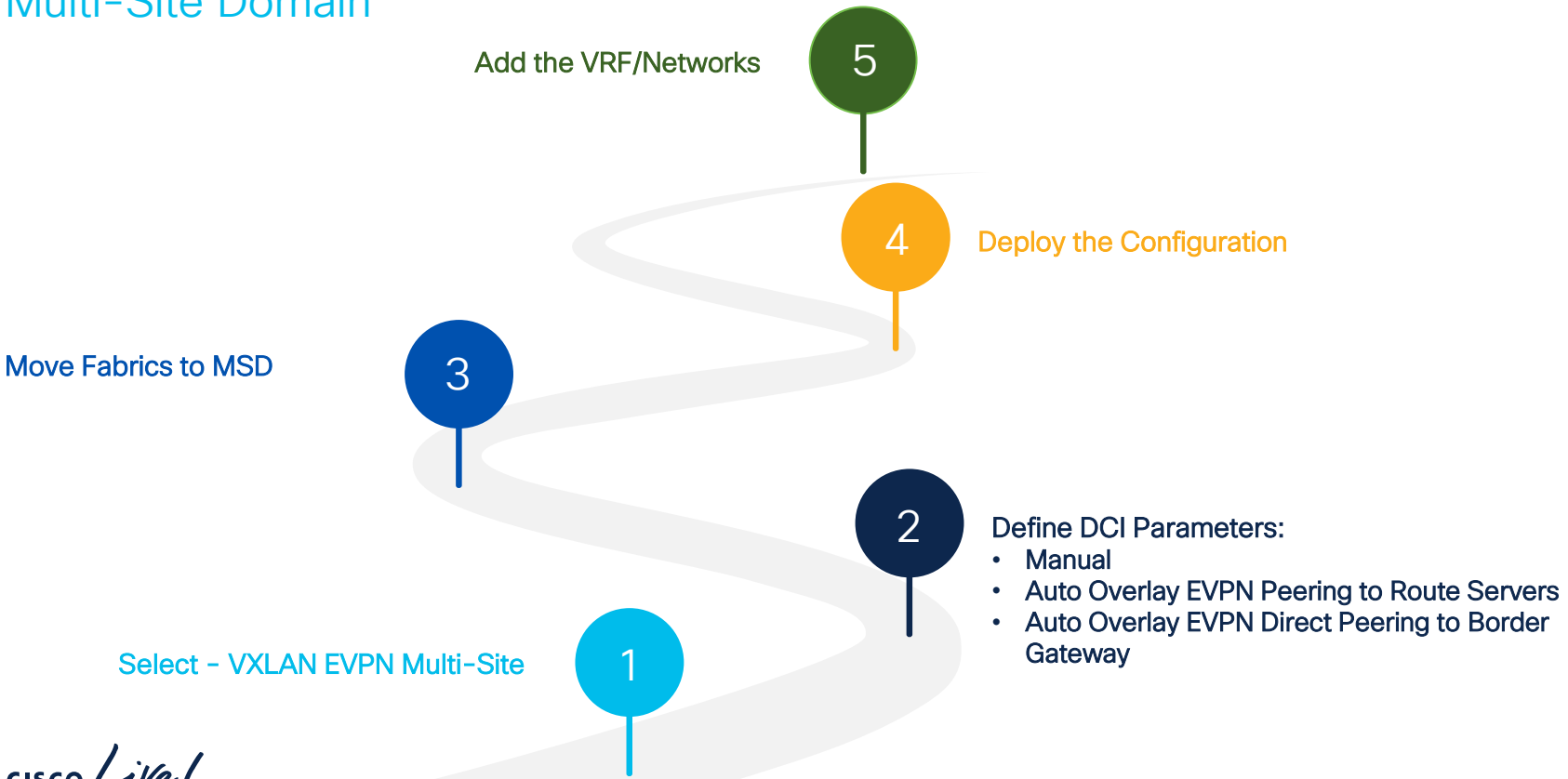
MacSec



1000's of CLI Configuration Lines

Data Center VXLAN EVPN

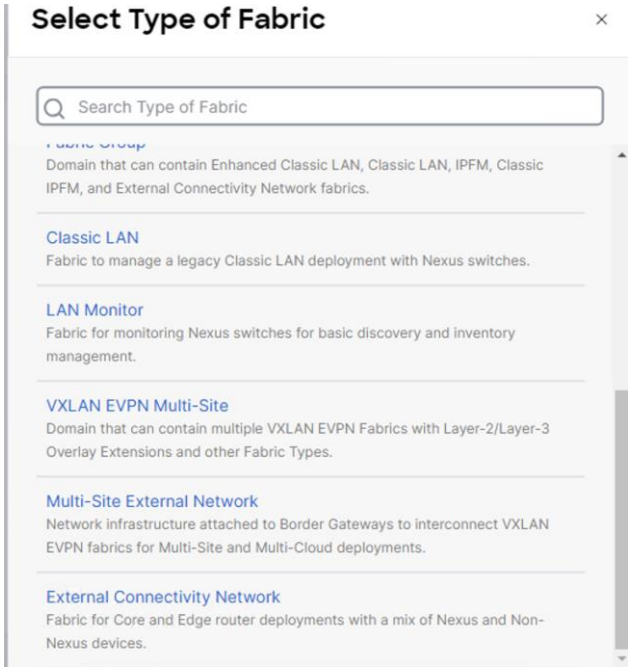
Multi-Site Domain



Data Center VXLAN EVPN

Step 1 -> Select - VXLAN EVPN Multi-Site

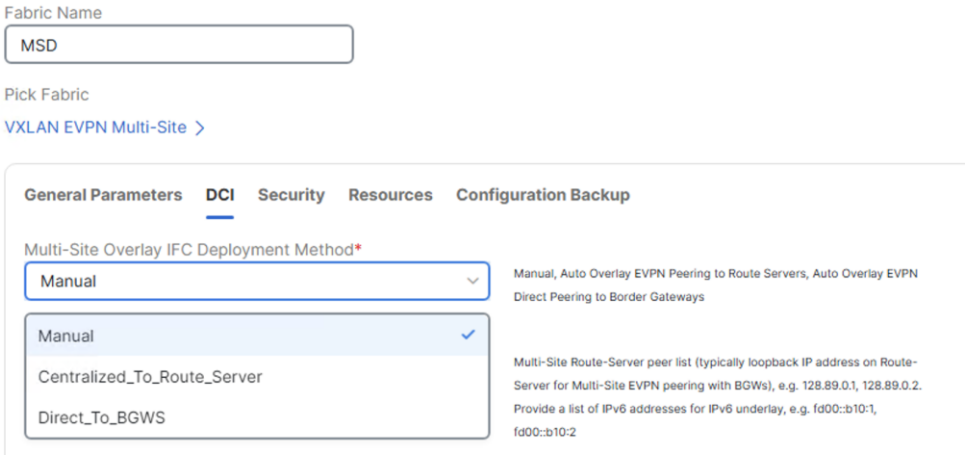
EVPM Multi-Site



Data Center VXLAN EVPN

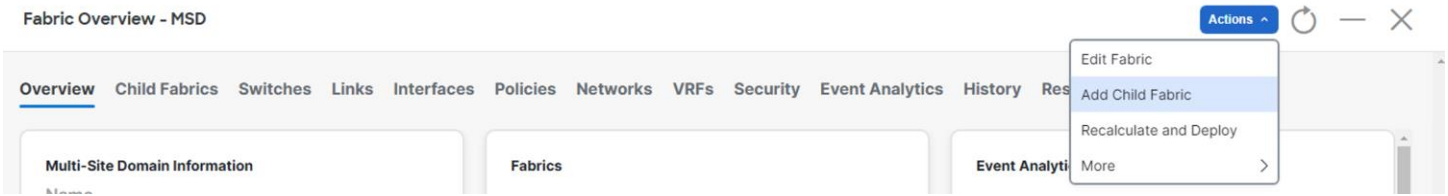
Step 2 -> Define DCI Parameters:

