Cisco Support Community
Deep Dive Expert Series Webcast

Cisco Nexus 1000v Series Switches,
Part 3: Game Changer: Silver Lining in the Cloud

Vishal Mehta
Technical Marketing Engineer
February 24, 2015

Upcoming Expert Series Webcast

Demystifying Unified Computing System (UCS) Interfaces for troubleshooting.

March 17th, 2015

Ever wonder what VFC, VETH, VIF and HIF are in UCS and which path your packets are taking? UCS infrastructure has several virtual components and this makes it challenging to troubleshoot but it is critical to understand. Cisco Expert, Niles Pyelshak will discuss UCS interfaces and how packets travels from the UCS server.

https://supportforums.cisco.com/event/12413926/expert-webcast-demystifying-unified-computing-system-ucs-interfaces-troubleshooting

Ask the Expert Events – Active

Now through March 13th

Cisco ServiceGrid — Service Integration in the Cloud, with experts Alexander Kalaschek and Patrick Schneider-Sturm

Cisco Email Security Appliance (ESA), Web Security Appliance (WSA), and Content Security Management Appliance (SMA). Join Cisco Expert, Nasir Abbas

Join the discussion for these Ask The Expert Events:
https://supportforums.cisco.com/expert-corner/knowledge-sharing

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https://supportforums.cisco.com/blog/154746

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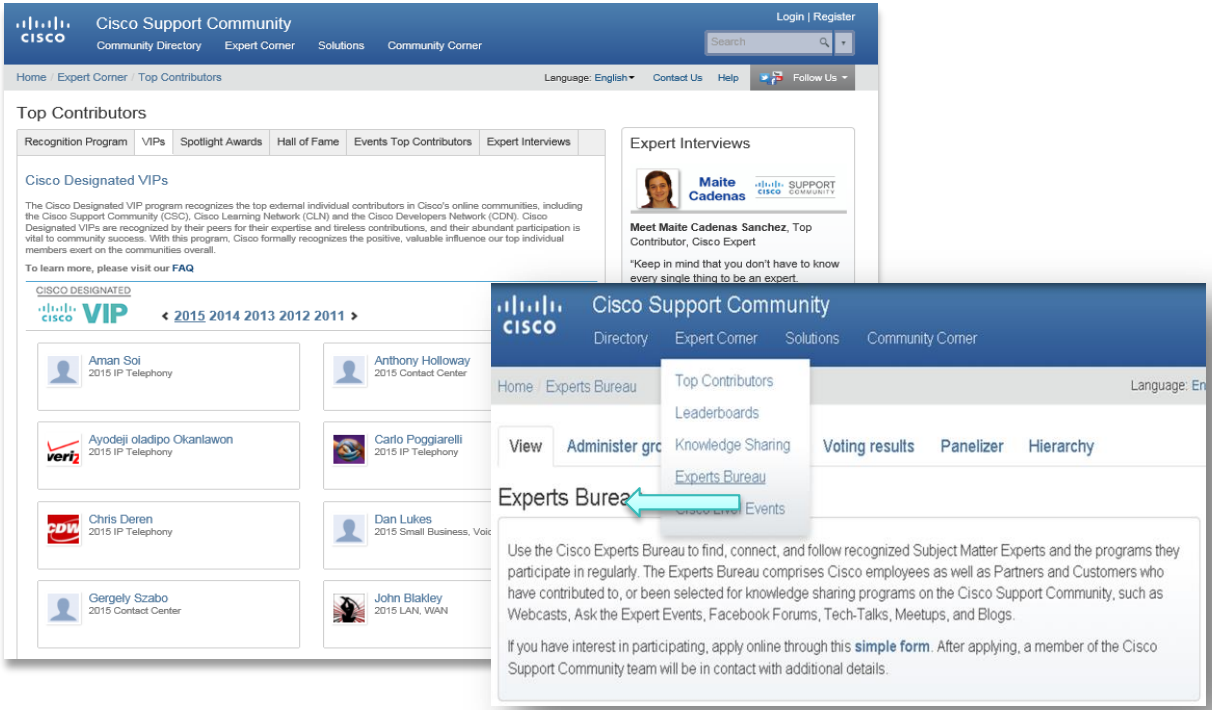


https://supportforums.cisco.com/expert-corner/top-contributors

Cisco Support Community Expert Series Webcast

Cisco Nexus 1000v Series Switches, Part 3: Game Changer: Silver Lining in the Cloud

February 24, 2015

- Today's featured expert is Cisco Technical Marketing Engineer Vishal Mehta
- Ask your questions now in the Q&A window

Vishal Mehta

Technical Marketing Engineer

Topic: Part 3: Game Changer: Silver Lining in the Cloud

Technical Expert – Question Manager

Gunjan Patel

Thank You For Joining Us Today!

If you would like a copy of the presentation slides, click the PDF file link in the chat box on the right or go to:

https://supportforums.cisco.com/document/12433991/expert-depth-series-cisco-nexus-1000v-series-switches-part-3-slides

Or, https://supportforums.cisco.com/expert-corner/knowledge-sharing

Ask the Expert Event following the Webcast

Now through March 4th

Vishal will be continuing the discussion in an Ask the Expert event. So if you have more questions, please visit the Knowledge Center on the Cisco Support Community

https://supportforums.cisco.com/discussion/12412941/ask-expert-deepdive-cisco-nexus-1000v-series-switches

Join the discussion for these Ask The Expert Events:
https://supportforums.cisco.com/expert-corner/knowledge-sharing

Submit Your Questions Now!

Use the Q & A panel to submit your questions and the panel of experts will respond.

Please take a moment to complete the survey at the end of the webcast

Cisco Nexus 1000V Series Switches

Part 3: Game Changer: Silver Lining in the Cloud

Cisco Support Community Deep Dive Expert Series Webcast

Vishal Mehta
Technical Marketing Engineer
February 24, 2015

Polling Question 1

Can Nexus 1000v be used for Cloud Computing ?

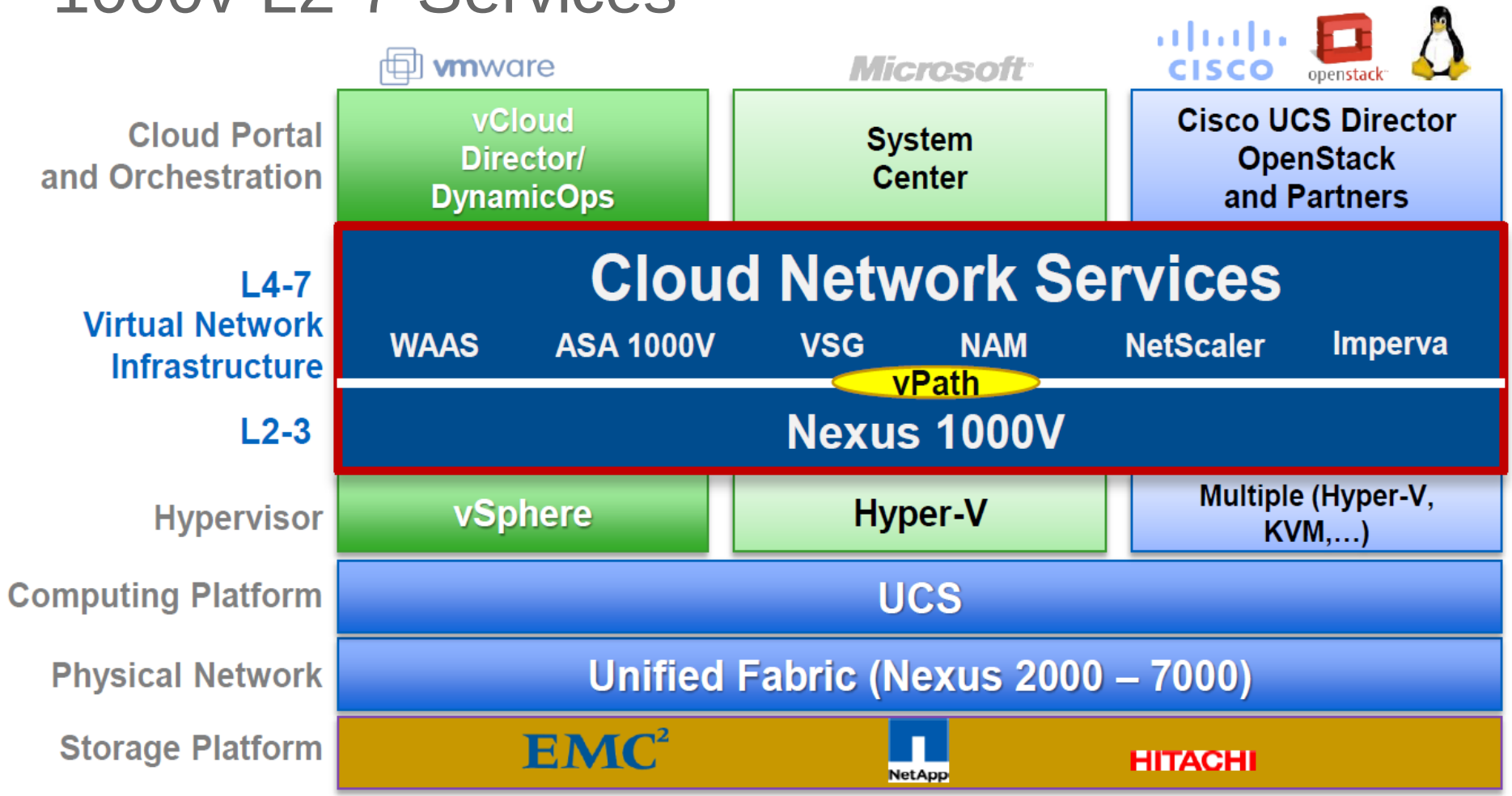
a. Yes

b. No

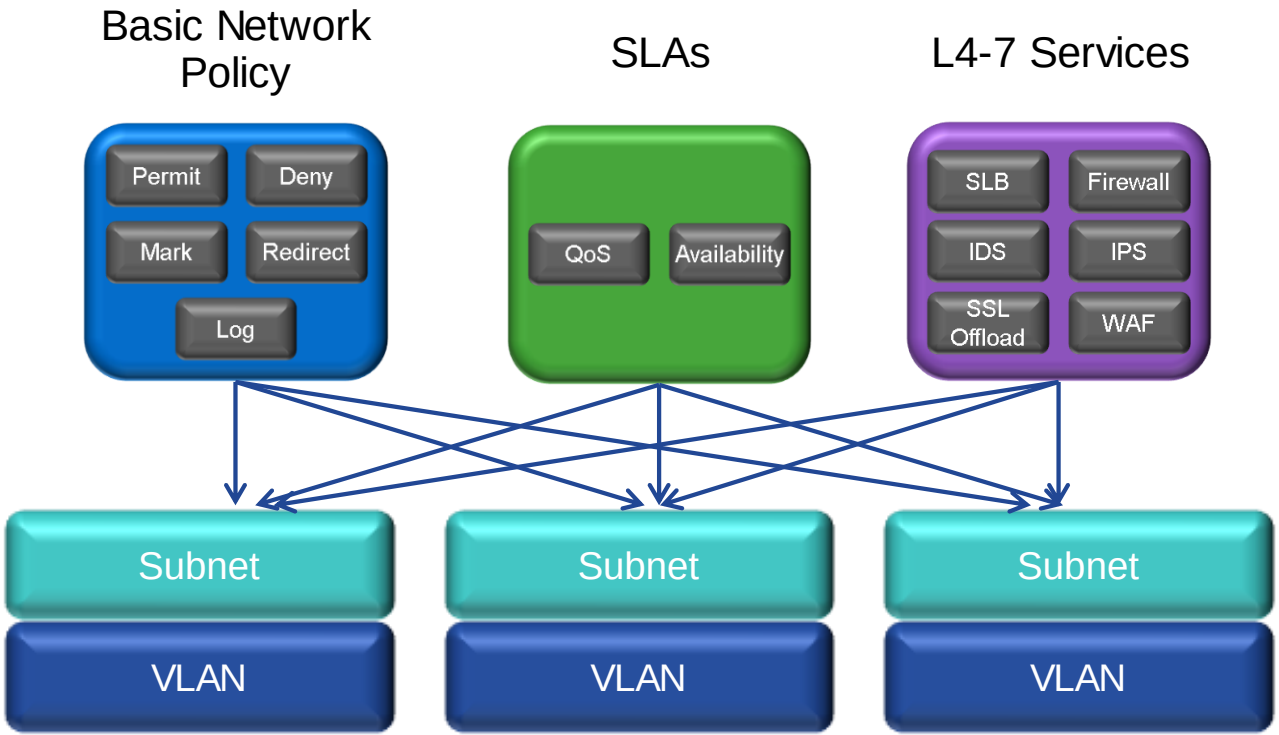
Agenda

- Application Virtual Switch for ACI
- InterCloud Fabric (ICF)

1000v L2-7 Services



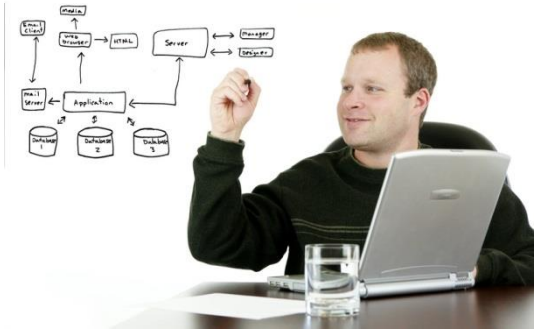
Overloaded Network Constructs



Network constructs are overloaded with unintended functionality.

Application Language Barriers

Developers



Application Tiers

Provider / Consumer Relationships

VLANs

Subnets

Protocols

Ports

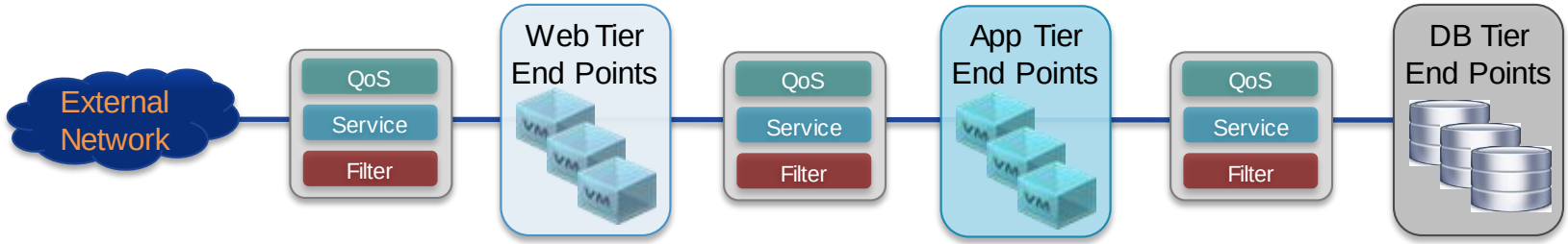
Infrastructure Teams

Developer and infrastructure teams must translate between disparate languages.

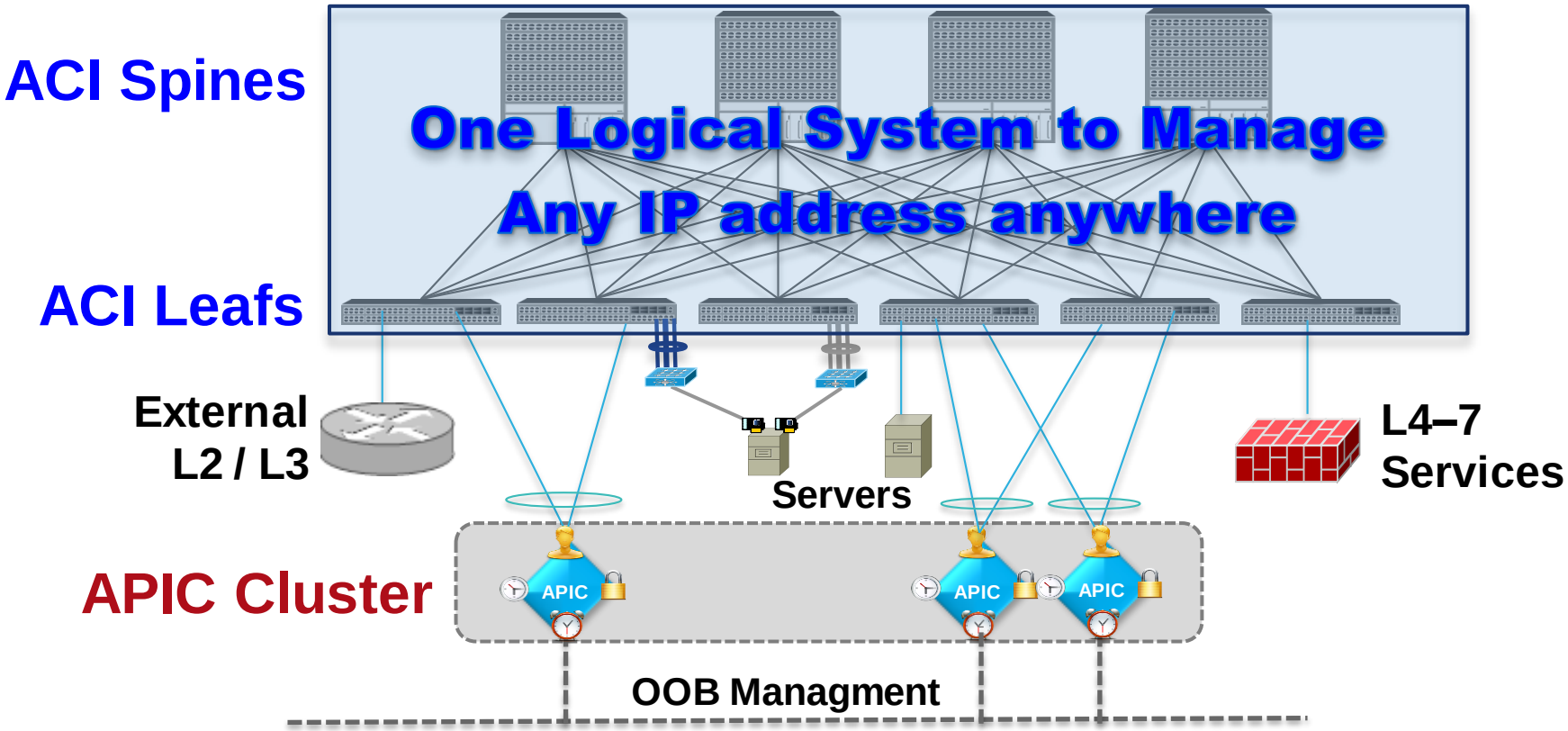
What is an Application to the Network?

It is More than just a VM or Server

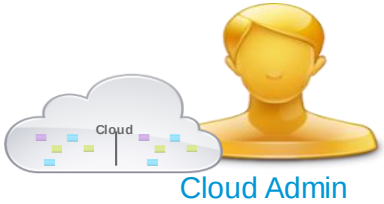
- ✓ It is collection of all the Application's End Points
  - ❖ 'plus'
- ✓ The Application's L2 – L7 Network Policies
  - ❖ 'plus'
- ✓ The Relationship between these End Points and their Policies



