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# Introduction to DCNM: Simplifying management of your Datacenter

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Intent Based Networking Group

BRKDCN-1687

cisco Live!
Barcelona | January 27-31, 2020

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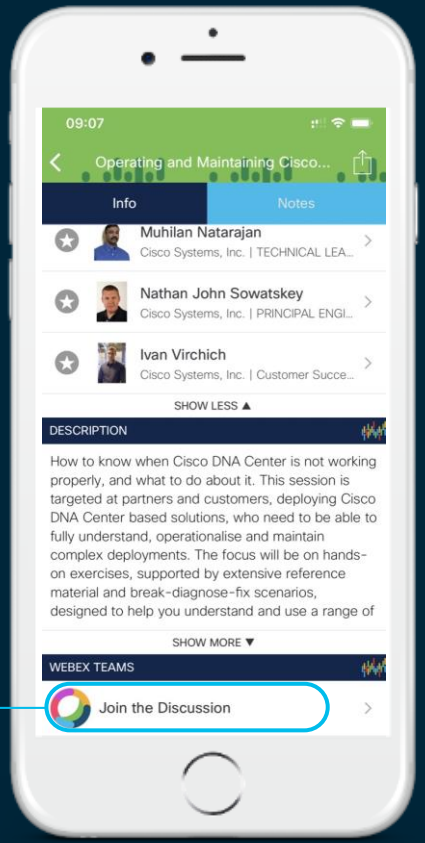



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# Session Abstract

Data Center Network Manager (DCNM) is the network management platform for all NX-OS (Nexus switching) enabled deployments, spanning LAN fabric and classic LAN architectures, IP Fabric for Media, and storage networking deployments for the Cisco Nexus-powered data center. This session will serve as an introduction to DCNM providing an overview of the product while highlighting the main features of the latest DCNM 11 release. Beginning with the available DCNM installation options, we will dive into a comparison between LAN Classic and LAN fabric modes. We will then move on to LAN fabric mode for VXLAN EVPN and routed fabric. The focus will be on best practice template-based provisioning capabilities with built-in Configuration Compliance and the myriad deployment scenarios. We will also walk through useful Day 2 features like Compute Visibility using Virtual Machine Manager (VMM) integration, the Switch Dashboard, real-time topology search, Endpoint locator, DCNM's application framework with computes for scale out, Network Insights applications, and finally close with the licensing structure. No prior knowledge of DCNM is necessary.

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# Agenda

- Introduction to DCNM 11
- Greenfield VXLAN Deployment
- Brownfield - Revamp your VXLAN fabric
- DCNM Day-2 operations
- Install and Licensing
- Conclusion


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# Data Center Network Manager (DCNM)

## Single Management Solution for

- VXLAN-EVPN Programmable Fabric
- Classic LAN Deployments
- IP Media Network Controller (PMN)
- SAN (MDS & Nexus)

## Helps in Day 2 Operations

- Real-Time Topology
- Integrated Compute Visibility
- Performance Monitoring
- Fault Management
- Configuration Compliance
- Image Management, Upgrades and RMA
- Network Insights Suite

## Addresses End-to-End Network Provisioning

- GUI/API-based provisioning
- Multi-Fabric & Multi-Site
- Network Configuration Backup & Restore


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# Network Architecture Deployment Models ~ DCNM modes

## Fabric / Overlay Models

### VXLAN + BGP-EVPN

- L2 over L3 overlay
- BGP-EVPN Control Plane
- VXLAN Data Plane

LAN Fabric Mode – Easy Fabric Template
(Nexus 3k/9k)

## Traditional Models

### Traditional L2 / L3

- L3 @ Aggregation & L2 @ Access
- L3 @ Access
- 3-tier or Spine-Leaf Model

LAN Fabric mode - External Fabric Template
LAN Classic Mode
(Nexus 2k-9k)


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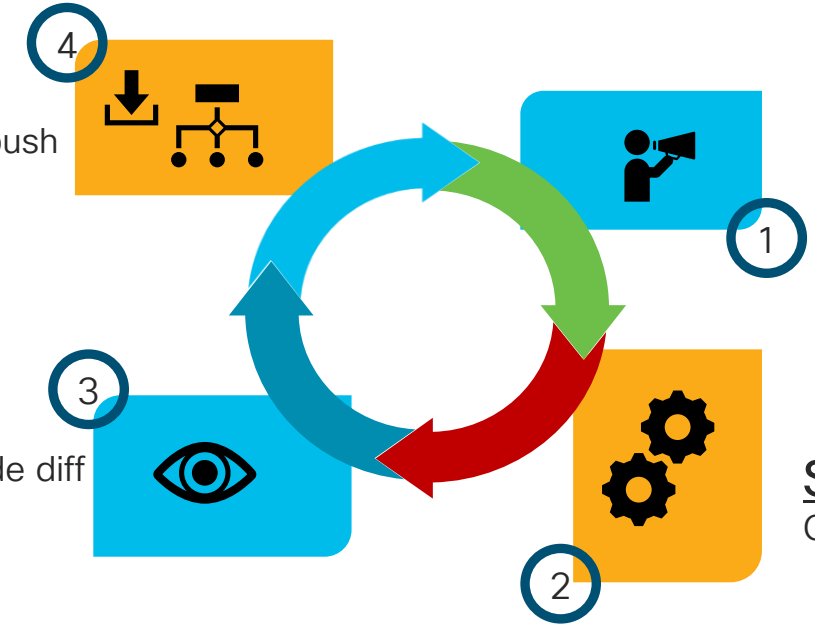
# Introducing LAN Fabric in DCNM 11




**Deploy**
Centralized config push

**Define**
Define Intent based on best practices
- Underlay
- Interfaces
- Overlay

**Preview**
Side-by-side diff

**Save**
Generates configuration based on intent

Voila! Your fabric is ready in a few minutes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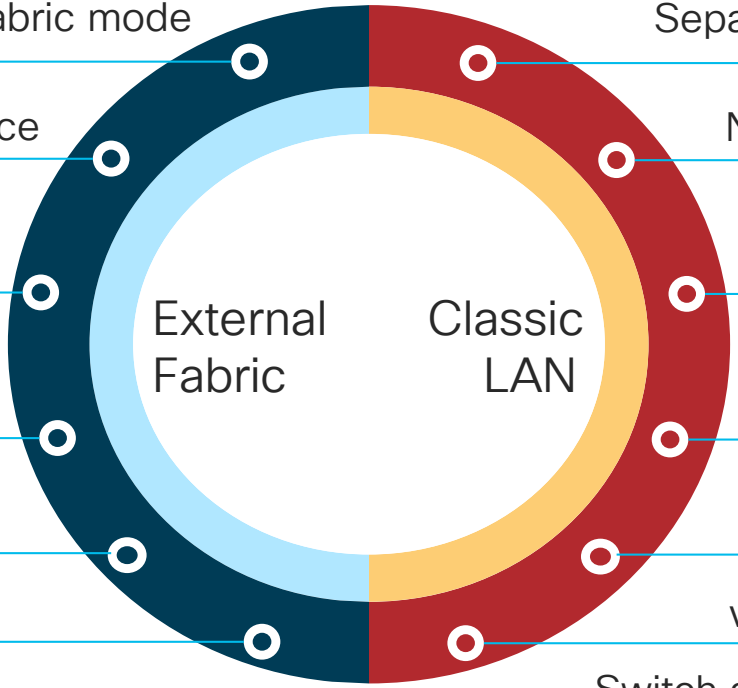
# Classic LAN and External Fabric – Nexus 2k-9k




Use within LAN Fabric mode

With Configuration Compliance

Backup and Restore of Configs and State

Flexible Python+ Templates

Endpoint Locator

One-click vPC Pairing

Bootstrap/SMU patching

Separate Install Mode

No Configuration ZCompliance

Backup and Restore of Configs

CLI based Templates

No Endpoint Locator

vPC Wizard

Switch and VDC POAP/SMU patching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# External Fabric – The Better LAN Classic

- External Fabrics can be Managed or Monitored
- Support for Nexus 2k – 9k for VXLAN/Traditional Deployments
- Non-Nexus Support
  - IOS-XE Devices: CSR1000v
  - IOS-XR Devices: ASR9000, NCS5500
  - 3rd Party


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DCNM 11.3(1) is now on cisco.com!


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# Greenfield VXLAN Deployment

## Not on VXLAN today?

DCNM LAN fabric mode

Build VXLAN fabric in few minutes

Templates already embed best practices

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


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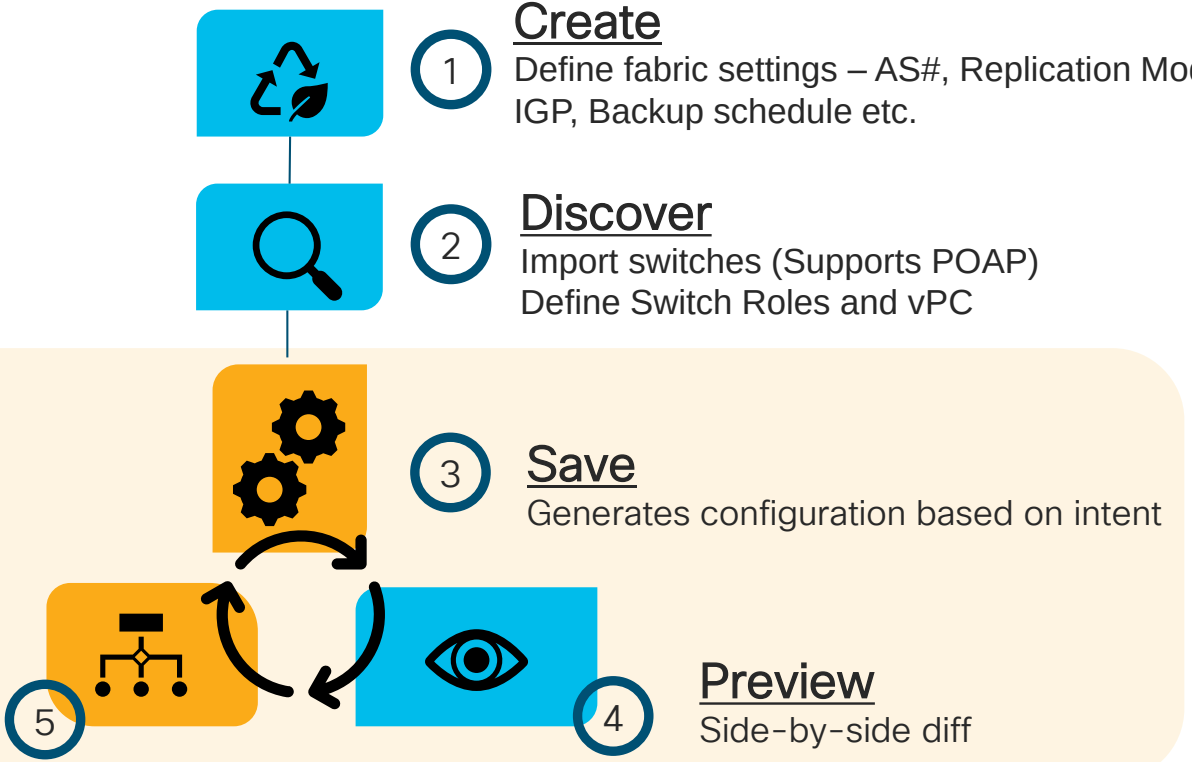
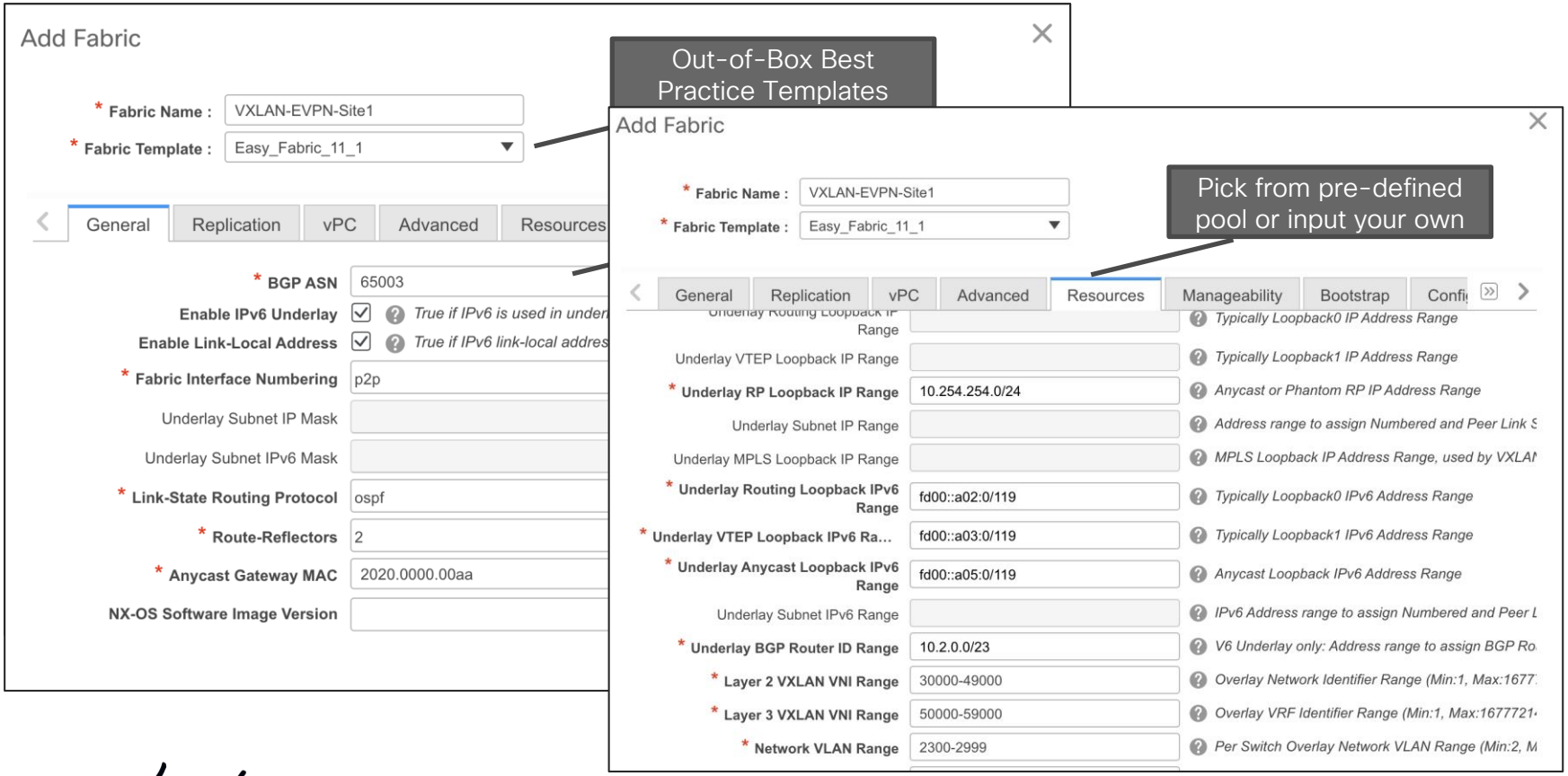
# Day in the life of DCNM – Underlay using Fabric Builder




Voila! Your VXLAN Underlay/Routed fabric is ready in a few minutes

# Step 1 – Create





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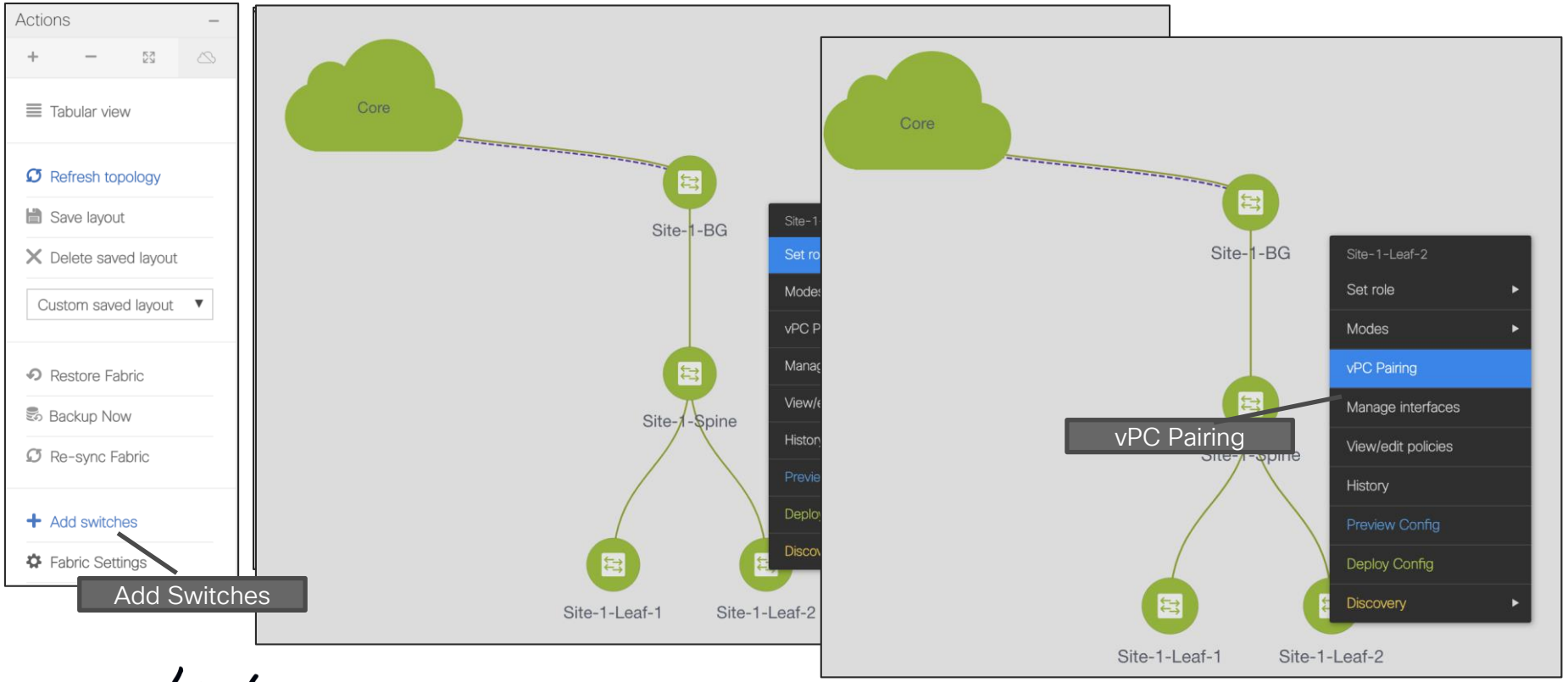
# Step 2 – Discover





