Cisco ACI — Basics and Updates
Market Momentum Continues

6,000+
Nexus 9K and ACI Customers Globally

1400+
ACI Customers

50
Ecosystem Partners

NEW
Infoblox, VERITAS, N3N, Tufin, vARMOUR

ECOSYSTEM

NetQoS, CA Technologies, AVI Networks, CFEngine, Panduit, Intel Security, Splunk, Radware, NIKSUN, Check Point Software Technologies, CloudStack,
Microsoft, Red Hat, IBM, Nutanix, NetScout, MapR, A10 Networks, Fortinet, Cloudera, Puppet, One Convergence,
VCE, NetApp, Symantec, BMC, ScienceLogic, EMC, Emulex, Sourcefire, Canonical, DataTorrent,
KillerIT, Vnomic, Zenoss, Apprenda, VMware, Citrix, CliQr, SAP, OpenStack, OPSCODE, CATBIRD, Python
Cisco Data Center Strategy
Defined by Applications. Driven by Policy. Delivered as a Service / Solution

BUSINESS OUTCOMES
- Efficiency
- Speed
- Digitization

BUSINESS REQUIREMENTS

APPLICATIONS
- Compute & Storage
- Cloud
- Network

SECURITY & SERVICES

MANAGEMENT AND ORCHESTRATION

FLEXIBLE SOFTWARE MODEL
Foundational Switching Platforms for the Next Decade

Nexus 9000
1/10/40/100G

- Industry Leading Price/Performance, Port Density: Fastest 10G/25G/40G/50G/100G Platform
- Programmability/ Open APIs: Linux Containers, Python, Power Shell, Puppet, Chef… Ideal for DevOps!!
- 15% Better Power & Cooling–2.8X Better Reliability
- Innovation Object Model, No Backplane, No Midplane, Health scores
- $ Multi-million Savings 40/100G on Existing Cables using BiDi Optics. Non disruptive migration to 40G

Standalone / ACI Ready
What problem are we solving?
Now let’s imagine a network switch …

… at the moment, largely configured on the CLI.
All nodes are managed and operated independently, and the actual topology dictates a lot of configuration

- **Device basics**: AAA, syslog, SNMP, PoAP, hash seed, default routing protocol bandwidth …

- **Interface and/or Interface Pairs**: UDLD, BFD, MTU, interface route metric, channel hashing, Queuing, LACP, …

- **Fabric and hardware specific design**: HW Tables, TCAM, …

- **Switch Pair/Group**: HSRP/VRRP, VLANs, vPC, STP, HSRP sync with vPC, Routing peering, Routing Policies, …

- **Application specific**: ACL, PBR, static routes, QoS, …

- **Fabric wide**: MST, VRF, VLAN, queuing, CAM/MAC & ARP timers, COPP, route protocol defaults
Cisco ACI solves the problem …

Interfaces, protocols, TCAM, etc … all represented in an object model, and ALL accessible through an XML/JSON API and CLI.
APIC becomes single point of management for the entire fabric ... with a policy-based model
... and the fabric acts like a single (virtualized) switch
Adding, removing or replacing nodes becomes extremely simple
And so do network upgrades …
... and you get best troubleshooting with full physical, virtual and services visibility ...
So, the first thing to remember about ACI: it is a programmable physical fabric with a single point of management …
Overview of the ACI Fabric

**ACI Spine Layer** – Provides bandwidth and redundancy between Leaf Nodes

**ACI Leaf Layer** – Provides all connectivity outside the fabric - including servers, service devices, other networks

**Optimized Traffic Flows** – Accommodates new E-W traffic patterns in simple, scalable, non-blocking design

**Decoupling of Endpoint Identity** – Network policies automatically move with VM/Server/Container

**Network Innovations** – Dynamic load balancing, dynamic packet prioritization, congestion management

Industry’s most efficient fabric:
- 220k+ 1/10Gb edge hosts
- High-density 40/100G spine
- 1 million+ IPv4 / IPv6 endpoints
- 64,000+ tenants
ACI Operational Simplicity
ACI – Day 2 Tools for Simplified Operations

