# Application Centric Infrastructure (ACI)

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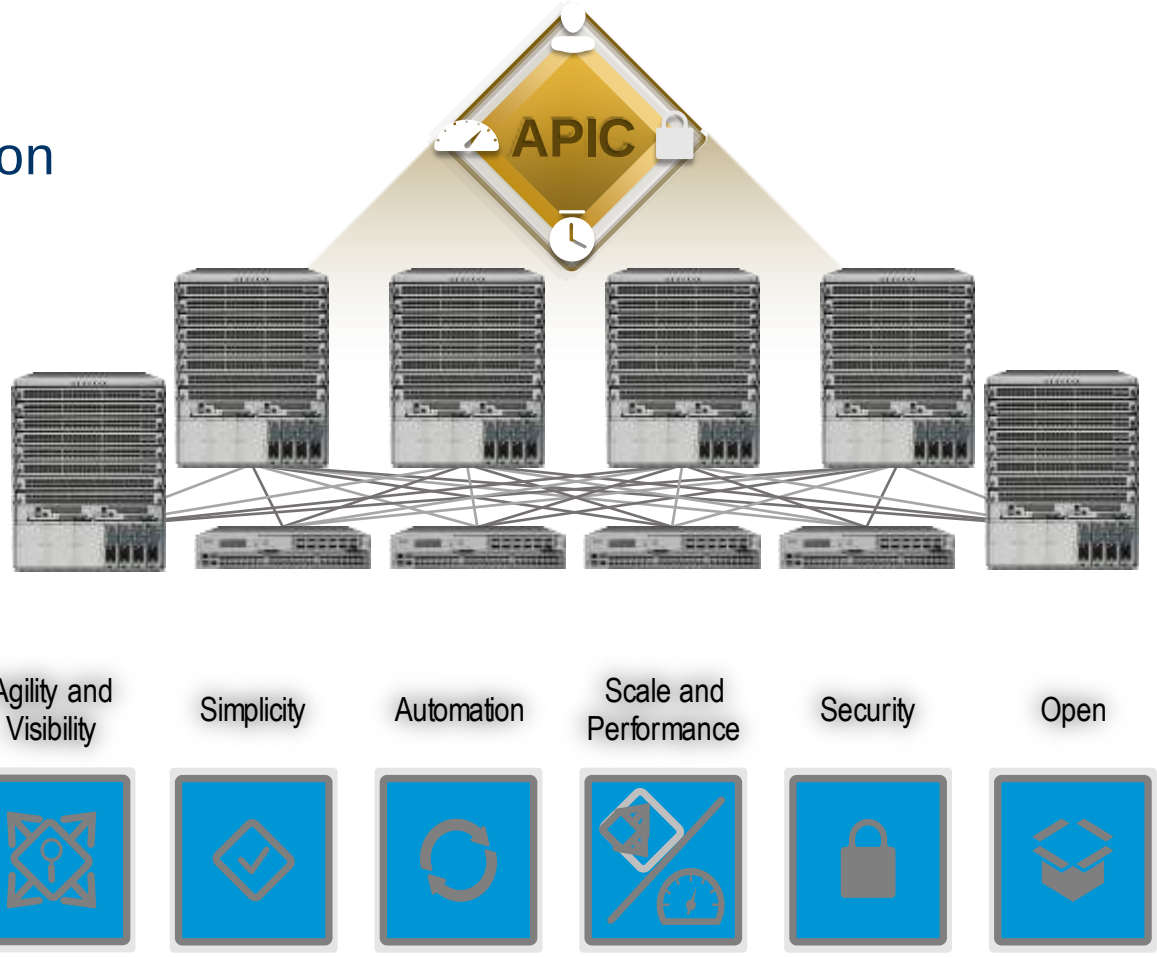
VMware Cloud Day

2013. November 19.

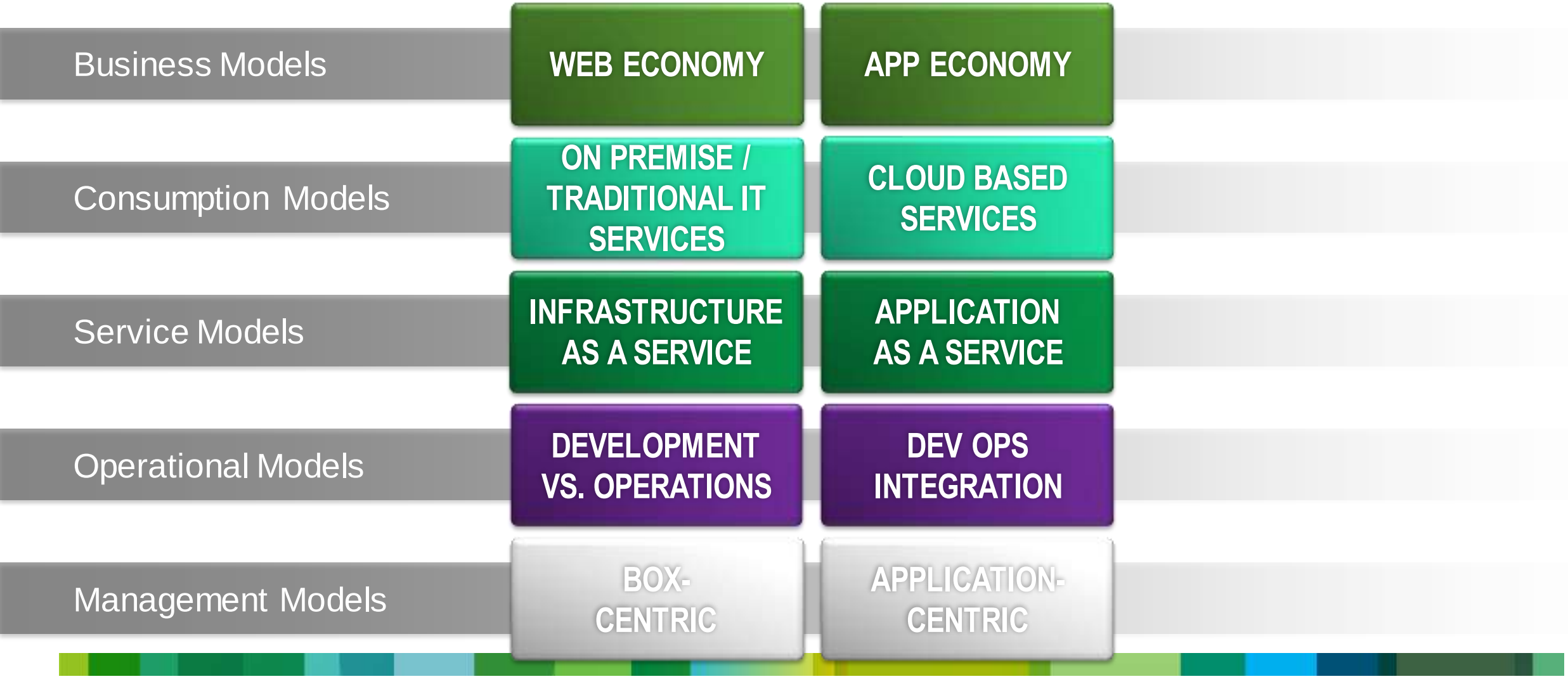
# Agenda

1. **Emerging Data Center Requirements**
2. Application Centric Infrastructure (ACI) Introduction
3. ACI Fabric
4. Nexus 9000 Hardware

