Building and operating VXLAN BGP EVPN Fabrics with Data Center Network Manager

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If Clouds come to earth they are fog….”
Cloud == FOG??
The Cloud –
The Cloud –
“Oh yes, We have a Button for That.”
So but it makes Sense to look under the Hood
Agenda

• Introduction
• Programmable Fabric Overview
• Infrastructure Fabric
• Fabric Management
• Lab Setup
Cisco Data Center Switching Portfolio

**SAN**
- Cisco MDS 9148
- Cisco MDS 9222i
- Cisco MDS 9250i
- Cisco MDS 9148S
- Cisco MDS 9710
- Cisco MDS 48x16G line-rate FC Module
- Cisco MDS 48x10G line-rate FCoE Module

**LAN / SAN**
- Cisco Nexus 7000
- Cisco Nexus 9500
- Cisco Nexus 9000
- Cisco Nexus 5500
- Cisco Nexus 5600
- Cisco Nexus 6000
- Cisco Nexus 2000
- Cisco Nexus 3000

**UNIFIED FABRIC**
Consistency across physical, virtual, and cloud environments.

- Scalable Capacity
- Virtualization & Cloud
- Security
- CapEx & OpEx Efficiencies
- Agility
Data Center Network Evolution
Journey to Cisco SDN

STP based “Tiered” Design

- Classic STP Limitation
- 50% of all Links not utilized
- Complex to Harden

VPC based “Tiered” Design

- No STP Blocked Ports
- Full Links Utilization
- Faster Convergence
- Macro for “best practice”

FabricPath Design

- No STP
- Simple to Configure
- Higher Fabric Bandwidth
- Consistent Latency

Spine
- Scales to provide fabric bandwidth

Leaf
- Scales to provide access port density

- Workload Mobility
- Increased App Communication
- Higher Server Port Density and Bandwidth
Programmable Fabric / VxLAN EVPN

Management

- Automation of Underlay and Overlay
- Integration with Orchestrators and Hypervisor Managers

Programmability

- Ready for DevOps
- Ease of Operations

Infrastructure

- Physical and Virtual Switching
- Topology Virtualization
- DataCenter Interconnect
Programmable Fabric

VxLAN-EVPN Fabric

Consistent Fabric across Nexus 2k, 5k, 7k and 9k
Infrastructure Fabric
Programmable Fabric Attributes

- VM Mobility
- VLAN Extensibility
- Any Subnet Anywhere

- Smaller failure domains
- Horizontal Scale
- Minimize Bottlenecks

Simplified Networking with Flexibility and Efficiency at Scale
Programmable Fabric Attributes
Rapid Deployment of VM and Network

1. Network Admin defines Network Profile Template for VMs/PMs in projects

2. Instances of Network Policies are automatically created in VTS (or DCNM) when a Server Admin provisions VMs/PMs

3. When a VM/PM pertaining to a project is detected, Network Policy is applied to the leaf

4. When VM moves, the Network Policy is applied automatically to the leaf
VXLAN Fabric With BGP-EVPN Control Plane

Available across the Nexus Portfolio

- Standards Based
- Increased Scale
- Optimized Mobility
- Flexibility
EVPN Control Plane – Overlay with optimized routing

- MP-BGP ➔ Scalable Multi-tenancy
- EVPN Address Family: host MAC+IP, internal/external IP subnets
- MP-BGP enhanced for fast convergence at large scale (100K+ routes)
- Mobility extensions to BGP
- Distributed GWY with Traffic Flow Symmetry
- ARP Suppression
Fabric Management
Data Center Network Manager
Fabric Management Strategy

Centralized - Database

- Tight integration with provisioning/management
- Limited scale

Distributed – Network Protocol

- Loose integration with provisioning/management
- Global Scale
Product Introduction
DCNM 10, What is It?

- **Underlay/Overlay manager for VXLAN-EVPN based** IP Fabrics in NX-OS Mode
- **Provisioning & Management of FabricPath, STP/VPC** networks
- Classic ‘FCAPs’ **LAN manager**
- **SAN management** for Nexus and MDS platforms
- **Flow Controller** for IP Media Solutions
  - Vertical market for Broadcast media
DCNM Functional Areas

- VXLAN- EVPN
- Programmable Fabric
- Nexus 9K-7K-5K-3K-2K-1K
- Day 0, Day 1, Day 2

- LAN-Classic Management
- Nexus 9K-7K-5K-3K-2K-1K

- Professional Media Net
  [PMN/Nexus 9K]

- SAN
  [MDS & Nexus]
DCNM 10: Functionality Dashboard

Inventory & Health
- Discovery
- CPU/Mem/Temp
- Traffic
- Health-Monitor
- Link View
- VM-connectivity

Configuration
- VXLAN & Classic
- Image Management
- Backup / Restore
- Templates