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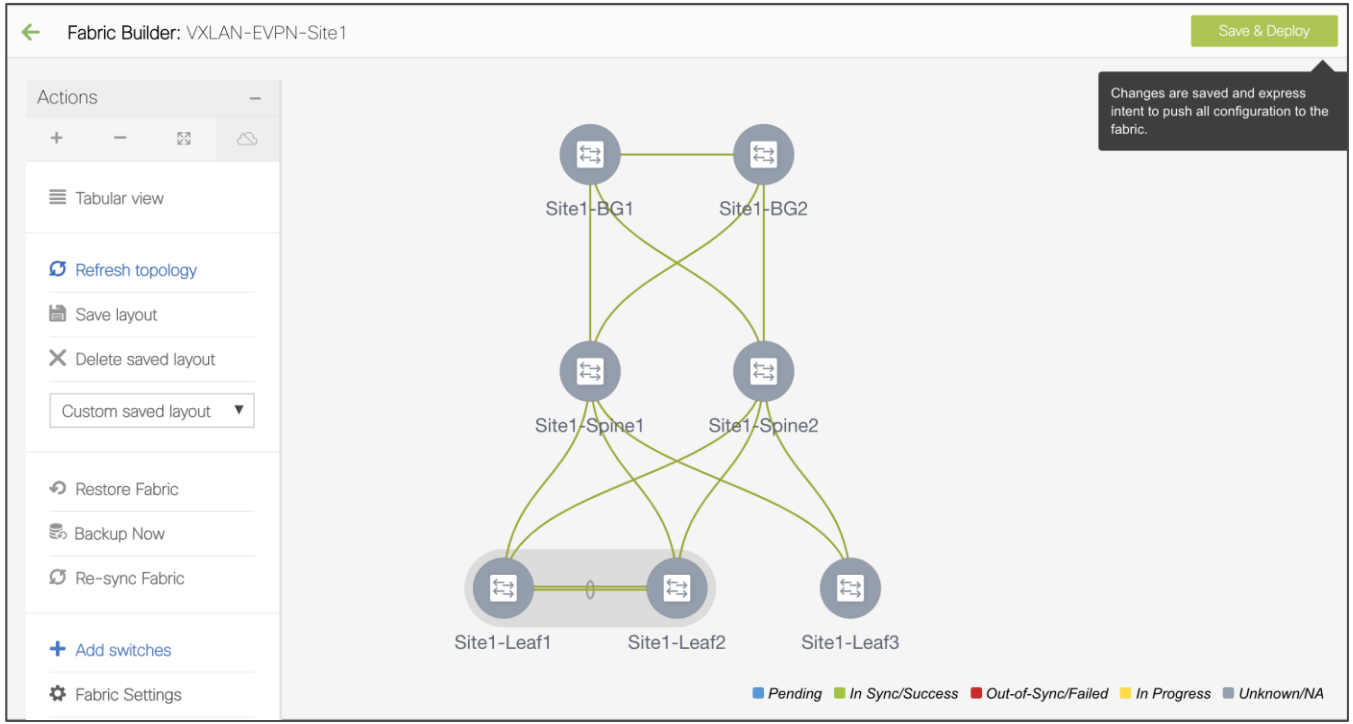
# Step 3 – Save

Save intent to generate configuration





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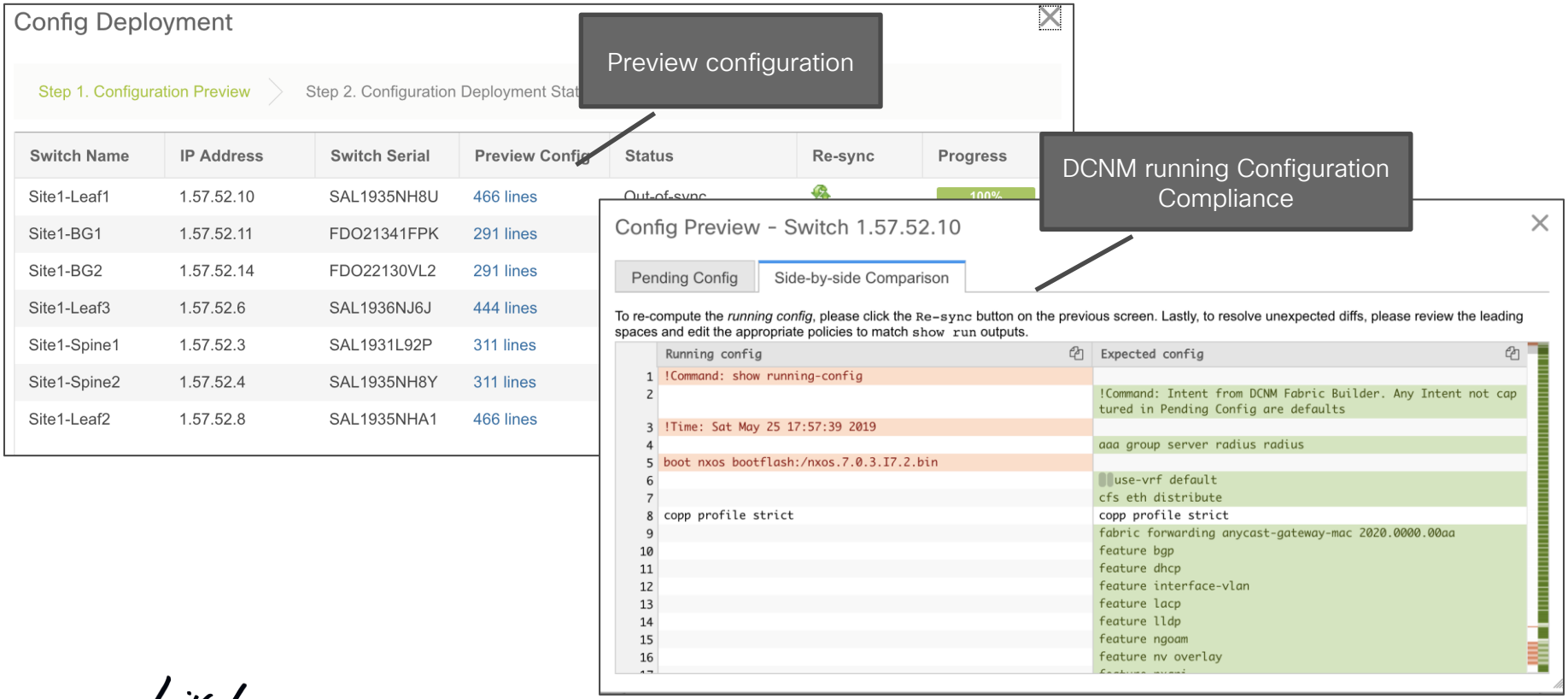
# Step 4 – Preview





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# Step 5 – Deploy

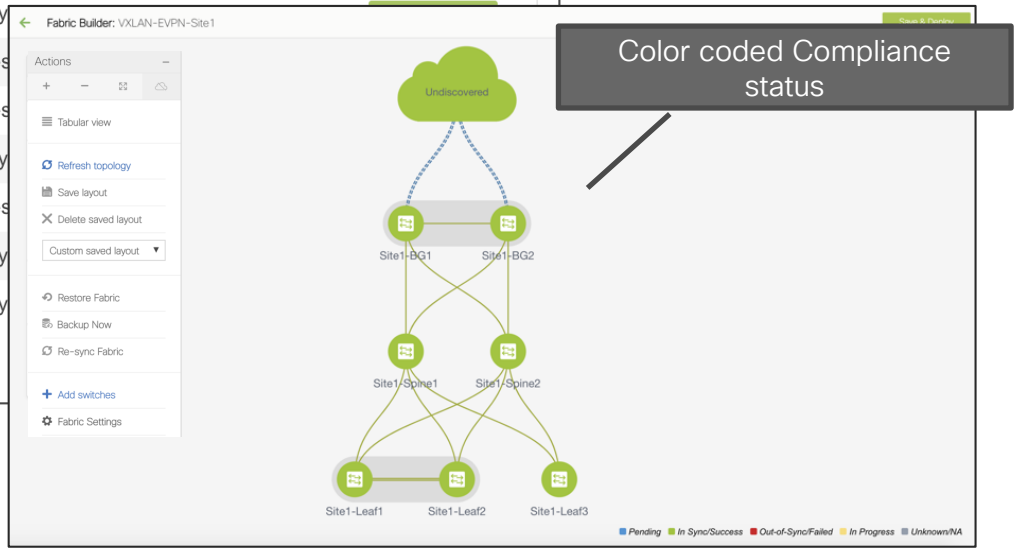
Parallel deployment of configurations once approved by user

Color coded Compliance status

## Config Deployment

Step 1. Configuration Preview > Step 2. Configuration Deployment Status

| Switch Name | IP Address | Status | Status Description | Progress |
|---|---|---|---|---|
| Site1-Spine2 | 1.57.52.4 | COMPLETED | Deployed successfully | |
| Site1-Leaf1 | 1.57.52.10 | STARTED | Deployment in progres | |
| Site1-Leaf3 | 1.57.52.6 | STARTED | Deployment in progres | |
| Site1-Spine1 | 1.57.52.3 | COMPLETED | Deployed successfully | |
| Site1-Leaf2 | 1.57.52.8 | STARTED | Deployment in progres | |
| Site1-BG2 | 1.57.52.14 | COMPLETED | Deployed successfully | |
| Site1-BG1 | 1.57.52.11 | COMPLETED | Deployed successfully | |





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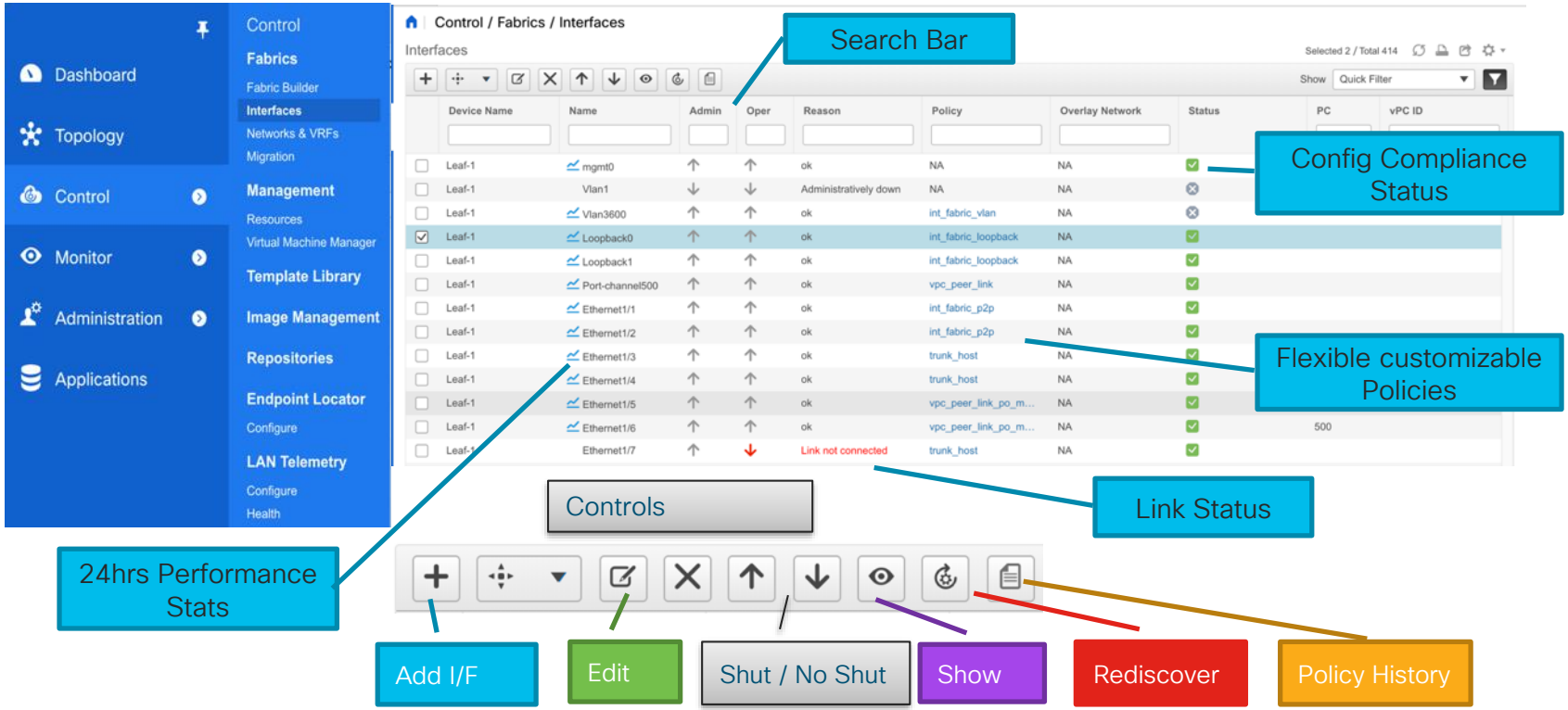
# Day in the life of DCNM – Interface Management





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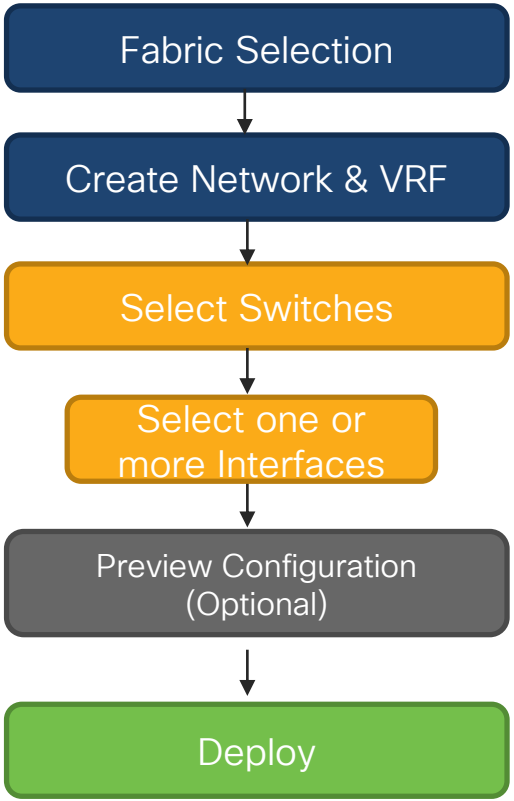
# Day in the life of DCNM – Overlay Management

- Top-Down deployment via GUI or REST APIs
- Network/VRF Creation with custom Overlay Policies
- Deployment to Switches and/or Interfaces
- Per Network/Per Switch deployment History
- Overlay Resource Manager Tracking for VNIs, VLANs etc.
- Centralized tracking of all deployment including Overlays in Fabric Builder





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# VXLAN-EVPN External Connectivity Deployment

## VRF Lite and Multi-Site

- Provisions external connectivity from Borders to WAN
  - VRF Lite using sub-interfaces
  - Devices in External fabrics can be any Nexus, Neighbor, or Meta
- Provisions Layer-2 and Layer-3 DCI Connectivity with EVPN Multi-Site via Border Gateways
  - Workflow for Multi-Site Underlay and Overlay external connection peering using a Multi-Site Domain (MSD)
  - MSD is a fabric of fabrics
    - One-time definition for Networks & VRFs
    - Tenant Routed Multicast supported


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# DCNM L4-7 Services Integration

## What is it?

- Network orchestration of L4-7 Service Appliances attached to a VXLAN EVPN Fabric
- Service Appliance Attachment
- Service Policy Definition
- Topology Visualization
- Monitoring Service Appliance Health
  - How much traffic is traversing Service Nodes?
- No configuration will be done on the service appliances themselves



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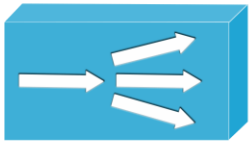
# Supported Use-cases