ACI Fabric



Goal: Common Policy & Operations Framework



Cloud Admin

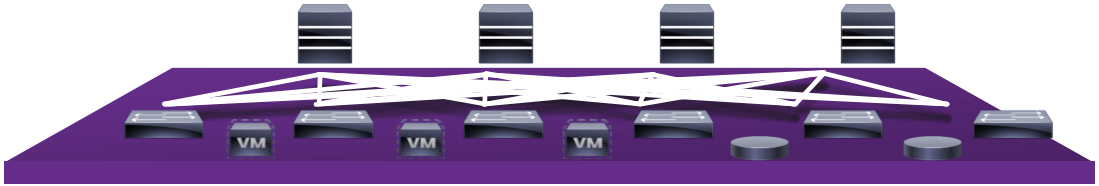
Application Admin

APPLICATION

Security Admin

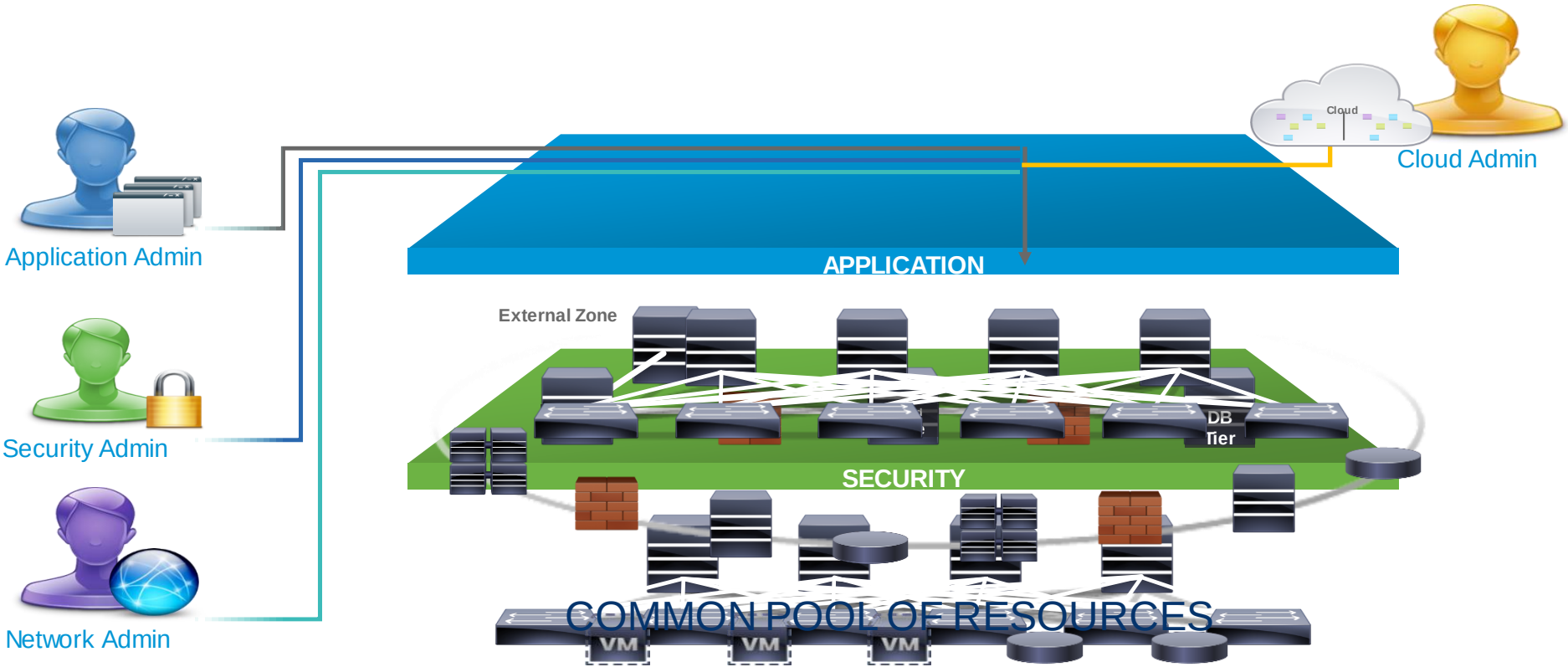
SECURITY

Network Admin



cisco

Goal: Common Policy & Operations Framework



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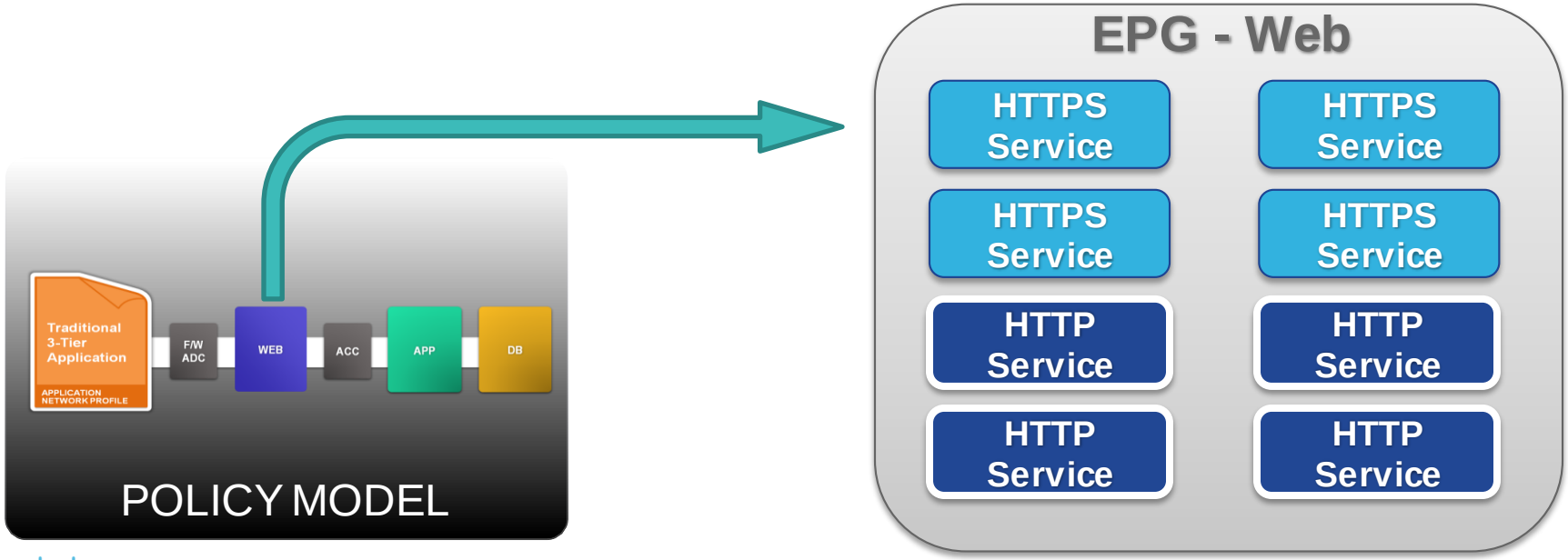
ACI policy model brings the concept of End-Point Group (EPG)

EPGs are a **grouping of end-points** representing **application or application components independent** of other network constructs.



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End-Points end EPG membership

Server

Virtual Machine

Storage

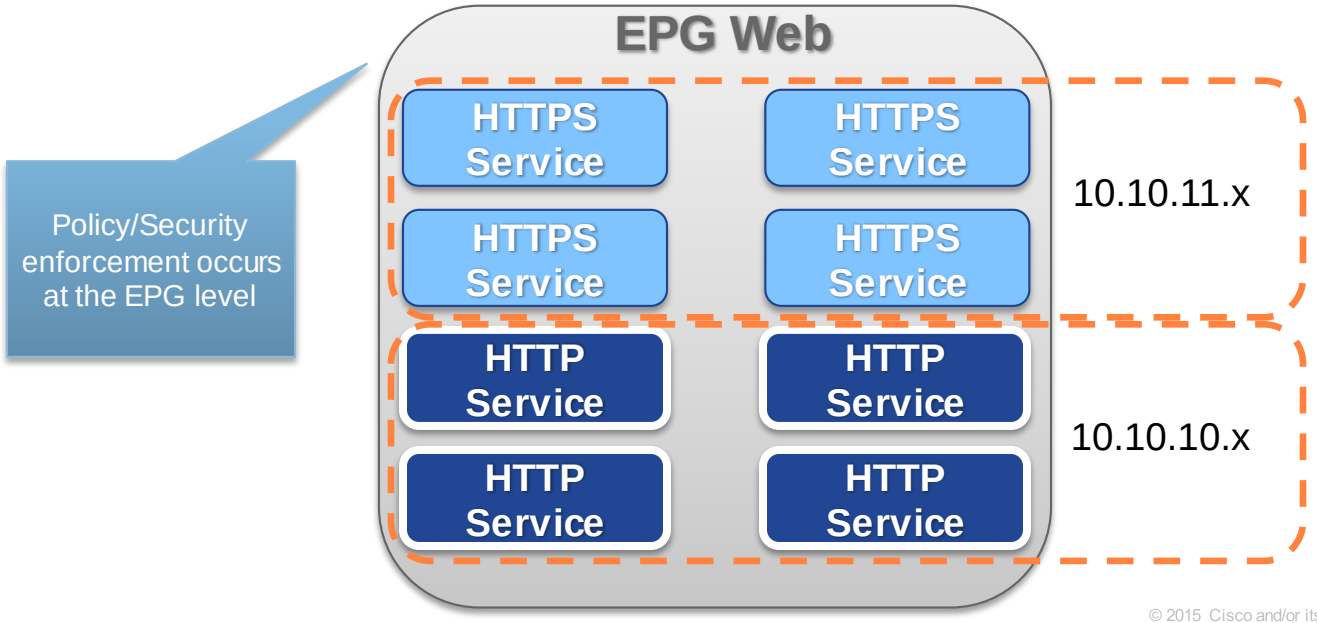
Client

- Device connected to network directly or indirectly
- Has address (identity), location, attributes (version, patch level)
- Can be physical or virtual

  - End Point Group (EPG) membership defined by:
    - Ingress physical port (leaf or FEX)
    - Ingress logical port (VM port group)
    - VLAN ID
    - VXLAN (VNID)
    - IP address
    - IP Prefix/Subnet
    - NVGRE (VSID)
    - DNS name
    - Layer 4 ports

Ex.: EPGs, Subnets and Policy

EPGs separate the addressing of an application
from it's mapping and policy enforcement on the network.



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EPGs @ ACI bring true network abstraction

Traditional Network Model

VLAN 100
10.10.10/24

Apps Coupled to Location

VLAN 200
10.10.20/24

Visibility At Network or VLAN Level

VLAN 300
10.10.30/24

ACL-based Policy Per Interface

VLAN 400
10.10.40/24

No Address Independence or Policy Mobility

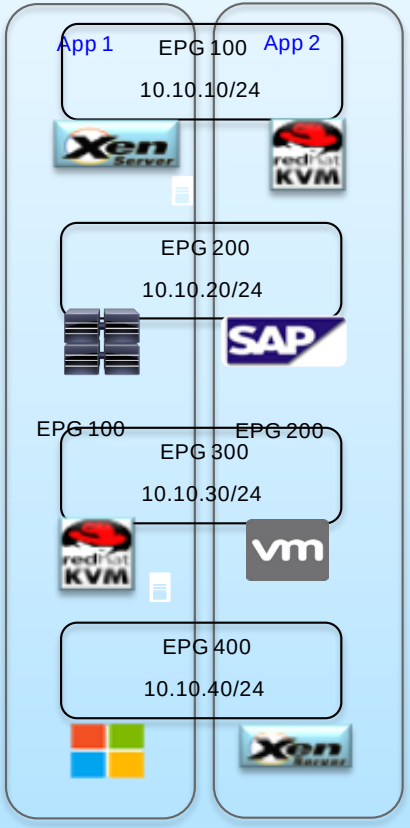
Application Centric Infrastructure

Apps Decoupled from Location

Visibility At App or Group Level

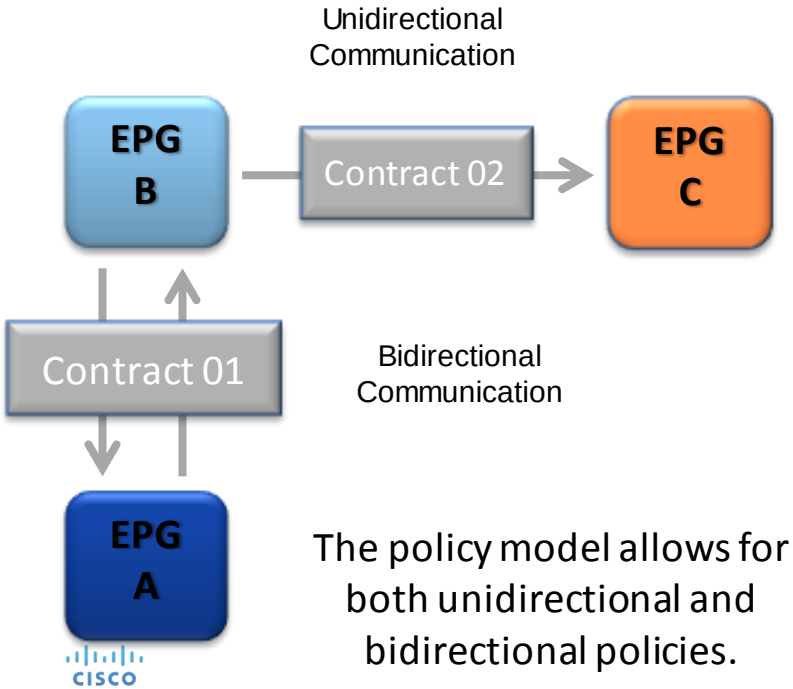
Policy Between Groups

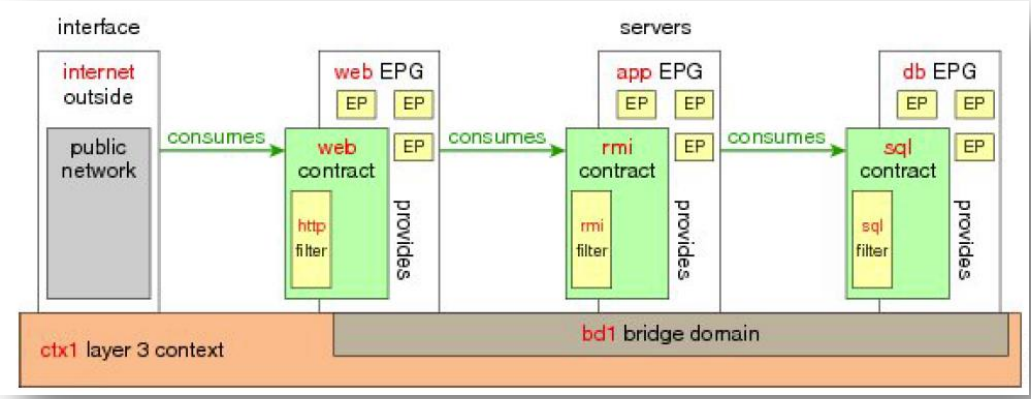
Complete Address Independence & Policy Mobility



Applying Policy between EPGs: ACI contracts

Contracts define the way in which EPGs interact.





Ex: ACI Logical Model applied to the "3-Tier App" ANP

The policy model allows for both unidirectional and bidirectional policies.

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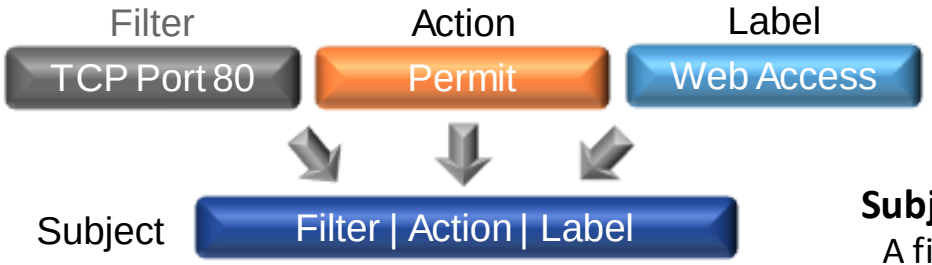
Building ACI Contracts

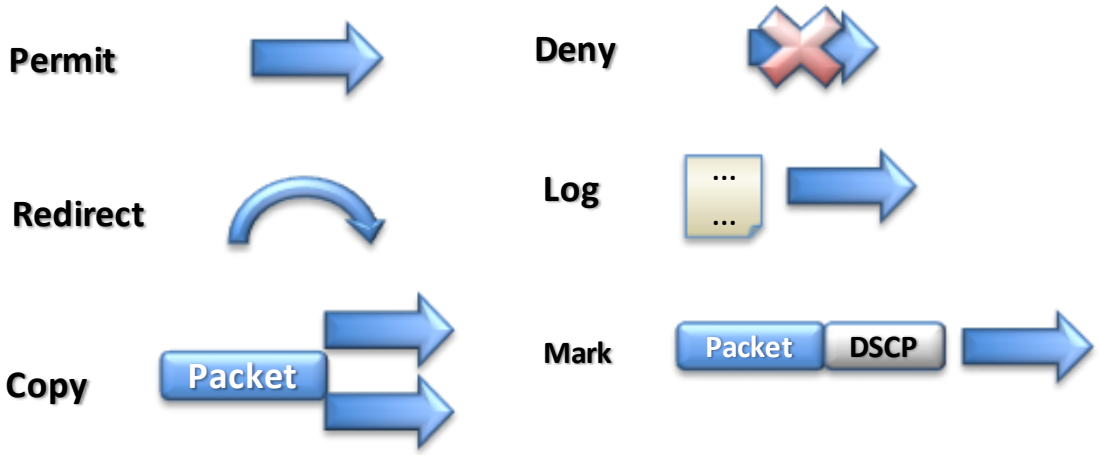


Subjects are a combination of A filter, an action and a label

Contracts define communication between source and destination EPGs

Contracts are groups of subjects which define communication between EPGs.

Policy Options: Actions



There are six policy options supported:

- Permit the traffic
- Block the traffic
- Redirect the traffic
- Log the traffic
- Copy the traffic
- Mark the traffic (DSCP/CoS)

Policy encompasses traffic handling, quality of service, security monitoring and logging.

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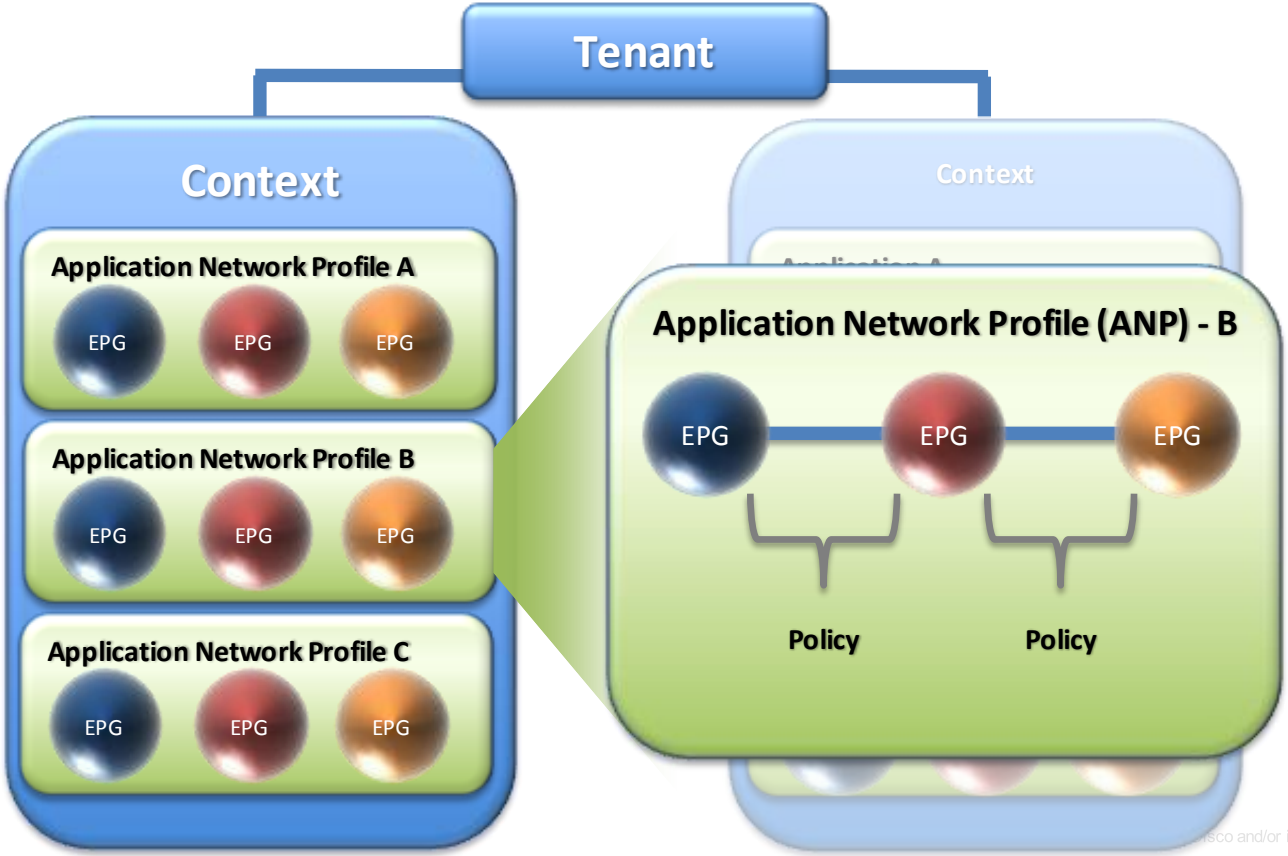
ACI Logical Model



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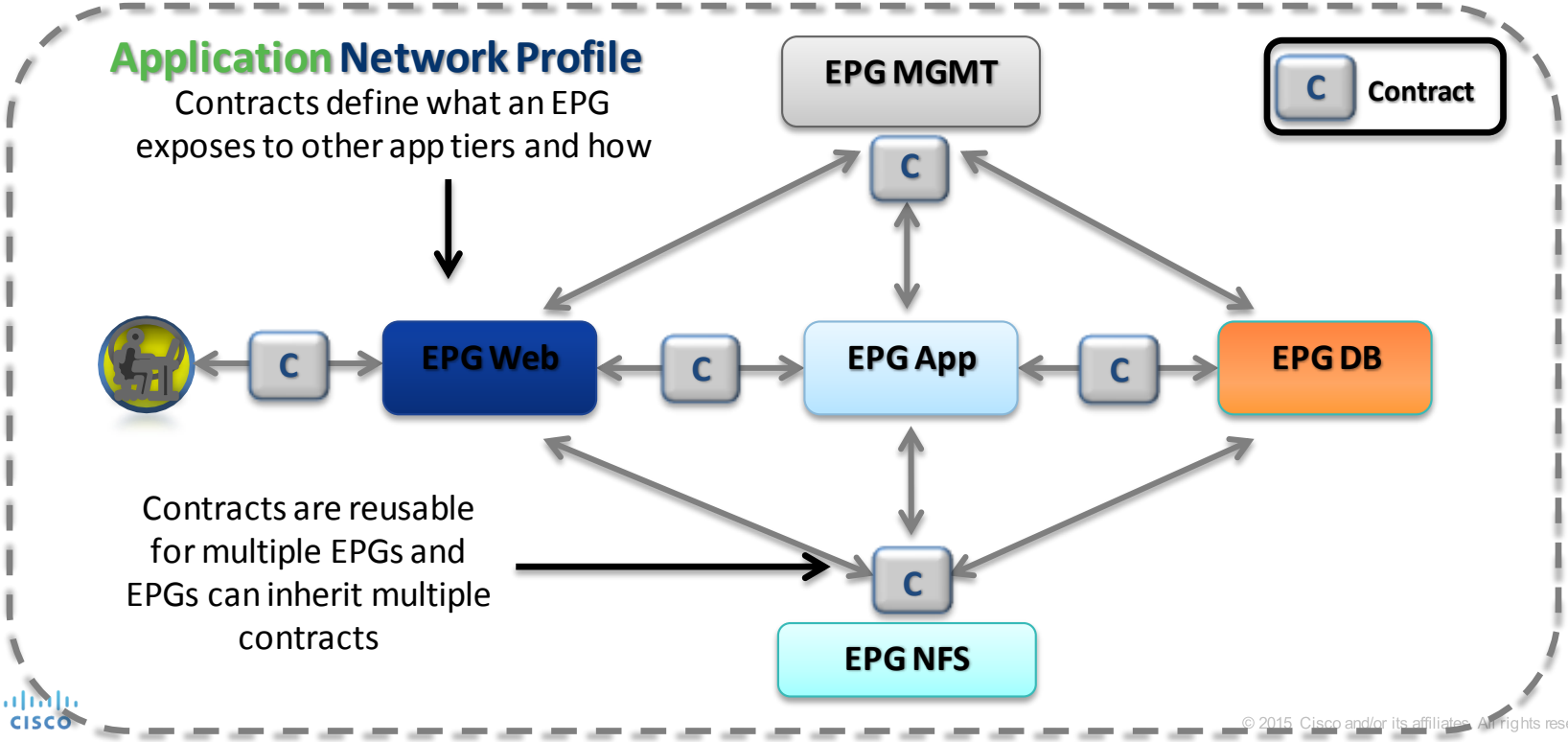
Ex.: Contract Model

The use of contracts separates 'what' a policy is from 'where' it exists, extending its use.



