



# Applications of SDN in Cisco

Software Defined Networking Webinar Series

Speakers: Serges Nanfack

Hostess: Kara Sullivan

22 February 2017



Welcome to the 3rd session of the ***Software Defined Networking*** webinar series!

- Use the Q and A panel to ask questions.
- Use the Chat panel to communicate with attendees and panelists.
- A link to a recording of the session will be sent to all registered attendees.
- Please take the feedback survey at the end of the webinar.

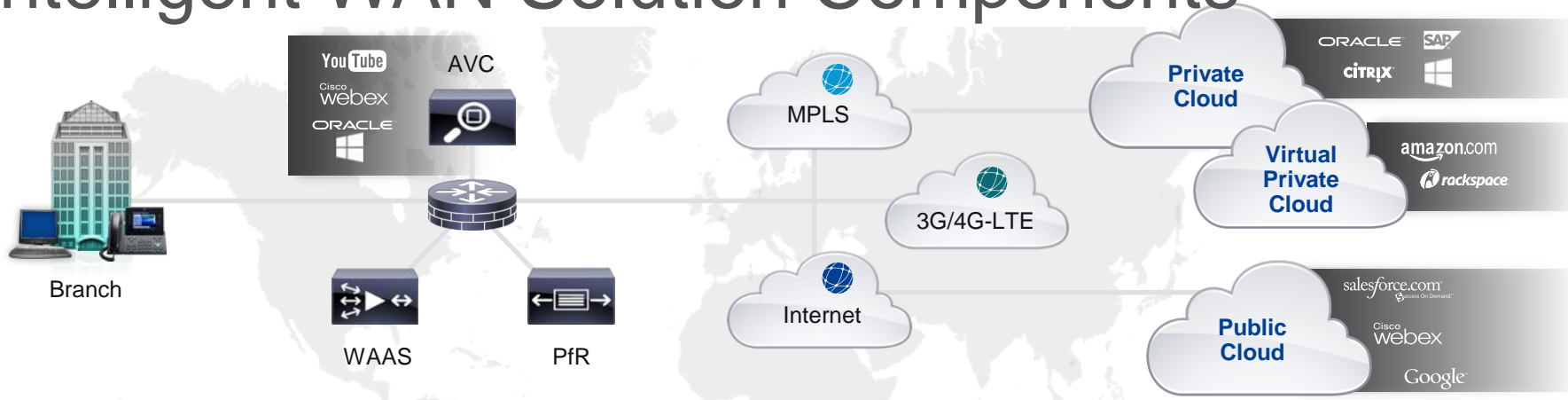


# SD-WAN: iWAN Overview

Sam Byers  
System Engineer, Cisco



# Intelligent WAN Solution Components



## Control and Management Automation



### Transport Independent

- Consistent operational model
- Simple provider migrations
- Scalable and modular design
- IPsec routing overlay design



### Intelligent Path Control

- Dynamic Application best path based on policy
- Load balancing for full utilization of bandwidth
- Improved availability



### Application Optimization

- Application visibility with performance monitoring
- Application acceleration and bandwidth optimization



### Secure Connectivity

- Certified strong encryption
- Comprehensive threat defense
- Cloud Managed Security for secure direct Internet access

# Hybrid WAN Designs

## Traditional and iWAN

### Active/Standby WAN Paths

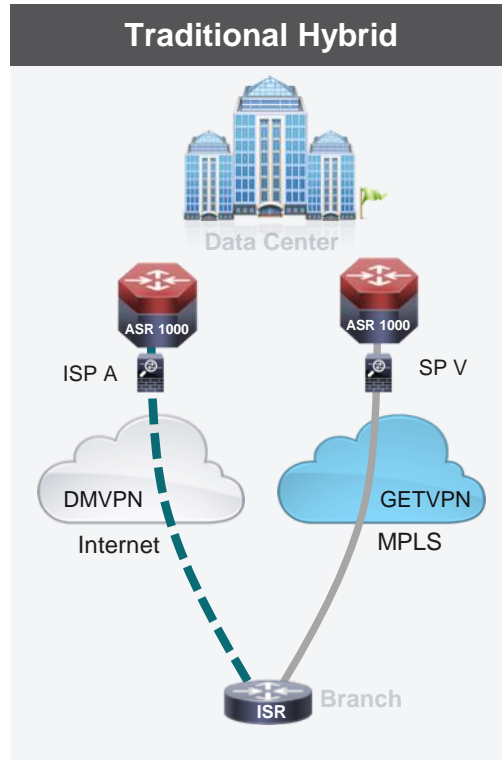
Primary With Backup

### Two IPsec Technologies

GETVPN/MPLS  
DMVPN/Internet

### Two WAN Routing Domains

MPLS: eBGP or Static  
Internet: iBGP, EIGRP or OSPF  
Route Redistribution  
Route Filtering Loop Prevention

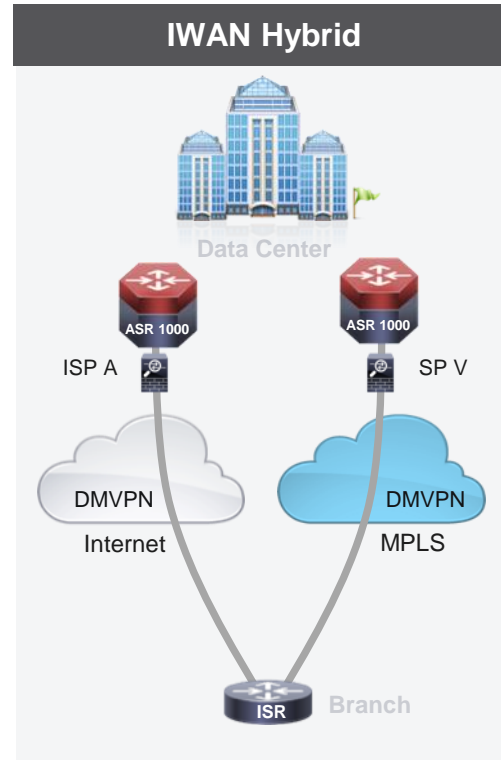


### iWAN Hybrid

### Active/Active WAN Paths

### One IPsec Overlay DMVPN

### One WAN Routing Domain iBGP, EIGRP, or OSPF



# SD-WAN Automation

## Performance Router (PfR)

Automated Discovery, Service Exchange, Peering & Coordination across the WAN Domain

### Learning

Network Discovers the Apps (NBAR2) or based on DSCP

Network Discovers site topology, connected networks and prefix ownership

### Passive Monitoring

Collect Application Performance

Using Unified Performance Monitors (AVC Infrastructure)