Virtual & Physical Form Factor
Static & Dynamic Peering
vPC/Non-vPC Attachments

## Intra-Tenant/Inter-Tenant

- PBR Use-cases
- Tenant-Edge Firewall

## One-Armed/Two-Armed

- PBR Use-case (No SNAT)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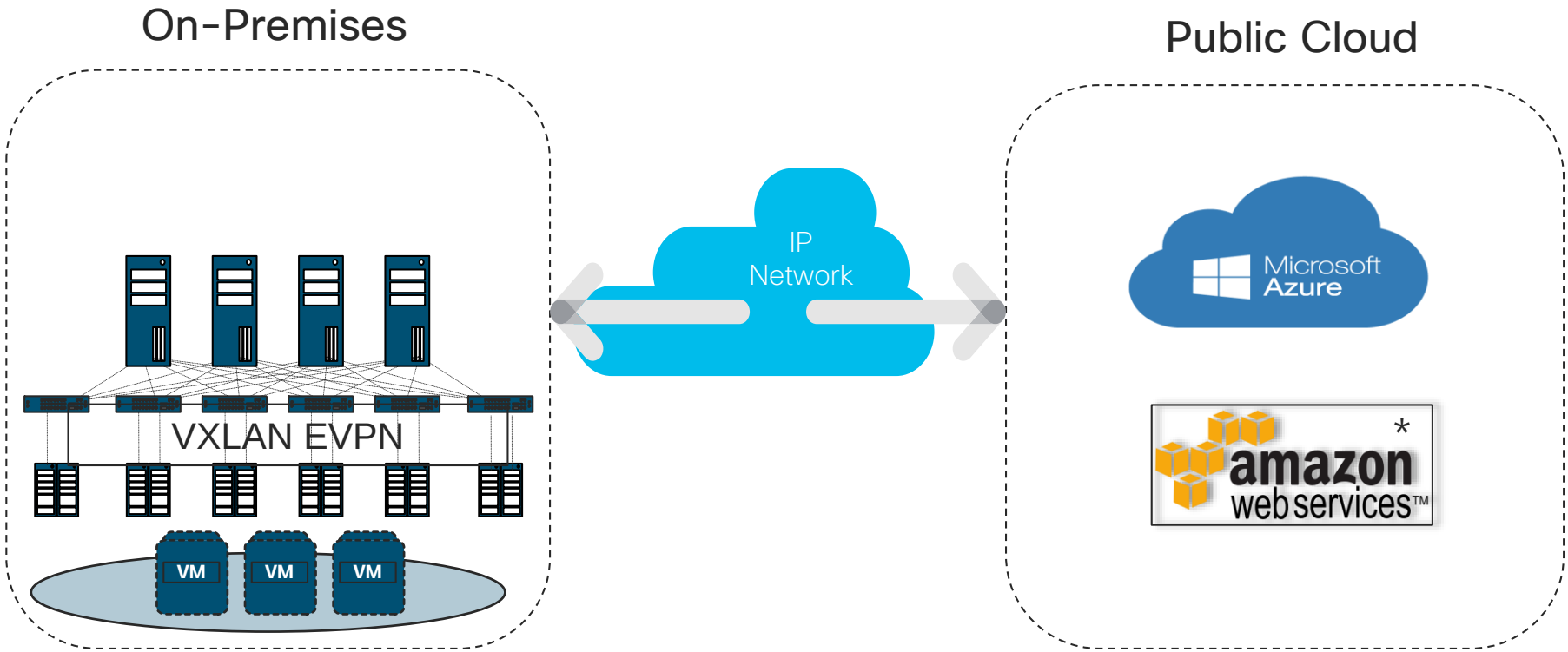
# Interconnecting On-Premises To Public Cloud




* Roadmap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# Brownfield VXLAN Deployment

Already using VXLAN?
Want to use DCNM for managing your existing Fabrics?

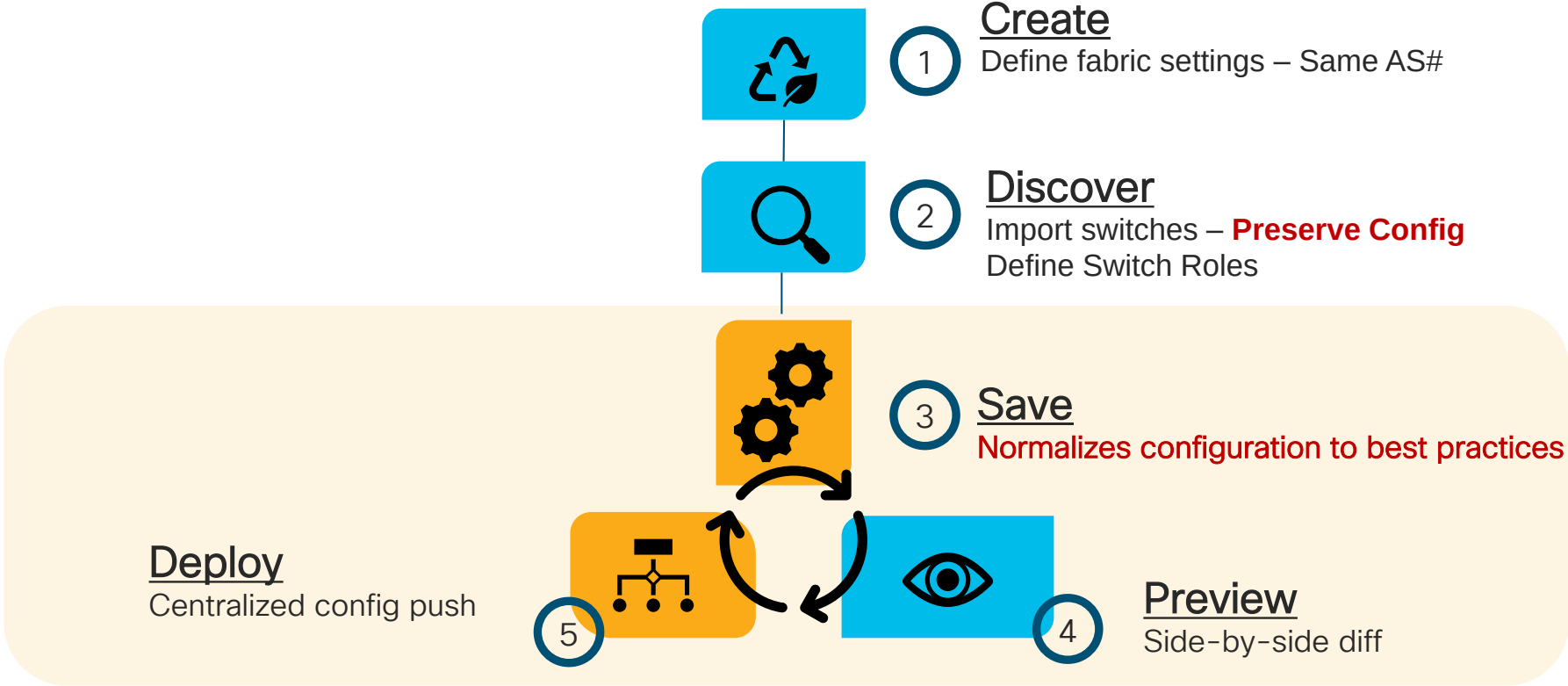
DCNM fully supports Brownfield

Non-disruptive import of existing VXLAN EVPN deployments

Manage fabric as if provisioned from DCNM

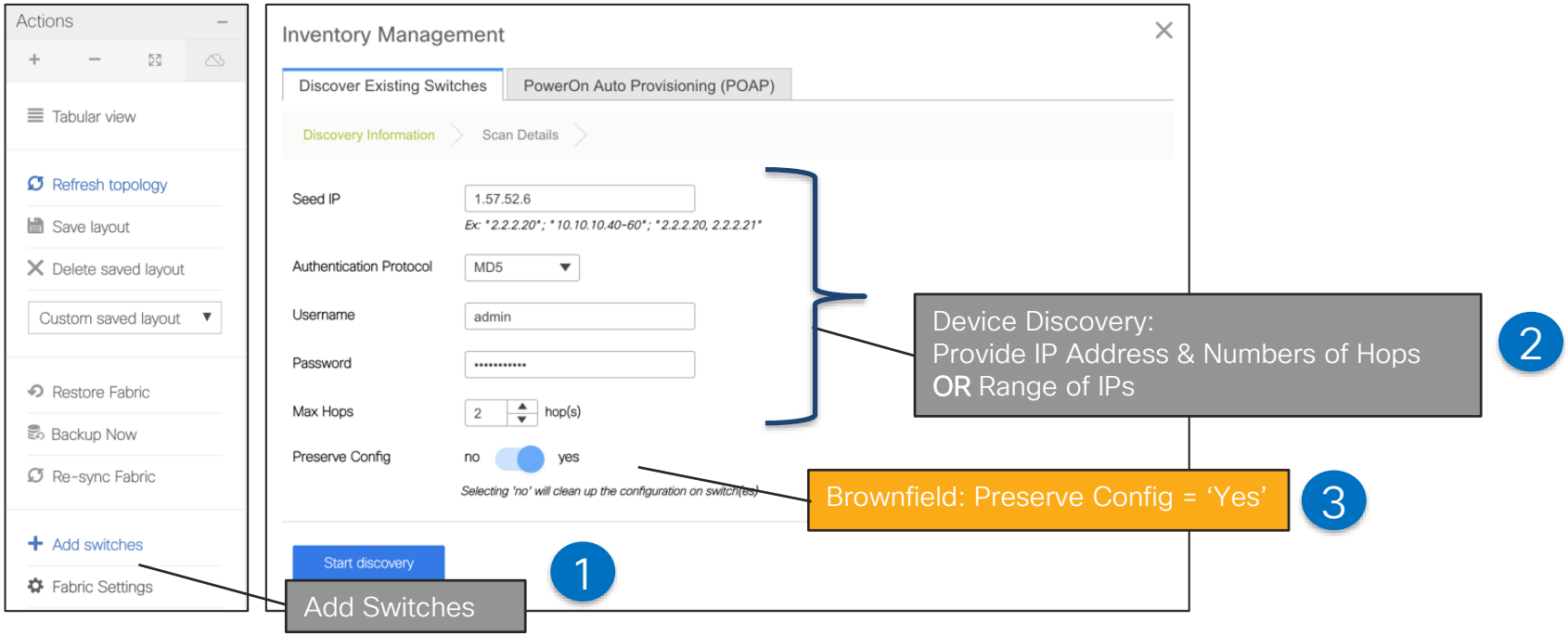
Learns topology, all configuration, associated resources, IP subnets, VNIs, VLANs etc.

# Day in the life of DCNM – Underlay using Fabric Builder




Voila! You just imported your existing VXLAN fabric

# Import Switches – Preserve Config




Import Existing VXLAN-EVPN Fabric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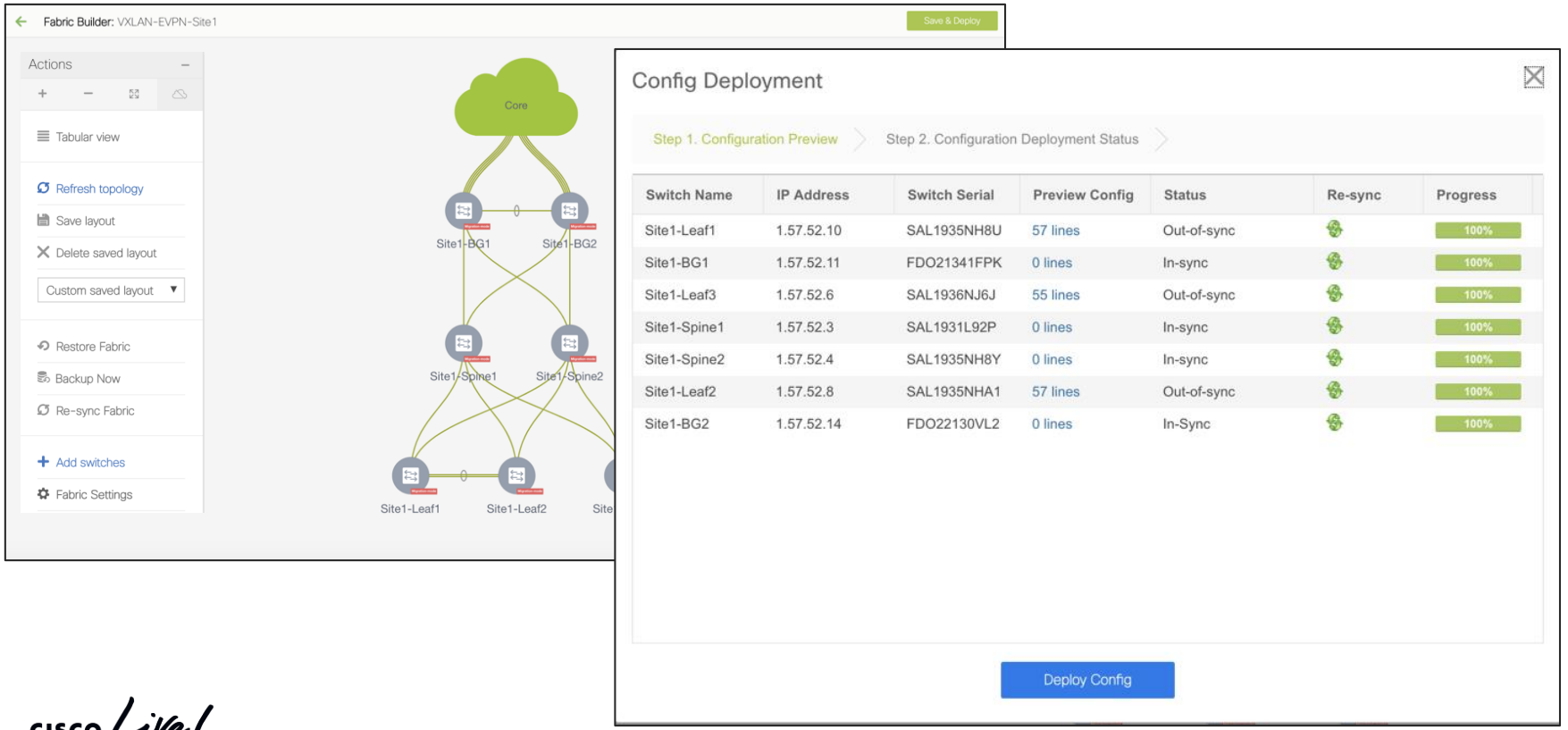
# Migration Mode – Inference from Existing Configs





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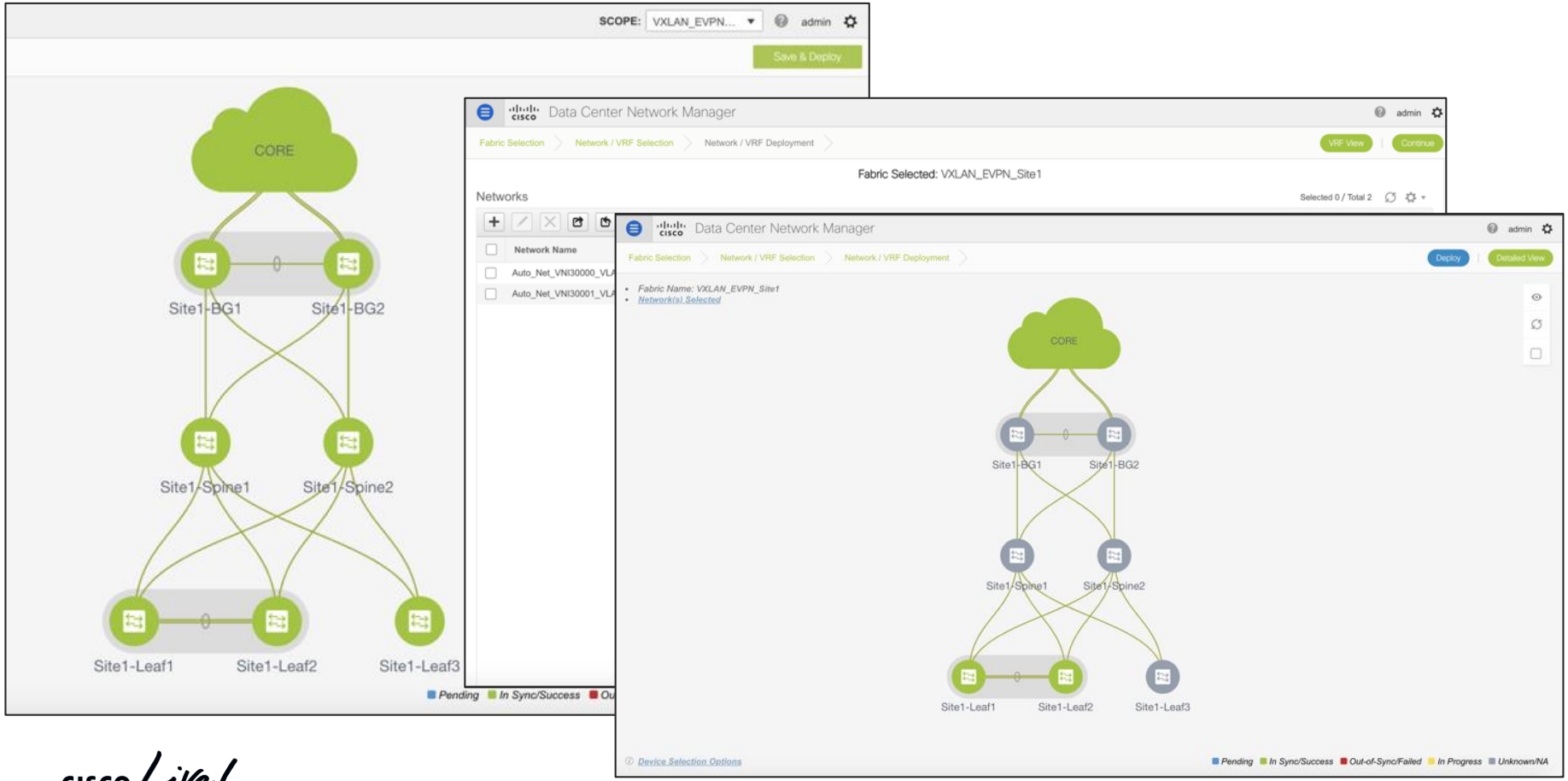
# Verification of Overlays





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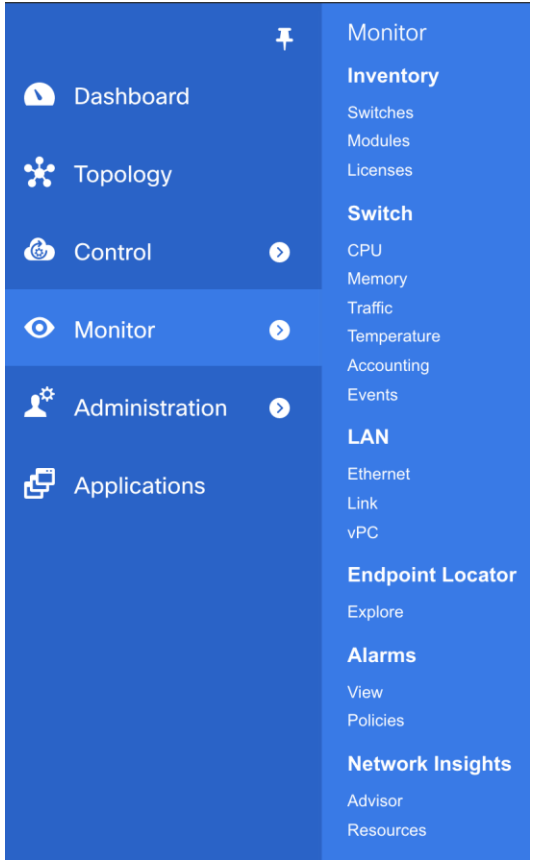
# We got your Day 2 needs covered!

