Cisco Next Generation Data Center Design

Maximizing Application Performance, Security And Economics To Accelerate Digital Transformation

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3S TECHNOLOGY CITY

INNOVATION STARTS HERE.

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Standard Sharing Software

Agenda

- Challenges of IT
- ACI Architecture & Deployments
- ACI Use Cases
- Application Driven Data Center & Cisco VTS
- Scalable Fabric, Network Virtualization & EVPN/VXLAN
- Use Cases
- Q & A

Applications Are Changing

Type
Consumption
Delivery

Big Data, Distributed Apps, Mobile

Cloud–public, Private, Hybrid

Anywhere, Anytime, Any Device

78% The network is even more critical to delivering applications than a year ago*

Deciding the Application Location(s)

Public, Private, Both?
Build, Buy, Rent?

Empowering LoB & App. Developers

PublicCloud-like agility and simplicity
Self-Service Operations

Mitigating Risk

Securing Apps, Users, Data.
Compliance. Data sovereignty.

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TECHNOLOGY
CITY

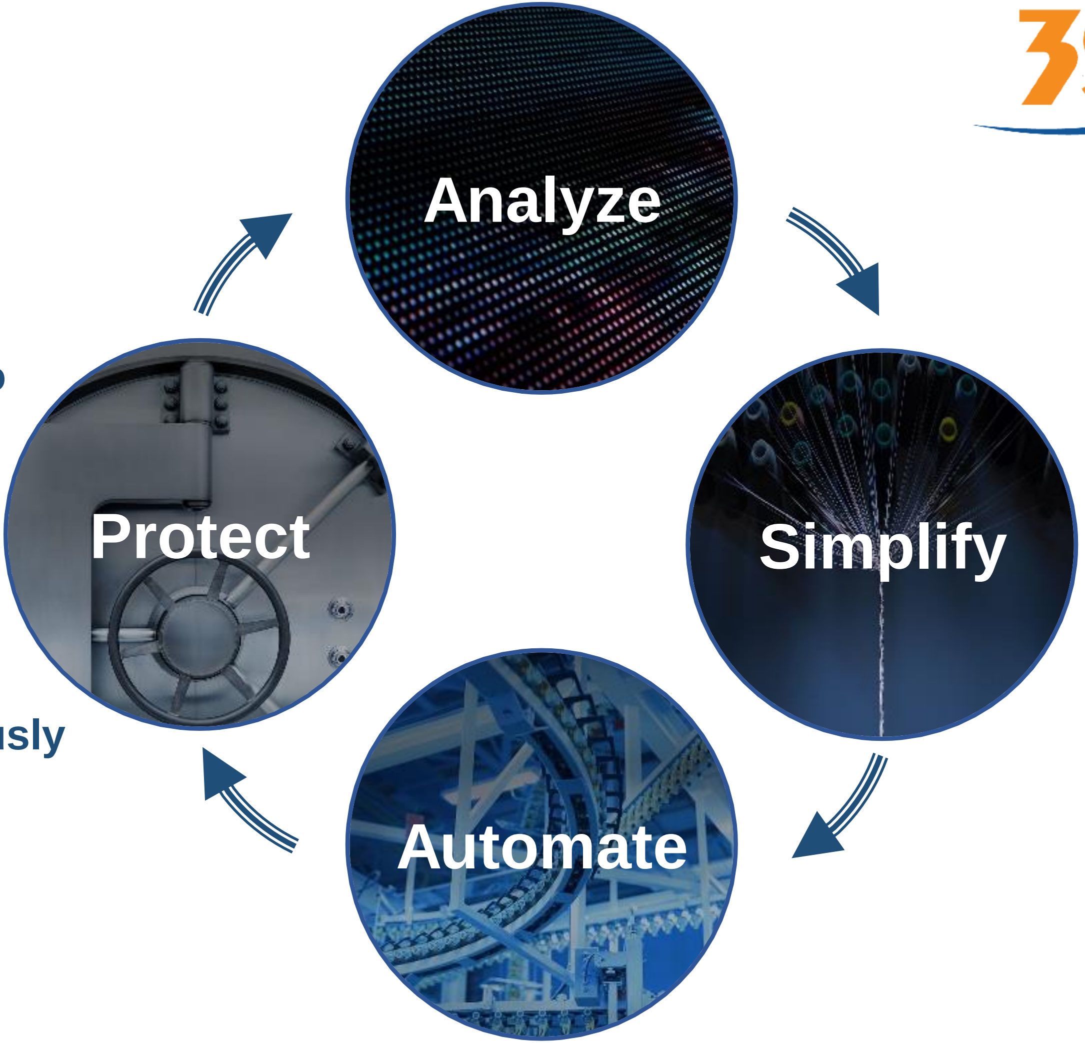
Cisco Data Center Architecture Design

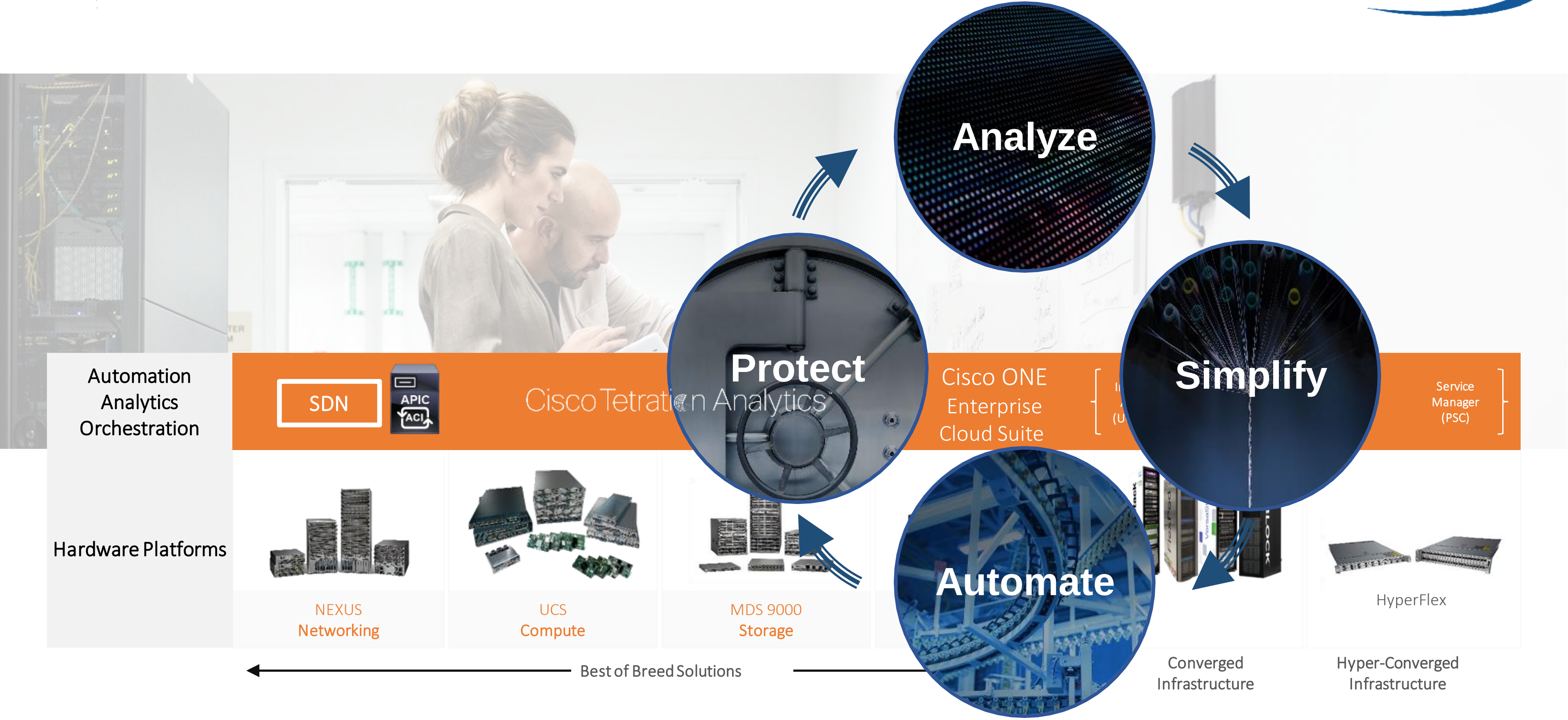
Cisco’s Differentiation:

Integration of DC/Cloud products to deliver the ASAP architecture

Consistent policy-defined model across entire hybrid cloud domain

Maximize Application Performance, economics and security Continuously





Automation
Analytics
Orchestration

SDN

Cisco Tetration Analytics

Cisco ONE
Enterprise
Cloud Suite

Service
Manager
(PSC)

Hardware Platforms

NEXUS
Networking

UCS
Compute

MDS 9000
Storage

HyperFlex

Converged
Infrastructure

Hyper-Converged
Infrastructure

Best of Breed Solutions

Customer Journey with Cisco ASAP Data Center

Optimize Infrastructure

Nexus, MDS

UCS

Next-gen Firewalls

Converged/ Hyperconverged

Performance

Scale

Security

Simplify Operations

APIC

Automation

Unify Policy

50+ eco-system

Build Cloud-native App Stack

openstack

Containers

Self-Service

DevOps Tools

Chose your Hybrid Cloud

Cisco CloudCenter

App. Benchmark

Extend Policy

Securely move data & workloads

Real-time Analytics

Cisco Tetration Analytics

Monitor every flow

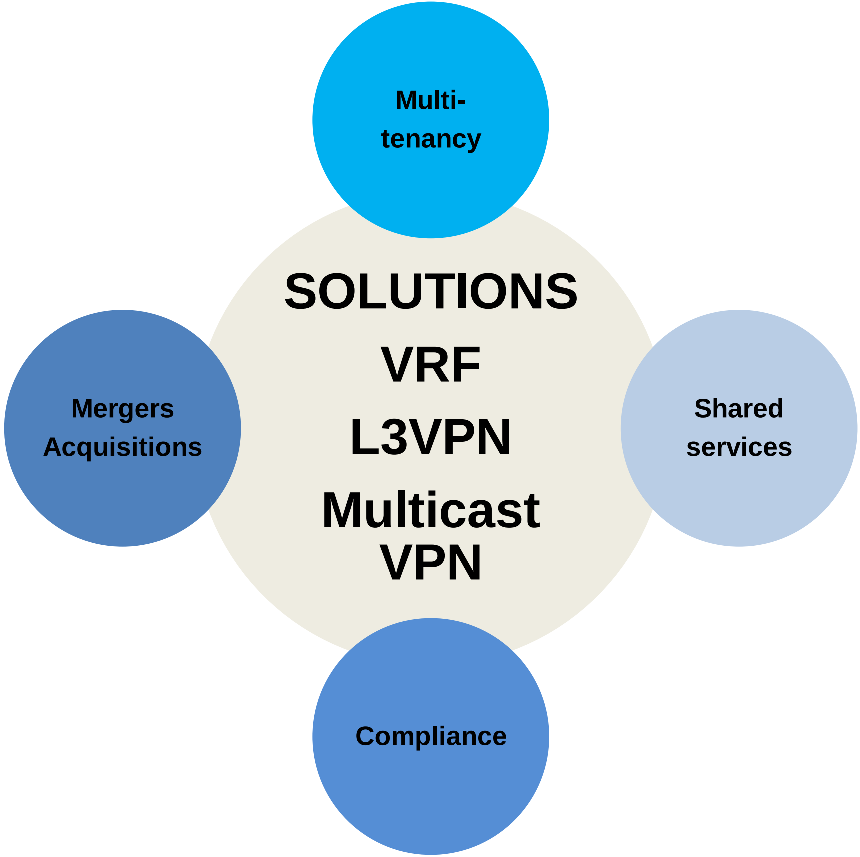
App dependency

On-prem & Cloud

ACI Real World Deployment

Requirements: Business Drivers & Solutions for Network Segmentation

- Multi-tenancy
- Security and Separation
- Traffic Engineering
- Scalable
- Flexible topology
- Minimise oversubscription
- Scale out and scale up
- Scalable L4-7 Service Layer
- No spanning tree
- Incremental scale
- Virtual FW/LB per tenant
- Flexible placement
- Incremental capacity



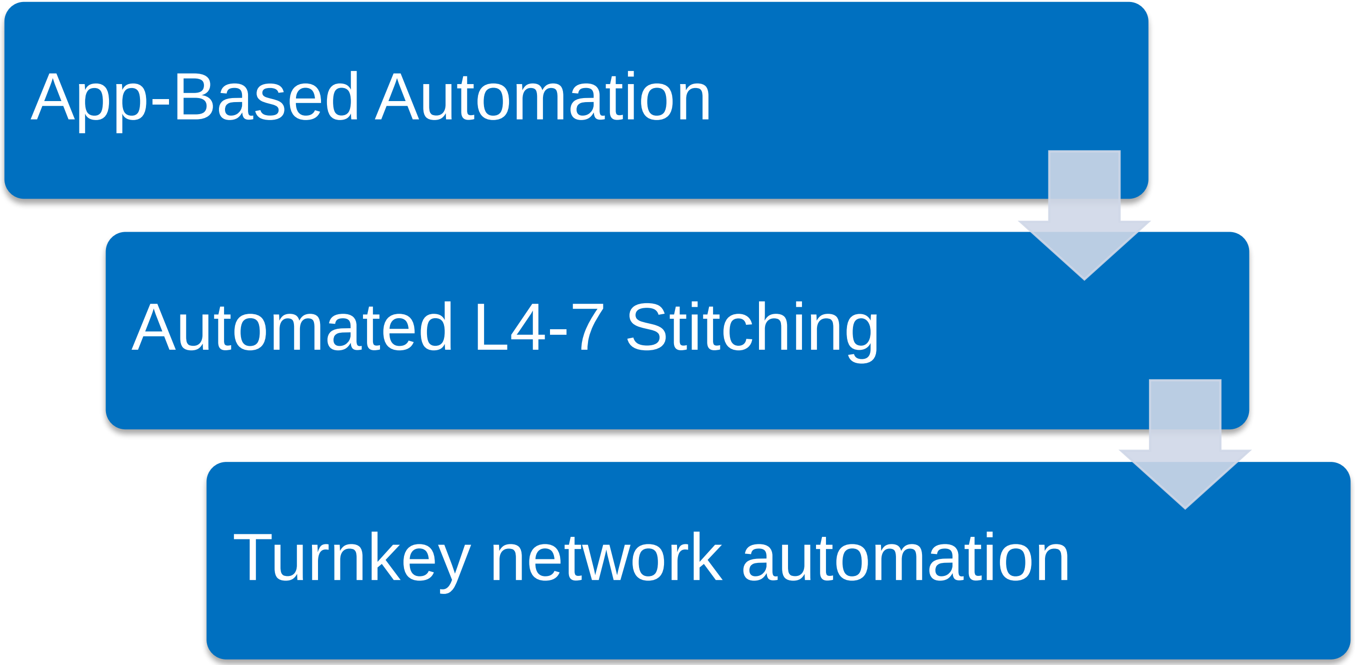
SOLUTIONS

VRF

L3VPN

Multicast VPN

Customer Deployment: Application Centric Infrastructure (ACI)



App-Based Automation

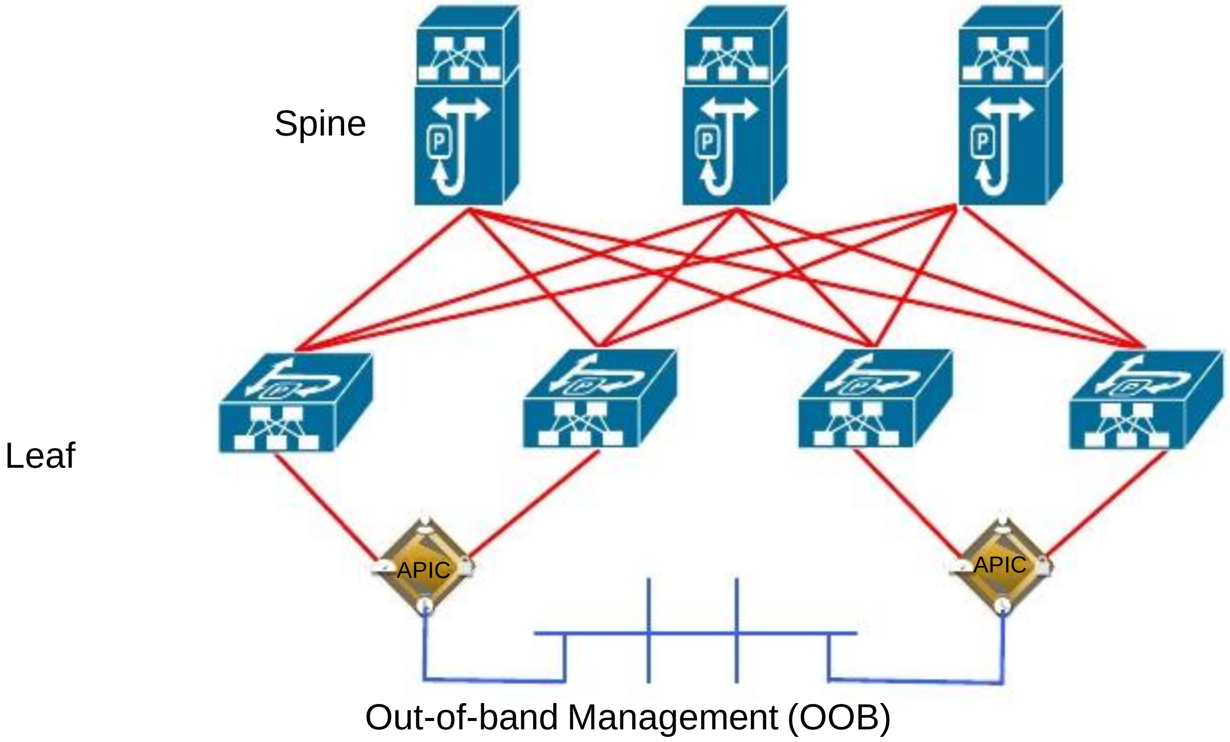
Automated L4-7 Stitching

Turnkey network automation

ACI Fabric Overview

Spine and Leaf Architecture / Design

Attaching the ACI APIC(s)



Defining Terms

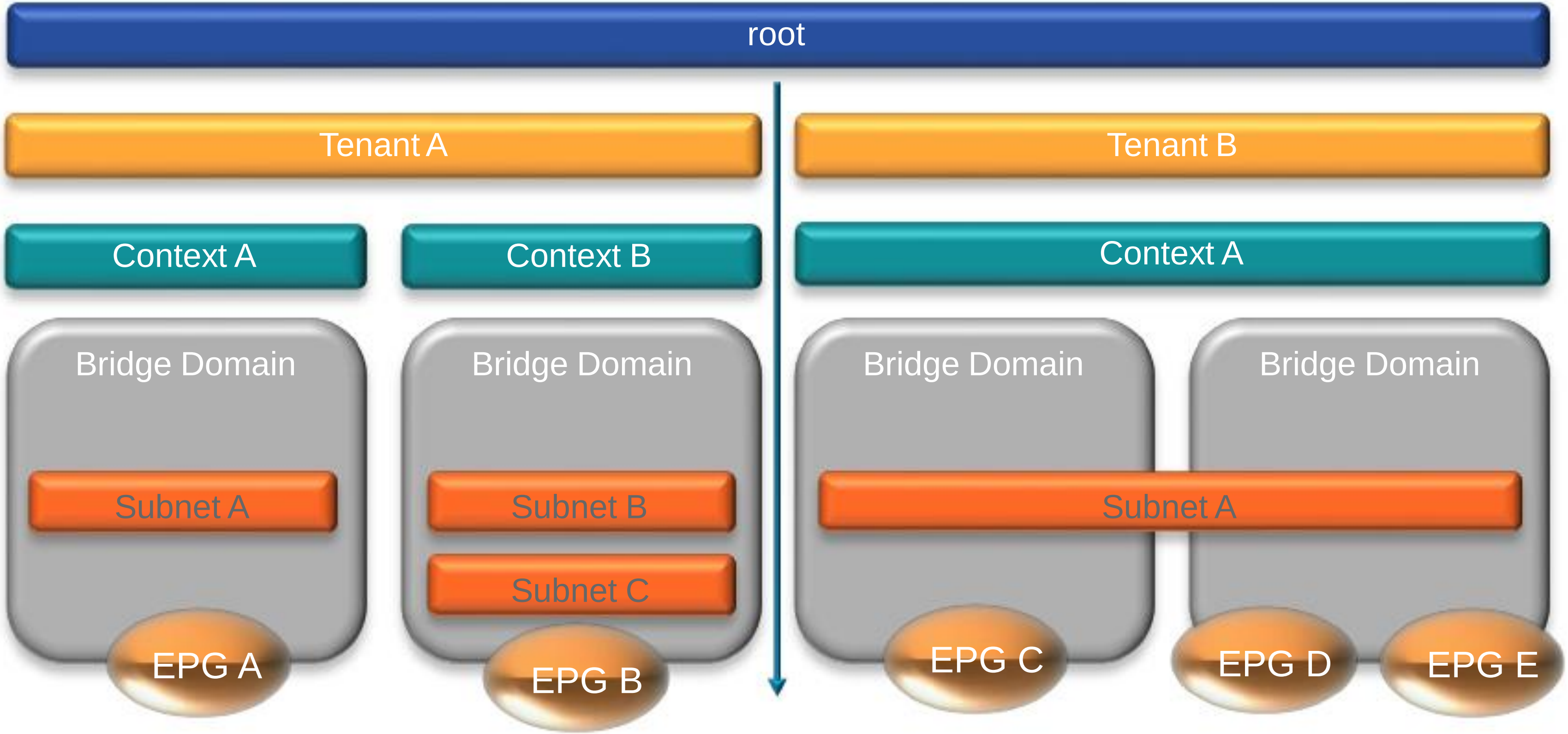
Tenant: Logical separator for: Customer, BU, group etc. separates traffic, admin, visibility, etc.

