
TOMORROW
starts here.
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Real World ACI Deployment and Migration

BRKACI-2601

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Solution Architect
Cisco Advanced Services

#clmel

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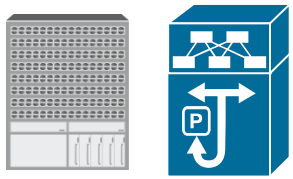
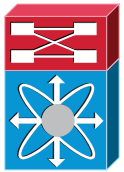
Icons and Terms

Application Policy Infrastructure Controller (APIC)



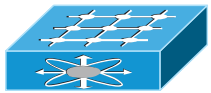
Cisco Nexus 9500

Cisco Nexus 9300

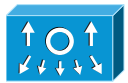


Nexus 7000

Nexus 5000

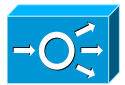


Nexus 2000 / FEX



Nexus 1000

Router



Load Balancer

Firewall

Storage

Virtual Machine

VMware vCenter

Agenda

- Application Centric Infrastructure (ACI) Overview
- ACI Adoption and Migration Strategies
  - Network Centric
  - Hybrid Approach
  - Application Centric

Nexus 9000 Series

Network Ops Driven, Switch Automation

User Driven, Policy Based Fabric Automation

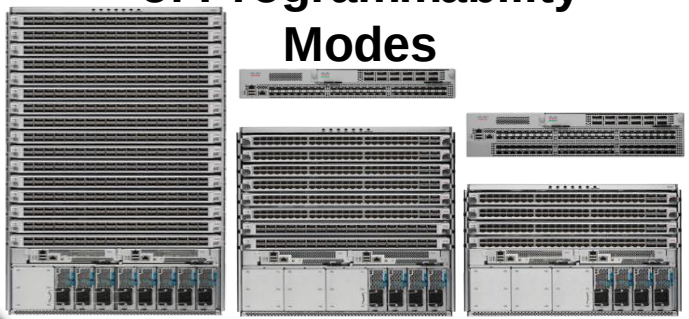
Per-Box Programmability

NX-API

Bash Shell

python

Open, Flexible, & Choice of Programmability Modes



1/10/40/100GE Common Platform

Policy Controller, Centralised Fabric Programmability

python

APIC

Bash Shell

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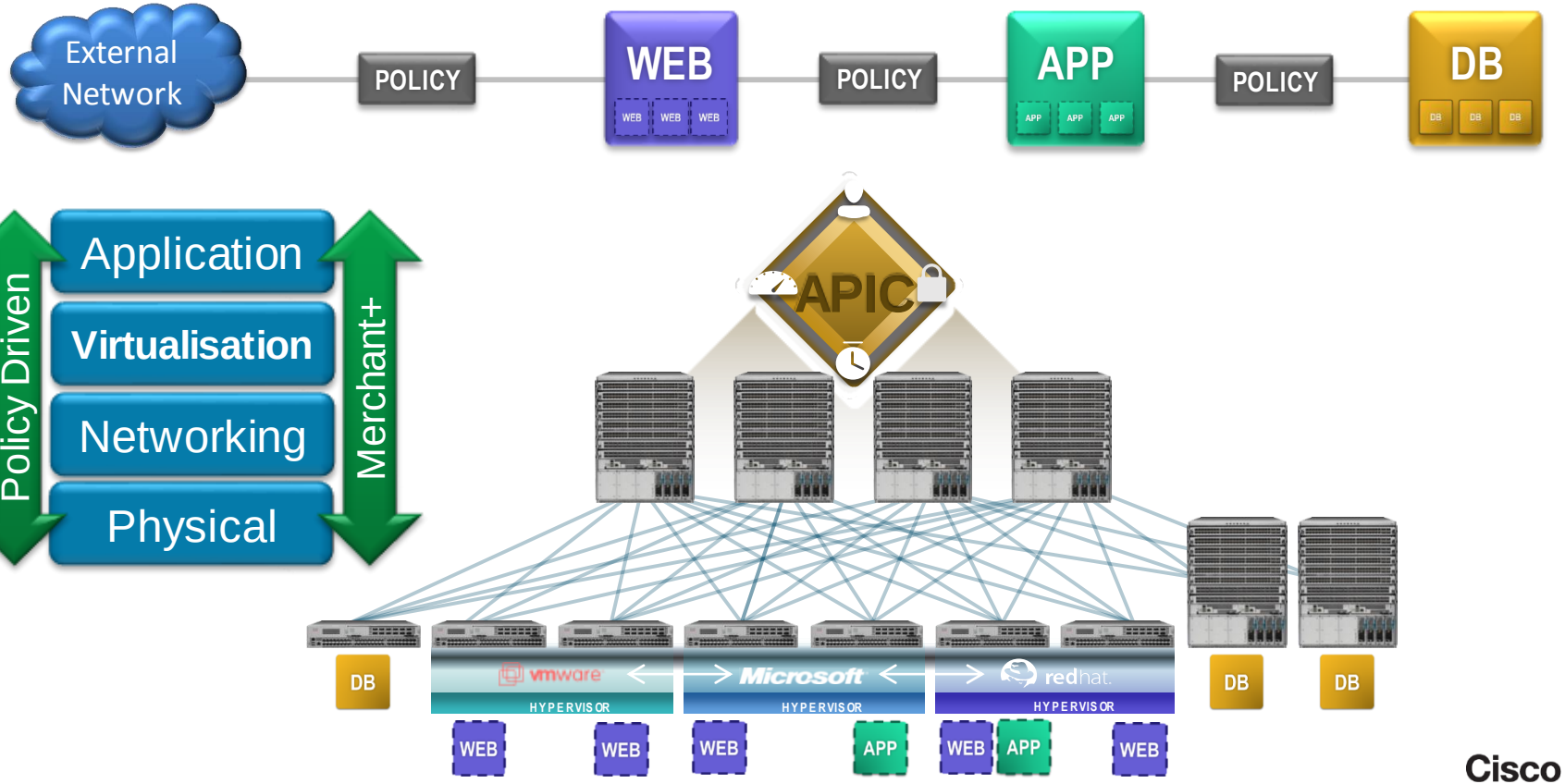
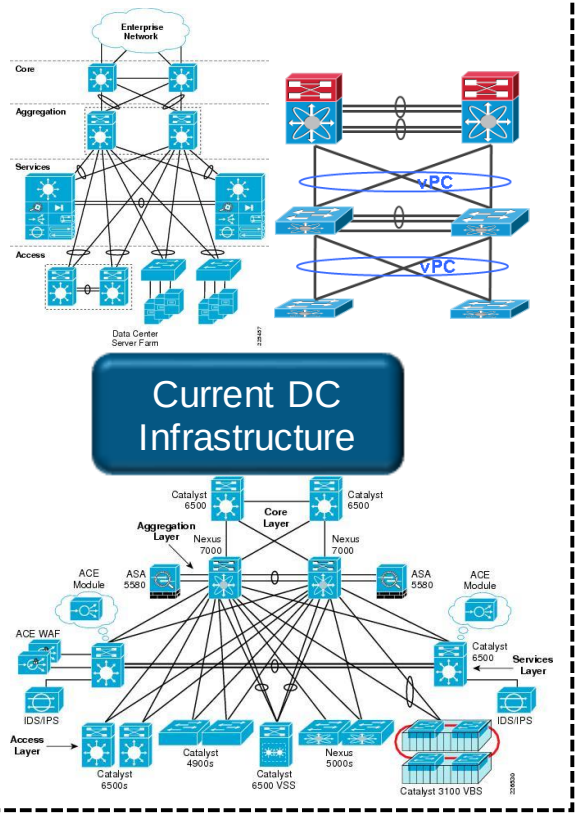
ACI Overview

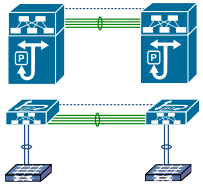


Migration Paths to ACI



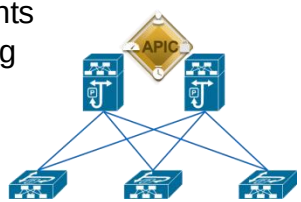
Classic mode

- Growth – Addition
- Network refresh



ACI Integration

- New environments
- Service Chaining
- Dev, Test



ACI Migration

- Business drivers
- Security, Compliance, TCO, Programmability, Operations etc.

ACI Fabric

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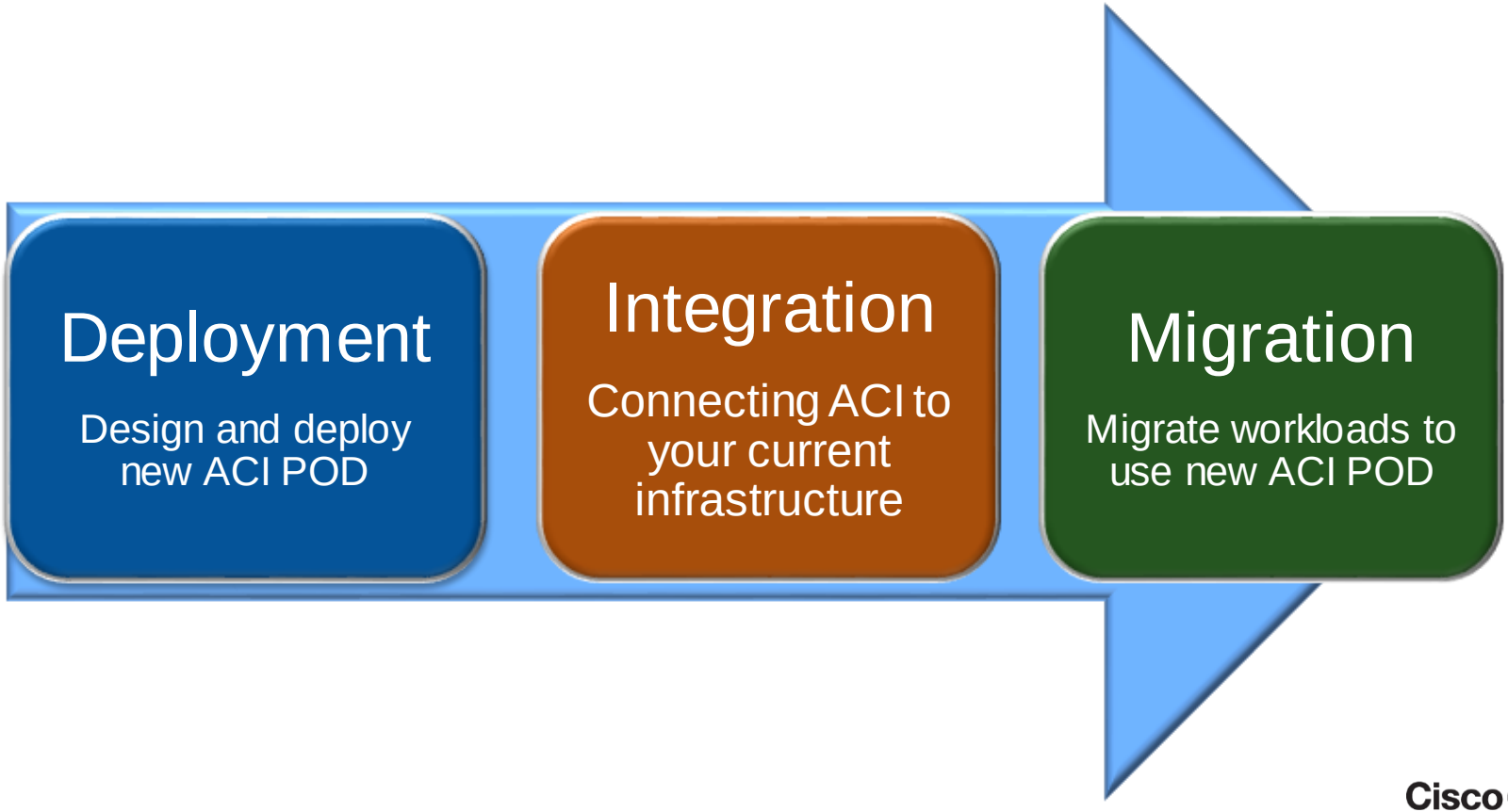
ACI Migration Methodology



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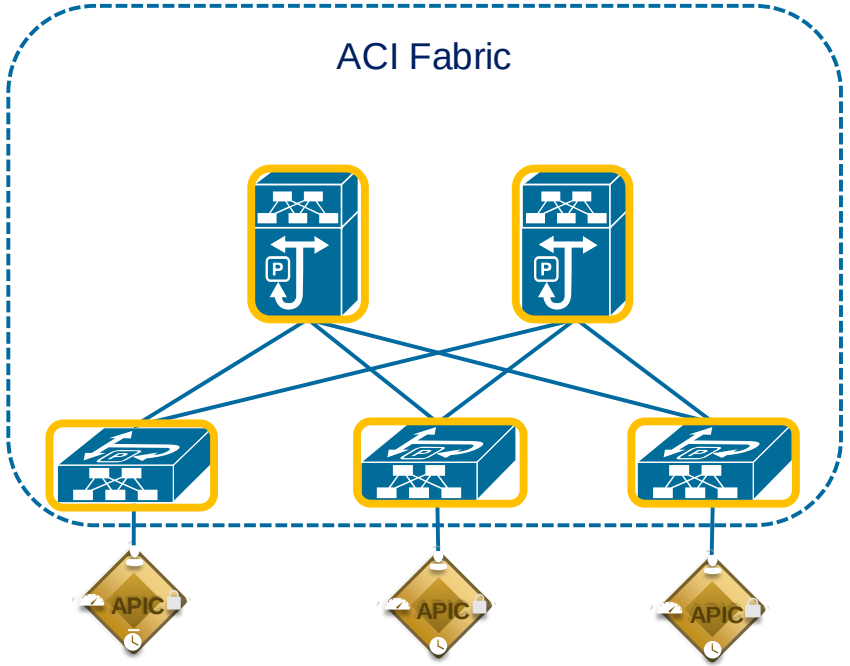
ACI Fabric Initialisation

ACI Fabric supports discovery, boot, inventory and systems maintenance processes via the APIC

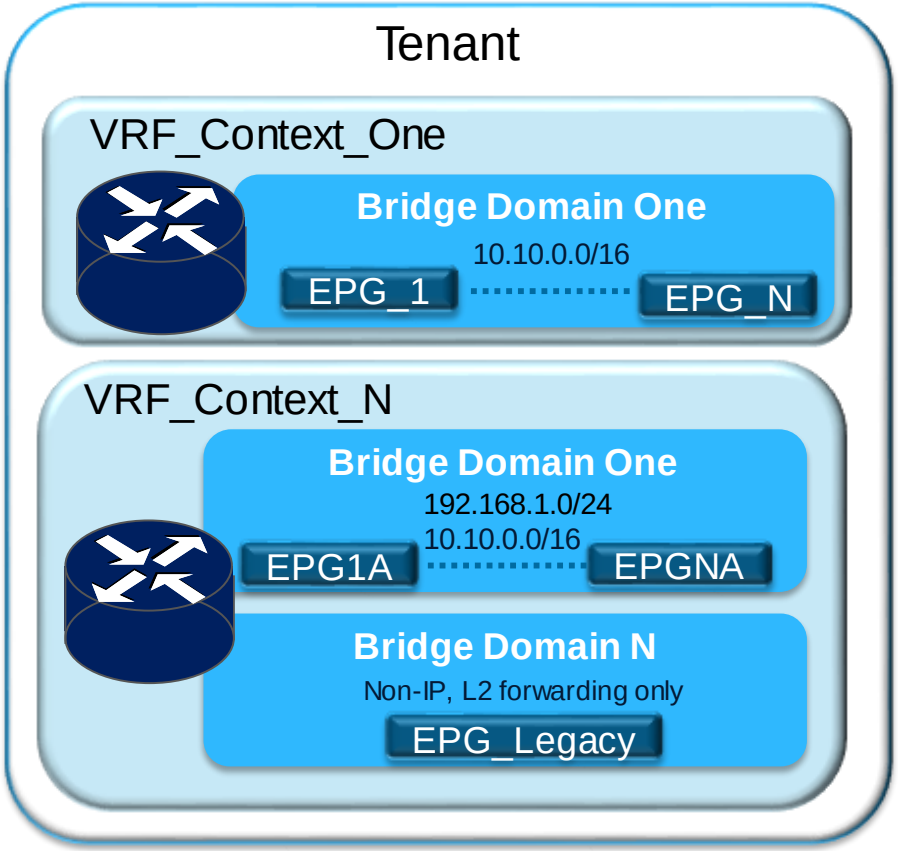
- Fabric Discovery and Addressing:

  Fabric Discovery is through LLDP and is done automatically and progresses as administrator registers the switches to join the fabric. Once a switch is registered, its LLDP neighbours are now visible for the admin to approve for them to join the fabric.

- Commissioning, Decommissioning, Image Management
- Lifecycle management of switches
- Topology validation through wiring diagram and systems checks

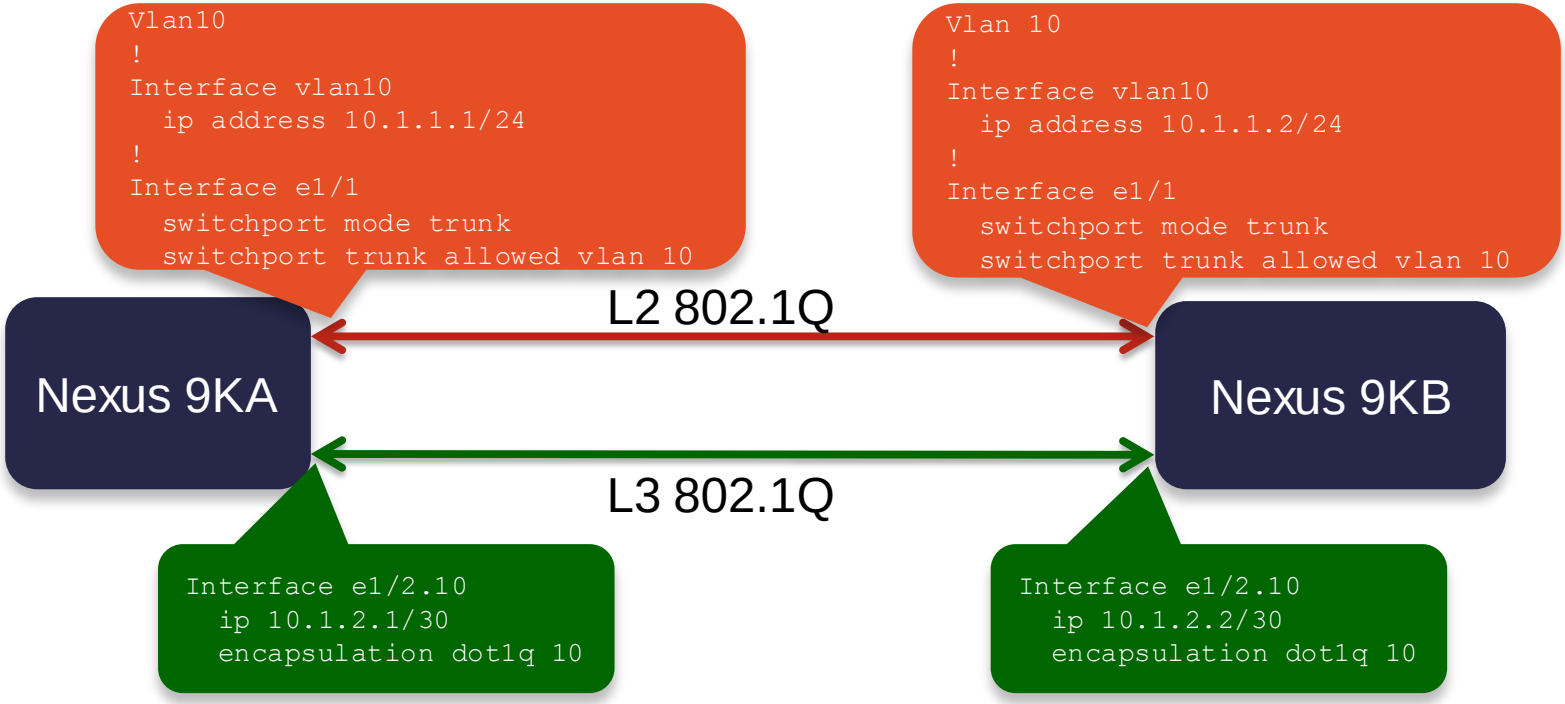


ACI Forwarding Model



- A Tenant is referred to by one or more VRFs/Contexts
- A Context/VRF is referred to by one or more Bridge Domains (BD)
- Bridge Domains identify properties influencing forwarding behaviour. One or more subnets, ARP handling, Multicast etc.
- A collection of end-points form an **end-point group(EPG).** EPG associates to a BD.
- EndPoint Groups Identified by:
  - Physical or Virtual Switch ports, VLAN ID, VNID
  - Future - NVGRE (VSID), DNS hostname, IP address