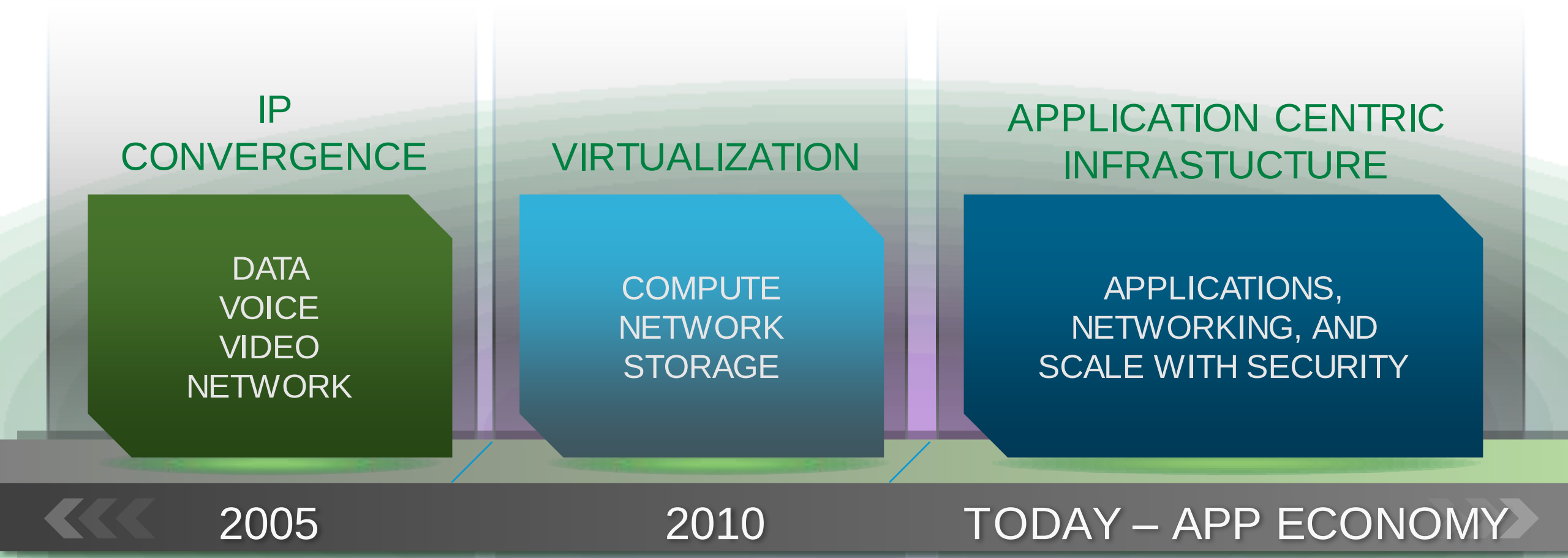


# All About the Application

## Shifts that are re-defining IT - at all levels



# Evolution to Application Centric Infrastructure



# Layer 2-7 Data Center Challenges …


Web Developer


App Developer


DBA



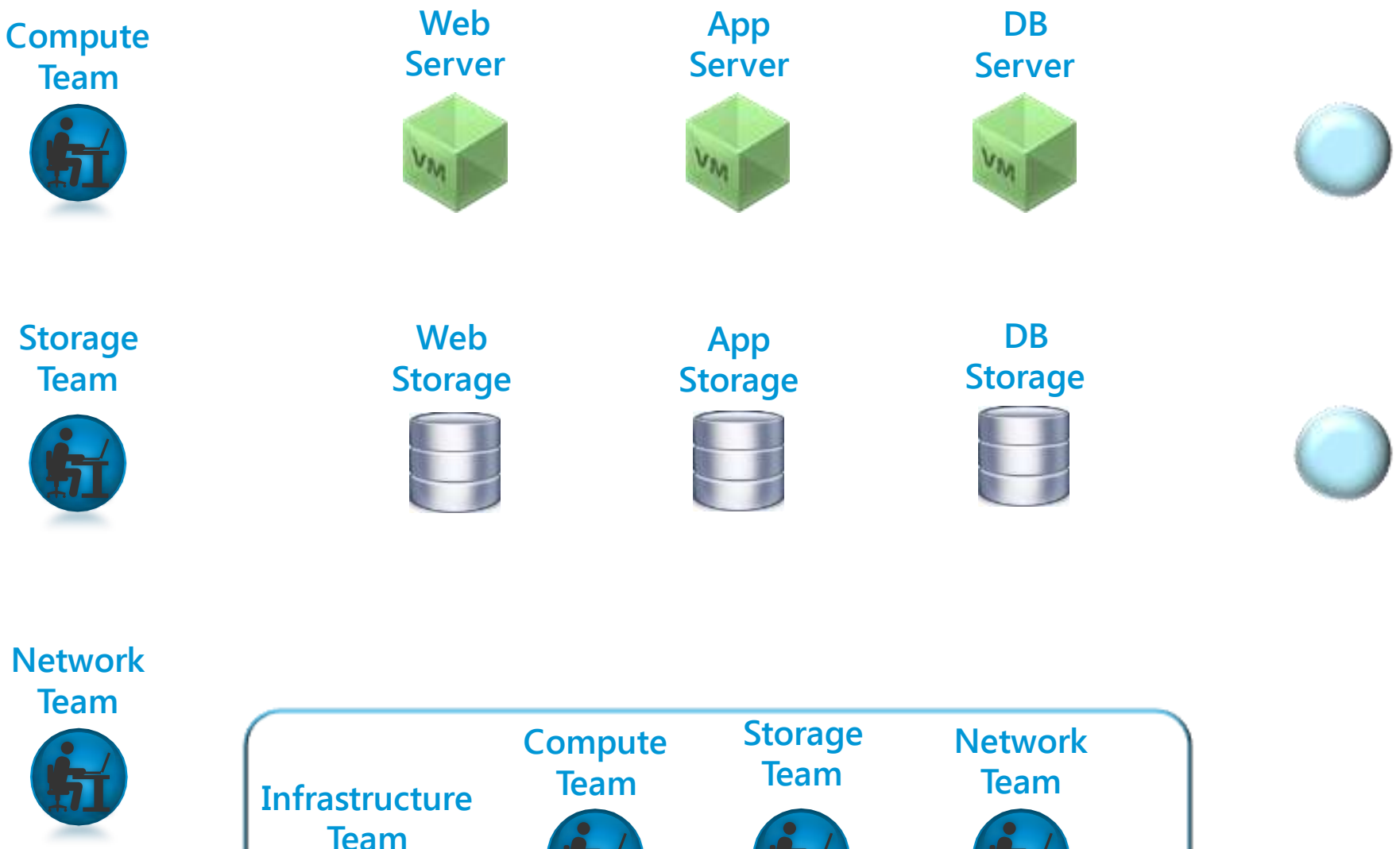
Infrastructure Team

Compute Team

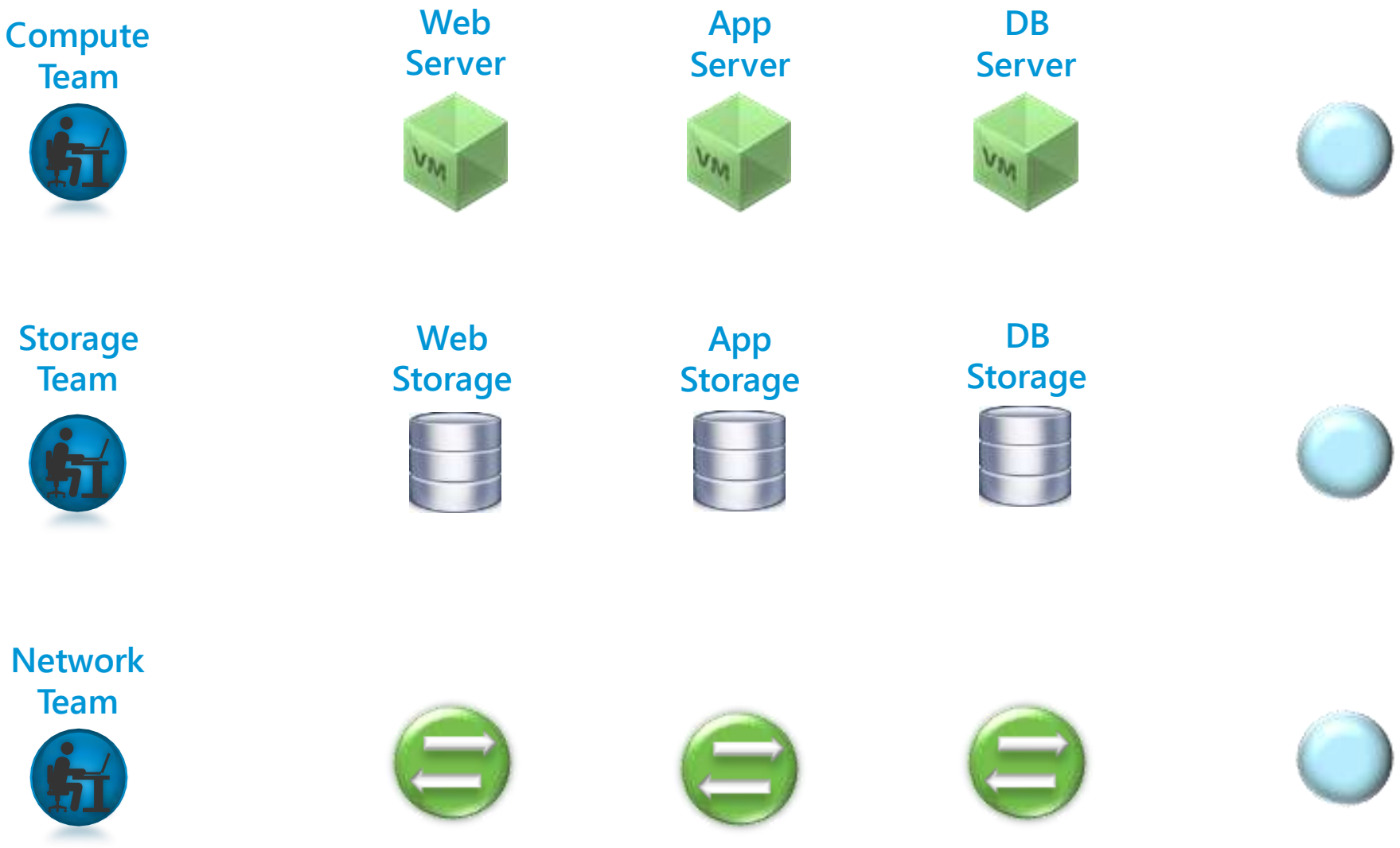
Storage Team

Network Team

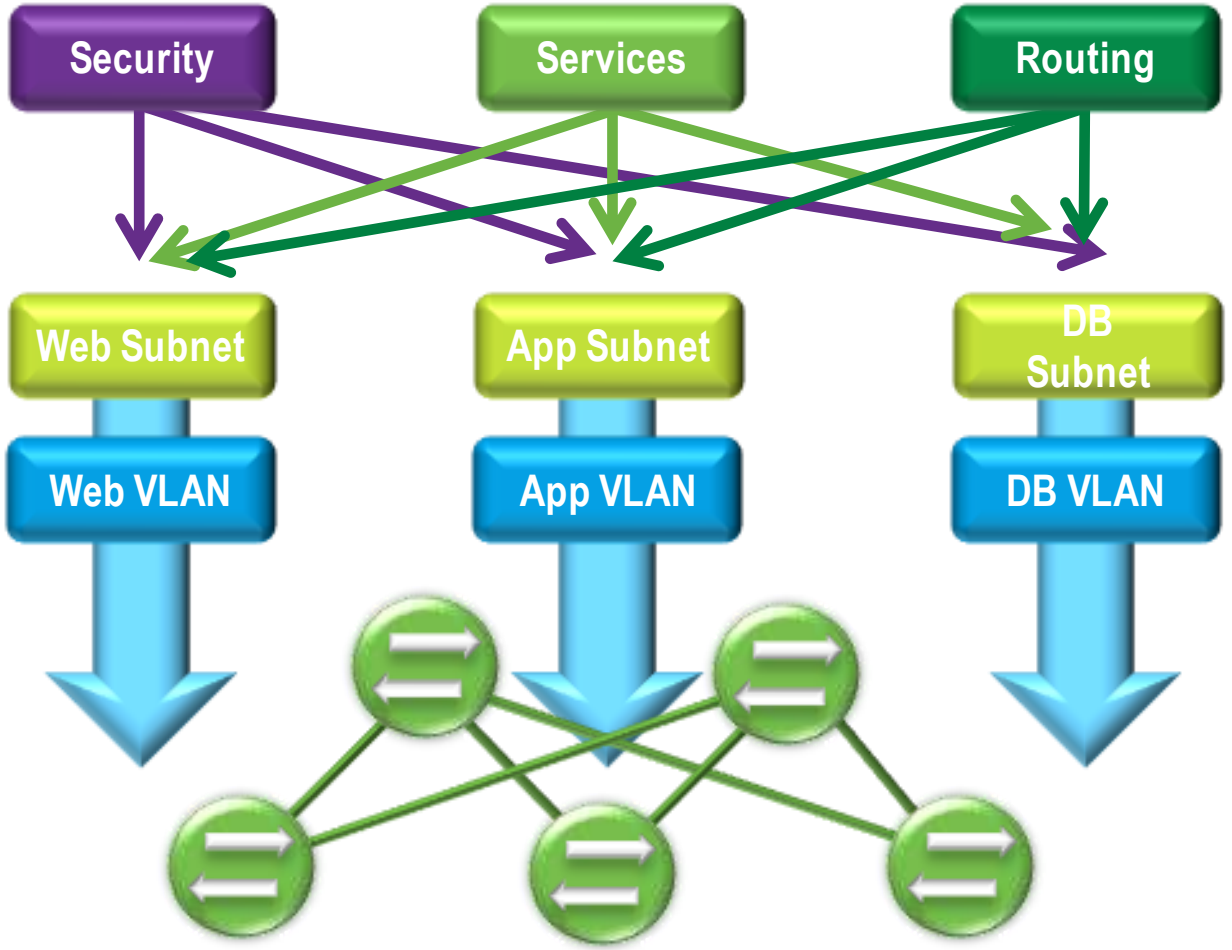
# Layer 2-7 Data Center Challenges – timing perspective