System Health Scores

Statistics Per App

Contract Deny Logs

Endpoint Tracker

Real-time Heat Maps

Endpoint Troubleshooting Wizard
THE MOMENT YOU PROVE IT IS NOT THE NETWORK.
Policy Defined by Application

Push configurations automatically to the entire network
The ACI Policy Model

Tenant ≈ VDC

VRF ≈ VRF

Bridge Domain ≈ Subnet/SVI

End Point Group ≈ Broadcast Domain/VLAN
  Private VLAN

Contracts ≈ Access Lists

L2 External EPG ≈ 802.1q Trunk
L3 External EPG ≈ L3 Routed Link

Any-Any Replicates a Traditional Switch
The ACI Policy Model – Network Centric Configuration

Global VRF/Routing Table and Protocol

Tenant

VLAN 10 BD
10.10.10.1/24

VLAN 10 EPG

VLAN 30 BD
10.10.30.1/24

VLAN 30 EPG

Any-Any Contract

Any-Any Contract

Any

- Any Contract

Any

- Any Contract
The ACI Policy Model – Network Centric Configuration

Tenant

Global VRF/Routing Table and Protocol

VLAN 10 BD
10.10.10.1/24
VLAN 10 EPG

VLAN 20 BD
10.10.20.1/24
VLAN 20 EPG

VLAN 30 BD
10.10.30.1/24
VLAN 30 EPG

Any-Any Contract

Any-Any Contract

Connect To External Switch

L2 External (802.1q Trunk)

L3 External (Routed Interface)
Advanced ACI Policy Model – Micro Segmentation

Application Profile

App 1 - Database Tier EPG

App 1 - App Tier EPG

App 1 - Web Tier EPG

L2/L3 External

Only SQL

Only HTTP (REST)

Only HTTP
Advanced ACI Policy Model – Service Insertion

Application Profile with Service Graphs
Software
Cisco ACI 1.2 Release

**Infrastructure**
- IP-based endpoint group (EPG)
- Shared Layer 3 outside (L3Out) connectivity
- Direct server return
- Common pervasive gateway for IPv4 and secondary IP address for IPv4
- ‘Multi-site Application’ – ACI Toolkit
- Service Insertion and Chaining for Any Layer 4-7 device (no device package)
- Ingress policy enforcement for L3Out scalability
- Class of Service Preservation
- VXLAN support (host to ACI Fabric)
- Static Route with Weights
- TLS 1.2
- Cisco Nexus® 9516 Switch (support for 10 slots)

**Virtualization**
- VMware vSphere 6.0 support enhancements (vMotion for X-vCenter, X-VDS)
- Micro-segmentation
  - Microsoft Hyper-V
- Cisco® Application Virtual Switch (AVS) for IPv6
- Authentication, authorization, and accounting (AAA) for L4-L7 services
- VMware vRealize integration
- New OpFlex for Open Virtual Switch (OVS)
  - Local policy enforcement
  - Virtual Extensible LAN (VXLAN) support
  - Network Address Translation (NAT) and floating IP address
  - Cisco Application Infrastructure Controller (APIC) GUI integration

**Troubleshooting and Operations**
- Basic GUI and Advanced GUI modes
- Simple Network Management Protocol (SNMP) support for APIC
- Accurate counter and SNMP MIB support for Layer 3 (L3Out) interface
- Troubleshooting wizard enhancements
- Cisco NX-OS style command-line interface (CLI) on APIC
- Configuration rollback
- Endpoint tracker
- Traffic map
IP-Based EPG

Description
- This feature allows detailed EPG derivation based on the IP address of the endpoint.
- Available for both physical and virtual endpoints.

Use Case
- Directly attached storage filers: Many enterprises use storage filers that expose one MAC address and many different IP addresses, and they want to apply policy per IP prefix. A Cisco 9300 ® E-Series leaf switch or module is required.

Matching Criteria
- IP address attribute: IP-prefix based
  - The IP address is specified in the Prefix/Subnet format: for example, 1.1.1.0/30.
  - A longest prefix match is performed for the IP address to derive the EPG.
- MAC address attribute (future)
  - The exact and complete MAC address must be specified as a part of this policy.
IP-Based EPG: Use Case 1
Shared Storage for Each Customer

Different security policy is needed for logical storage that uses the same VLAN and same MAC address but different IP address.