### Dynamic Probing

Smart Probes for discovery

Also used if there is no traffic

### Remote Feedback

Performance measured on ingress on the remote site

Sends performance feedback to Peers

### QoS Synthesis

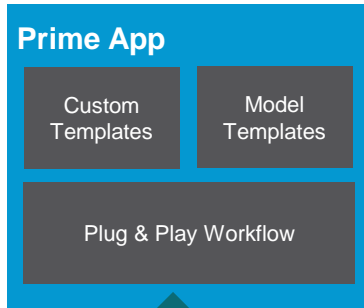
WAN Edge peers, learns link performance (per DSCP),

Manages congestion (local CAC, Remote CAC\*)

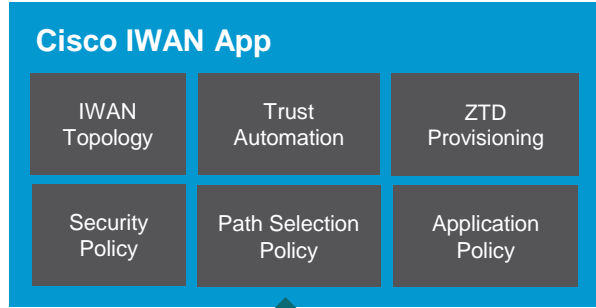
# SDN Orchestration with APIC-EM

## Addressing the whole branch, not just the WAN.

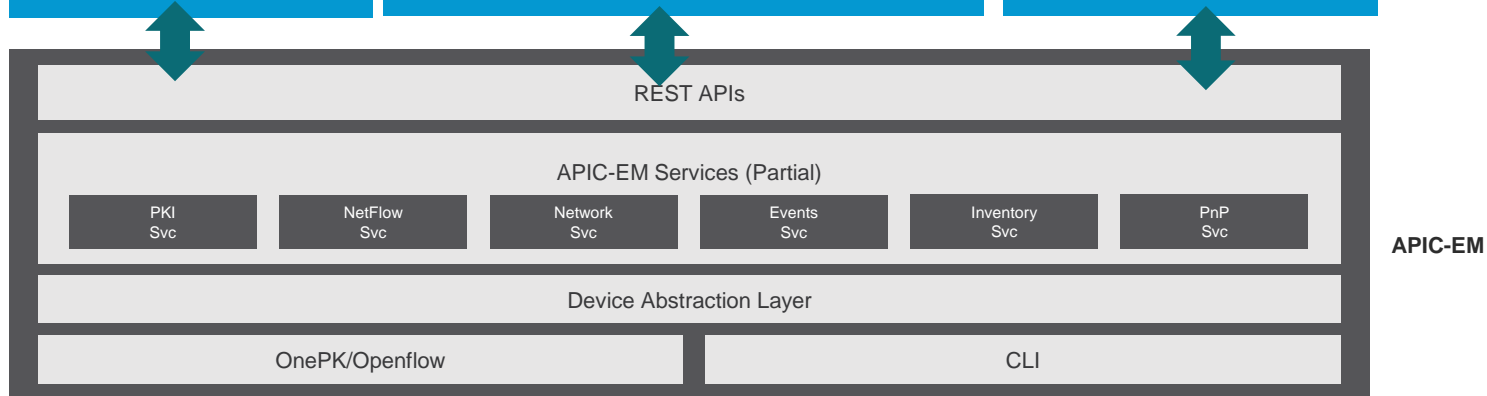
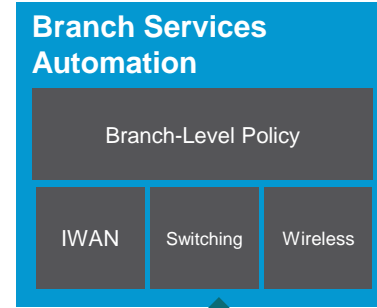
Customized Deployment  
with SDN



Prescriptive Deployment  
with SDN



Whole Branch  
Automation



# iWAN Branch Services Routers

## ISR4000 Series - IWAN AX Ready, Next Generation Branch

### APPLIANCE LEVEL PERFORMANCE

- Service-Aware Dataplane
- Resilient Service Virtualization
- Multi-gigabit Fabric

### APPLICATION CENTRIC

- App/User policy-driven deployment
- APIC-EM Automation: deploy in minutes
- Pay-as-you-grow
- Up-to-75% cost savings

### INTEGRATED IWAN SERVICES

- IOS Firewall, VPN, IPSec, PfRV3, NBAR2, AVC, AppNav, VRF, MPLS
- Scalable on-chip service provisioning

ISR4451



1-2Gbps

ISR4431



500Mbps/1Gbps

ISR 4351



200/400Mbps

ISR 4331



100/300Mbps

ISR4321



50/100Mbps



# iWAN Aggregation Border Routers

ASR1000 - IWAN AX ready, high performance routers

## COMPACT, POWERFUL ROUTER

- Line-rate performance 2.5G to 200G+ with services enabled
- Crypto performance from 2G to 60G+
- Flexible I/O: SPAs and Ethernet LCs

## BUSINESS-CRITICAL RESILIENCY

- Separate control and data planes
- Hardware and software redundancy
- In-service software upgrades

## INTEGRATED IWAN SERVICES

- IOS Firewall, VPN, IPSec, PfRV3, NBAR2, AVC, AppNav, VRF, MPLS
- Scalable on-chip service provisioning