Context: Equivalent to a VRF, separates routing instances, can be used as an admin separation

End-Point Group (EPG): Container for objects requiring the same policy treatment, i.e. app tiers, or services.

Bridge Domain: Not a VLAN, simply a container for subnets. It can be used to define a L2 boundary.

Logical Model Overview



Context and subnets are independent between tenants

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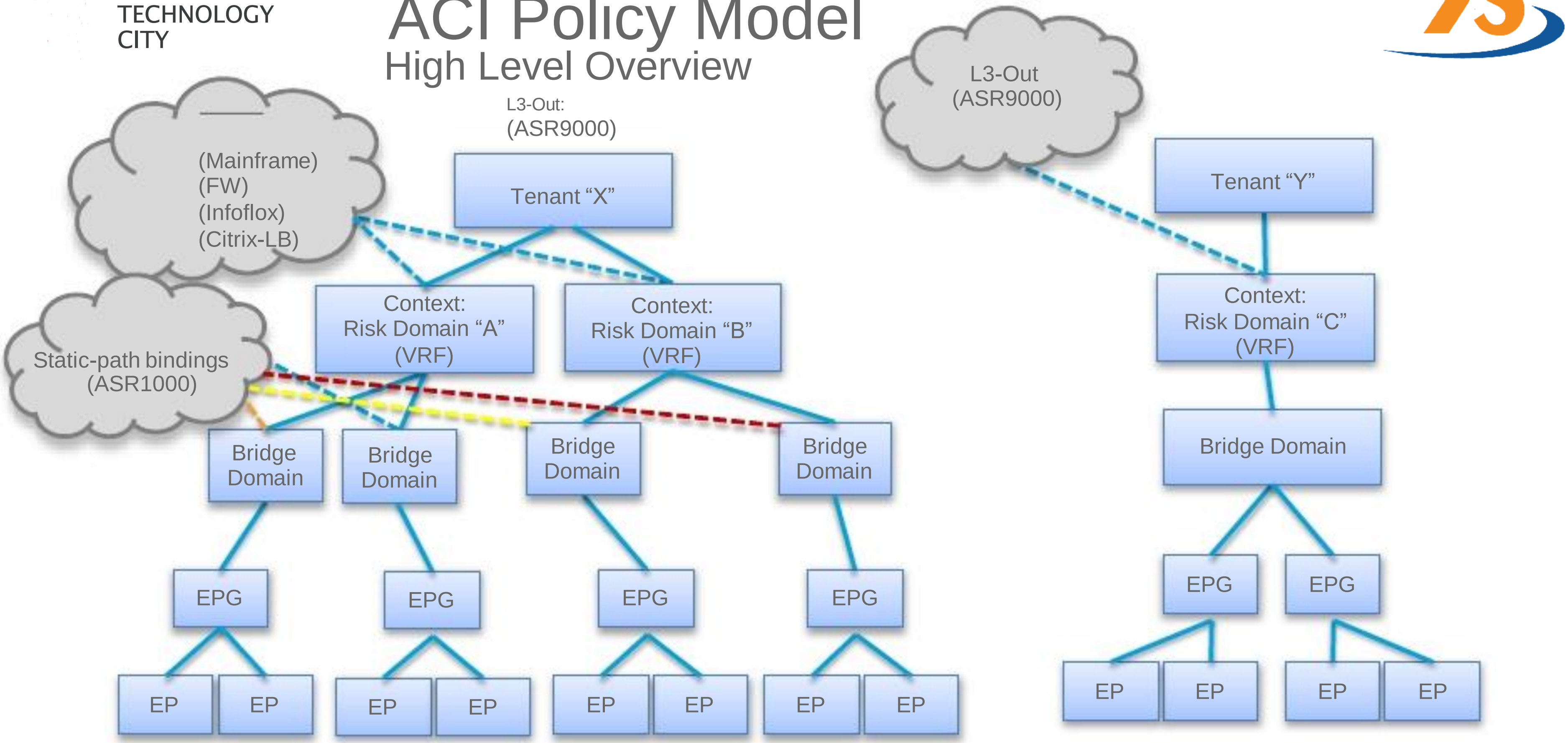
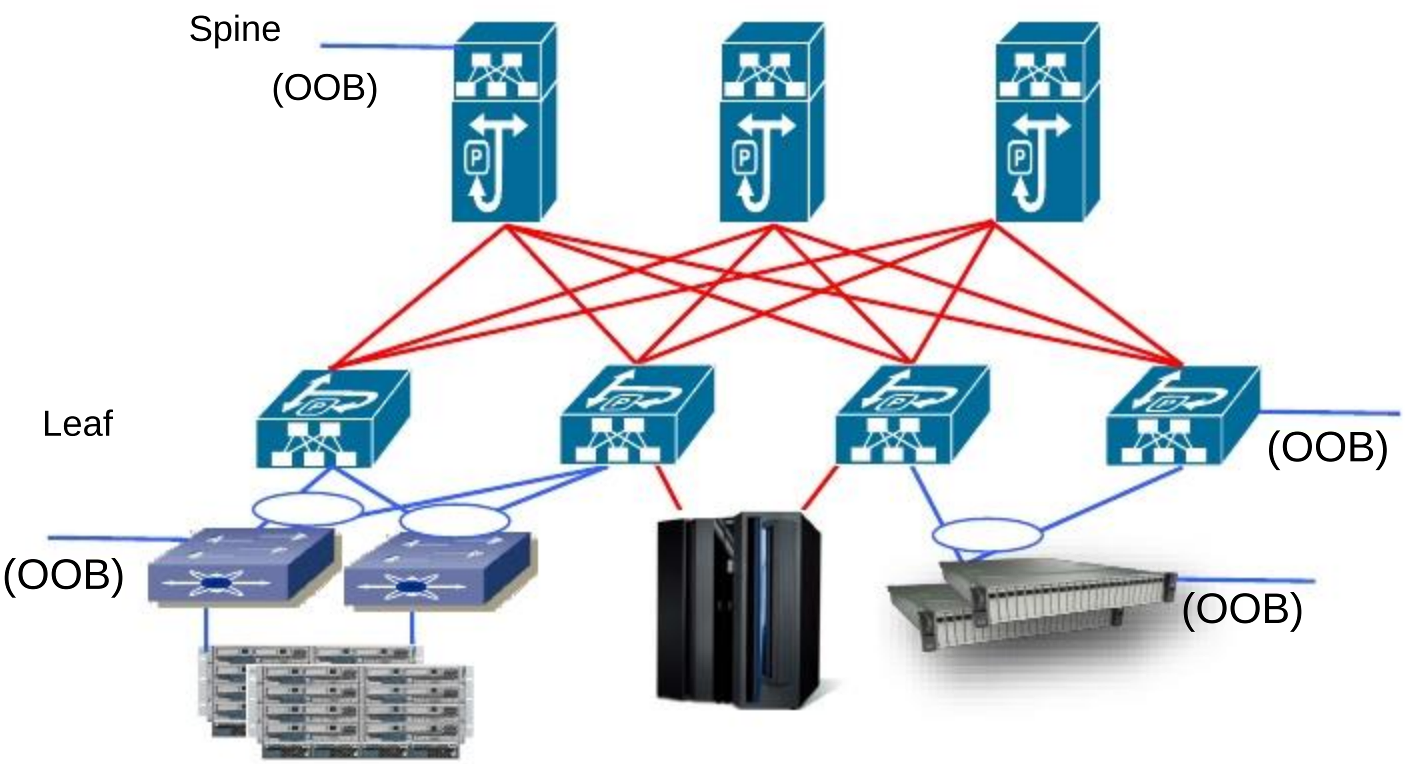
ACI Policy Model

High Level Overview



ACI Fabric

Attaching the Compute Resource to the Fabric



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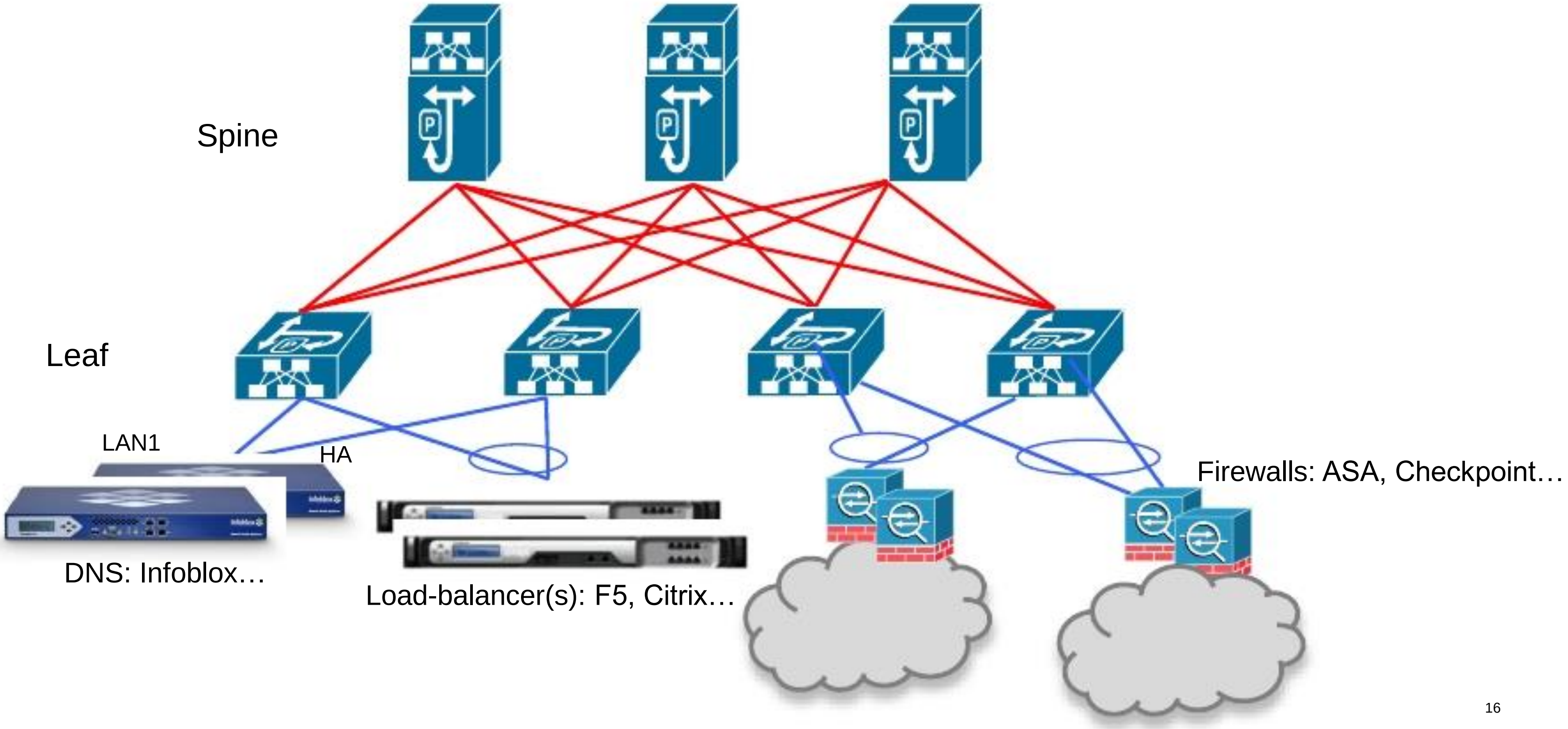
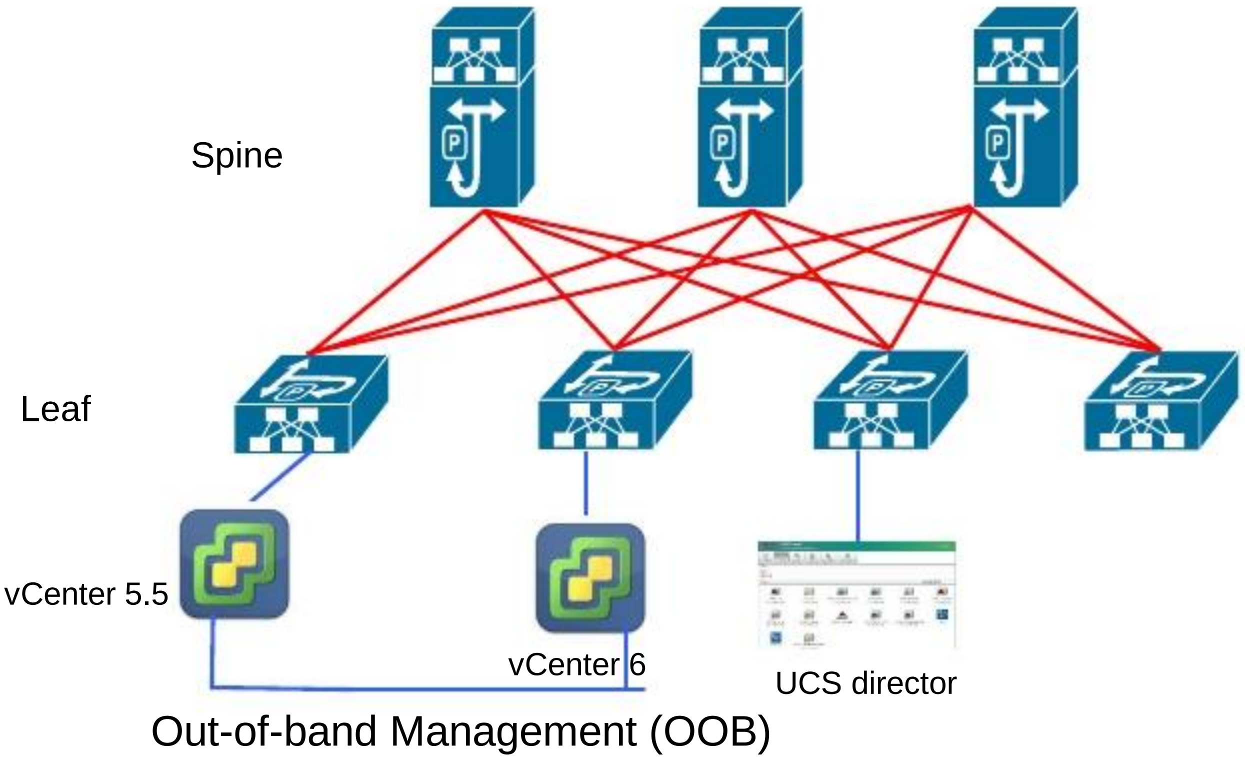
ACI Fabric