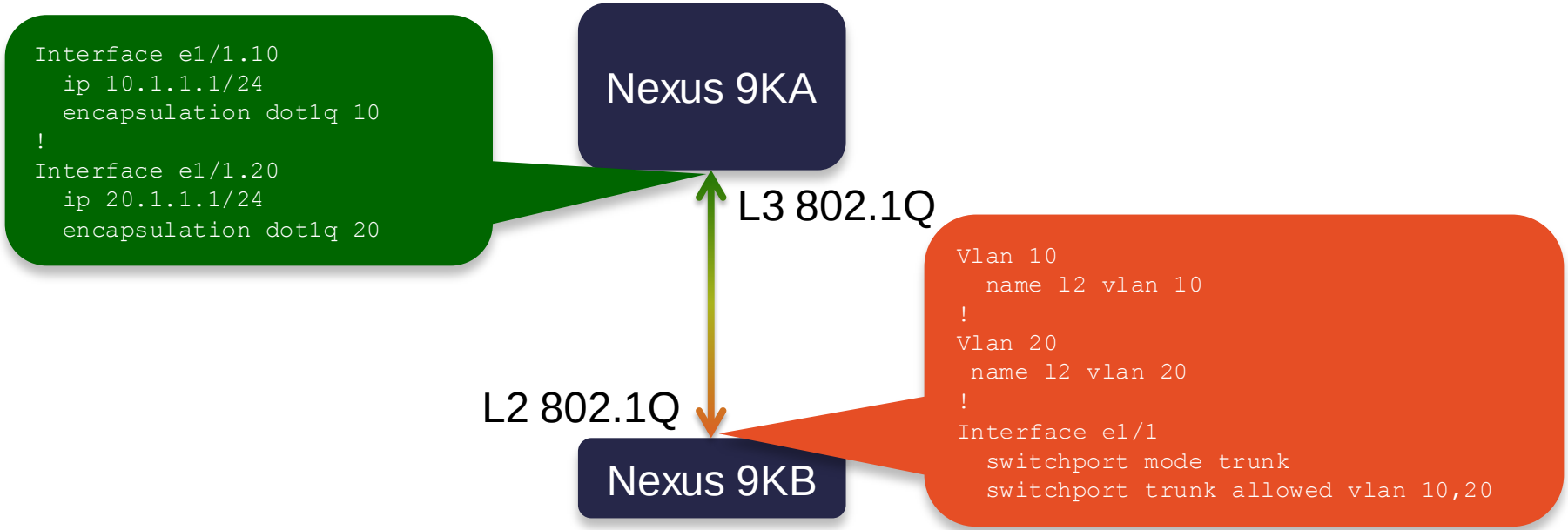
L3 Sub-Interfaces…Key Concept to Understand



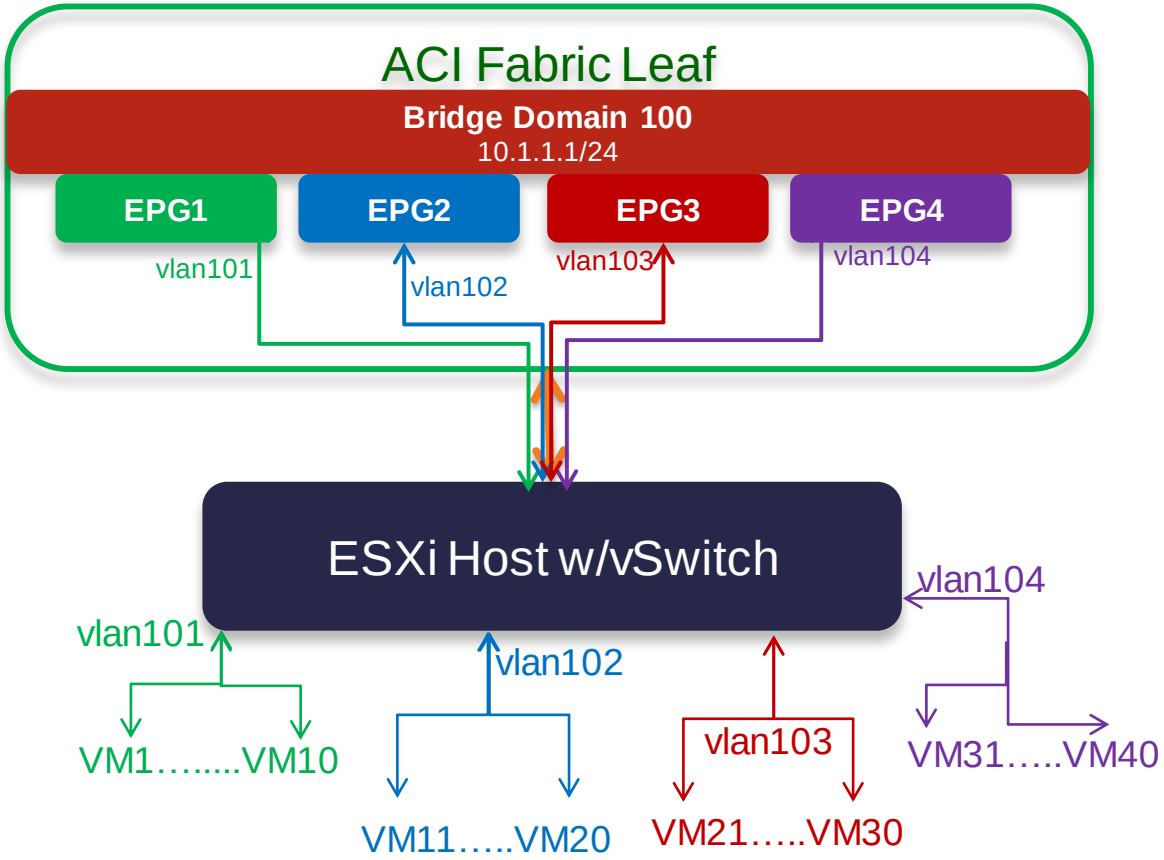
- When configuring L3 Sub-interfaces on a Nexus Switch, The 802.1Q tag is local to the interface and has no relevance to a VLAN with same number on the same switch.
- Eventhough L3 subinterface uses 802.1Q, the 802.1q tag determines the IP L3 interface and not the L2 vlan.

L3 Sub-Interfaces…Key Concept to Understand

- In the following valid topology, N9KA L3 sub-interface is treating 802.Q as just a tag to identify the L3 IP interface, while on the N9KB side, the tags correspond to the L2 VLANs.

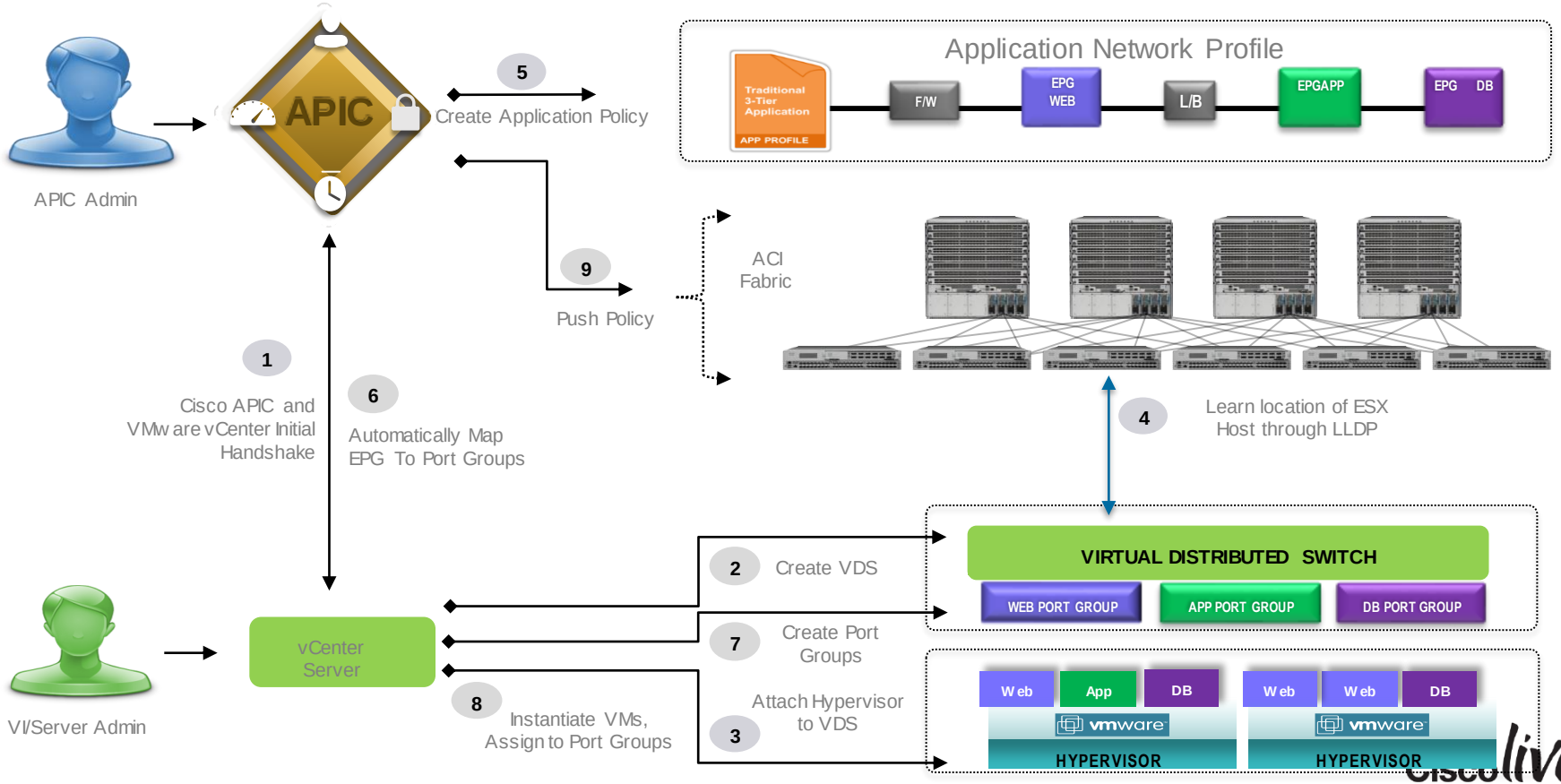


EPG Identification Example



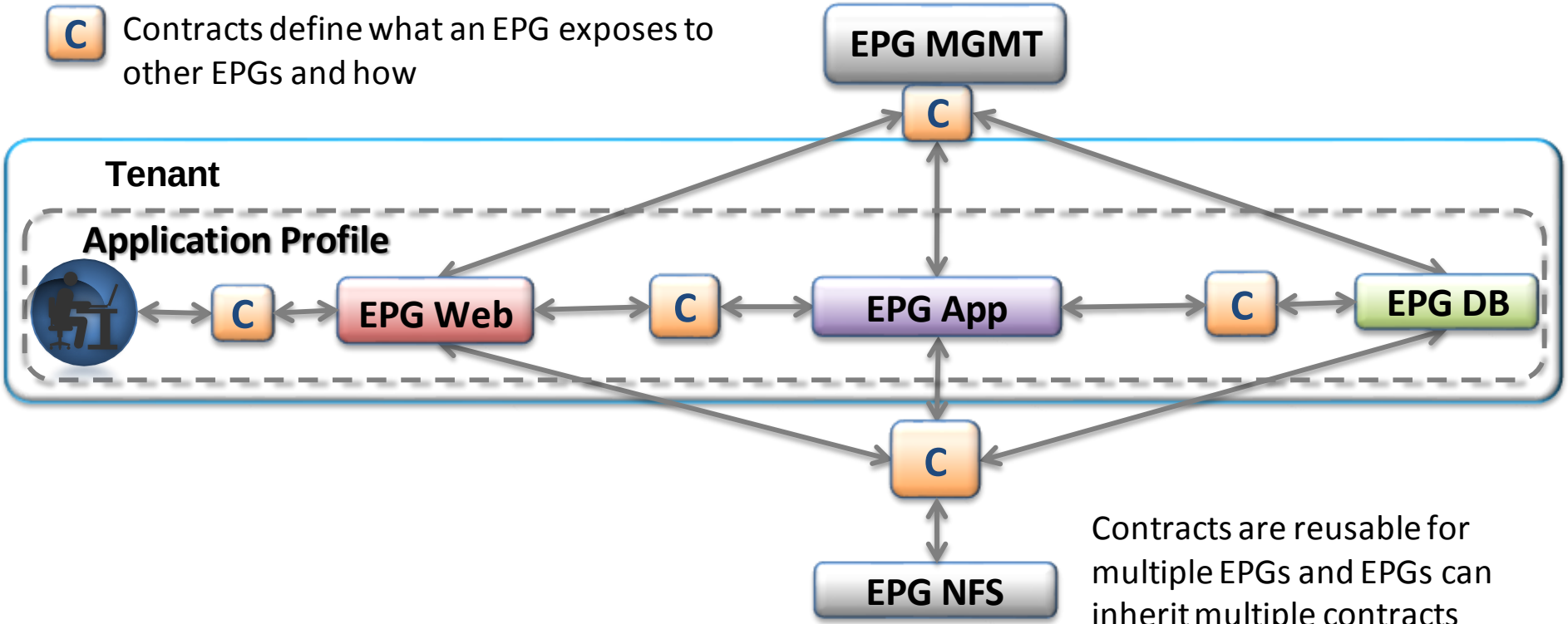
- VLANs outside the ACI Fabric, map to EPGs inside the fabric
- EPGs then map to a BD where the gateway addresses are defined
- Policies are applied to let the VMs communicate

Cisco ACI Hypervisor Integration – VMWare DVS



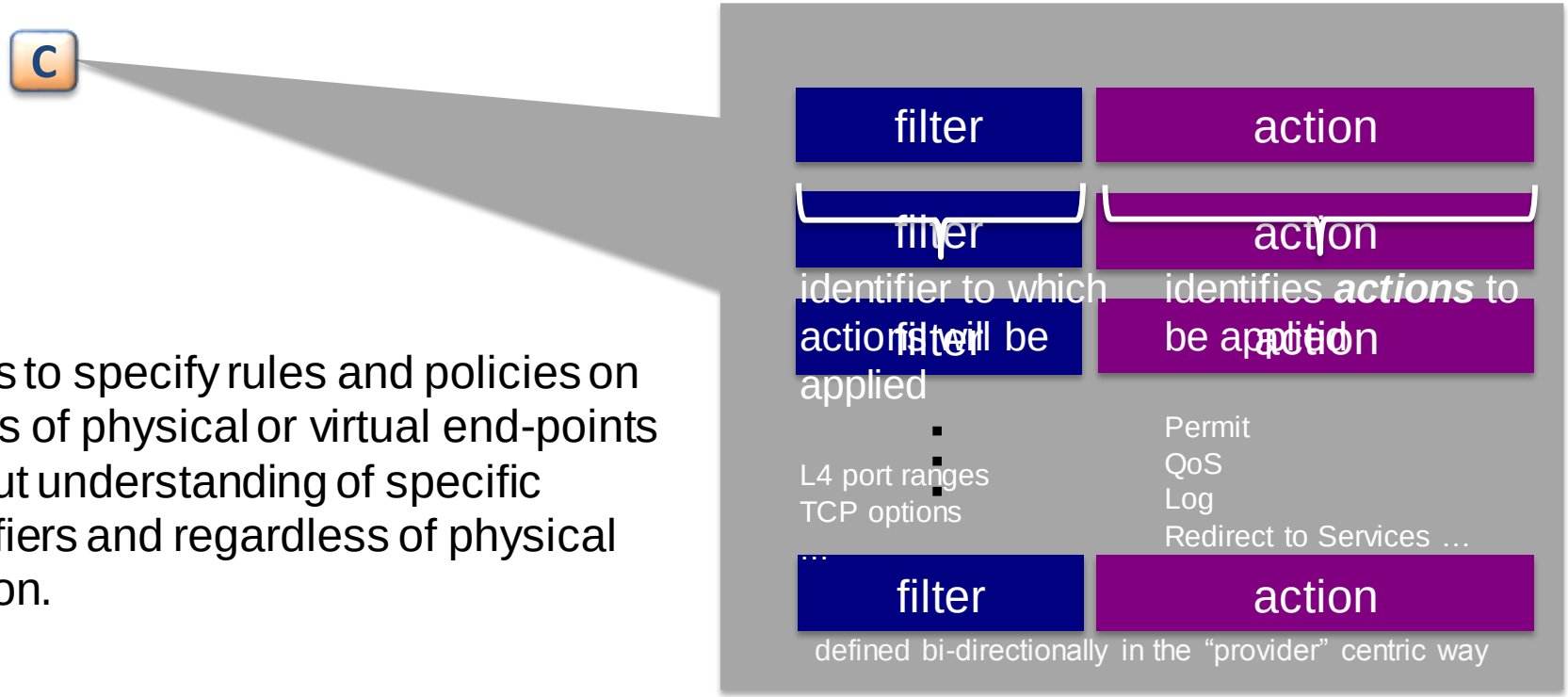
ACI Policy Model

C Contracts define what an EPG exposes to other EPGs and how



Contracts are reusable for multiple EPGs and EPGs can inherit multiple contracts

ACI Policy Model – What is a Contract



Allows to specify rules and policies on groups of physical or virtual end-points without understanding of specific identifiers and regardless of physical location.