DCI Parameters



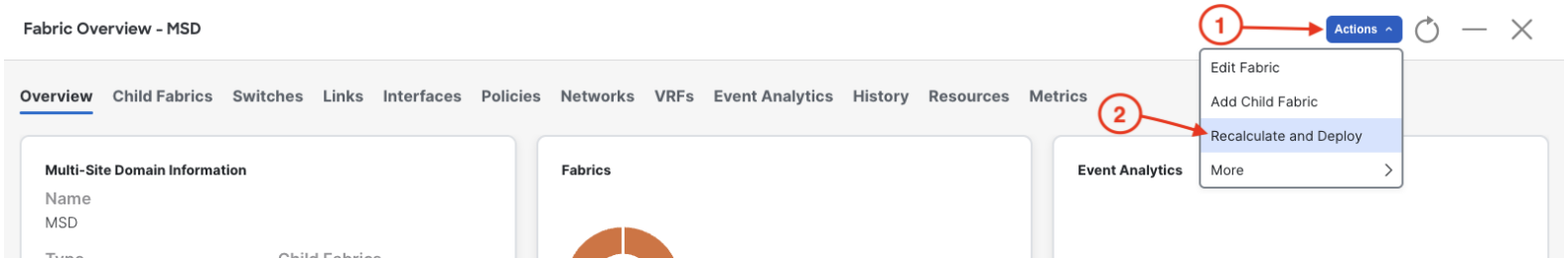
Data Center VXLAN EVPN

Step 3 -> Move Fabrics to MSD



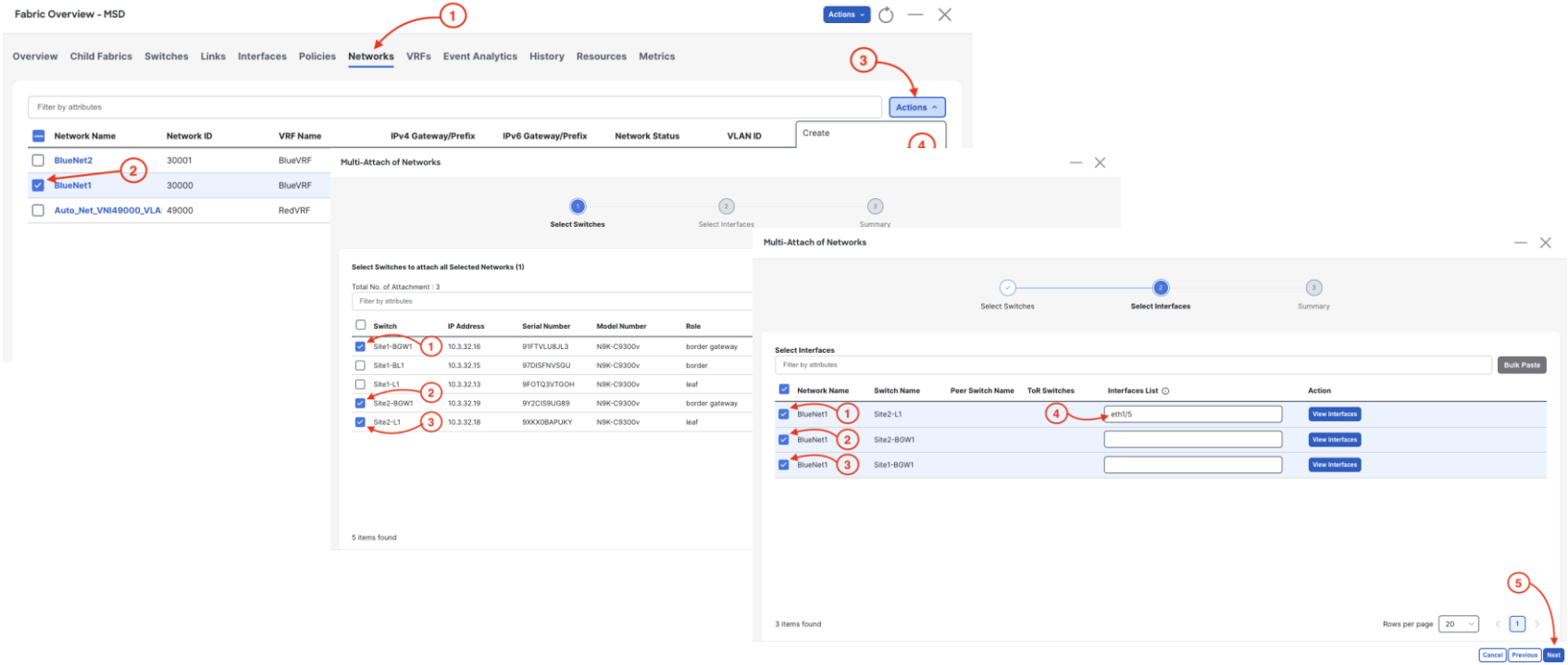
Data Center VXLAN EVPN

Step 4 -> Deploy the Configuration



Data Center VXLAN EVPN

Step 5 -> Add the VRF/Networks



Broadcast, Unknown Unicast and Multicast (BUM)

Ingress/Headend Replication or Tenant Routed Multicast (TRM)

Ingress / Headend Replication

- Replicate and **send copy of BUM traffic to all** VTEPs in the L2VNI
  - List of VNI to VTEP pairing (type 3 route)

Multicast (Underlay)

- Send **single copy of BUM traffic** to multicast group (L2VNI)
  - Any vPC peer can encapsulate traffic and send to anycast RP (spine) -> only one of the vPC peers is elected to de-encapsulate traffic

An illustrative example for ingress-replication

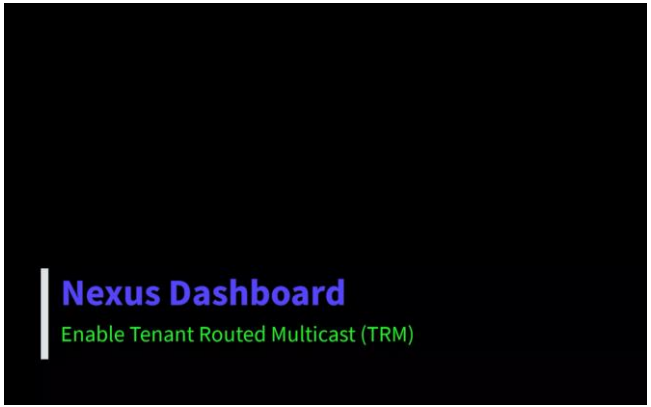
- **ToR with 48x 10G Host facing | 16 ToR Total**
- Each Host port is creating 0.01% BUM traffic
- Each Host port in different VLAN (=VNI) (768 total)

This example would create a little under 800Mbps BUM traffic on your uplinks. Nothing dramatic or impactful in the world of 40/100/400G but this will grow depending on the network size, amount of BUM traffic, number of VLANs etc..

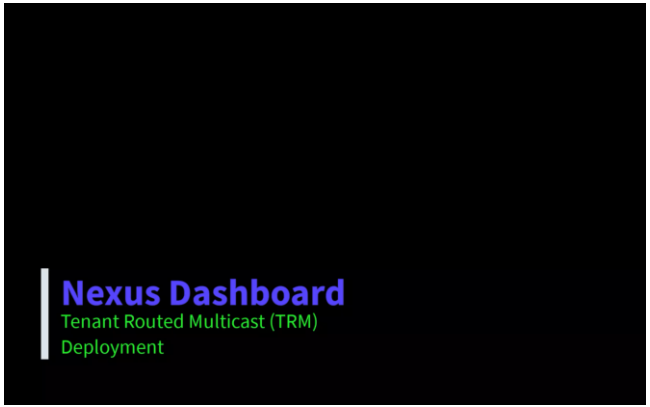
Scale | Efficiency | Preference

Tenant Routed Multicast (TRM)