## ASR1001-X



- 2.5G Upgradeable to 5G, 10G, 20G
- Up to 8G Crypto Throughput

## ASR1002-X



- 5G Upgradeable to 10G, 20G, 36G
- Up to 4G Crypto Throughput

## Modular ASR1006



- Modular, Redundant up to 200G
- Up to 60G Crypto Throughput

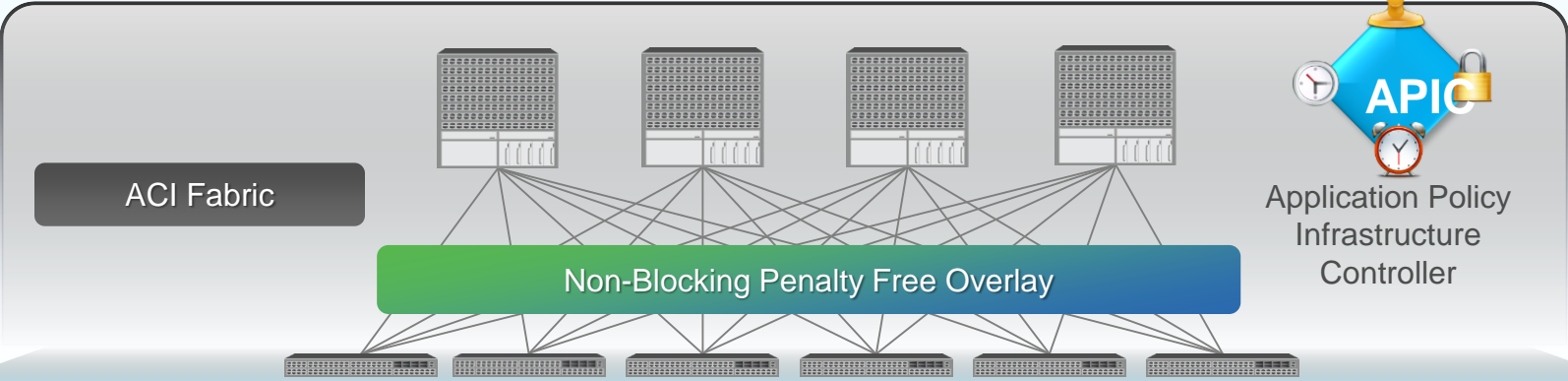
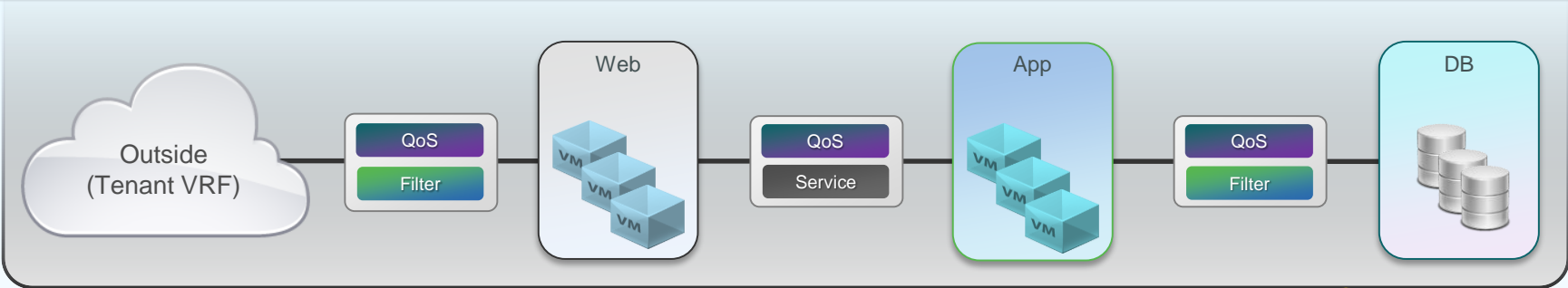


# Introduction to ACI

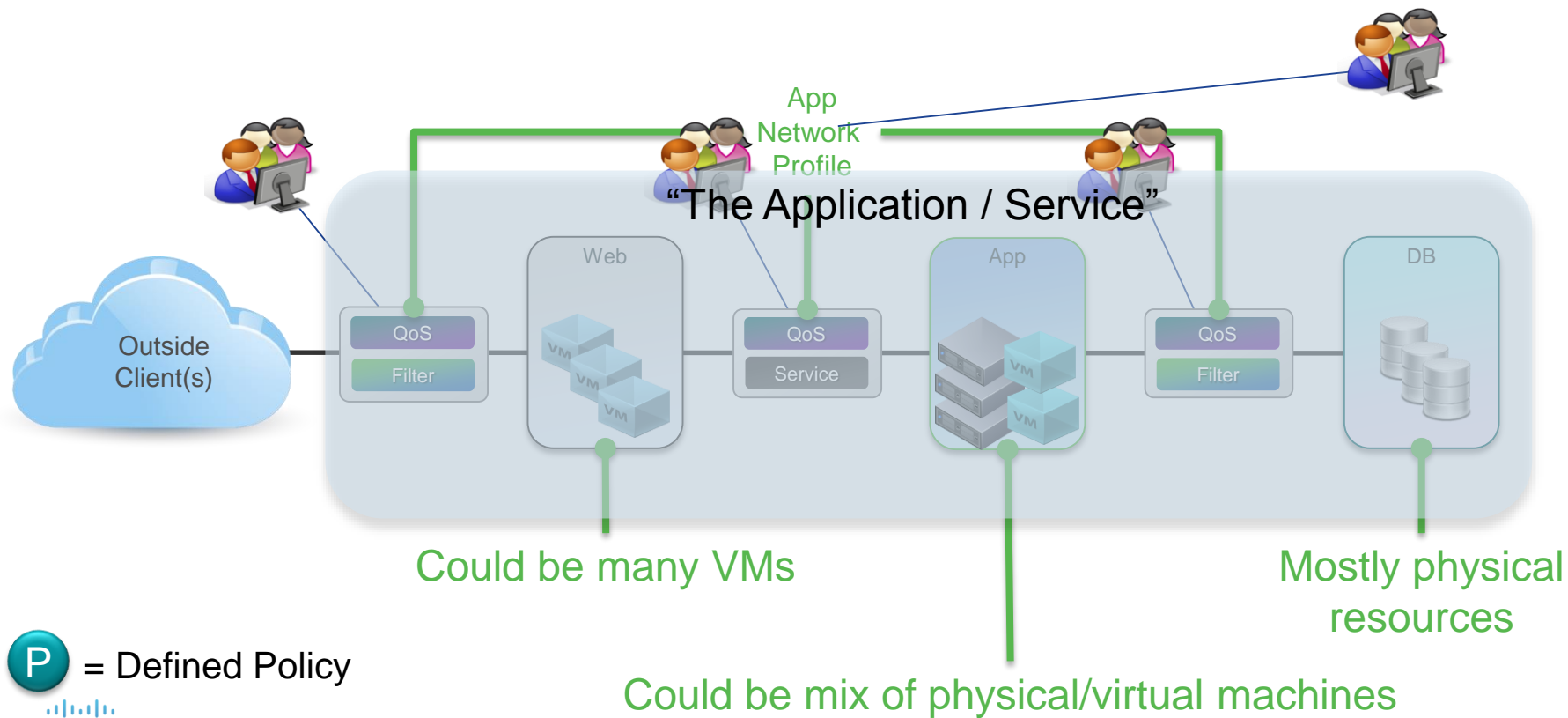
Dana Turner  
Consulting Systems Engineer  
[danaturn@cisco.com](mailto:danaturn@cisco.com)