- Real-Time Network View
- Common Operations
  - Update Credentials, Policies, etc.
- Configuration Compliance
- Resync Fabric
- Backup and Restore
- Endpoint Locator
- Virtual Machine Manager (VMM) / Kubernetes Cluster Visualization
- VXLAN OAM
- Software Upgrades/RMA
- Network Insights





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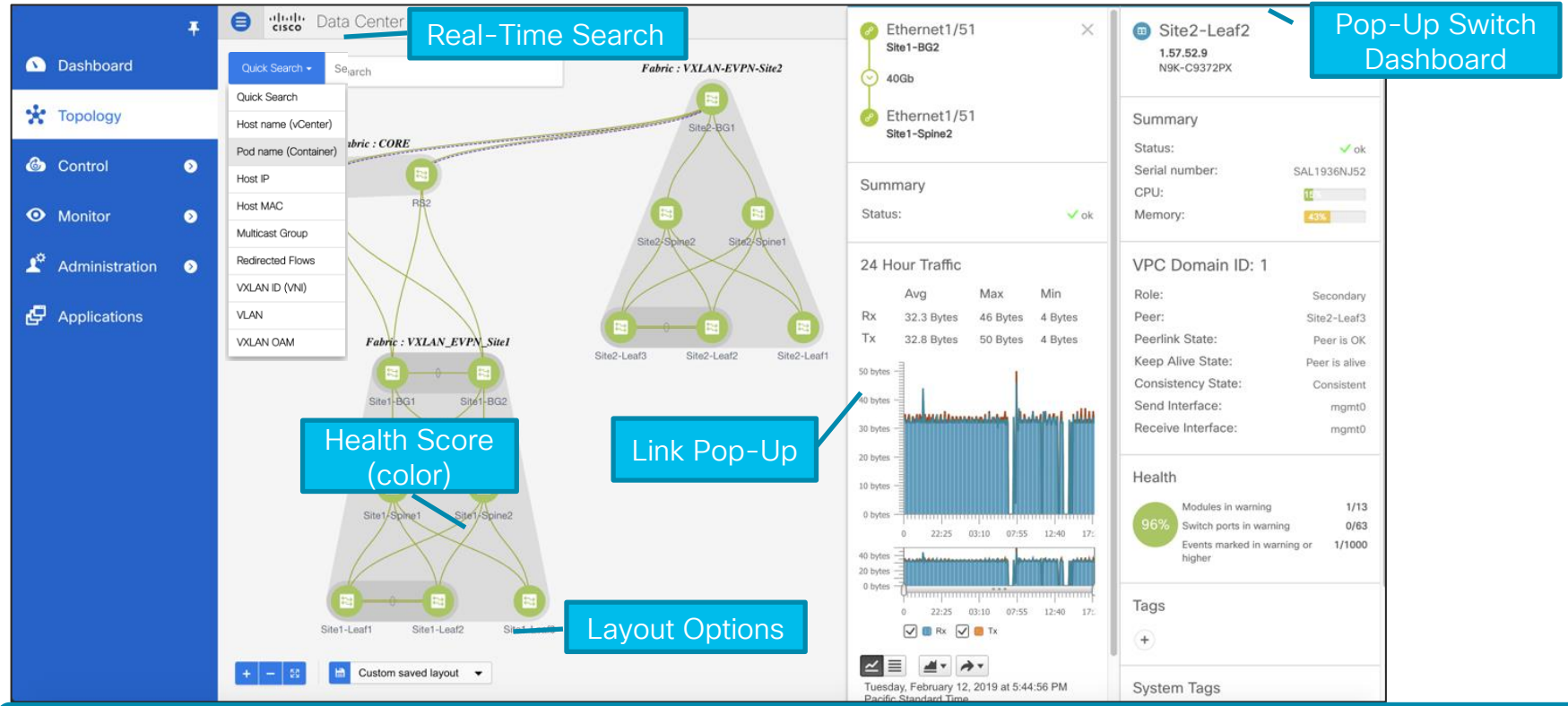
# Real Time Topology View





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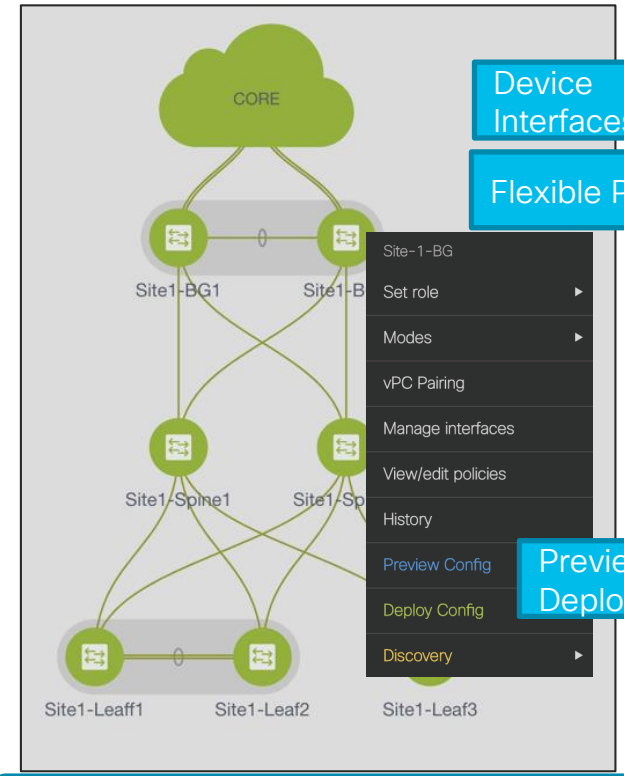
# Device Options




Device Interfaces

Flexible Policies

Preview without Deploy

## Device Options

Site-1-BG
- Set role
- Modes
- vPC Pairing
- Manage interfaces
- View/edit policies
- History
- Preview Config
- Deploy Config
- Discovery

## Device Roles

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

## Device Modes

- Maintenance Mode
- Active/Operational Mode

RMA

Configuration Status & History

Device-Level Deployment

## Discovery

- Update device credentials
- Reload
- Rediscover
- Remove from fabric

Fabric Builder Day 2 Topology Views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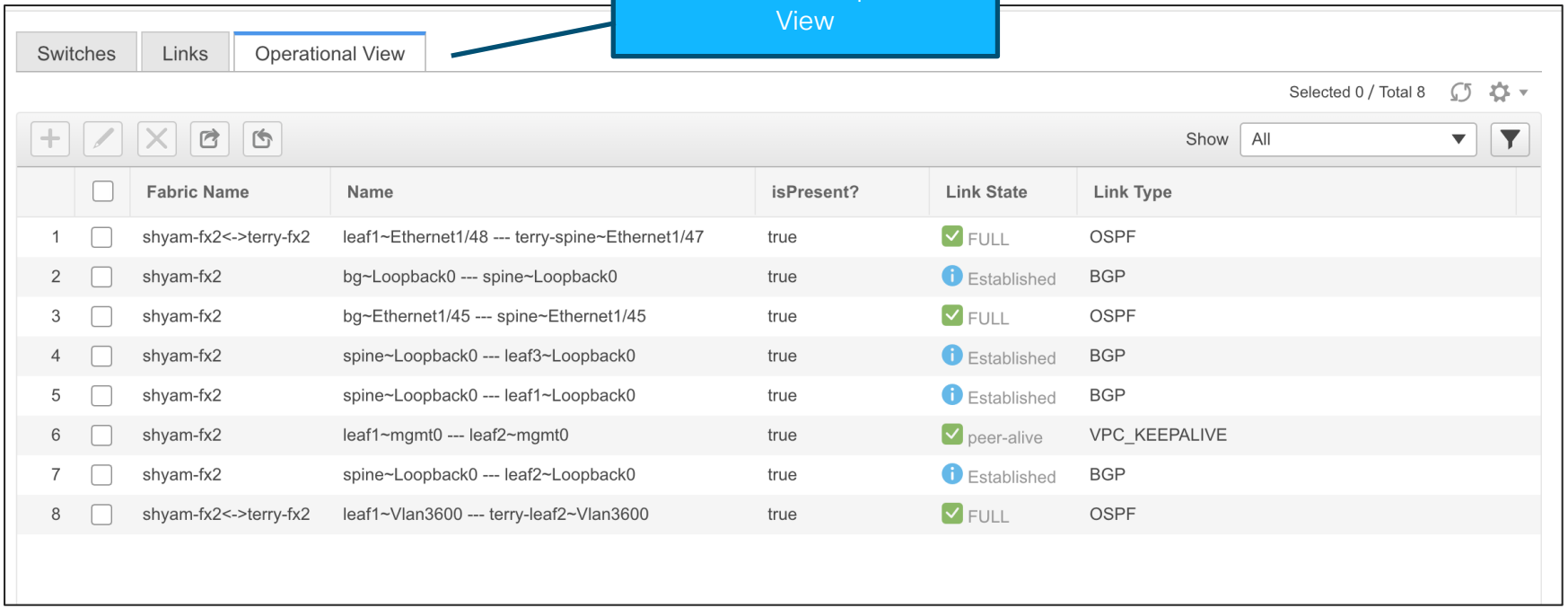
# View Operational Status

Fabric Builder -> Fabric -> Tabular View -> Operational View




| | | Fabric Name | Name | isPresent? | Link State | Link Type |
|---|---|---|---|---|---|---|
| 1 | | shyam-fx2<->terry-fx2 | leaf1~Ethernet1/48 --- terry-spine~Ethernet1/47 | true | FULL | OSPF |
| 2 | | shyam-fx2 | bg~Loopback0 --- spine~Loopback0 | true | Established | BGP |
| 3 | | shyam-fx2 | bg~Ethernet1/45 --- spine~Ethernet1/45 | true | FULL | OSPF |
| 4 | | shyam-fx2 | spine~Loopback0 --- leaf3~Loopback0 | true | Established | BGP |
| 5 | | shyam-fx2 | spine~Loopback0 --- leaf1~Loopback0 | true | Established | BGP |
| 6 | | shyam-fx2 | leaf1~mgmt0 --- leaf2~mgmt0 | true | peer-alive | VPC_KEEPALIVE |
| 7 | | shyam-fx2 | spine~Loopback0 --- leaf2~Loopback0 | true | Established | BGP |
| 8 | | shyam-fx2<->terry-fx2 | leaf1~Vlan3600 --- terry-leaf2~Vlan3600 | true | FULL | OSPF |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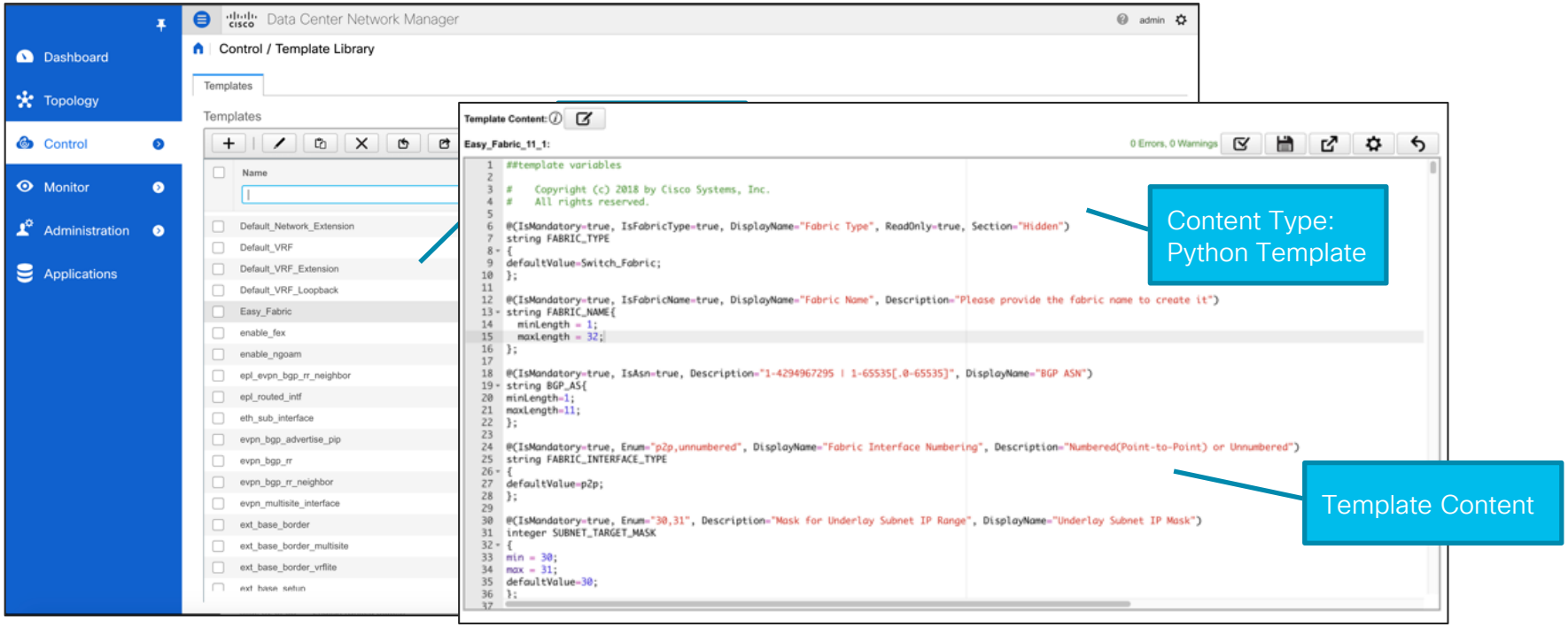
# Template Library – Customize or Create New





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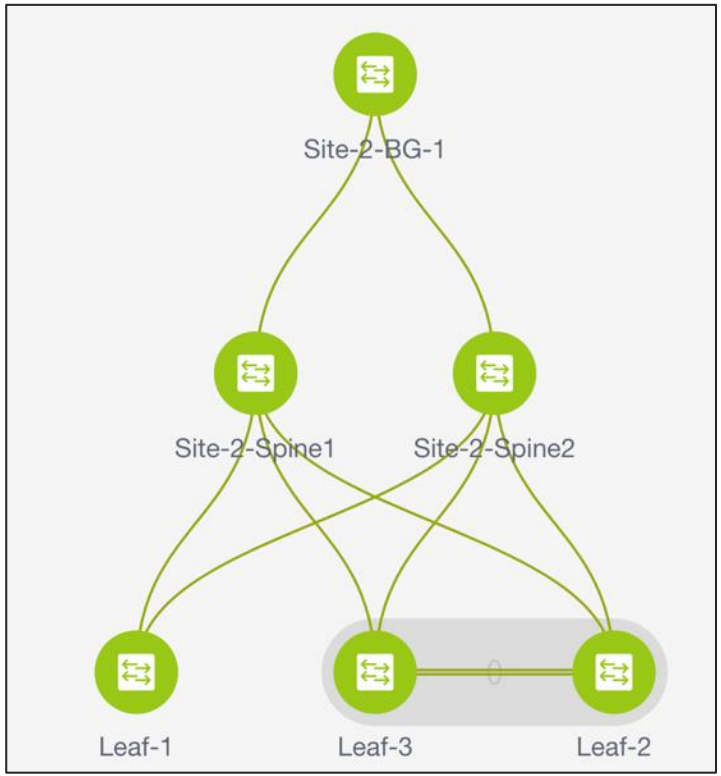
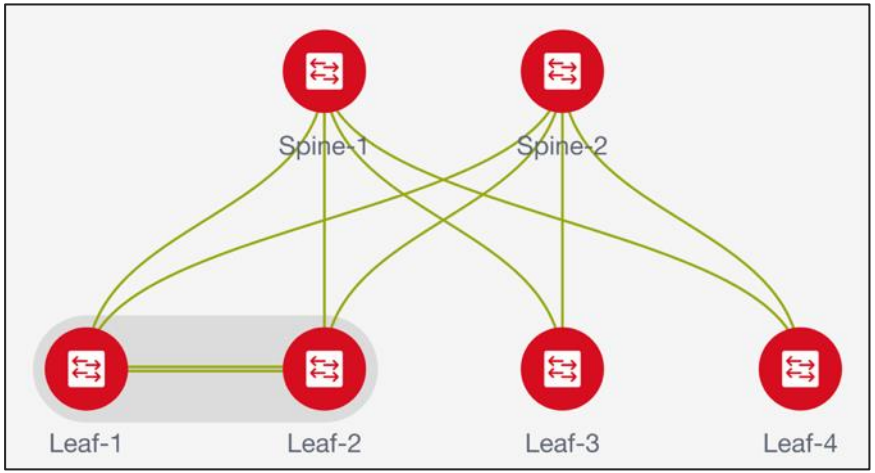
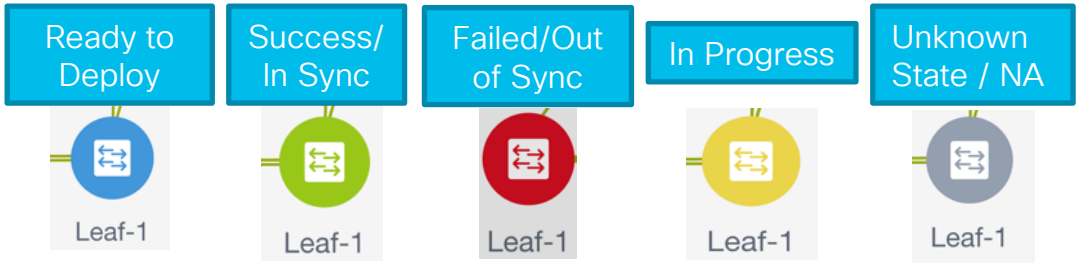
# Configuration Compliance