Agenda

- Application Centric Infrastructure (ACI) Overview
- ACI Adoption and Migration Strategies
  - Network Centric
  - Hybrid Approach
  - Application Centric

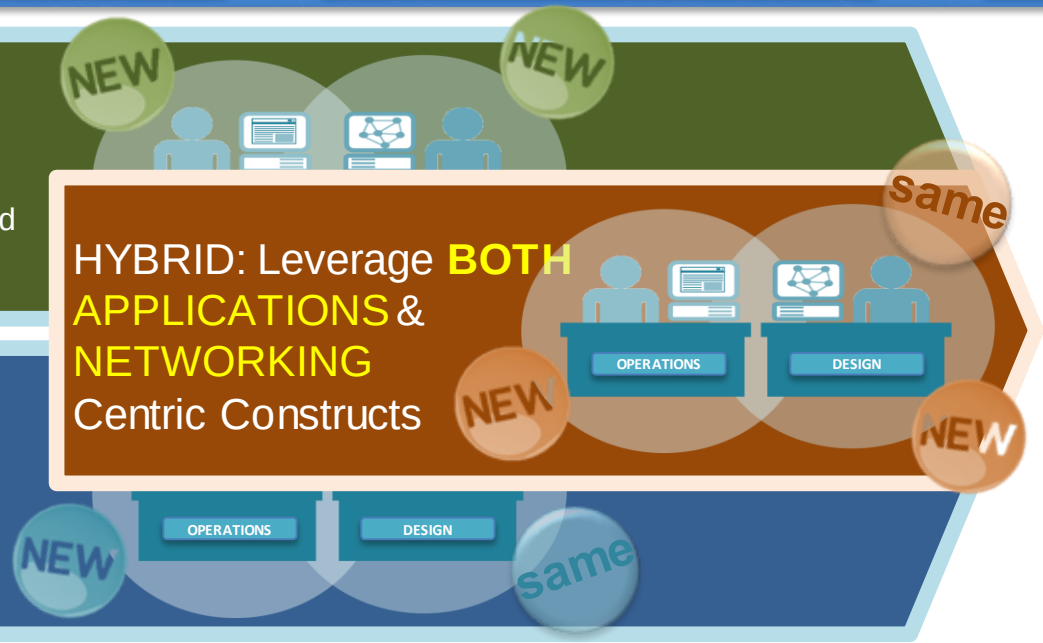
ACI Adoption Strategies

ACI Fabric Model = New **OPERATIONS** Model + **DESIGN** Model

Leverage Known **APPLICATIONS** Constructs (decoupled from Network)

HYBRID: Leverage **BOTH** APPLICATIONS & NETWORKING Centric Constructs

Leverage Known **NETWORKING** Constructs



ACI Fabric

New ACI Fabric Operational Model

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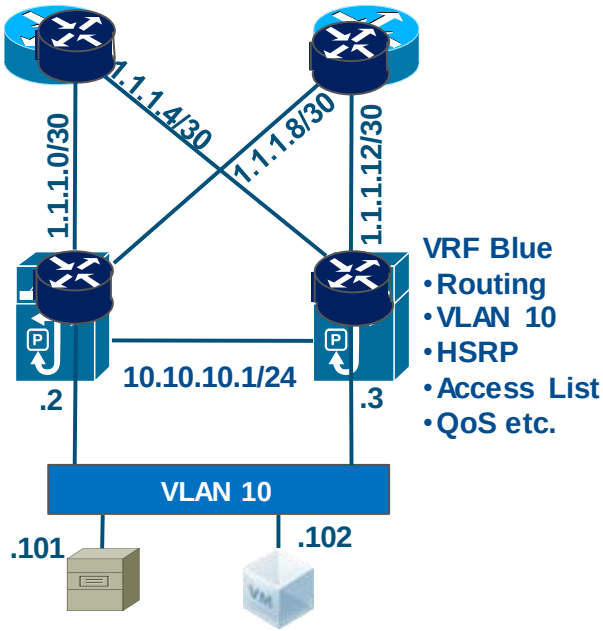
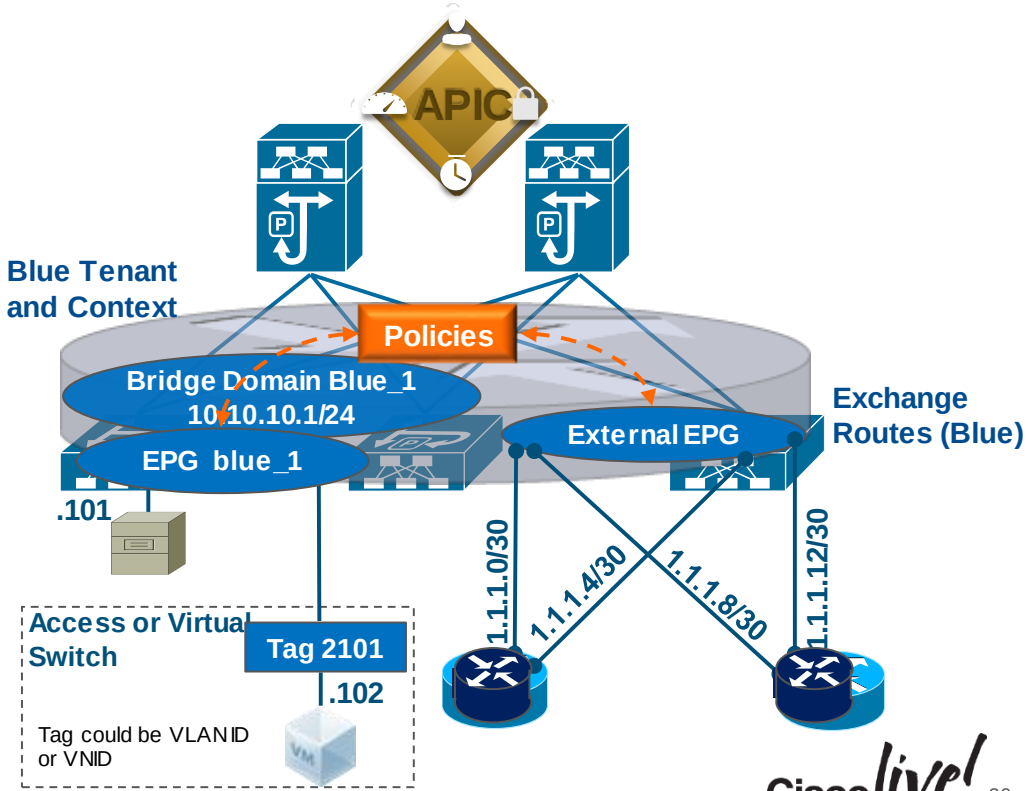
Network Centric

Network Centric Deployment Example
1 VRF + 1 VLAN

Classic mode shown here for Reference

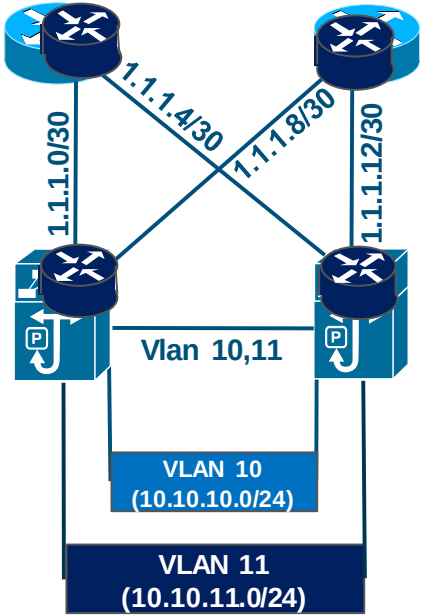


ACI Fabric

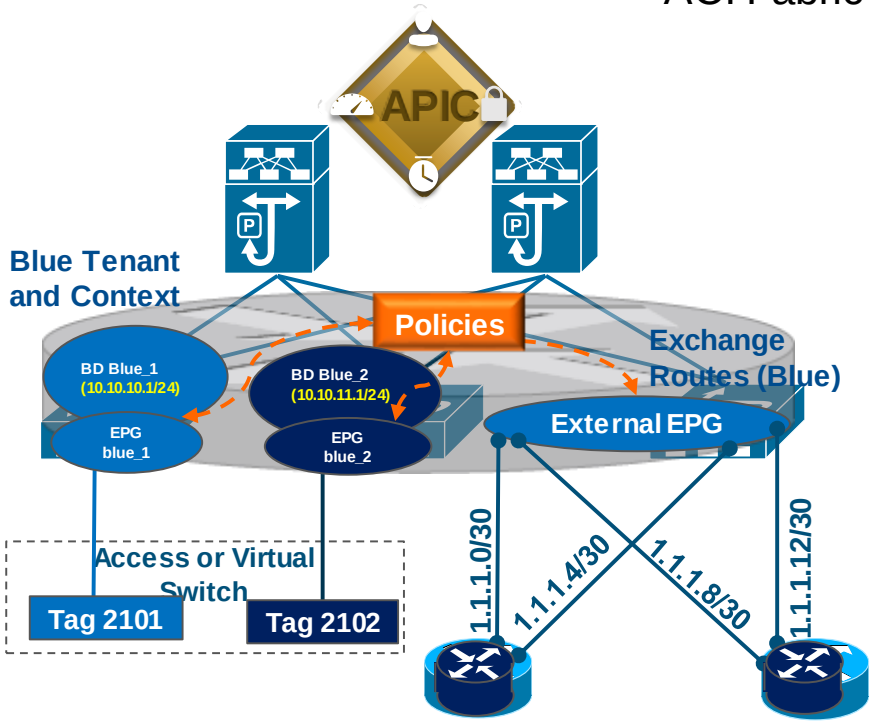


Network Centric Deployment Example
1 VRF + 2 VLANs – Option 1

Classic mode shown here for Reference

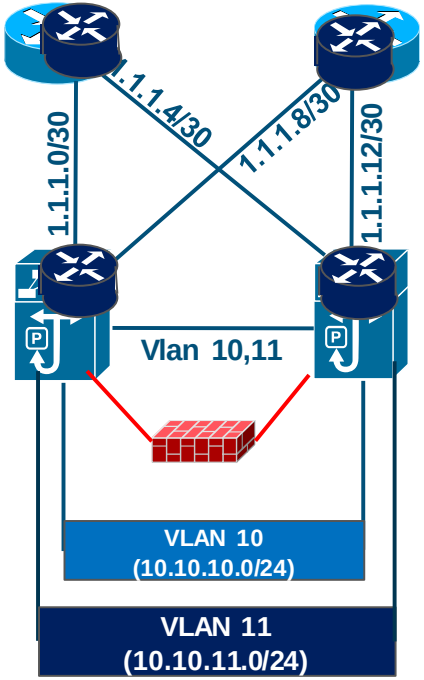


ACI Fabric

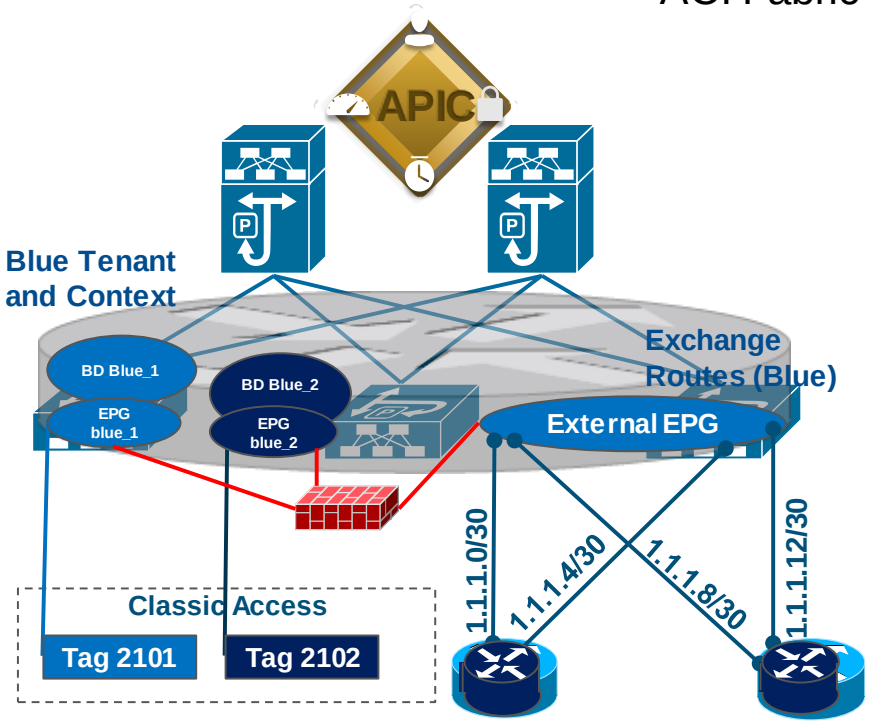


Network Centric Deployment Example
1 VRF + 2 VLANs – FW is the Def. GW

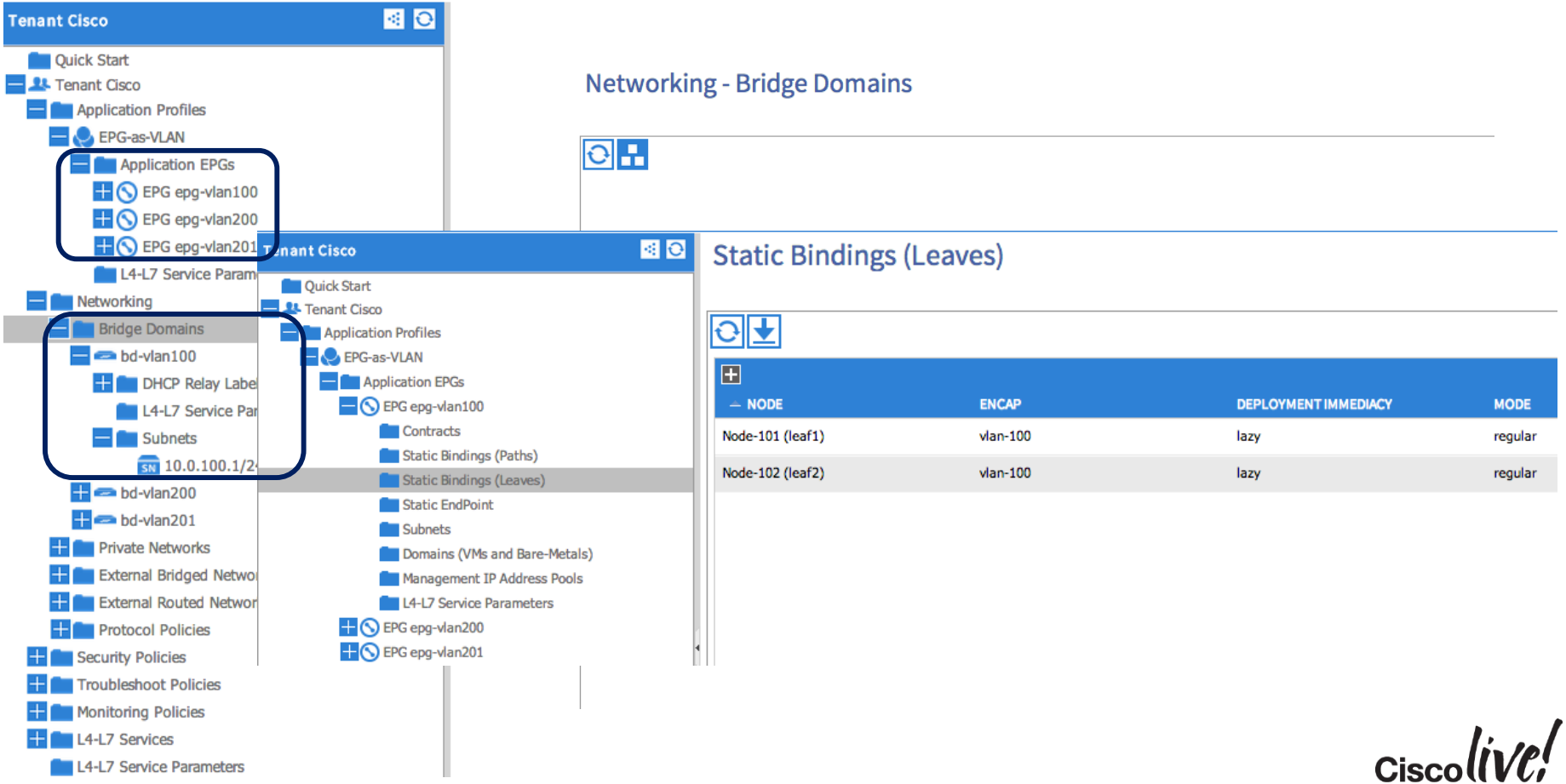
Classic mode shown here for Reference



ACI Fabric

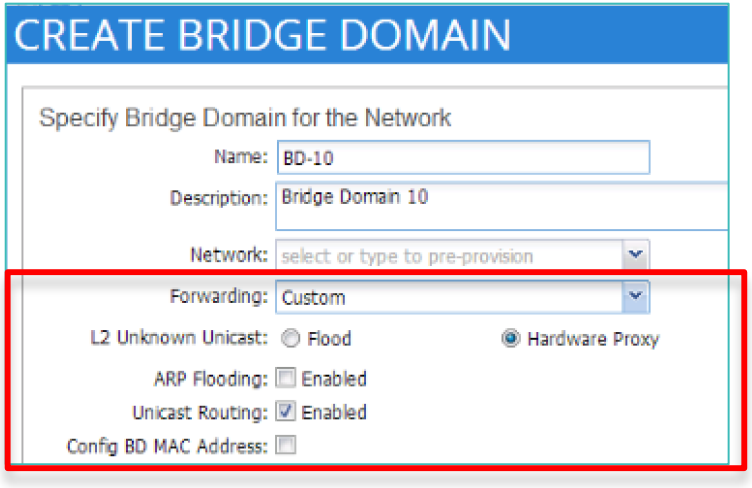


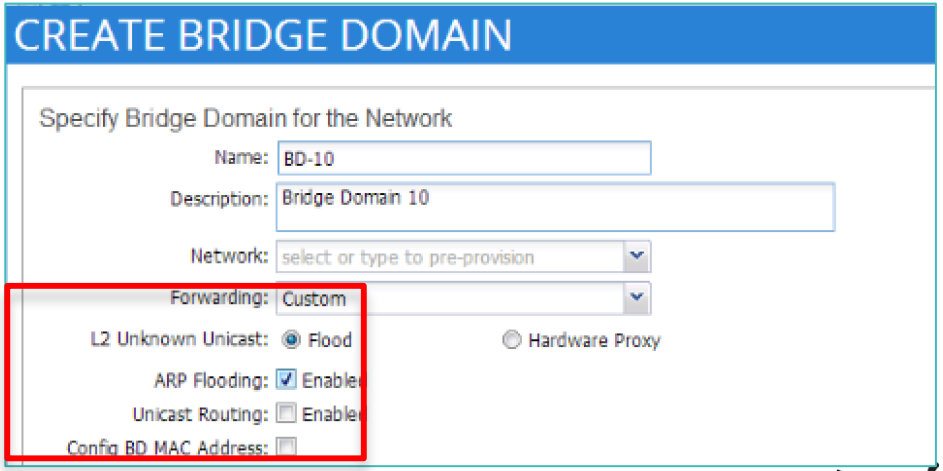
Network Centric Configuration



Configuring ACI Forwarding

- **Unicast Routing:** Enable both L3 and L2 Forwarding (IP or MAC address). Enabled by default.
- **L2 Unknown Unicast:** forwarding method for unknown layer 2 destinations. The method can be flood or proxy (default)
- **ARP Flooding:** Specifies whether ARP flooding is enabled. If flooding is disabled, unicast routing will be performed on the target IP address. Can be on or off (default)

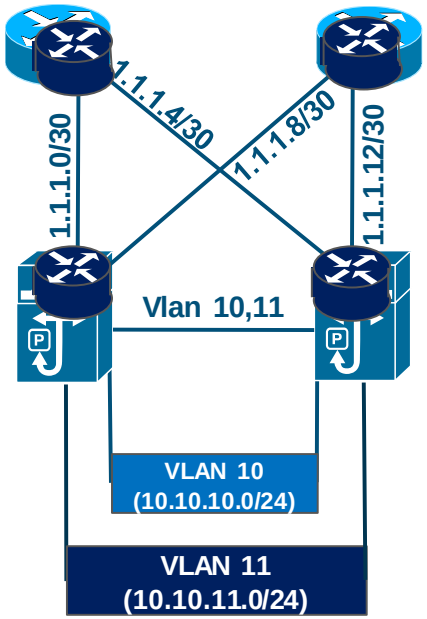




Network Centric Deployment Example
1 VRF + 2 VLANs – Option 2

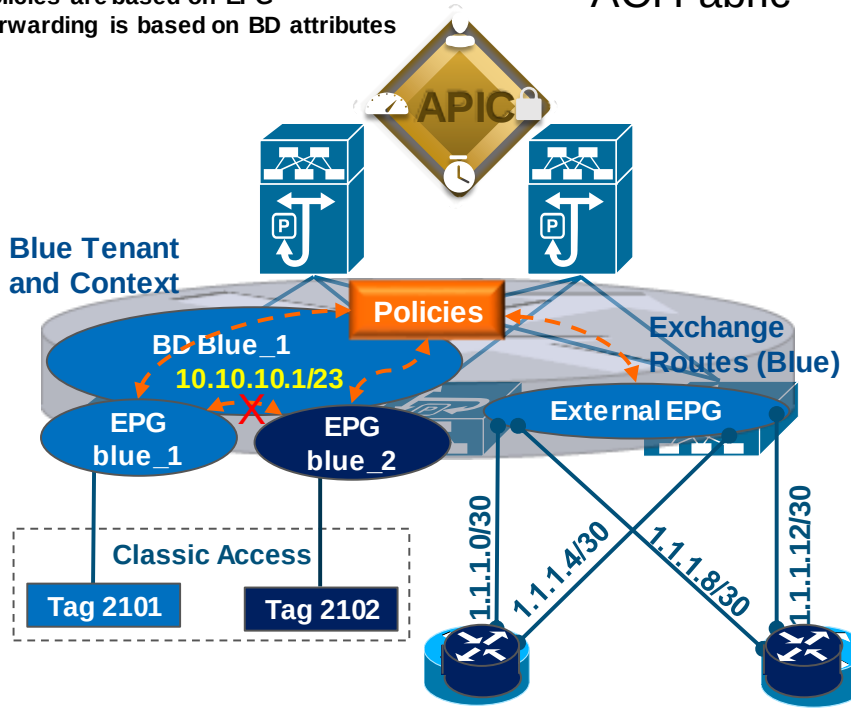
Classic mode shown here for Reference

What if different policies between two groups mandated separate VLANs in Classic Networks.