# ACI Introduces Logical Network Provisioning Of Stateless Hardware



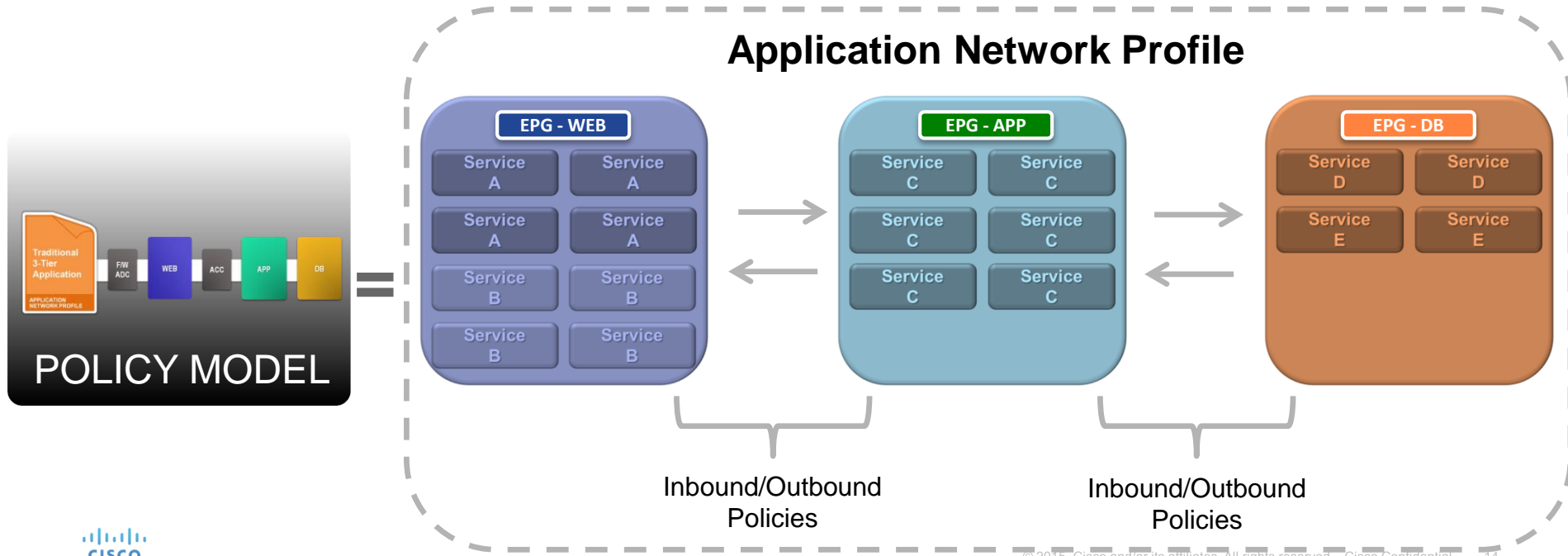
# ACI and Today's 3-Tier applications



**P** = Defined Policy  
cisco

# Application Network Profiles (ANP) – what's that ?

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



# Application Awareness

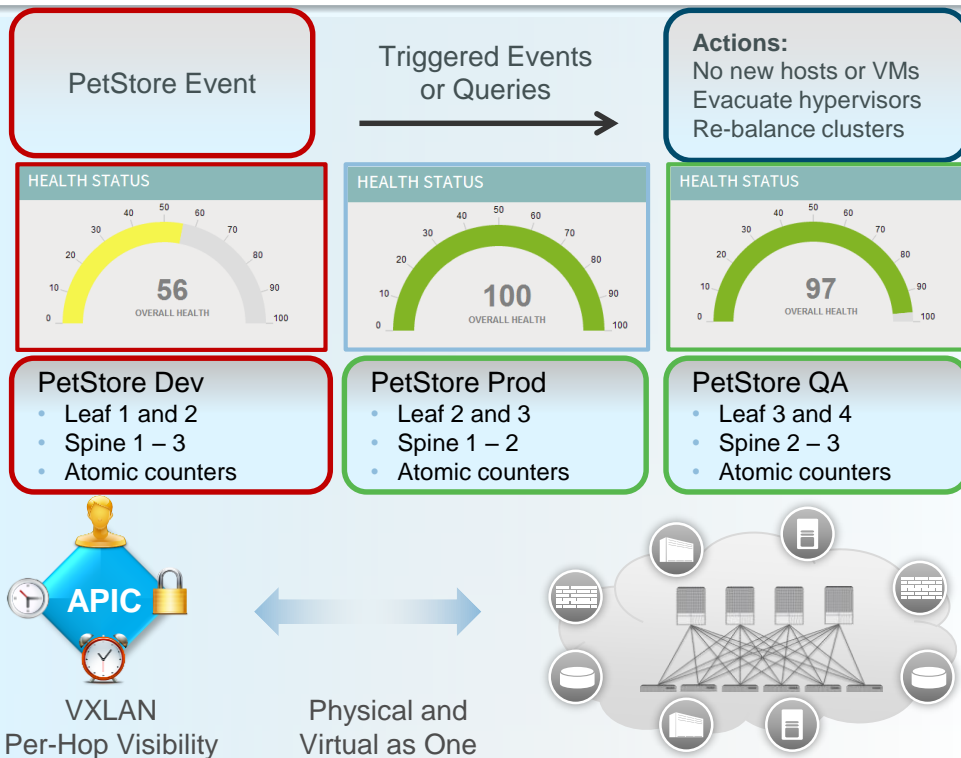
## Application-Level Visibility

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



# 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



### Hypervisor Management



### Automation Tools



### Orchestration Frameworks



Object-Oriented  
Centralized Automation  
RESTful XML / JSON

## Open Ecosystem Framework

Comprehensive  
Programmability and  
System Access

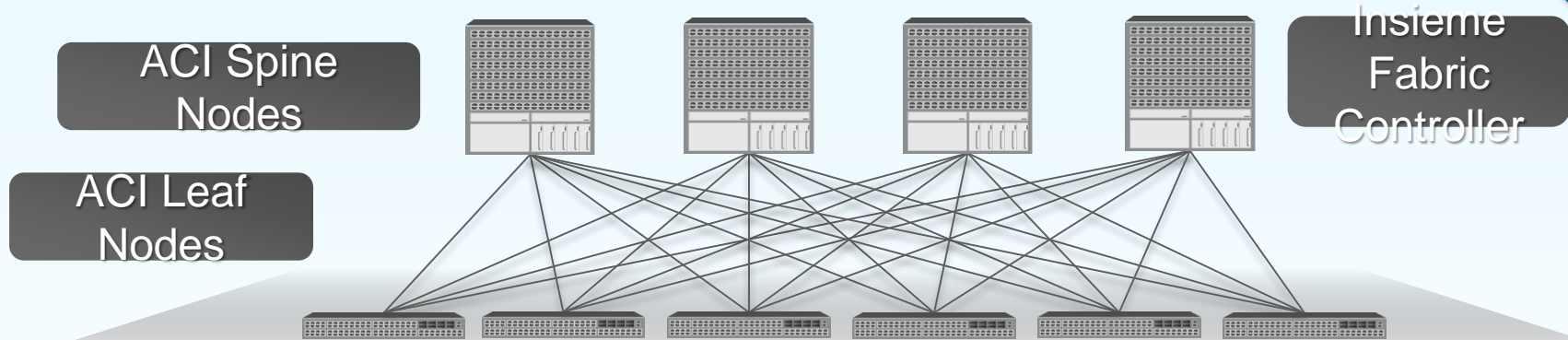
### Southbound

- API
- Publish data model
  - Open source
  - Enables application portability



\*Only straight chains supported at FCS

# Overview Of The ACI Fabric



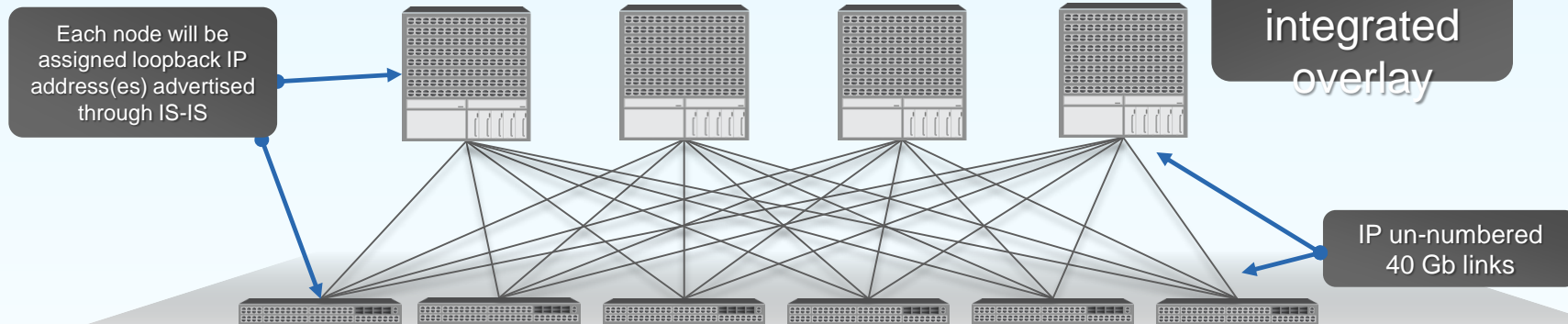
- ACI Fabric provides:

- Decoupling of endpoint identity, location, and associated policy, all of which are independent from the underlying topology
- Full normalization of the ingress encapsulation mechanism used: 802.1Q VLAN, IETF VXLAN, IETF NVGRE
- Distributed Layer 3 gateway to ensure optimal forwarding for Layers 3 and 2
- Support for standard bridging and routing semantics without standard location constraints (any IP address anywhere)
- Service insertion and redirection



# ACI Fabric

## IP Network With An Integrated Overlay

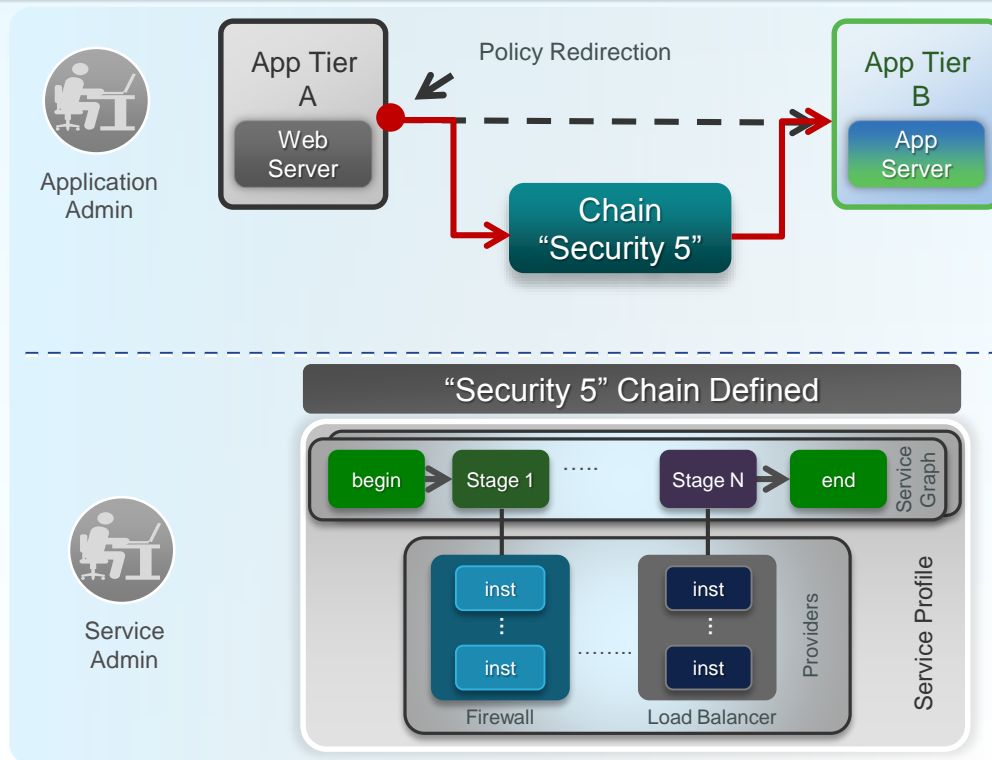


- ACI Fabric is based on an IP fabric supporting routing to the edge with an integrated overlay for host routing
  - All end-host (tenant) traffic within the fabric is carried through the overlay
- The fabric is capable of supporting an arbitrary number of tiers and/or partial mesh if required
- Why 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)

# ACI Layer 4 - 7 Service Integration

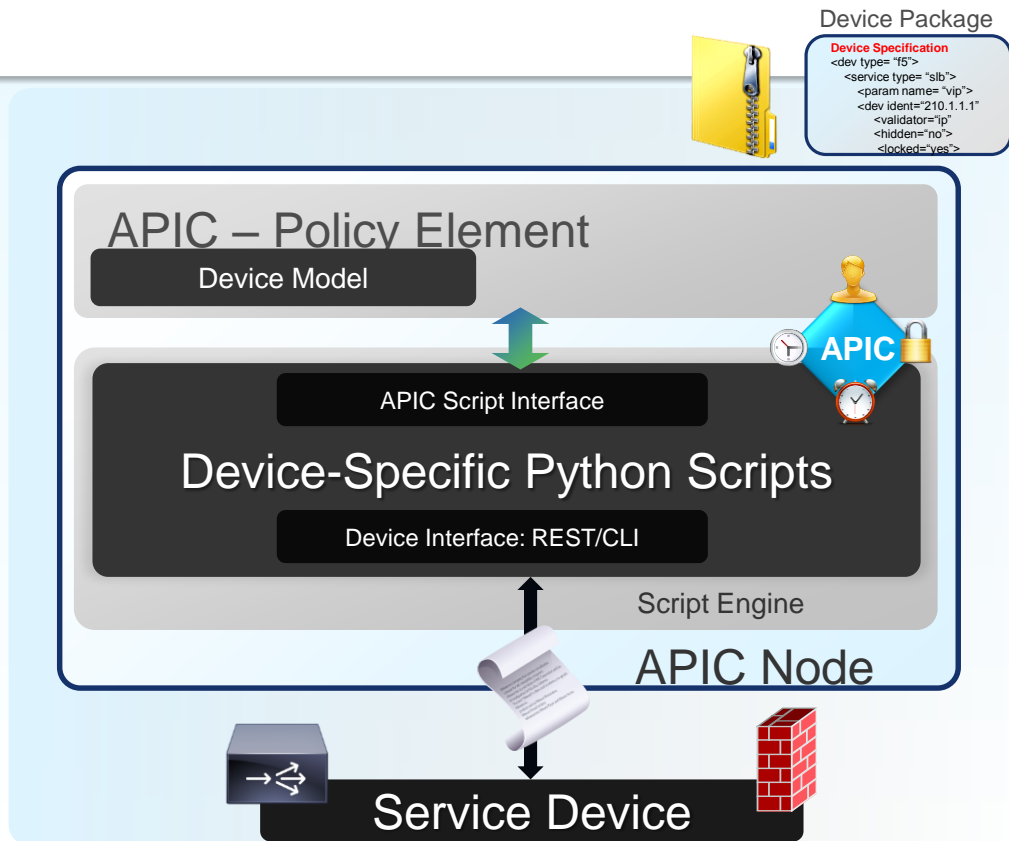
## Centralized, Automated, And Supports Existing Model