Enable TRM

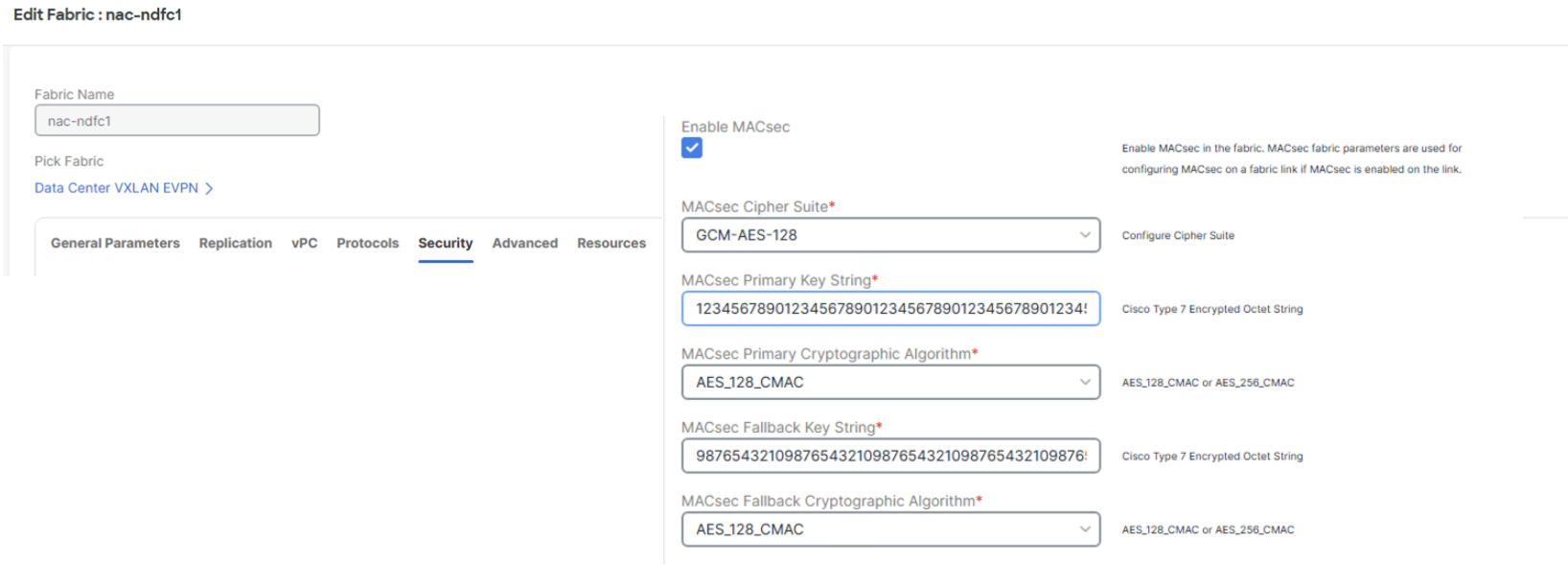


VRF/VLAN Config



Tenant Routed Multicast

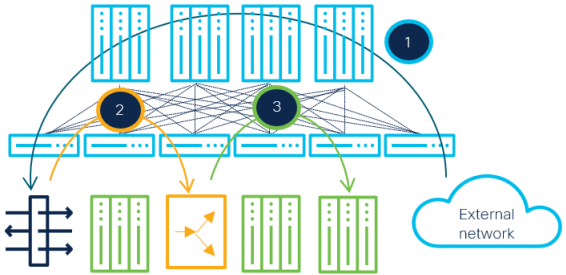
MacSec



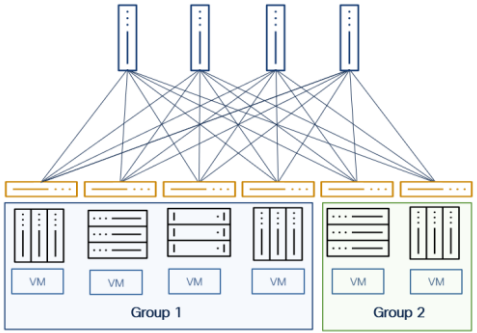
Line Rate Encryption of a Link / Port

Advanced NDFC Features

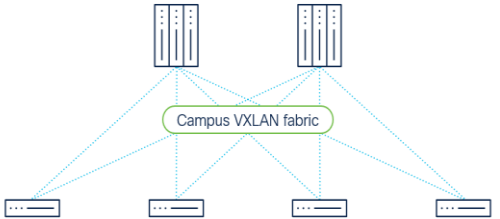
L4-7 Service Insertion



Segmentation / GPO

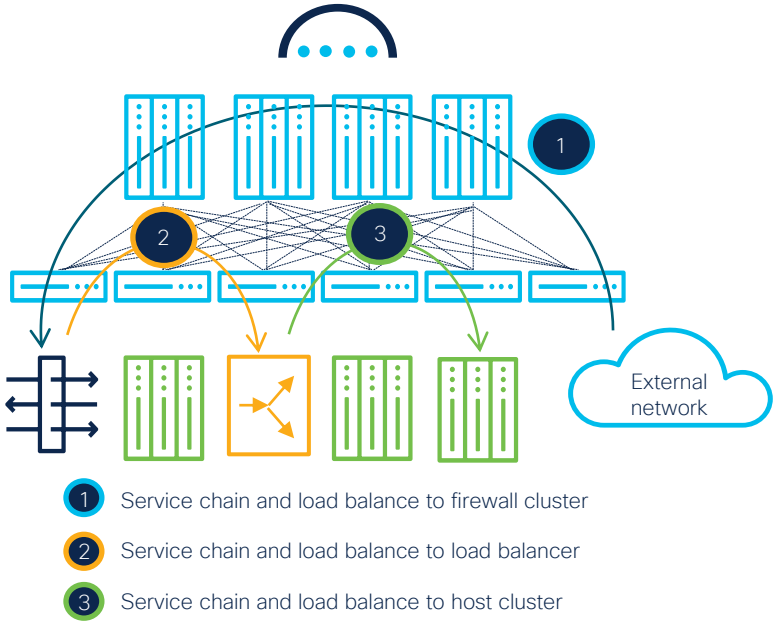


Campus VXLAN EVPN



1000's of CLI Configuration Lines