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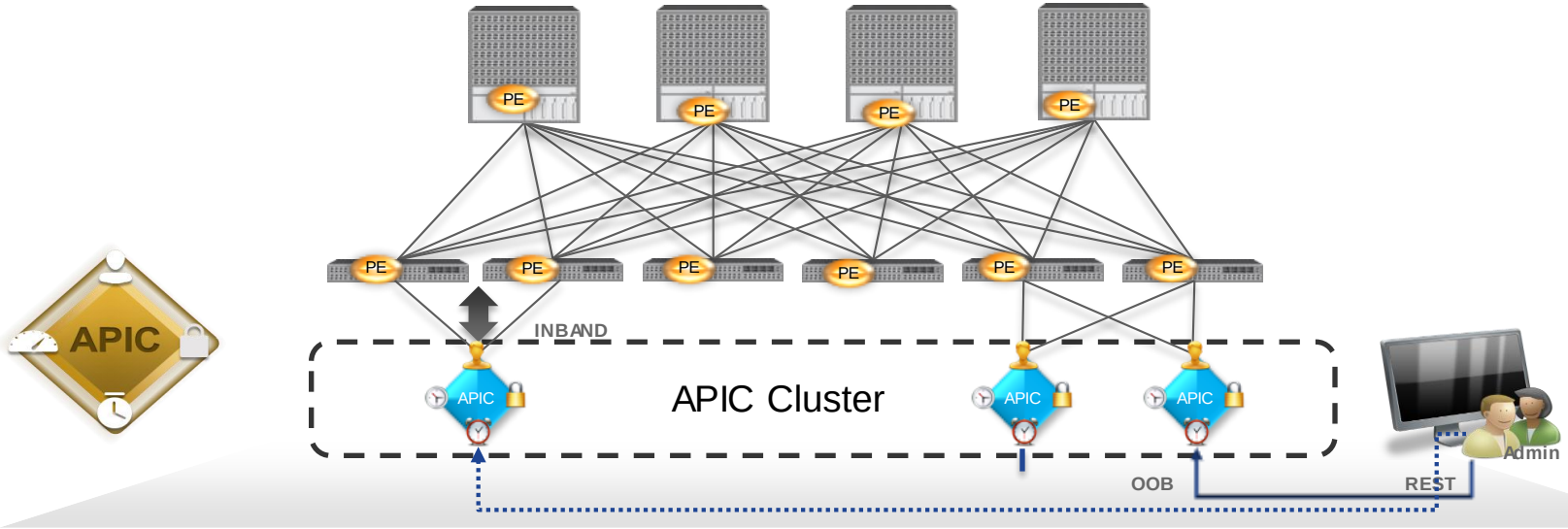
ACI Concepts

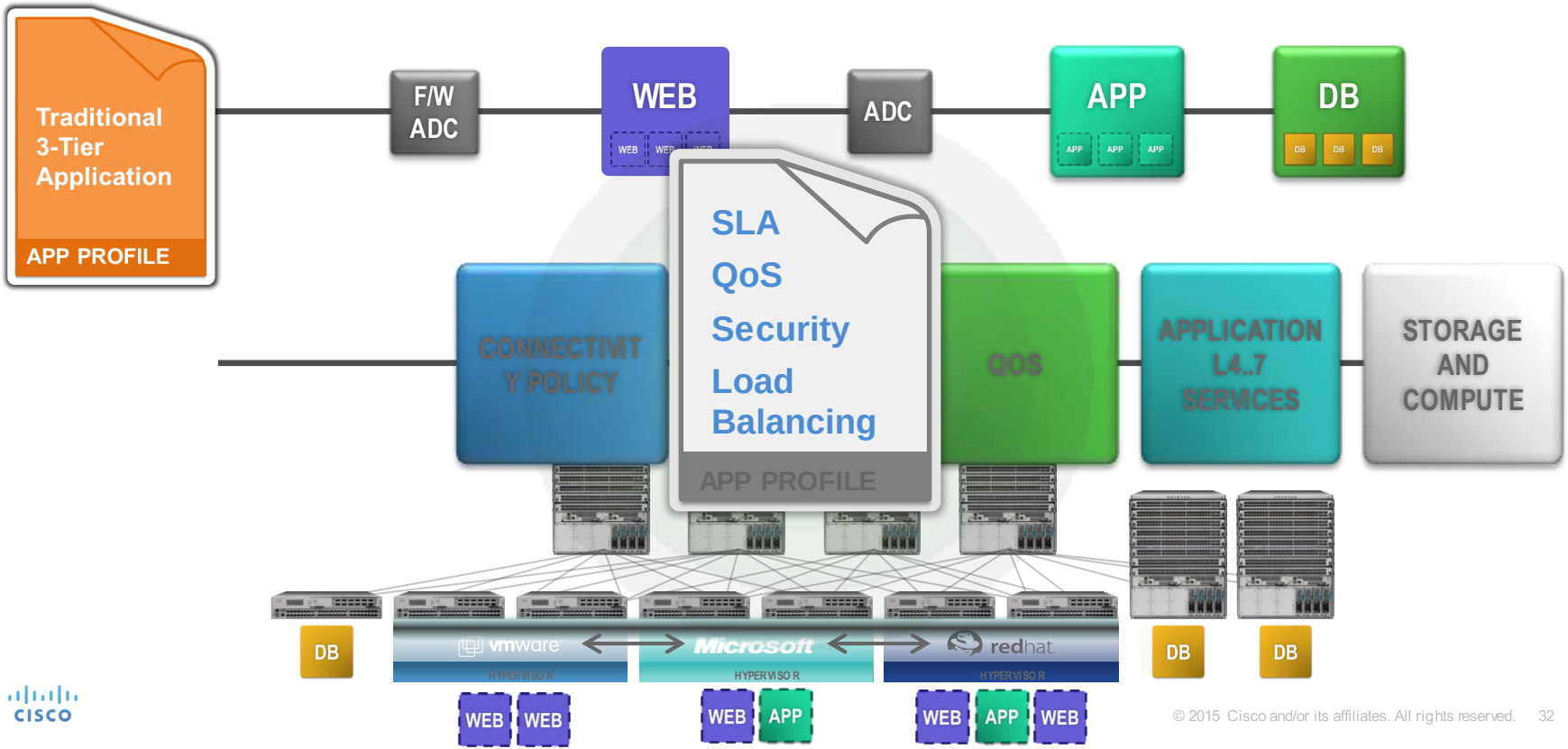
- Tenant – A logical construct within the APIC to configure tenant policies, profiles and network configuration.
- Application Profile – A profile used to classify an application or traffic type and define network and policy configuration
- EPG – End point groups used to classify what traffic belongs to a particular application profile, and what contracts (similar to ACLs) are defined for a particular traffic type
- VMM Domain – Associated to a vCenter and a DVS on ESX Hosts. Each vCenter will be apart of a separate VMM domain

What is APIC

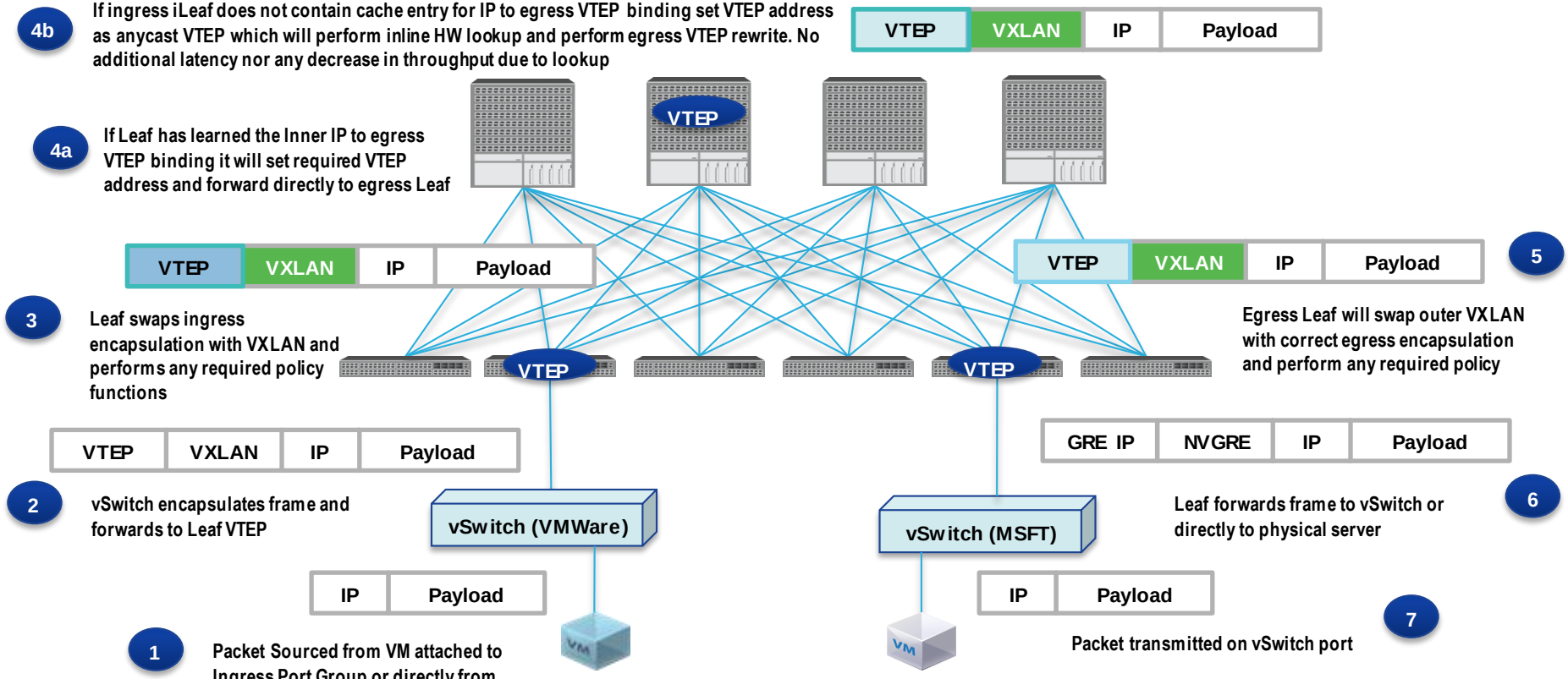


- APIC cluster is the distributed controller for managing all the policies and running state for ACI fabric and for interfacing with VM controllers and L4-L7 services boxes
- It is a highly redundant **cluster of linux based servers** connected to Leaf switches on infra network
- It is not in the control plane or datapath
- Application networking needs are expressed in APIC as application-level policies through REST interface.
- The policies are automatically pushed and applied to the network infrastructure via embedded policy elements

Application Network Profiles (ANP) & ACI: how it works ?



Overview of ACI Fabric Unicast Forwarding

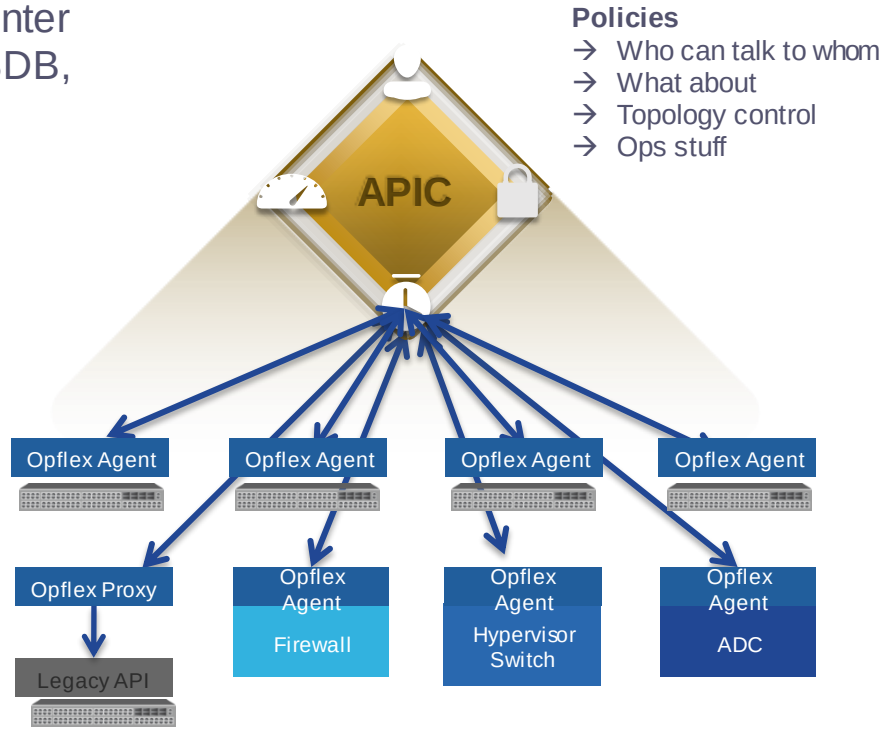


OpFlex – A Flexible, Extensible Policy Protocol

OPFLEX is a new extensible policy resolution protocol designed for declarative management of any datacenter infrastructure. Unlike legacy protocols such as OVSDB, OPFLEX was designed to offer:

- Declarative resolution – Push + Pull API support
- Abstract policies rather than device-specific configuration
- Flexible, extensible definition of using XML / JSON
- Support for any device – vswitch, physical switch, network services, servers, etc.

http://tools.ietf.org/html/draft-smith-opflex-00



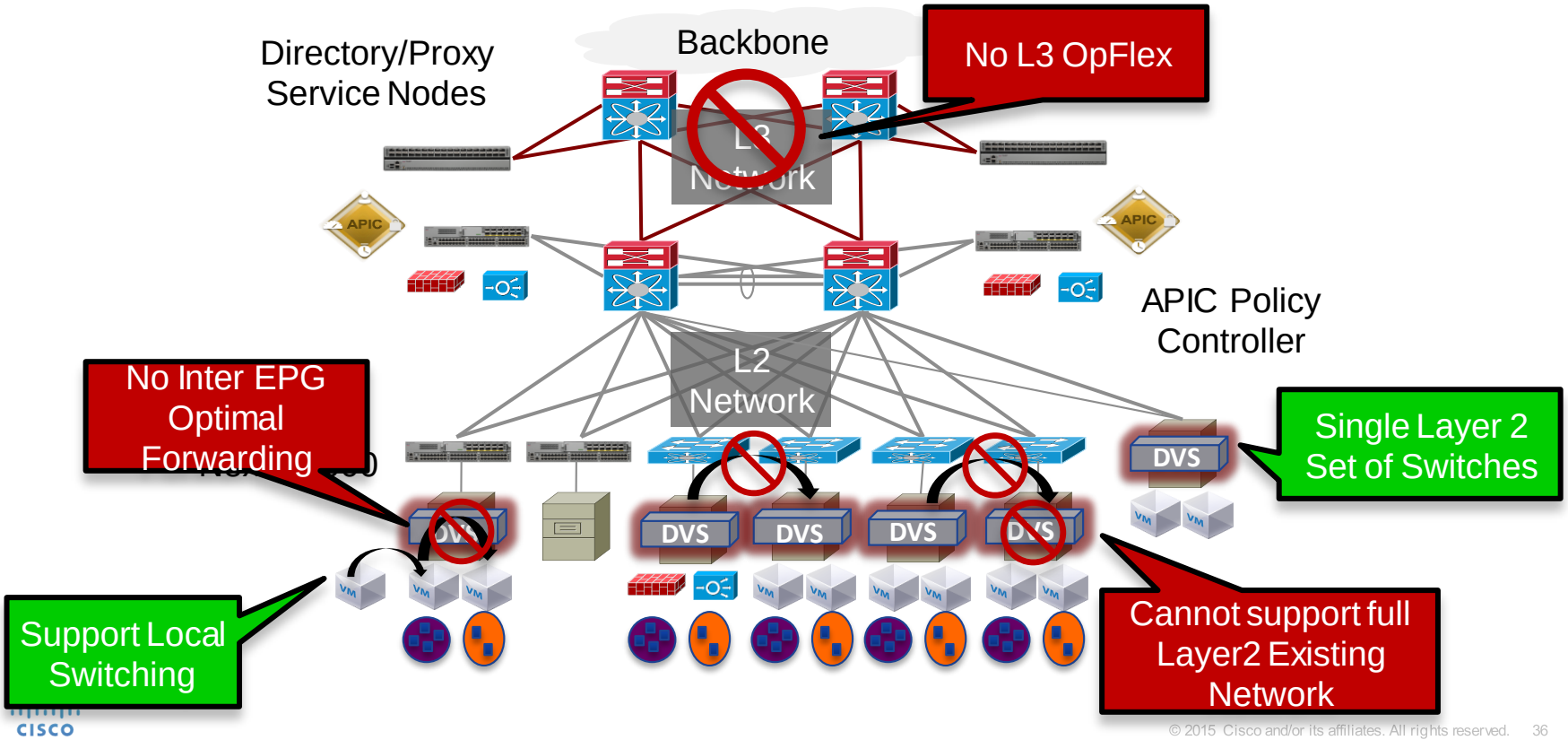
Polling Question 2

Can ACI architecture influence Virtual Workloads ?

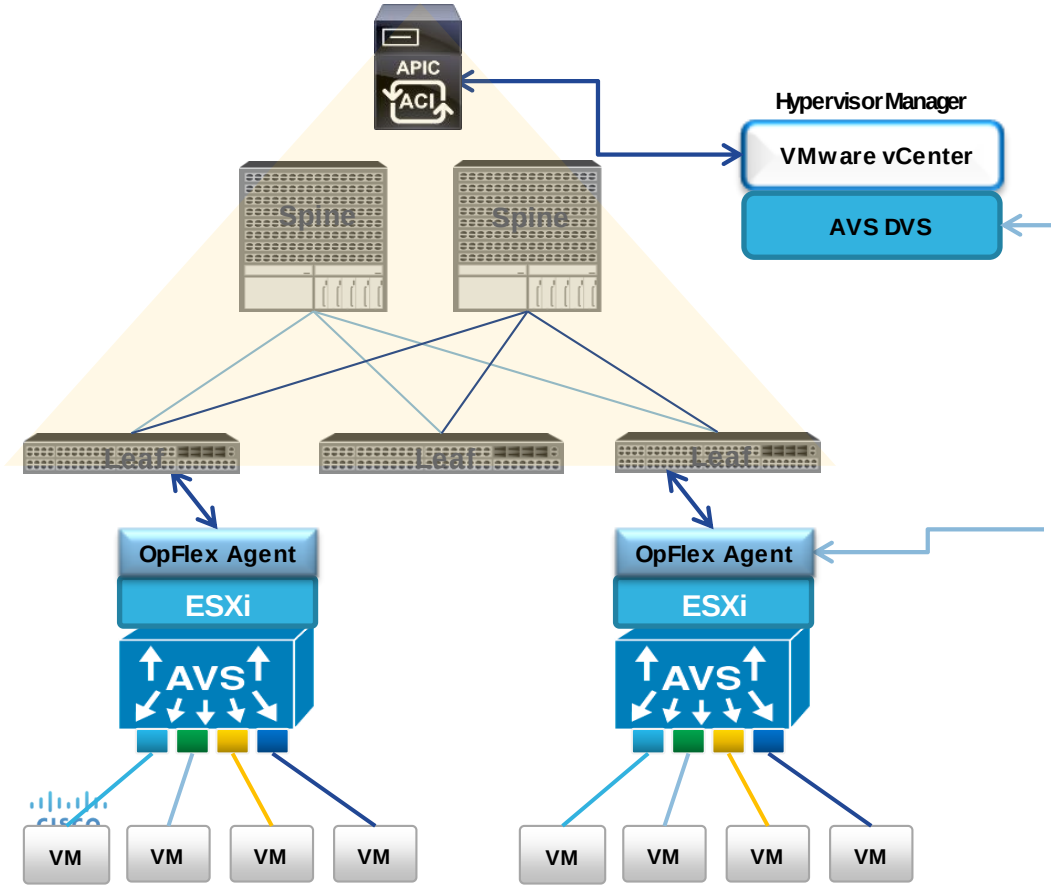
a. Yes

b. No

Limitations of vSwitch



AVS Architecture and Components



- AVS has two major components
  - AVS-DVS (Distributed Virtual Switch) on vCenter
  - AVS kernel module on ESXi host
- OpFlex Agent runs on AVS ESXi host inside AVS kernel module
- Increased control plane scale through APIC cluster and Leaf Node

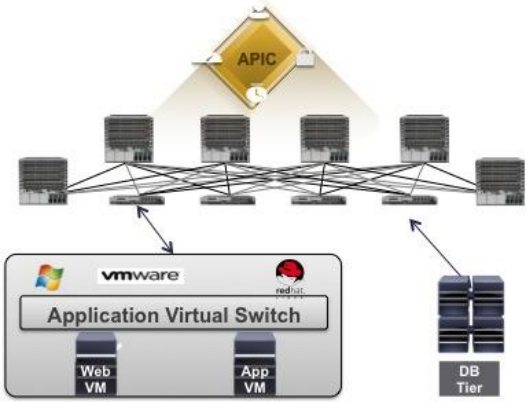
Cisco Nexus 1000V & Application Virtual Switch

Nexus 1000V

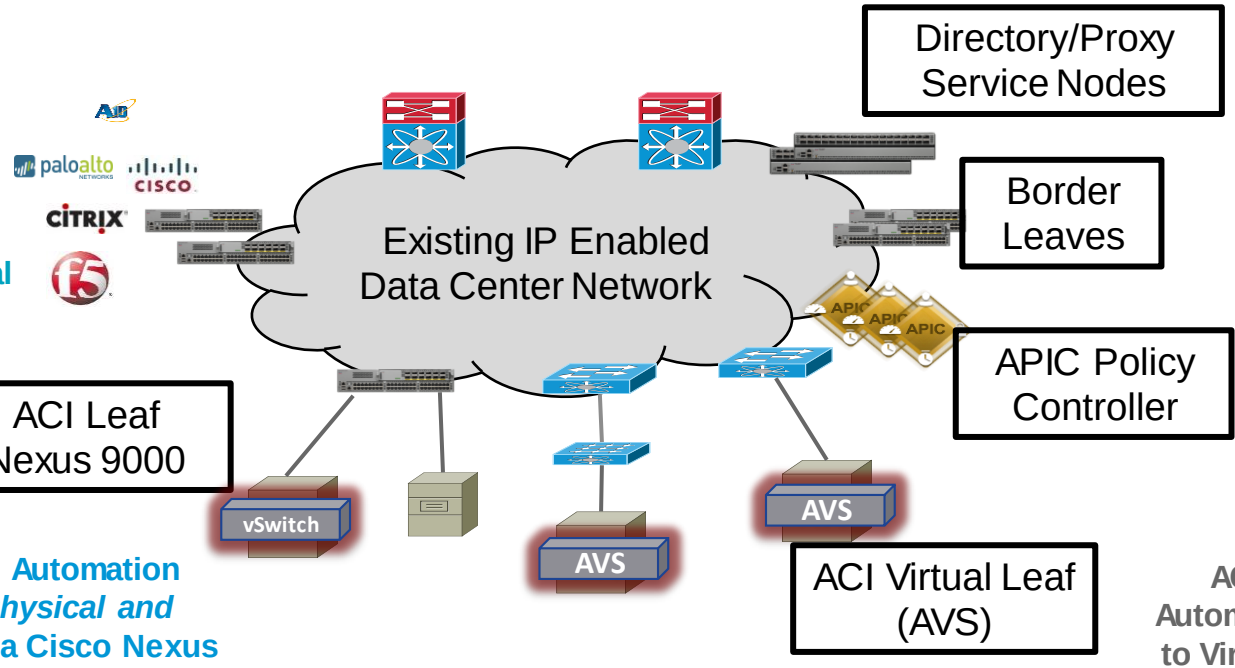
- Only virtual networking and services solution across multiple hypervisors
- Single point of management for virtual networking via VSM with integration to cloud management platforms (Cisco UCS Director, OpenStack, SCVMM, vCD etc)
- L4-L7 integrated via vPath
  - Firewall, Load Balancer, L3 services, WAN optimization, Network Monitoring
- Advanced edition includes distributed zone firewall (Virtual Security Gateway)
- Licensing : Licensed per CPU socket for advanced edition