Attaching the Services to the Fabric



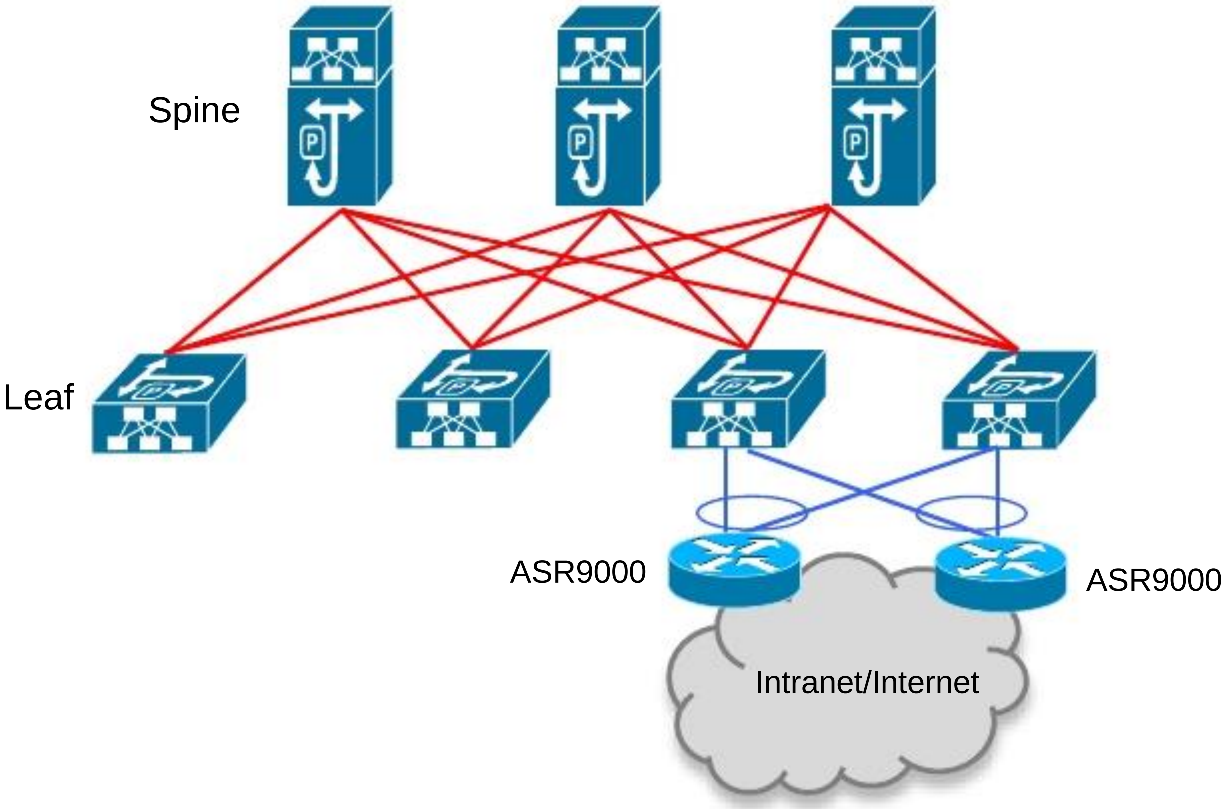
ACI Fabric

Attaching the VMM/Orchestration to the Fabric

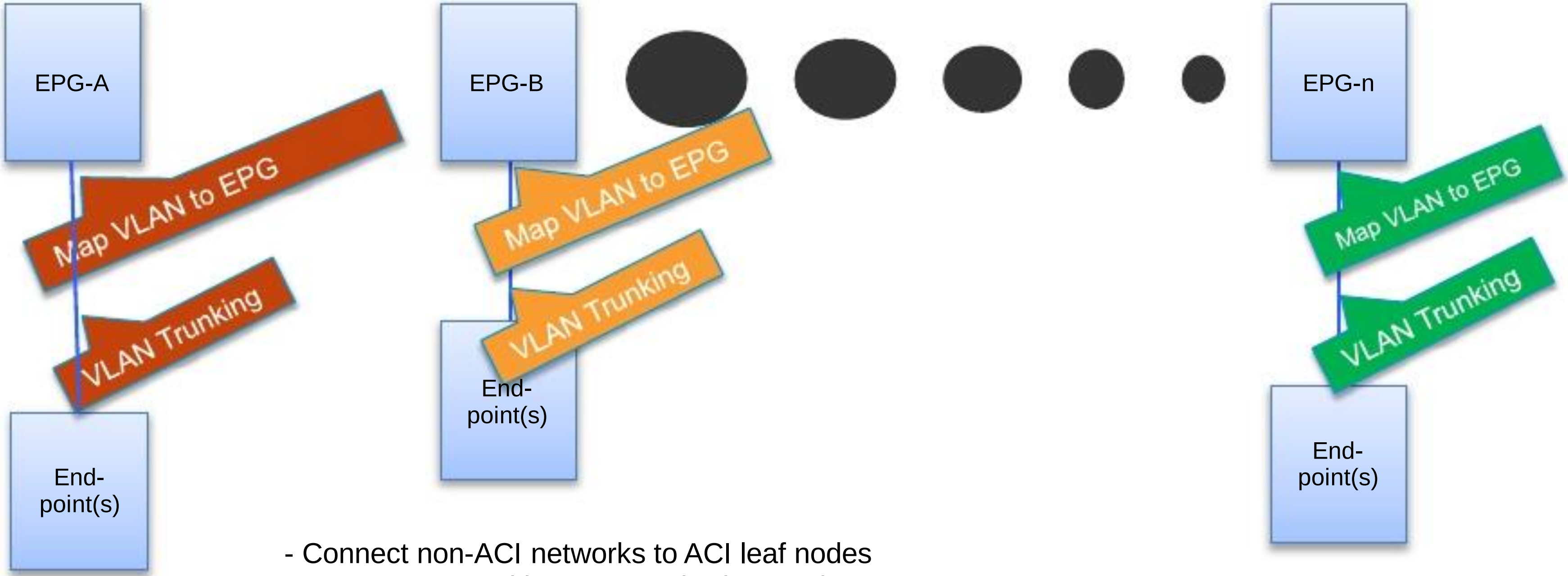


ACI Fabric

Attaching the External WAN/Enterprise to the Fabric

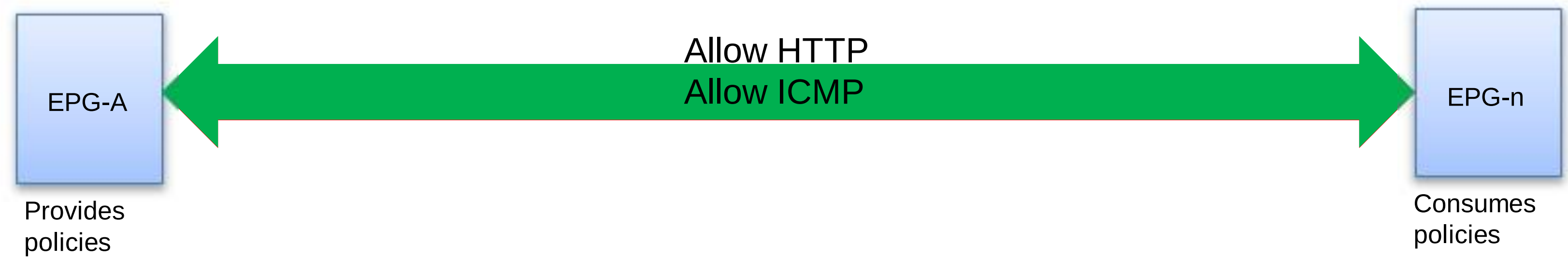


VLAN = EPG



- Connect non-ACI networks to ACI leaf nodes
- Connect at L2 with VLAN trunks (802.1Q)
- Objective: Map VLANs to EPGs, extend policy model to non-ACI networks

ACI Policy Model: EPG To EPG Communication



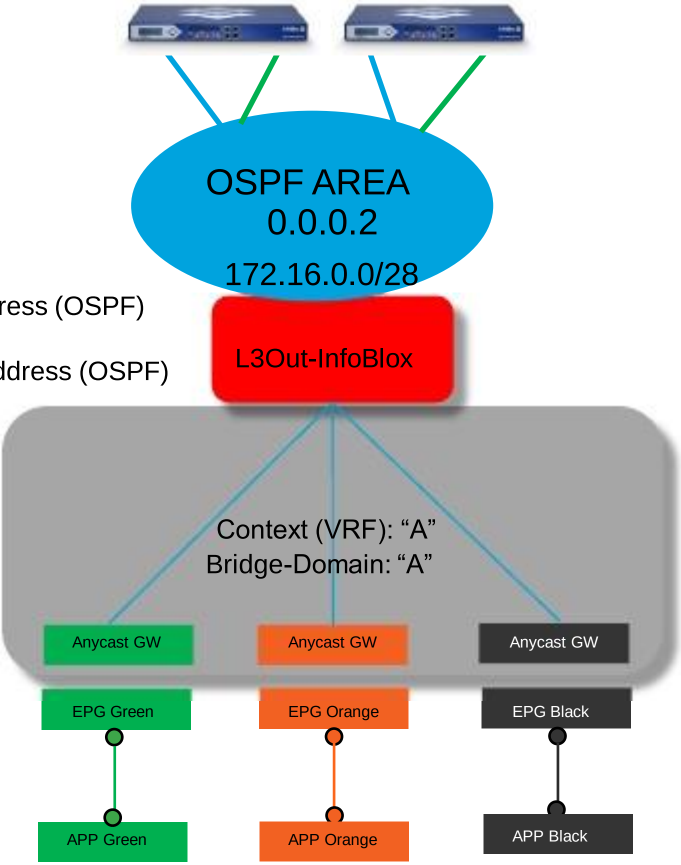
Zero Trust Security Model

- Need to define a Contract (Policy); - A contract is used to specify the interaction between two EPG(s), a provider/consumer pair.
- The goal is to provide a global policy view that focuses on improving automation and scalability.

DNS/DHCP Integration: Infoblox

Infoblox Anycast (DNS/DHCP) L3-Out ACI Deployment

Anycast DNS address 172.16.0.25/32



— LAN1

— HA (VRRP)

- Anycast DNS Address (OSPF)

- Grid Management Address (OSPF)
(Floats btw act/std)

Grid Management 172.16.0.8/32

Access Interface (Untagged)

Leaf advertises default-route to the Infoblox. "External Network Instance Profile advertise 0.0.0.0/0 to Infoblox – like OSPF Stub no-summary.

Infoblox OSPF Priority = 0

OSPF Network Type: Broadcast

HA Active / Standby Anycast Management VIP

Physical: Infoblox1 LAN1/HA connects to Leaf1. Infoblox2 LAN1/HA connects to Leaf2. (2 OSPF peers)

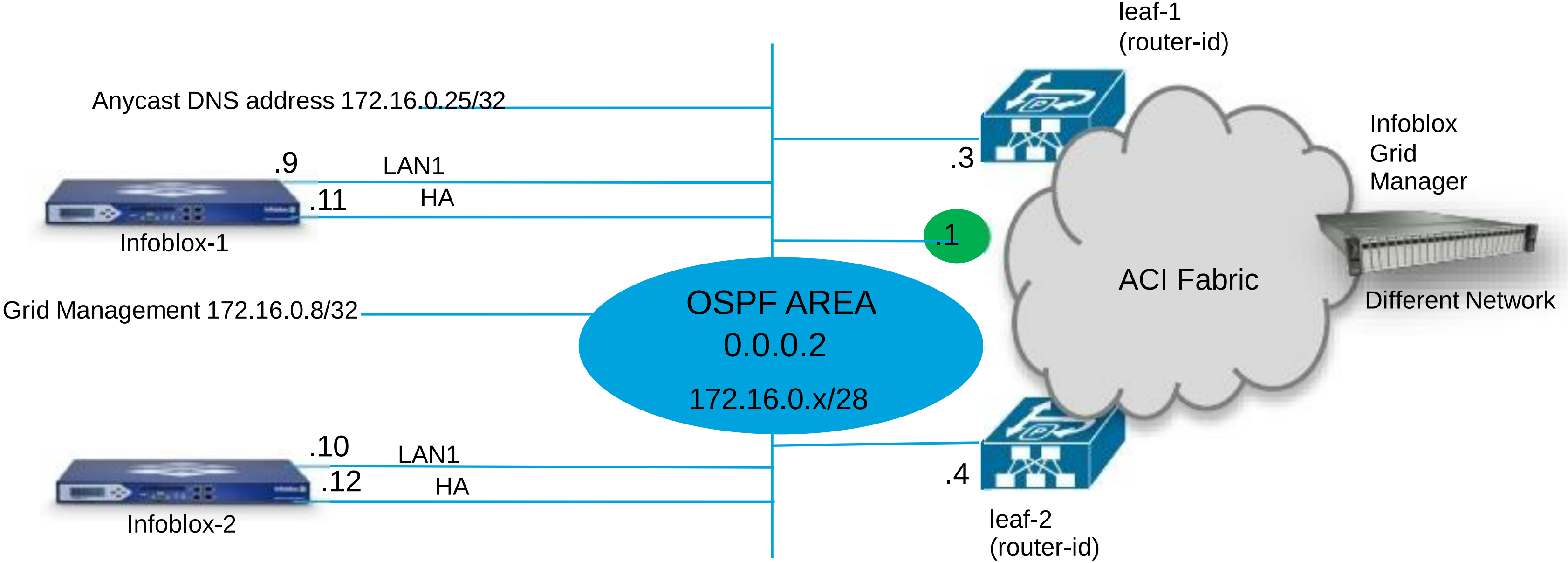
LAN and HA interfaces all have to be in the same EPG/BD/Subnet.

Passive nodes listen to VRRP advertisements on the HA port while Active nodes listen on the LAN port.

Peering is on leaf interface, the SVI for the default gateway

Default route leak policy being used as an alternative to a pre-existing default-route. The VRF-Intra, it is being injected via the ASR9000 (OSPF) or configure a static-route via the FW (security

Infoblox Grid Geographical Redundancy



● Floating IP .1 (SVI); this is the default gateway for the Infoblox Grid management.

L3-Outside Configuration: OSPF

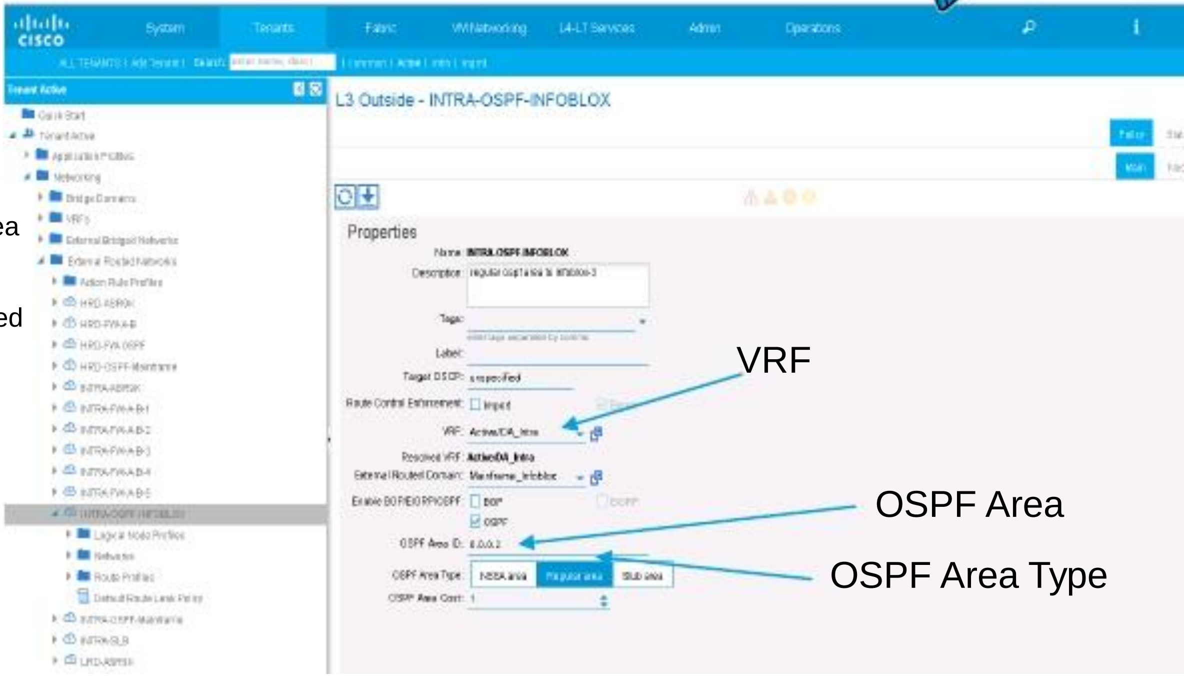
1) Configure L3Out for OSPF

2) Select Context / VRF

3) Define OSPF Area, in this case OSPF Area 0.0.0.2

4) Define OSPF Area type, in this case regular OSPF Area

5) The external routed domain, policy for managing the physical infrastructure, such as ports/VLANS, that can be used by an L3 routed outside network.



L3 Outside - INTRA-OSPF-INFOBLOX

Properties

Name: INTRA-OSPF-INFOBLOX

Description: regular ospf area to infoblox-3

Tags:

Label:

Target DSCP: unspecified

Route Control Enforcement: □ Import

VRF: Active/DA_Intra

Resolved VRF: ActiveDA_Intra

External Routed Domain: Mainframe_Infoblox

Enable BGP/EIGRP/OSPF: □ BGP ☑ OSPF □ EIGRP

OSPF Area ID: 0.0.0.2

OSPF Area Type: NSSA area [✓ Regular area] Stub area

OSPF Area Cost: 1

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Mainframe OSPF Integration

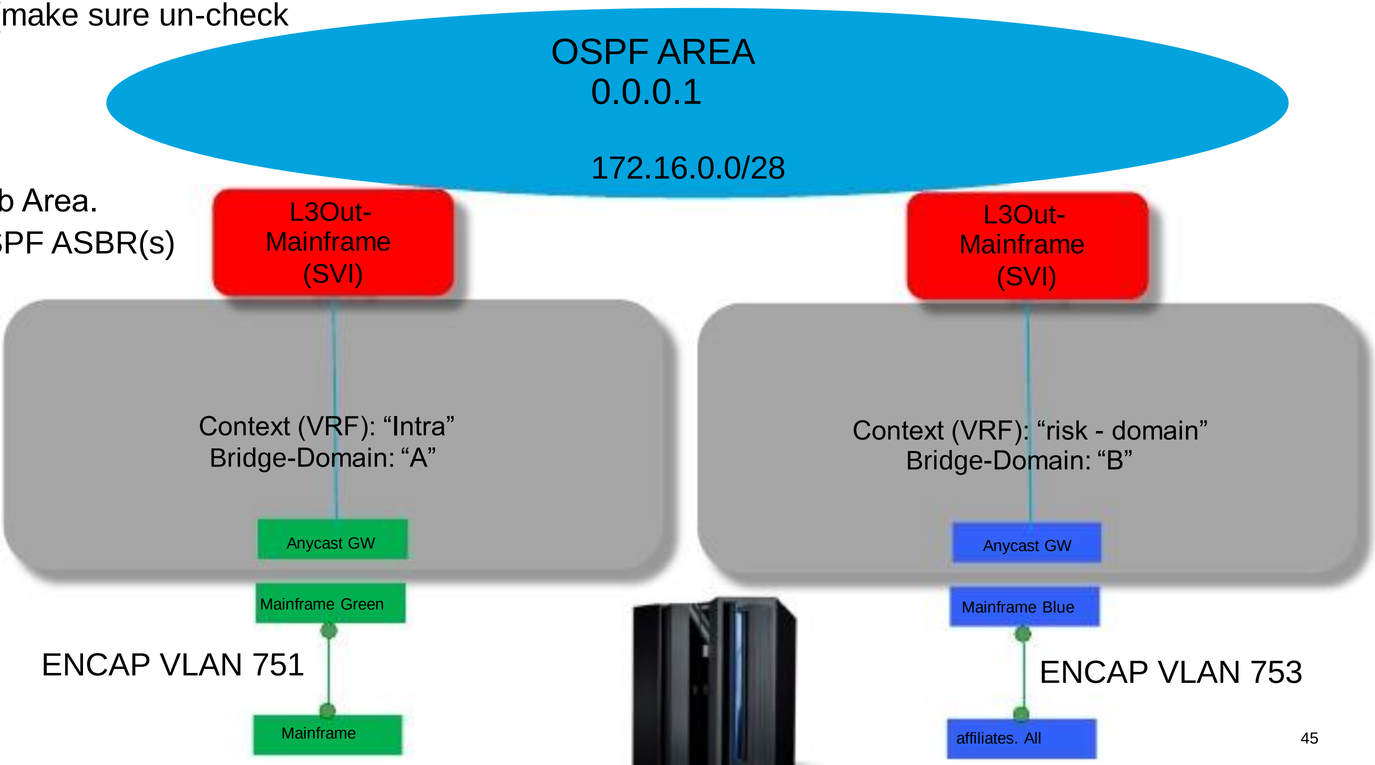
Mainframe: L3-Out ACI Deployment

Mainframe L3-out is a regular OSPF Area.

Defined external network instance for Export Route Control Subnet for 0.0.0.0/0 (make sure un-check "Aggregate Export“)

Trying to “treat” as OSPF Stub Area.