# Layer 2-7 Data Center Challenges – timing perspective



# Expanding to multiple network services …



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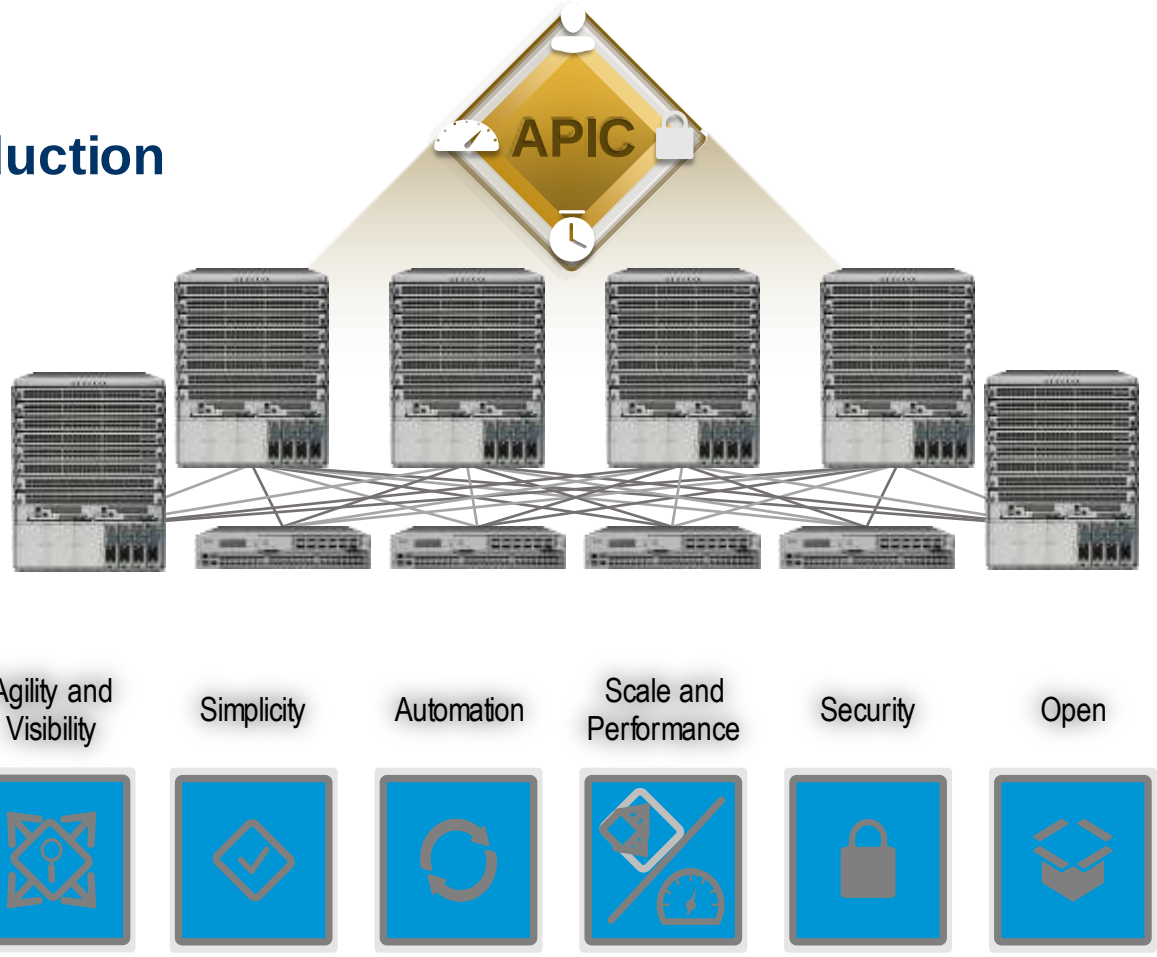