Automation
- VXLAN & Classic
- Underlay (POAP)
- Overlay (VRF/VNI)
- REST APIs

Trend Analysis and VM Analytics
- Port Consumption
- VM Net Trace
- Monitor Graphs

Host/Endpoint Monitoring
- VM Lifecycle
- Network Location
- Fabric-Wide View

Visualization and Troubleshooting
- Integrated Topology
- Search
- VXLAN-OAM

Alert/Notifications
- Trap & Syslog
- Events & Forwarding

Storage Management
- Classic FC/FCOE SAN Analytics

IP Media Net Controller
- Digital Media Flow Control
- Endpoint Topology View
DCNM 10.2.x/10.3.x Recent Updates

- Simplified VXLAN Overlay provisioning
- Endpoint Locator
- VLAN Editing
- Show Templates for Customized Op’s
- FEX Provisioning
- Network Config Audit
- VXLAN Ingress-Replication

IP Media Controller Updates

Policy (Micro) Templates

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LTRDCT-2781
DCNM 10.4.x Updates

External Fabric Connectivity Provisioning

Software Telemetry (Preview)

Enhanced Installer Options

EVPN Multi-Site Provisioning

Brownfield Migration for EVPN

REST-APIs for Fabric Deployment

VMM Integration (Preview)
DCNM for New or Existing Fabrics
Leveraging DCNM for New and Existing Fabrics

Install / Use DCNM (Virtual Appliance)

Bootstrap Devices [POAP]

Create New VXLAN Fabrics

Discover Existing Fabrics / Networks
- STP/VPC
- DFA / FabricPath

Manage New VXLAN Fabrics & Existing FabricPath or VLAN Fabrics

Deploy
Discover
Configure

Maintain & Operate
Here is what that looks like in DCNM...
Getting Started with DCNM
VXLAN Underlay Bring-Up – DCNM Starting Point

Use Virtual Appliance (VA)
- VA includes Fabric Infrastructure

Configure DCNM Fabric Management (OVA / ISO Setup)
- Management IP
- Fabric Management subnet

Use POAP
-- Generate POAP definitions for the switches

Bootstrap Switches
- Switch VTEP
  Configures Automatically during POAP

Fabric Underlay Installed
POAP Dashboard

Configure / Deploy / POAP
Power-On Auto Provisioning (POAP)

Configuration Steps:

- **DHCP Scopes**
  Allocate temporary IP Address
  Configure bootscript settings.

- **Images and Configuration**
  Store Kickstart and System Image, POAP switch configuration.

- **POAP Definitions**
  Generate definitions in bulk from an existing template.
  Upload individual switch configuration files and assign each file to a switch.
  Switch Serial Numbers are required.

- **Cable Plan**
  A cable plan specifies your intended cabling and can be used to detect mis-cabling errors.
  Create a cable plan in the following ways:
  - Generate from POAP Definition
  - Capture from Existing Deployment
  - Import Cable Plan File

What is POAP

POAP automates the process of upgrading software images and installing configuration files on Cisco Nexus Switches when deployed in the network for the first time. More Info...
Exploring Dashboards & Topology Views
Exploring .. Summary Dashboards

Add & remove Dashlets on demand
Customize for your environment
Exploring Topology

- Dynamic Arrangement
- Multi-Fabric/Overlay
- Arrange by Tier
  - [Core, Ag, Access Leaf, Spine etc..]
- Metadata Tags
- Show FEX links
- Device Pop-Over
  - Side-By Side View
Exploring Topology .. Details

Search (overlays)

- Quick Search
- Host name
- Host IP
- Host MAC
- Segment ID
- Multicast Group
- VxLAN ID (VNI)
- VLAN
- FabricPath

View Options

- Hierarchical
- Hierarchical Left-Right
- Force-directed
- Circular
- Tier Circular

Switch Role / Hierarchy

- anm-ace251
- 172.23.244.251
- N7K-C7009

- Spine
- Super Spine
- Spine
- Leaf
- Border Spine
- Border Leaf
- Border PE
- Edge Router
- Core
- Access
- Aggregation
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Switch Pop-Over

Activate Beacon

Metadata Tags
System & User-Defined

Switch Details

Metadata Tags

System Tags
feature: BGP

Show more details

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Cisco Live!
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Pop-Over
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Top Down Deployment

- Deploys Configuration Profile for VRF, Network or Interface to Switch
- Pushed from DCNM GUI or REST API
- Doesn’t Require Switch Auto-configuration
- Supports VXLAN-EVPN for N9K
Adding A New VXLAN Fabric

Select a Fabric

Choose a fabric with appropriate switches where you want the Top Down functionality to be enabled or create a new fabric.