Type 5 LSA(s); leaf(s) are OSPF ASBR(s)



OSPF AREA
0.0.0.1

172.16.0.0/28

L3Out-Mainframe (SVI)

L3Out-Mainframe (SVI)

Context (VRF): “Intra”
Bridge-Domain: “A”

Context (VRF): “risk - domain”
Bridge-Domain: “B”

Anycast GW

Anycast GW

Mainframe Green

Mainframe Blue

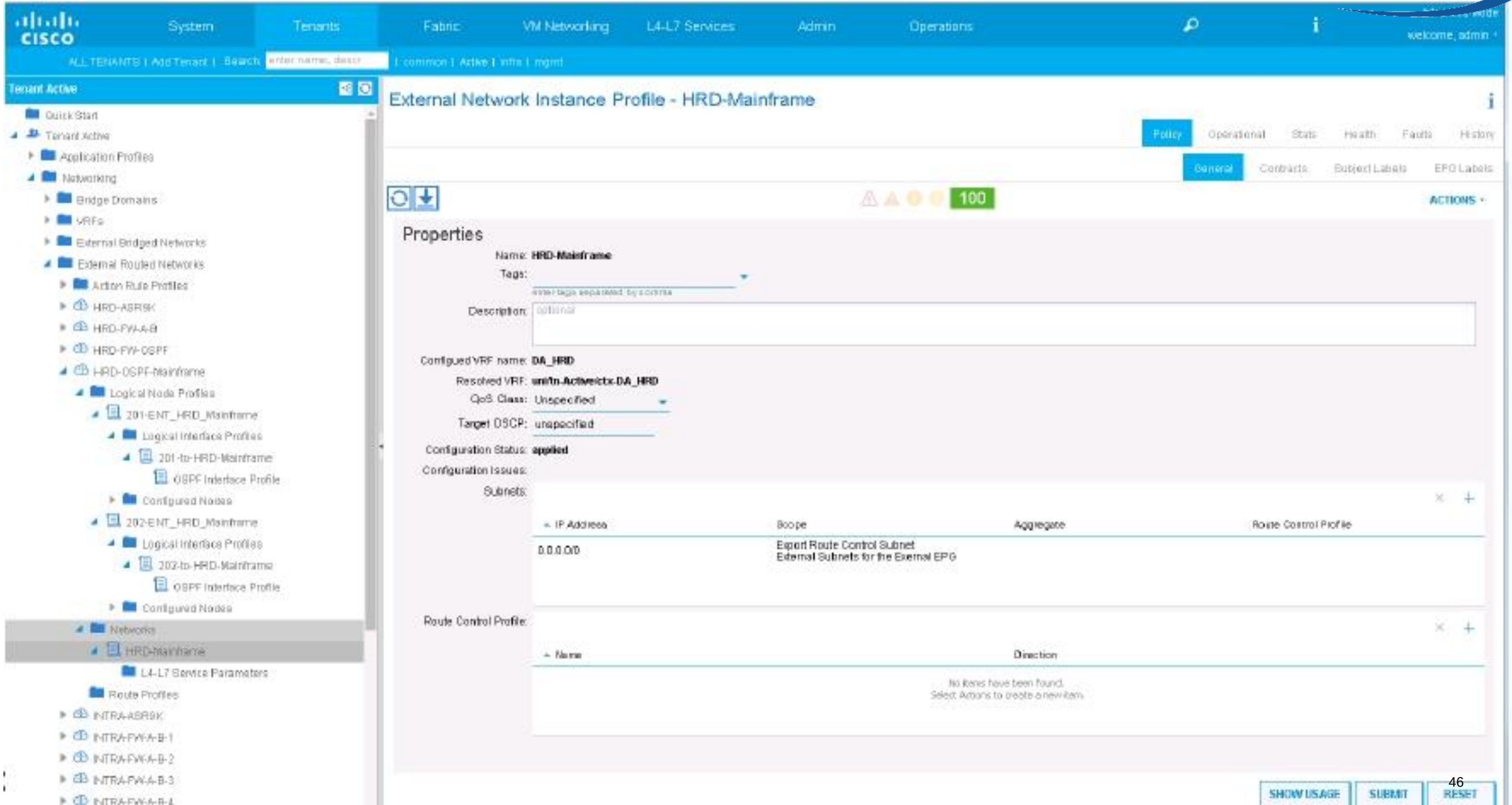
ENCAP VLAN 751

ENCAP VLAN 753

Mainframe

affiliates. All

ACI Configuration: External Networks



- Quick Start
- Tenant Active
  - Application Profiles
  - Networking
    - Bridge Domains
    - VRFs
    - External Bridged Networks
    - External Routed Networks
      - Action Rule Profiles
      - HRD-ASR9K
      - HRD-FW-A-B
      - HRD-FW-OSPF
      - HRD-OSPF-Mainframe
        - Logical Node Profiles
          - 201-ENT_HRD_Mainframe
            - Logical Interface Profiles
              - 201-to-HRD-Mainframe
                - OSPF Interface Profile
            - Configured Nodes
          - 202-ENT_HRD_Mainframe
            - Logical Interface Profiles
              - 202-to-HRD-Mainframe
                - OSPF Interface Profile
            - Configured Nodes
        - Networks
          - HRD-Mainframe
            - L4-L7 Service Parameters
        - Route Profiles
      - INTRA-ASR9K
      - INTRA-FW-A-B-1
      - INTRA-FW-A-B-2
      - INTRA-FW-A-B-3
      - INTRA-FW-A-B-4

External Network Instance Profile - HRD-Mainframe

Properties

Name: **HRD-Mainframe**

Tags: enter tags separated by comma

Description: optional

Configured VRF name: **DA_HRD**

Resolved VRF: **uni/tn-Active/ctx-DA_HRD**

QoS Class: Unspecified

Target DSCP: unspecified

Configuration Status: **applied**

Configuration Issues:

Subnets:

IP Address	Scope	Aggregate	Route Control Profile
0.0.0.0/0	Export Route Control Subnet External Subnets for the External EPG		

Route Control Profile:

Name	Direction

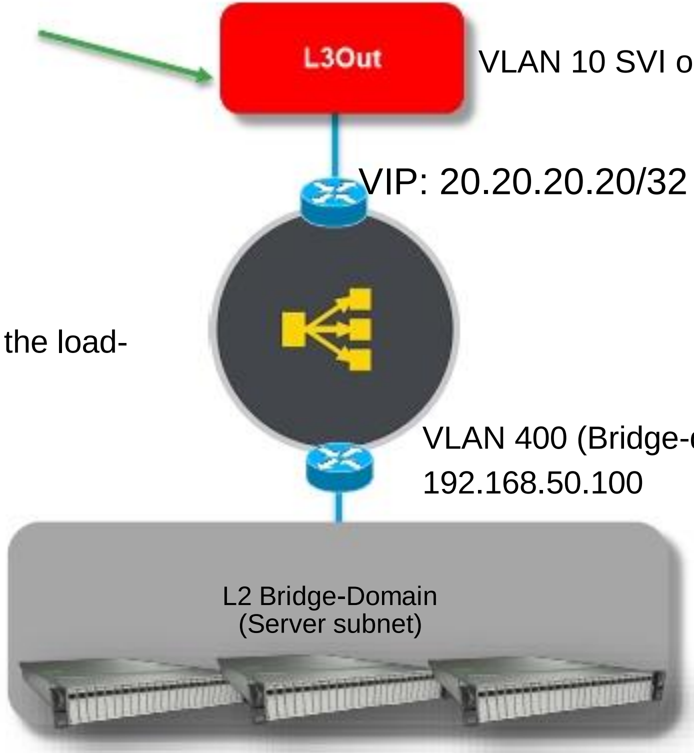
No items have been found.
Select Actions to create a new item.

Load-balancers Integration: Citrix/F5

Citrix 2-arm Load-balancer: Static-Bindings

Static route for LB servers pointing to VIP

External-arm (VLAN) for the VIP / Client



VLAN 10 SVI on L3out

VIP: 20.20.20.20/32

VLAN 400 (Bridge-domain same for Servers)
192.168.50.100

1) External-arm: VIP / Client
2) Internal-arm: server default-gateway is on the load-balancer.

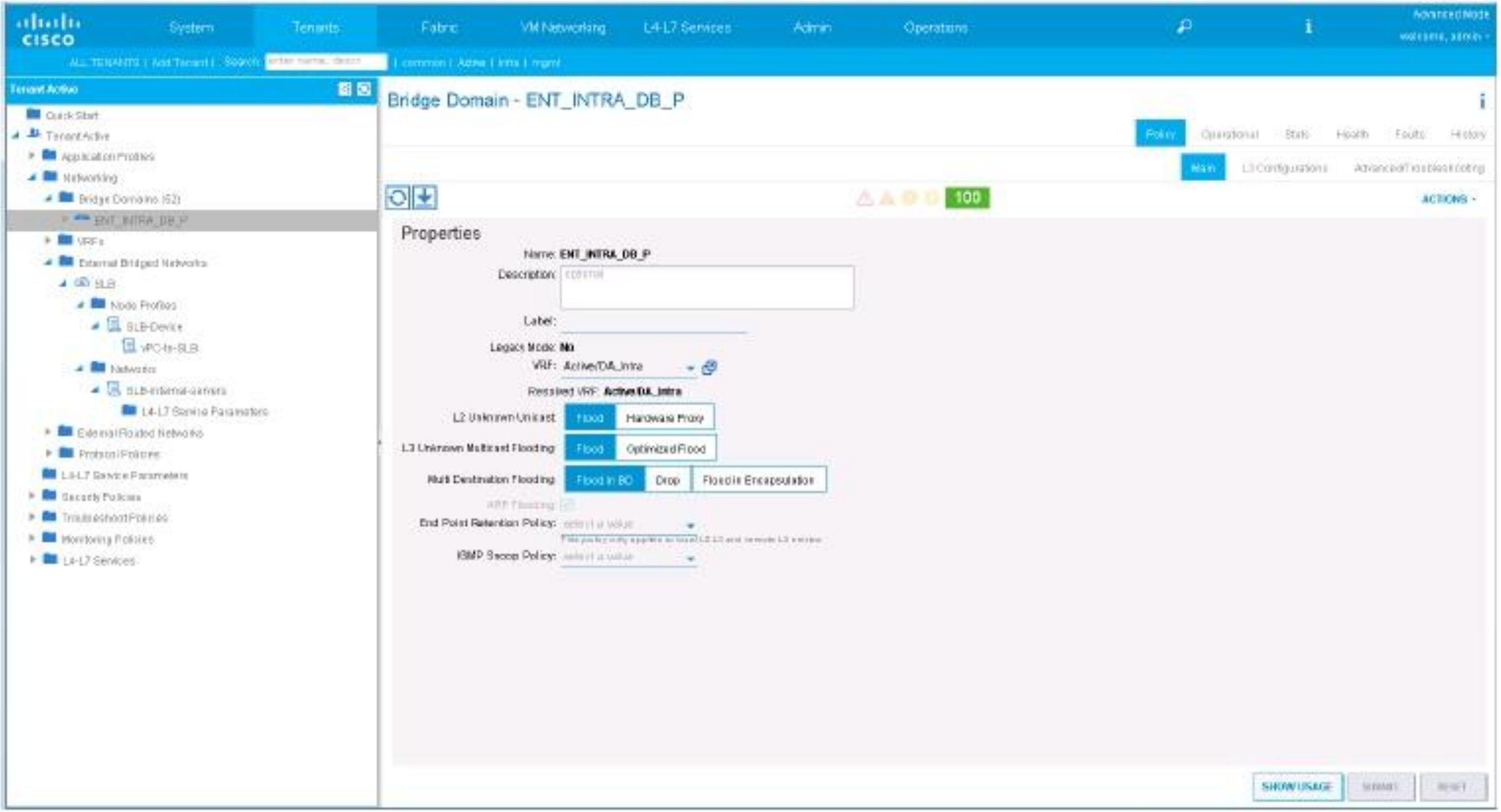
Server(s) default-gateway

L3Out Static route to Servers

Internal-arm (VLAN) is the Server default-gateway on the load-balancer

ACI: Configuring the Server-side bridge-domain

Enabled Flooding (ARP) as this L2 Only



Bridge Domain - ENT_INTRA_DB_P

Properties

Name: ENT_INTRA_DB_P

Description: optional

Label:

Legacy Mode: No

VRF: Active/DA_Intra

Resolved VRF: Active/DA_Intra

L2 Unknown Unicast: [✓ Flood] Hardware Proxy

L3 Unknown Multicast Flooding: [✓ Flood] Optimized Flood

Multi Destination Flooding: [✓ Flood in BD] Drop Flood in Encapsulation

ARP Flooding: ☑

End Point Retention Policy: select a value

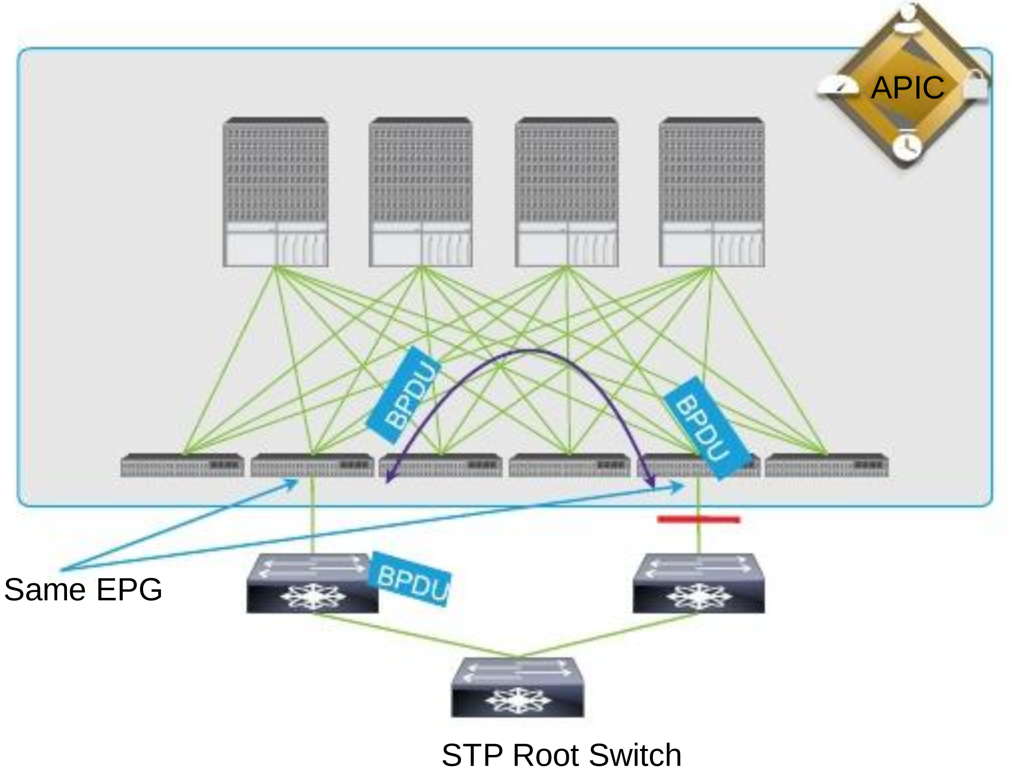
This policy only applies to local L2 L3 and remote L3 entries

IGMP Snoop Policy: select a value

External Connectivity

ACI Interaction with STP

- No STP running within ACI fabric
- BPDU frames are flooded within EPG. No Configuration required
- External switches break any potential loop upon receiving the flooded BPDU frame fabric
- BPDU filter and BPDU guard can be enabled with interface policy

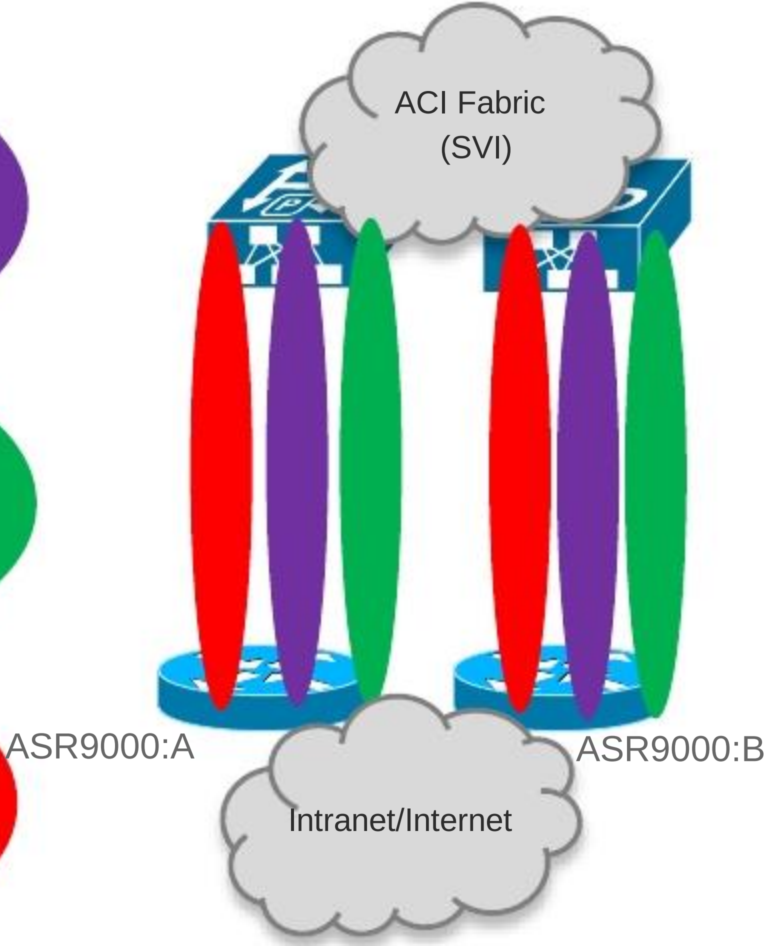


ASR9000 External L3out OSPF via SVI and vPC

VRF: risk-domain
VLAN 902
172.18.159.64/29
OSPF Area 0

VRF: Intra
VLAN 900
172.18.0.64/29
OSPF Area 0

VRF: risk-domain
VLAN 904
172.18.181.0/29
OSPF Area 0



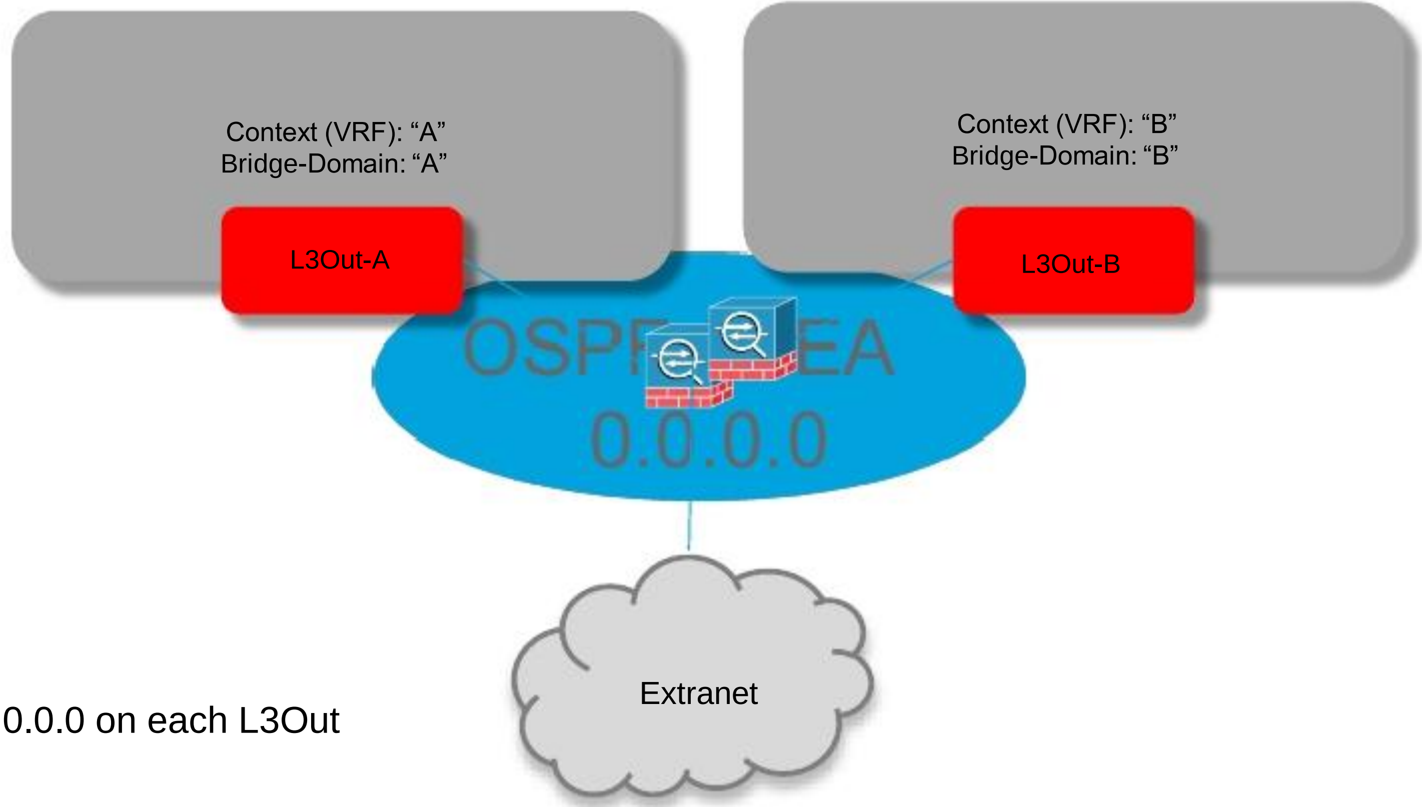
VRF: risk-domain
VLAN 903
172.18.159.72/29
OSPF Area 0