Application Virtual Switch

- Purpose built ACI virtual leaf with OpFlex integration
- APIC specifies network policy for virtual and physical networks and does L4-L7 integration
- AVS does local switching/routing and provides distributed segmentation intra/inter EPG



Extending ACI to Current DC: Remote vLeaf support



ACI Enabled L4-7 Virtual and Physical Services (Existing and New)

ACI Services extended in to any existing IP enabled Data Center

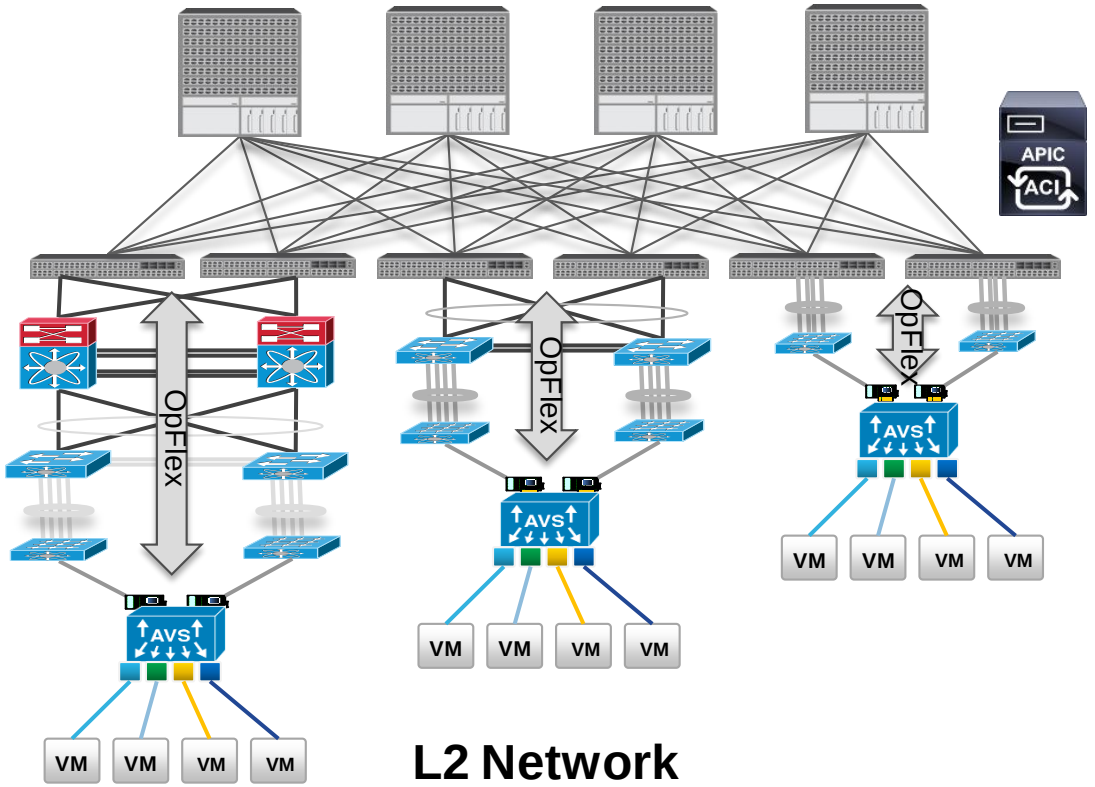
ACI Policy and Automation Extended to *Physical and Virtual Servers* via Cisco Nexus 9000

ACI Policy and Automation Extended to Virtual Servers via Cisco AVS

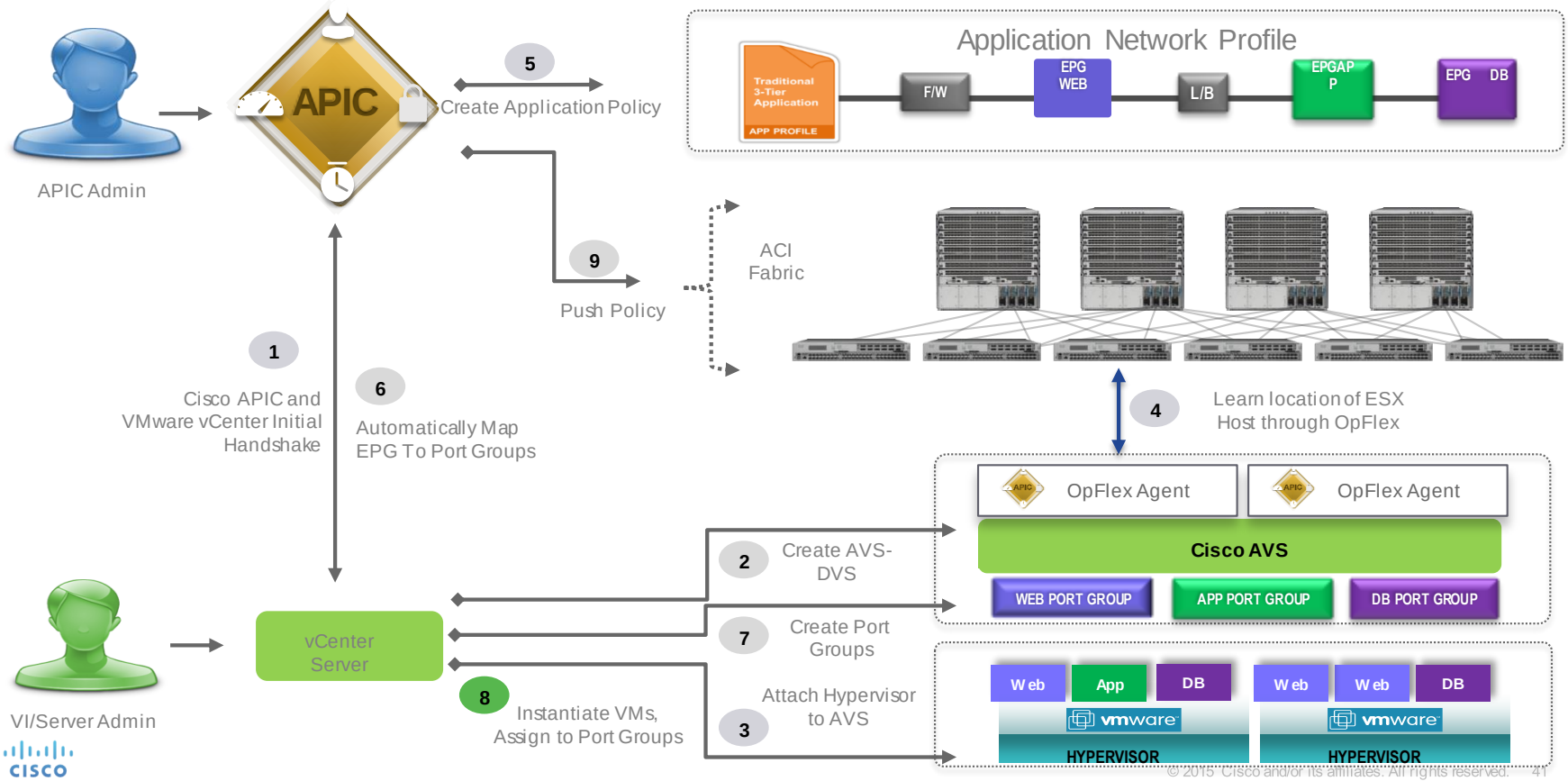
Extending ACI Policy and Automation into the Existing Data Center

AVS Makes Existing Switching Network ACI Enabled

- Supports a **Full Layer 2 Network (Nexus 7k/6k/5k/3k/2k/FI)** between Nexus 9k and AVS: Investment Protection
- VDS (VMware Distributed Switch) can only support a single L2 switch between N9k and VDS
  - Due to lack of OpFlex support
  - N2K with N5K/N6K/N7K/N9K considered one L2 switch
- Layer 2 network is required to support OpFlex bootstrapping in this phase



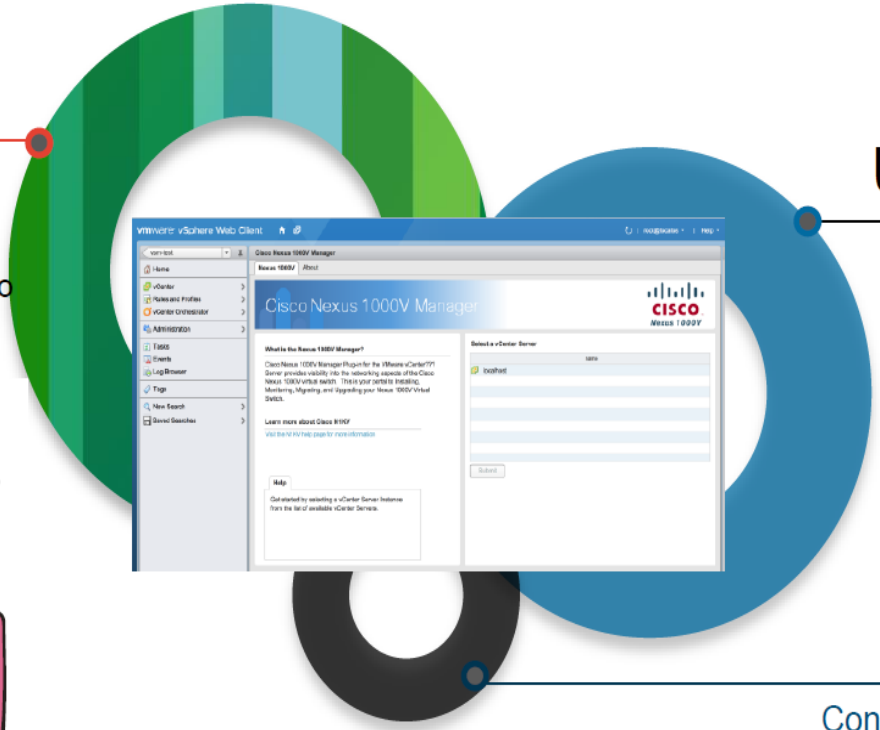
Cisco ACI Hypervisor Integration – Cisco AVS



Introducing Cisco VSUM

Install & Migrate

- Easily install the Nexus1000V & Cisco AVS using vCenter
- Smoothly migrate vSwitch/VDS to N1KV



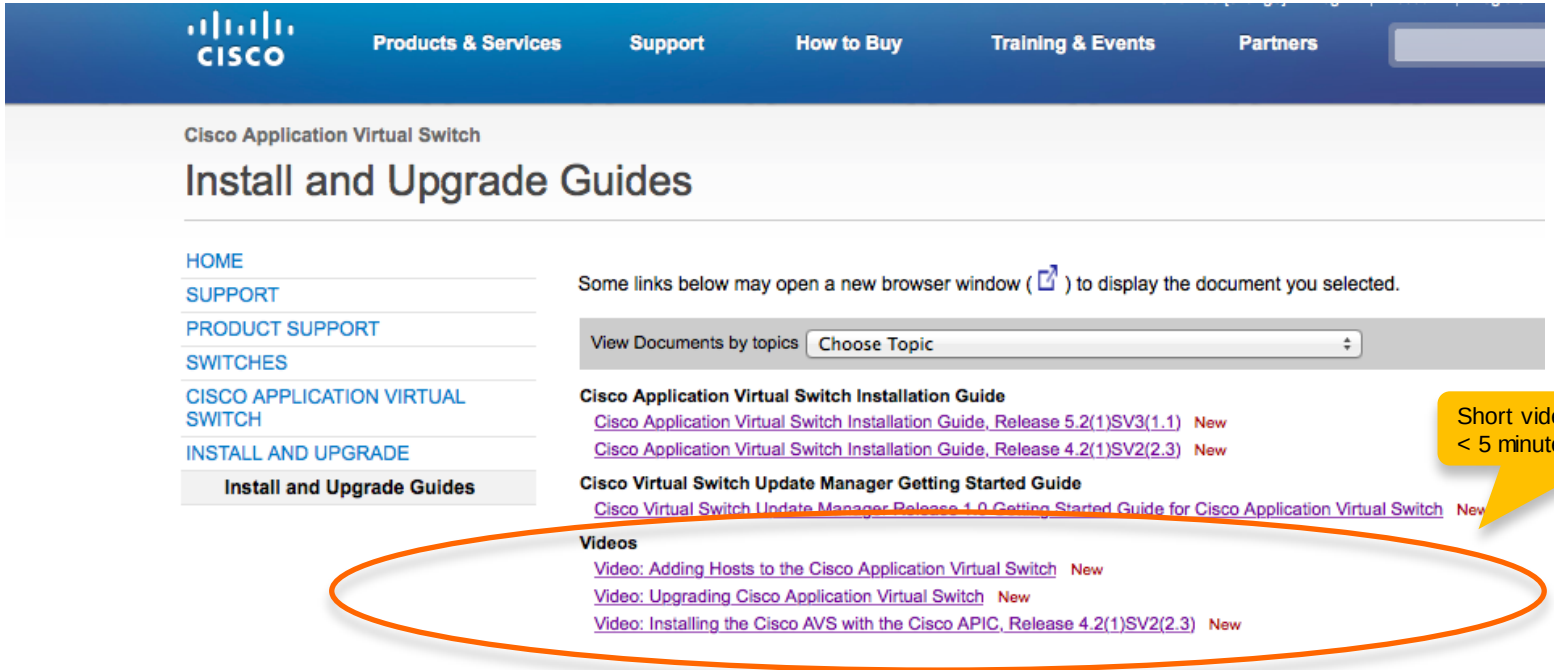
Upgrade & Monitor

- Upgrade the Nexus1000V and AVS(multiple hosts allowed).
- Easily monitor your virtual network.

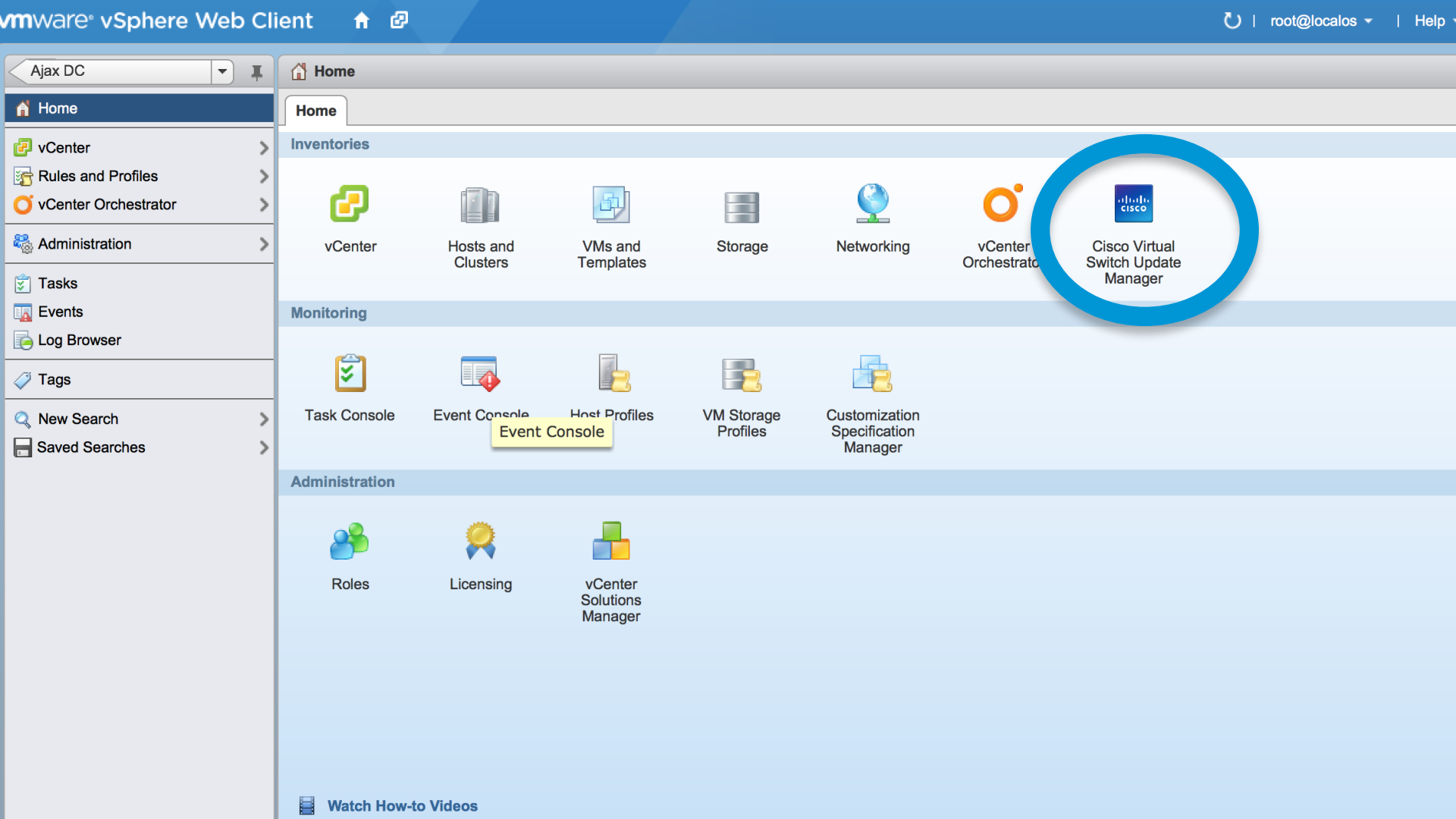
Configure*

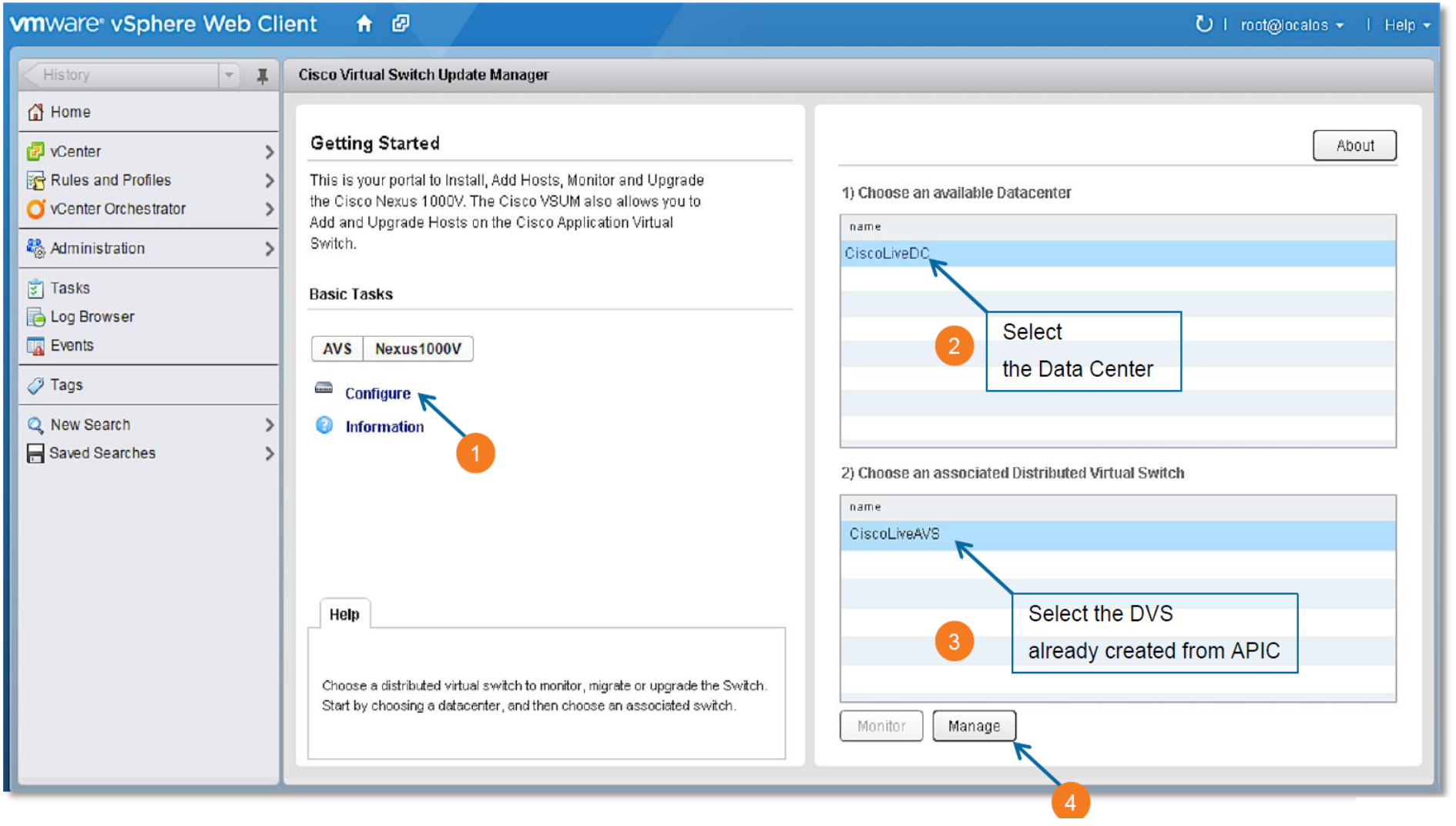
Configure and Manage Nexus1000V features and port-profil

Installation and upgrade made easier using Virtual Switch Update Manager (VSUM)