L4-L7 Service Insertion and Chaining



Enhanced Policy Based Redirect (ePBR)

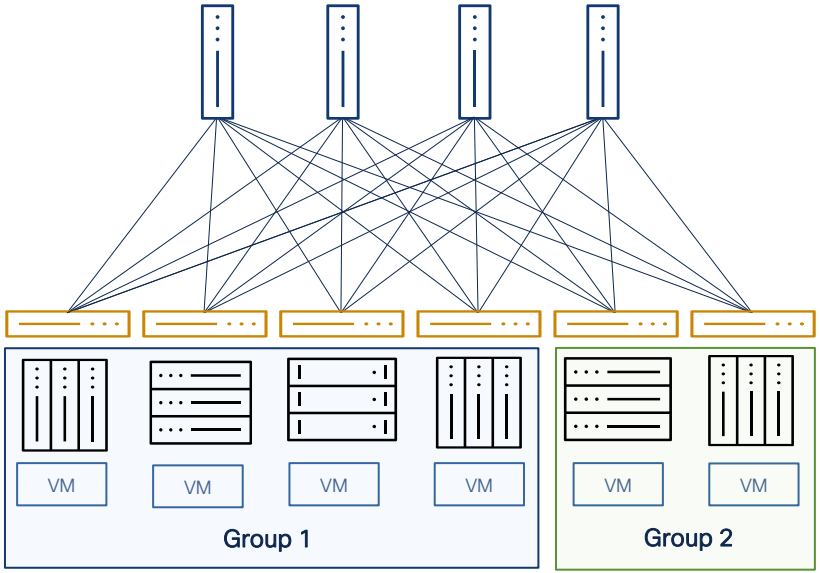
- Load balance across cluster of service nodes
- Service chain between different service node clusters
- Apply filters at each step
- Monitor for service node health with multiple failover options
- Deploy with:
  - VXLAN fabrics
  - EPBR Single fabric
  - EPBR Multi-fabric *(Planning Q1CY25)*