VRF: Intra
VLAN 901
172.18.0.72/29
OSPF Area 0

VRF: risk-domain
VLAN 905
172.18.181.8/29
OSPF Area 0

Firewall Integration :
ASA / Checkpoint

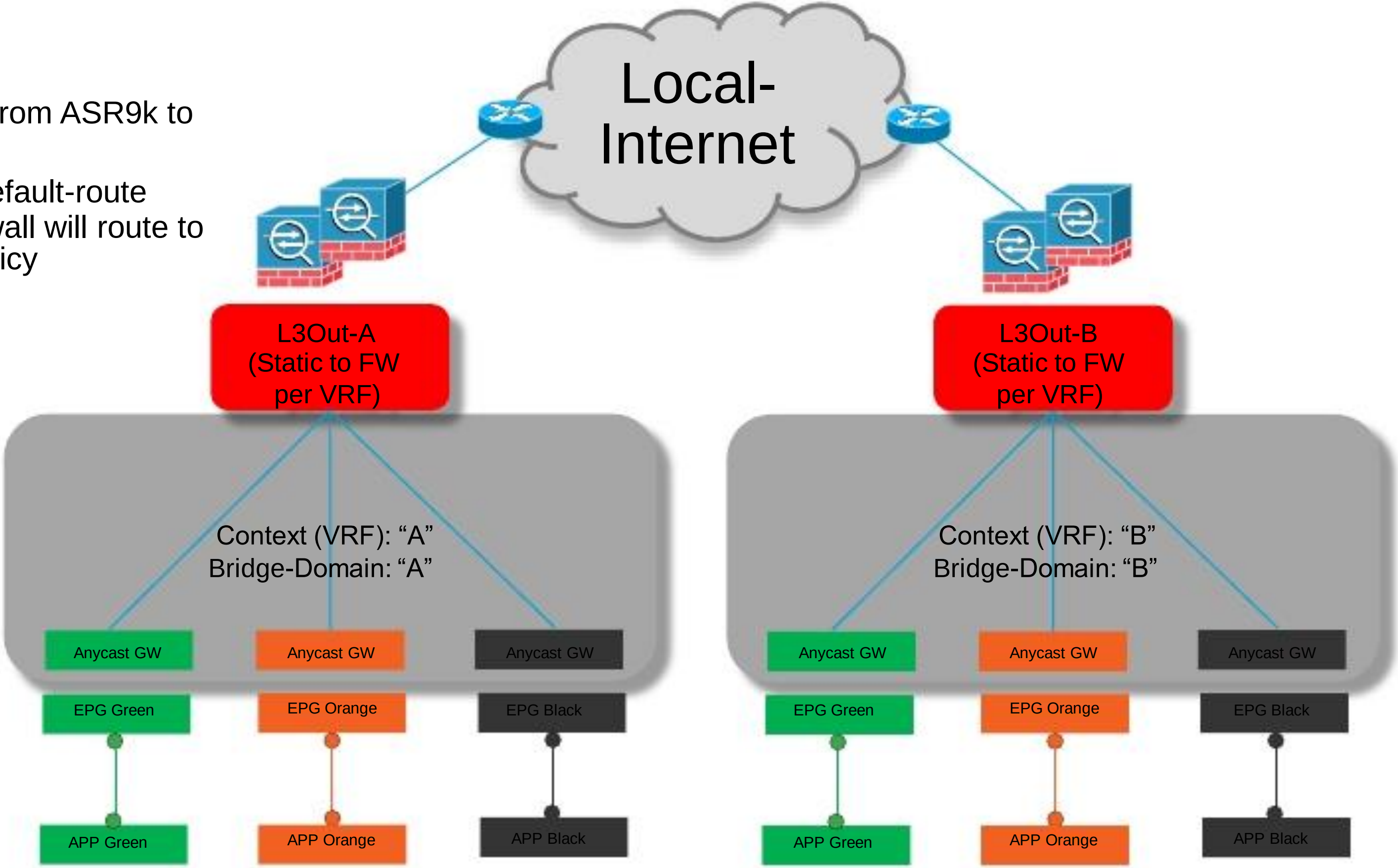
Extranet: Routing Between Contexts



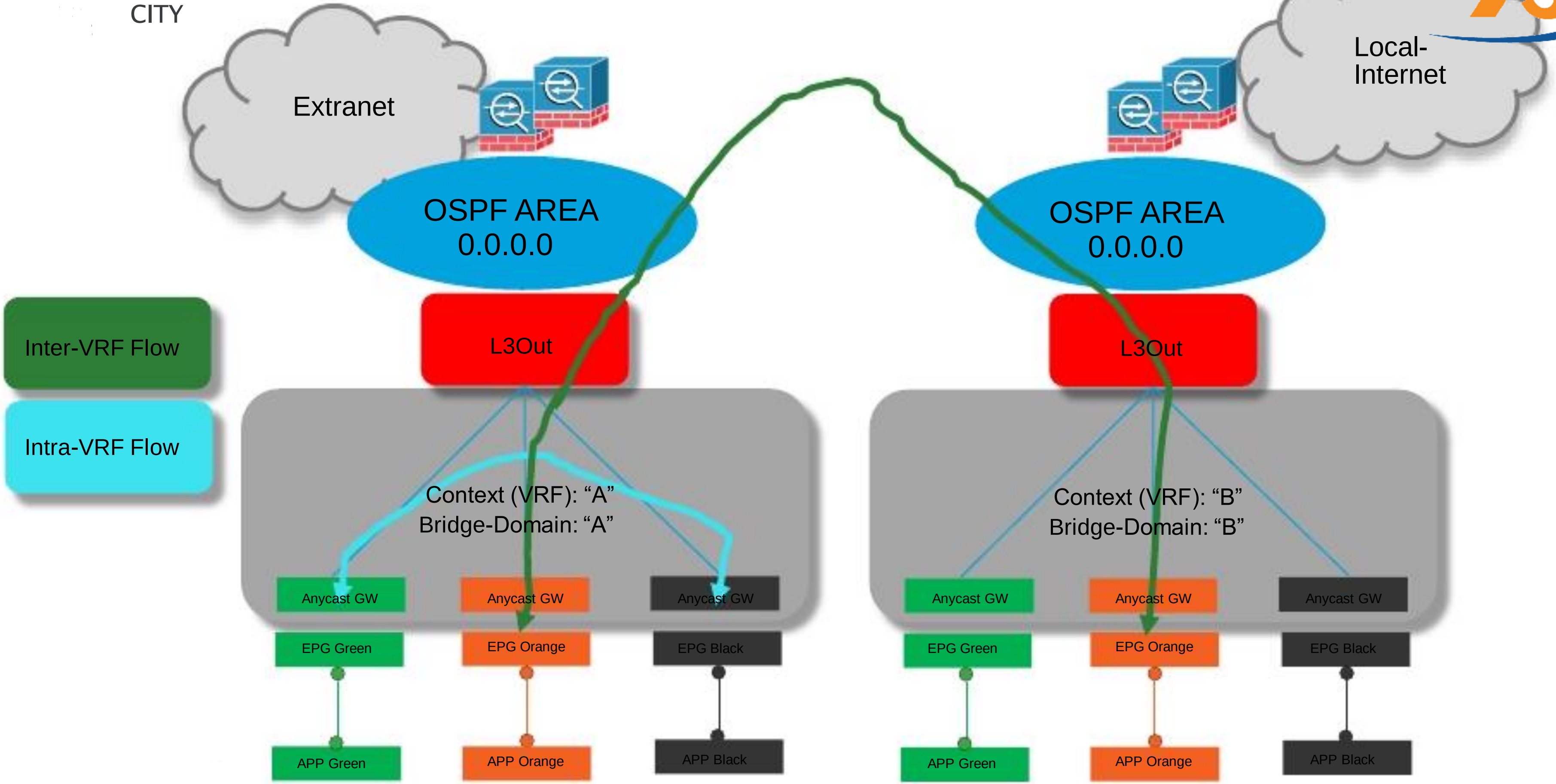
L3Out OSPF Area 0.0.0.0 on each L3Out

Local-Internet: Logical view

1) Intra-VRF default routes from ASR9k to Fabric to Internet Only
2) Other VRF(s) will have default-route point to Firewall and Firewall will route to Intranet; based on FW policy

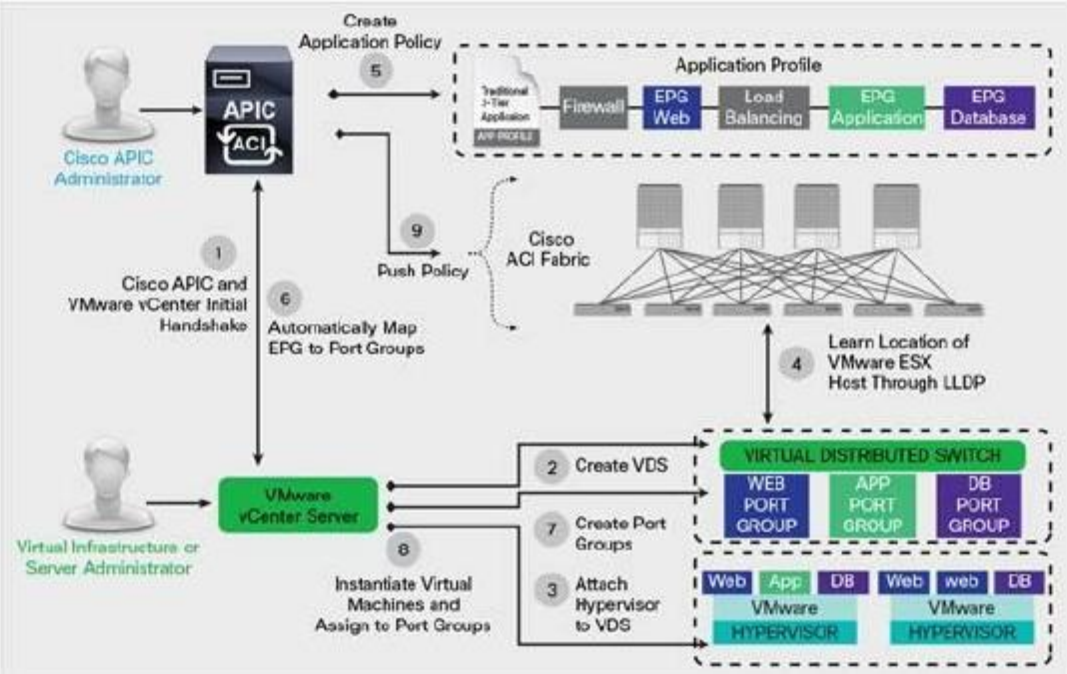


Intra-VRF and Intera-VRF Traffic Flows



ACI and VMM vCenter Integration

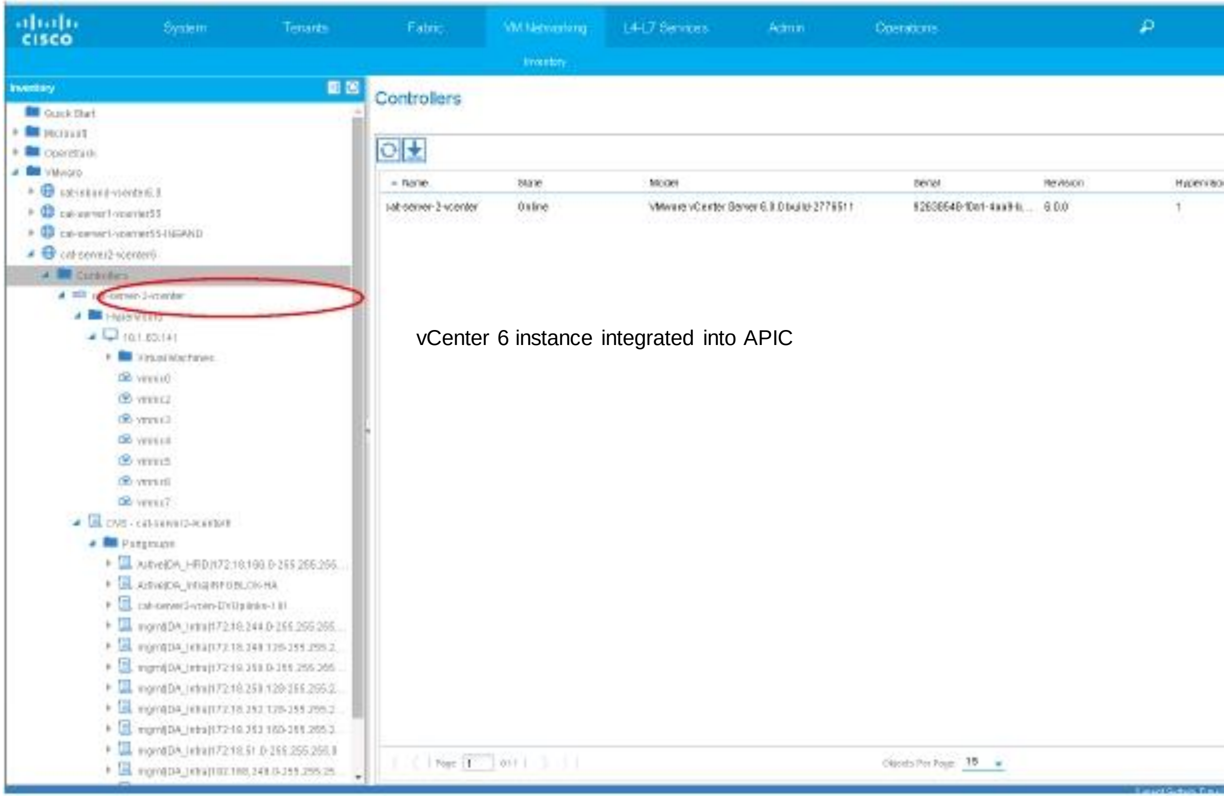
- Cisco APIC integrates with the VMware vCenter.
- Ability to transparently extend the Cisco ACI policy framework to VMware vSphere workloads.
- APIC uses Application Network Profiles (ANPs) to represent the Cisco ACI policy.
- APIC creates a virtual distributed switch (VDS) in VMware vCenter for virtual networking.
- APIC manages all application infrastructure components. The network administrator creates EPGs and pushes them to VMware vCenter as port groups on the DVS.
- Server administrators can then associate the virtual machines and provision them accordingly.



ACI and VMM vCenter Integration

- Show configured VMware VMM vCenter

- Focusing on vCenter 6 instances



Controllers

Name	State	Model	Serial	Revision	Hypervisor
cat-server-2-vcenter	Online	VMware vCenter Server 6.0.0 build-2776511	82636548-f0a1-4aa8-b...	6.0.0	1

vCenter 6 instance integrated into APIC

UCS Director workflows

- Provision new server
- Decommission server
- ACI - Create Context
- ACI - Create Bridge Domain
- ACI - Create EPG
- ACI - Create Application Profile
- ACI - Create Contract
- ACI - Assign EPG to PortChannel/Alias
- ACI - Unassign EPG from PortChannel/Alias
- ACI Combined Provisioning Workflow
- ACI Combined De-provisioning Workflow
- Create a data LUN (array based on 'class') for presentation via VPLEX
- Expand LUN and volume
- Remove LUN and volume
- Present virtual volume to a host
- Present virtual volume to a RP cluster

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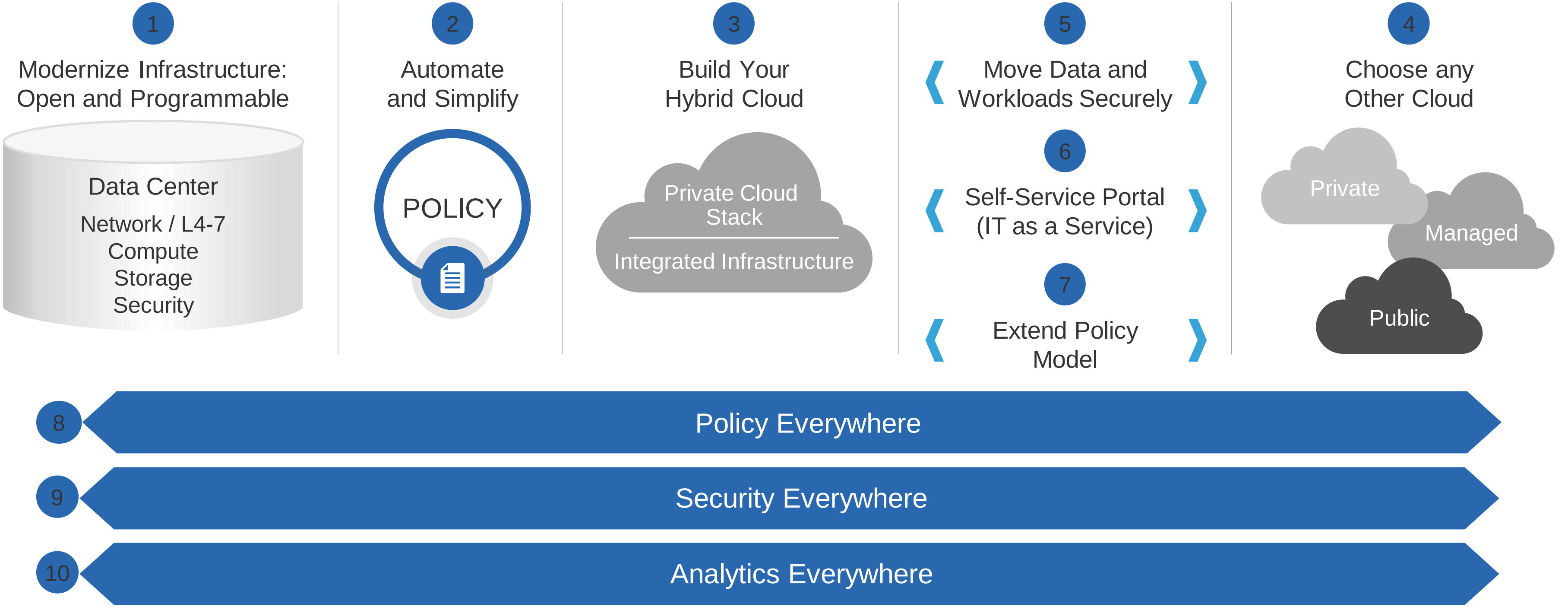
Driving Innovation

The Path to Agility in an App-Centric World

Policy-Driven Integrated Infrastructure Answers Customers’ Request



1 Modernize Infrastructure: Open and Programmable

Data Center

Network / L4-7
Compute
Storage
Security

2 Automate and Simplify

POLICY

3 Build Your Hybrid Cloud

Private Cloud Stack

Integrated Infrastructure

5 Move Data and Workloads Securely

6 Self-Service Portal (IT as a Service)

7 Extend Policy Model

4 Choose any Other Cloud

Private

Managed

Public

8 Policy Everywhere

9 Security Everywhere

10 Analytics Everywhere

Policy Driven Automation for a Cloud Model

ACI Solves

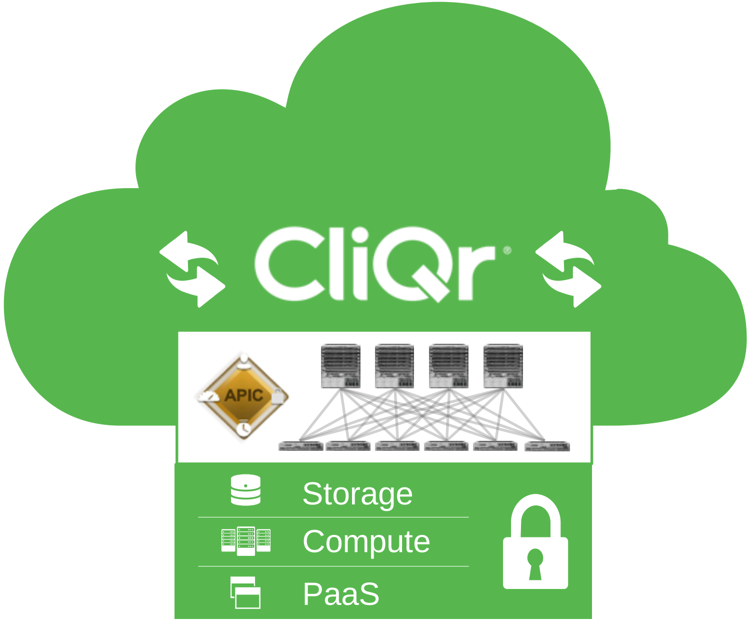
Foundational Challenges

Simplification ✓
Drive Agility & Automation

Optimize Operations > TCO ✓
Open & Programmable

Security to Meet Compliance ✓
Segment with Multi-tenancy

Elastic Model ✓
Develop Hybrid Cloud Model



Enhancing Bi-Modal IT with ACI and UCS

Tenant 1 = Mode 1

Manufacturing

IT Department

Recently Acquired Company

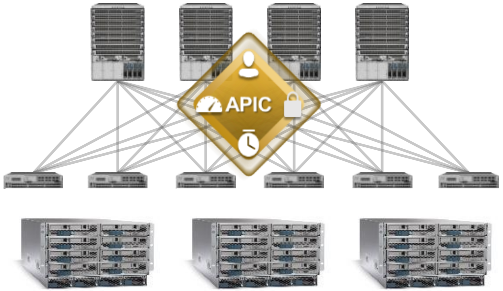
Marketing Department

Tenant 2 = Mode 2

Pivotal

openstack
CLOUD SOFTWARE

apprenda



Common Infrastructure, and Management With Secure, Stable Separation

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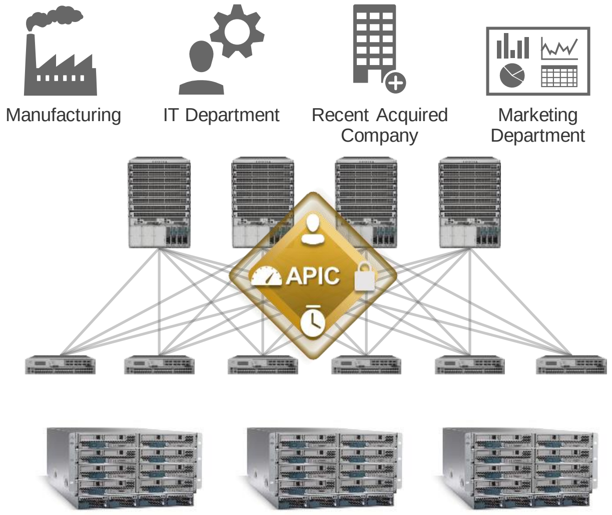
Enhancing Bi-Modal IT with ACI and CliQr