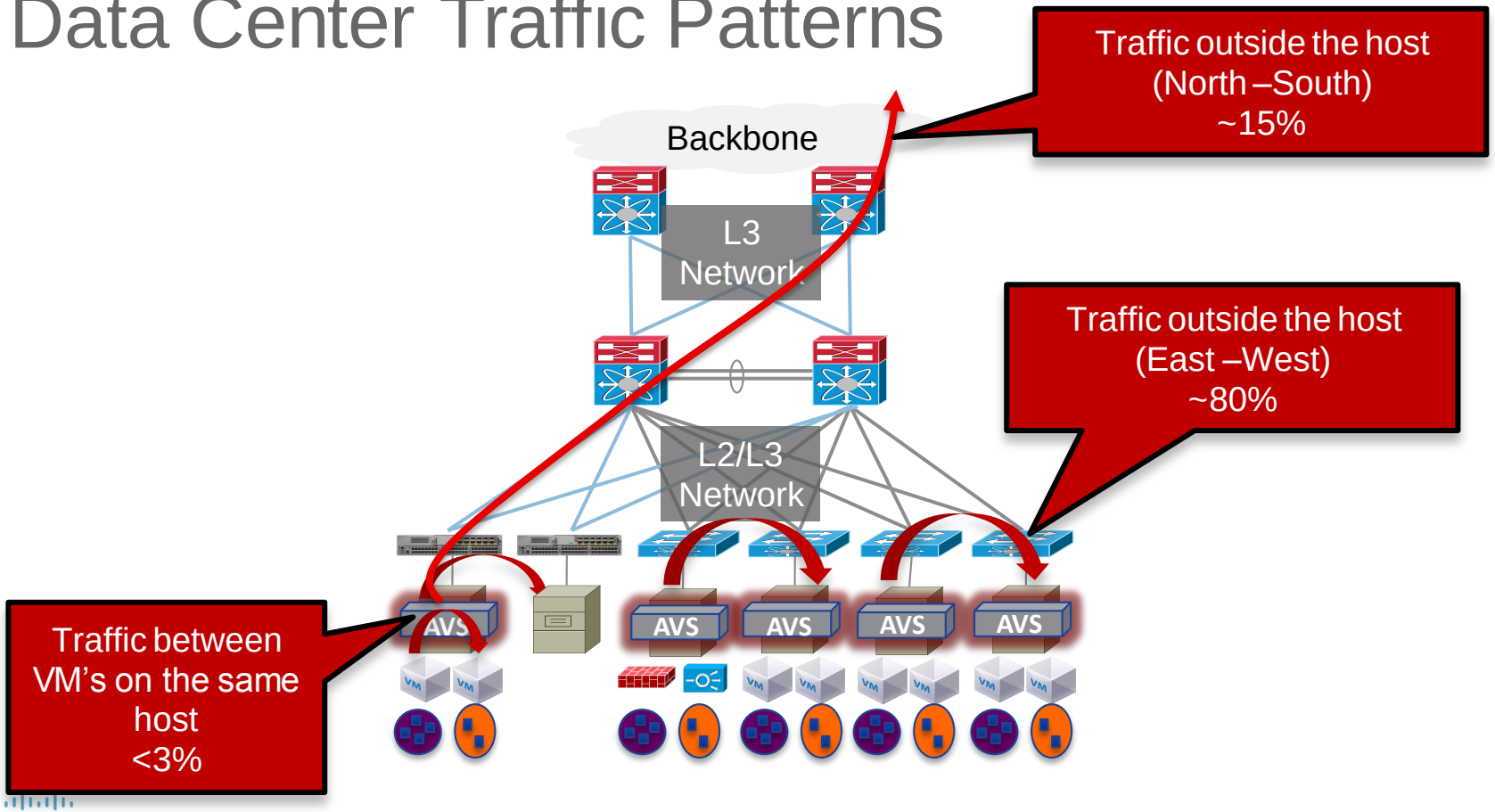


http://www.cisco.com/c/en/us/support/switches/application-virtual-switch/products-installation-guides-list.html


vmware vSphere Web Client
root@localos
Help
Ajax DC
Home
vCenter
Rules and Profiles
vCenter Orchestrator
Administration
Tasks
Events
Log Browser
Tags
New Search
Saved Searches
Home
Home
Inventories
vCenter
Hosts and Clusters
VMs and Templates
Storage
Networking
vCenter Orchestrato
Cisco Virtual Switch Update Manager
Monitoring
Task Console
Event Console
Host Profiles
VM Storage Profiles
Customization Specification Manager
Event Console
Administration
Roles
Licensing
vCenter Solutions Manager
Watch How-to Videos

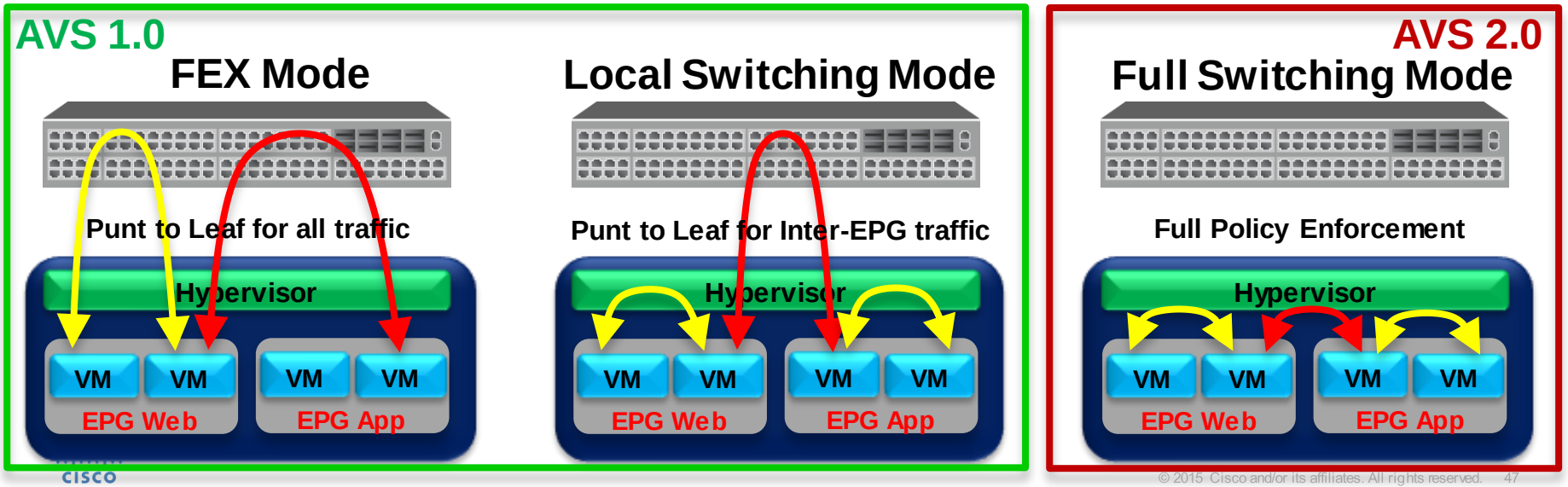

vmware vSphere Web Client
root@localos
Help
History
Home
vCenter
Rules and Profiles
vCenter Orchestrator
Administration
Tasks
Log Browser
Events
Tags
New Search
Saved Searches
Cisco Virtual Switch Update Manager
Getting Started
This is your portal to Install, Add Hosts, Monitor and Upgrade the Cisco Nexus 1000V. The Cisco VSUM also allows you to Add and Upgrade Hosts on the Cisco Application Virtual Switch.
Basic Tasks
AVS
Nexus1000V
Configure
Information
1
Help
Choose a distributed virtual switch to monitor, migrate or upgrade the Switch. Start by choosing a datacenter, and then choose an associated switch.
About
1) Choose an available Datacenter
name
CiscoLiveDC
2
Select
the Data Center
2) Choose an associated Distributed Virtual Switch
name
CiscoLiveAVS
3
Select the DVS
already created from APIC
Monitor
Manage
4

Data Center Traffic Patterns



Virtual Leaf Switching Modes

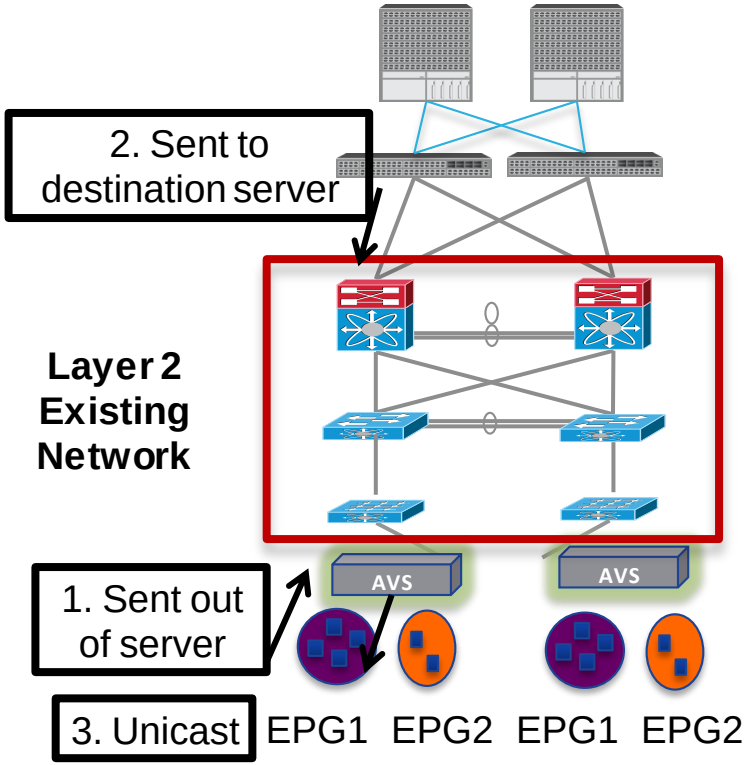
- FEX Mode: All traffic sent to Leaf for switching
- Local Switching (LS) Mode: Intra-EPGs traffic switched on the same host
- Full Switching (FS) Mode: Full APIC policy enforcement on server



AVS Packet Walk: FEX Mode

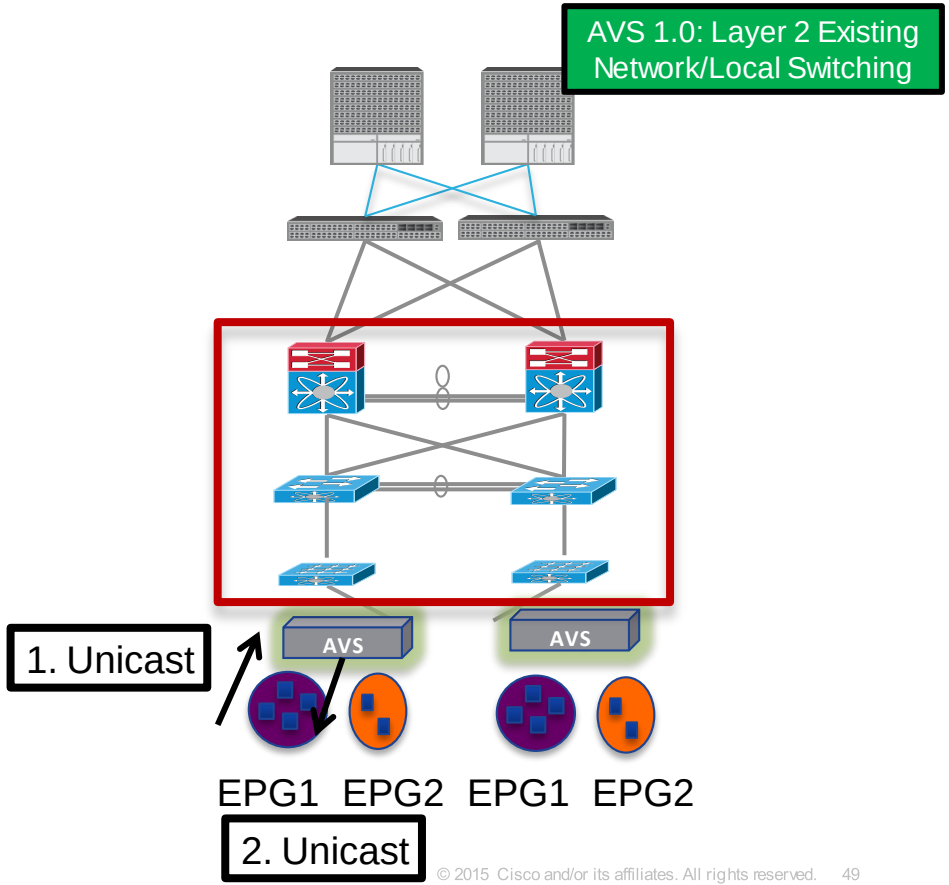
AVS 1.0: Layer 2 Existing Network/Local Switching

1. All traffic, within and between EPG, is sent to Leaf (only intra-EPG within same server shown in diagram as example)
2. All traffic traverse through the Existing Network
3. Leaf switch atomic counters for enhanced statistics



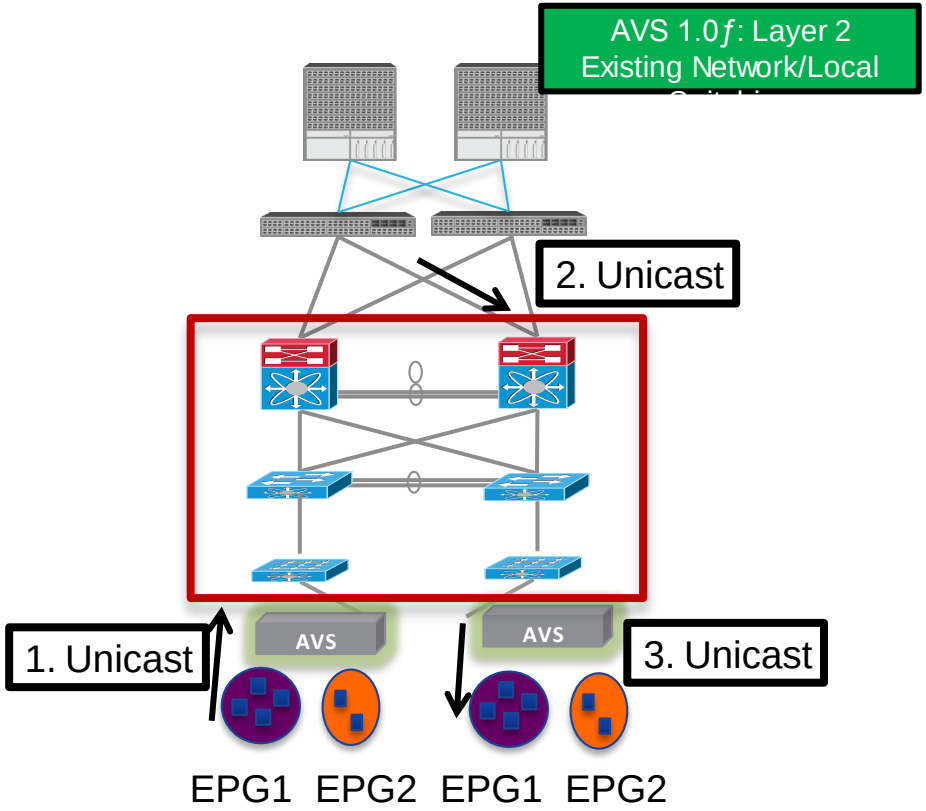
LS Packet Walk: Unicast within EPG within Server

1. VM in EPG1 starts unicast packet to VM
2. AVS unicasts packet to destination VM within the server



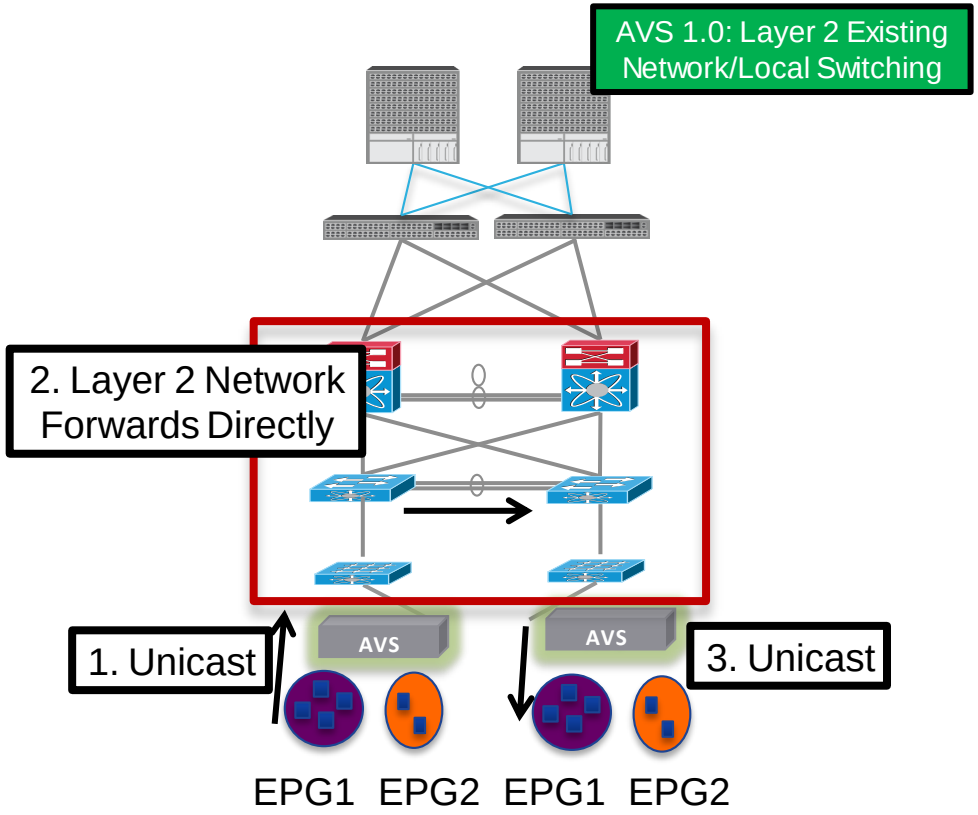
LS: Unicast within EPG Between Servers with VXLAN

1. VM in EPG1 starts unicast packet
2. Leaf decides to send unicast to other locations have EPG1
3. Unicast delivered to other VM in EPG1



LS: Unicast within EPG Between Servers with VLAN

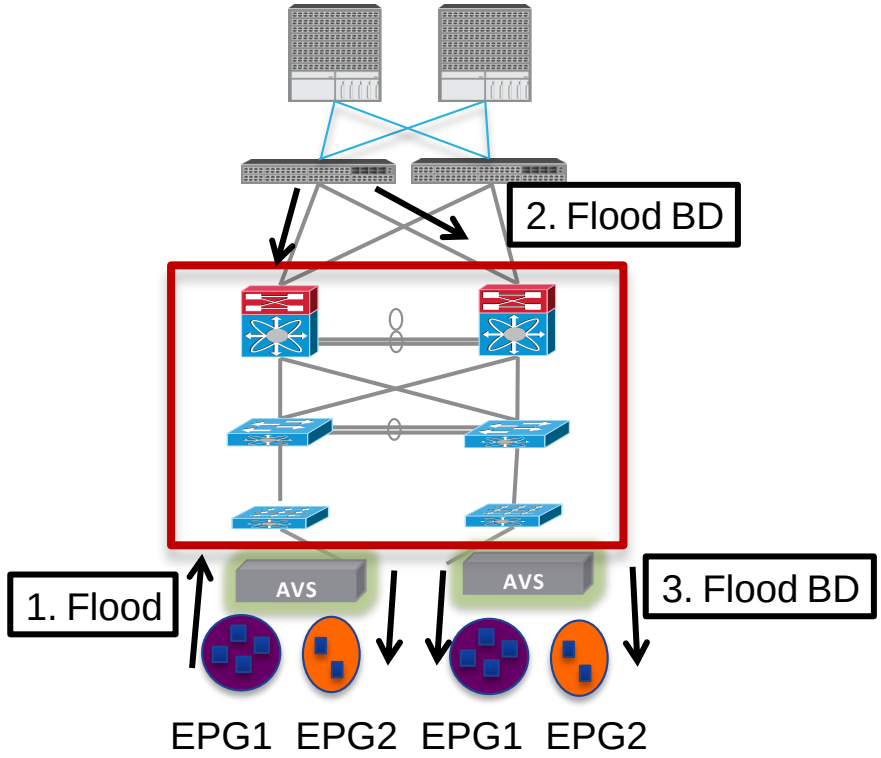
1. VM in EPG1 starts unicast packet
2. Layer 2 Network forwards directly
3. Unicast delivered to other VM in EPG1



LS Packet Walk: Flooding within EPG

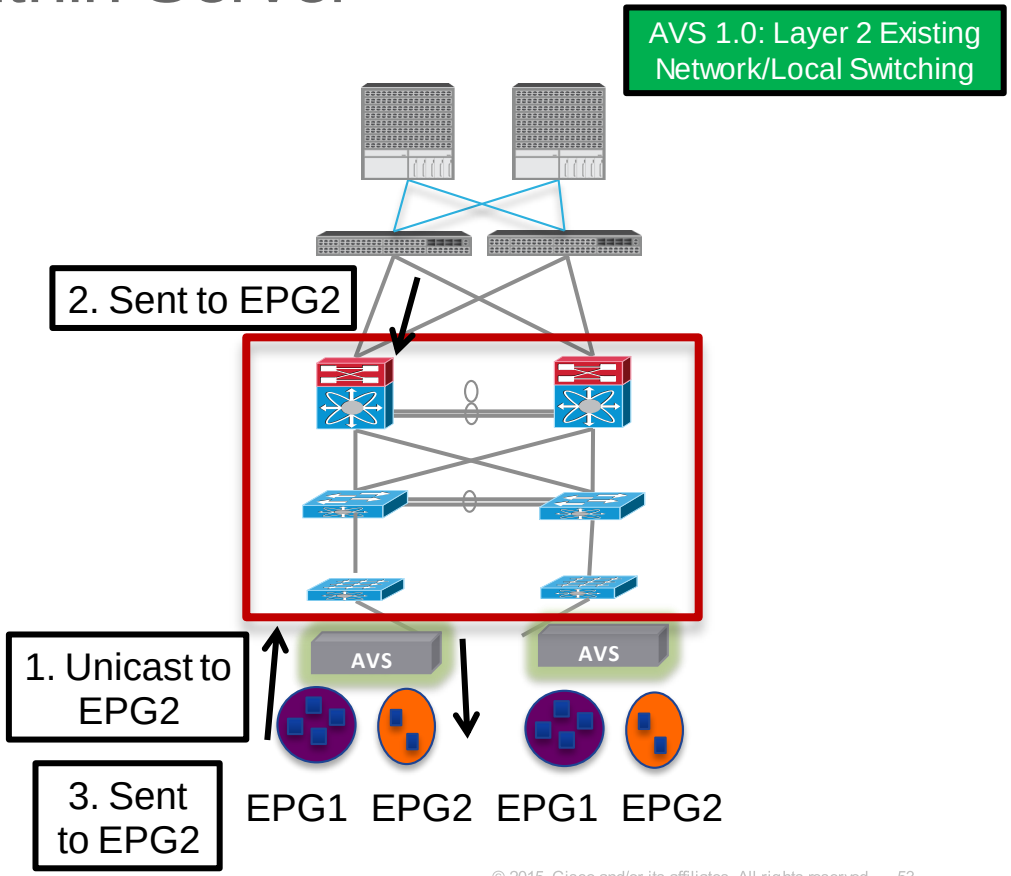
AVS 1.0: Layer 2 Existing Network/Local Switching