# ACI Building Blocks

Next Generation Software Upgradable Networks

OPEN RESTFUL APIS
CENTRALIZED POLICY MODEL
OPEN SOURCE

APIC

CONTROLLER

APIC


SIMPLE, SECURE

NEXUS 9500 and 9300

BUILT-IN LINE RATE
END POINT DIRECTORY

INNOVATIONS IN SOFTWARE HARDWARE AND SYSTEM DESIGN

PRICE | PERFORMANCE | PORT DENSITY | PROGRAMMABILITY | POWER EFFICIENCY

SCALE OUT WITHOUT COMPROMISE
COMMON BUILDING BLOCKS - ACCESS AND CORE
0G NON-BLOCKING FABRIC

RESILIENCY:
IN SERVICE PATCHING,
UPGRADE, FAST RESTART

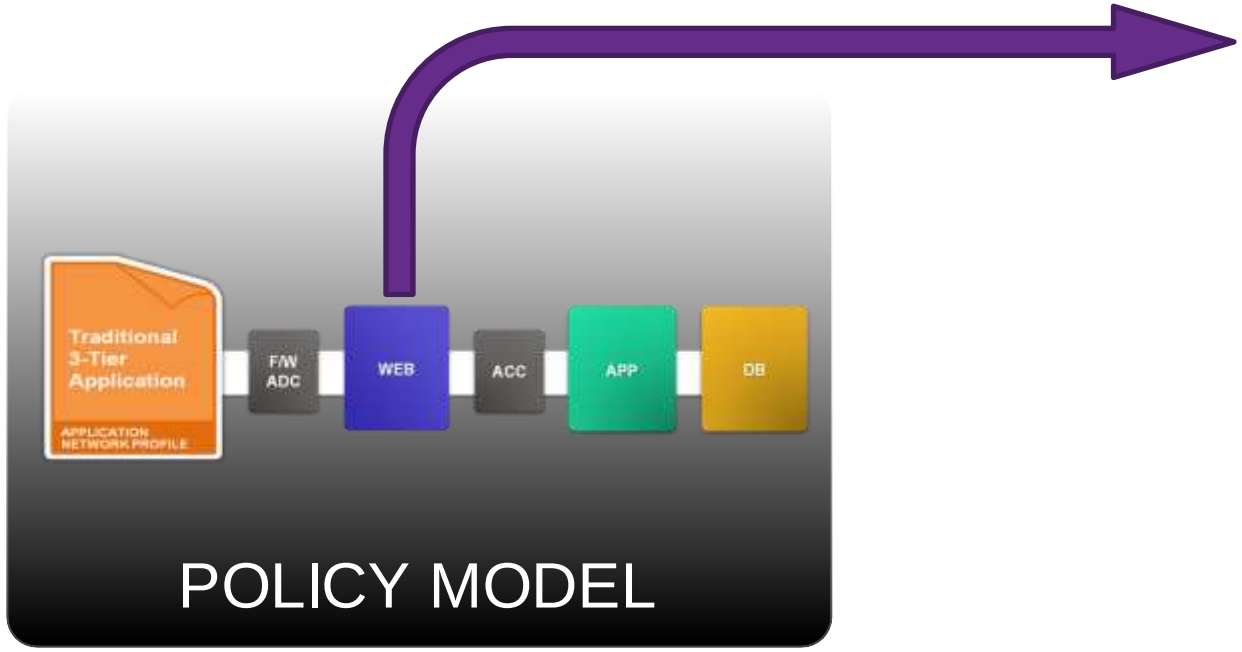
50% SIMPLER
CODE BASE

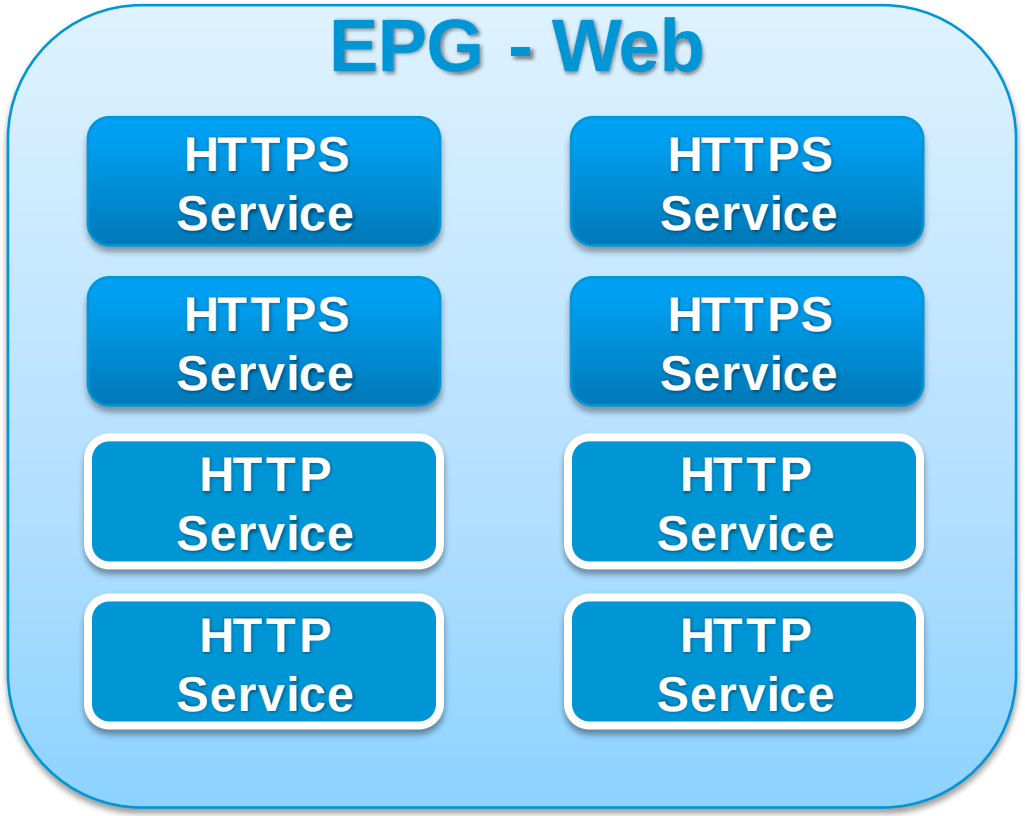
FUTURE PROOF
UPGRADABLE
TO ACI

NETWORK
VIRTUALIZATION
SUPPORT

PROGRAMMABILITY
AND AUTOMATION

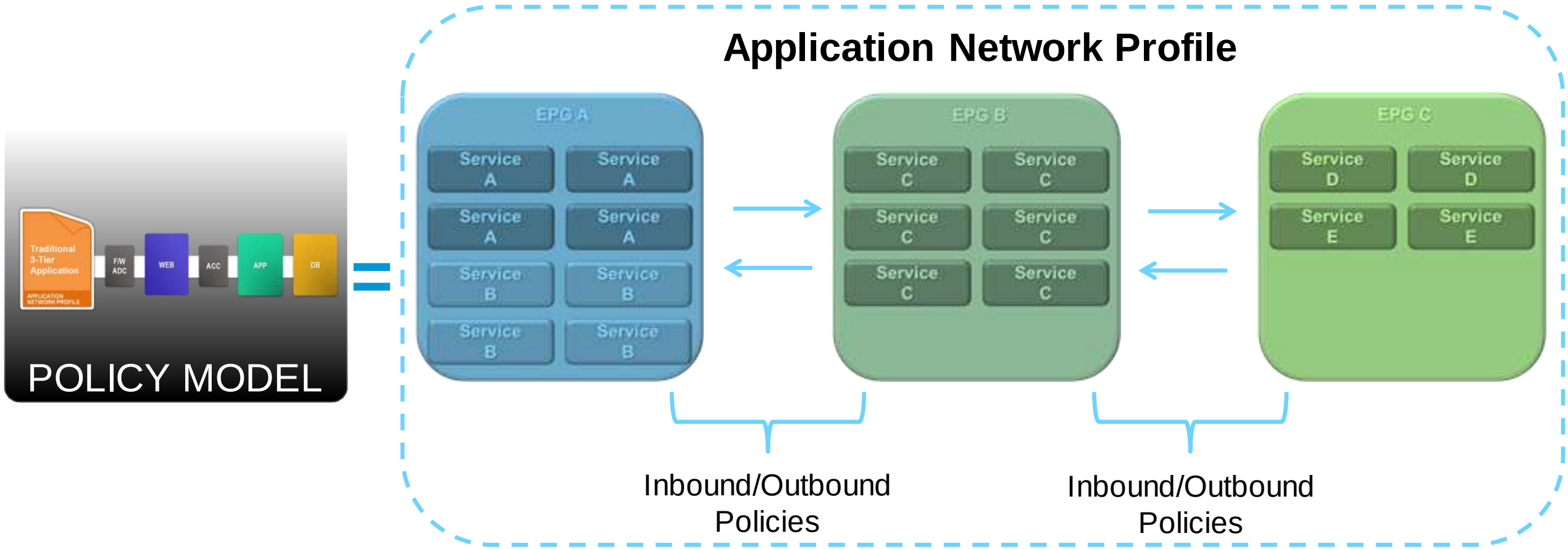
# ACI policy model brings the concept of End-Point Group (EPG)




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

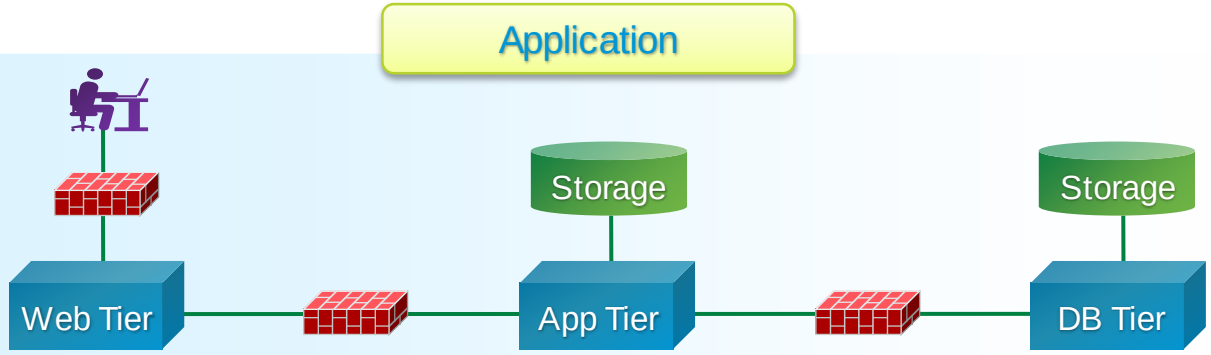
# Application Network Profiles (ANP)




Application Network profiles are a group of EPGs and the policies that define the communication between them.

# ACI Application Network Profile (ANP) Detailed
## Policy-Based Fabric Management

- Extend the principle of Cisco UCS® Manager service profiles to the entire fabric
- Application Network profile: **stateless definition of application requirements**
  - Application tiers
  - Connectivity policies
  - Layer 4 – 7 services
  - XML/JSON schema
- **Fully abstracted** from the infrastructure implementation
  - Removes dependencies of the infrastructure
  - Portable across different data center fabrics




The network profile fully describes the application connectivity requirements

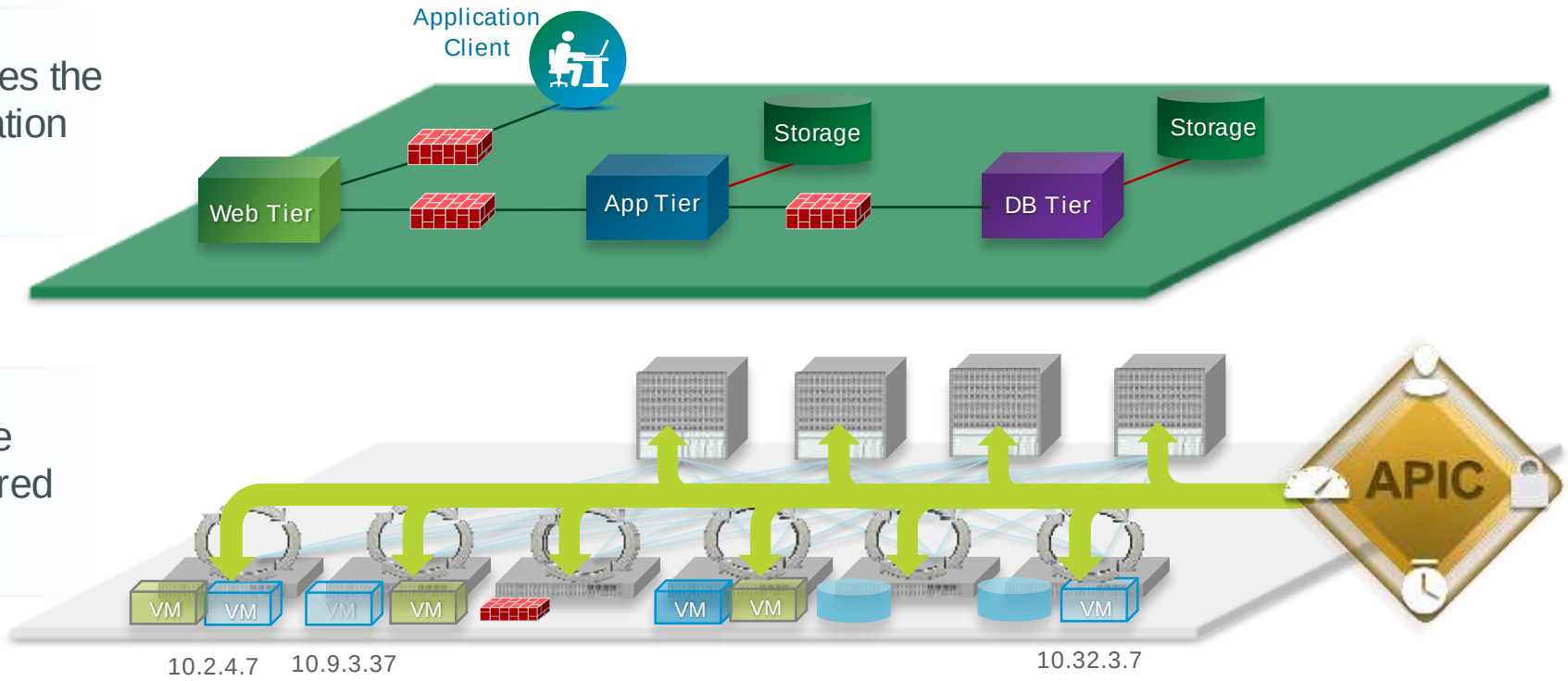
```
## App Network Profile: Defines Application Level Metadata (Pseudo Code Example)

<Network-Profile = Production_Web>
  <App-Tier = Web>
    <Connected-To = Application_Client>
       <Connection-Policy = Secure_Firewall_External>
   <Connected-To = Application_Tier>
       <Connection-Policy = Secure_Firewall_Internal & High_Priority>
. . .
 <App-Tier = DataBase>
   <Connected-To = Storage>
       <Connection-Policy = NFS_TCP & High_BW_Low_Latency>
. . .
```

# Application Policy Model and Instantiation

**Application policy model**: Defines the application requirements (application network profile)

**Policy instantiation**: Each device dynamically instantiates the required changes based on the policies




All forwarding in the fabric is managed through the application network profile

- IP addresses are fully portable anywhere within the fabric
- Security and forwarding are fully decoupled from any physical or virtual network attributes
- Devices autonomously update the state of the network based on configured policy requirements