VLAN 10

Storage

Storage for Customer A 192.168.1.1
Storage for Customer B 192.168.1.2

Servers for Customer A

Servers for Customer B

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Sharing VRF and L3Out Among Tenants
Bridge Domain, Subnet, and L3Out Under Tenant Common

- No overlapping IP addresses among tenants, VRF instances shared among tenants, and traffic isolation through contract
- Bridge domain and subnet and L3Out defined under tenant common
- EPG, contract, and application profile under individual tenants
- Dynamic routing protocol with external routers

VRF

Tenant-Pepsi

- Web
- APP
- DB

Tenant-Coke

- Web
- APP
- DB

Tenant-Common

- BD-Coke 192.168.102.1/24
- BD-Pepsi 192.168.101.1/24

Dynamic protocol
Static route

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Sharing L3Out Across VRF Instances with Cisco ACI 1.2(x)

- Shared service provider is an external EPG.
- Shared service provider can be in any tenants.
Shared Service with L3Out Across VRF Instances

- Shared service provider is tenant EPG.
- External EPGs of different tenant and VRF access to shared services.
Virtualization
VMware vSphere 6.0

- No changes in Cisco® APIC configuration and operations
  - A new VMware DVS Release 6.0 is added to force configuration to DVS to Release 6.
- Support for inter-data center and intra-vCenter
  - Both vCenters should be part of the same single sign-on (SSO) instance.
  - Long-distance vMotion is not verified or supported.
  - Support applies only to DVS, not Cisco Application Virtual Switch.
Attribute-Based EPG

Description
• This feature allows detailed EPG derivation based on various virtual machine attributes such as virtual machine name, guest OS, MAC address, and IP address.
• Prior to Brazos, this feature was available for virtual endpoints attached with the Cisco® AVS distributed virtual switch (B release). It is not available with VMware DVS. Available with 1.3 with EX switches!
• Brazos also adds this feature for Cisco ACI™ and Microsoft SCVMM

Note: This feature does not provide an intra-EPG security policy.

Use Case
• Isolate malicious virtual machines.
• Create security across zones.

Benefits
• Without changing the port-group association of servers, additional security and segmentation can be provided.
Use Case 1
Isolate Malicious Virtual Machines

• Problem: A vulnerability is detected in a particular type of operating system (for example, Microsoft Windows). The network security administrator wants to isolate all Windows virtual machines.

• Solution: Define a security EPG with a criterion such as Operating System = Windows. No contracts are provided or consumed by this EPG. It will stop all inter-EPG communication for the matching virtual machines.

• No virtual machine attachment or detachment or placement in a different port group is needed.
• Problem: Virtual machines belonging to different departments (for example, HR and Sales) or different roles (for example, Production and Testing) are placed in the port group. But isolation across departments is required (for example, HR-Web-VM should not be able to talk to Sales-Web-VM).

• Solution: Define EPGs that match if the virtual machine name contains a matching string (for example, HR or Sales).

• Each attribute-based EPG can have its own security policies.
Service Insertion for Any Layer 4-7 device
(No device package)

Description
• Unmanaged L4-L7 devices to be used as service node in a service graph between EPGs.
• This approach allows the network team to handle the network automation part for the service devices with Cisco® APIC. However, configuration and management can continue to follow their current model.
• This approach also helps those L4-L7 devices for which a device package is not available.

1: Configure Cisco ACI® fabric for L4-L7 service appliance – network part only.

2: Administrator configures L4-L7 service appliance in the usual way (CLI or GUI).
UI hides all other settings related to the package, configuration parameters, and connectivity when the managed mode is not selected.
Managed and unmanaged devices can be combined in a single graph.
Troubleshooting and Operations
Basic GUI
Basic GUI

- The Basic GUI mode shows only the most commonly used features and emphasizes ease of use.
- Some features are simply not exposed: L4-L7 integration, advanced routing (L3Out), etc.
Purpose of the Basic GUI

With the Cisco ACI 1.2 release, Release 1.2(x), Cisco ACI™ introduces an alternative user interface to the existing GUI.