1. VM in EPG1 starts flooding packet, assuming BD is configured for flooding
2. Leaf decides to flood to all EPGs in the same BD
   - Needed just in case other EPGs are in other Leaves
3. Multicast packet is sent for each EPG



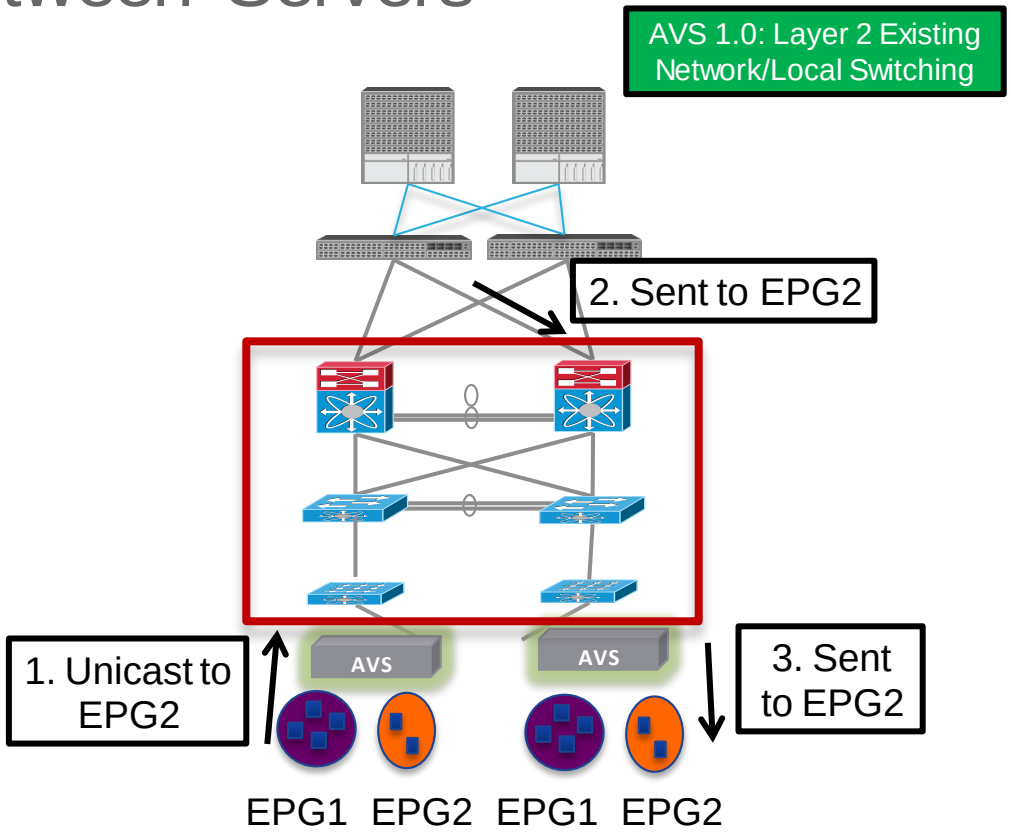
LS: Inter-EPG Traffic Within Server

1. VM in EPG1 unicast packet to VM in EPG2 on the same server
2. Leaf decides to send packet back to same link
3. VMs in EPG2 receives unicast



LS: Inter-EPG Traffic Between Servers

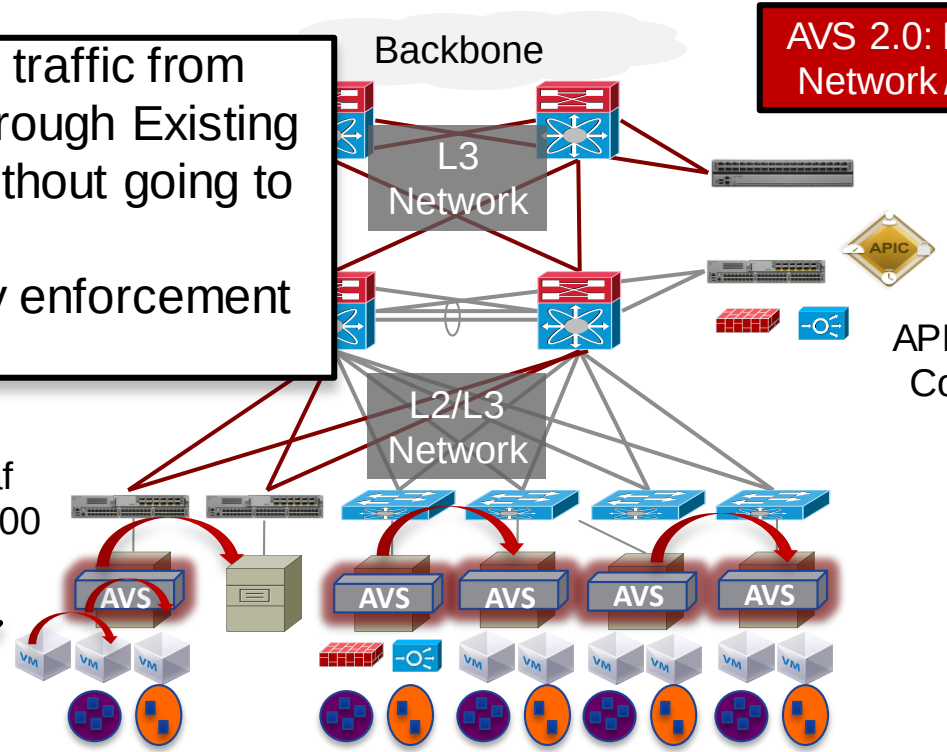
1. VM in EPG1 unicast packet to VM in EPG2
2. Leaf decides to send packet to multiple links
3. VMs in EPG2 receives unicast
    1. NOTE: Same behavior for VLAN and VXLAN



Optimal Forwarding of Intra & Inter EPG Traffic

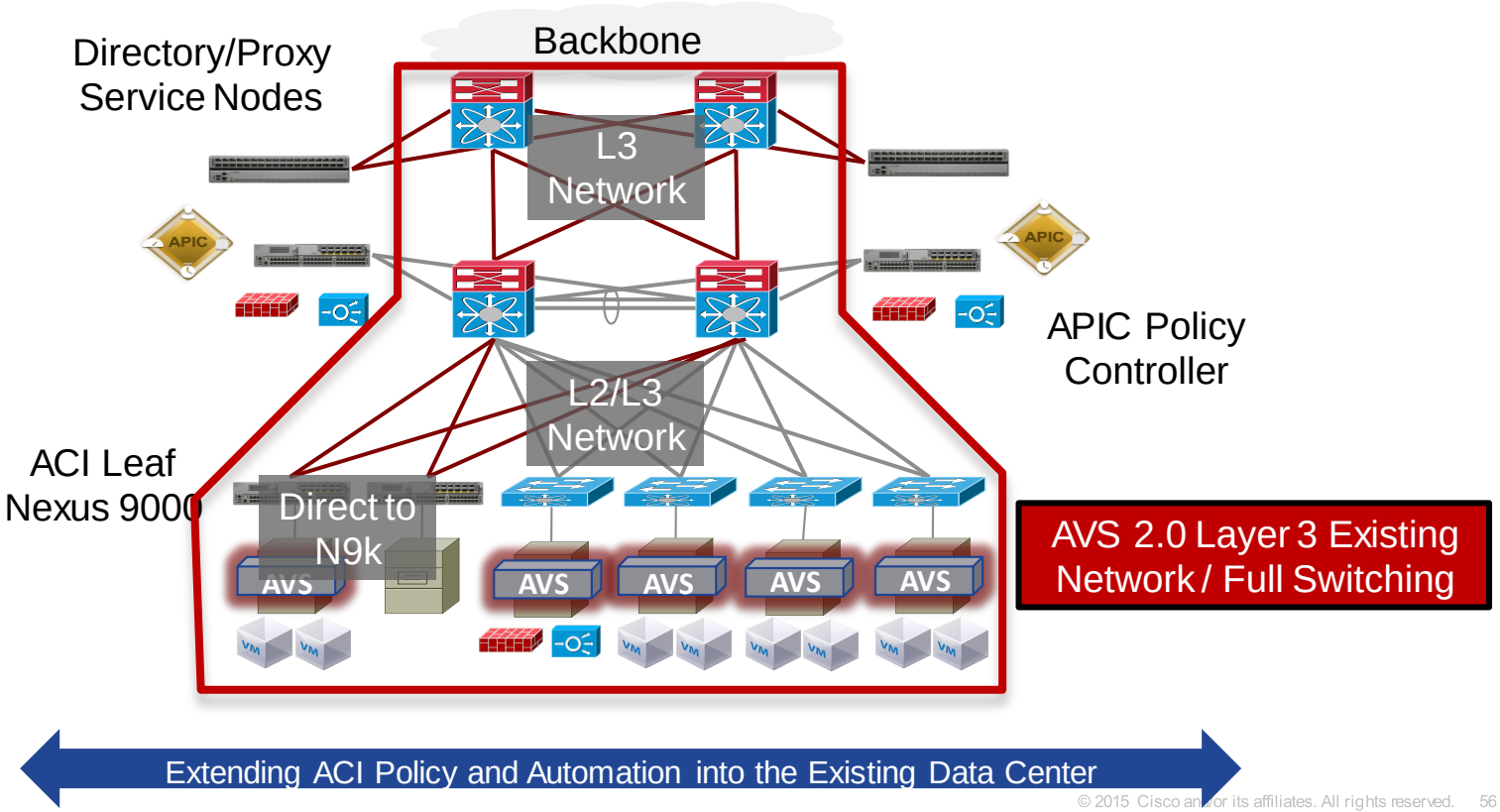
- Intra- and Inter-EPG traffic from AVS goes directly through Existing L3 & L2 Networks without going to Leaf
- Full Inter-EPG policy enforcement within server

AVS 2.0: Layer 3 Existing Network / Full Switching



Optimal Forwarding of Intra- and Inter-EPG Traffic through Existing Network

Extending ACI to Current DC with Full Switching



SUMMARY

- Application Virtual Switch extends application policy into the virtual environments of ACI.
- ACI supports hypervisor native virtual switches and Cisco Application Virtual Switch (AVS)
- AVS also extend ACI to existing data center for physical and virtual workloads
- Application Virtual Switch provides investment protection and advanced ACI Virtual Leaf capabilities

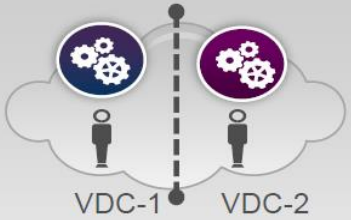
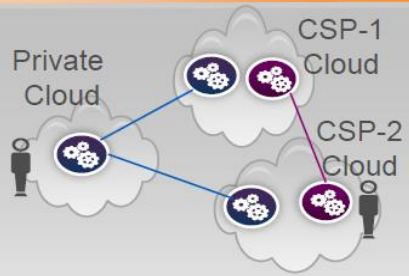
Polling Question 3

Is it possible to move Virtual Workloads across the clouds?

a. Yes

b. No

Consistency Across Physical – Virtual – Cloud(s)

PHYSICAL	VIRTUAL	CLOUD	HYBRID CLOUD
			
• One app per Server • Static • Manual provisioning	• Many apps per Server • Mobile • Dynamic provisioning	• Multi-tenant per Server • Elastic • Automated Scaling	• Cross-Cloud Mobility • Flexible – Anywhere, Anytime • Service-centric Provisioning

CONSISTENCY: Policy, Features, Security, Management, Separation of Duties

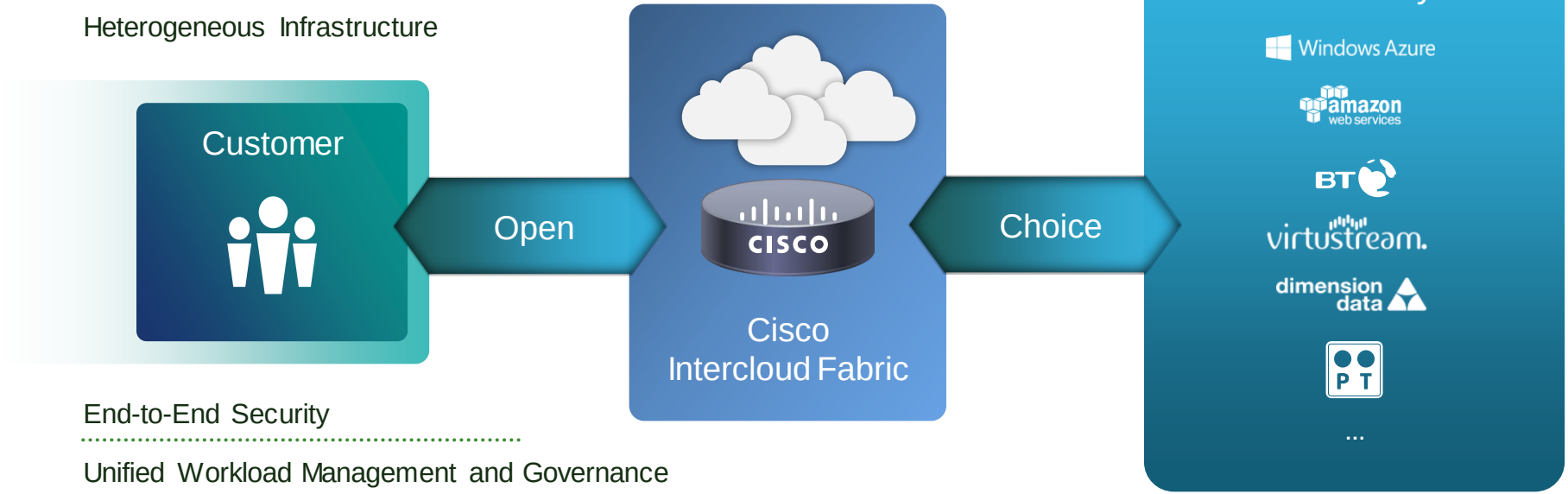
Switching	**Nexus 9K/7K/5K/3K/2K**	**Nexus 1000V, Application Virtual Switch**
Routing	**ASR, ISR**	**Cloud Services Router (CSR 1000V)**
Services	**WAAS, ASA, NAM, NetScaler**	**vWAAS, VSG, ASA 1000V, vNAM, NetScaler 1000V**

Cisco's Hybrid Cloud Approach

No Vendor Lock-In

Any Hypervisor to Any Provider

Heterogeneous Infrastructure



End-to-End Security

Unified Workload Management and Governance

Workload Mobility Across Clouds

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PRESS RELEASE

Cisco Adds Over 30 Intercloud Partners, Including Deutsche Telekom, BT, NTT DATA & Equinix; Expands Reach with 250 New Data Centers in 50 Countries

Cisco Introduces Hybrid Cloud Bundles, Ships Cisco Intercloud Fabric, and Commits $1 Billion in Cloud Financing

SAN JOSE, Calif. – September 29, 2014 – Cisco today

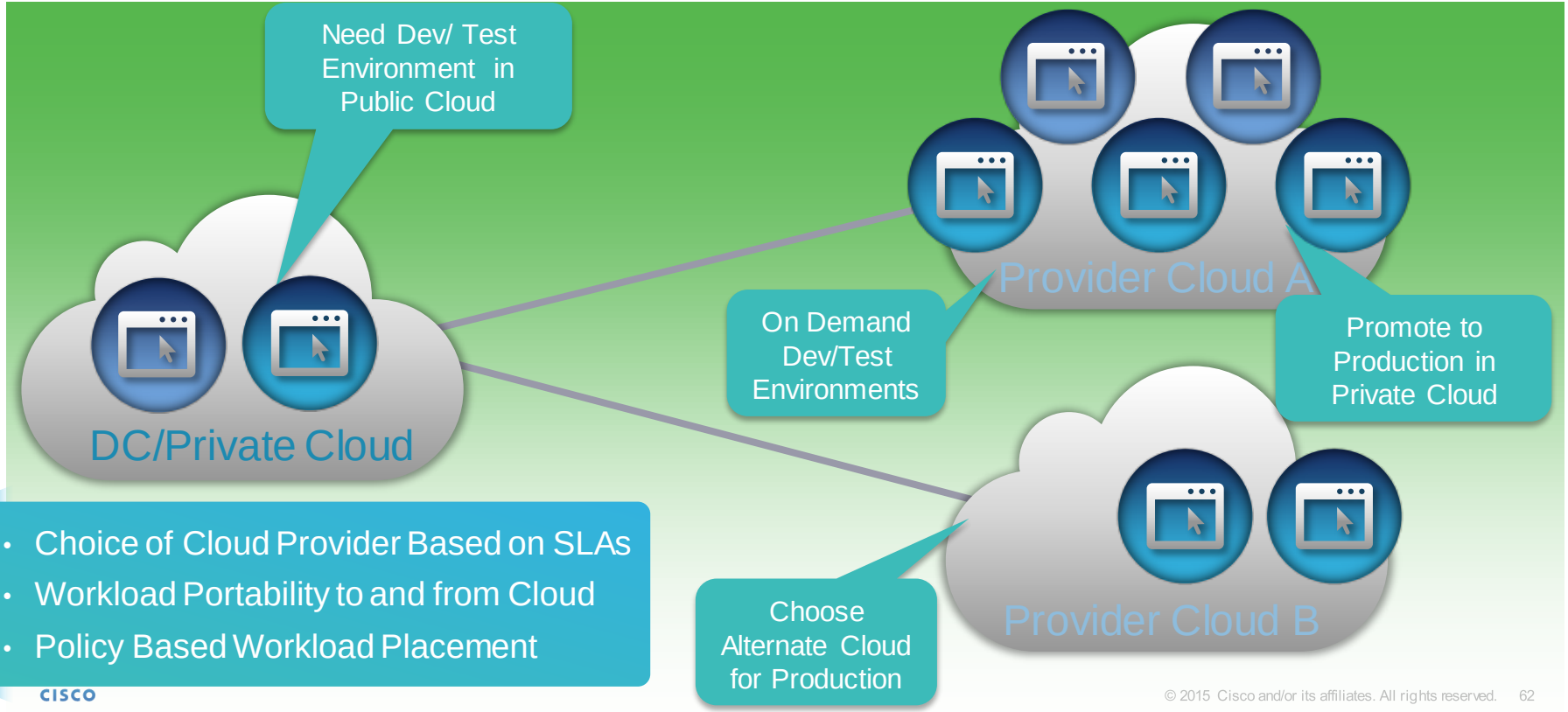
Building Momentum with Current Intercloud Partners

Cisco continues to build momentum with existing Intercloud partners, including Dimension Data, Johnson Controls, Sungard Availability Services, Telstra, NetApp, Red Hat and VCE. Highlights include:

- Telstra, which became Cisco's first Intercloud partner in March 2014, recently announced the expansion of its Cisco Cloud Services capability beyond Australia to Hong Kong and Singapore, leading the way in providing customers with choice across private and public clouds with the flexibility in how to consume them.
- Dimension Data and Cisco are partnering to deliver a hybrid cloud solution for customers and resellers that will combine IaaS with Cisco technology and software-as-a-service (SaaS) applications.
- Sungard Availability Services is using its cloud infrastructure to deliver new Cisco Powered cloud services to customers and resellers. It recently became the first service provider globally to deploy the Cisco APIC Controller to drive cloud services.
- Red Hat recently announced it is teaming with Cisco to deliver an OpenStack-based integrated infrastructure solution. The new solution will support Cisco ACI to deliver an on-ramp to the Intercloud for enterprise and mid-market customers.