3S

ACI, UCS, UCSD = Mode 1

CliQr

Public Cloud = Mode 2



Manufacturing

IT Department

Recent Acquired Company

Marketing Department

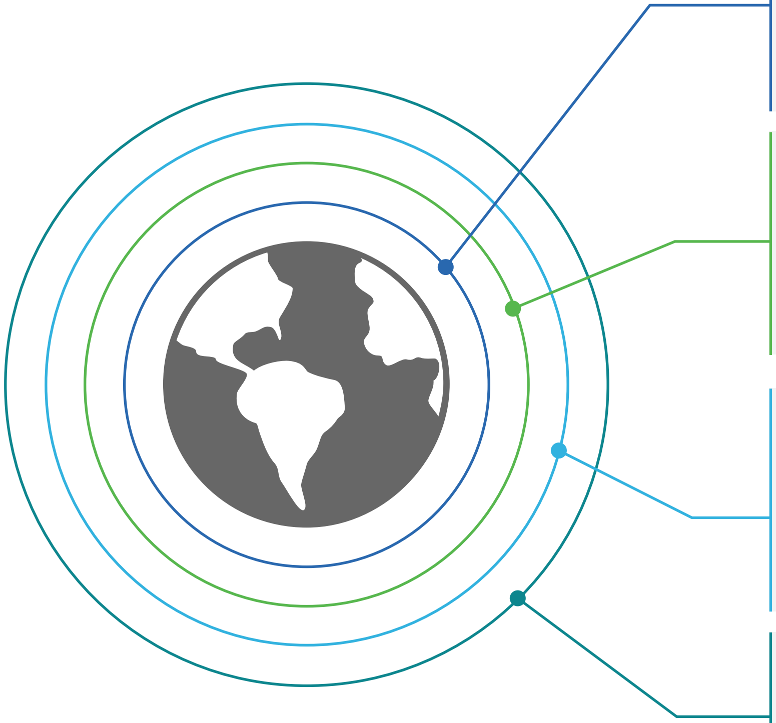
amazon web services™

Microsoft Azure

SOFTLAYER® an IBM Company

Google Cloud Platform

Stability With on Premises Model 1. Agility with Public Model 2.



SW Overlay Apps

cisco
PLUMgrid
midokura
vmware NSX
nuagenetworks

Hypervisor and/or Container

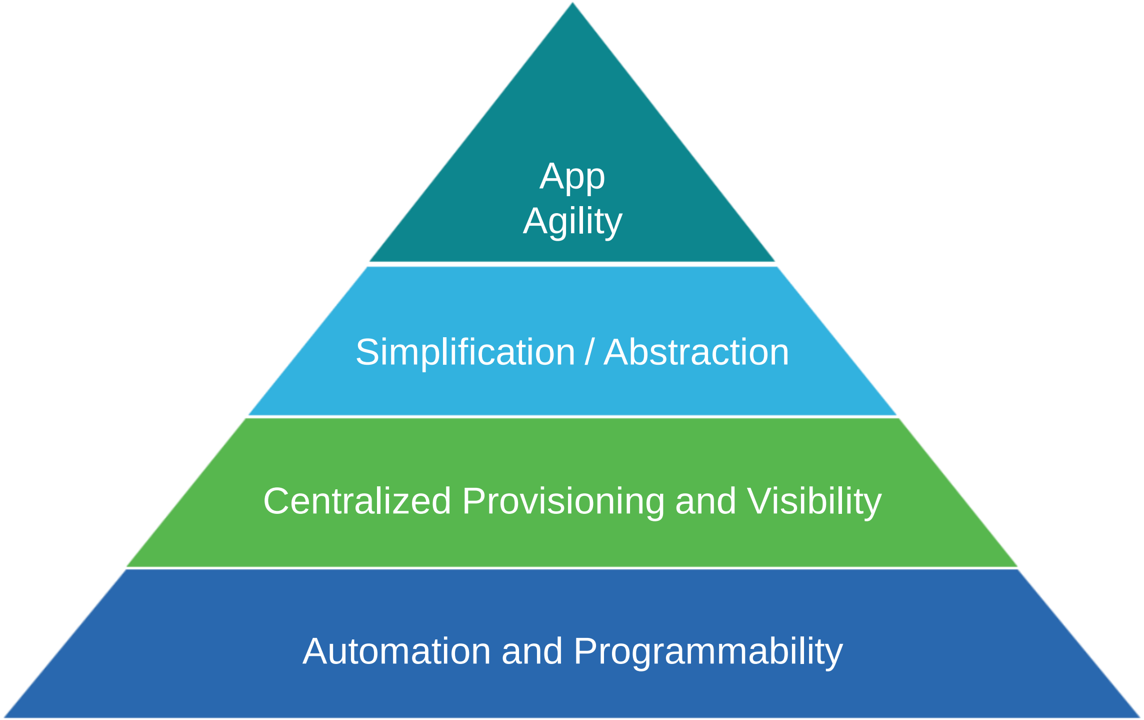
Microsoft
vmware
docker
redhat.

Bare Metal

SAP BusinessObjects
Microsoft Exchange
ORACLE
hadoop

Orchestration/Automation

cisco
openstack
CliQr

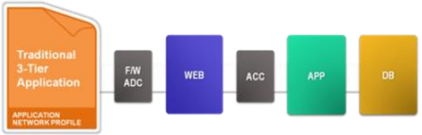


App Agility

Simplification / Abstraction

Centralized Provisioning and Visibility

Automation and Programmability



Different Teams
Different Languages

Application Language

Security – SLA – Dependency – Performance – Compliance – Tenants – Geo-dependency

Network Language

VLAN – IP Addressing – Subnet – Firewalls – QoS – ACL – Load Balancer

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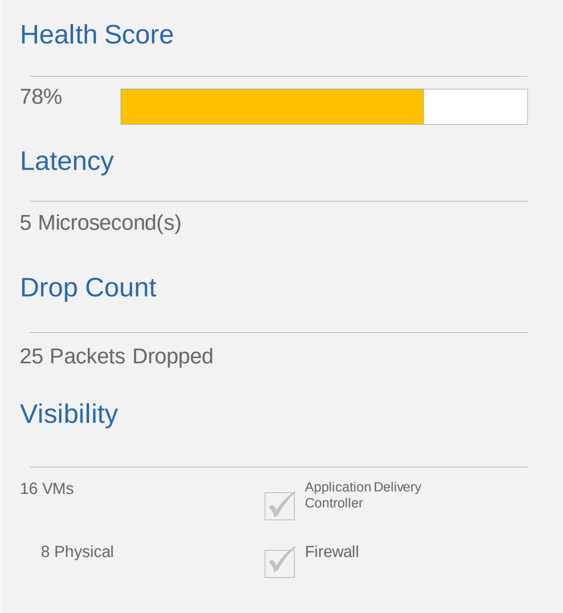
Our Vision for ACI:
Scale, Security and Full Visibility

Tenant



Health Score

78%

Latency

5 Microsecond(s)

Drop Count

25 Packets Dropped

Visibility

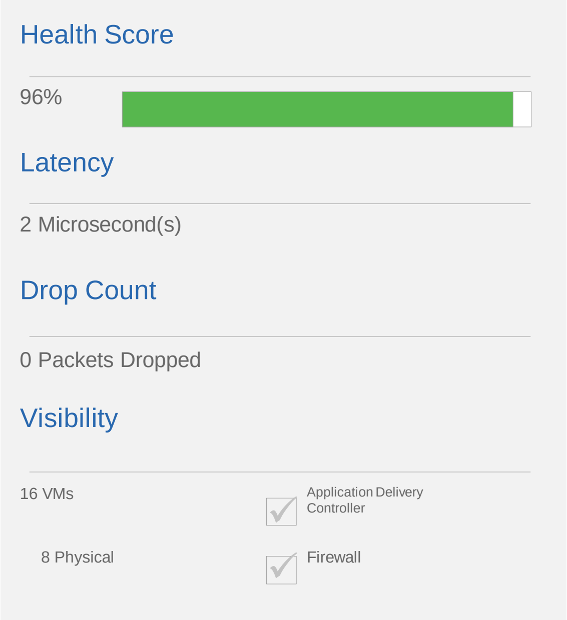
16 VMs

8 Physical

☑ Application Delivery Controller

☑ Firewall

Application



Health Score

96%

Latency

2 Microsecond(s)

Drop Count

0 Packets Dropped

Visibility

16 VMs

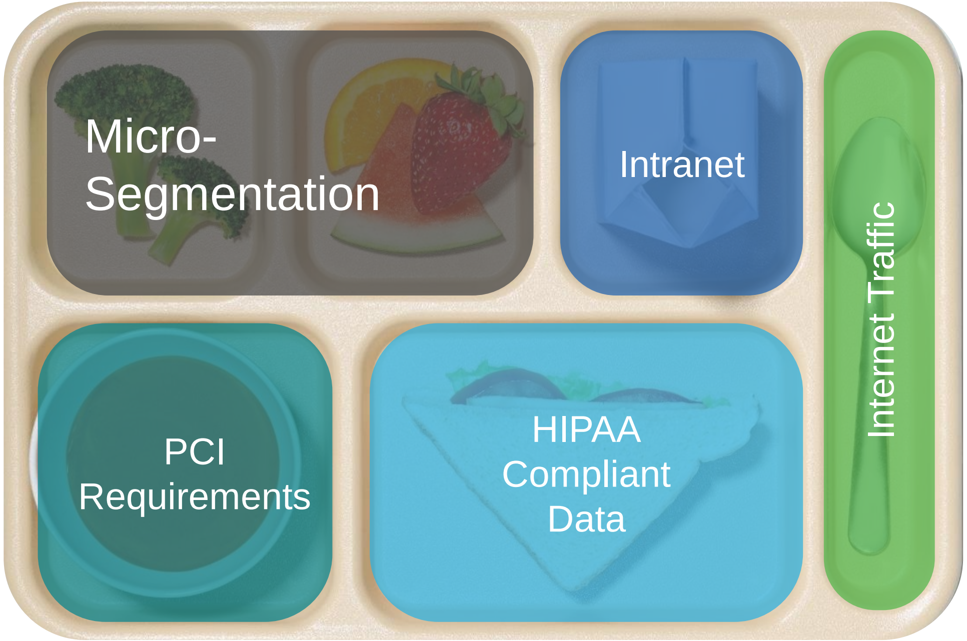
8 Physical

☑ Application Delivery Controller

☑ Firewall

Enabled By Physical and Virtual Integration

Implement Granular Security Groups



ACI Security

With Focus on Simplification, Multi-Tenancy and Scalability

Integrated in ACI

Policy–Physical and Multi-Cloud

Automated Audit, Detect, Mitigate

Stateless Firewall and Micro Segmentation*

* State-full with Cisco AVS

Investment Protection

Symantec.
FORTINET
radware
intel Security
Check Point SOFTWARE TECHNOLOGIES LTD.
SOURCEfire
A10 Networks
cisco
CiTRIX
Infoblox CONTROL YOUR NETWORK
AVI Networks
f5

Validated for Deployment in PCI Compliant Networks

ACI Visibility

Across Physical, Virtual and Containers

Integrated Overlay/Underlay

Centralized Management and Open APIs

TENNANT APPS

Health Scores

Hybrid Cloud Orchestration

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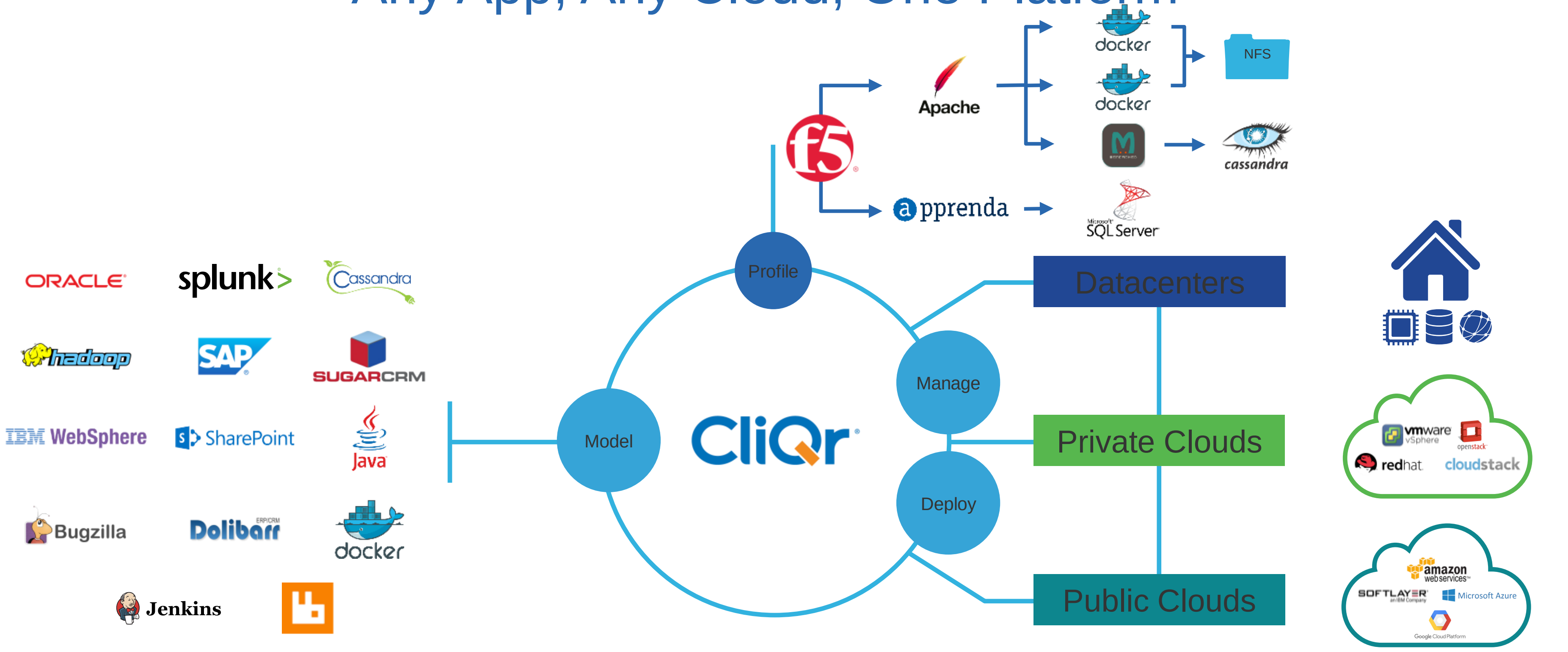
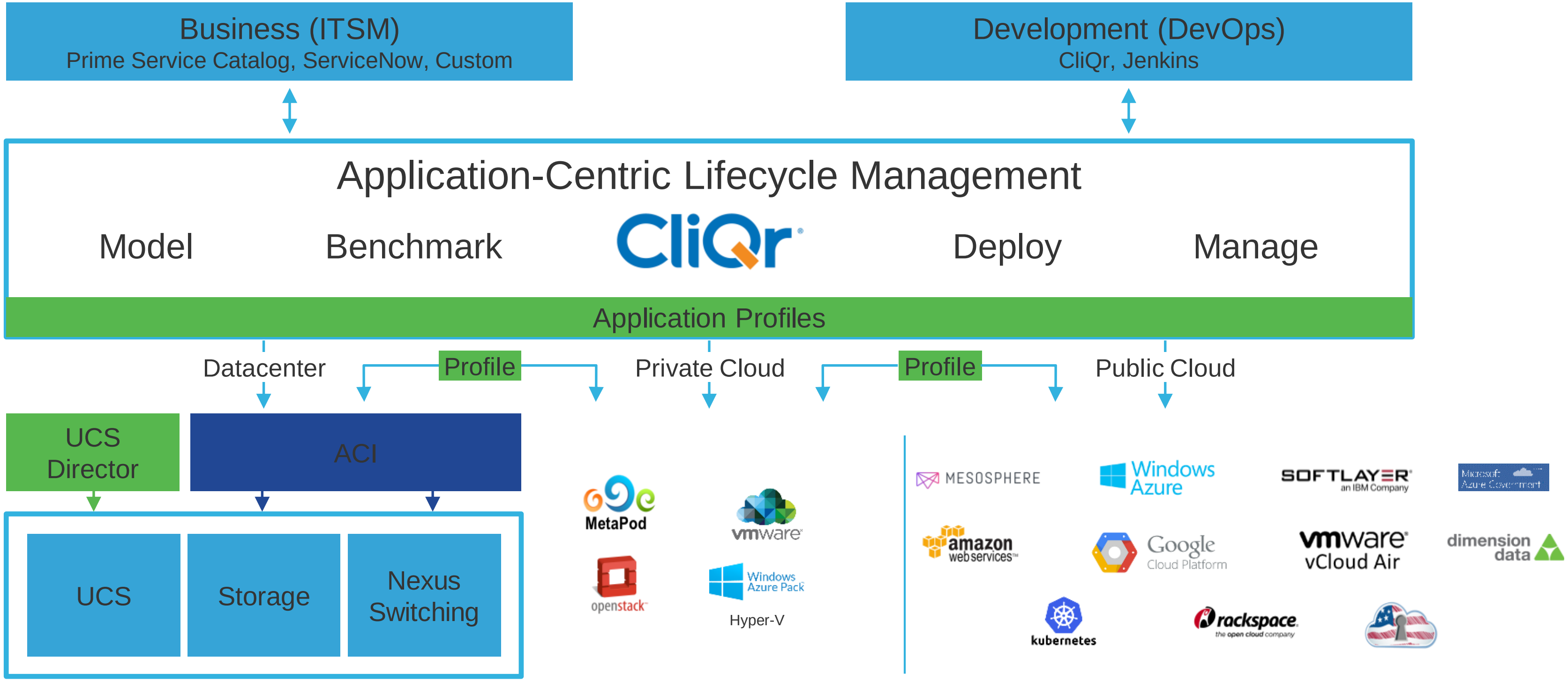
CliQr CloudCenter

Any App, Any Cloud, One Platform



Working Together
End-to-End Orchestration



Business (ITSM)
Prime Service Catalog, ServiceNow, Custom

Development (DevOps)
CliQr, Jenkins

Application-Centric Lifecycle Management

Model Benchmark CliQr Deploy Manage

Application Profiles

Datacenter Profile Private Cloud Profile Public Cloud

UCS Director

ACI

UCS Storage Nexus Switching

Application Driven Datacenter & Cisco Virtual Topology System

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Application Driven Data Center

Today's App

- Scale: Connectivity, Tenancy, Secure Access
- + Integration: APIs, IOT, M2M, Cloud
- + Data: Volume, Streaming & Predictive Analytics
- + Agile: CI/CD, Devops, Scale Out, Containers, Microservices