Benefits

Load-Balancing and Service-Chaining

Line Rate, Hardware Based Multi-Terebit

VXLAN Group Policy Option (GPO)



Segment East-West Traffic

Reduce Attack Surface

Flexible Security Isolation

Grouping

- Classify endpoints to create groups
- Based on IP, VM or VLAN attributes

VXLAN GPO

- Group Policy Object **carried in standard VXLAN header**
- Based on IETF draft-lrss-bess-evpn-group-policy-00
- Extension to VXLAN that allows policy enforcement
- Backward compatible

Micro-Segmentation using GPO

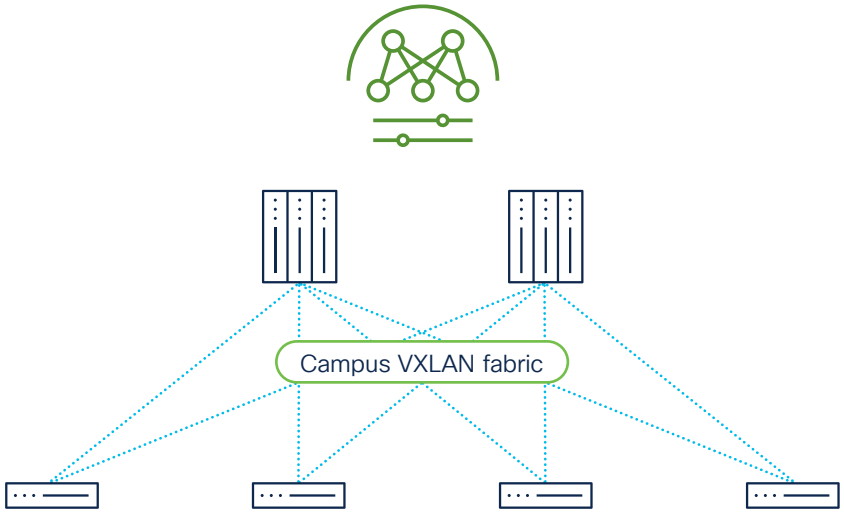
- Ability to segment east-west traffic
- Smaller attack surface and better security
- Flexible security isolation

Campus VXLAN EVPN Management

Manage Catalyst VXLAN EVPN Deployments with NDFC

Support for configuration automation via Fabric Builder

Single Point of automation and provisioning for all VXLAN EVPN deployments



Benefit

Unified and Seamless Management Across Various Platforms

Increase Developer Agility with NDFC DevOps

DevOps

RED HAT ANSIBLE

HashiCorp Terraform

REST : API

Utilize GUI or automation through APIs

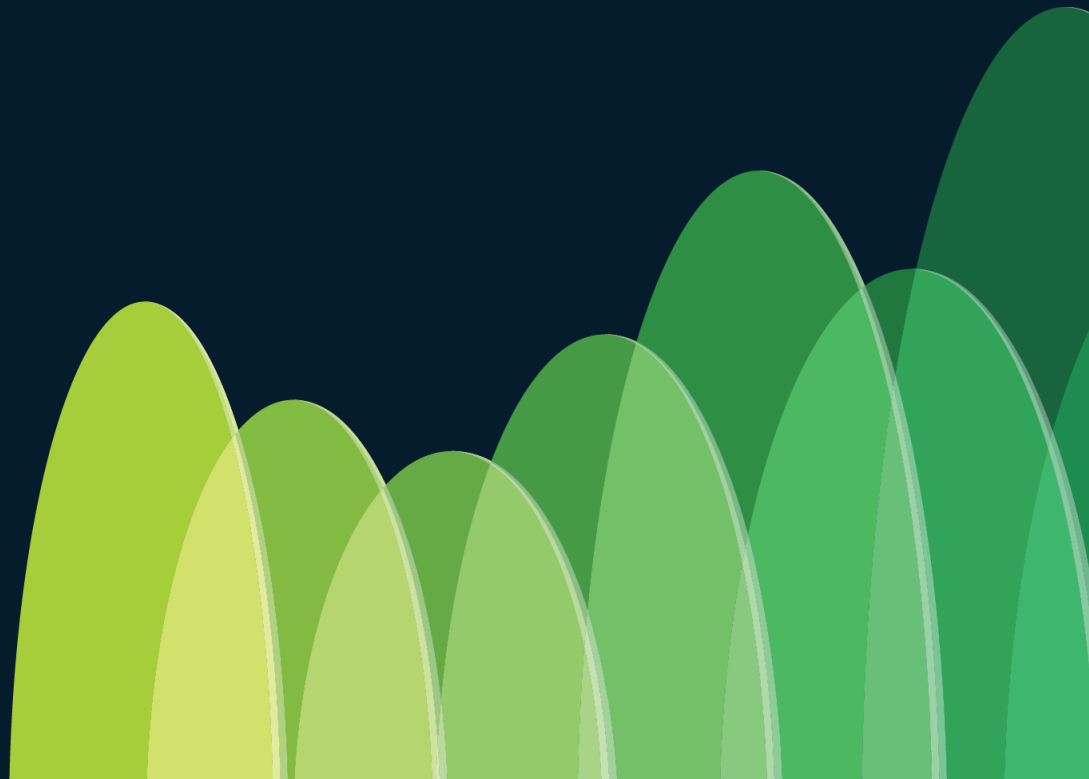
Integrations with Ansible and Terraform

https://netascode.cisco.com/

Benefits

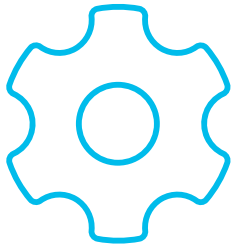
Accelerate Deployments	Increase Consistency	Minimize Risk