- 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



# ACI Service Automation Architecture

- Service automation requires a vendor device package. It is a zip file containing
  - Device specification (XML file)
  - Device scripts (Python)
- APIC interfaces with the device using device Python scripts
- APIC uses the device configuration model provided in the package to pass appropriate configurations to the device



# Multi-Hypervisor-Ready Fabric

## Virtual Integration



- Integrated gateway for VLAN, VxLAN, and NVGRE networks from virtual to physical
- Normalization for NVGRE, VXLAN, and VLAN networks
- Customer not restricted by a choice of hypervisor

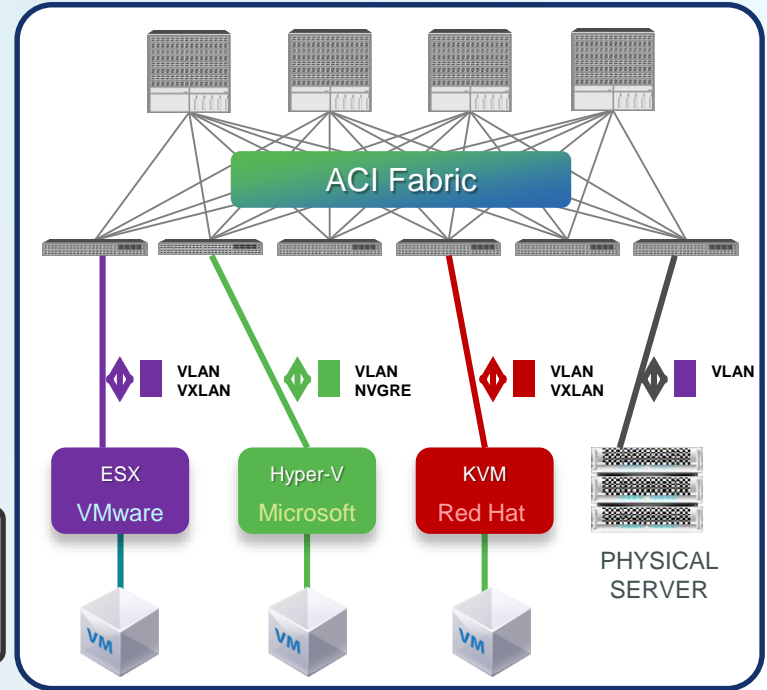
Network Admin



Application Admin

VMware  
Microsoft  
Red Hat  
XenServer

Hypervisor Management



# ACI Operational Simplicity – GUI Drag and Drop

Accelerating Time to Deploy Application



**Easy to Use, Policy Driven, Automated Deployment**

Drag & Drop



Tenant



Network

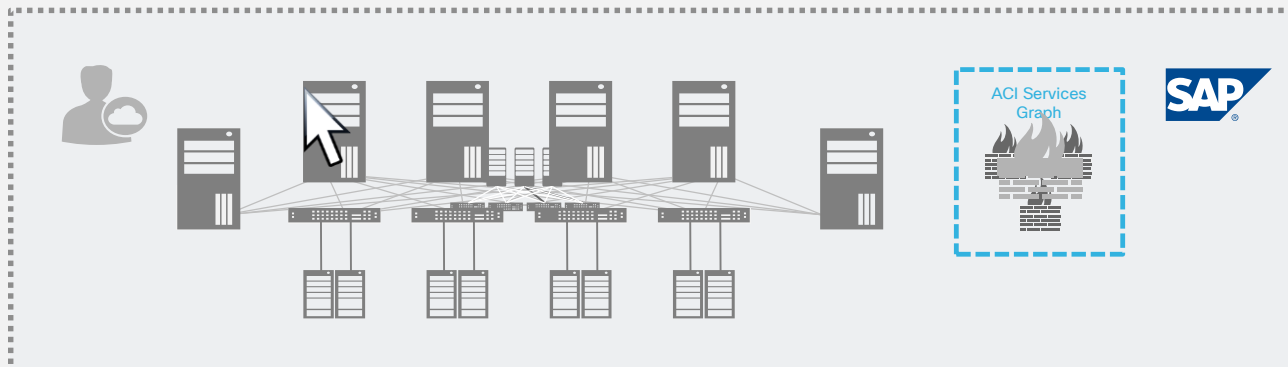


Tenant Sales Deployed

Network VRF Deployed

Firewall Deployed

Apps Deployed



“Now we can spin up an environment in 17 minutes (from 4.5 months)”