Traditional Applications

Monolithic Model

Multi-tier Apps

→ Scale & Modularity →

Cloud-native applications

Business Agility with cloud model

Micro-services / Bi-Modal IT / DevOps

Focus on Products

Disjoint approaches to solve technical demands. Cohesiveness as "after thought"

→ Integration →

Focus on Integrated Solutions

Data Center is the foundation for business agility. Delivered as a solution and / or as a service

Manual Interaction

IT Silos based approach

Configuration driven

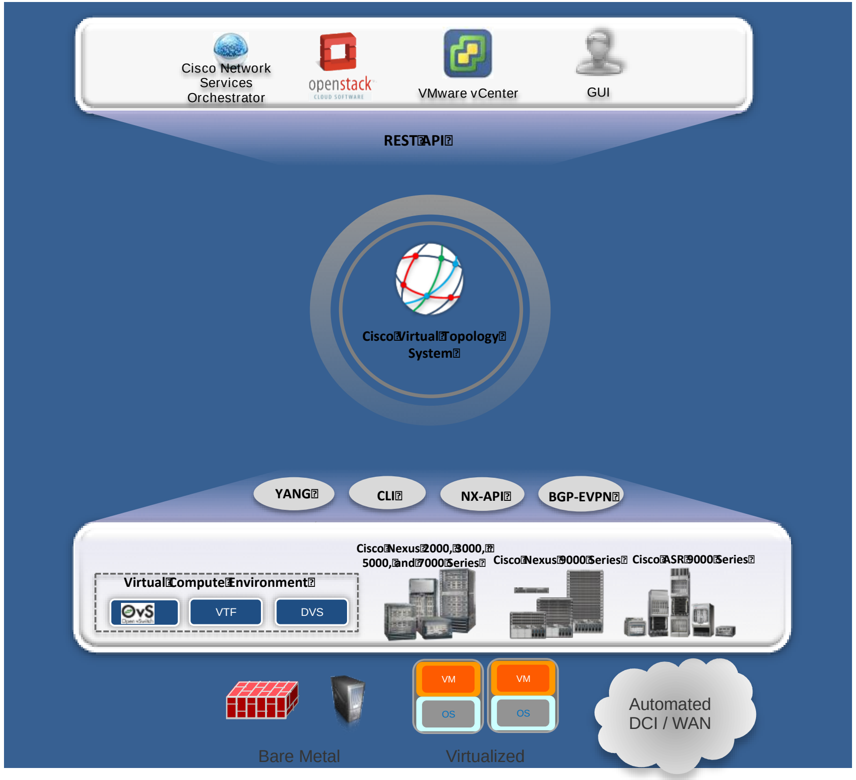
→ Automation →

Policy Driven Automation

Enterprise-wide policy, hyper-convergence and cross-domain automation. Consumption driven with analytics and programmability

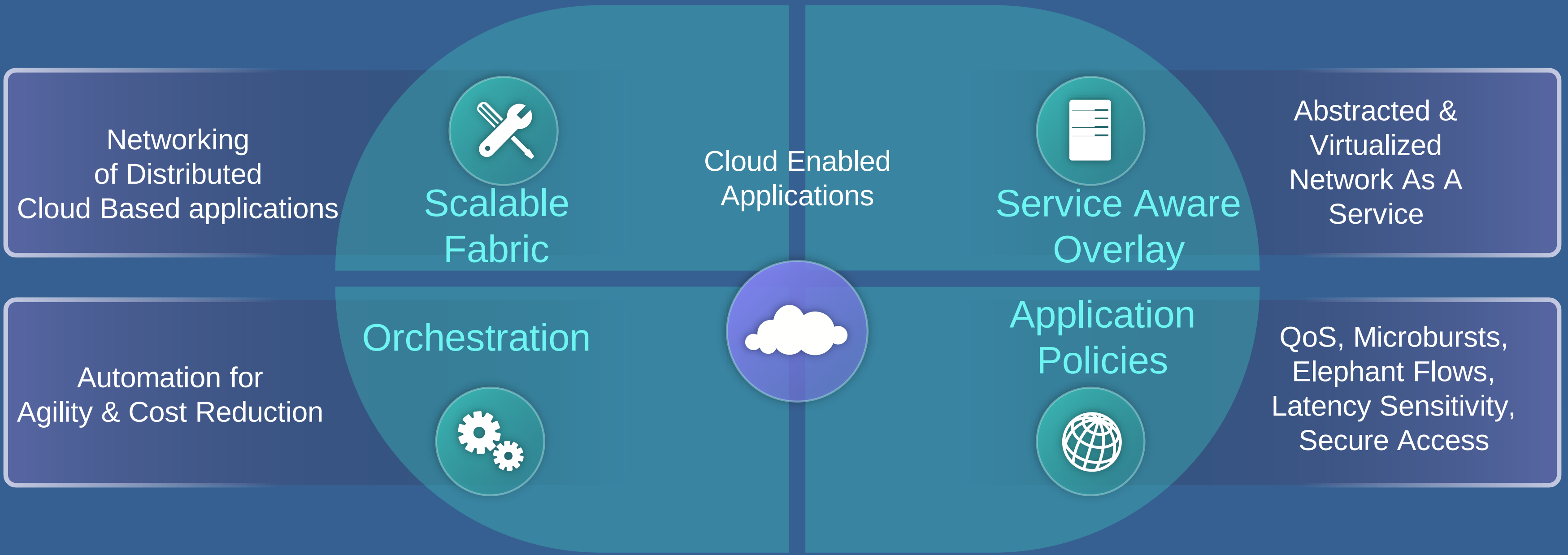
What is Cisco Virtual Topology System (VTS)?

- Overlay Provisioning and Management System
- Automates Overlay provisioning across Cisco Datacenter Top of Rack Nexus switches (Nexus 2000- Nexus 9000), Virtual Switches & DCI routers
- Automates fabric provisioning for both virtual and bare metal workloads.
- Programmable using North Bound REST APIs
- Tighter Integration with Orchestration systems such as Openstack, vCenter and Cisco NSO



Simplified Management for Ease of Operations

VTS : Addressing Application Needs



Networking of Distributed Cloud Based applications

Scalable Fabric

Cloud Enabled Applications

Service Aware Overlay

Abstracted & Virtualized Network As A Service

Automation for Agility & Cost Reduction

Orchestration

Application Policies

QoS, Microbursts, Elephant Flows, Latency Sensitivity, Secure Access

Scale & Automation Drives Business Success

Why Cisco VTS?

Open

- Control & Data Plane
- Programmable Architecture (NB & SB)
- Interoperability (MPLS/VPN, OTV)

Agility and Automation

- Network as a Service
- Integration with Orchestrators
- Automated DCI/WAN
- Multi-Tenancy

Seamless Integration

- Multi-Hypervisor Multi-VMM
- Heterogeneous Workloads
- Custom NB Integration
- Services Integration (P&V)

Scale Performance Efficiency

- Scale-Out PODs
- Fabric Efficiency
- Multi-POD & Multi-DC

Investment Protection

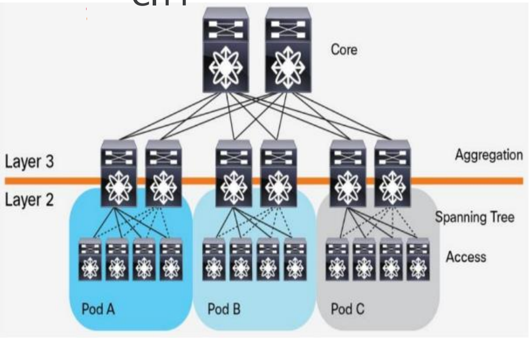
- Host Based Overlays
- N2k-N9k, ASR Support
- Bare metal Apps/Services
- Interoperability

Policy Driven

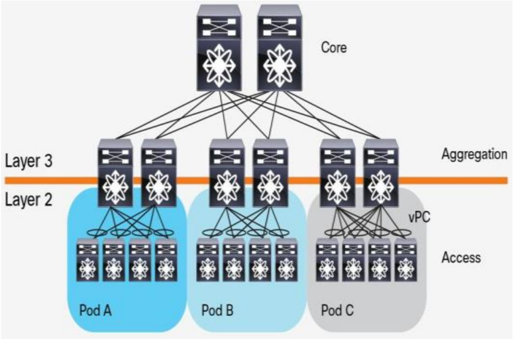
- Infrastructure
- Network Connectivity
- Group Based Policies
- Service Assurance

Scalable Fabric, Network Virtualization & Overlays

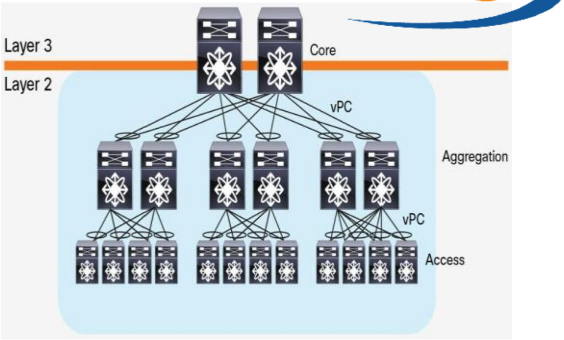
Scalable Fabric to meet Application Demands



Three tier DC with STP

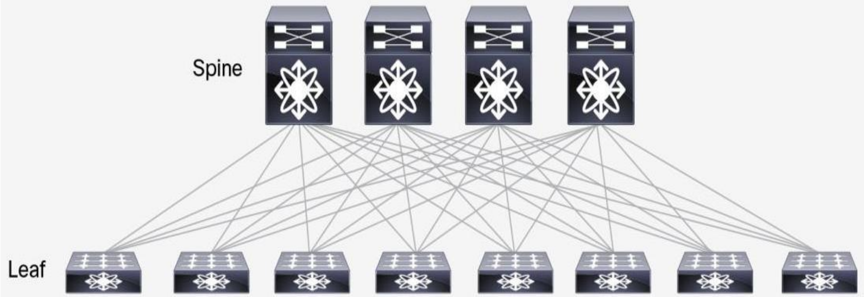


Three tier DC with VPC



Three tier DC with L2 Extended

Spine-Leaf, L3 Fabric



VTS

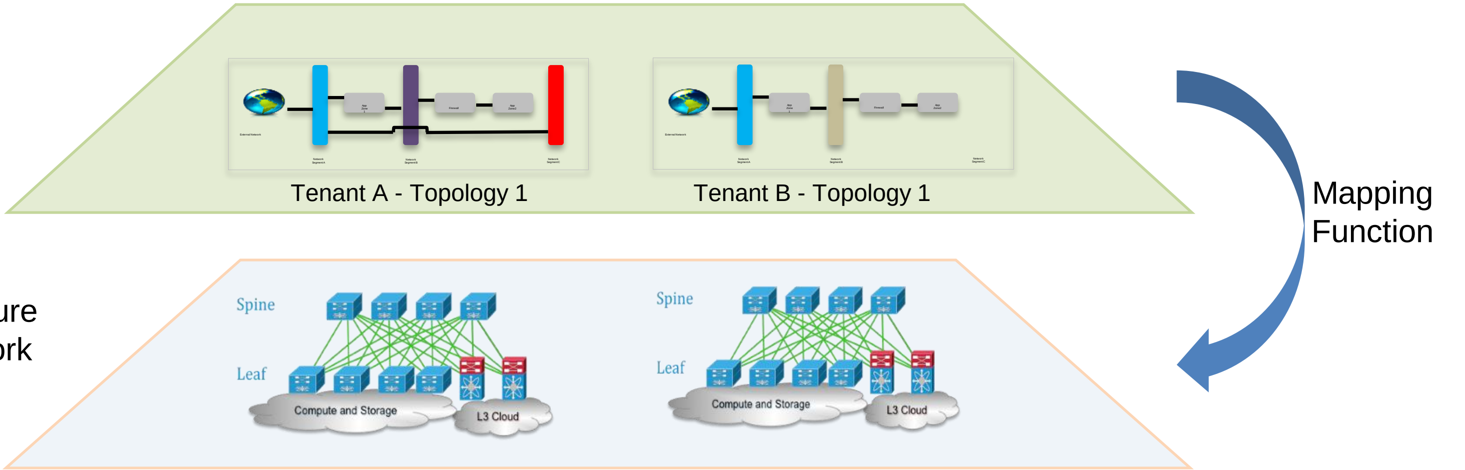
Spine Leaf Evolution

Fabric Path + BGP → VXLAN (Flood & Learn) → Fabric Path + BGP + Automation → VXLAN + EVPN → VXLAN + EVPN + Automation

Network Virtualization and Multi-Tenancy using Overlays

Network virtualization: ability to separate, abstract and decouple the physical infrastructure & topology from a ‘logical’ topology or infrastructure typically by creating overlay networks.

Network overlays helps disassociates applications from physical networks infrastructure & topology, allowing a transition to cloud based multi-tenanted & scalable networks.



Overlay Service Definition

Tenant A - Topology 1

Tenant B - Topology 1

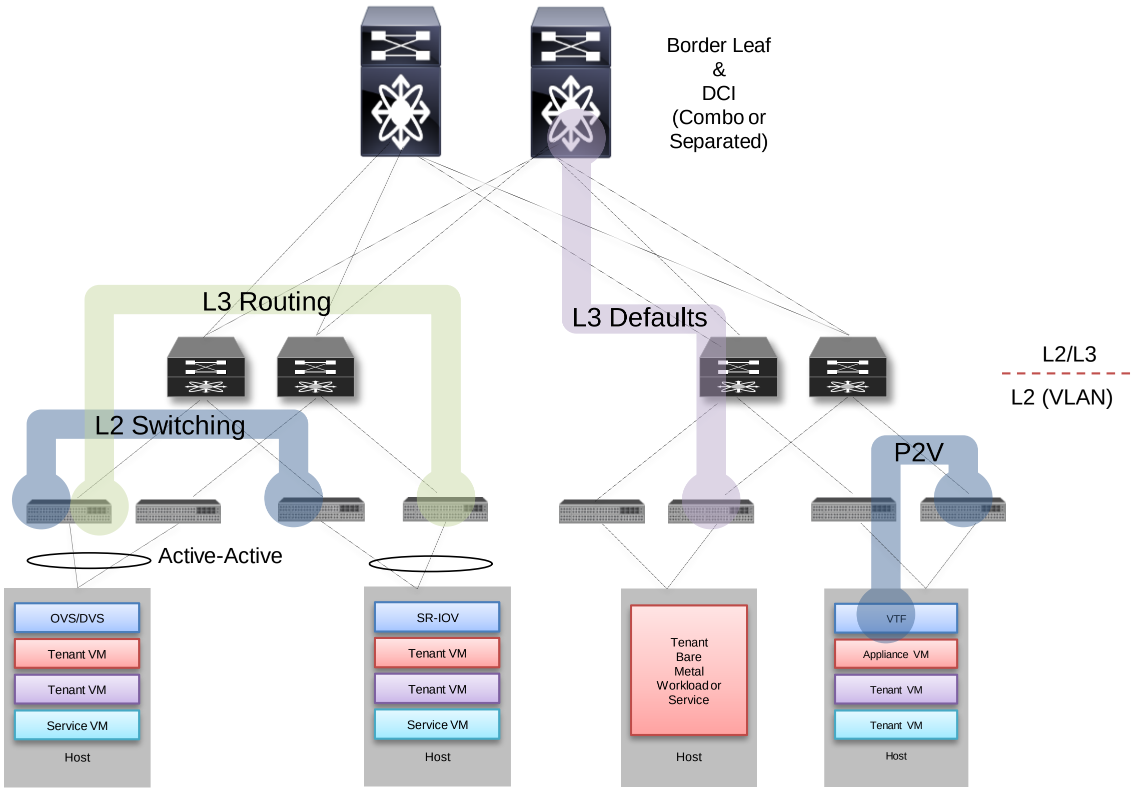
Mapping Function

Physical Infrastructure i.e. Underlay Network

Routing and Forwarding Requirements For Overlays

Must Have Requirements for CP & DP:

- ➢ Underlay Topology Agnostic
- ➢ IP Only Underlay
- ➢ Open Standards Based
- ➢ Scalable multi-tenancy
- ➢ Optimal forwarding of L2 and L3
- ➢ Unified CP/DP for inter & intra POD



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MPBGP-EVPN/VXLAN based Overlays

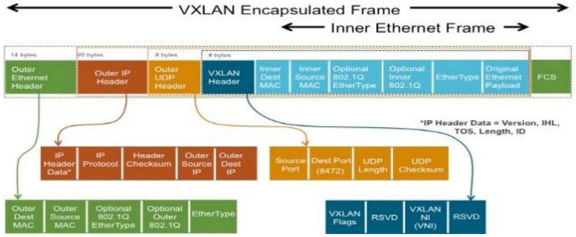
EVPN

Overlay Forwarding Table

T1,S1	MAC, IP Address	P1/2
T1,S2	MAC, IP Address	VTEP2
T2,S3	MAC, IP Address	VTEP3
T2,S4	MAC, IP Address	VTEP4

Layer-2 MAC and Layer-3 IP information distribution by Control-Plane (BGP)

VXLAN

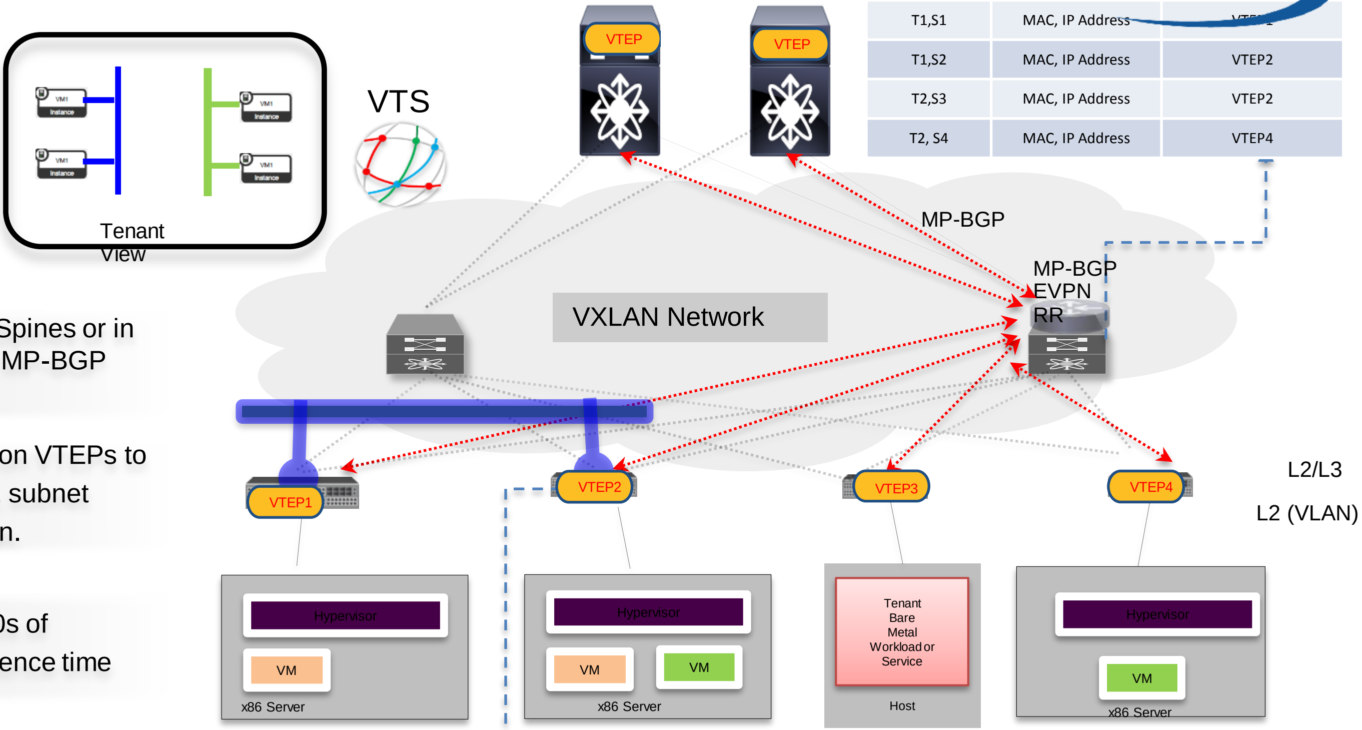


*IP Header Data = Version, IHL, TOS, Length, ID

- Built in multi-tenancy (at scale)
- Integrated Routing/Bridging (IRB) for Optimized Forwarding
- Minimize flooding through ARP suppression
- Fast convergence upon network failures and host movements
- Security through VTEP peer-authentication

- IP routing – proven, stable, scalable
- ECMP – utilize all available network paths
- Flexible placement of multitenant segments
- Better utilization of network paths
- Scalable network domain (16M VNI vs. 4K VLANs)

EVPN Control Plane & VXLAN Data Plane in Action



T1,S1	MAC, IP Address	VTEP1
T1,S2	MAC, IP Address	VTEP2
T2,S3	MAC, IP Address	VTEP2
T2, S4	MAC, IP Address	VTEP4

VTS can be used to deploy the RR at the Spines or in VTS Control plane and then automate the MP-BGP peering on all the VTEPs in the fabric

Use MP-BGP with EVPN Address Family on VTEPs to distribute internal host MAC/IP addresses, subnet routes and external reachability information.