1. **Policies are based on EPG**
2. **Forwarding is based on BD attributes**

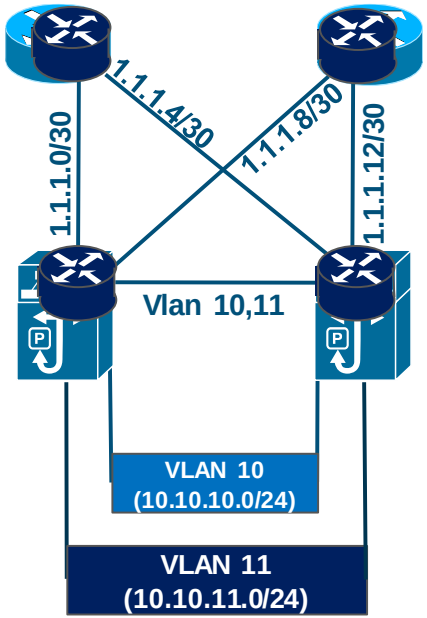
ACI Fabric



Network Centric Deployment Example
1 VRF + 2 VLANs – Option 3

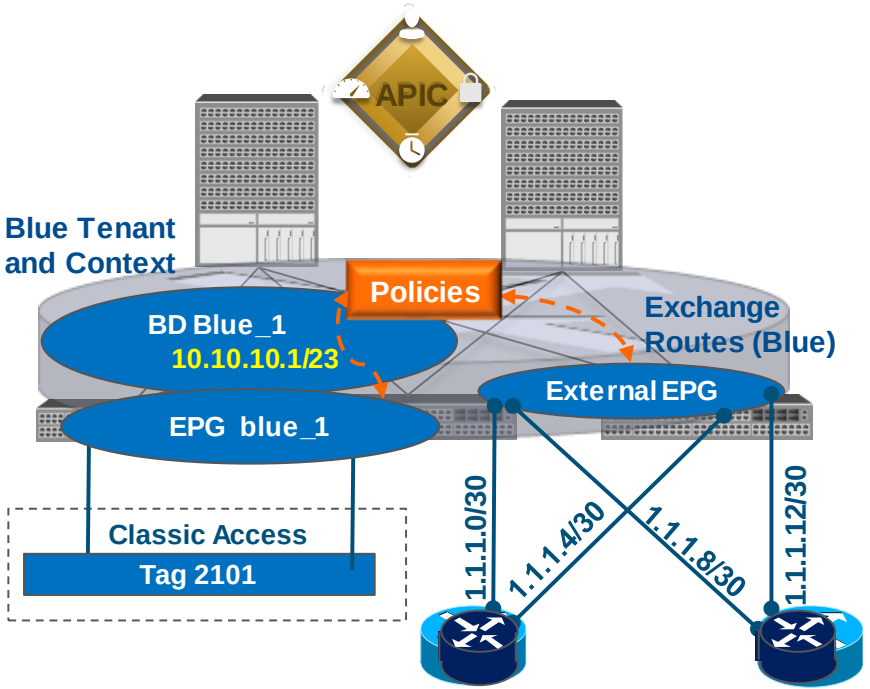
Classic mode shown here for Reference

What if two VLANs was only due to ARP broadcast concerns.



Hardware based directed ARP forwarding

ACI Fabric



Network Centric - ACI Deployment as a L2 Fabric

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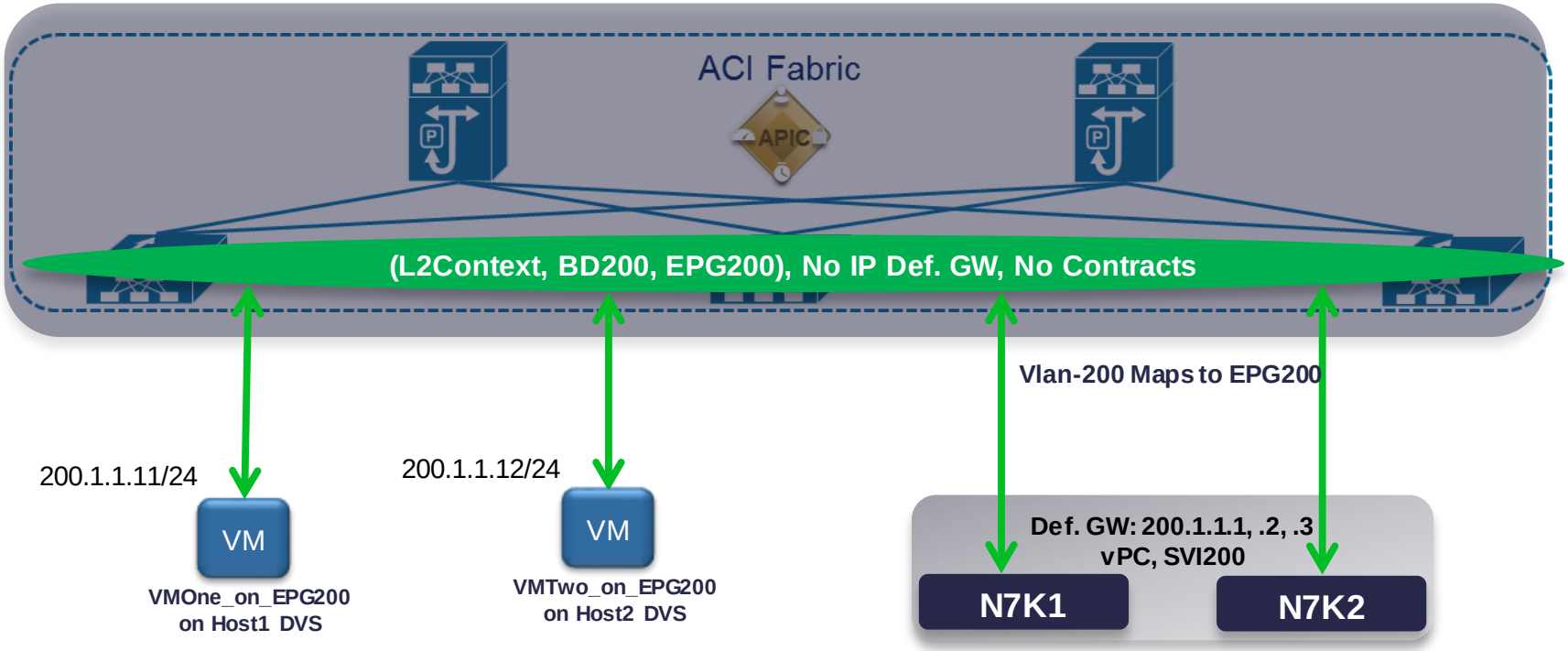
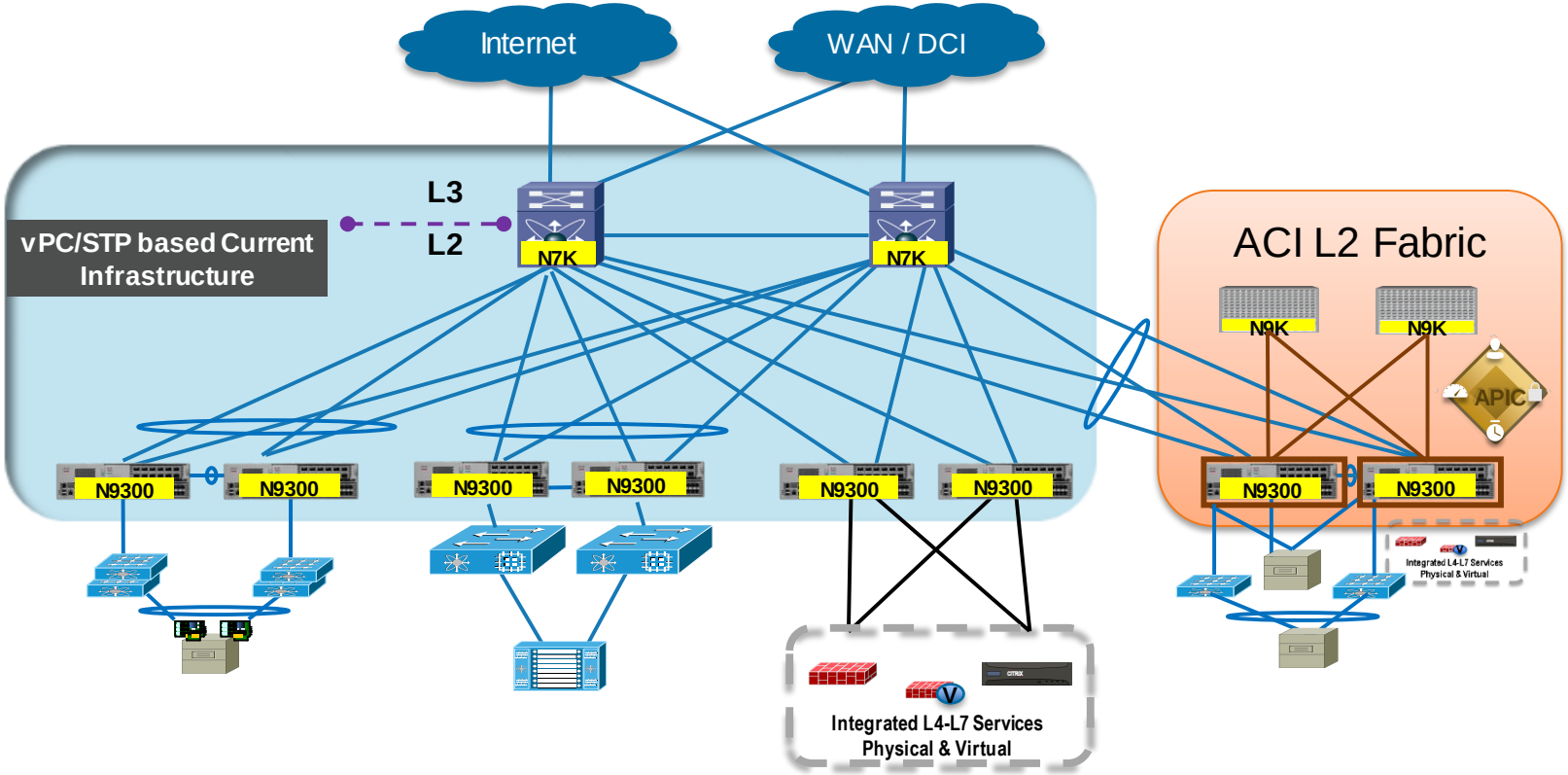
ACI as a Layer 2 Fabric

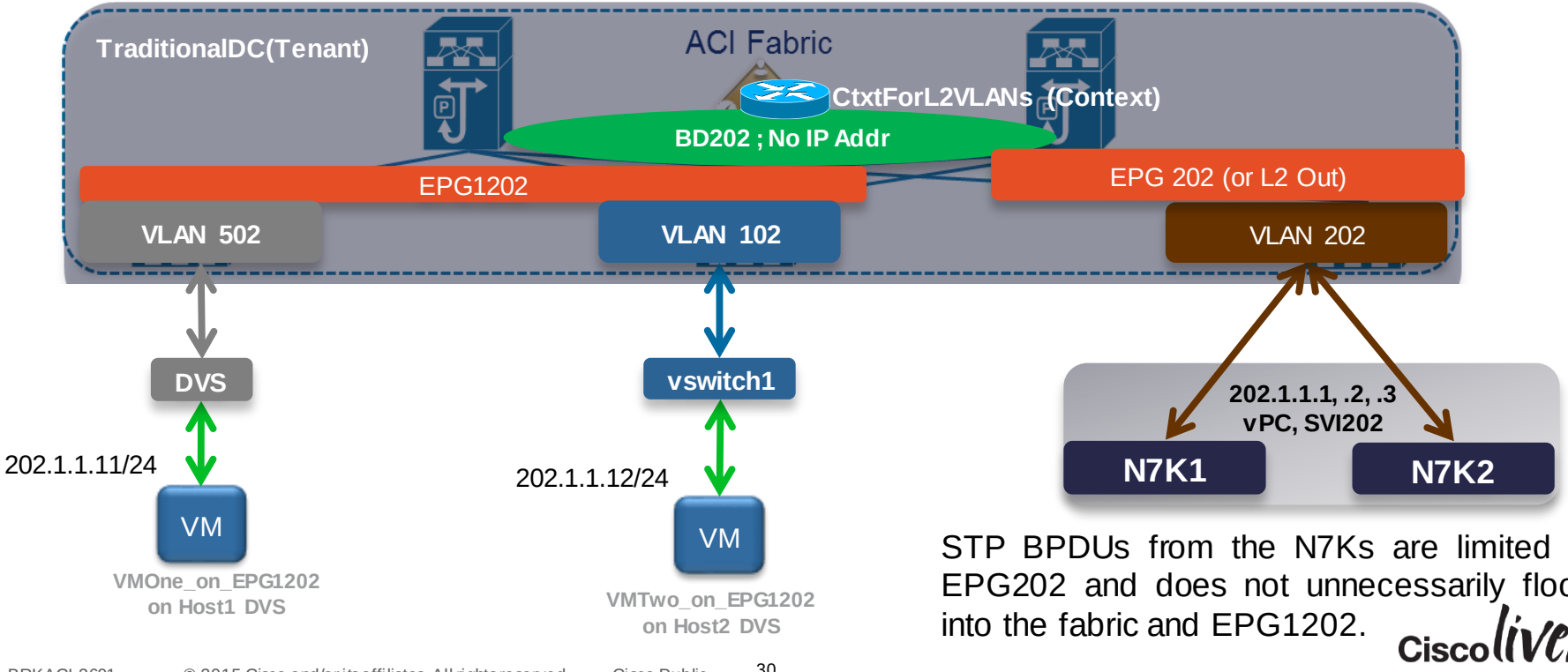


Extending Current Infrastructure with Layer 2 ACI Fabric



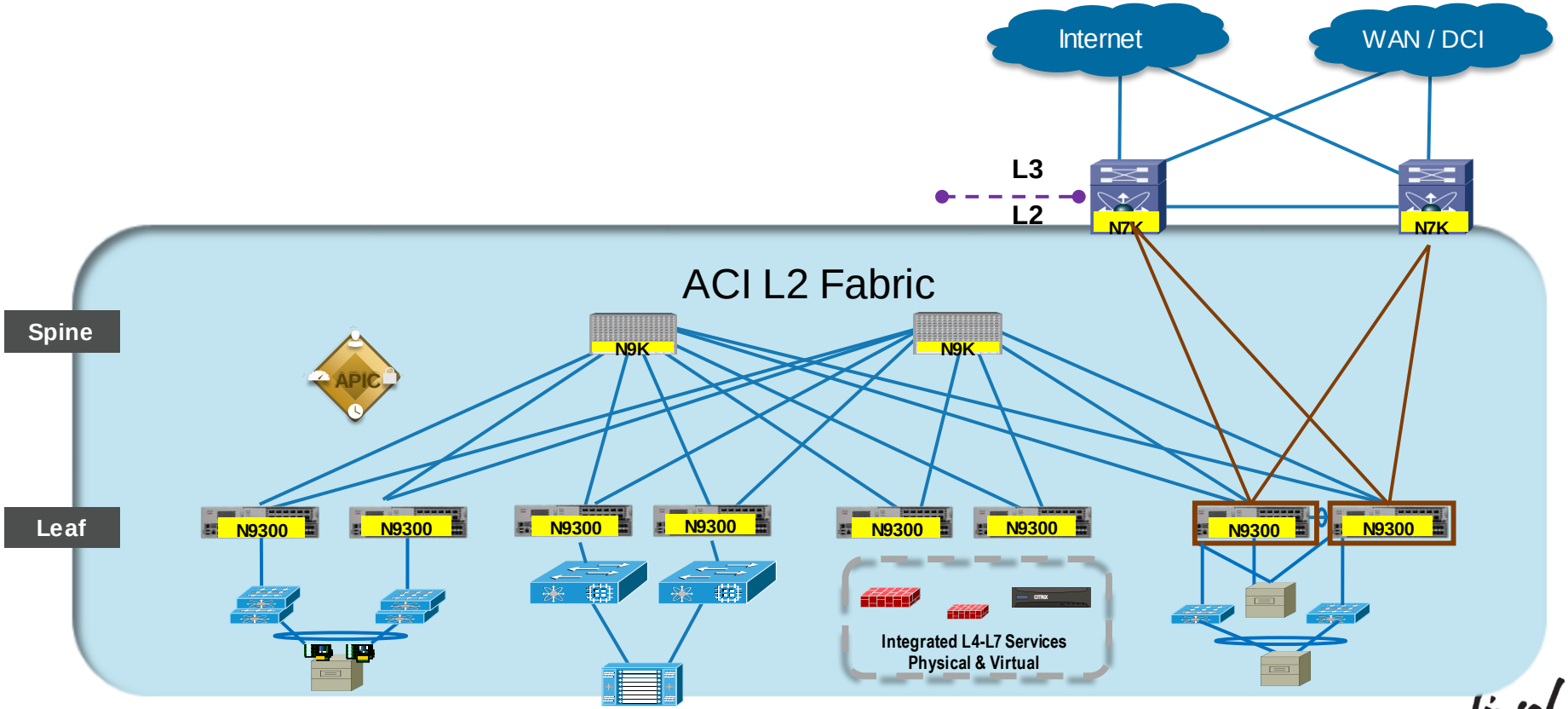
Layer 2 Fabric STP Containment

- Tenant(TraditionalDC)→Context(CtxtForL2VLANs)→BridgeDomain(BD202)→EPG(EPG202, EPG1202)
- If Context is in enforced mode, Contracts are needed to communicate between EPG202 and 1202 even though they are on same Subnet.

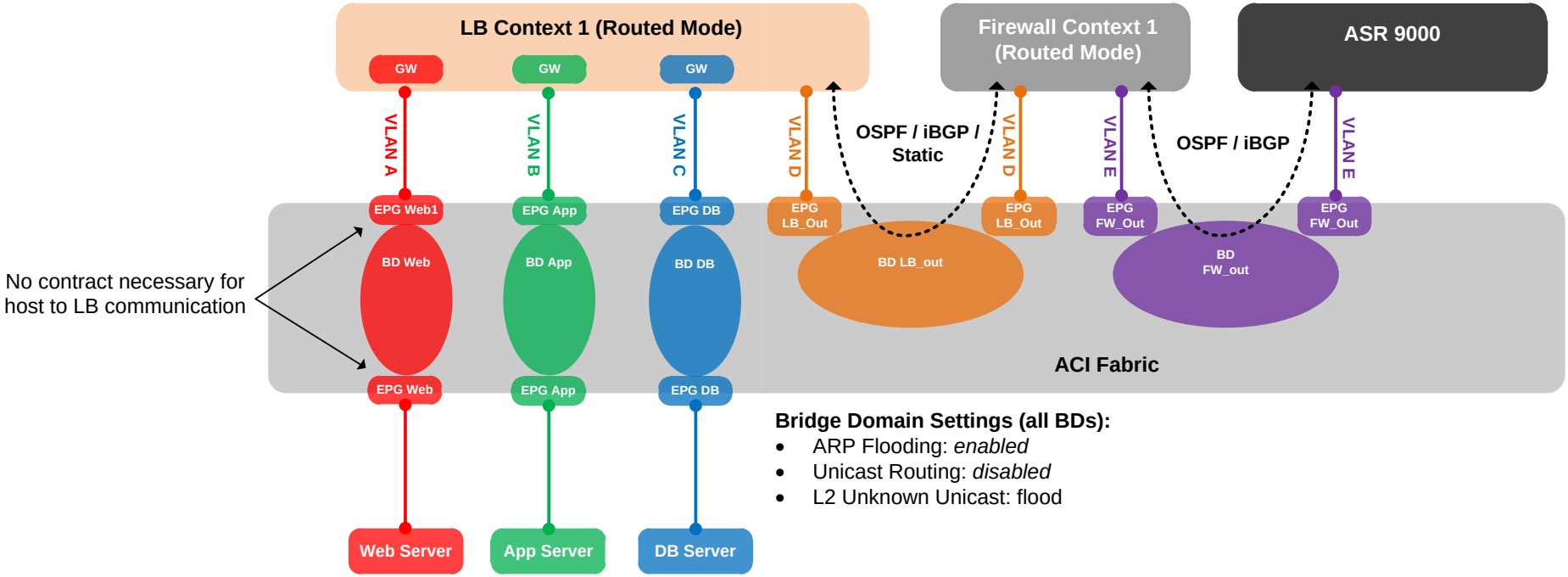


STP BPDUs from the N7Ks are limited to EPG202 and does not unnecessarily flood into the fabric and EPG1202.