The goals of this GUI are as follows:

Reduce the time needed for deployment:

• Shorten the time needed to test Cisco ACI
• Provide ease of use in implementing Cisco ACI

Reduce the need for new learning:

• Provide network engineers with configurations based on current and traditional networking concepts (ACLs, VLANs, subnets, etc.) as much as possible

Switching back and forth between the Advanced and Basic GUIs is not recommended.

Address the markets for specific customers:

• Provide a tool for commercial customers
• Simplify the most common operations
## Main Differences Between Basic and Advanced GUls

<table>
<thead>
<tr>
<th>Feature</th>
<th>Basic GUI</th>
<th>Advanced GUI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port configurations from the topology view</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Use of switch and port selectors</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Reuse of the same policy</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>L4-L7 device-package based</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>L4-L7 network-only stitching</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Simplified Basic GUI Hierarchy
Inband and Out of Band

Differences with existing GUI:

- No need to use “Tenant mgmt”
- All in-band and out-of-band management configurations consolidated on a dedicated tab
Drag-and-Drop Configuration
For Both Advanced and Basic GUIs

Drag-and-drop configuration is available for the following features:

- EPGs
- Attributed-based EPGs
- Association of EPG with VMM and physical domain
- Contracts
- External EPG for L2Out
- External EPG for L3Out
Simplified Interface Configuration

- One place to configure everything related to interface
- Creation of port channels and virtual port channels (vPCs)
- Interface-level configuration: speed, link debounce, LLDP, and Cisco® Discovery Protocol
- Layer 2 protocol
- VLAN and VMM domain association
### Simplified Interface Configuration

- One place to configure everything related to interface
- Creation of port channels and vPCs
- Interface-level configuration: speed, link debounce, LLDP, and Cisco® Discovery Protocol
- Layer 2 protocol
- VLAN and VMM domain association

#### Interface Configuration Table

<table>
<thead>
<tr>
<th>Interface</th>
<th>L2 Protocols</th>
<th>VLAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>STP Interface controls:</td>
<td></td>
<td>BPU Filter enabled</td>
</tr>
<tr>
<td>MCP State:</td>
<td>Enabled</td>
<td>Disabled</td>
</tr>
</tbody>
</table>
Simplified Interface Configuration

- One place to configure everything related to interface
- Creation of port channels and vPCs
- Interface-level configuration: speed, link debounce, LLDP, and Cisco® Discovery Protocol
- Layer 2 protocol
- VLAN and VMM domain association
Statistics Through GUI
Cisco NX-OS Style of CLI on Cisco APIC

Configuring port channels
Searching the MAC address table in leaf switches
Showing the configuration for a tenant and leaf
Overview

Cisco® NX-OS style of CLI runs on the Cisco APIC, **not** on the leaf and spine switches.

- The APIC NX-OS style of CLI reuses the **exact** same REST API as used by the GUI.
- The **show version** and **show running** commands are back (you can view the entire running configuration).
Command Output

```bash
azesulem$ ssh admin@172.31.218.86
Application Policy Infrastructure Controller
admin@172.31.218.86's password:
apic1#
```

```
<table>
<thead>
<tr>
<th>Role</th>
<th>Id</th>
<th>Name</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>controller</td>
<td>1</td>
<td>apic1</td>
<td>1.2(0.245)</td>
</tr>
<tr>
<td>controller</td>
<td>2</td>
<td>apic2</td>
<td>1.2(0.245)</td>
</tr>
<tr>
<td>controller</td>
<td>3</td>
<td>apic3</td>
<td>1.2(0.245)</td>
</tr>
<tr>
<td>leaf</td>
<td>101</td>
<td>leaf1</td>
<td>n9000-11.2(0.83)</td>
</tr>
<tr>
<td>leaf</td>
<td>102</td>
<td>leaf2</td>
<td>n9000-11.2(0.83)</td>
</tr>
<tr>
<td>leaf</td>
<td>103</td>
<td>leaf3</td>
<td>n9000-11.2(0.83)</td>
</tr>
<tr>
<td>spine</td>
<td>104</td>
<td>spine1</td>
<td>n9000-11.2(0.83)</td>
</tr>
<tr>
<td>spine</td>
<td>105</td>
<td>spine2</td>
<td>n9000-11.2(0.83)</td>
</tr>
</tbody>
</table>
```
Cisco NX-OS Style of CLI on Cisco APIC