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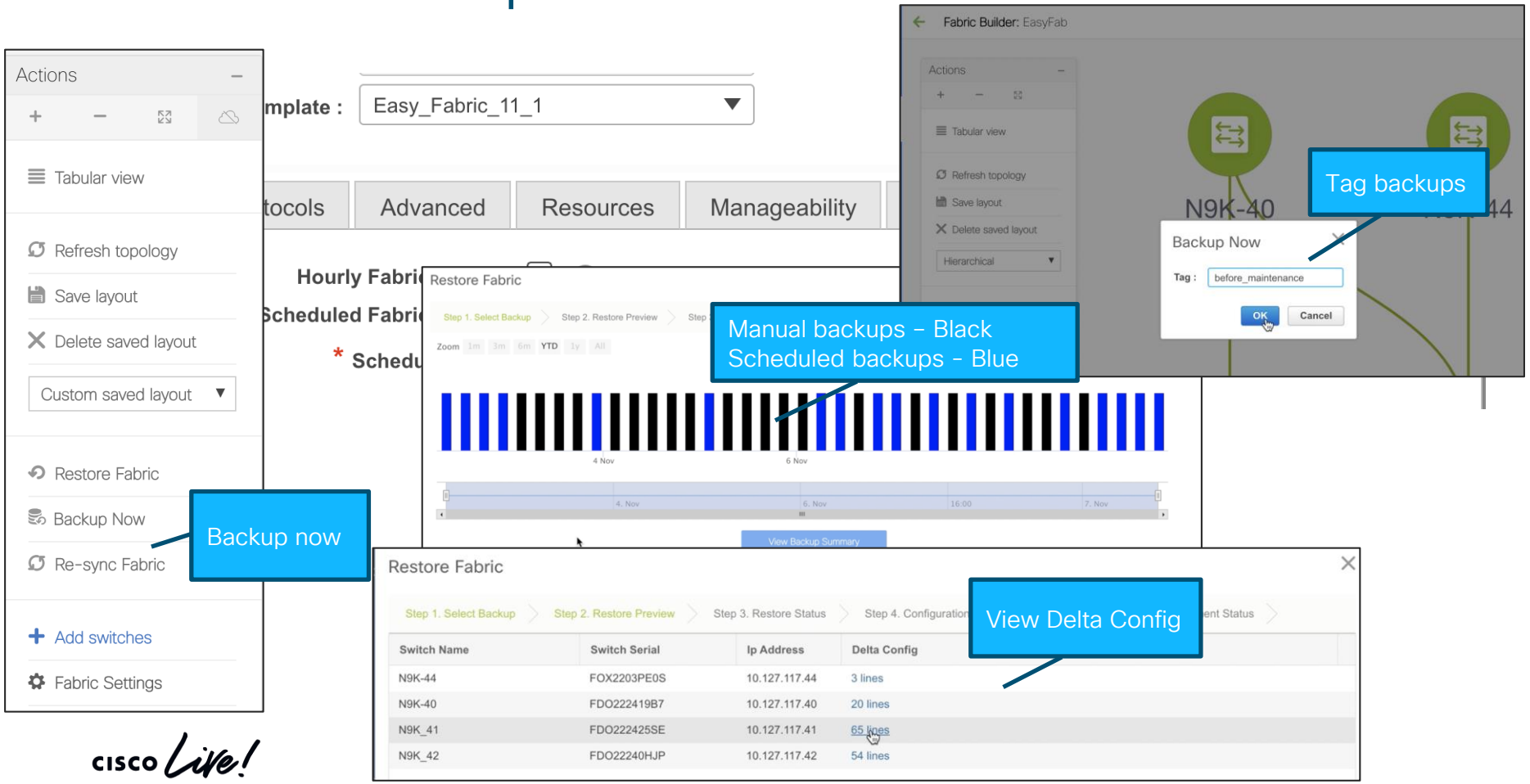
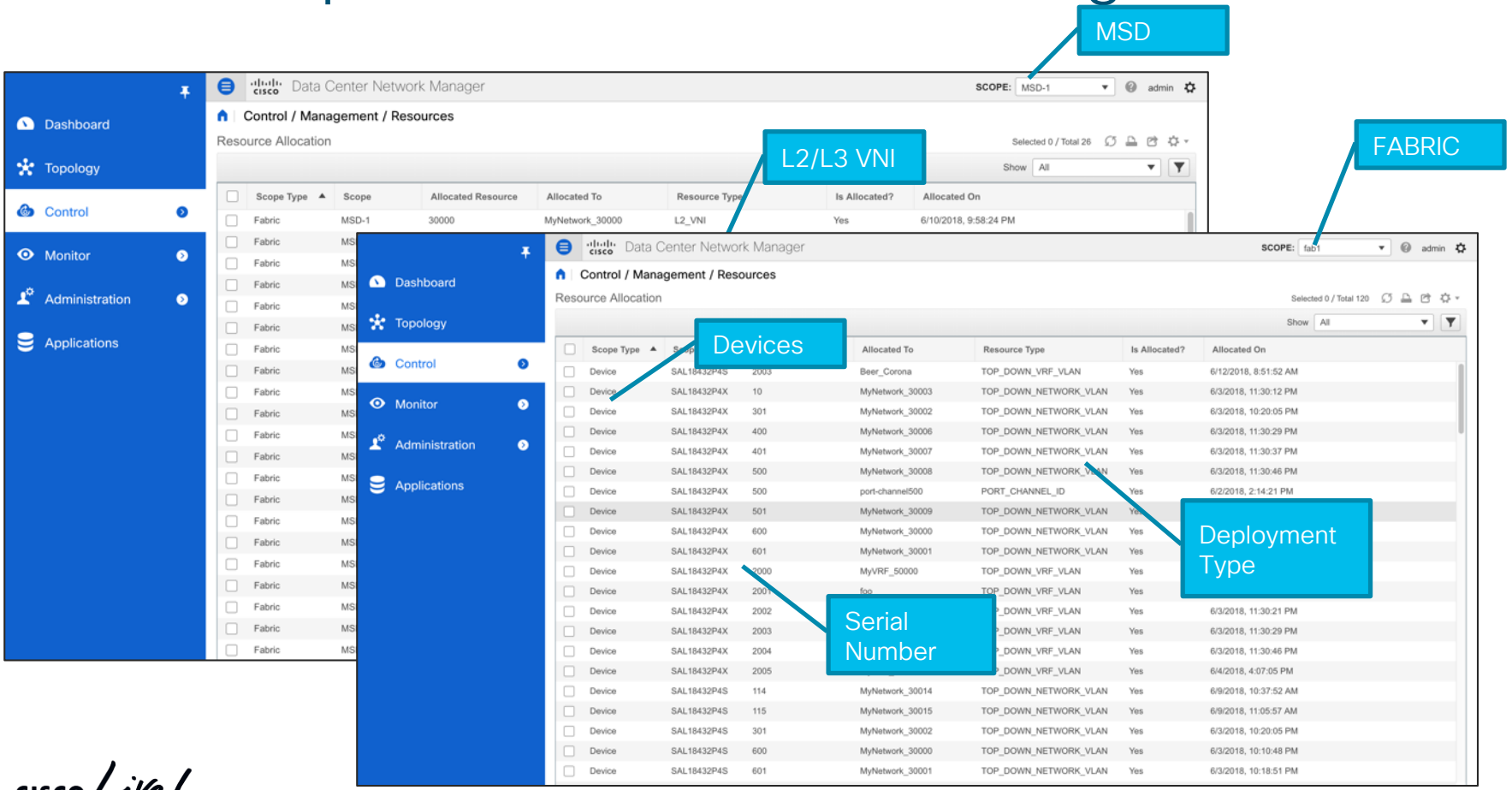
# Network Backup and Restore




cisco Live!

# DCNM keeps track – Resource Manager





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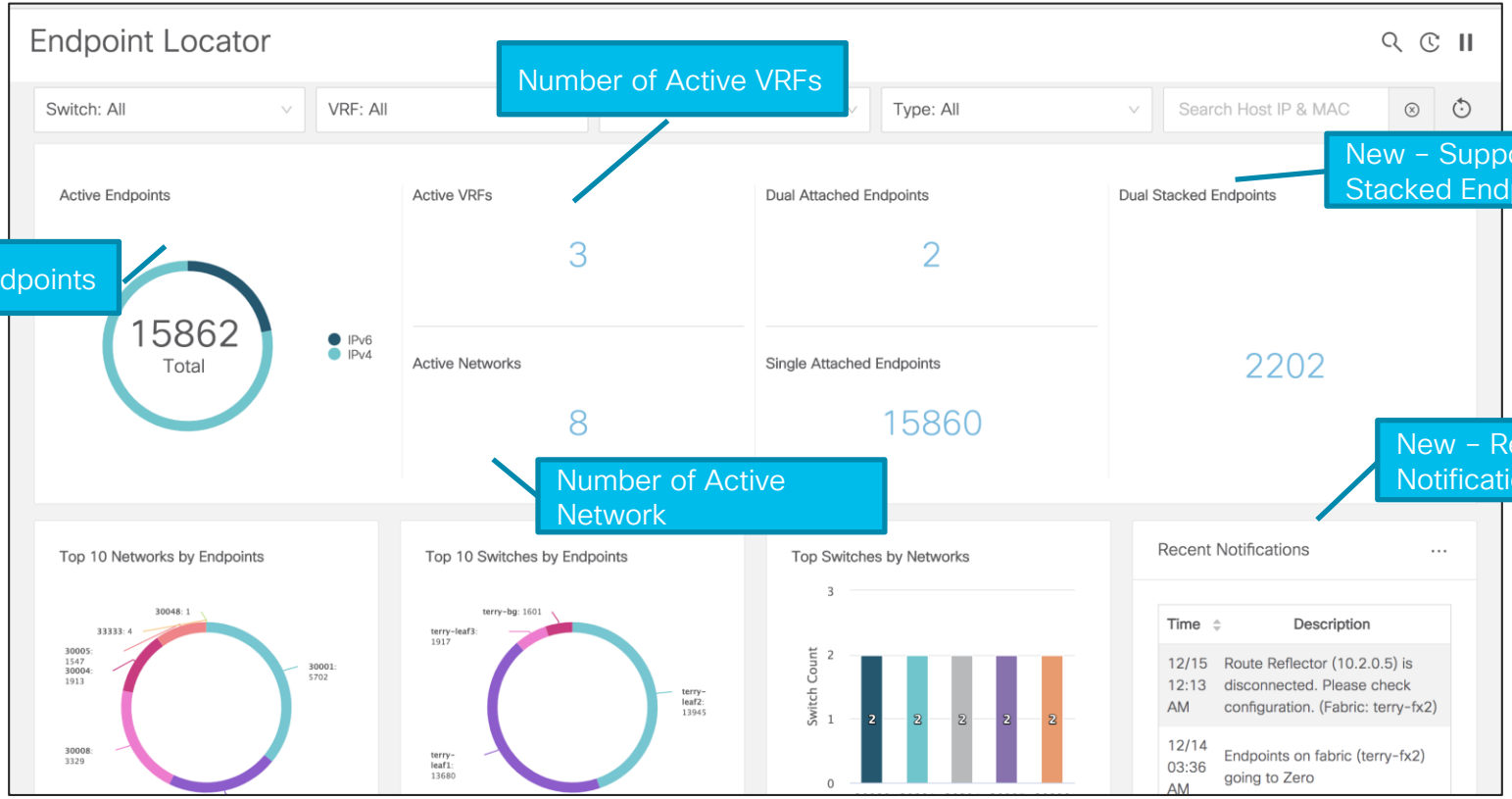
# Endpoint Locator (EPL)




Number of Active VRFs

New – Support for Dual Stacked Endpoints

Number of Endpoints

Number of Active Network

New – Recent Notifications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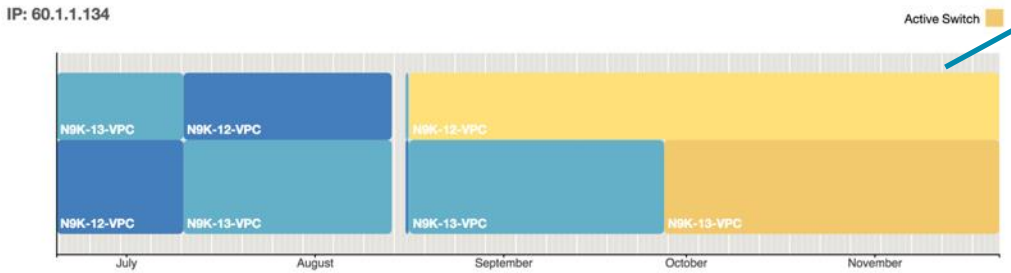
# Endpoint Locator (EPL)

- How many hosts on vlan 10 on eth1/1 on Leaf10 at 11/01/2020 between 2am - 3am?
- How many networks and VRFs are active on leafs 1-10?

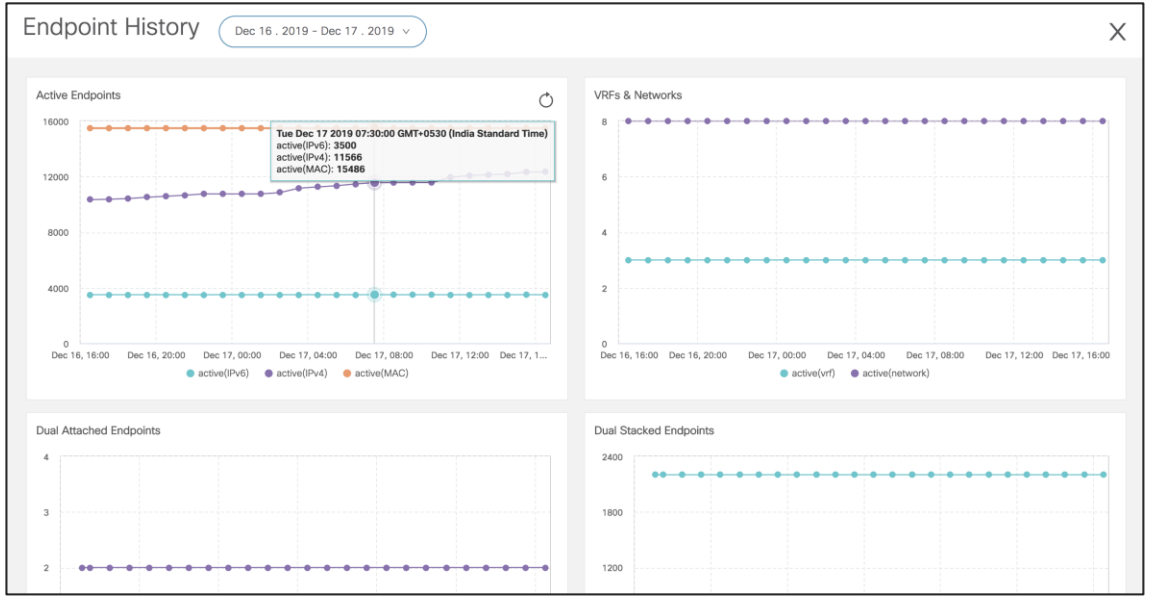



Graphical view of host life-cycle on the network

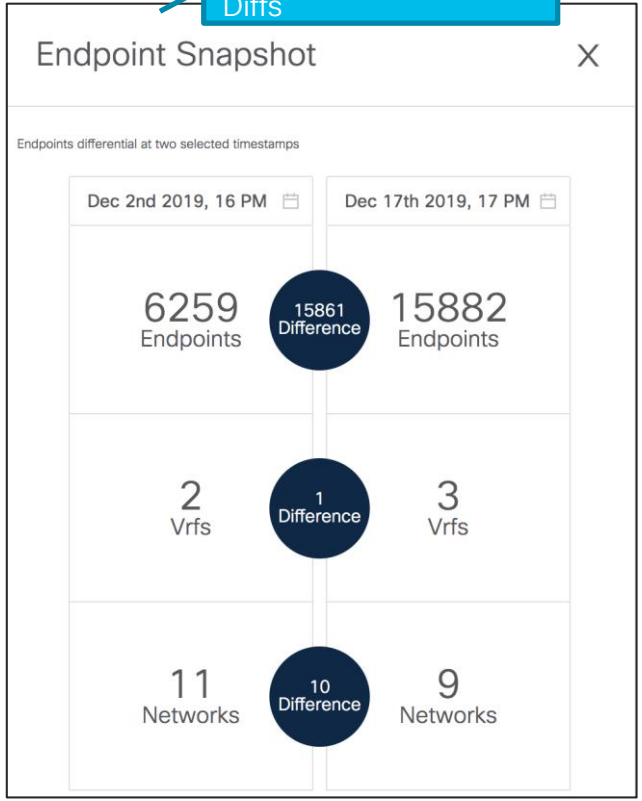
Endpoint Locator (EPL)