Layer 2 ACI Fabric with External GW



ACI as L2 Fabric – With Services



Bridge Domain Settings (all BDs):

- ARP Flooding: *enabled*
- Unicast Routing: *disabled*
- L2 Unknown Unicast: flood

Layer 2 ACI Fabric

- How?
  - 1 BD and 1EPG per Current Infrastructure VLAN
  - Also available is BD in legacy mode which preserves VLAN resources to allow for 3500 BDs per Leaf.
- Who are deploying ?
  - Customers who want to slowly introduce ACI
  - NFV or Virtual Overlay Use Case
- Benefits:
  - Network Operations, Network Automation
  - Any VLAN, Any Workload, Any Where
  - Network Capacity and Bandwidth

Network Centric - ACI Deployment as a L3 Fabric

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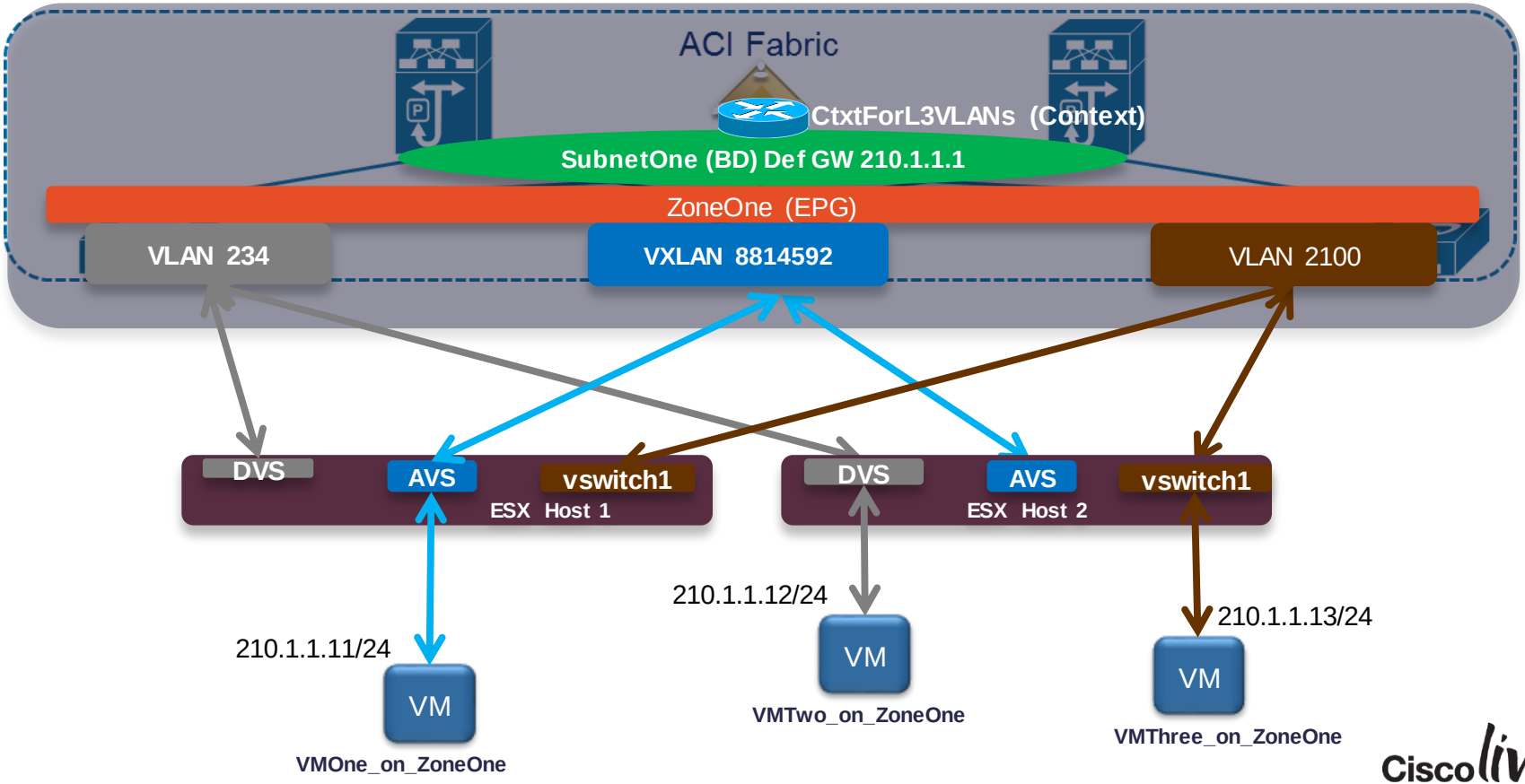
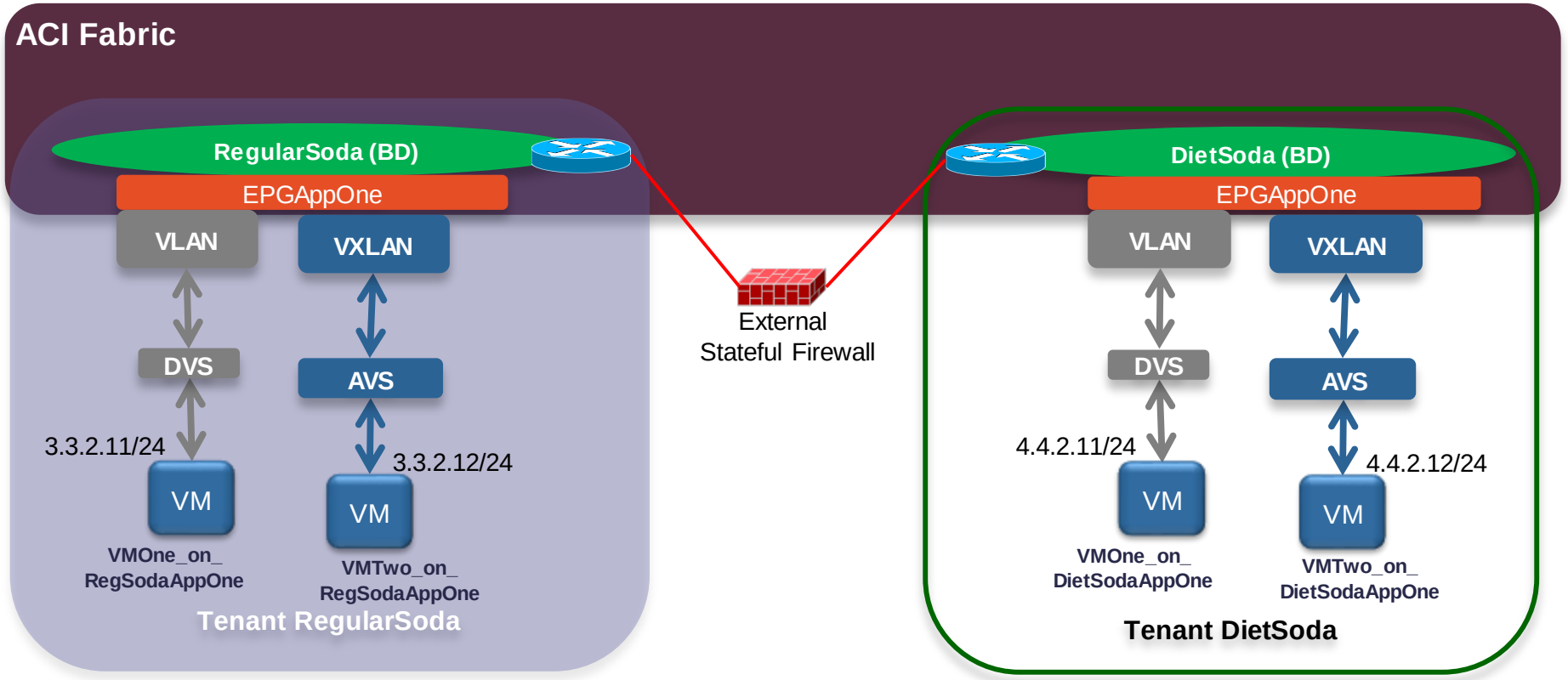
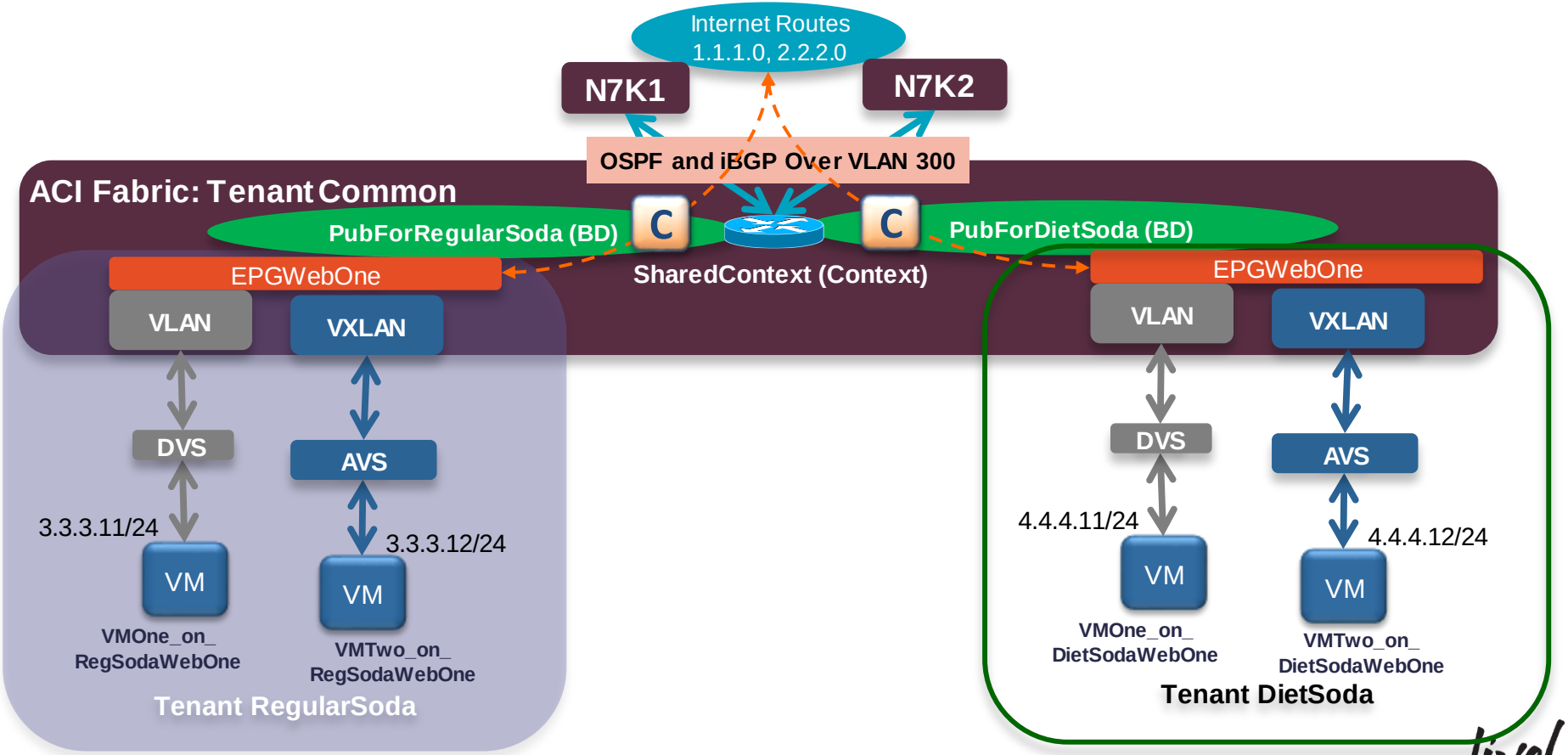
ACI as a Layer 3 Fabric



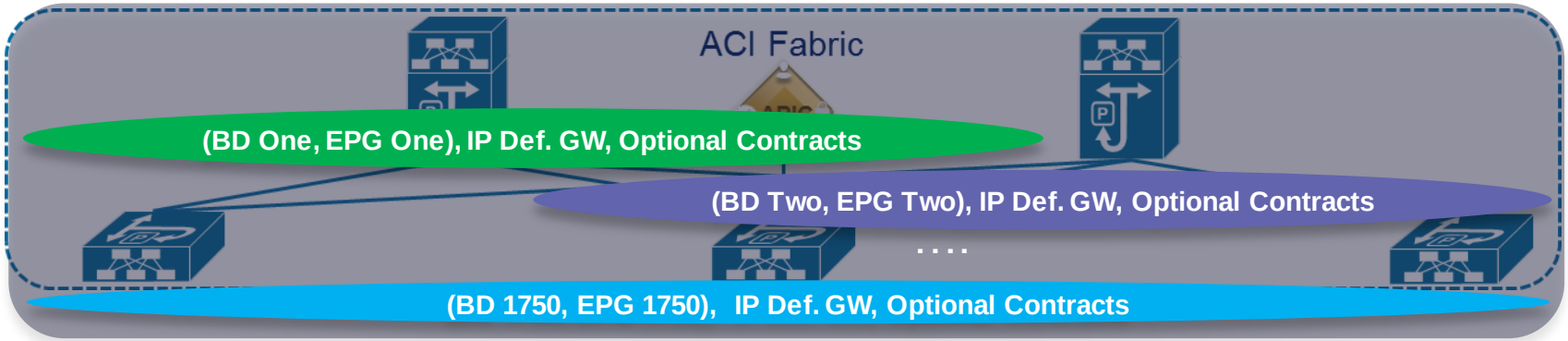
Multi-Tenancy with Services



Multi-Tenancy: Shared External Routes Example



Layer 3 ACI Fabric



- How?
  - 1 BD and 1EPG per Current Infrastructure VLAN
  - Fabric as default gateway **with or without policy enforcement.**

- Who are deploying ?
  - Customers who want basic L3 ACI Features, and adopt ACI Fabric as a single DC switching system

- Benefits:
  - Pervasive Gateway, Directed ARP and other features
  - Network Operations, Network Automation
  - Any VLAN, Any Workload, Any Where
  - Network Capacity and Bandwidth

Network Centric ACI Migration

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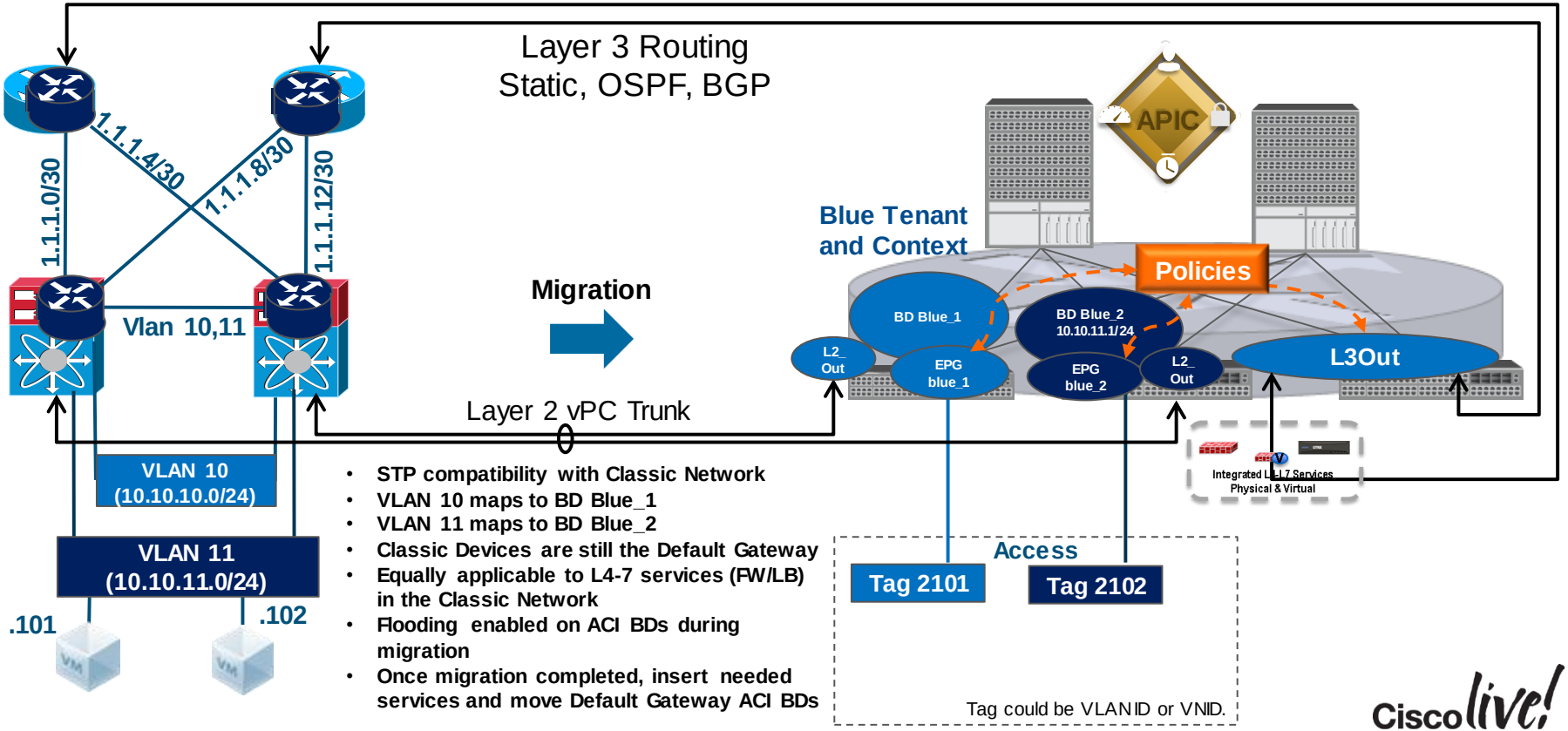
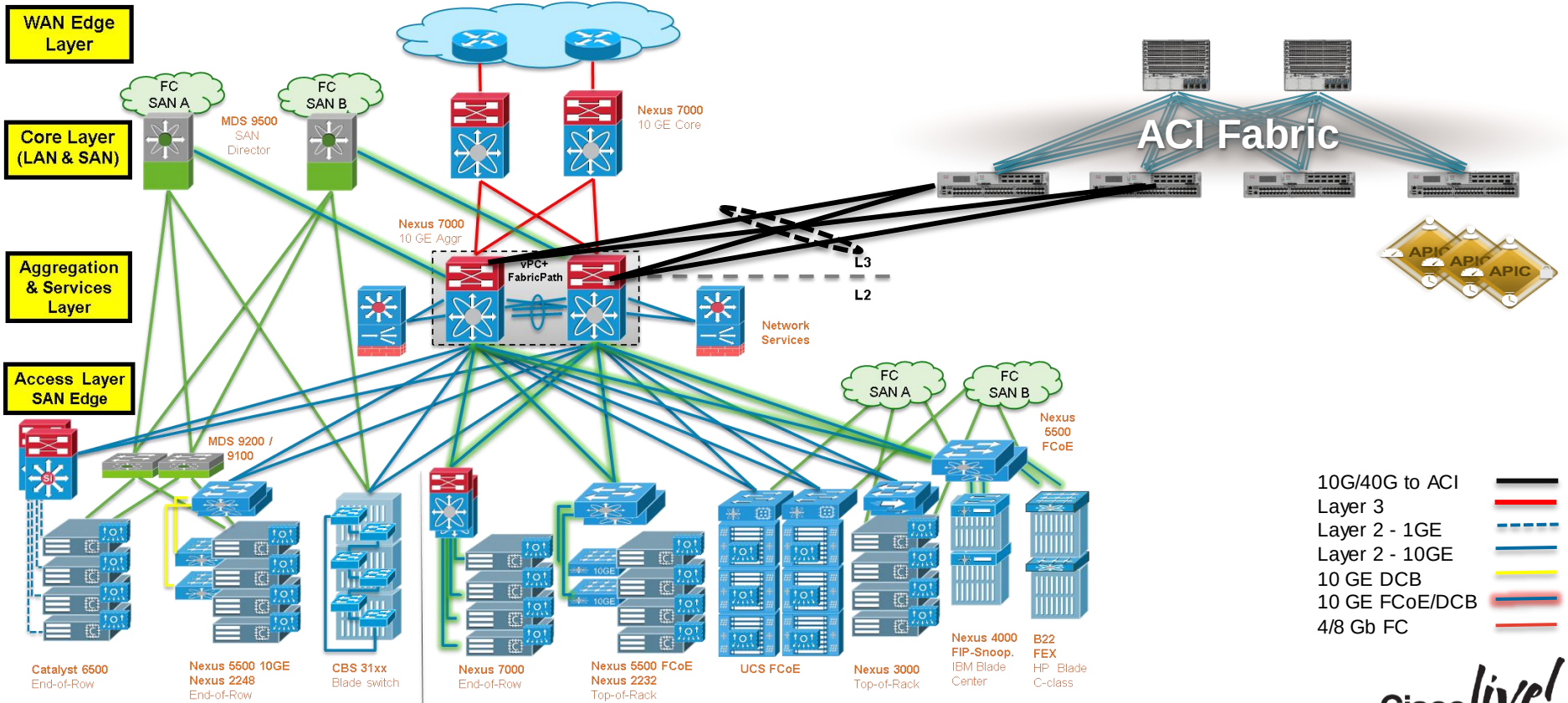
Network Centric Migration Example