Conclusion



Cisco Nexus Dashboard

Nexus Dashboard Fabric Controller

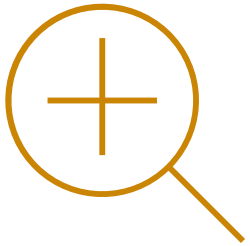


Automation

Accelerate provisioning and simplify deployments

Management

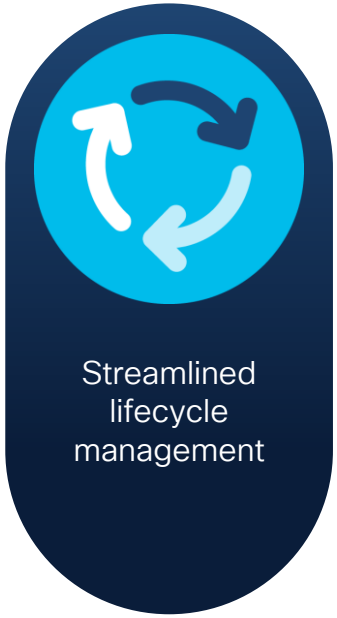
In depth Management and control for all network deployments

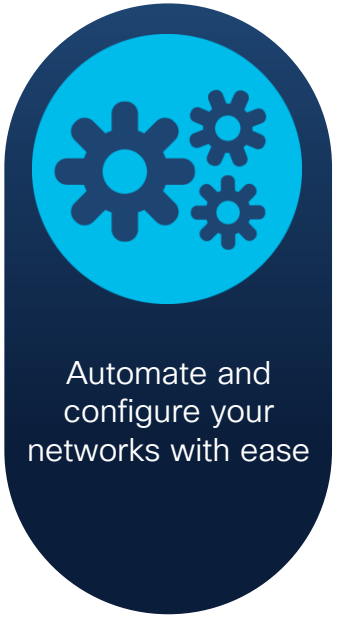


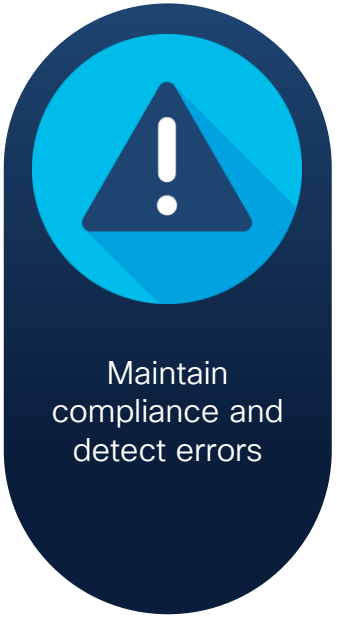
Visibility

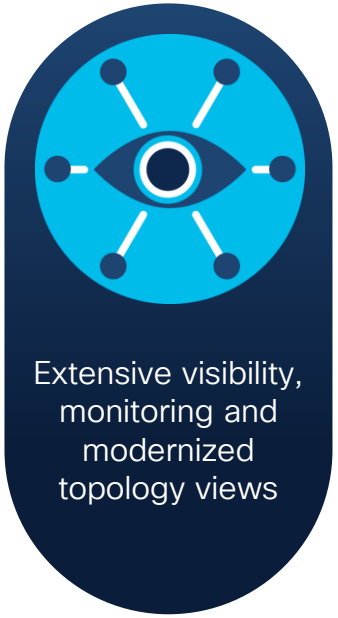
Get Centralized Visibility and Monitoring views

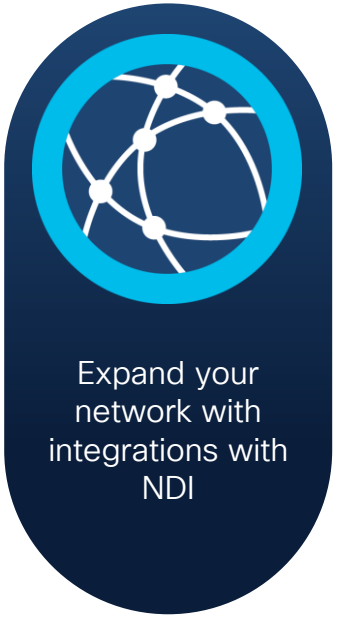
NDFC Summary











Related ‘DCN’ Sessions – This Week -> On Demand

- PSODCN-1870 – A Unified Nexus Dashboard Experience
  (Wednesday Feb. 12 | 930am-1030am)
- BRKDCN-1619 – Introduction to NDFC: Simplifying Management of Your Data Center
  (Tuesday Feb. 11 | 8am-9am)
- BRKDCN-2974 – Architecting Layer 4-7 Network Services in a Multi-Tenant Data Center with VXLAN EVPN
  (Wednesday Feb. 12 | 930am-1030am)
- IBODCN-1011 – An Interactive Conversation on Micro-Segmentation Using VXLAN GPO for NX-OS VXLAN EVPN Fabrics
  (Thursday Feb. 13 | 130pm – 230pm)
- BRKDCN-2933 – Deployment of Micro-Segmentation in Cisco NX-OS VXLAN EVPN Fabrics with VXLAN Group Policy Option (GPO)
  (Wednesday Feb. 12 | 1pm -230pm)
- BRKDCN-2913 – VXLAN BGP EVPN Multi-Site
  (Thursday Feb. 13 | 1030am -1130am)
- BRKDCN-3738 – Overlay Multicast in VXLAN EVPN (Tenant Routed Multicast – TRM)
  (Thursday Feb. 13 | 5pm – 6pm)