# Endpoint Locator (EPL)

History of Endpoints and VRFs/Networks




Ability to Generate Diffs





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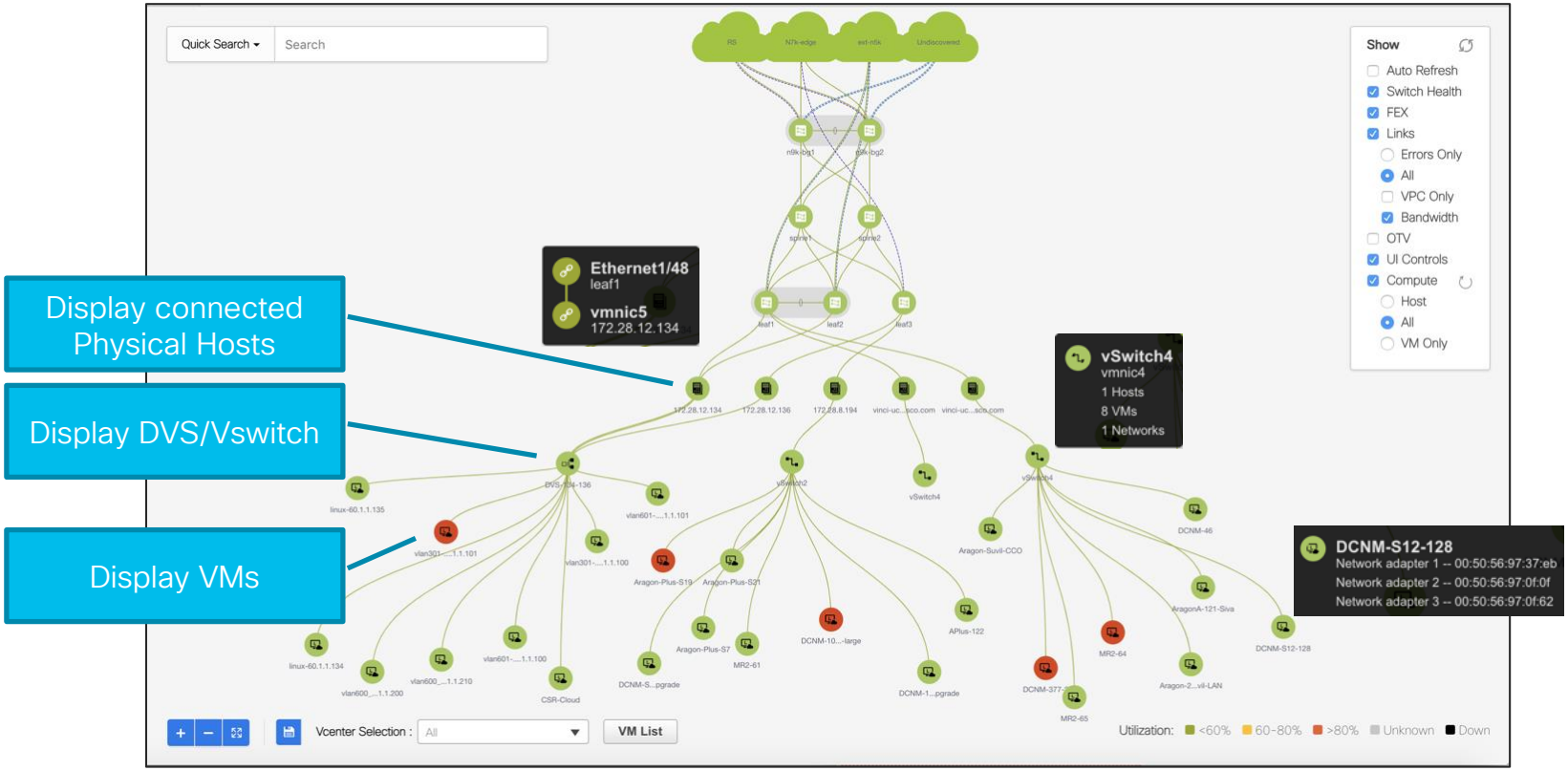
# Virtual Machine Manager – Compute Visibility





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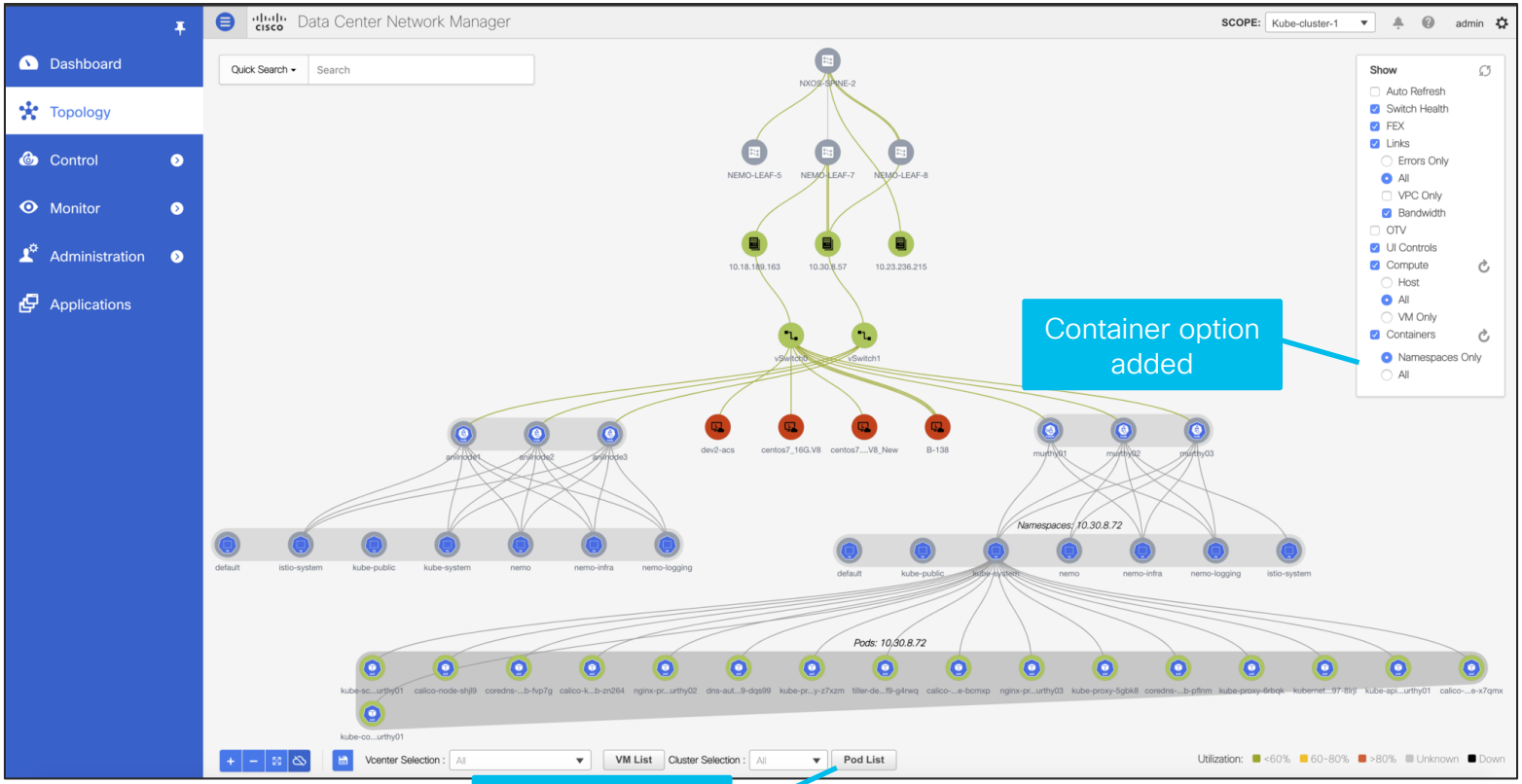
# Kubernetes Cluster Visualization in Topology





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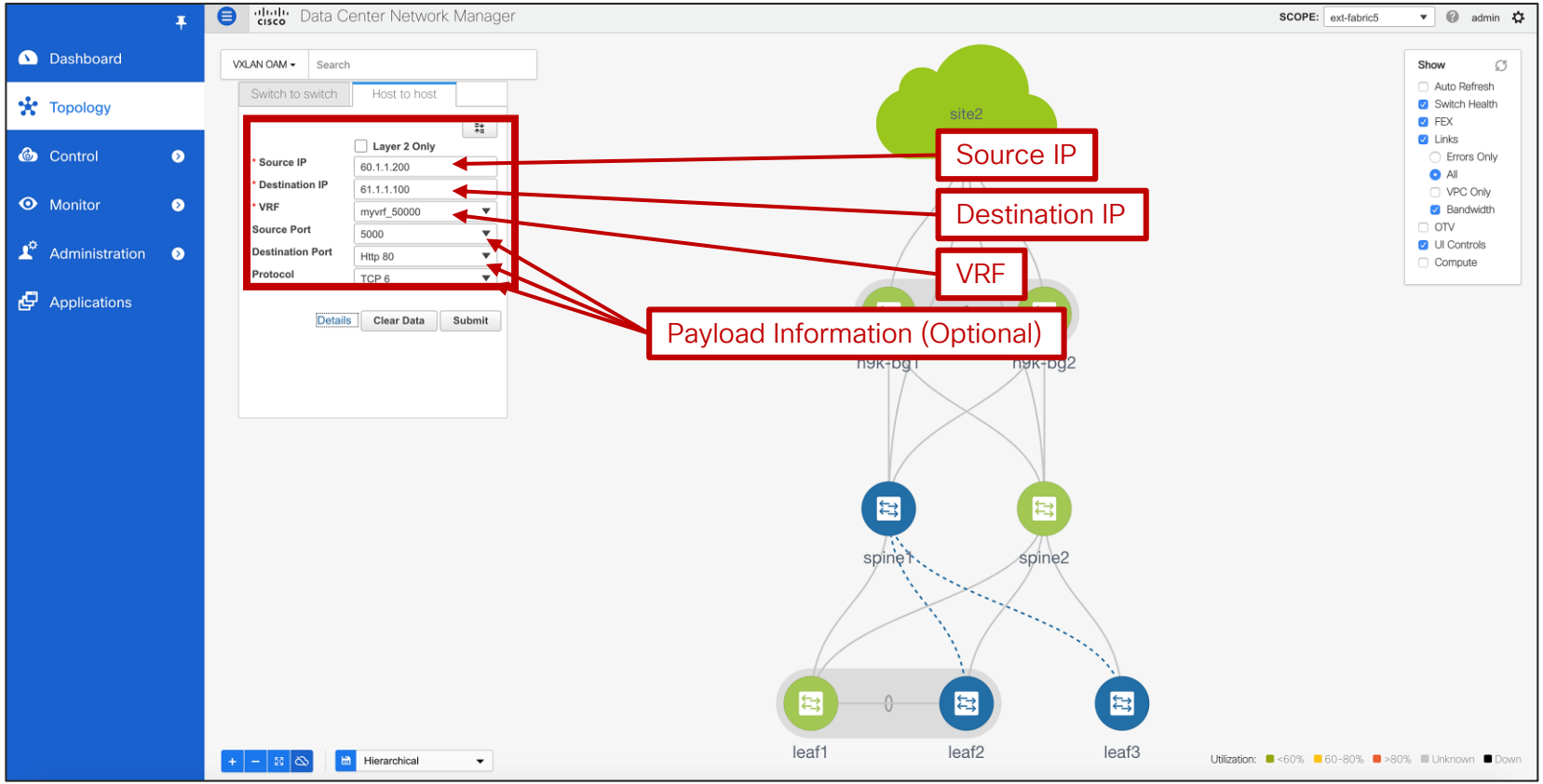
# VXLAN OAM





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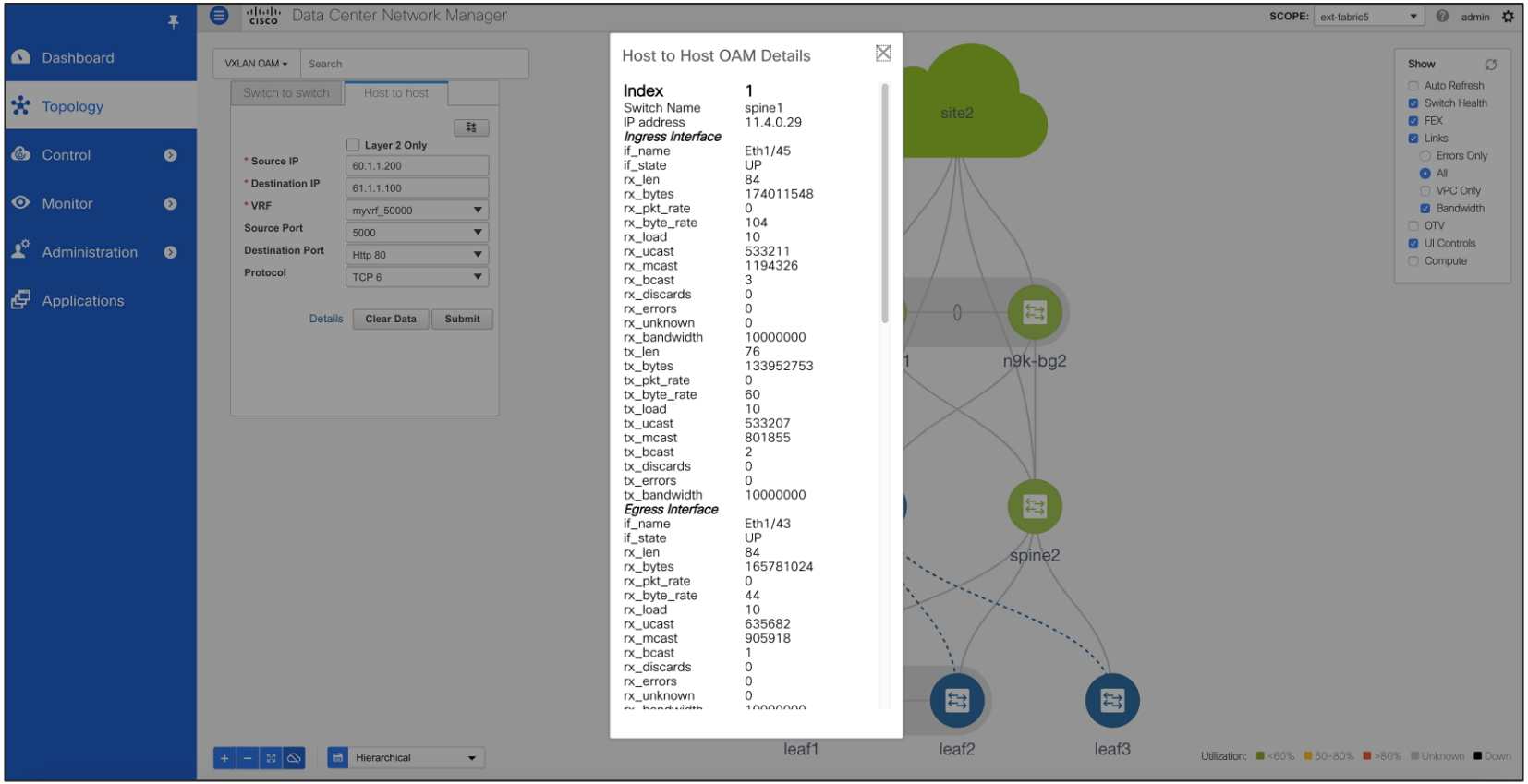
# VXLAN OAM





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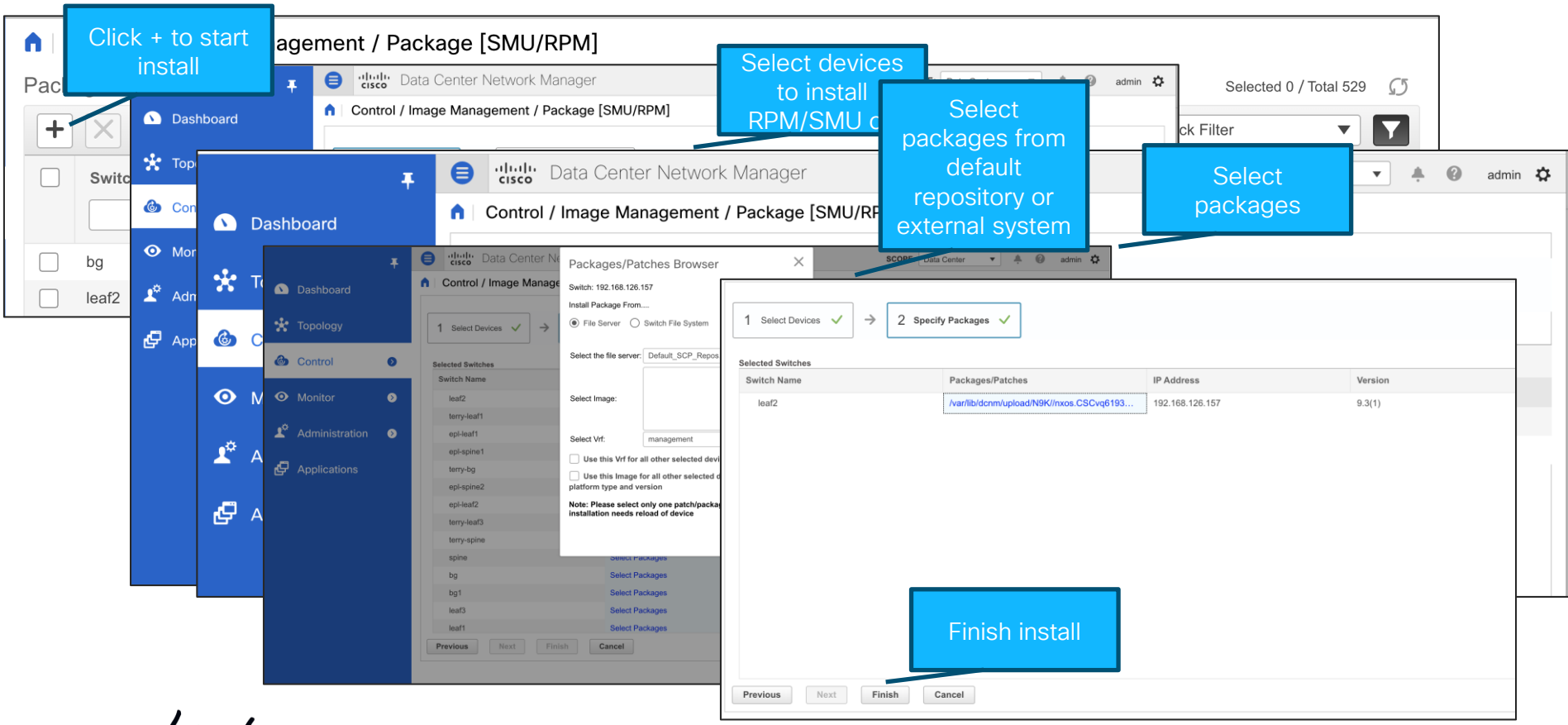
# Install RPM/SMU