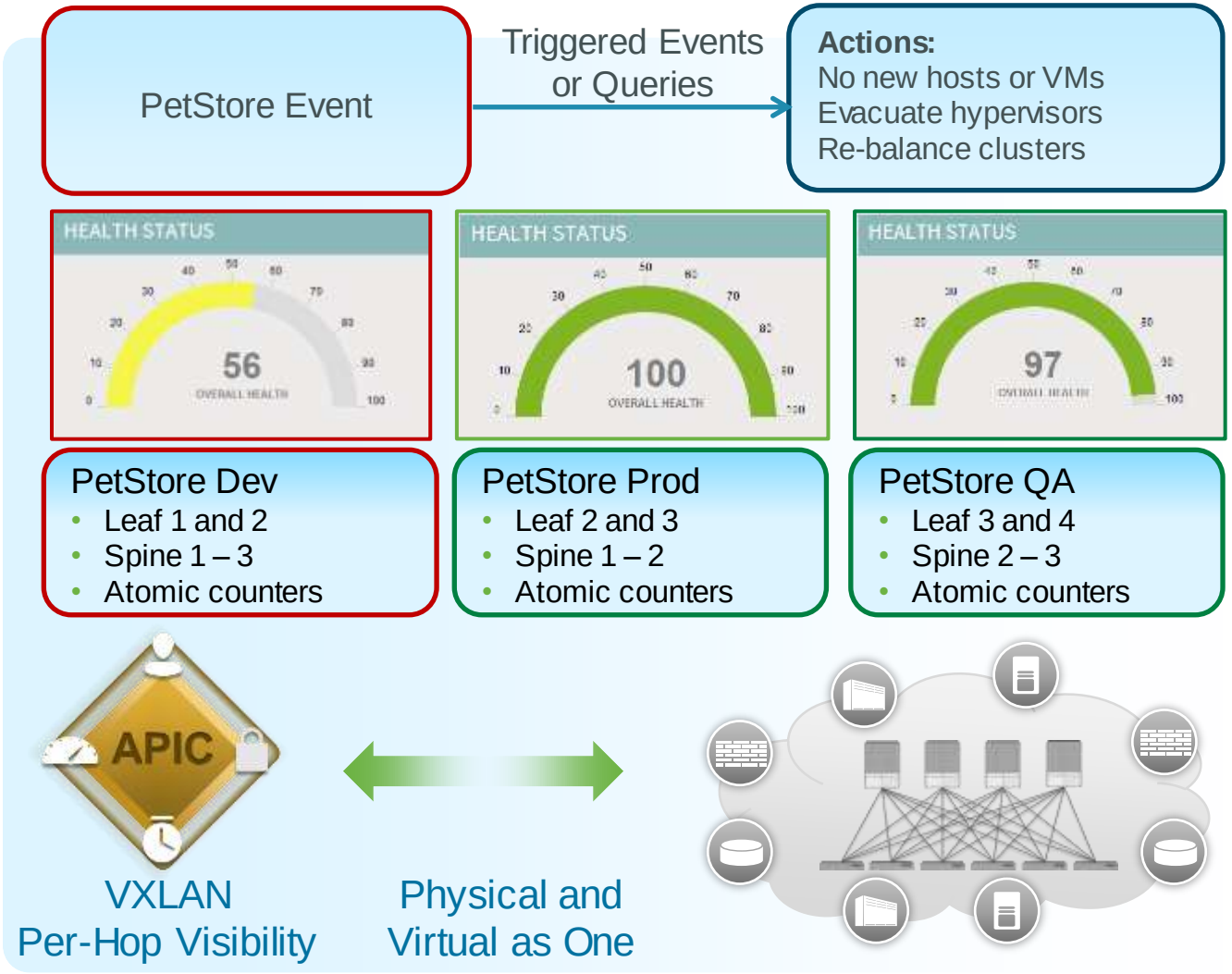
# Application Awareness
## Application-Level Visibility

ACI Fabric provides the next generation of analytic capabilities

Per application, tenants, and infrastructure:

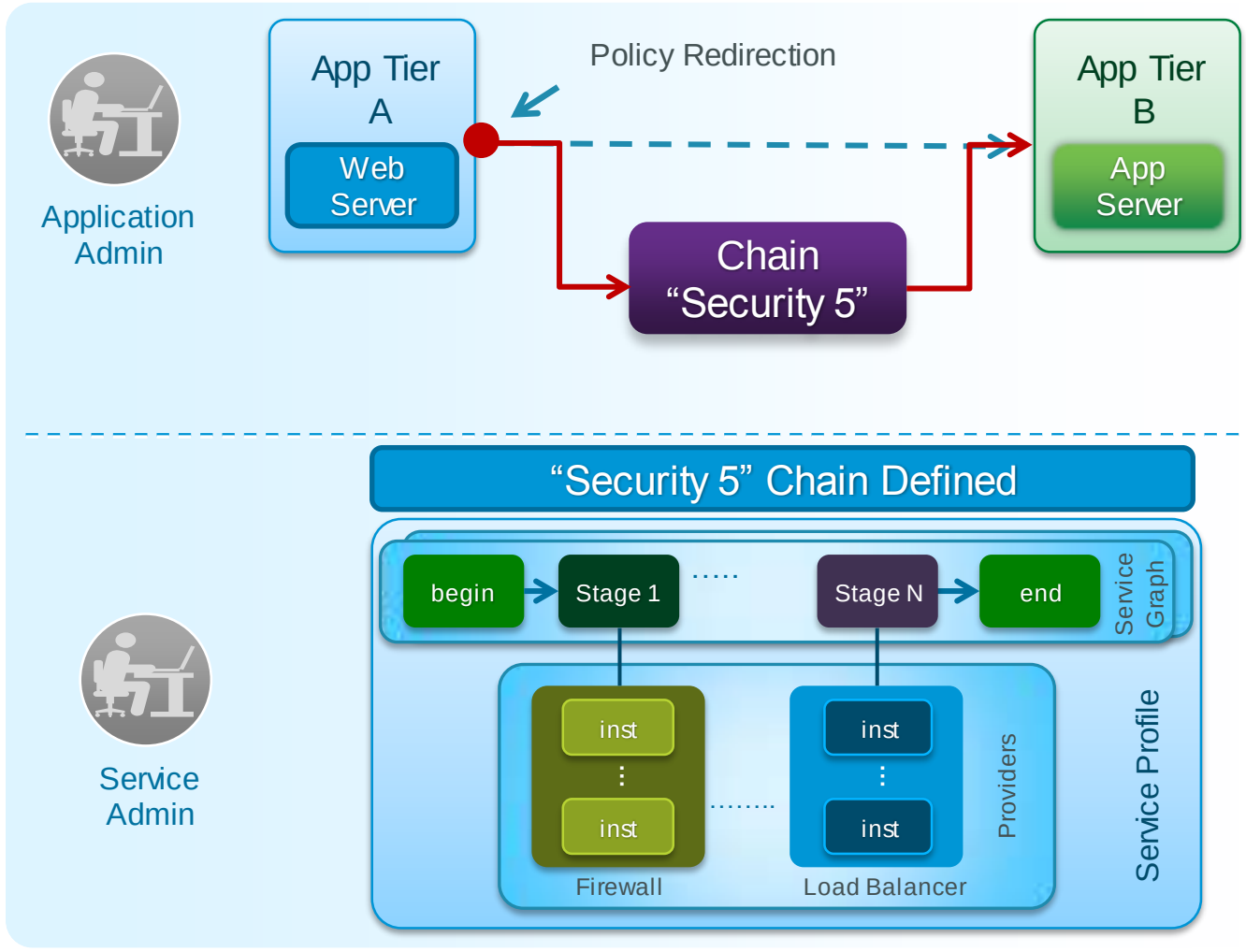
- Health scores
- Latency
- Atomic counters
- Resource consumption

Integrate with workload placement or migration



# ACI Layer 4 - 7 Service Integration
## Centralized, Automated, and Supports Existing Model

- Elastic service insertion architecture for physical and virtual services
- Helps enable administrative separation between application tier policy and service definition
- APIC as central point of network control with policy coordination
- Automation of service bring-up / tear-down through programmable interface
- Supports existing operational model when integrated with existing services
- Service enforcement guaranteed, regardless of endpoint location

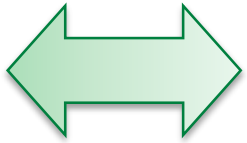


# Open Ecosystem Framework

## Full-Featured, Programmable API and Data Model

### Northbound API

- Rapid integration with existing management frameworks
- OpenStack
- Tenant- and application-aware