Intercloud Fabric Enabling Dev/ Test Use Case

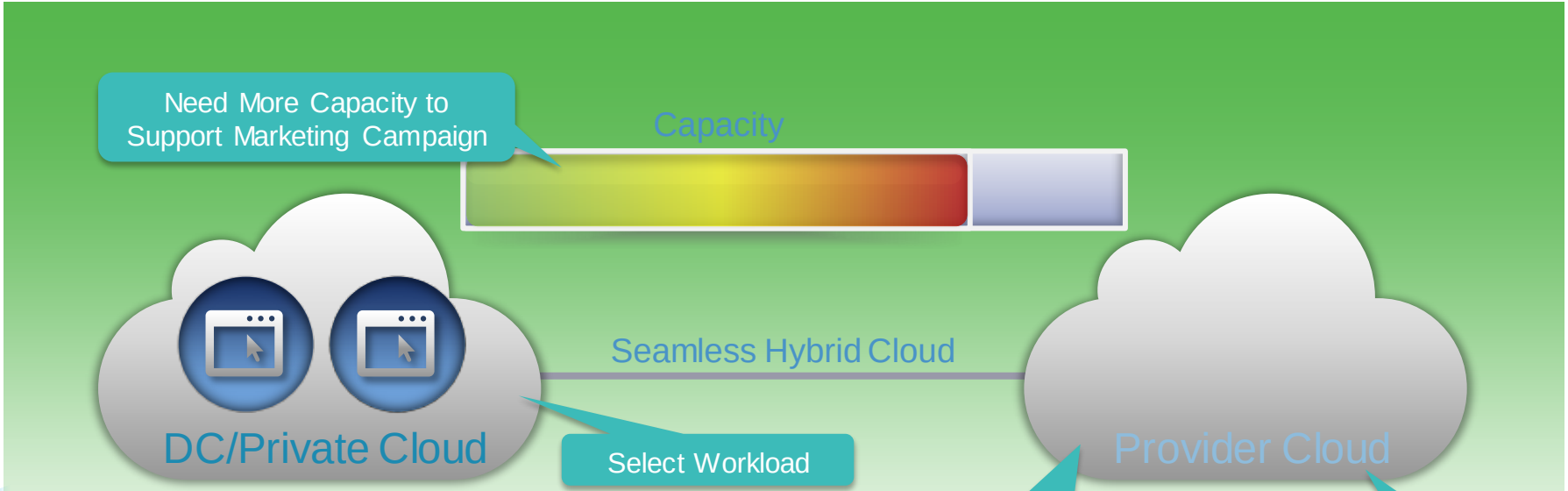
Online Gaming Company Needs Faster Access to Resources to Test New Games



- Choice of Cloud Provider Based on SLAs
- Workload Portability to and from Cloud
- Policy Based Workload Placement

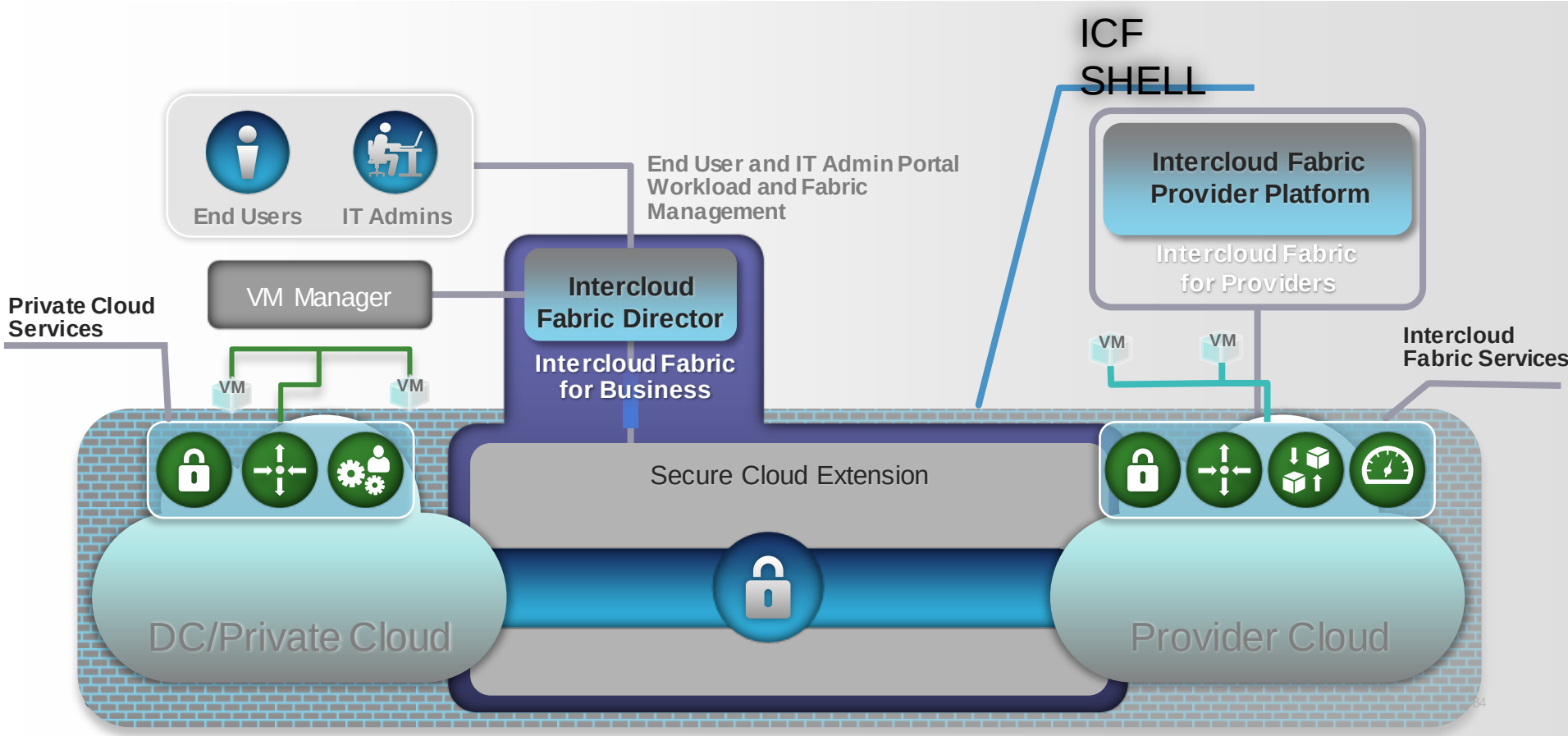
Intercloud Fabric Enables Capacity Augmentation

Marketing Company Needs Resources to Run Time Sensitive Web Campaign

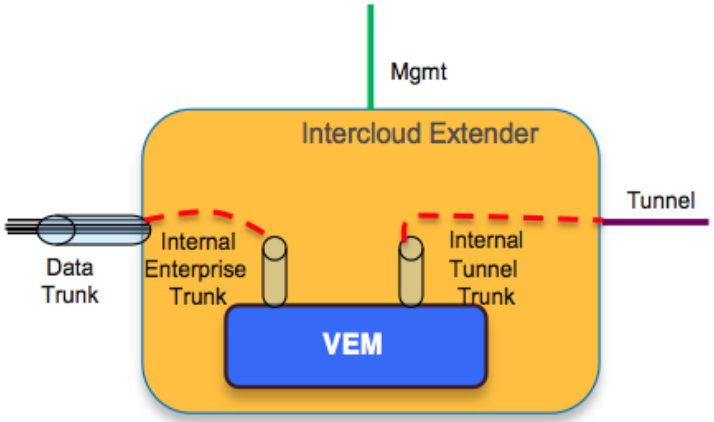


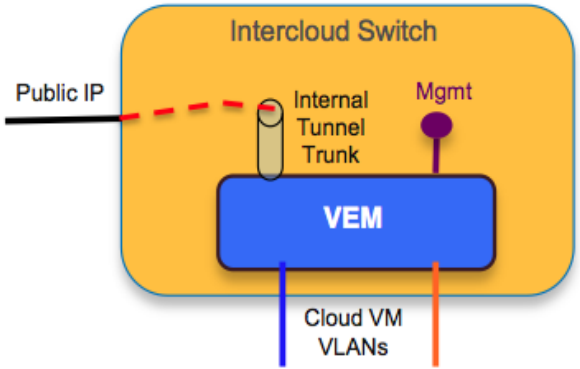
- Elastic Capacity
- Secure and Policy Driven
- No data migration necessary

Cisco Intercloud Fabric Architectural View



Intercloud Extender and Intercloud Switch Interfaces





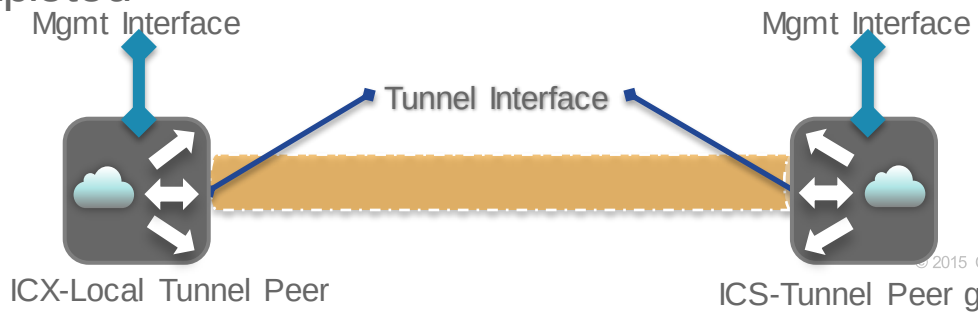
- Management Interface – Used for communication with Intercloud Fabric Director. Can also be used as secure tunnel endpoint
- Tunnel interface – Can be used for secure tunnel to Intercloud Switch
- Trunk interface – Enterprise trunk allowing all VLANs that are being extended

- Management Interface – Used for communication with Intercloud Fabric Director and Intercloud Fabric Extender.
- Public interface – Provider interface with public IP.
- Cloud VM interfaces – Cloud VMs on VLANs extended from the enterprise

Site to Site Communications :: How it happens

Secure Cloud Extension

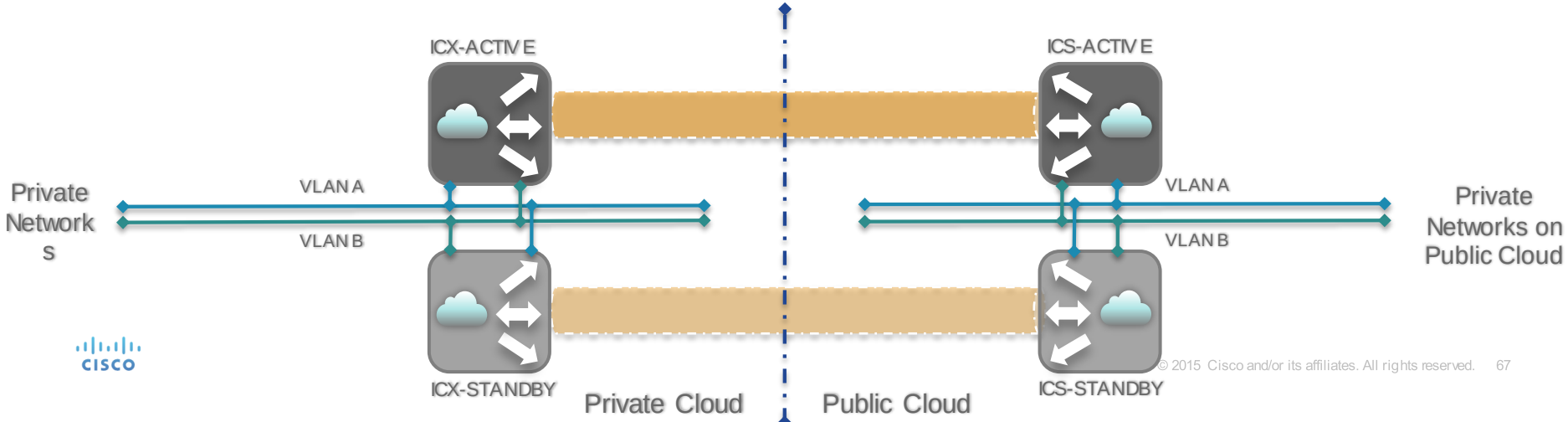
1. ICX and ICS are installed. Control connection is established to each
2. ICX is initialized – receives ICS peer config
3. ICS is initialized – receives ICX peer config
4. Control connection is established between ICX and ICS
5. Tunnel connections are established (control and data)
6. Heartbeat and handshake process are initialized (HA mode)
7. Peers Exchange HA State
8. Deployment is completed



Site to Site Communications:: HA

Secure Cloud Extension

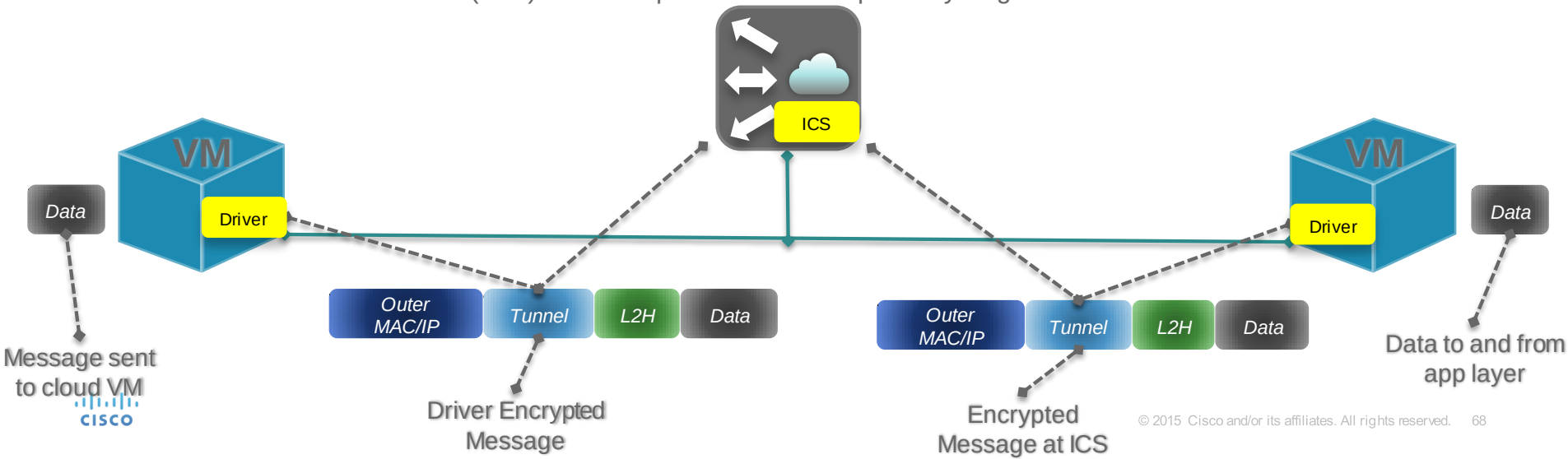
- Redundancy is offered on site to site connection
  - Both ICX and ICS offer redundant peers
  - Operation is active-standby
- The HA mechanism leverages a handshake and heartbeat process
  - A handshake to acknowledge initial state (initial role selected at configuration time)
  - A heartbeat to determine ongoing state and trigger switchover



Driver :: Functional Capabilities

❖ Driver Functions

- To control mgmt plane functions: keep the tunnel health
- To control data plane functions: establish tunnels and send/receive traffic
- Encapsulate / decapsulate traffic to and from cloud VMs
- Driver allows tunneled traffic (data) & control plane traffic :: drops everything else



Intercloud Fabric Deployment Requirements

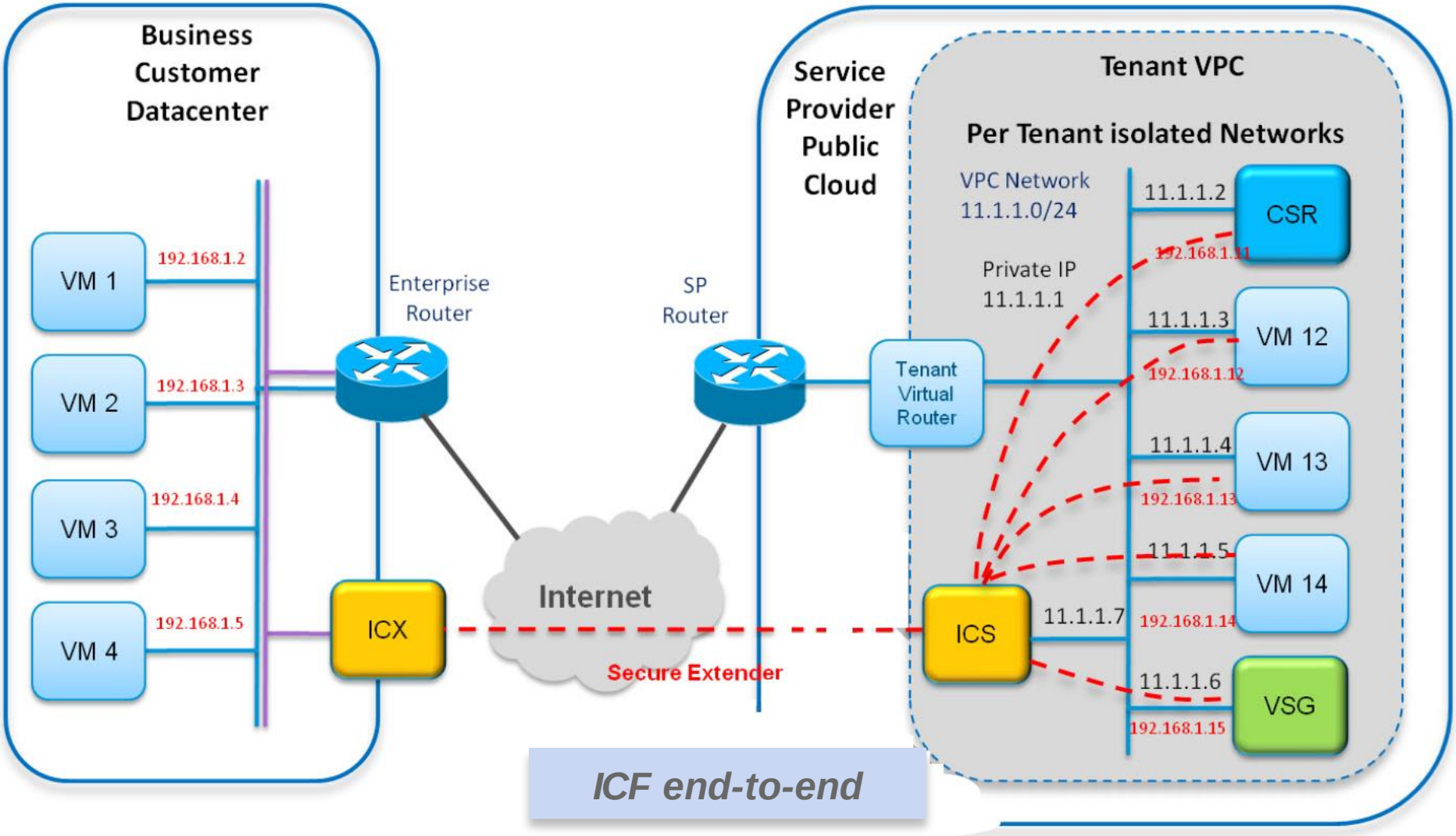
Internet Router/Firewall must allow outbound/inbound traffic originating from enterprise network to the range of provider IP addresses for the following protocols and ports:

Protocols/ports in Use

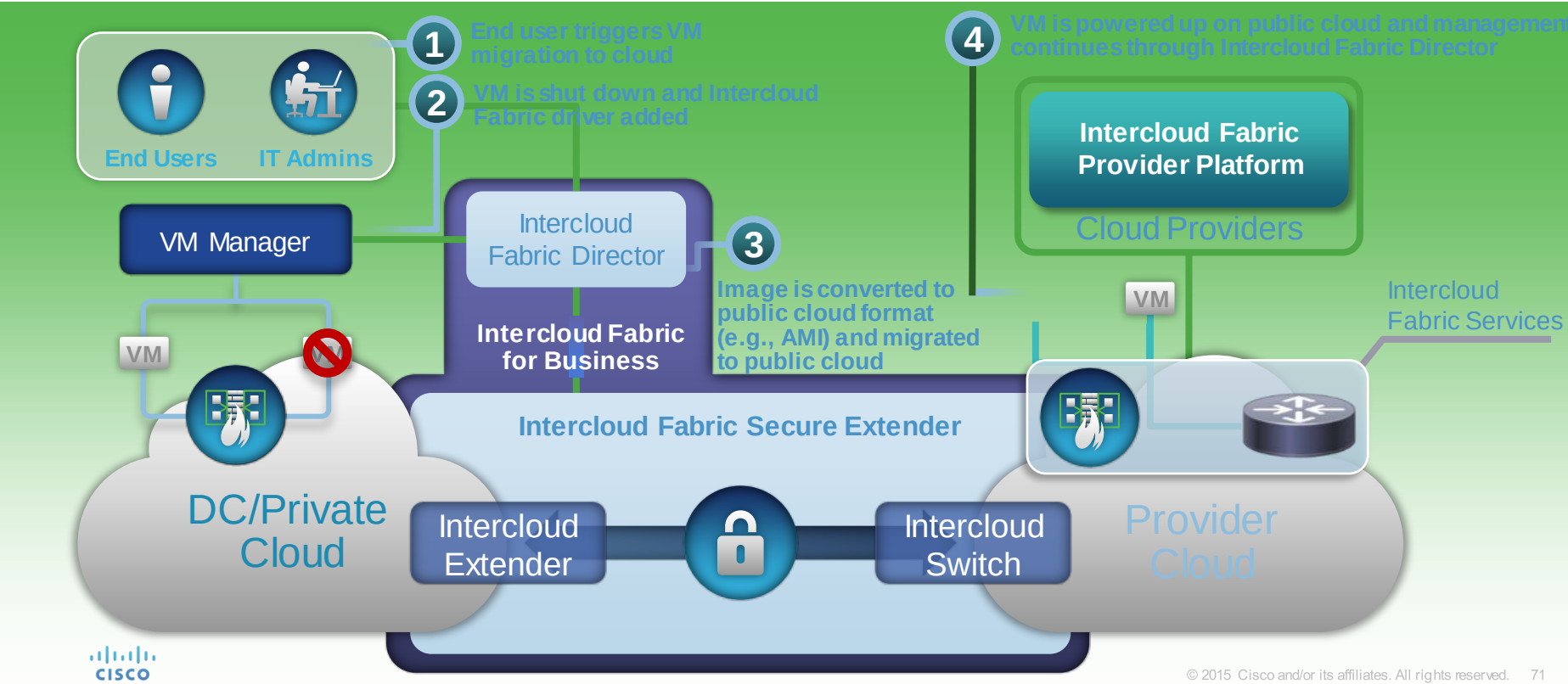
- 80 – HTTP access for AWS calls and communicating with InterCloud VMs in provider cloud
- 443 – HTTPS access for AWS calls and communicating with InterCloud VMs in provider cloud
- 22 – SSH to InterCloud VMs in provider cloud
- UDP 6644 – TLS data tunnel (if UDP is used for transport)
- TCP 6646 – TLS data tunnel (if TCP is used for transport) – added as a choice given enterprise rules
- TCP 6644 – TLS control tunnel