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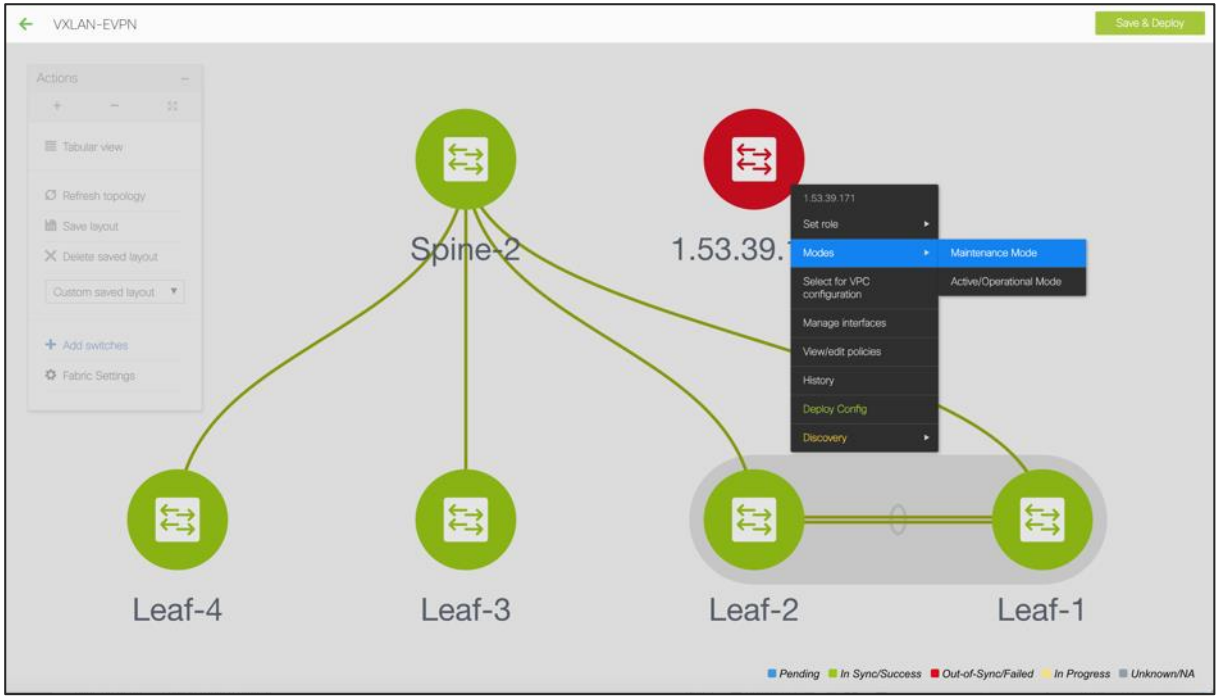
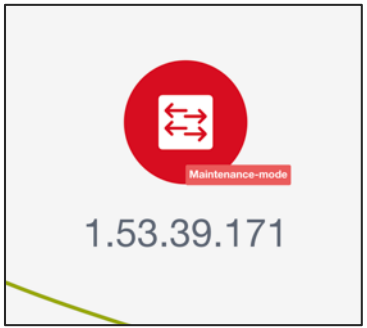
# Switch Maintenance Mode




- Put the device in maintenance mode
- Physically replace the device in the network





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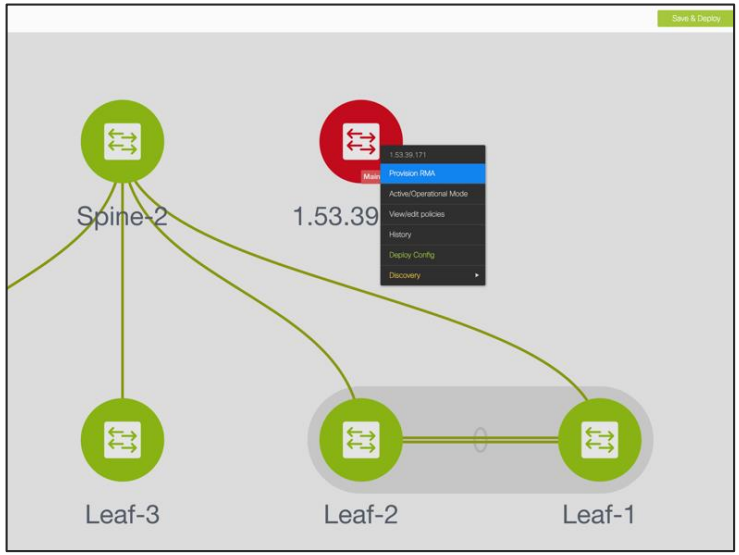
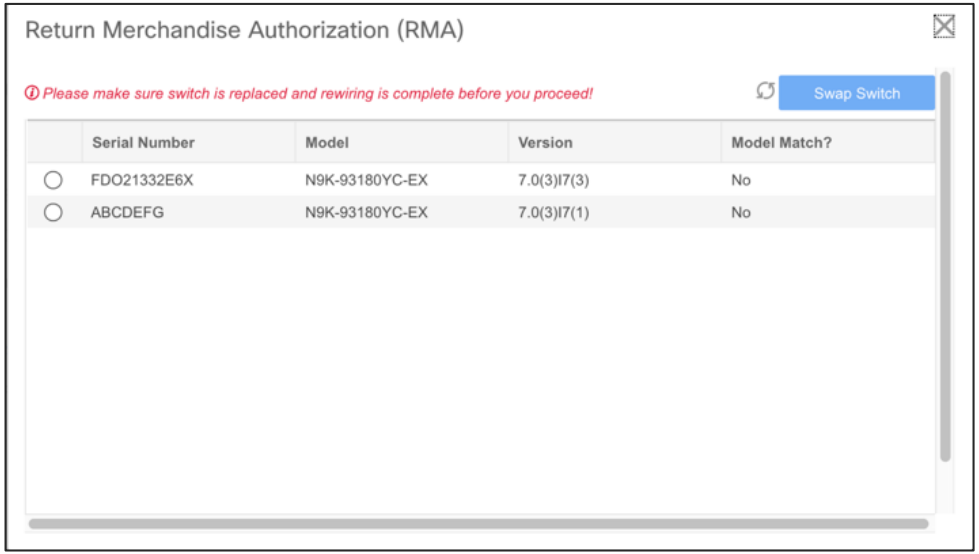
# Provision RMA




1. Choose the Provision RMA option and select the replacement device
2. DCNM will provision the device using POAP with the expected configuration for the node
3. Once the new device is online move the device back into Normal Mode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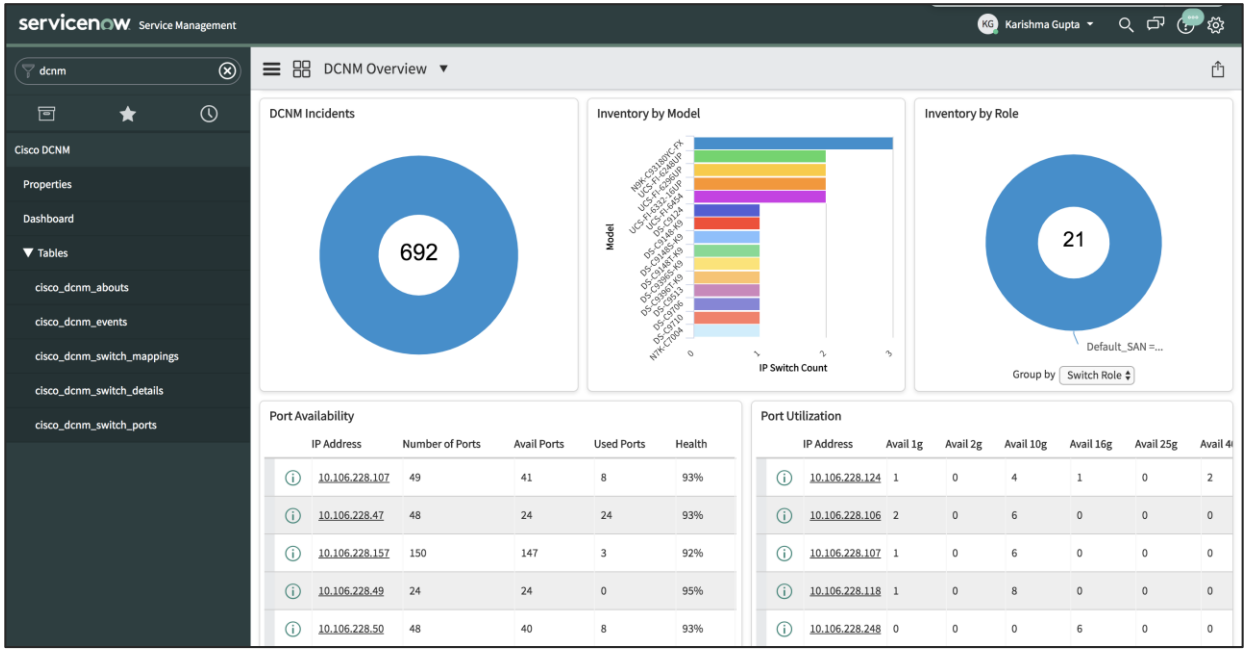
# DCNM Integration with ServiceNow

- Inventory imported on DCNM Instance Import
- Alarms collected periodically
- Auto creation of Incidents supported for each critical Alarm





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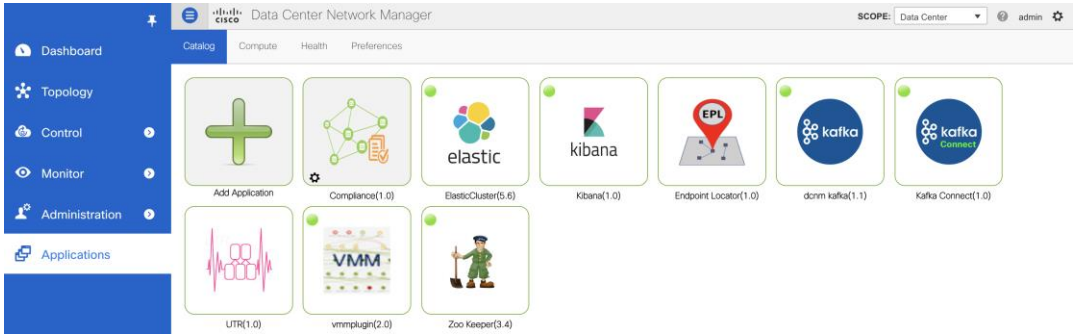
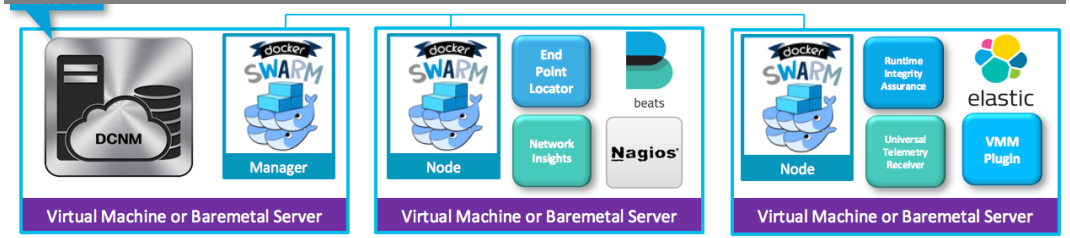
# DCNM Application Hosting Framework

- Extensible Framework
- Applications can run on the framework instead of core S/W
  - "Future Proof" – new apps on existing framework
  - Separation between apps
  - Extensible
- Examples: Telemetry, Analytics Apps, Reporting, Automation
- Uses Worker-Nodes for expansion

## Make All the Apps into Containers




## Expand Compute Nodes as Necessary





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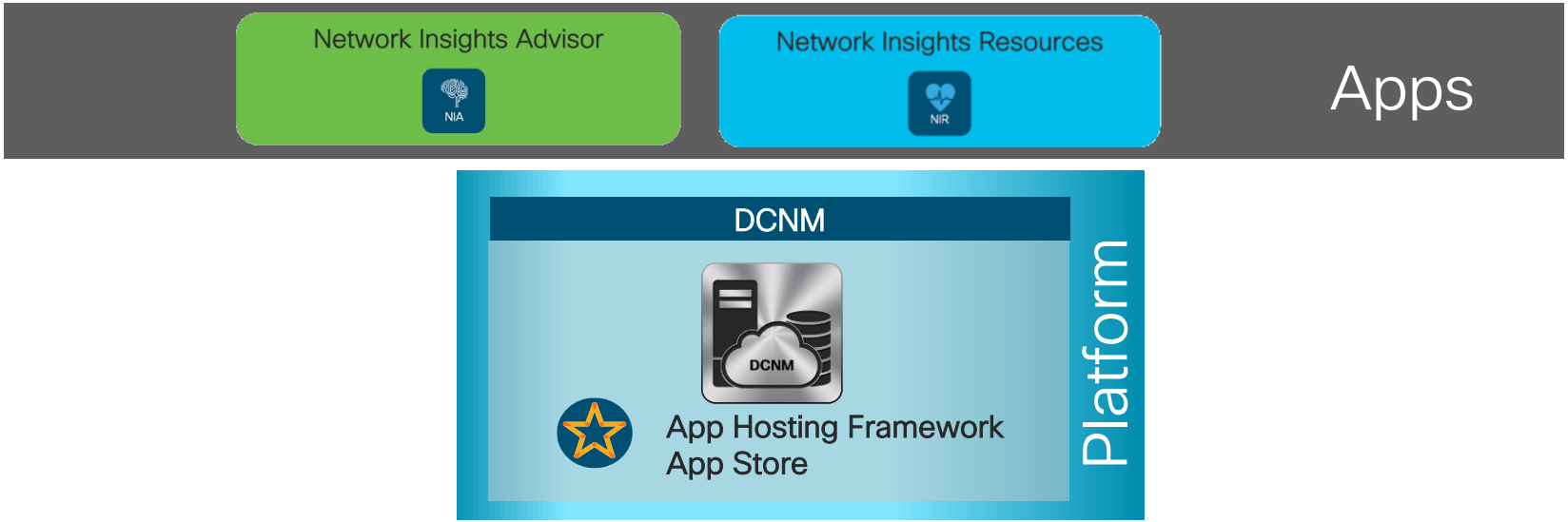
# Network Insights Applications




**Visibility**
Learn from your network and recognize anomalies

**Insights**
See problems before your end users do

**Proactive Troubleshooting**
Find root cause faster with granular details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# How Can NIR Help with Day 2 Operations?

| | |
|---|---|
| Resources | Monitor fabric-wide and node-specific resource utilization |
| Environmental | Track CPU & memory consumption, monitor power and temperature |
| Statistics | Monitor network bandwidth utilization, packet drops, and network protocol statistics |
| Flows | Track flow paths, identify applications experiencing high latency or packet drops |
| Events | Correlate changes to events, identify faults |


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# How Can NIA Help with Day 2 Operations?

| | |
|---|---|
| Advisories | Deployment-specific recommendations & best practices, upgrade impact analysis |
| Notices | Inbox function, proactive EOL/EOS announcements, new Field Notices, new software/SMUs |
| Anomalies | Alert to known defects, PSIRTs, anomalous runtime behavior* |
| Compliance | System hardening checks, version-specific scale limits monitoring* |
| Diagnostics | TAC assist, forwarding state checks* |

* Roadmap


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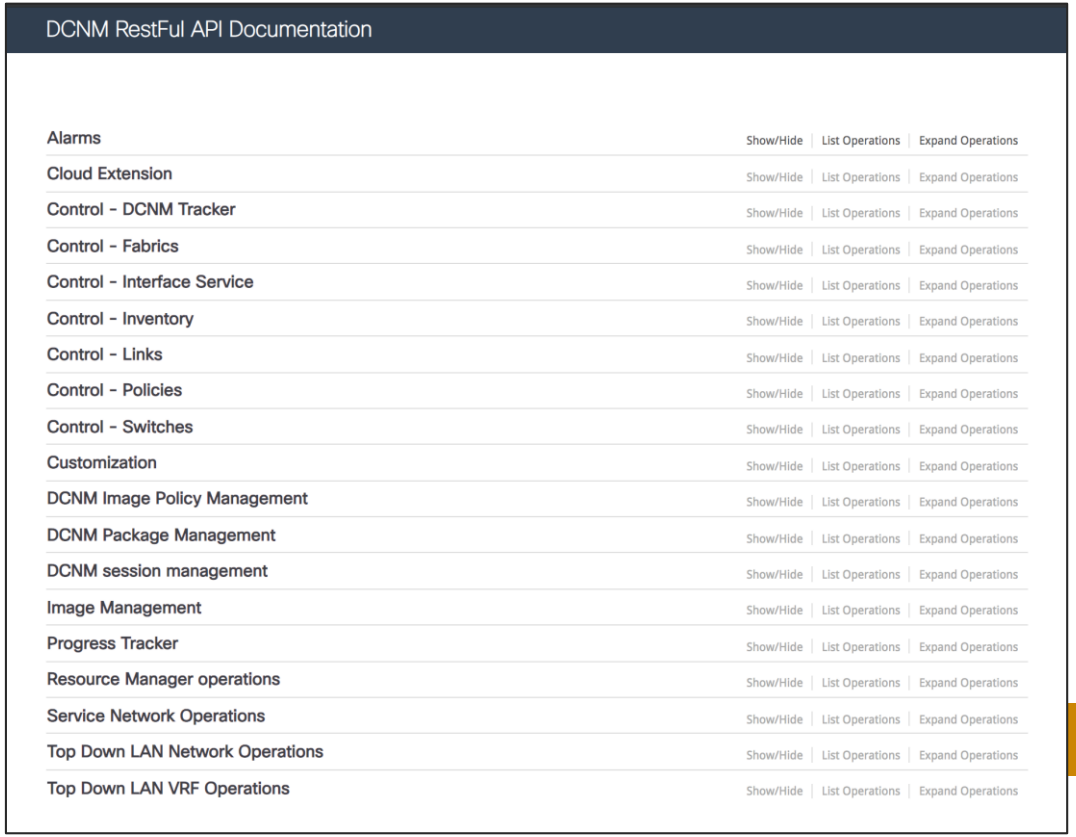
# Want to automate or deploy at bulk? REST away!