System Management


Automation Tools


Hypervisor Management


Orchestration Frameworks

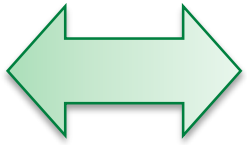

Object-Oriented
Centralized Automation
RESTful XML / JSON

Open Ecosystem Framework

Comprehensive Programmability and System Access

### Southbound API

- Publish data model
- Open source
- Enables application portability




*Only straight chains supported at FCS

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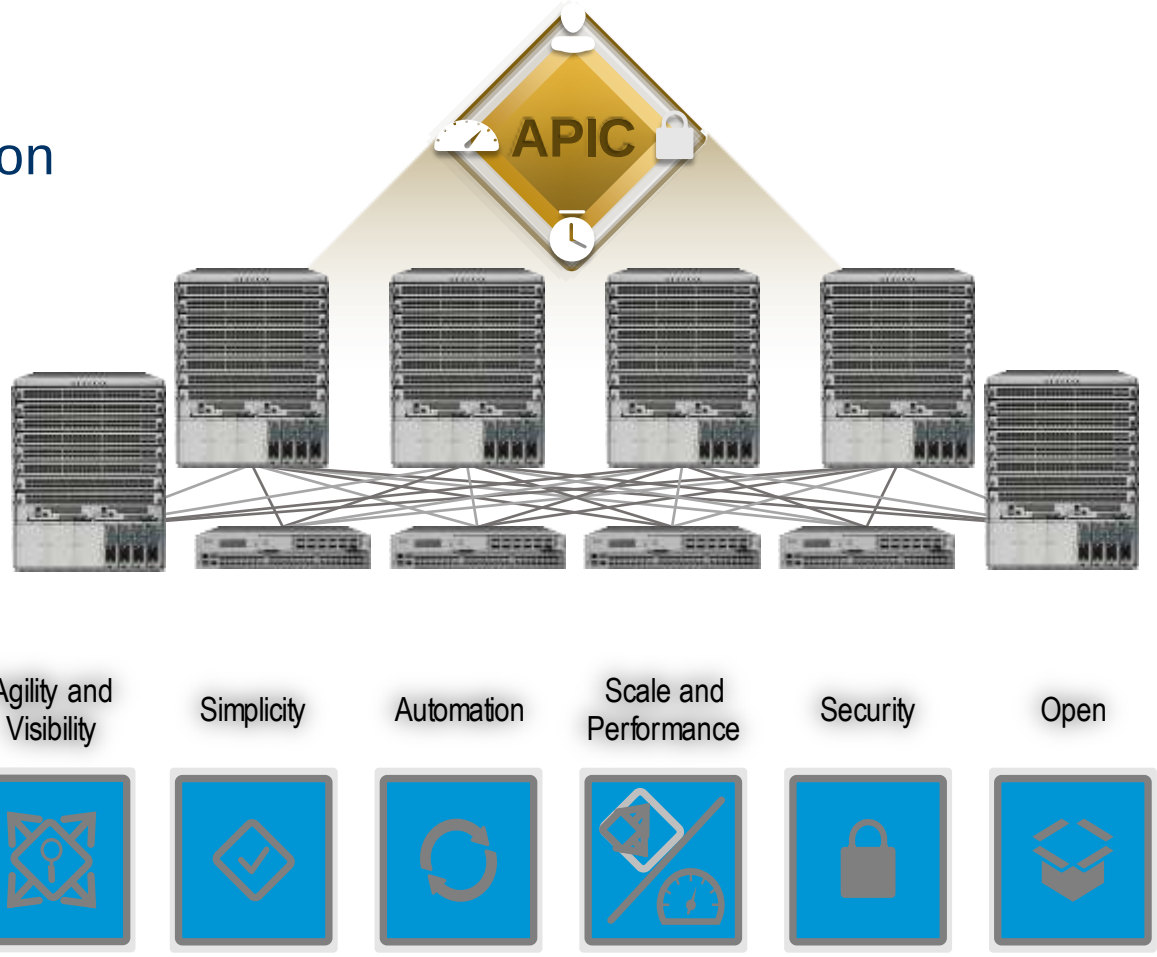
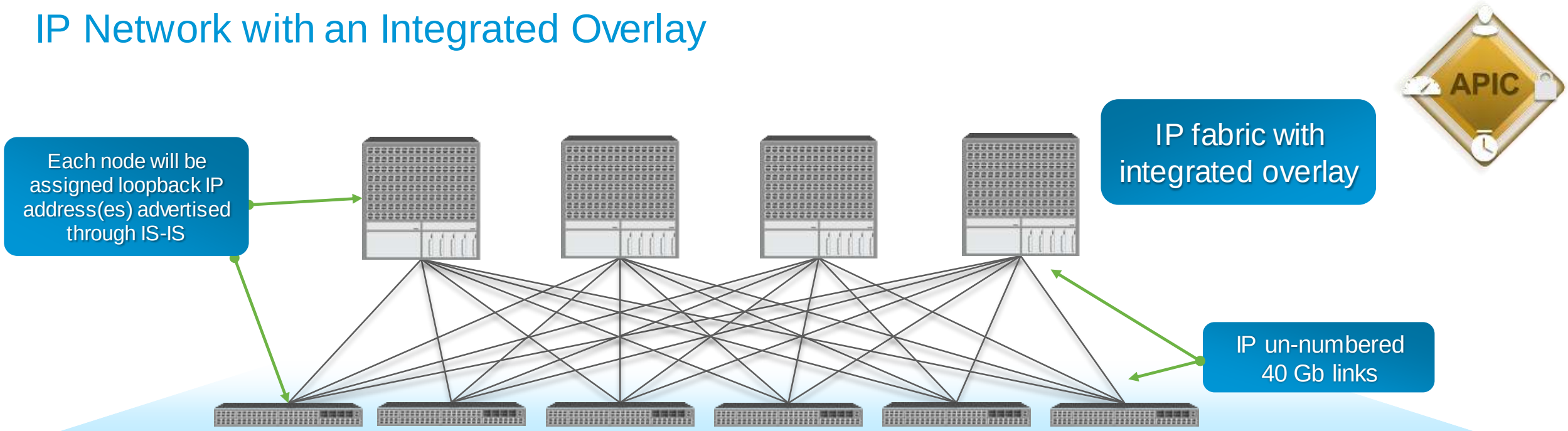


# ACI Fabric
## IP Network with an Integrated Overlay

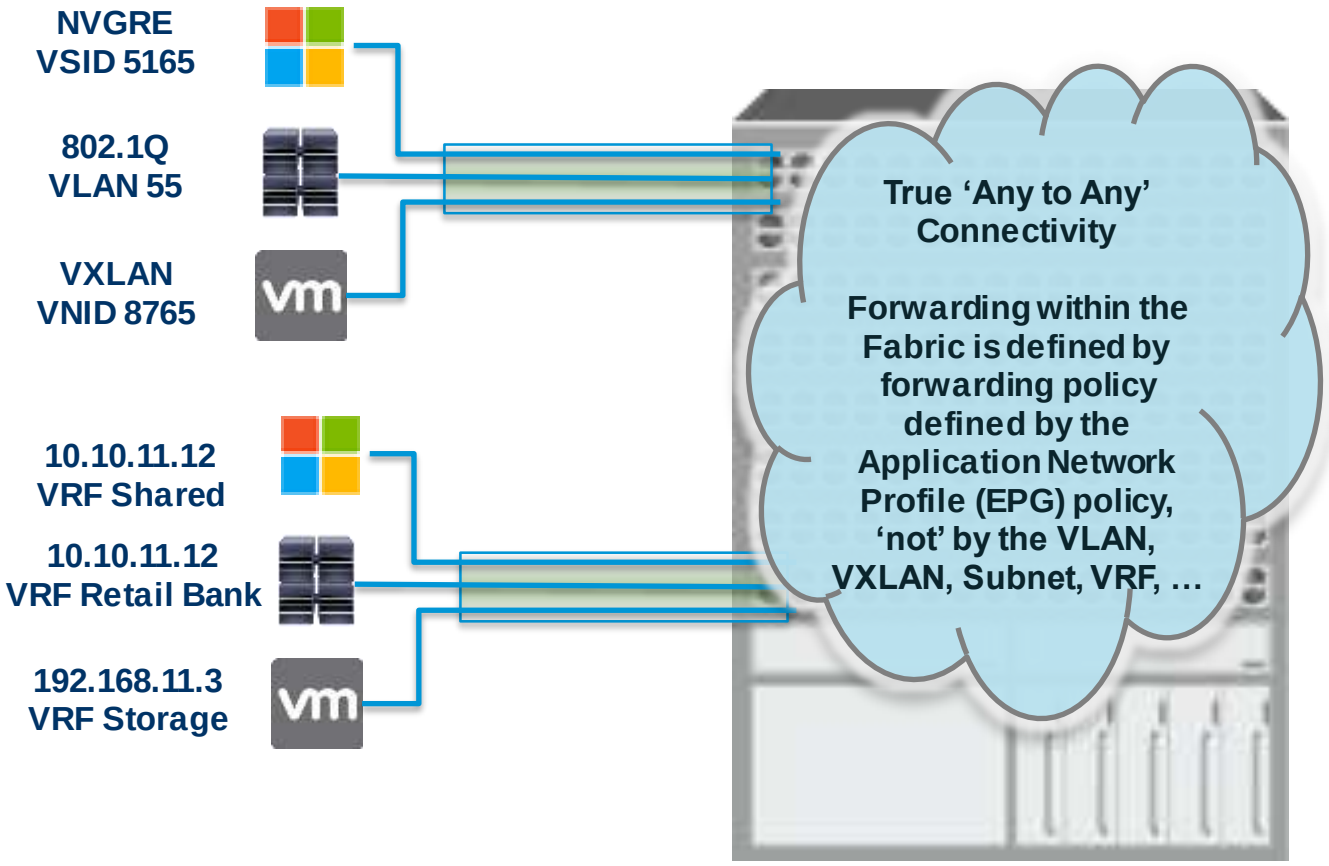



- ACI Fabric is based on an IP fabric supporting routing to the edge with an integrated overlay for host routing
  - All end-host (tenant) traffic within the fabric is carried through the overlay
- The fabric is capable of supporting an arbitrary number of tiers and/or partial mesh if required
- Why choose an integrated overlay?
  - Mobility, scale, multi-tenancy, and integration with emerging hypervisor designs
  - Data traffic can now carry explicit meta data that allows for distributed policy (flow-level control without requiring flow-level programming)

# Encapsulation Normalization
# Forwarding and Policy are Fully Decoupled

All single port can support all encapsulations simultaneously

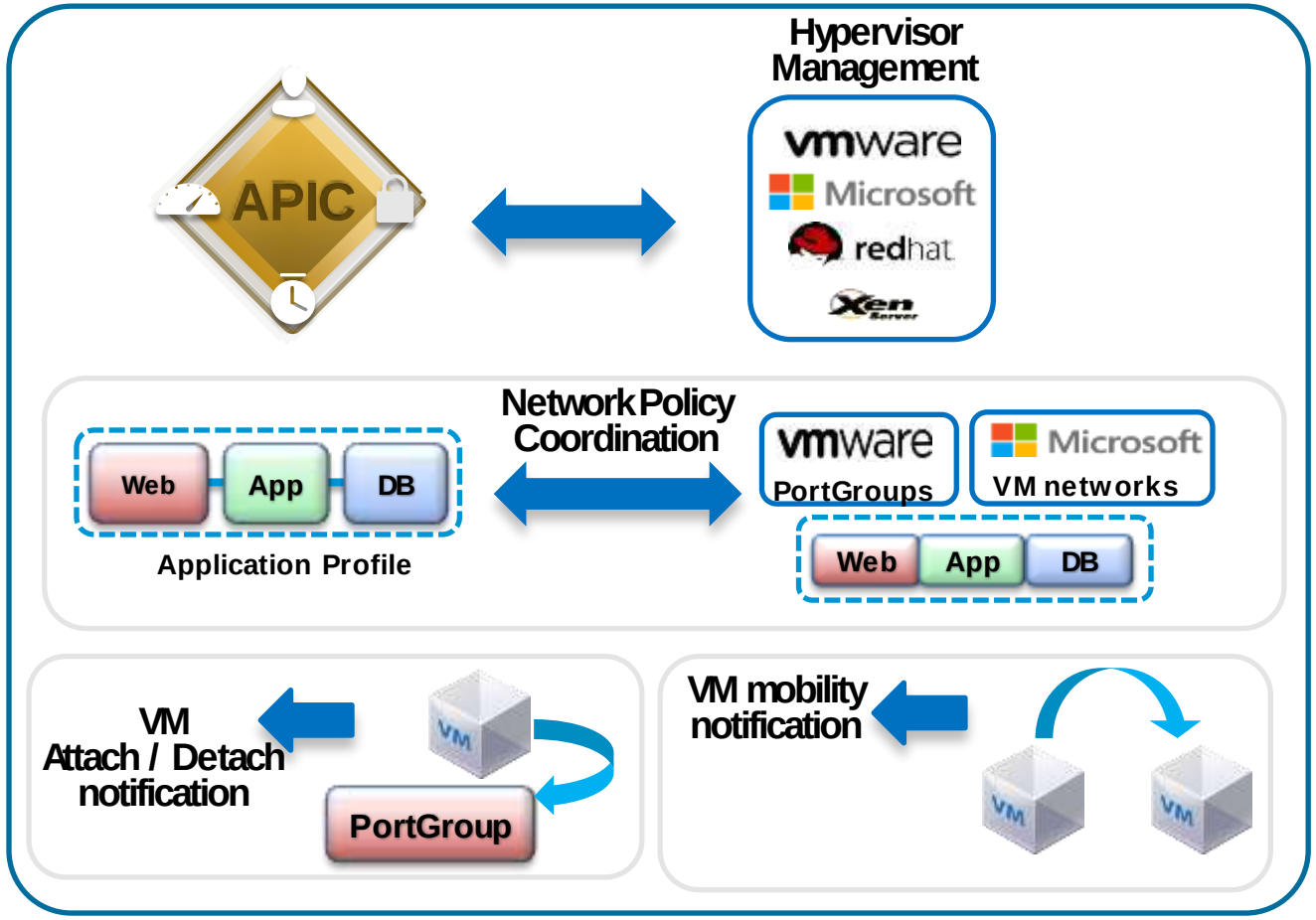
Forwarding is defined by Policy EPG 'Web' can talk to EPG 'DB' independent of IP subnet, VLAN/VXLAN, VRF is Policy says it should