Other Protocols in use

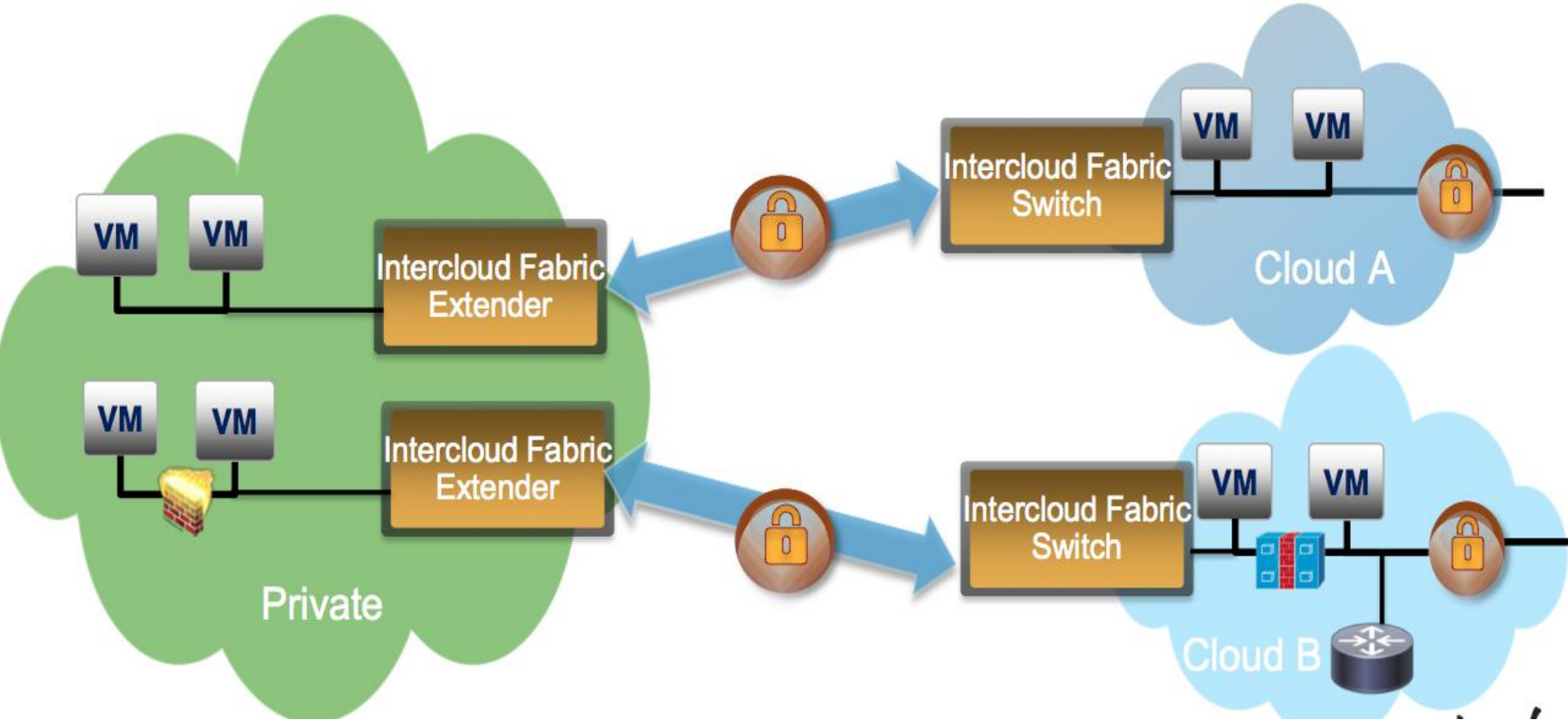
- ICX to ICX messages: UDP port 9984


Business
Customer
Datacenter
VM 1
192.168.1.2
VM 2
192.168.1.3
VM 3
192.168.1.4
VM 4
192.168.1.5
Enterprise
Router
ICX
Internet
Secure Extender
SP
Router
Service
Provider
Public
Cloud
Tenant VPC
Per Tenant isolated Networks
VPC Network
11.1.1.0/24
Private IP
11.1.1.1
Tenant
Virtual
Router
ICS
11.1.1.2
CSR
192.168.1.11
11.1.1.3
VM 12
192.168.1.12
11.1.1.4
VM 13
192.168.1.13
11.1.1.5
VM 14
192.168.1.14
11.1.1.7
11.1.1.6
VSG
192.168.1.15
ICF end-to-end

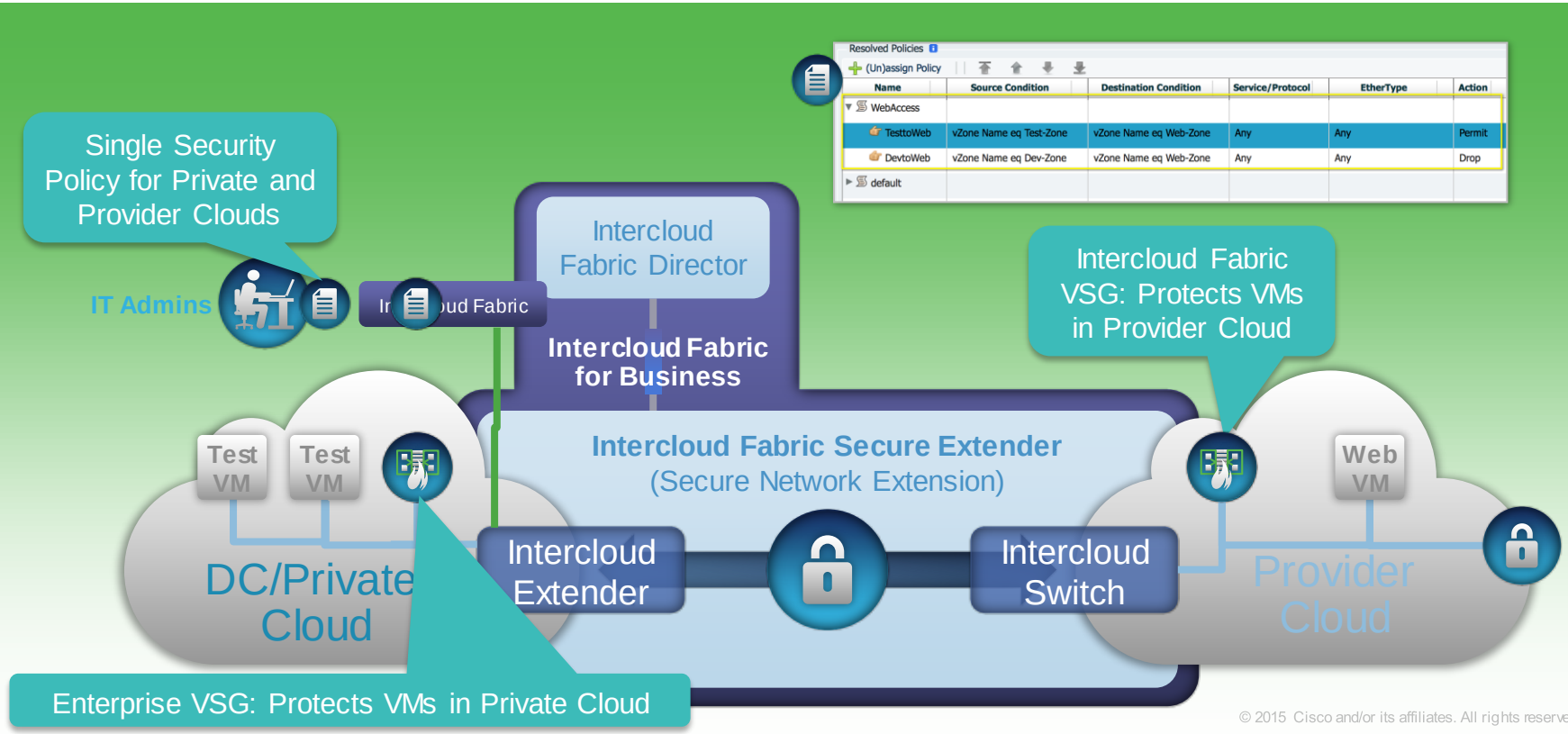
VM Portability: Migration Across Hybrid Cloud



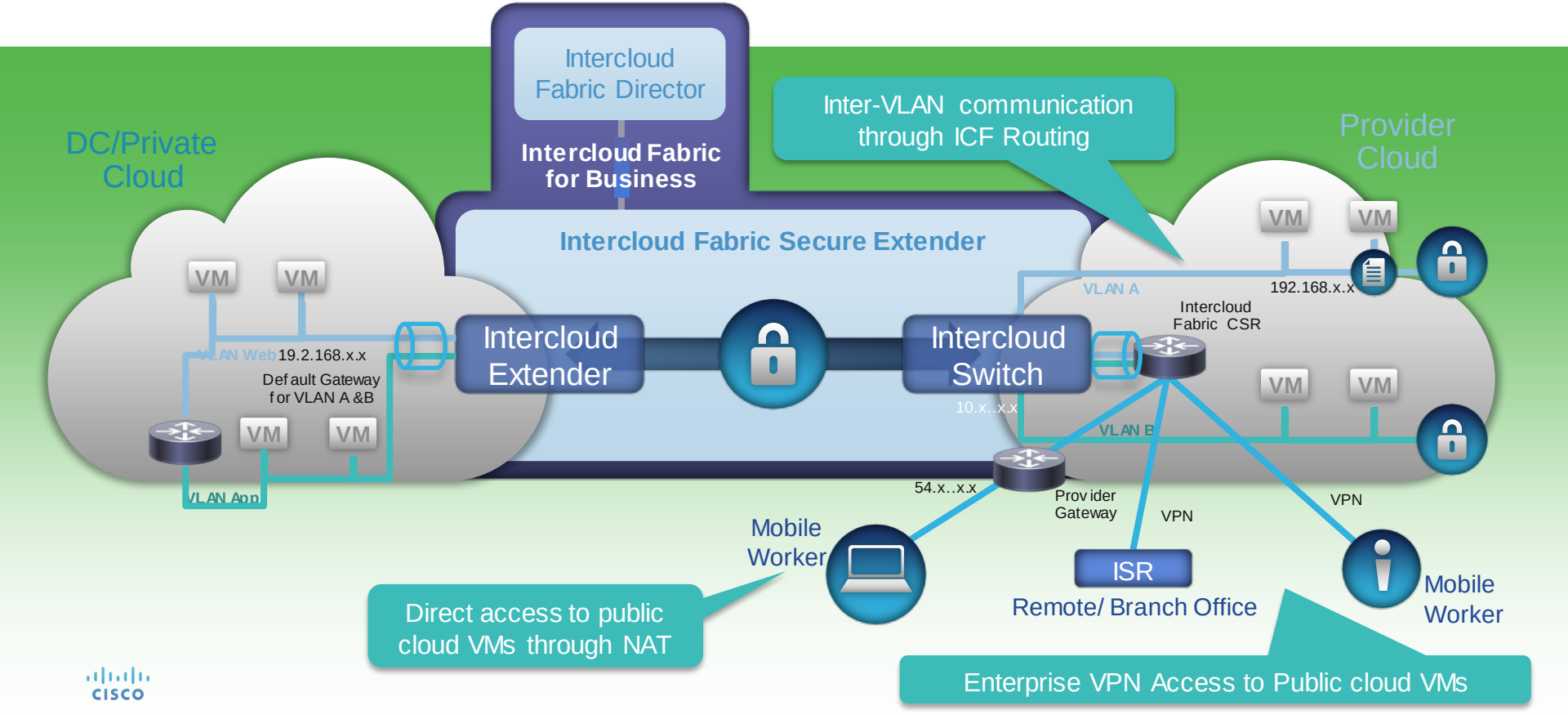
Intercloud Fabric Extender – Connecting to multiple clouds



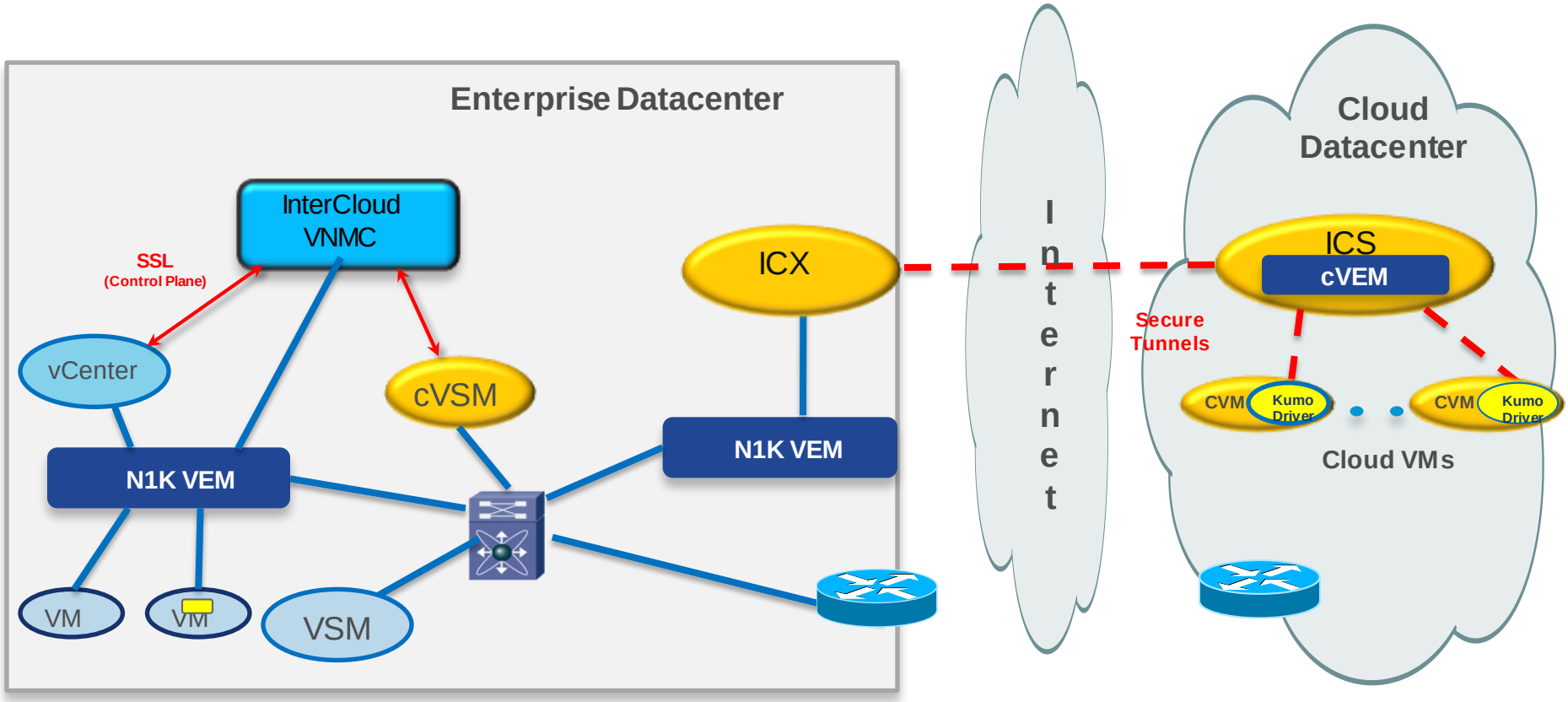
Core Services: Firewalling/Zoning



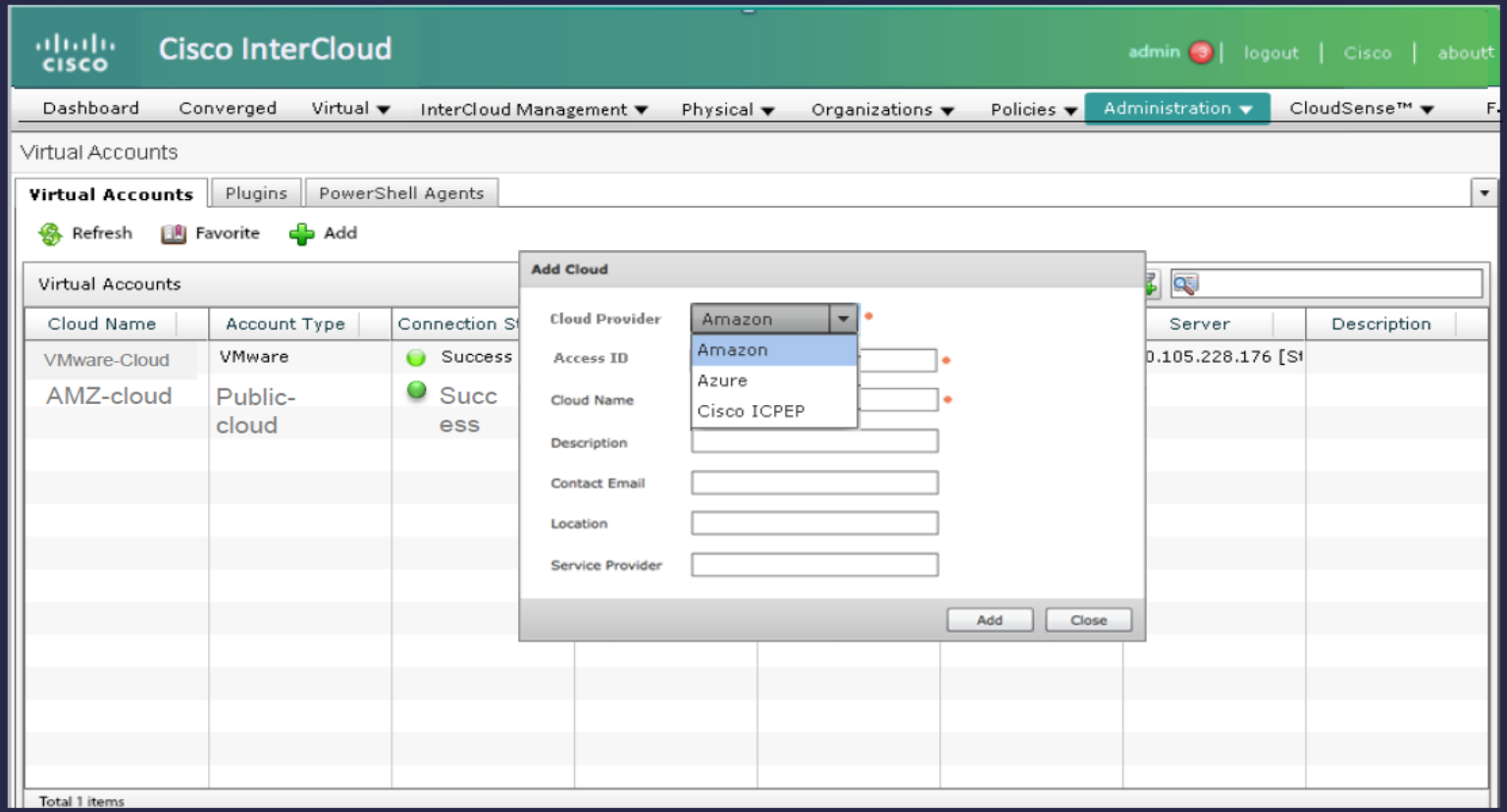
Core Services: Routing Across Hybrid Cloud



Packet Flow: VM → ICX → ICS → CVM



Easy Hybrid Cloud Setup and Consumption



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Cisco Intercloud Fabric Getting Started Guide, Release 2.1.2 New

Videos and Workflows

Cisco Intercloud Fabric Installation Workflow, Release 2.1.2 New
Video: Cisco Intercloud Fabric - Installing Intercloud Fabric Using OVA New
Video: Cisco Intercloud Fabric - Installing Intercloud Fabric License
Video: Cisco Intercloud Fabric - Installing Intercloud Fabric Infrastructure Components
Video: Cisco Intercloud Fabric - Creating an Intercloud Fabric Cloud New
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Video: Cisco Intercloud Fabric - Assigning a Virtual Machine to a Private VDC
Video: Cisco Intercloud Fabric - Migrating a VM to Intercloud Fabric Cloud New
Video: Cisco Intercloud Fabric - Migrating a VM to the Enterprise

Cisco Intercloud Fabric Installation Workflow, Release 2.1.2

The following installation workflow describes the information and actions that you must take in order to implement a functioning Cisco Intercloud Fabric.

1. **Installing Intercloud Fabric Director Using OVA** [Show]

2. **Installing Intercloud Fabric License** [Show]

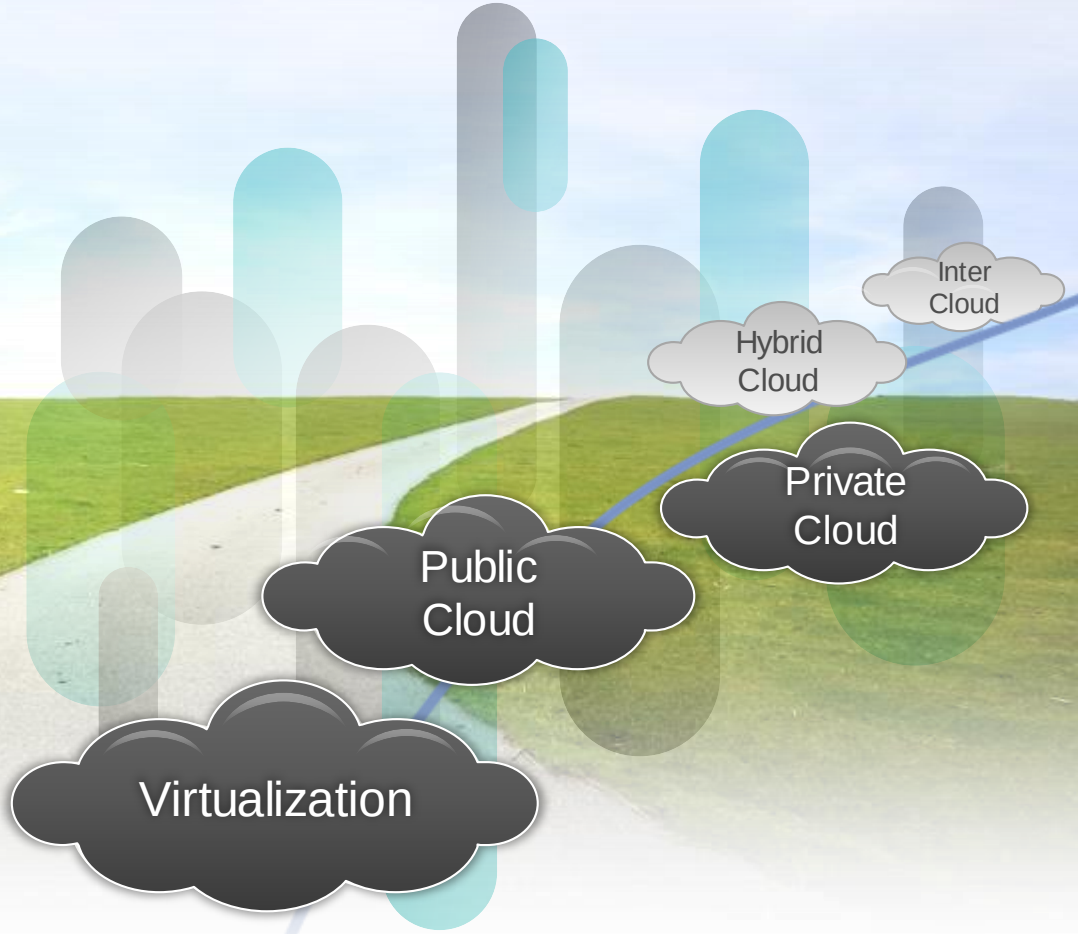
3. **Installing Intercloud Fabric Infrastructure Components** [Show]

4. **Creating Intercloud Fabric Cloud and Enabling Services** [Show]

5. **Configuring Intercloud Fabric Firewall (VSG)** [Show]

6. **Configuring Intercloud Fabric Router (CSR 1000V)** [Show]

Physical to Virtual to Cloud Journey



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