VRF + 2 VLANs

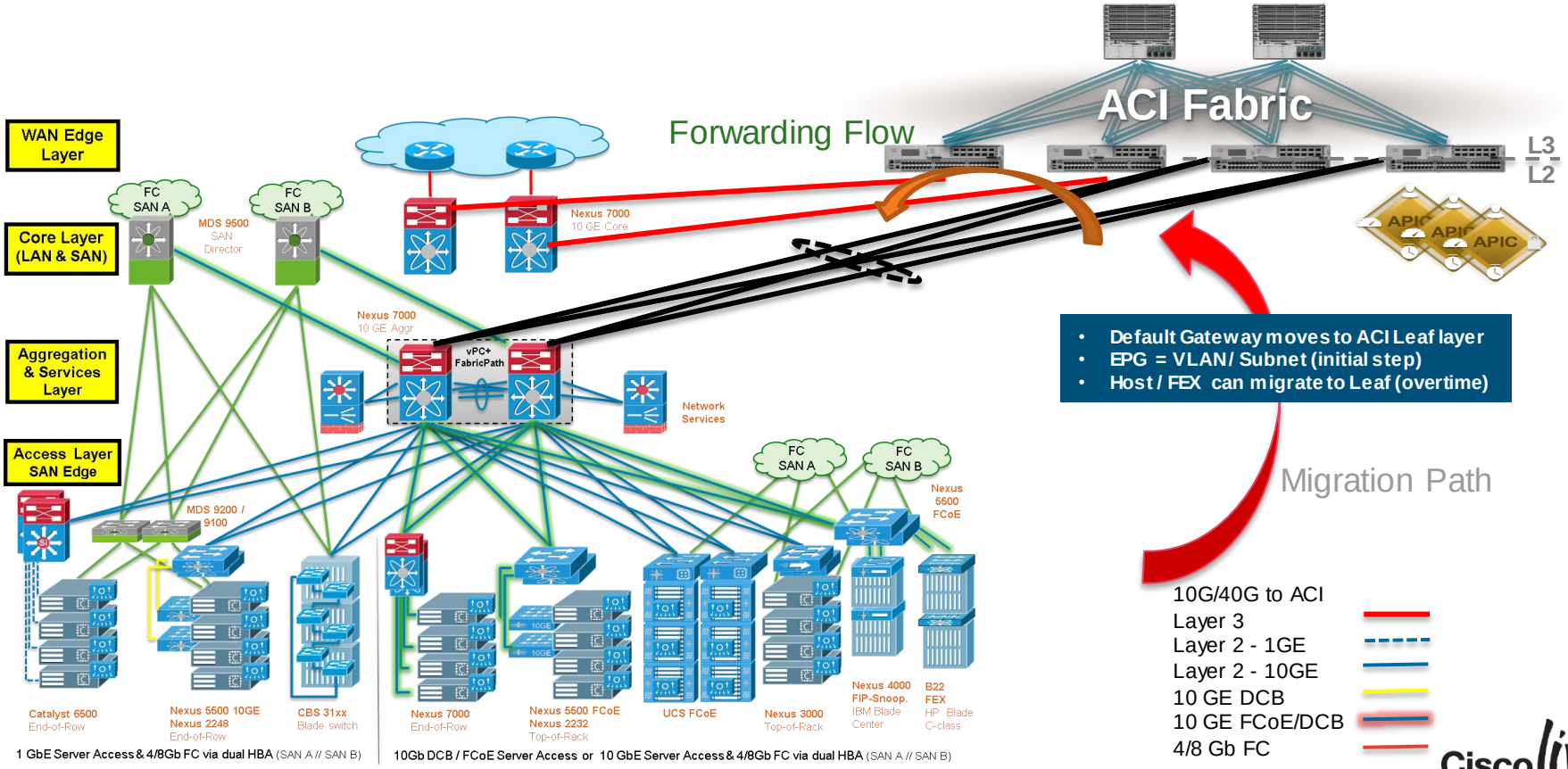


- STP compatibility with Classic Network
- VLAN 10 maps to BD Blue_1
- VLAN 11 maps to BD Blue_2
- Classic Devices are still the Default Gateway
- Equally applicable to L4-7 services (FW/LB) in the Classic Network
- Flooding enabled on ACI BDs during migration
- Once migration completed, insert needed services and move Default Gateway ACI BDs

ACI Integration and Migration



ACI Integration and Migration



Nexus 9000 Migration from Standalone to ACI mode

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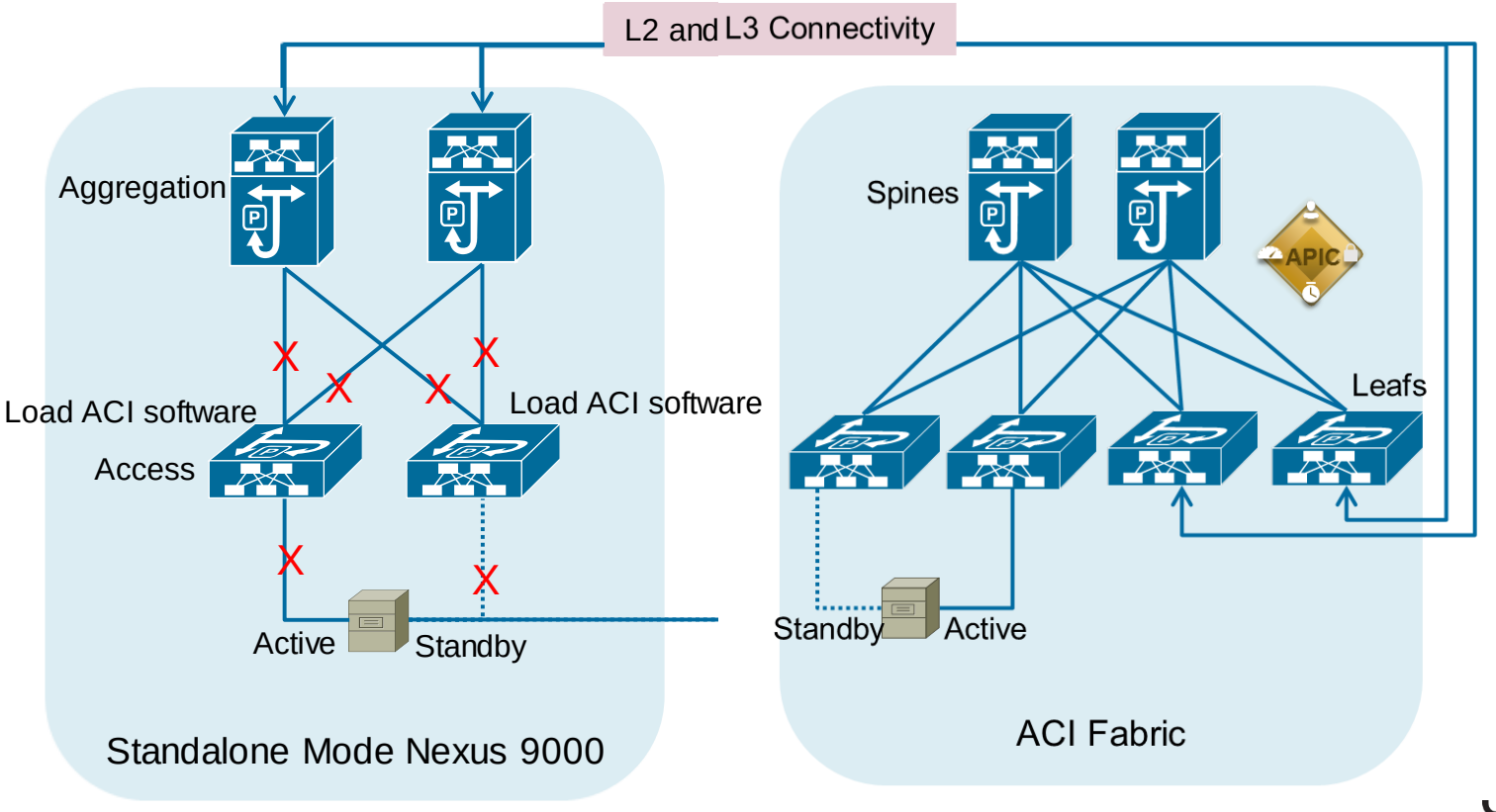
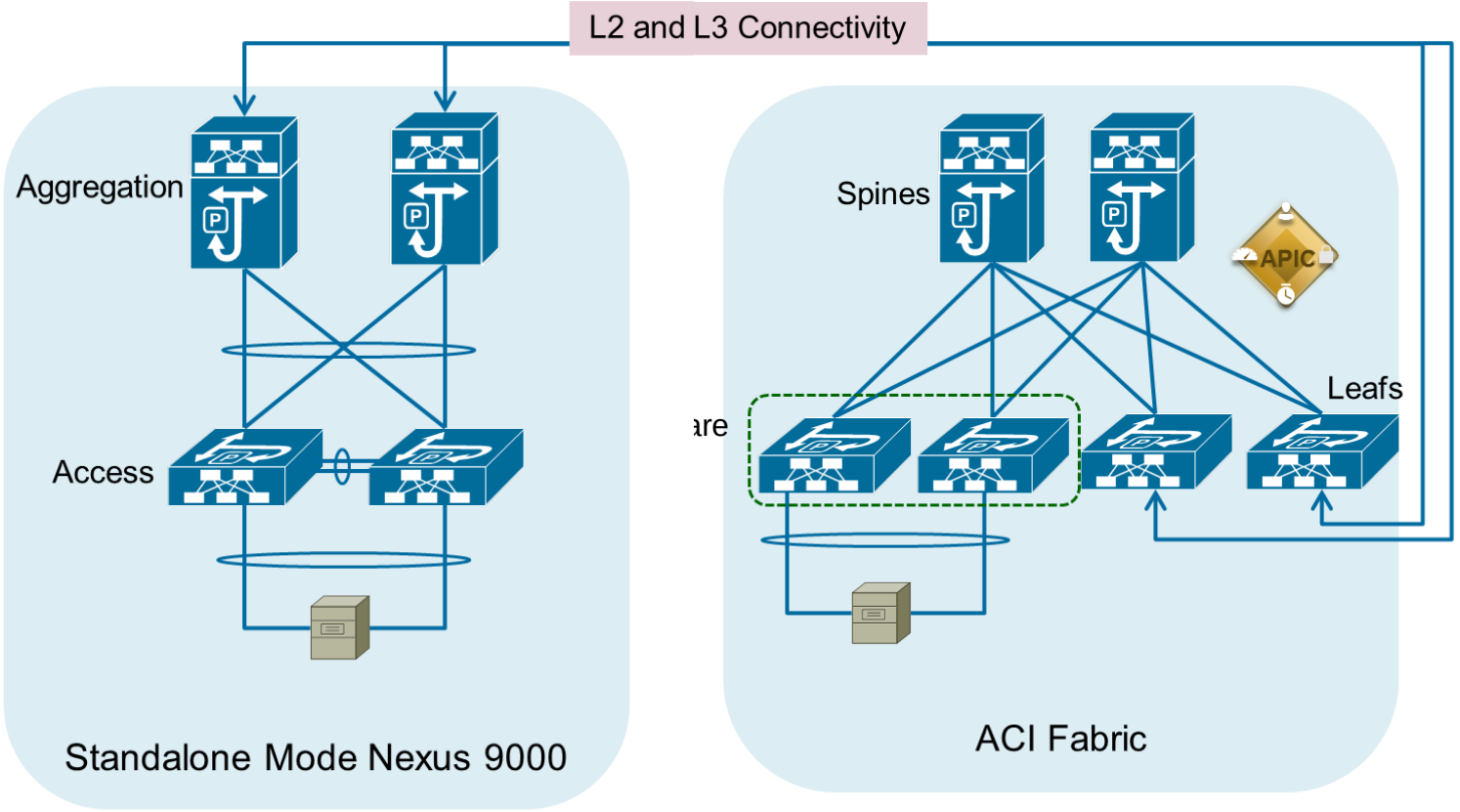
Nexus 9000 Standalone to ACI Mode Migration non vPC



Nexus 9000 Standalone to ACI Mode Migration: vPC

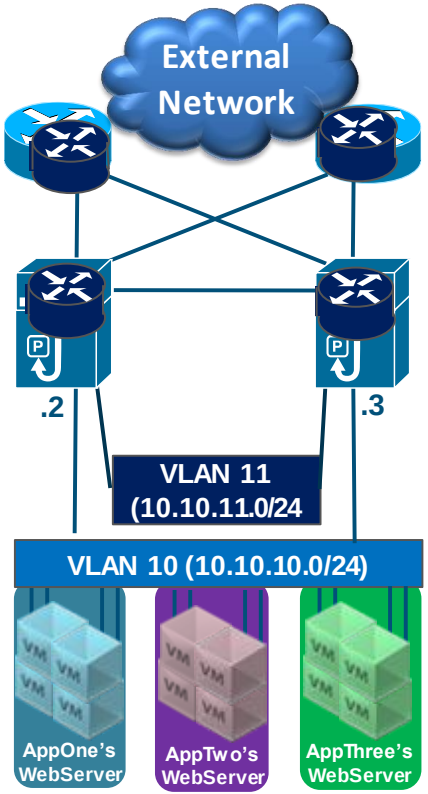


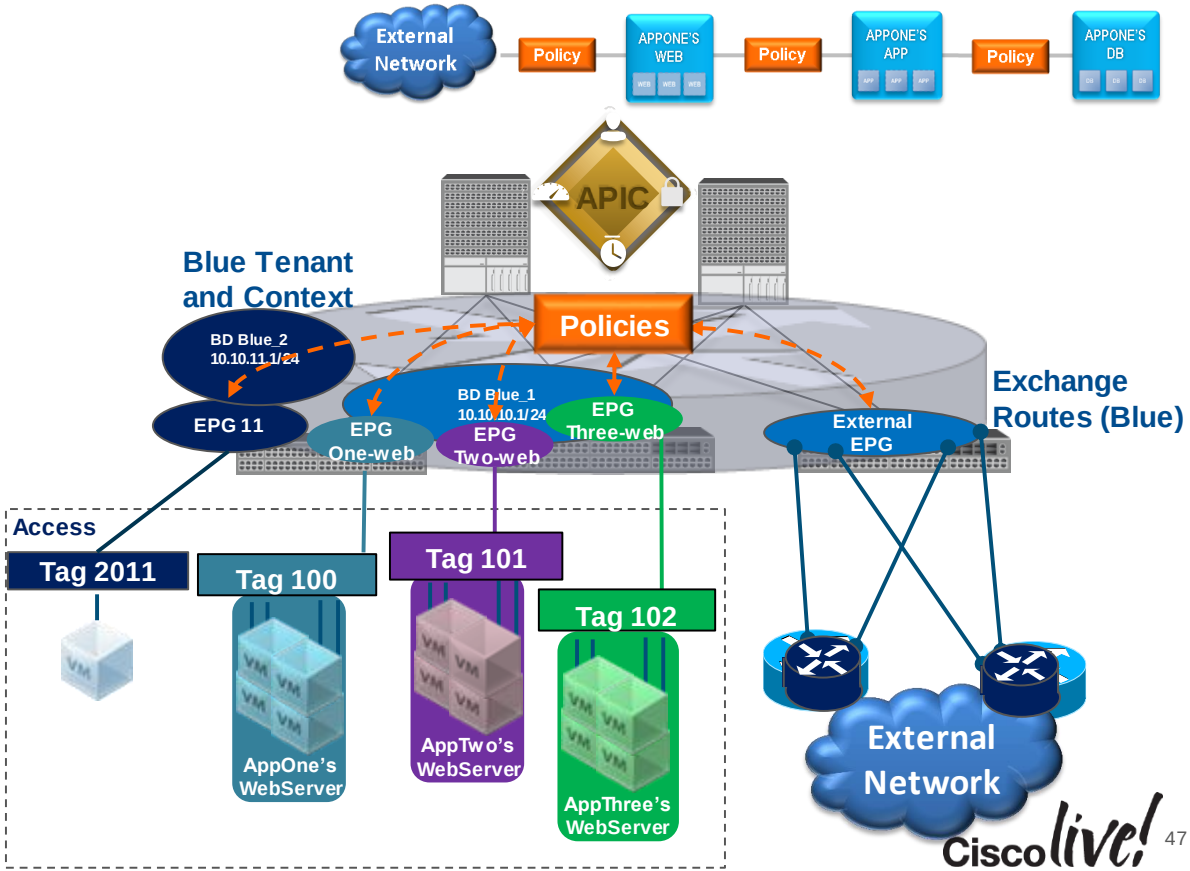
Agenda

- Application Centric Infrastructure (ACI) Overview
- ACI Adoption and Migration Strategies
  - Network Centric
  - Hybrid Approach
  - Application Centric