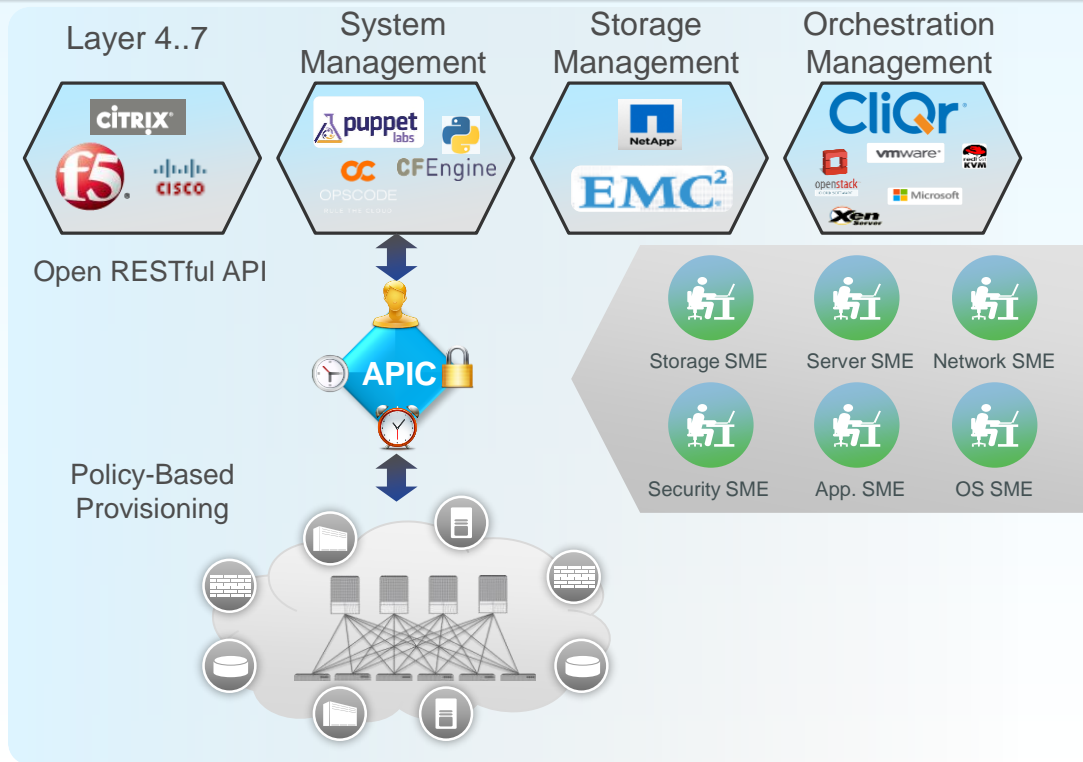
- Vince Spina, DC Architect



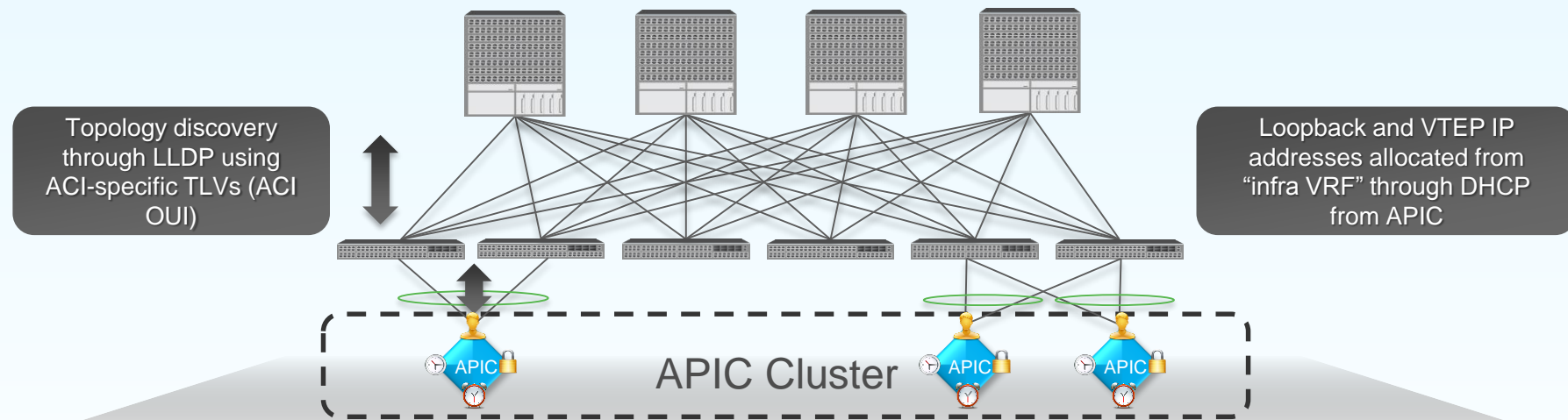
# Application Policy Infrastructure Controller

## Centralized Automation and Fabric Management

- Unified point of data center network automation and management:
  - Application-centric network policies
  - Data model-based declarative provisioning
  - Application, topology monitoring, and troubleshooting
  - Third-party integration (Layer 4 - 7 services, storage, compute, WAN, etc.)
  - Image management (Spine / Leaf)
  - Fabric inventory
- Single APIC cluster supports one million+ endpoints, 200,000+ ports, 64,000+ tenants
- Centralized access to all fabric information - GUI, CLI, and RESTful APIs
- Extensible to compute and storage management



# Fabric Initialization And Maintenance



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

- Fabric discovery and addressing
- Image management
- Topology validation through wiring diagram and systems checks

# NEXUS 9000 ACI PLATFORMS

## ACI SPINES



9516



9508



9504



9336PQ

## ACI CONTROLLER



## ACI LEAVES



93120TX



9372PX



9396PX



9332PQ



9396TX



93128TX



9396PX

NX-OS and ACI

Choice of Fabric Architectures

Best Price / Performance  
10G / 40G / 100G





# Additional Slides that were not covered in webinar: Meraki SD-WAN

**Shiyue Cheng, CCIE**  
Consulting Systems Engineer  
Commercial East Area





Technology can connect us, empower us, and drive us. At Meraki we believe by simplifying powerful technology we can free passionate people to focus on their mission and reach groups previously left in the darkness.

Technology that simply works

# About Cisco cloud-managed networking

## Cisco Meraki: a complete cloud-managed networking solution

- Wireless, switching, security, MDM, phones and cameras centrally managed over the web
- Built from the ground up for cloud management
- Integrated hardware, software, and cloud services

## Leader in cloud-managed networking

- Among Cisco's fastest-growing portfolios: over 100% annual growth
- Tens of millions of devices connected worldwide

## Recognized for innovation

- Gartner Magic Quadrant, InfoWorld Technology of the Year, CRN Coolest Technologies

Trusted by thousands of customers worldwide:



# MX: Security Appliance / Firewall



## Security - UTM

NG Firewall, Client VPN,  
Site to Site VPN, IDS/IPS,  
Anti-Malware, Geo-  
Firewall



NAT/DHCP, 3G/4G  
Cellular,  
Application Control  
Intelligent WAN (I-WAN)



Web Caching, Traffic  
Shaping, Content  
Filtering

# SD-WAN Pillars

Enabling transport independence, intelligent path control, application optimization, and secure connectivity for multi-site deployments.