- Use CLI with Cisco® NX-OS look and feel to create tenants, VRF instances, and bridge domains.
- Use CLI to enable distributed anycast gateway for the bridge domain.

```
apic1# config terminal
apic1(config)#
apic1(config)# tenant test-tenant-cli
apic1(config-tenant)# vrf context vrf-cli
apic1(config-tenant)# bridge-domain BD-1
apic1(config-tenant-bd)# vrf member vrf-cli
apic1(config-tenant-bd)# unicast routing
apic1(config-tenant-bd)# arp flooding

apic1(config-tenant)# interface bridge-domain BD-1
apic1(config-tenant-interface)# ip address 7.7.7.1/24
```
Cisco NX-OS Style of CLI on Cisco APIC

EPG and Contract

- Create contracts.
- Create EPGs. Associate EPGs with bridge domains and VMM domains. Apply contracts.

```bash
apic1(config-tenant)# access-list nfs
apic1(config-tenant-acl)# match arp
apic1(config-tenant-acl)# match icmp
apic1(config-tenant-acl)# match tcp dest 111
apic1(config-tenant)# contract NFS_contract
apic1(config-tenant-contract)# subject nfs
apic1(config-tenant-contract-subj)# access-group nfs out
apic1(config-tenant)# application app-1
apic1(config-tenant-app)# epg WEB
apic1(config-tenant-app-epg)# bridge-domain member BD-1
apic1(config-tenant-app-epg)# vmware-domain member DC1
apic1(config-tenant-app-epg)# contract consumer NFS_contract
```
Cisco NX-OS Style of CLI on Cisco APIC

L3Out

- External EPG and route map are under configuration context “tenant.”
- Interface and protocol configurations are under configuration context “leaf.”

```bash
apic1(config)# leaf 103
apic1(config-leaf)# interface ethernet 1/40.628
apic1(config-leaf-if)# vrf member tenant test-tenant-cli vrf vrf-cli
apic1(config-leaf-if)# ip address 77.77.77.1/30

apic1(config-leaf)# router ospf default
apic1(config-leaf-ospf)# vrf member tenant test-tenant-cli vrf vrf-cli
apic1(config-leaf-ospf-vrf)# area 20 nssa
apic1(config-leaf-ospf-vrf)# exit
apic1(config-leaf-ospf)# exit

apic1(config-leaf)# interface ethernet 1/40.628
apic1(config-leaf-if)# ip router ospf default area 20
apic1(config-leaf-if)# mtu 1500
```
Cisco NX-OS Style of CLI on Cisco APIC

Show Commands

- Check fabric, tenant, and related configurations.
- Run `show` command on multiple leaf switches and get results in one window.
- See notes for sample output from CLI.

```
apic1# show running-config tenant

api1# show endpoints | grep 192.168.1.100
Tenant2    Appl   WEB      00:50:56:94:97:FF   192.168.1.100
  102      eth1/11                         vlan-153  not-applicable

api1# fabric 102-103 show vpc
api1# fabric 102-103 show system internal epm vlan all
api1# fabric 102-103 show ip ospf neighbors vrf all
```
You can use configuration rollback to undo the changes made between two snapshots. Objects are processed as follows:

- Deleted managed objects are re-created.
- Created managed objects are deleted.
- Modified managed objects are reverted to their prior state.

Remote archives are not supported.

**Diff Tool**

- A special REST API is available that shows the differences between two snapshots:
  
apichost/mqapi2/snapshots.diff.xml?s1dn=SNAPSHOT_ONE_DN&s2dn=SNAPSHOT_TWO_DN
Configuration Rollback

### Config Rollbacks

<table>
<thead>
<tr>
<th>Snapshots</th>
<th>File Name</th>
<th>File Size (KB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015-11-06 10:37:14.4...</td>
<td>ce2_defaultOneTime-2015-11-06T10:37-...</td>
<td>62077</td>
</tr>
<tr>
<td>2015-11-10 14:05:39.7...</td>
<td>ce2_defaultOneTime-2015-11-10T14:05-...</td>
<td>61761</td>
</tr>
<tr>
<td>2015-11-10 14:06:03.7...</td>
<td>ce2_defaultOneTime-2015-11-10T14:06-...</td>
<td>61825</td>
</tr>
</tbody>
</table>