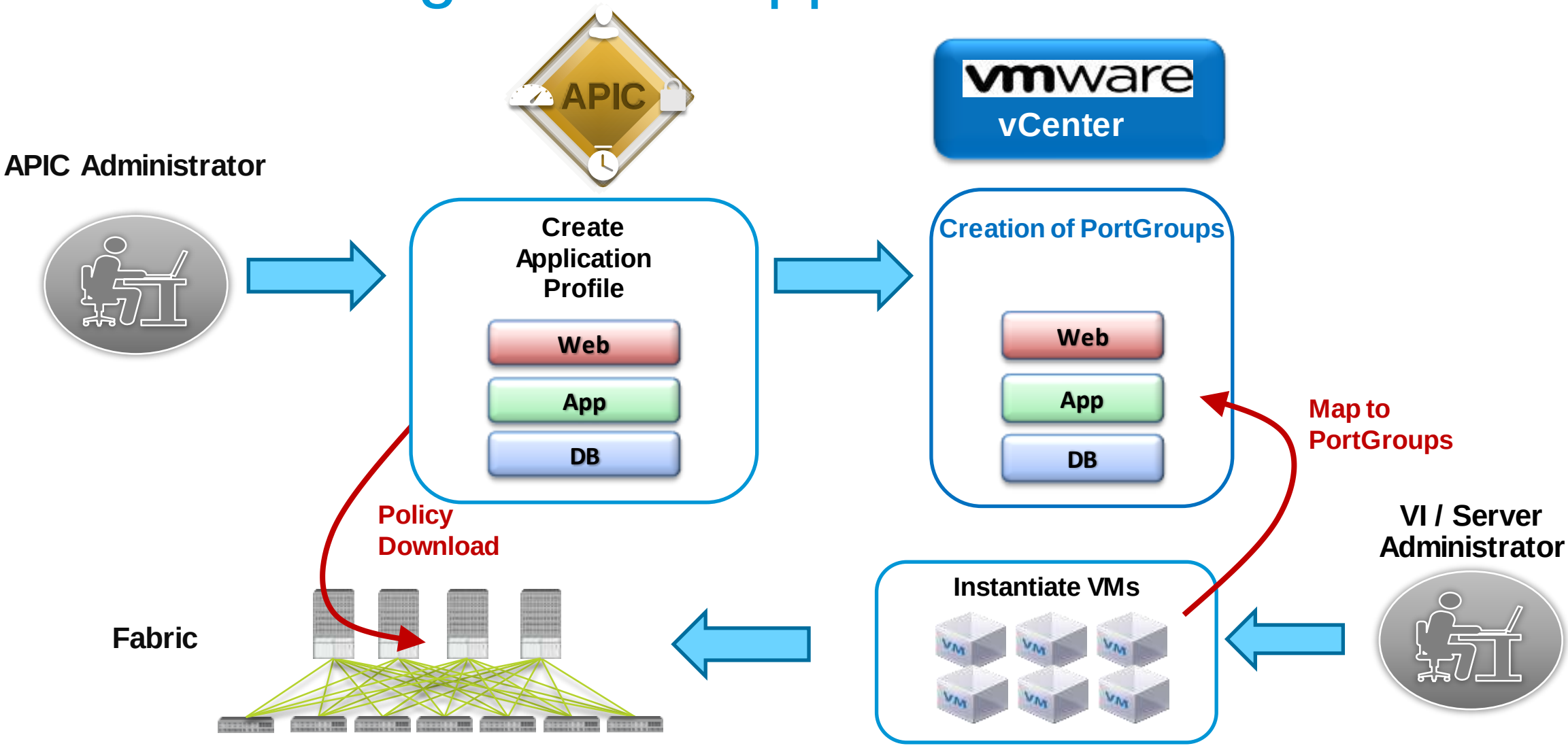

- Forwarding is fully decoupled, flattened IP address space
- You can define a Bridge Domain forwarding policy to 'create' standard VLAN behavior where required

# Policy Coordination with VM Managers

- Network policy coordination with virtualization managers
- Automatic virtual end point detection and policy placement
- Policies consistently implemented in virtual and physical
- Network policy stays sticky with VM

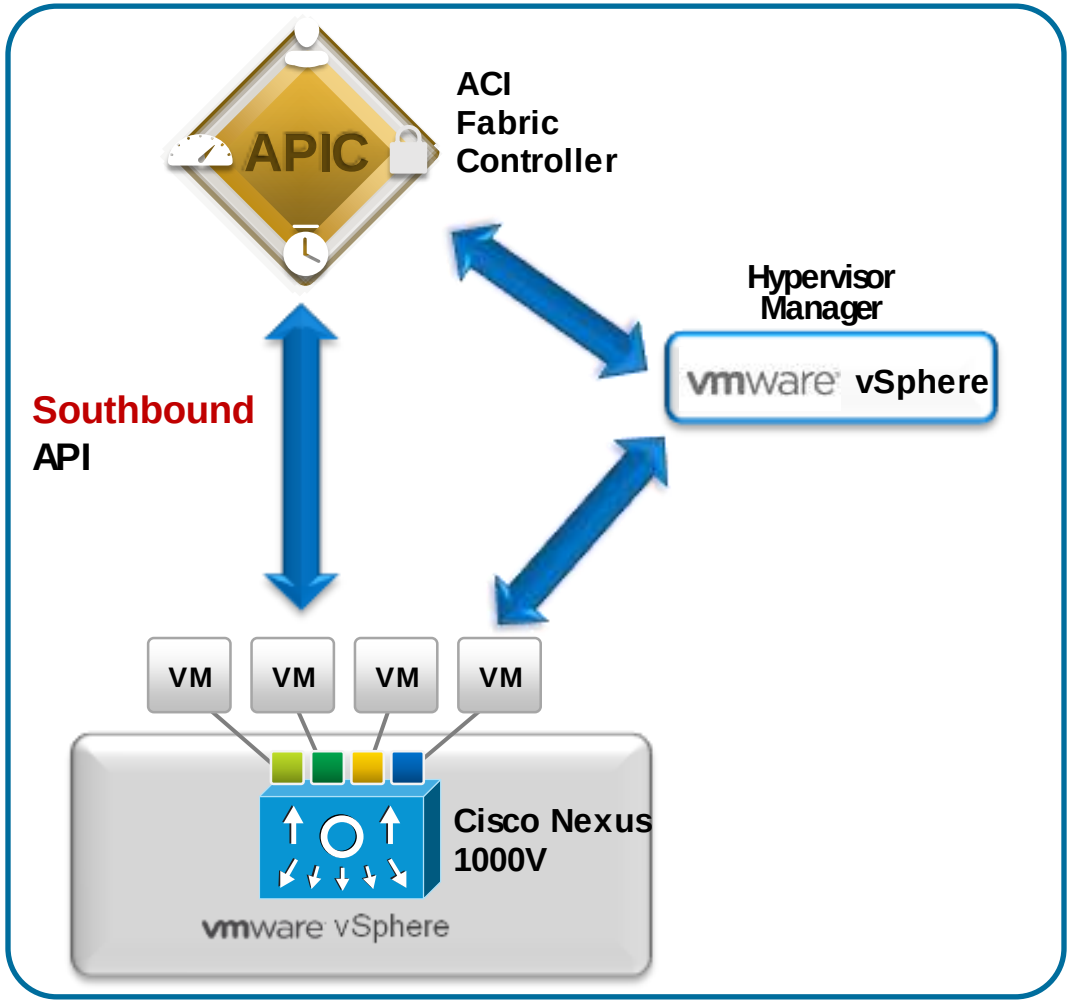


# VMware Integration – App Instantiation



# Nexus 1000V Integration Overview

- **ACI-focused Control protocol**
  - Control channel in Port Channel, VPC modes
  - VM attach/detach, link states notifications via control channel
  - vMotion
- VEM extension to the fabric
- vSphere 5.0 and above (4.1 under consideration)
- BPDU Filter/BPDU Guard
- SPAN/ERSPAN
- Port level stats collection