DCNM GUI uses REST APIs

1:1 parity with UI

Automate

Deploy at Bulk

Interface with 3rd party tools

https://<dcnm-server-IP>/api-docs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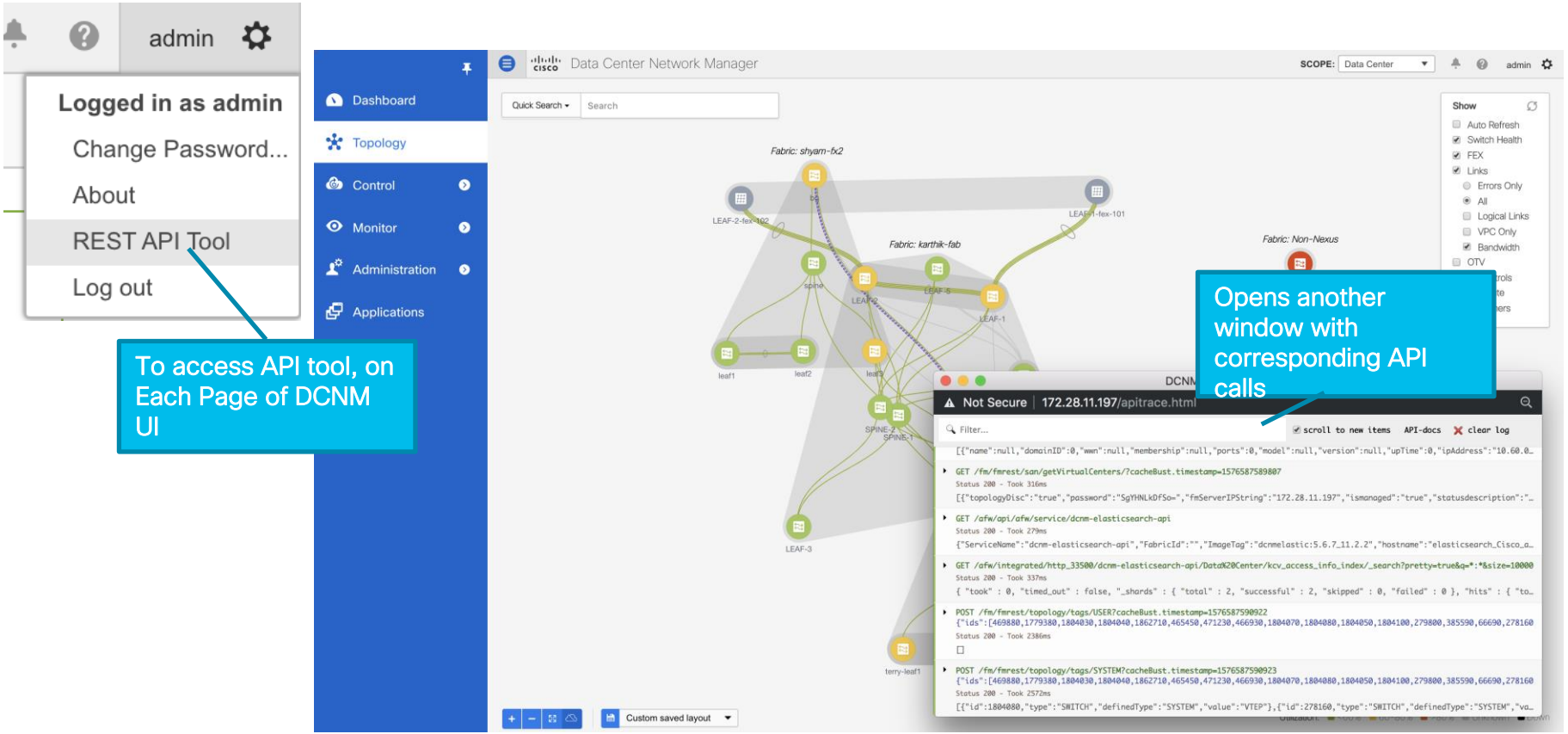
# API Inspector





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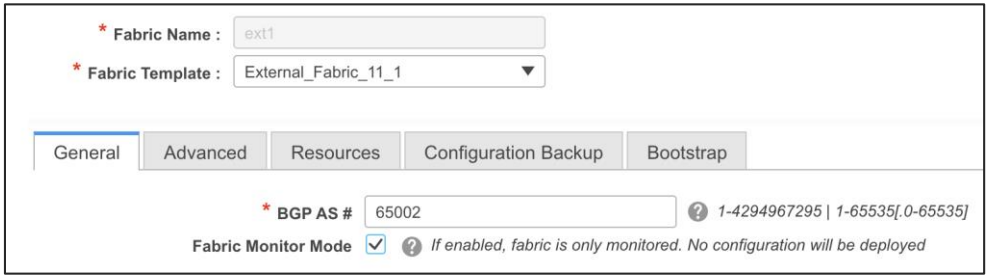
# DCNM Monitor Mode

- External Fabrics can be in Monitor mode
  - DCNM still generates configs to be pushed to the switches
    - Available via APIs
- Day 2 Operations
  - Network Insights (NIR/NIA)
  - Monitoring Environmental data
  - Events, Alarms
  - Real time Topology View, VMM, K8s viewer
  - EPL





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# Agenda

- Introduction to DCNM 11
- Greenfield VXLAN Deployment
- Brownfield - Revamp your VXLAN fabric
- DCNM Day-2 operations
- Install and Licensing
- Conclusion


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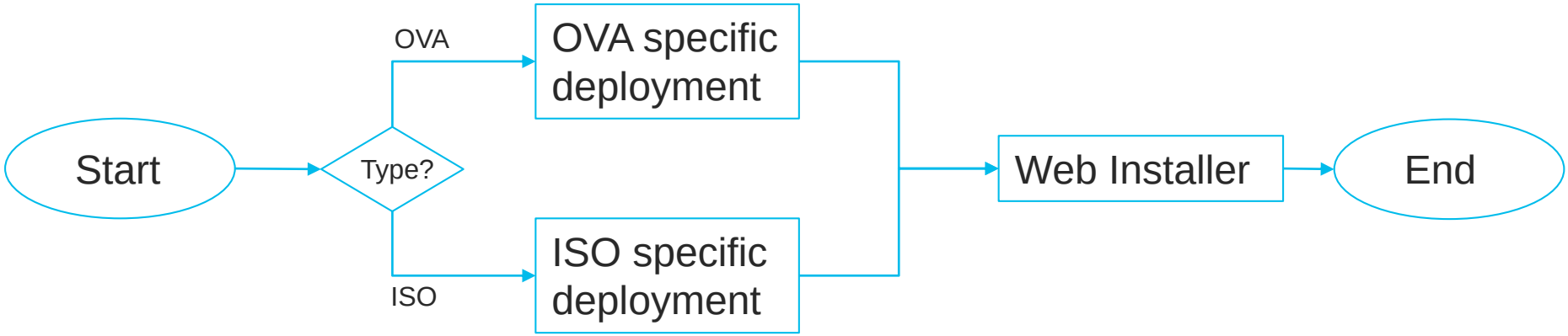
# DCNM11 Installation – New Installation Mechanism

Full support for DCNM HA nodes





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# DCNM11 Installation –
## DCNM11 Web Installer (common to OVA and ISO)

Fresh Installation if it's the first time DCNM is installed (e.g. new user installation)

Select mode when installing:

- Easy Fabric/LAN fabric
- Classic LAN
- IP Fabric for Media
- Compute


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# DCNM 11.3(1) Verified Scale

## LAN Fabric Installation Mode

| Feature | Scale |
|---|---|
| Physical Interfaces | 30,000 |
| Switch Scale | 350 – In Managed Mode<br>750 – In Monitor Mode |
| L3 Scenario: Networks and VRFs per Fabric | 1000 Networks/500 VRFs |
| L2 Scenario: Networks per Fabric | 1500 Networks |
| Endpoint Locator | 100K Endpoints across 4 Fabrics |
| Virtual Machine Manager End Points | 5k |
| Maximum vCenter Instances per DCNM | 4 |


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# DCNM 11.3 LAN Deployment

## Without Network Insights

### Up to 80 Switches

| Node | Deployment Mode | CPU | Memory | Storage | Network |
|---|---|---|---|---|---|
| DCNM | OVA/ISO | 16 vCPUs | 32G | 500G HDD | 3xNIC |
| Computes | NA | | | | |

### 81-350 Switches

| Node | Deployment Mode | CPU | Memory | Storage | Network |
|---|---|---|---|---|---|
| DCNM | OVA/ISO | 16 vCPUs | 32G | 500G HDD | 3xNIC |
| Computes x 3 | OVA/ISO | 16 vCPUs | 64G | 500G HDD | 3xNIC |


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# DCNM/NX-OS Compute Requirements for Network Insights

| Hardware Recommendations for Deployments up to 80 Switches and 2000 Flows | | | | | |
|---|---|---|---|---|---|
| **Node** | **Deployment Mode** | **CPU** | **Memory** | **Storage** | **Network** |
| Cisco DCNM | OVA/ISO | 16 vCPUs | 32G | 500G HDD | 3x NIC |
| Computes (x3) | OVA/ISO | 32 vCPUs | 64G | 500G HDD | 3x NIC |

| Hardware Recommendations for Deployments from 81 to 250 Switches and 10000 Flows | | | | | |
|---|---|---|---|---|---|
| **Node** | **Deployment Mode** | **CPU** | **Memory** | **Storage** | **Network** |
| Cisco DCNM | OVA/ISO | 16 vCPUs | 32G | 500G HDD | 3x NIC |
| Computes (x3) | ISO | 40 vCPUs | 256G | 2.4TB HDD | 3x NIC* |

* Network card: Quad-port 10/25G


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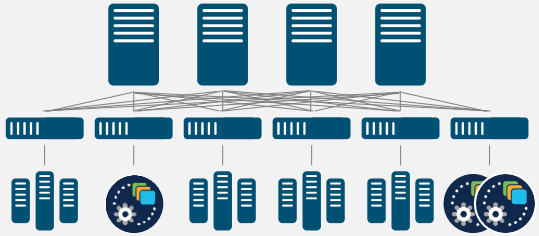
# Cisco Application Services Engine

Modern Scale-out Application Services stack to host Day-2 Operations applications



Network insights

DCNM Plugins

3rd Party apps *

* planning

2.2 GHz 10 core CPU x 2

256 GB memory

2.4 TB x 4 HDD

10G/25G/40G connect

Network automation | Scale-out cluster | SE-CL-L3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# Licensing
# (Trial now for 60 days, Honor Based)

| Feature | Data Center Network Manager (DCNM) |
|---|---|
| DCNM-SVR-11-K9<br>DCNM-SVR-11-K9= | DCNM Server License per server instance |
| Switch Licenses | |
| DCNM LAN for Fixed Switch:<br>e.g.<br>DCNM-LAN-N93-K9=<br>DCNM-LAN-N3K-K9= | Perpetual Fixed Chassis RTM Advanced feature license License for DCNM for one Switch |
| DCNM LAN for Modular Switch:<br>e.g. DCNM-LAN-N95-K9= | Perpetual Modular Chassis RTM Advanced feature license License for DCNM for one Switch |
| OR | |
| NX-OS Essentials, Advantage, Premier Licenses include DCNM Right-to-Manage (RTM) licenses for LAN / LAN Fabric | |


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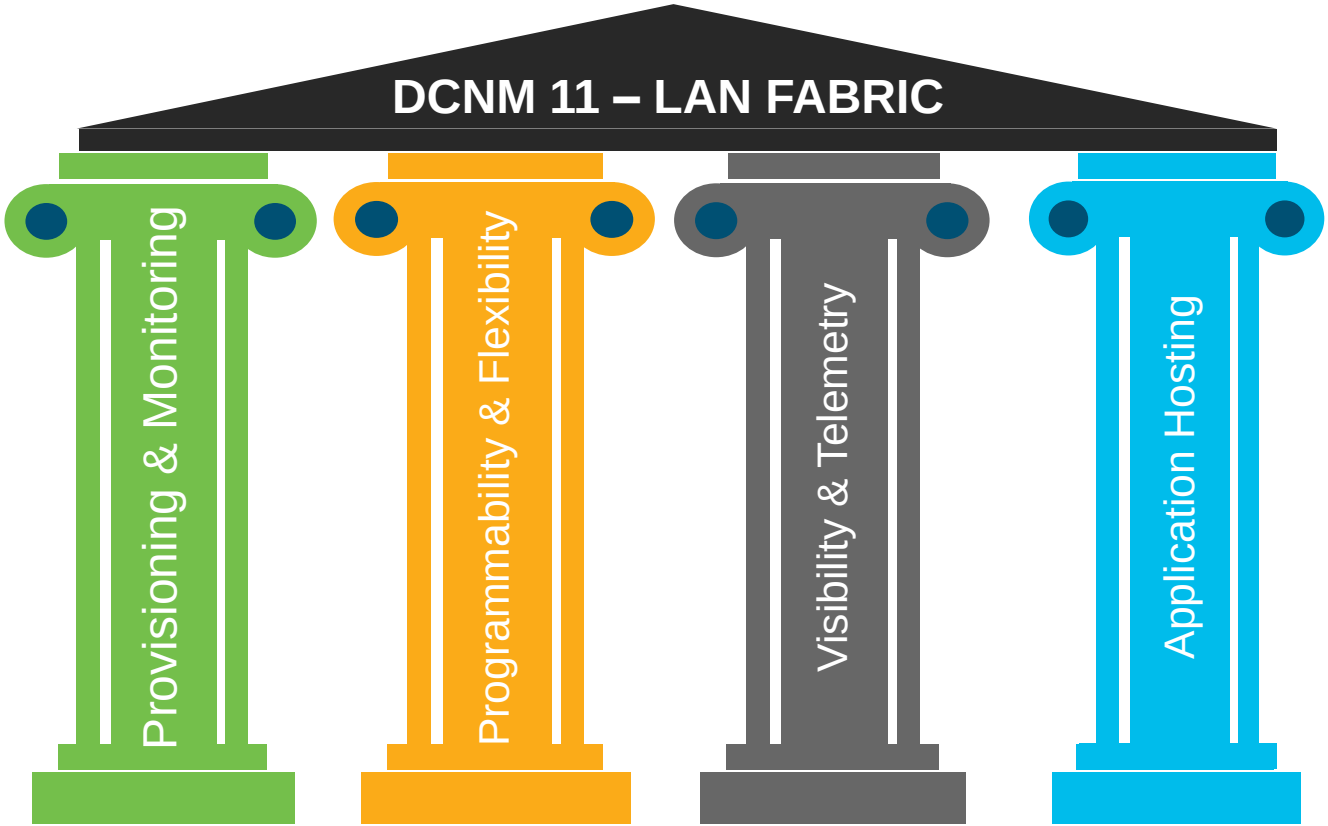
# Conclusion





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# Reference Sessions

Part 2 of this session -

Easy deployment and management of NXOS Fabrics ( VXLAN ) with DCNM - BRKDCN-2939

Tuesday, Jan 28th, 5:00 PM – 06:30 PM

Related sessions -

- Day-2 Telemetry better - Network Insights for ACI/NX-OS – BRKDCN-2712
- Overlay Management and Visibility with VXLAN - BRKDCN-2125
- Building DataCenter Networks with VXLAN BGP EVPN - BRKDCN-3378
- Introduction to VXLAN: The future path of your datacenter - BRKDCN-1645


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