Deployment Example – Hybrid Approach

Classic mode shown here for Reference





Hybrid (Network and Application Centric) ACI Migration

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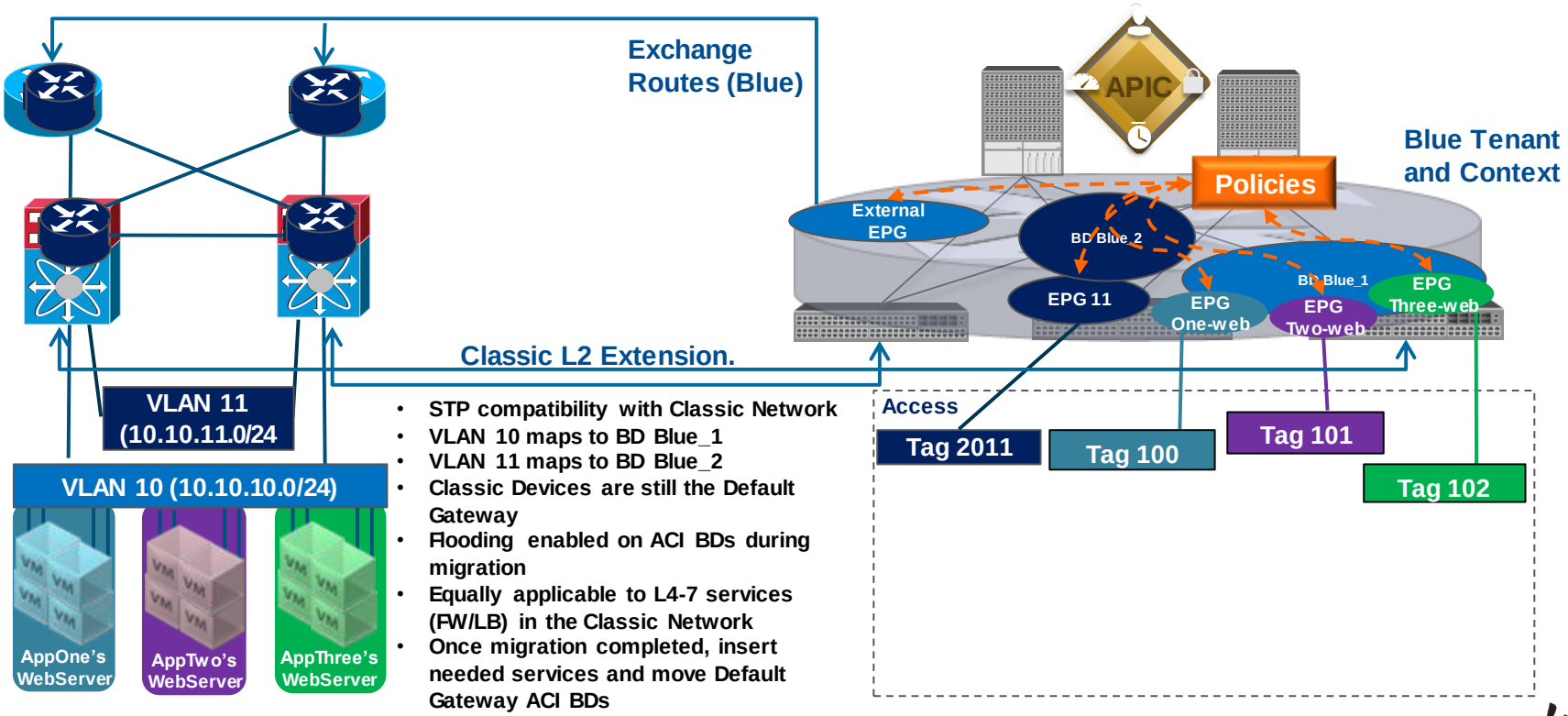
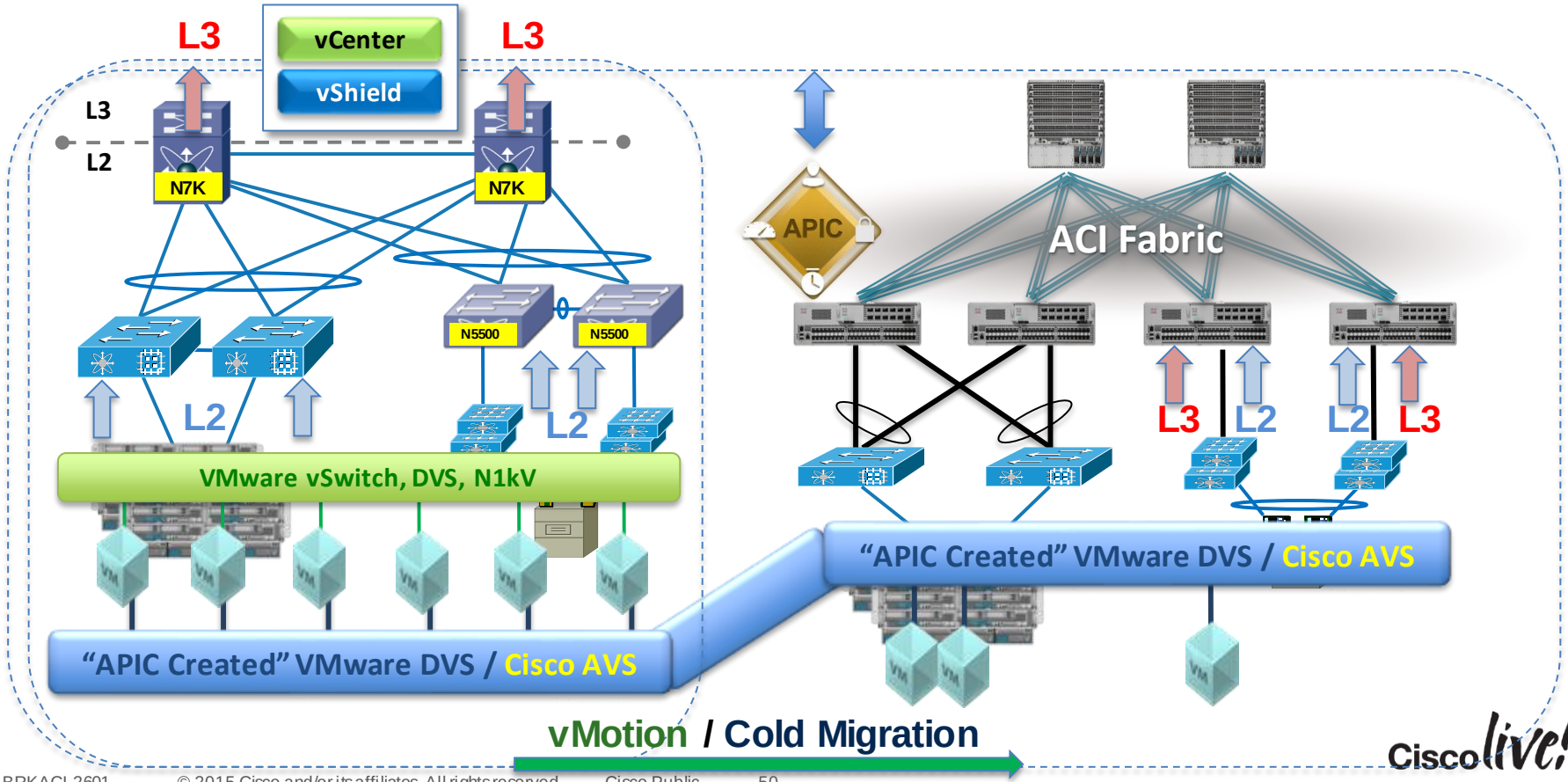
ACI Migration for Hybrid Approach

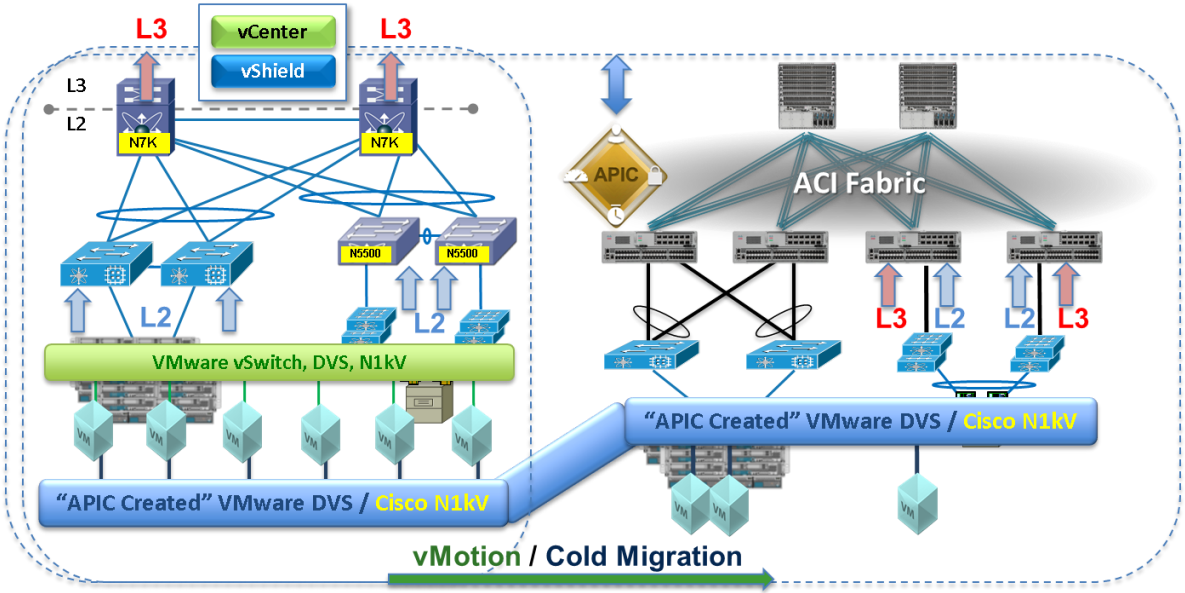


- STP compatibility with Classic Network
- VLAN 10 maps to BD Blue_1
- VLAN 11 maps to BD Blue_2
- Classic Devices are still the Default Gateway
- Flooding enabled on ACI BDs during migration
- Equally applicable to L4-7 services (FW/LB) in the Classic Network
- Once migration completed, insert needed services and move Default Gateway ACI BDs

Virtual Environment Migration Example



ACI Virtual Migration Assistant



- User and Workflow driven
- Multiple scenarios
  - vSwitch → ACI
  - DVS → ACI
  - N1kv → ACI
  - Any Combination → ACI

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Agenda

- Application Centric Infrastructure (ACI) Overview
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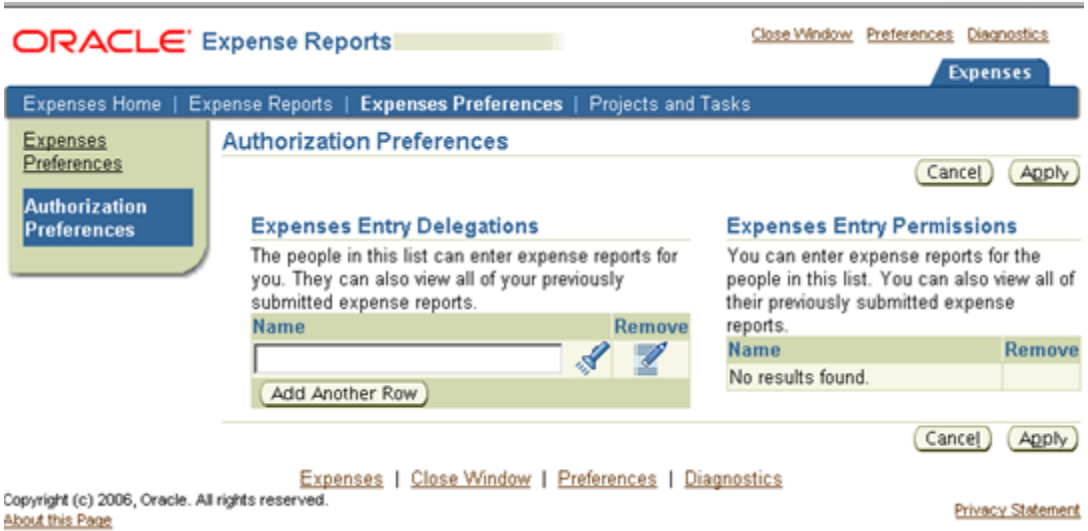
  - Hybrid Approach
  - Application Centric

Application Centric Migration

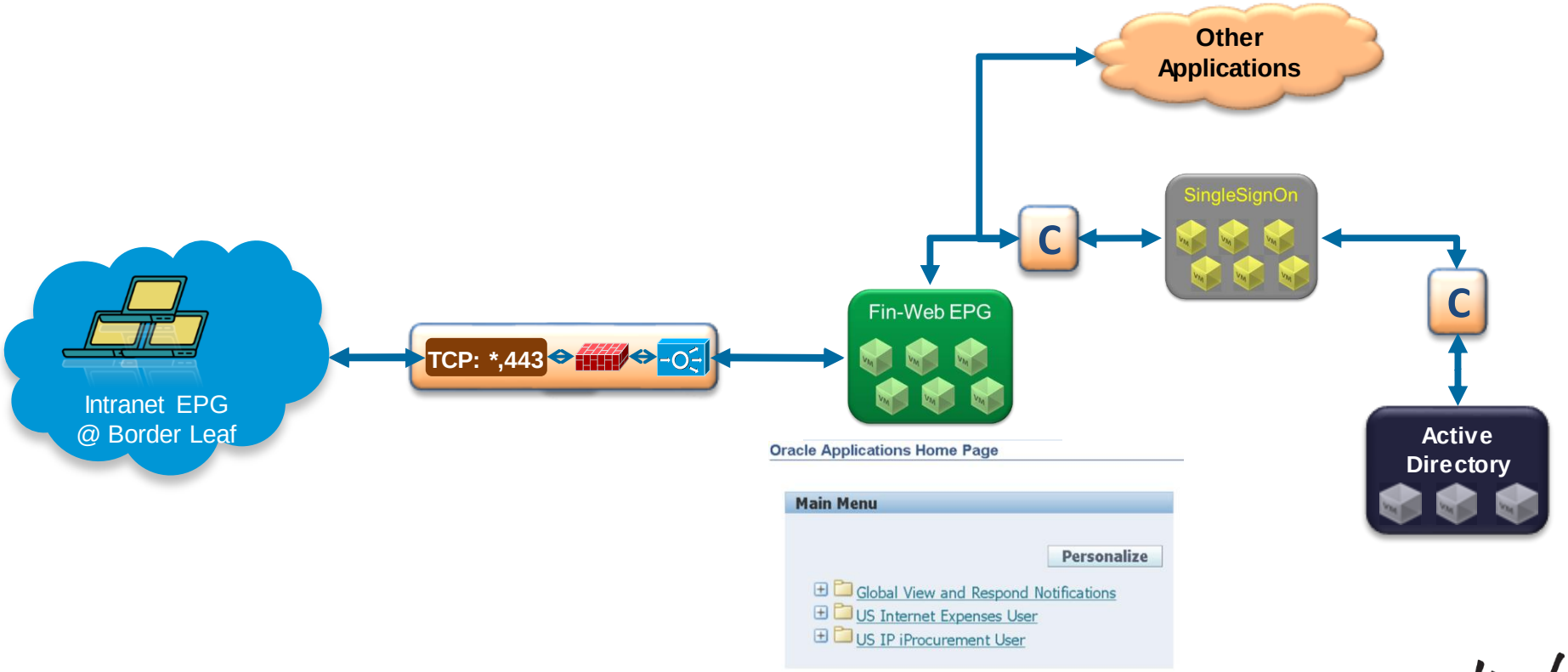
Building the Application Profile – an Example

Oracle Internet Expenses



Application Centric Migration

Building the Application Profile – an Example



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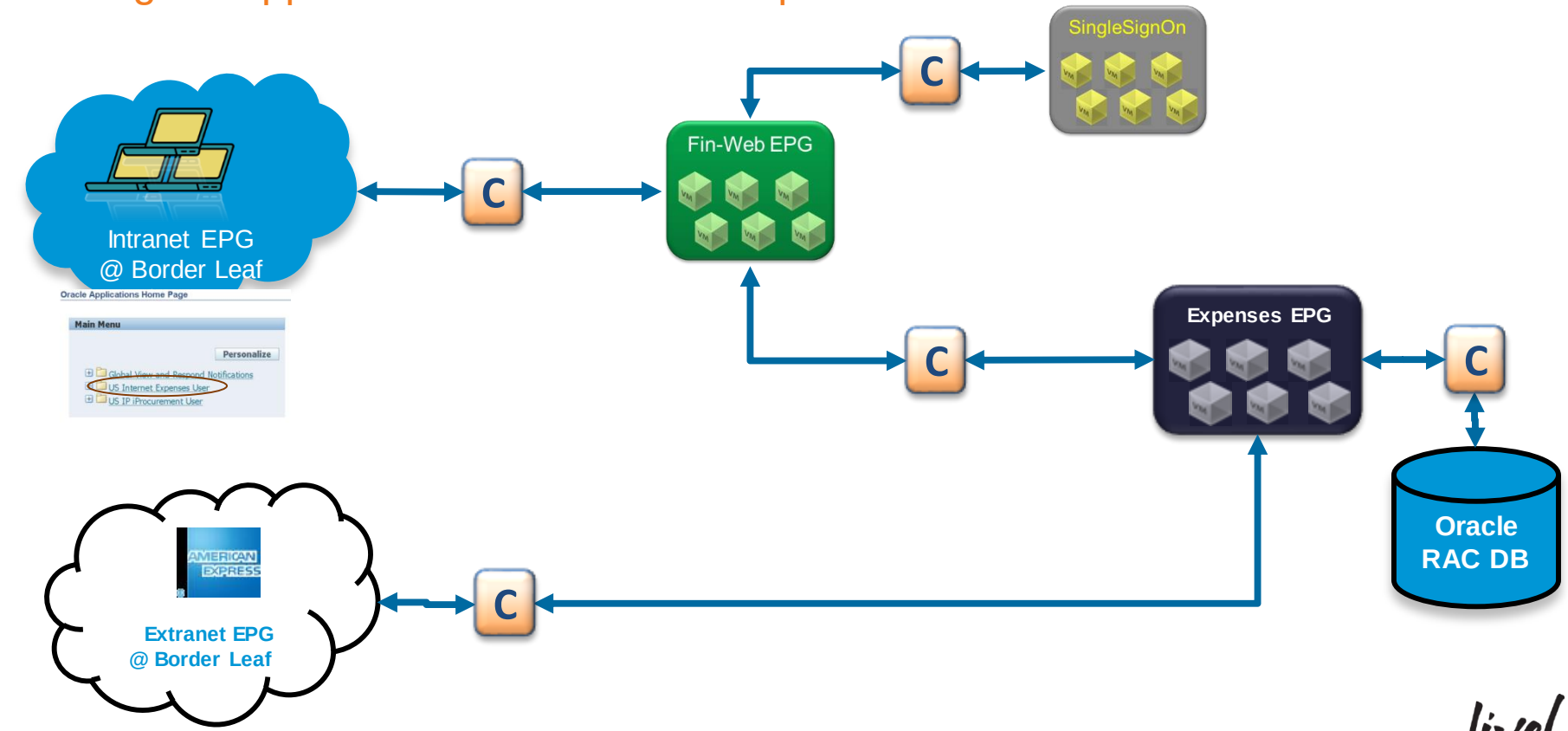
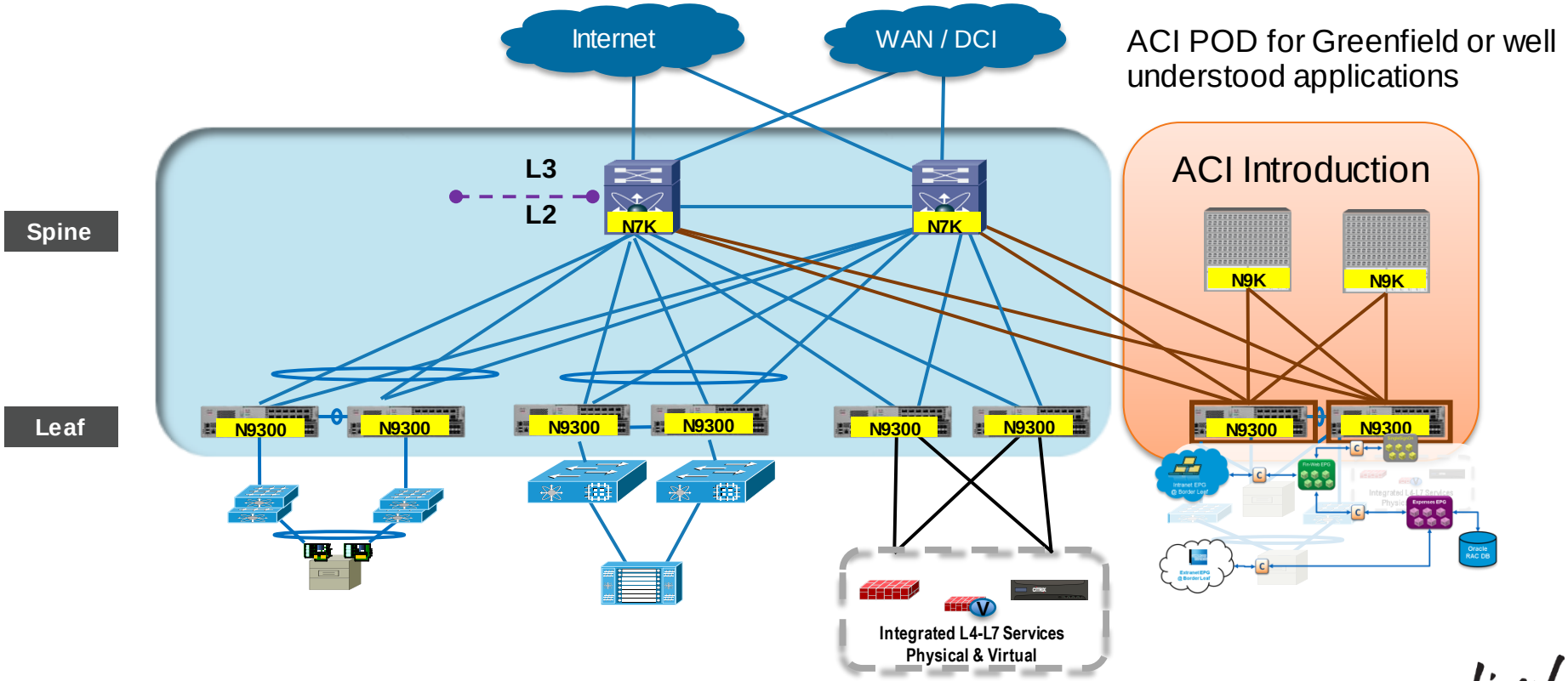
Application Centric Migration