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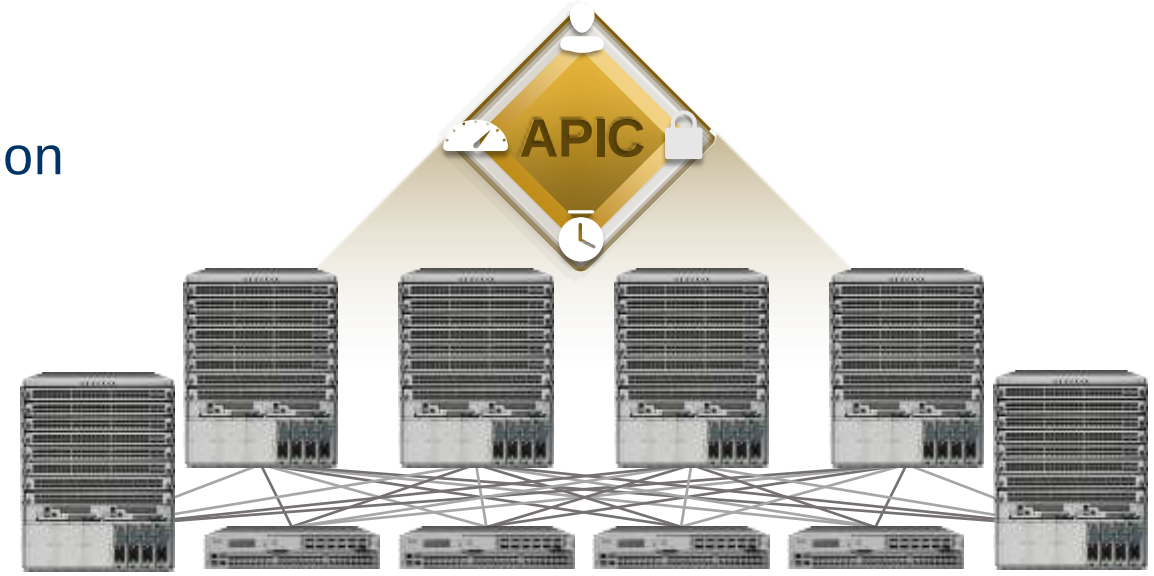
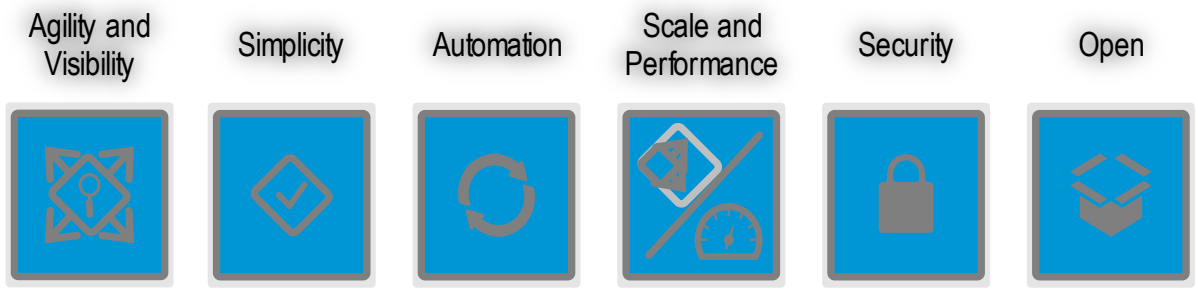
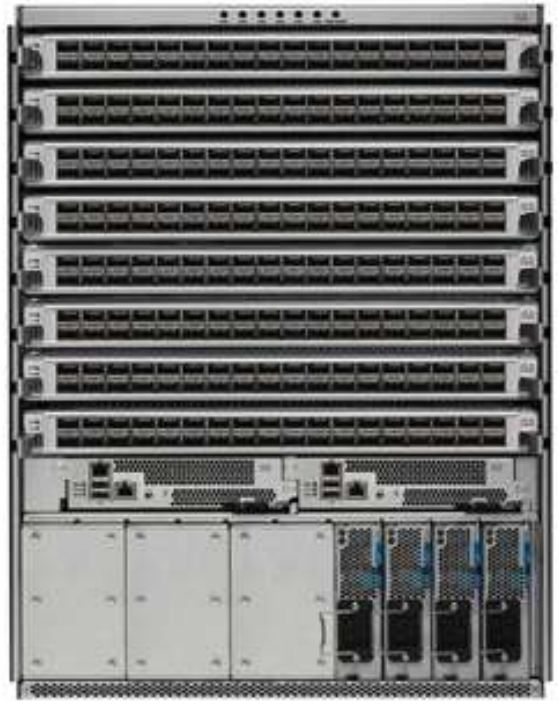


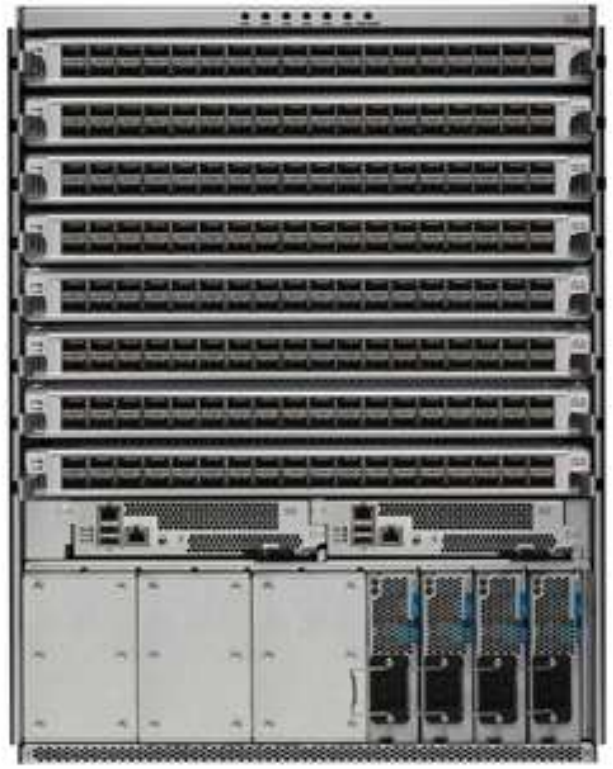



# Built with a Better Switch – Nexus 9000



- Merchant+ ASIC Foundation
- State of the Art Mechanical Design
- Object Oriented Programmable OS
- Next Gen Development and Verification Methodology
- Two Modes of Operation
  - Standalone (NX-OS)
  - Fabric Mode

# Modular Switch Platform – Nexus 9500



## Nexus 9508

- 13 RU high
- 30Tbps fabric today
- Up to 288p 40G & 1,152p 10G
- Headroom for 100G densities (connectors, power)

# Fixed Switch Platform – Nexus 9300

**Nexus 9396PQ**

- 48 port 10G SFP+ & 12 port 40G QSFP+
- 2 RU

**Nexus 93128TX**

- 96 port 1/10G-T & 8 port 40G QSFP+
- 3 RU

**ACI Ready Access Uplink Module**

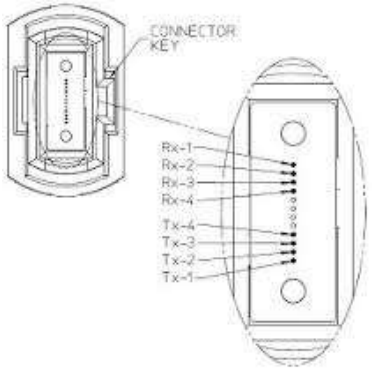
- 12 port 40G QSFP+
- Additional 40MB buffer
- Full VxLAN Bridging & Routing Capability

**Nexus 9300 - Common**

- Redundant FAN and Power Supply
- Front-to-back and Back-to-Front airflow

# Cisco Optical Innovation
## Removing 40G Optics and Cabling Barriers

### Problem
- 40G Optics are significant portion of network CAPEX
- 40G Optics require new cabling

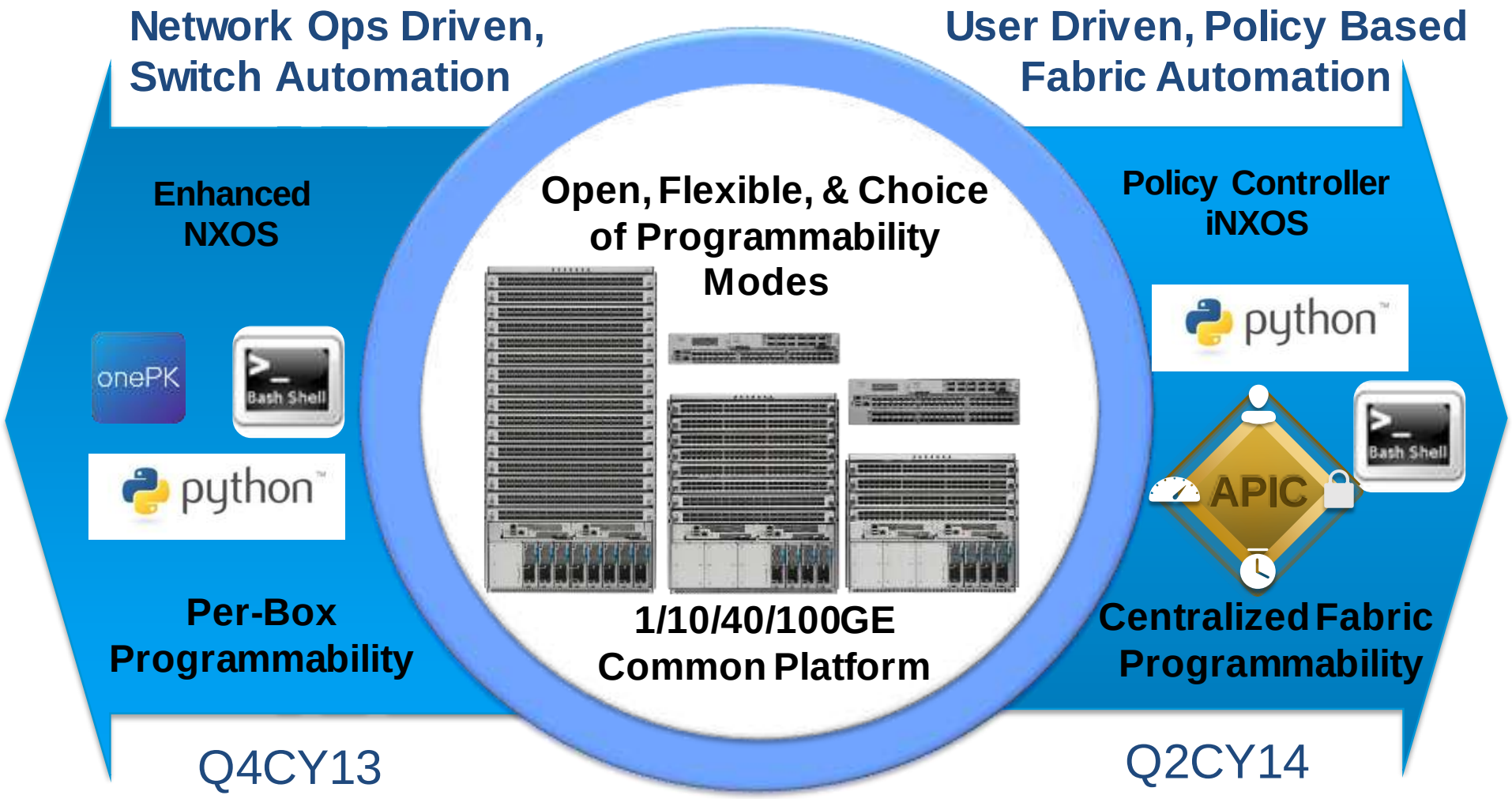



### Solution
- Re-use existing 10G MMF cabling infrastructure
- Re-use patch cables (same LC connector)

### Cisco 40G SR-BiDi QSFP
- QSFP pluggable, MSA compliant
- Dual LC Connector
- Support for 100m on OM3 and 125m+ on OM4
- TX/RX on 2 wavelength @ 20G each

Available end of CY 13

# Common Platform & Investment Protection
# Complete Architecture




CISCO
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