Cisco
Modeling Labs

Cisco Modeling Labs

The Simulation is Your Network

https://developer.cisco.com/modeling-labs

Labs = Isolated virtual networks

Configurable network connectivity

Console multiplexing

Breakout client utility

Live topology modification – drag, drop, and wire networks in a running simulation

Device persistence – just like shutting down a real router

Admin control of all labs

Clustering for horizontal scaling*

Ability to support Kernel-based Virtual Machine hypervisor

Server-side labs with an easy-to-use HTML5 front end

{ REST:API }

API First Design

Swagger interface

Python client library

Network operations, management, and design

- Test and validate your network, management tools, and deployments
- Design new router configurations virtually

Network security

- Design and test security configurations on a virtual network
- Simulate attacks, find fail points

Learning

- Build and share labs for yourself and your team
- Using supplied Cisco® images, build configurations to prepare for certification exams

Nexus 9K | EVPN VXLAN | NDFC Reference Links

EVPN VXLAN – Ciscolive.com OnDemand

CiscoLive OnDemand Content is accessible for all with a Ciscolive.com account (separate than your Cisco.com account)

Introduction to VXLAN: The Future Path of Your Datacenter – BRKDCN-1621
https://www.ciscolive.com/on-demand/on-demand-library.html?#/session/1686177757990001VnsV

How to Talk to the Rest of the World – External Connectivity for VXLAN EVPN Fabrics – BRKDCN-2267
https://www.ciscolive.com/on-demand/on-demand-library.html?#/session/1655242242060001QF9P

A Day in the Life of a VXLAN EVPN Packet – BRKDCN-2563
https://www.ciscolive.com/on-demand/on-demand-library.html?#/session/1655242253340001QqkI

VXLAN BGP EVPN Multi-Site – BRKDCN-2913
https://www.ciscolive.com/on-demand/on-demand-library.html?#/session/1686177761247001VE7O

N9K / EVPN VXLAN White Papers

https://www.cisco.com/c/en/us/products/switches/nexus-9000-series-switches/white-paper-listing.html

Nexus 9K Platform

Main CCO Nexus 9K Landing Page (Data Sheets, Config Guides etc..)
https://www.cisco.com/c/en/us/support/switches/nexus-9000-series-switches/tsd-products-support-series-home.html

Nexus 9K Cisco.com White Paper List
https://www.cisco.com/c/en/us/products/switches/nexus-9000-series-switches/white-paper-listing.html

NDFC – Ciscolive.com OnDemand

Introduction to NDFC: Simplifying Management of Your Data Center – BRKDCN-1619
https://www.ciscolive.com/on-demand/on-demand-library.html?#/session/1686177757715001VQns

Automating Highly Available Data Center Architecture with NDO and NDFC – BRKDCN-2931
https://www.ciscolive.com/on-demand/on-demand-library.html?#/session/1686177761986001VhBr

NDFC YouTube Videos

NDFC / DCNM YouTube Playlist
https://www.youtube.com/playlist?list=PLFT-9JpKjRTAZC7YSciYcPNFyimCrJHb0

Nexus Dashboard Fabric Controller – A Quick Overview
https://www.youtube.com/watch?v=Ka-Nju48_vo

NDFC Cisco.com Links and White Papers

Main NDFC Cisco.com Landing Page
https://www.cisco.com/c/en/us/products/cloud-systems-management/prime-data-center-network-manager/index.html

NDFC Support Landing Page (Data Sheets, Config Guides etc..)
https://www.cisco.com/c/en/us/support/cloud-systems-management/nexus-dashboard-fabric-controller-12/model.html

Webex App

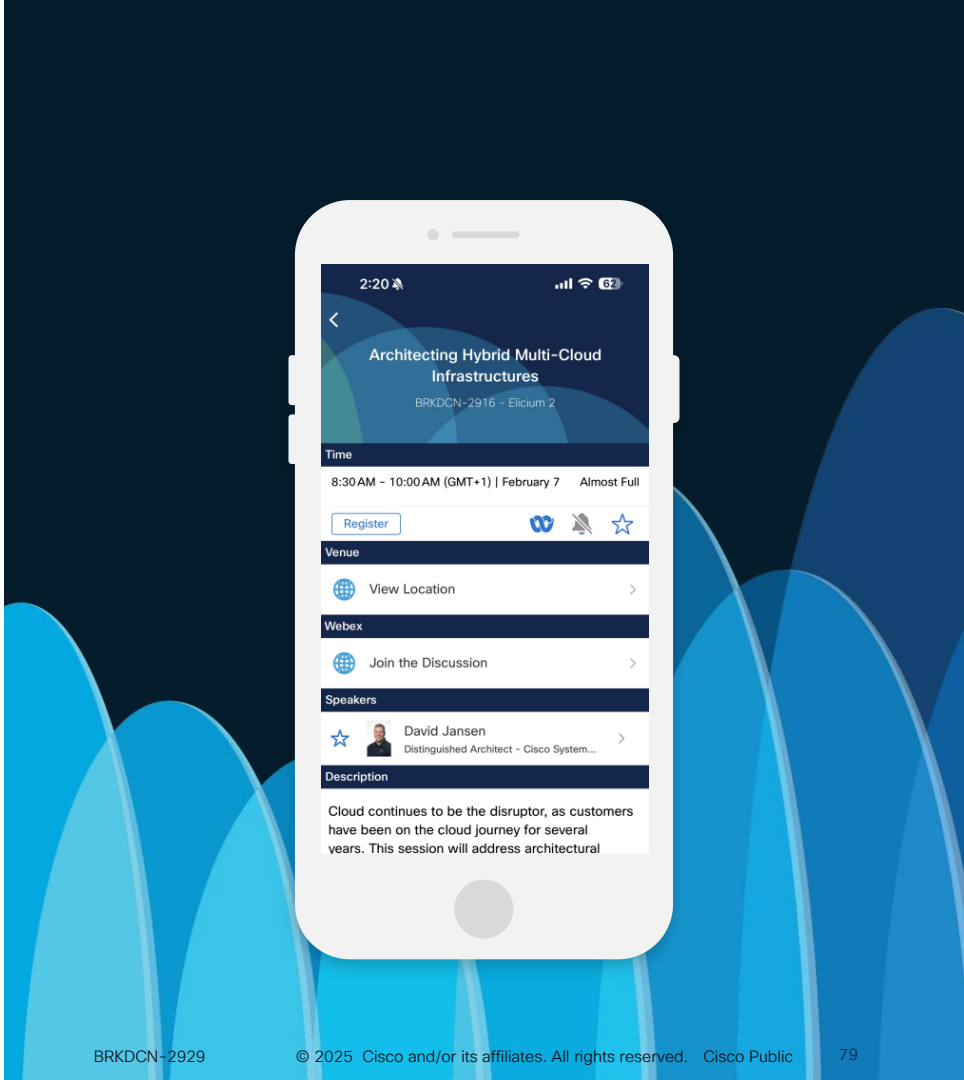
Questions?