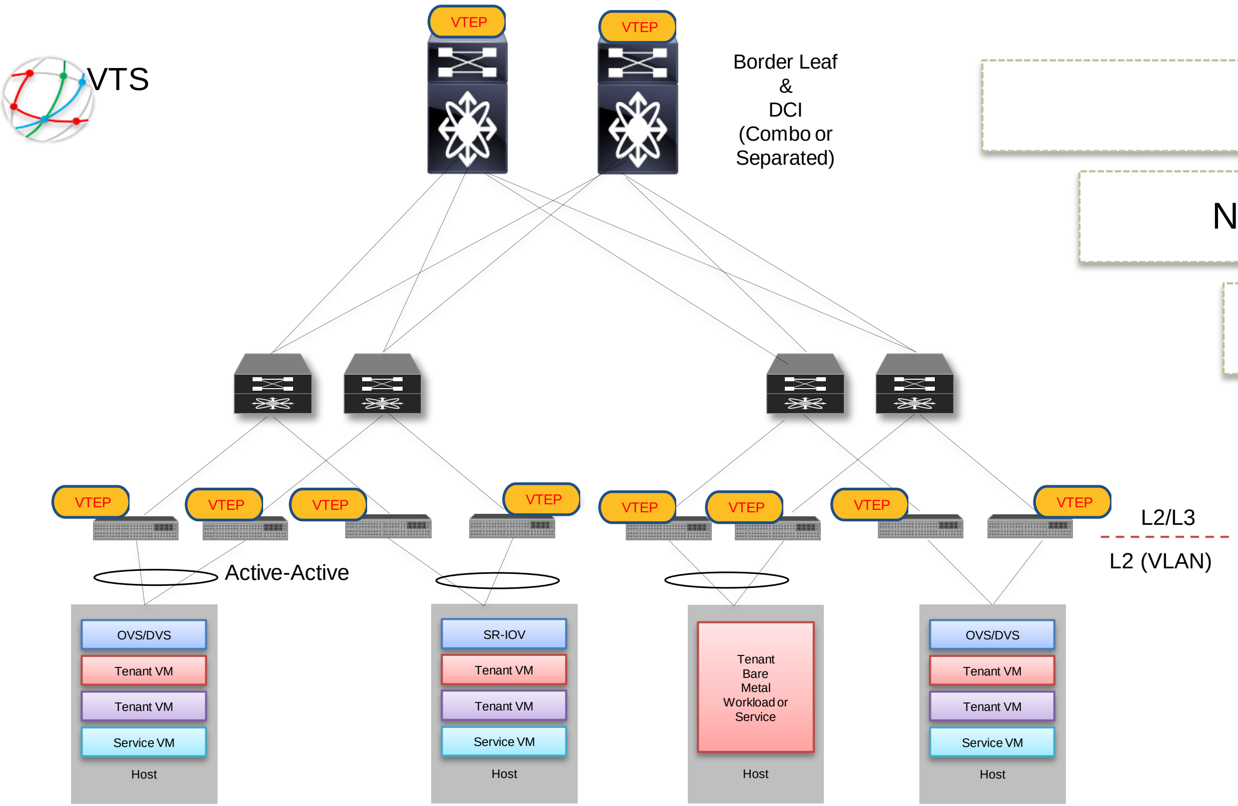
MP-BGP enhancements to carry up to 100s of thousands of routes with reduced convergence time

Overlay Forwarding Table		
T1,S1	MAC, IP Address	VTEP1
T1,S2	MAC, IP Address	P1/2
T2,S3	MAC, IP Address	P1/2
T3,S4	MAC, IP Address	VTEP4

VTEP – VXLAN Tunnel End-Point

BGP Update
Host-MAC
Host-IP
Internal IP Subnet
External Prefixes

VTS Architecture: Hardware VTEPs



Nexus 9200/9300/5600 – ToR

Nexus 9x00/5000/7x00– Spine (RR)

ASR9000, Nexus 7x00– DCI

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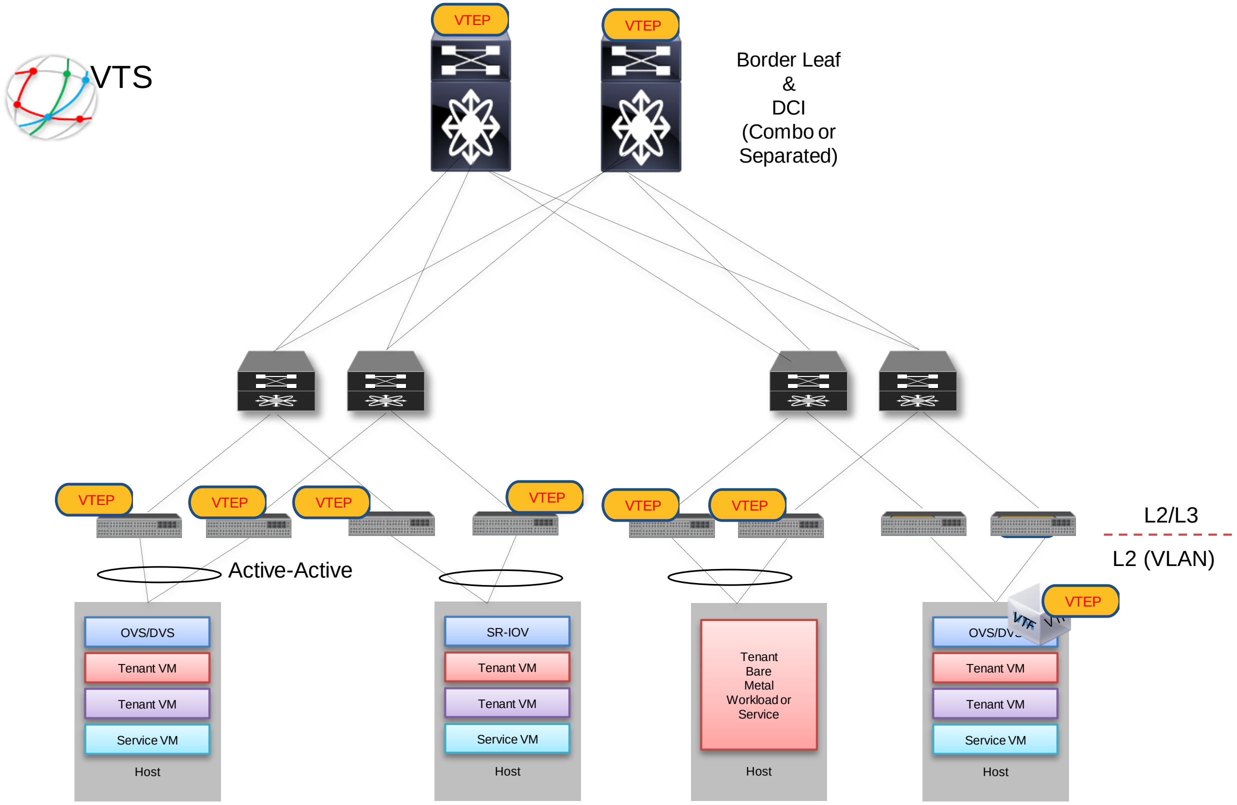
VTS Architecture: Software VTEPs



VTS Use Cases

VTS Use Cases

Multi-Tenant
Data Centers

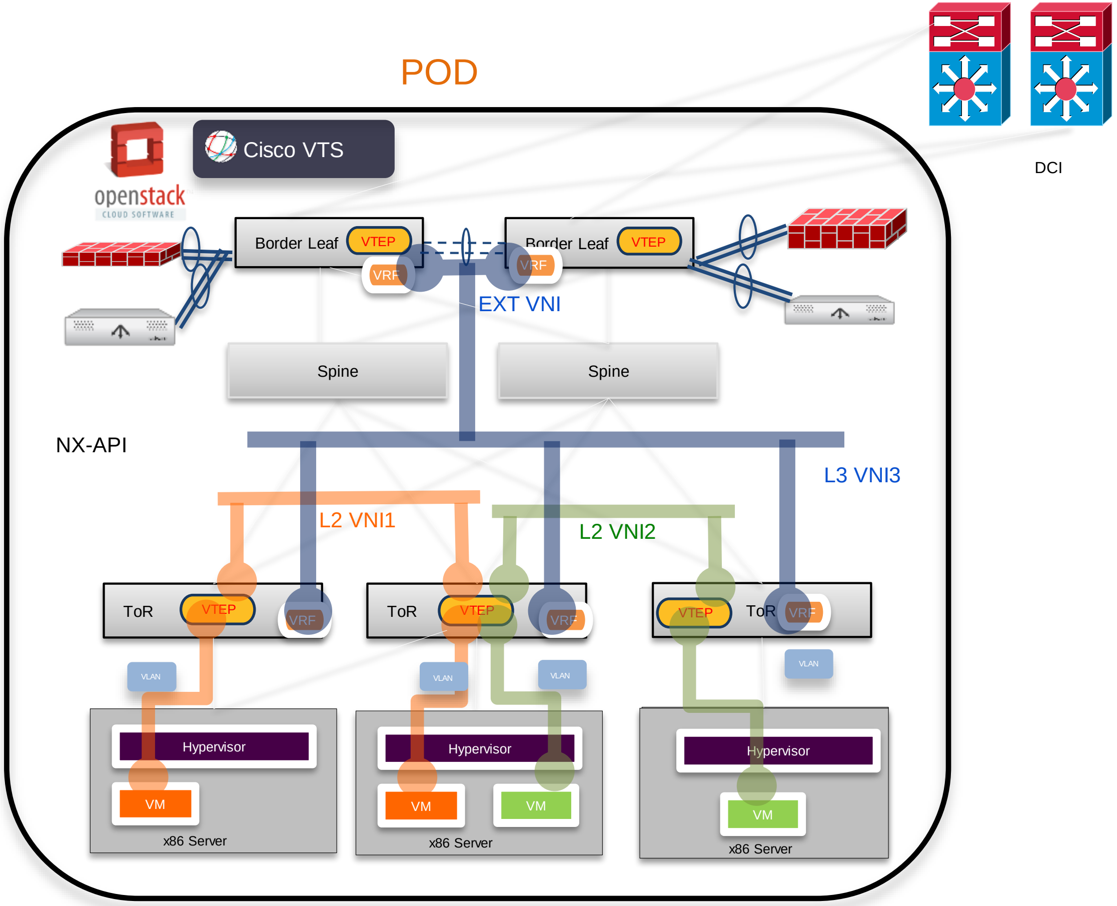
Network-Function
Virtualization

VTS – Multitenant Data Center A case study

- Cloud Management: OpenStack
- Host OS: RHEL, Hypervisor: KVM
- Sites: Multi-POD, Multi-DC
- Core: MPLS Core
- Servers Connected as VPC
- Services: Firewall & Load Balancer

- Management and IP Storage Network
- L2/L3 Connectivity
- Selectively allow L2 outside POD
- Remote access for branches
- Integrated DCI/BL
- N9k within POD and ASR9k as DCI

VTS Architecture – Single POD



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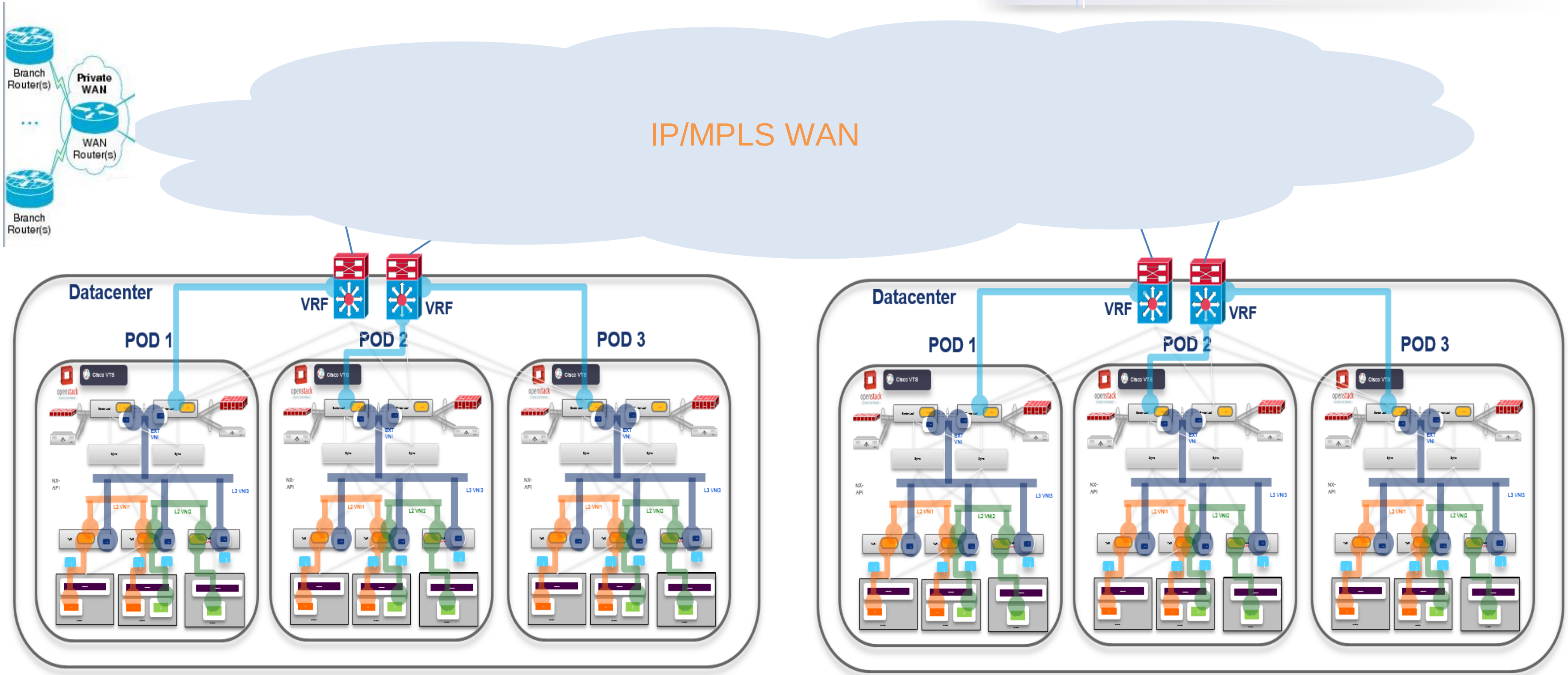
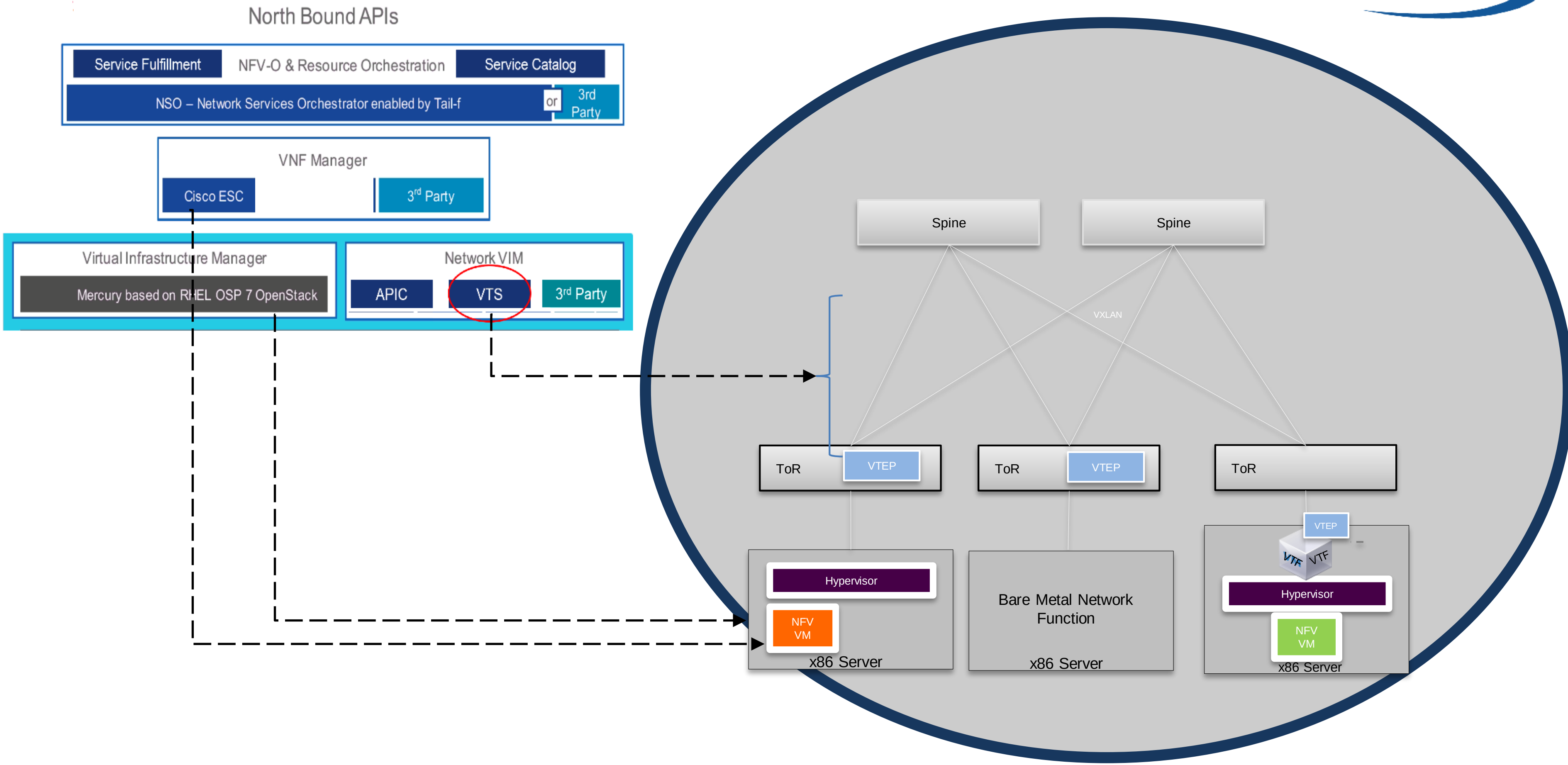
VTS Architecture Multi-Site

- For Disaster recovery, High Availability
- Integrate EVPN/VXLAN to MPLS-L3VPN



Cisco NFV Integration with VTS



North Bound APIs

Service Fulfillment

NFV-O & Resource Orchestration

Service Catalog

NSO – Network Services Orchestrator enabled by Tail-f

or

3rd Party

VNF Manager

Cisco ESC

3rd Party

Virtual Infrastructure Manager

Mercury based on RHEL OSP 7 OpenStack

Network VIM

APIC

VTS

3rd Party

Spine

Spine

VXLAN

ToR

VTEP

ToR

VTEP

ToR

VTEP

VTF

VTF

Hypervisor

NFV VM

x86 Server

Bare Metal Network Function

x86 Server

Hypervisor

NFV VM

x86 Server

3S

Innovation for a Better Future