## Transport Independence

- IPsec overlay (Auto VPN)
- Scalable (Cloud Controller)
- Traffic distribution over multiple pathways (Internet, cellular, MPLS-to-VPN failover)



## Application Optimization

- App visibility & control (Meraki dashboard, group-based policies, traffic analytics)
- Application QoS & bandwidth optimization (Traffic shaping)



## Intelligent Path Control

- Dynamic Path Selection - Uplink chosen by link latency, data loss, etc. (performance-based routing)
- Uplink assigned by traffic protocol, subnet, source, destination, etc. (PbR, policy-based routing)

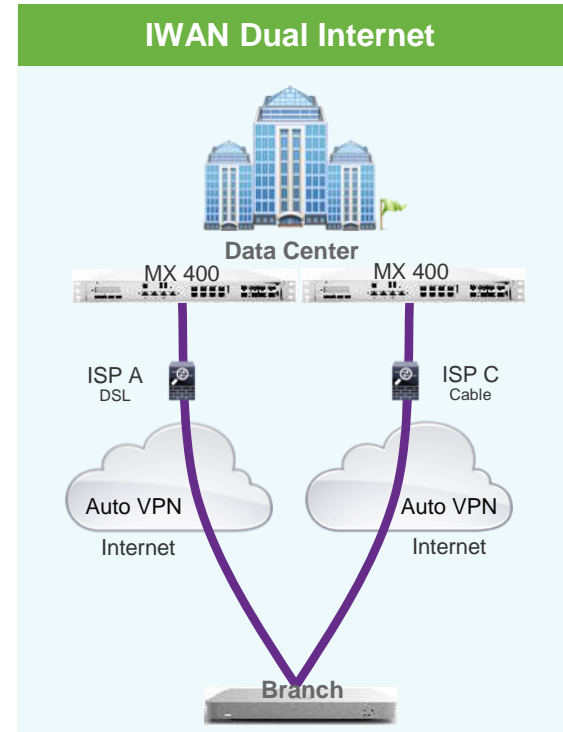
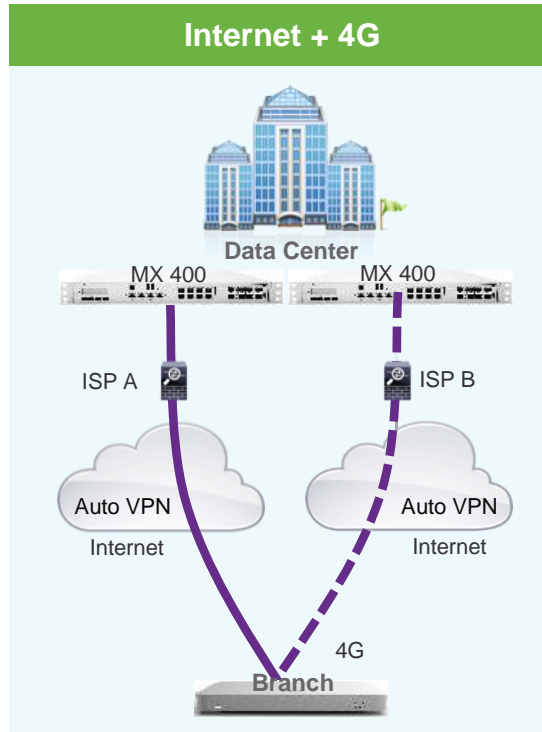
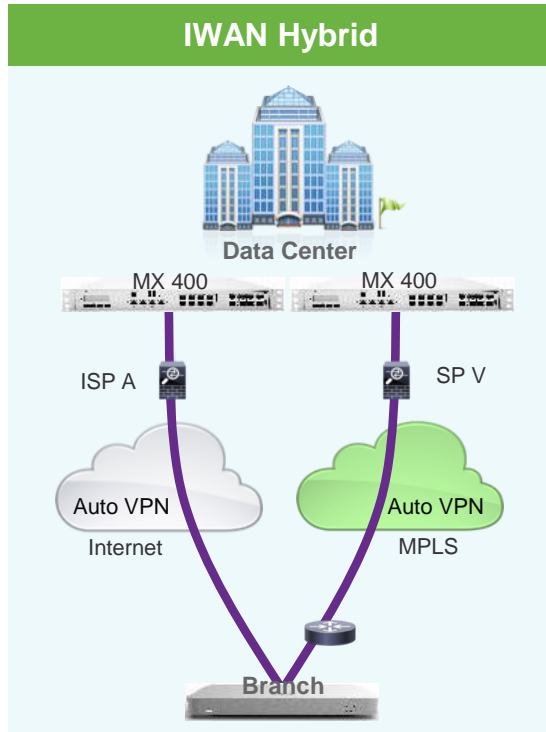


## Secure Connectivity

- Intuitive, automatic, scalable VPN solution to connect remote branch sites (Auto VPN)

# Transport Independence

Consistent deployment models simplify operations



# New SD-WAN features for the MX

## Dual-active path:

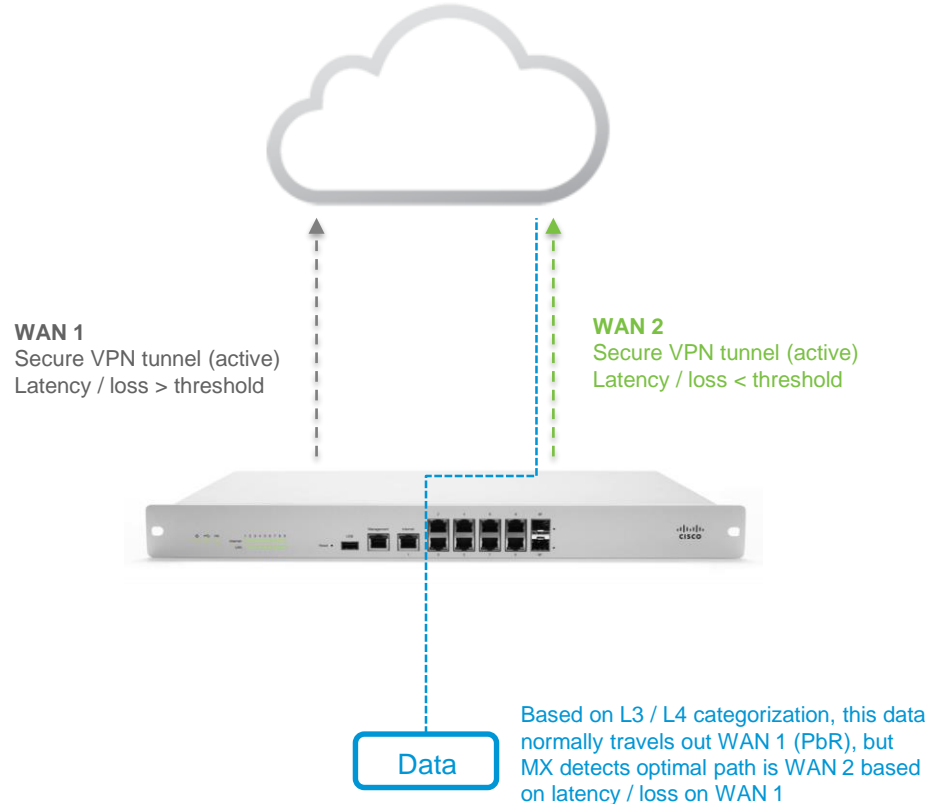
- Dual-active VPN
- Dual-active VPN & MPLS

## Dynamic Path Selection:

Ensures that the best VPN tunnel is used based on latency and loss performance metrics

## Policy-based routing (PbR) :

Allows uplinks to be intelligently assigned based on traffic protocol, subnet, source, destination, etc.



# Q&A





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