N9K-Fresh

OR

Create a new fabric

Both Multicast & Ingress Replication Options Supported
Creating A New Network

Select a Fabric

Choose a fabric with appropriate switches where you want the Top Down functionality to be enabled or create a new fabric.

+ Create a new fabric
Deploying The Network

1) Select Network

2) Choose which Switches to Deploy to

Staged Deployment is Blue
Yellow is “Deploying”
Green indicates Success
Red indicates failure

Fabric Selection | Network Selection | Network Deployment | Continue

Networks

Network Name | Network ID | VRF Name | IPv4 Gateway/Subnet | IPv6 Gateway/Prefix

- MyNetwork_40000 | 40000 | MyVRF_52000 | 11.11.11.1/24

Deploy
Deploying The Network – Selecting Switches

- Double Click the Switches where you want the network
- Select "Apply to Switch"
- Select Deploy
- Green indicates success

**Deploy Options:**
- **Apply To Switch**
  - *Switch VLAN: 1509*
- **Apply To Ports**

**Select Ports if desired** (Not necessary if default is 'trunk')

---

**Switch Deploy**

Fabric Name: N9K-Fresh
Network Name: MyNetwork_40011
Switch Name: Leaf-1

**Deploy Options:**
- **Apply To Switch**
  - *Switch VLAN: 1509*
- **Apply To Ports**

**Select Ports if desired** (Not necessary if default is 'trunk')

<table>
<thead>
<tr>
<th>Interface/Ports</th>
<th>Status</th>
<th>Channel Number</th>
<th>Port Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethernet1/13</td>
<td>NA</td>
<td>NA</td>
<td>trunk</td>
</tr>
<tr>
<td>Ethernet1/14</td>
<td>NA</td>
<td>NA</td>
<td>trunk</td>
</tr>
</tbody>
</table>
Deploying the Network – Selecting Switches

Switches Deploy

Fabric Name: SITE_2

Deploy Options:

Select the row and click on the cell to edit
Please save config for the network before switching tabs

Double click on a node to apply configuration

Interfaces

<table>
<thead>
<tr>
<th>Interface/Ports</th>
<th>Status</th>
<th>Channel Number</th>
<th>Port Type</th>
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<tbody>
<tr>
<td>Ethernet1/1</td>
<td>NA</td>
<td>NA</td>
<td>access</td>
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<td>Ethernet1/10</td>
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<td>access</td>
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<tr>
<td>Ethernet1/11</td>
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<td>NA</td>
<td>access</td>
</tr>
<tr>
<td>Ethernet1/12</td>
<td>NA</td>
<td>NA</td>
<td>access</td>
</tr>
</tbody>
</table>

Save
Resource Manager

Data Center Network Manager

Configure / LAN Fabric Provisioning / Resource Manager

Resource Objects

<table>
<thead>
<tr>
<th>Scope Type</th>
<th>Allocated ID</th>
<th>Allocated To</th>
<th>Resource Type</th>
<th>Is Allocated</th>
<th>Allocated On</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device 13</td>
<td>MyNetwork_30003</td>
<td>TOP_DOWN_NETWORK_VLAN</td>
<td>Yes</td>
<td>11/30/2017, 1:13:40 PM</td>
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</tr>
<tr>
<td>Device 2000</td>
<td>MyVRF_50001</td>
<td>TOP_DOWN_VRF_VLAN</td>
<td>Yes</td>
<td>11/30/2017, 1:13:40 PM</td>
<td></td>
</tr>
<tr>
<td>Device 10</td>
<td>MyNetwork_30000</td>
<td>TOP_DOWN_NETWORK_VLAN</td>
<td>Yes</td>
<td>12/1/2017, 7:22:18 PM</td>
<td></td>
</tr>
<tr>
<td>Device 11</td>
<td>MyNetwork_30001</td>
<td>TOP_DOWN_NETWORK_VLAN</td>
<td>Yes</td>
<td>12/1/2017, 5:09:35 PM</td>
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<td>Device 2001</td>
<td>MyVRF_50000</td>
<td>TOP_DOWN_VRF_VLAN</td>
<td>Yes</td>
<td>12/1/2017, 5:09:35 PM</td>
<td></td>
</tr>
<tr>
<td>Device 16</td>
<td>VLAN_16</td>
<td>TOP_DOWN_NETWORK_VLAN</td>
<td>Yes</td>
<td>12/3/2017, 10:4:18 AM</td>
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</tr>
<tr>
<td>Device 2004</td>
<td>VRF_50013</td>
<td>TOP_DOWN_VRF_VLAN</td>
<td>Yes</td>
<td>12/3/2017, 10:4:18 AM</td>
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<tr>
<td>Device 17</td>
<td>VLAN_17</td>
<td>TOP_DOWN_NETWORK_VLAN</td>
<td>Yes</td>
<td>12/3/2017, 10:4:23 AM</td>
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<tr>
<td>Device 25</td>
<td>VLAN_25</td>
<td>TOP_DOWN_NETWORK_VLAN</td>
<td>Yes</td>
<td>12/3/2017, 10:3:37 AM</td>
<td></td>
</tr>
<tr>
<td>Device 12</td>
<td>VLAN_12</td>
<td>TOP_DOWN_NETWORK_VLAN</td>
<td>Yes</td>
<td>12/3/2017, 10:3:37 AM</td>
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</tr>
<tr>
<td>Device 2002</td>
<td>VRF_50011</td>
<td>TOP_DOWN_VRF_VLAN</td>
<td>Yes</td>
<td>12/3/2017, 10:3:37 AM</td>
<td></td>
</tr>
<tr>
<td>Device 14</td>
<td>VLAN_14</td>
<td>TOP_DOWN_NETWORK_VLAN</td>
<td>Yes</td>
<td>12/3/2017, 10:3:37 AM</td>
<td></td>
</tr>
<tr>
<td>Device 2003</td>
<td>VRF_50012</td>
<td>TOP_DOWN_VRF_VLAN</td>
<td>Yes</td>
<td>12/3/2017, 10:3:37 AM</td>
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</tr>
<tr>
<td>Device 15</td>
<td>VLAN_15</td>
<td>TOP_DOWN_NETWORK_VLAN</td>
<td>Yes</td>
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</tr>
<tr>
<td>Device 18</td>
<td>VLAN_18</td>
<td>TOP_DOWN_NETWORK_VLAN</td>
<td>Yes</td>
<td>12/3/2017, 10:3:37 AM</td>
<td></td>
</tr>
</tbody>
</table>
External Fabric Connectivity Provisioning
External Fabric Connectivity Provisioning