Use the Webex app to chat with the speaker after the session

How

1. Find this session in the Cisco Events mobile app
2. Click “Join the Discussion”
3. Install the Webex app or go directly to the Webex space
4. Enter messages/questions in the Webex space

Webex spaces will be moderated by the speaker until February 28, 2025.



Fill Out Your Session Surveys

Participants who fill out a minimum of 4 session surveys and the overall event survey will get a unique Cisco Live t-shirt.

(from 11:30 on Thursday, while supplies last)

All surveys can be taken in the Cisco Events mobile app or by logging in to the Session Catalog and clicking the ‘Participant Dashboard’

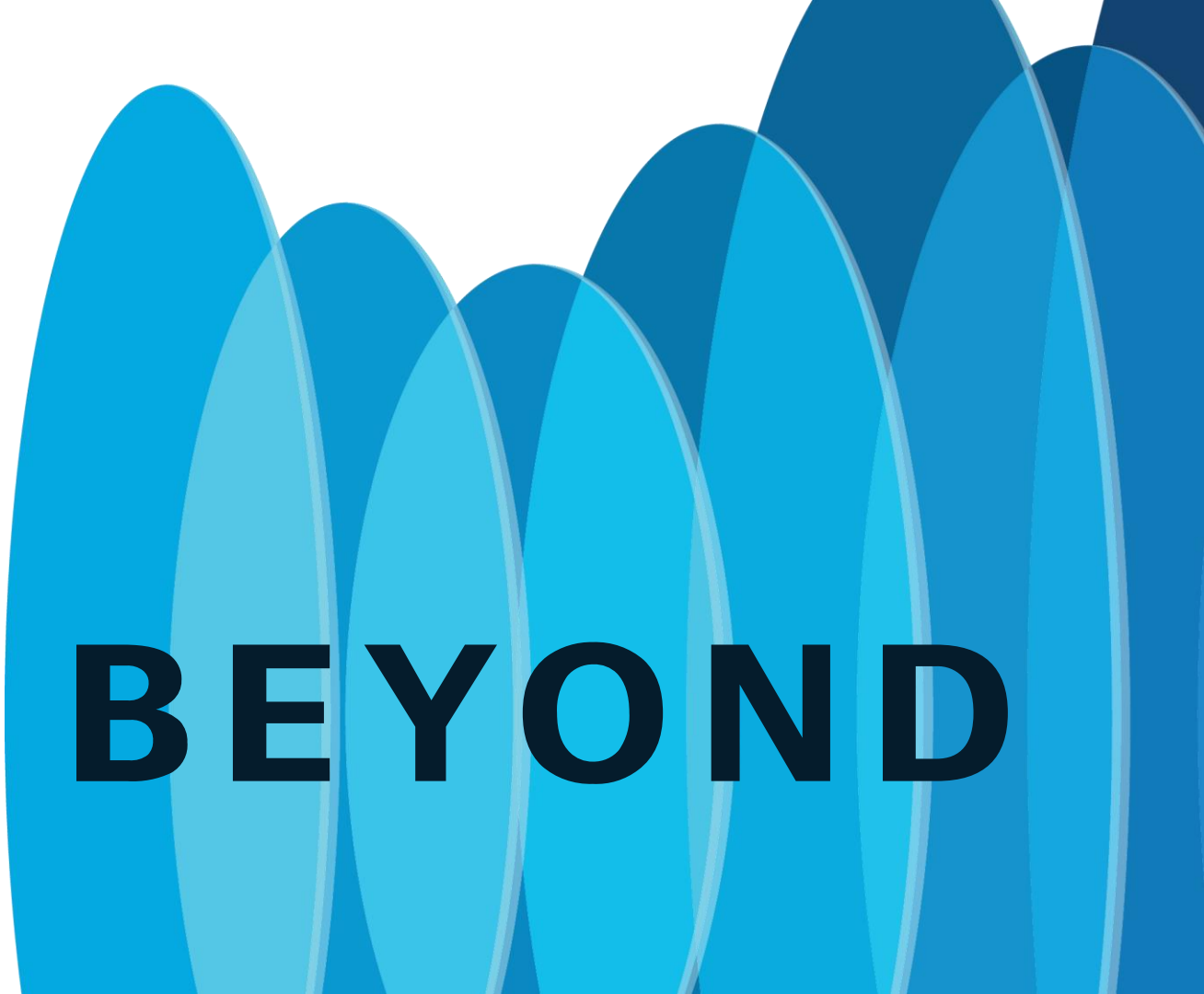
Content Catalog

Continue your education

- Visit the Cisco Showcase for related demos
- Book your one-on-one Meet the Engineer meeting
- Attend the interactive education with DevNet, Capture the Flag, and Walk-in Labs
- Visit the On-Demand Library for more sessions at ciscolive.com/on-demand. Sessions from this event will be available from March 3


cisco
Thank you
cisco Live!

cisco Live!



GO BEYOND