### ACTIONS

- **Rollback**
  - Select a snapshot on left to start

- **Take a snapshot to Apic**
  - Or Save to Remote Location:

- **Create recurring snapshots**
  - Click  icon on top

- **Import export file to snapshot**
  - Click  icon on top

- **Modify Import/Export Security Settings**
  - Click  icon on top
Endpoint Tracker

State Transitions

<table>
<thead>
<tr>
<th>Date</th>
<th>IP</th>
<th>MAC</th>
<th>EPG</th>
<th>Action</th>
<th>Node</th>
<th>Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015/11/05 09:05:24</td>
<td>0.0.0.0</td>
<td>00:50:56:94:07:7E</td>
<td>Tenant-CrossFabric/APP1</td>
<td>attached</td>
<td>Node-102</td>
<td>eth1/11</td>
</tr>
<tr>
<td>2015/11/08 21:05:16</td>
<td>100.100.100.20</td>
<td>00:50:56:94:07:7E</td>
<td>Tenant-CrossFabric/APP1</td>
<td>detached</td>
<td>Node-102</td>
<td>eth1/11</td>
</tr>
<tr>
<td>2015/11/08 21:31:42</td>
<td>0.0.0.0</td>
<td>00:50:56:94:07:7E</td>
<td>Tenant-CrossFabric/APP1</td>
<td>attached</td>
<td>Node-103</td>
<td>eth1/12</td>
</tr>
<tr>
<td>2015/11/08 21:45:23</td>
<td>100.100.100.20</td>
<td>00:50:56:94:07:7E</td>
<td>Tenant-CrossFabric/APP1</td>
<td>detached</td>
<td>Node-103</td>
<td>eth1/12</td>
</tr>
<tr>
<td>2015/11/08 22:06:23</td>
<td>0.0.0.0</td>
<td>00:50:56:94:07:7E</td>
<td>Tenant-CrossFabric/APP1</td>
<td>attached</td>
<td>Node-103</td>
<td>eth1/12</td>
</tr>
</tbody>
</table>
Power of Cisco ACI

Automation  Investment Protection  Open  Visibility  Security  Lowering OPEX and TCO
Greater Business Agility
Lower Capital Expenses
Reduced Costs/Complexity
Lower Operating Cost
Resource Optimization

58%
Reduce Network Provisioning

25%
CAPEX Reduction

21%
Reduce Management Costs

45%
Reduce Power and Cooling Costs

10–20%
Compute and Storage Optimization

Reduced Costs/Complexity
58%
“If you don’t like change, you’re going to like irrelevance even less.”

General Eric Shinseki
Back-up
Brazos M1 Release
Target Q1 CY 2016

Infrastructure

Hardware: 9372TX-E
- 3-site Stretched fabric + RR increase

Routing & Switching
- DSCP marking for traffic based on protocol
- IPv6 Management
- BFD – v4 and v6 for external links
- EIGRPv6 support
- OSPF forward address suppression

Routing & Switching
- BGP knobs (Set Attributes, Dynamic Neighbors, Route Dampening, weight attribute, remove-private-as, Route Aggregation)
- QoS Policing (support on T2)

Security
- Intra-EPG isolation policy for Bare Metal and VMWare vDS

Virtualization, Operations

- Spine L3 In-band connectivity
- SNMP traps for APIC
- AVS Features
  1. Stretched Fabric (incl 3-sites)
  2. IPv6 Management
  3. 96 ports usable per leaf
- Cluster Manager for Services – Sourcefire, PANW, F5
- WAP - IP Pool Manager integration

Openstack
- OpenStack Kilo (Plugin only)
- Installer support (Plugin only)

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**Bronx Release**
Target Q2 CY 2016

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**Hardware**

**Nexus 9500 – 100G**
- Fabric Module for 8 and 4-slot (E)
- Line cards: 32p 40/100G (EX)

**N9K-X9732C-EX**

**Nexus 9300 TOR**

93180YC-EX
(48p 10/25G + 6p 100G)

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**Software**

- IP Based EPG support on N93xx-EX
- Vmware vDS Micro-segmentation on 9300-EX

- Vmware AVS intra-EPG isolation