Border Node Deployments

- Setting up base and setup configuration
- Deploying VRFs
- Deploying VRF_LITE using sub-interfaces with pool management of dot1q IDs
  - IPv4 & IPv6 support
  - VPC Support
- Deploying Networks for vanilla VLAN hand-off
External Connectivity using VRF-LITE
Verifying External Connectivity using VRF-LITE
EVPN Multi-Site Provisioning
EVPN Multi-Site Deployment

Support for Border Gateways

• Multi-Site Underlay & Overlay inter-fabric connection setup
  • B2B and Route-Server based topology support

• Multi-Site Overlay extension
  • Networks & VRFs

• Simultaneous VRF-LITE & Multi-Site support
Multi-Site Inter-fabric Underlay and Overlay Connections

Extension Setup Configuration

interface Ethernet1/7
no switchport
ip address 10.10.121.2/24 tag 54321
mtu 9216
evpn multisite dci-tracking
no shutdown
router bgp 65001
   address-family ipv4 unicast
   redistribute direct route-map RMAP-REDIST-DIRECT
neighbor 10.10.121.1 remote-as 65101
   update-source Ethernet1/7
   address-family ipv4 unicast
   next-hop-self
copy running-config startup-config

Extension Setup Configuration

router bgp 65001
neighbor 10.101.101.101 remote-as 65100
   update-source Loopback0
ebgp multihop 5
type fabric-external
   address-family 12vpn evpn
   send-community
   send-community extended
   rewrite-evpn-rt-asn

copy running-config startup-config
Extending a Network via Multi-Site

If a Layer-3 Network is extended, both VRF & Network are deployed on the selected Border Gateways.
Features for LAN Fabrics
Features in DCNM
Topology Views

- Real-Time Search
- Health Score (color)
- Link Pop-Up
- Detected VTEP
- Pop-Up Switch Dashboard
Topology Views - VMM Integration (Preview)

- Display Host Details
- Display connected Physical Hosts
- Display DVS/Vswitch
- Display VMs
- Filter by VMM
Endpoint Locator

- How many hosts on vlan 10 on eth1/1 on Leaf10 at 11/01/2017 between 2am - 3am?
- How many networks and VRFs are active on leafs 1-10?
- Network activity heat-map

Graphical view of host life-cycle on the network
Lab Setup
Dcloud Lab Setup

Primary VLAN (198.18.126.0/18)

Inband Mgmt(192.168.55.0/24)

Enhanced Fabric Mgmt(198.18.4.0/24)
Nexus Fabric Setup
Lab Walkthrough

- Familiarization with DCNM
- Using Endpoint Locator
- Deploying EVPN with Power-On Auto Provisioning
- Deploy Overlay to EVPN Fabric
- Optional: Explore REST-API of DCNM
- Optional: Run PoAP for existing Leaf
Accessing the Lab

• Lab is hosted in dcloud.cisco.com
• Proctors will distribute login data for anyconnect
Cisco Spark

Questions?
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