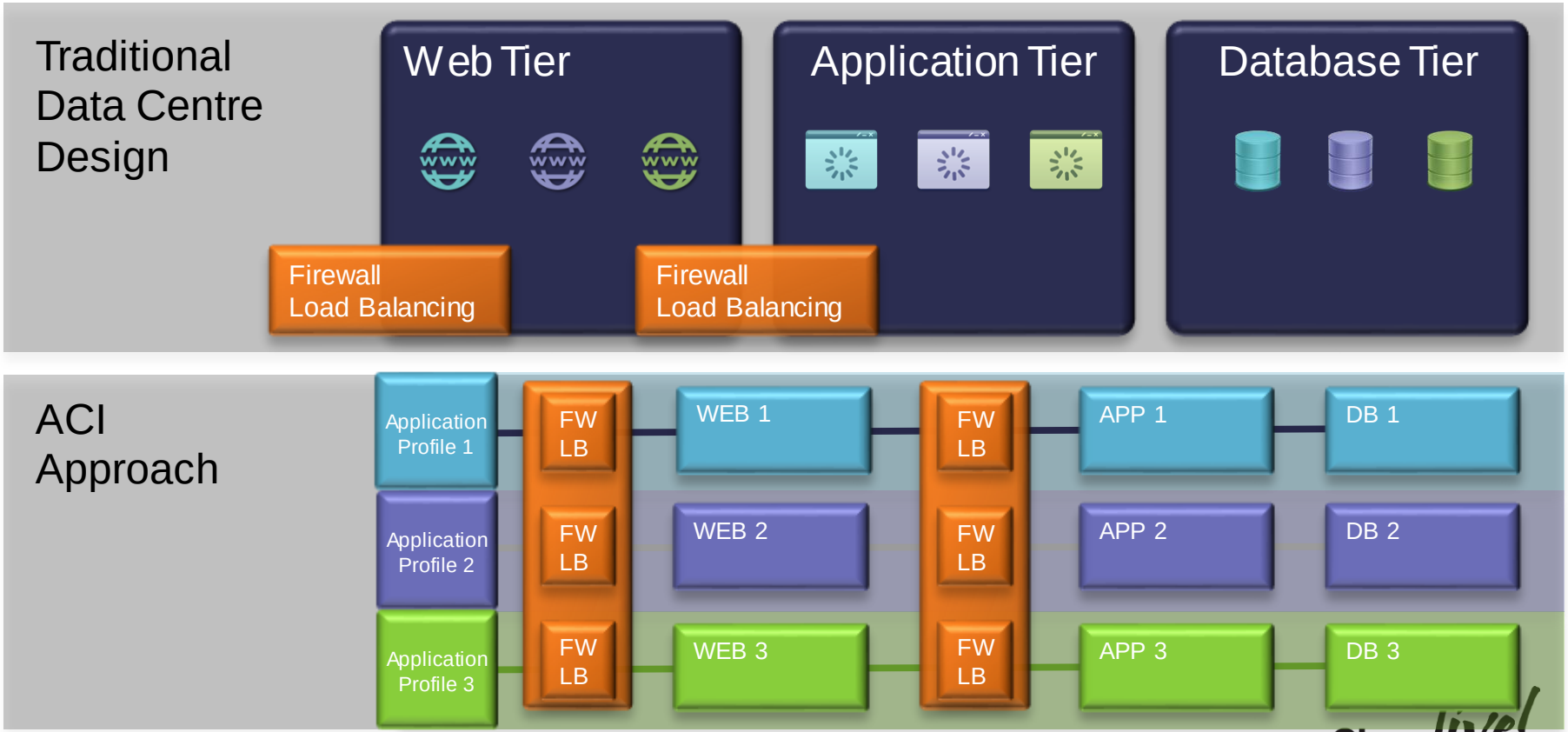
Building the Application Profile – an Example



ACI Deployments for Known Application Profiles



ACI Approach to Applications



Operational Challenges

1 Lack of Confidence in Existing Information

2 No Endpoint Details

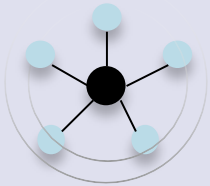
Identification

Layer 4 Ports

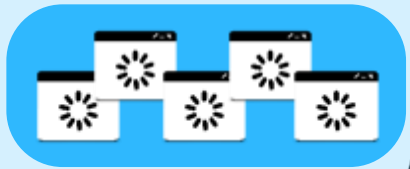
App → Host Association

3 Classify and Group

Endpoint Classification



Application Grouping



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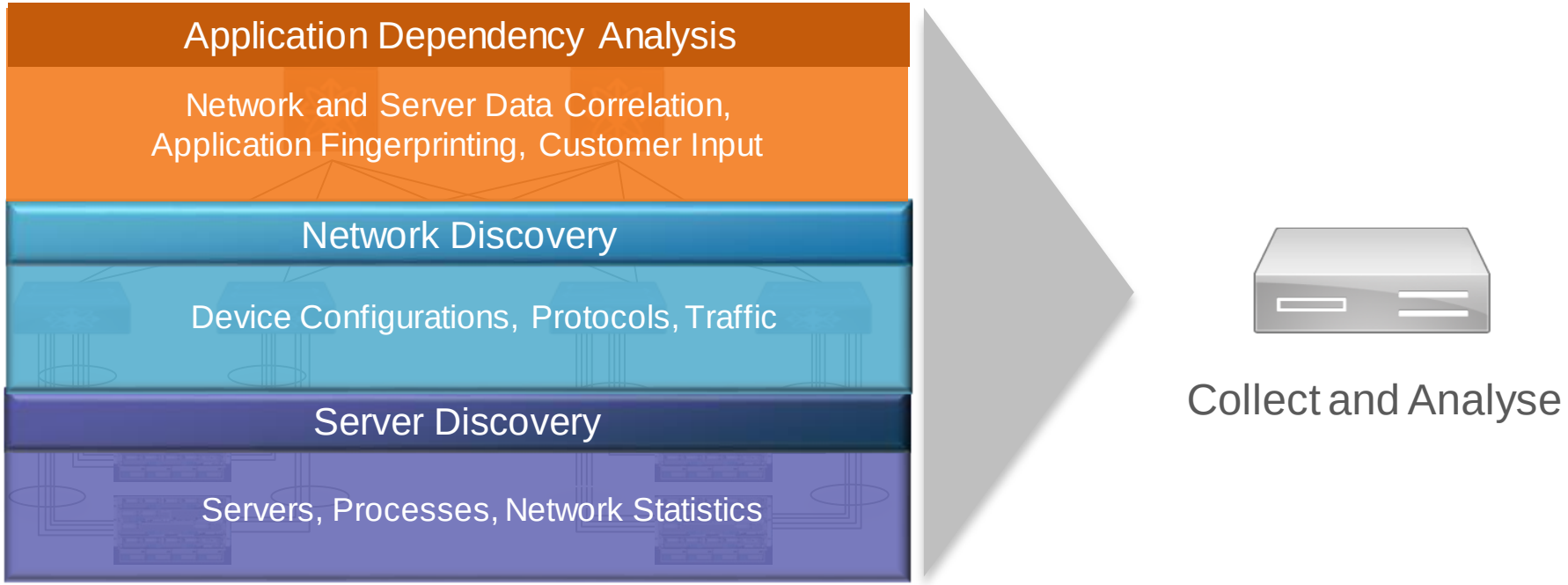
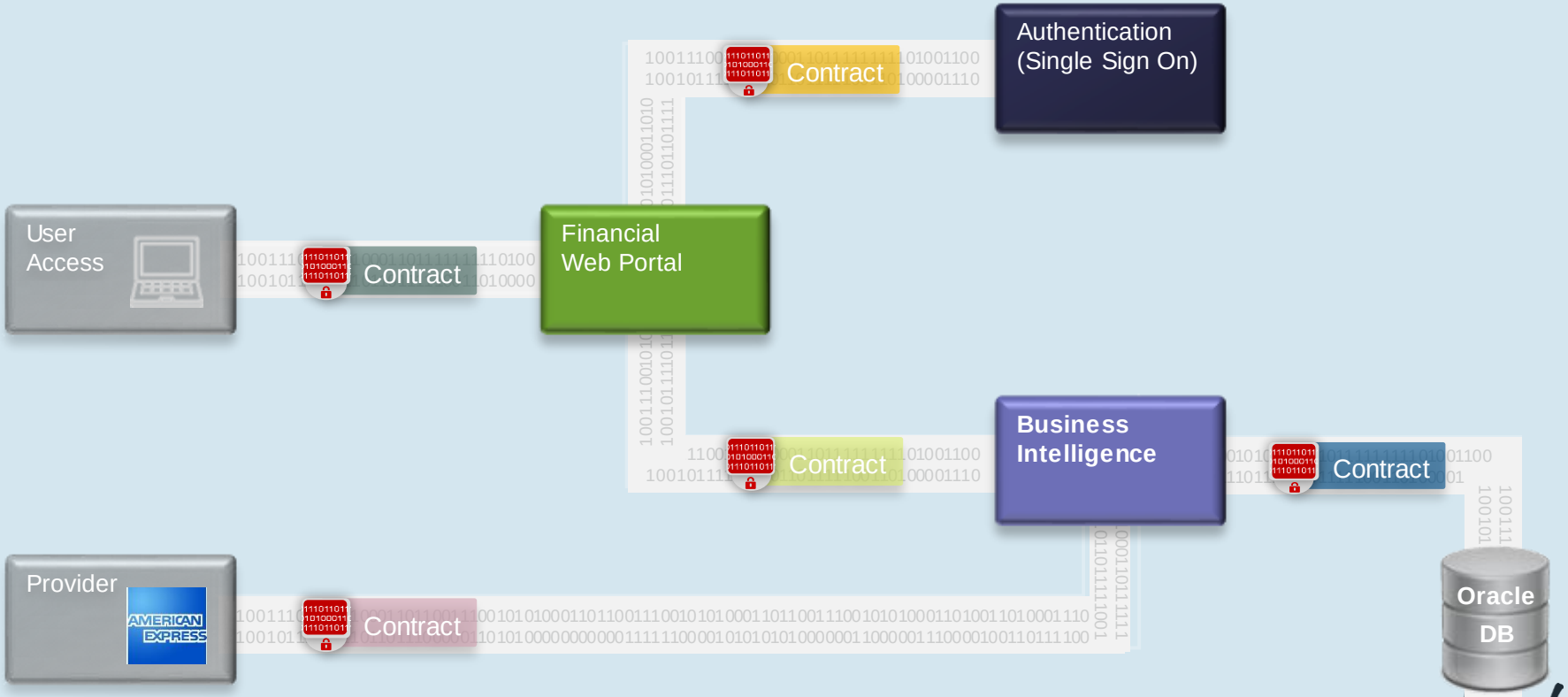
Application Profiling Methodology



Proposal for iExpenses



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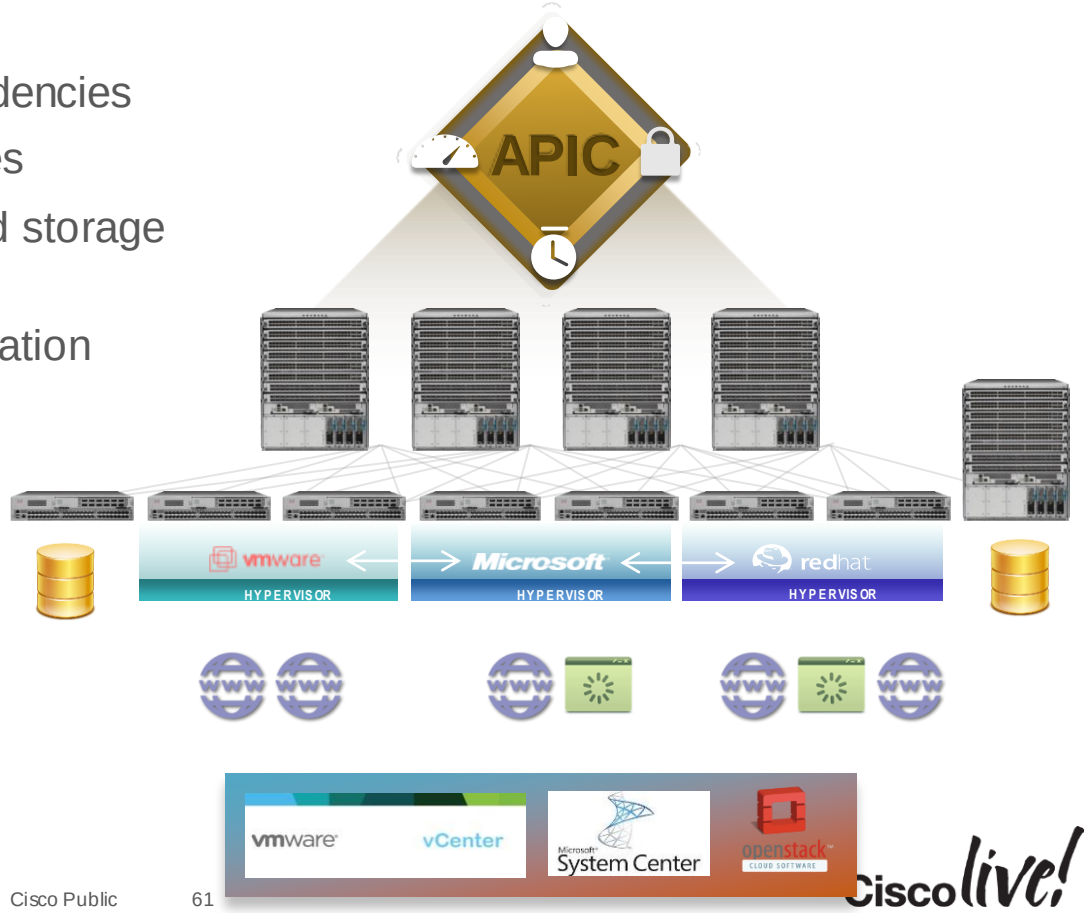
Advanced Services: Application Profiling for ACI

- Comprehensive application dependencies
- Multiple application network policies
- Application, compute, network, and storage mapping
- Automate physical and virtual migration



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ACI Migration Summary

- ACI designed from the ground-up to be Application Centric
- Flexible and customisable to fit your business needs
- A phased approach: Grow, Integrate, Migrate
- Solution flexible to be Network Centric, Application Centric or a Hybrid approach

Thank You!!

Call to Action

- Visit the World of Solutions for
  - Cisco Campus – Data Centre, ACI Booths with **Advanced Services Tools Demo**
  - Walk in Labs
  - Technical Solution Clinics
- Follow-up Breakout Sessions
  - BRKACI-2333 - Intermediate - Application Centric Networking Troubleshooting 101 - Install & Implementation of ACI
  - BRKACI-3344 - Advanced - Application Centric Networking Troubleshooting 201 – Day 2 Operations
- Meet the Engineer
- Lunch time Table Topics
- DevNet zone related labs and sessions
- Recommended Reading: for reading material and further resources for this session, please visit www.pearson-books.com/CLMilan2015


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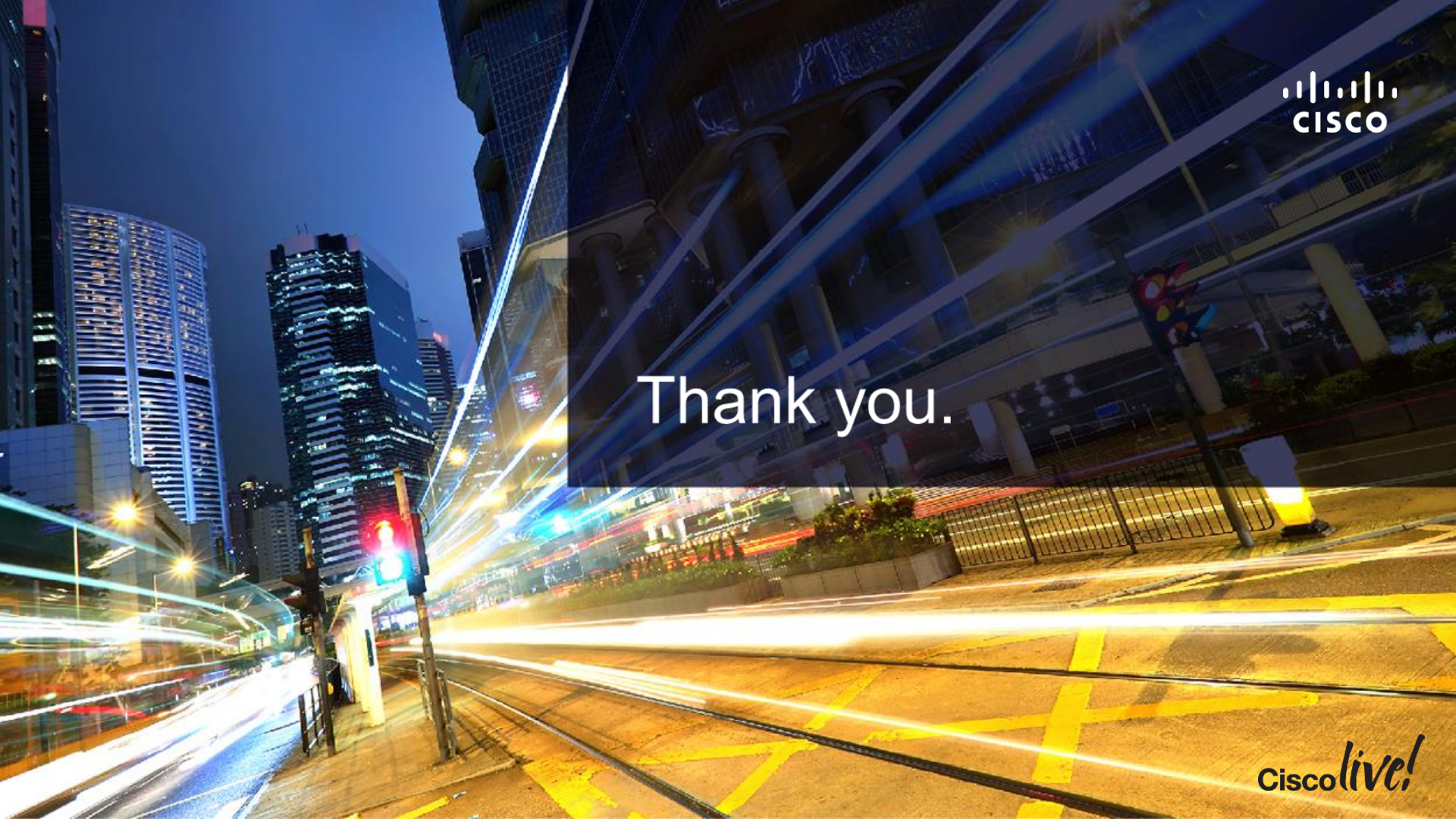
Thank you.


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