Networking in the Digital Era

Ioana Manea
Cisco Systems Engineer

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Not again about DIGITALIZATION!
“Digital disruption will displace 40% of incumbent companies in the next 5 years.”

- John Chambers, Cisco 2016 Partner Summit

**DIGITAL**

Every Company, City, Country

**UBER**, The world’s largest taxi company owns no vehicles

**AIRBNB**, The world’s largest accommodation provider owns no real estate

**NETFLIX**, The world’s largest movie provider owns no theater

**AMAZON**, The world’s largest bookstore owns no brick and mortar stores
Problem: CIOs are challenged to keep running existing IT more efficiently and safely, while enabling business innovation and differentiation at a quickening pace.

Solution: Bimodal IT, enabling developers and enabling governance.
### Bimodal IT

#### Traditional

<table>
<thead>
<tr>
<th>Mode 1</th>
<th>Reliability</th>
<th>Goal</th>
<th>Mode 2</th>
<th>Agility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal</td>
<td>Price for performance</td>
<td>Value</td>
<td>Revenue, brand, customer experience</td>
<td></td>
</tr>
<tr>
<td>Approach</td>
<td>Waterfall, V-Model, high-ceremony IID</td>
<td>Approach</td>
<td>Agile, Kanban, low-ceremony IID</td>
<td></td>
</tr>
<tr>
<td>Governance</td>
<td>Plan-driven, approval-based</td>
<td>Governance</td>
<td>Empirical, continuous, process-based</td>
<td></td>
</tr>
<tr>
<td>Sourcing</td>
<td>Enterprise suppliers, long-term deals</td>
<td>Sourcing</td>
<td>Small, new vendors, short-term deals</td>
<td></td>
</tr>
<tr>
<td>Talent</td>
<td>Good at conventional process, projects</td>
<td>Talent</td>
<td>Good at new and uncertain projects</td>
<td></td>
</tr>
<tr>
<td>Culture</td>
<td>IT-centric, removed from customer</td>
<td>Culture</td>
<td>Business-centric, close to customer</td>
<td></td>
</tr>
<tr>
<td>Long (months)</td>
<td>Cycle times</td>
<td>Cycle times</td>
<td>Short (days, weeks)</td>
<td></td>
</tr>
</tbody>
</table>

#### DevOps / Fast IT

- Agile, Scrum, Continuous Delivery (CD), Continuous Integration (CI), etc

- Speed of Iteration (minutes, seconds)

- ITIL, eTOM, TOGAF, COBIT, etc
Ingredients of Bimodal and Hybrid IT

Towards a Network Architecture for Softwarization / Digitization

- **Application Centricity**
- **Programmability**
  - Cloud / Services
  - Controllers
  - Infrastructure
- **Virtualization**
  - vAF: Application Functions
  - vMF: Management Functions
  - vNF: Network Functions
APIC-EM Platform Architecture
Open and Simple

APIC-EM Applications
- Network PnP
- IWAN
- Path Trace
- Network Inventory
  Advanced Topology Visualizer

APIC-EM Controller
Northbound REST APIs

APIC-EM Services
- Inventory Manager
- RBAC
- Policy Analysis
- Policy Programmer
- Topology Services
- Data Access Service
- Network PnP
- IWAN Services

Grapevine
- Elastic Service Infrastructure

Addressing Scale Out and HA Requirements
Network Plug and Play (PnP)

Discovery
Device can reach PnP Server on APIC-EM

Deployment
Device receives target image and configuration

No Staging
No Staging Required
PnP Runs from Cisco Factory-Default Configuration

Switches (Catalyst®)
Routers (ISR, ASR)
Wireless Access Points
How Does PnP Work?  
Deep Dive Details

1. **Pre-provision**  
   Network PnP app pre-provisioned with device SR number
   - Network PnP app on APIC-EM

2. **Discovery**  
   Configure device discovery  
   • DHCP Option-43 or DNS
   - DHCP Server OR DNS Server

3. **Secure Deployment**  
   • Installer powers on devices  
   • Devices download image and configuration

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**Plug & Play**

Enterprise-wide scale  
Automated workflow  
79% lower deployment costs

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Cisco Connect
PnP – Simple & Secure & Consistent

APIC-EM PnP Dashboard

- Switches (Catalyst)
- Routers (ISR/ASR)
- Wireless AP

APIC-EM PnP REST API Support

- Device Repository and Database
- Python
- APIC-EM API

APIC-EM Bulk Import/Export

- Customer’s Existing Automation Frameworks (i.e. Python scripts, configuration generator, etc.)

Automation Framework

Customer's Existing Automation Frameworks
The Easy QoS App reduces deployment times for network-wide QoS dramatically. We can now respond to changing application needs via policy-based automation within minutes or even seconds.

"The Easy QoS App reduces deployment times for network-wide QoS dramatically. We can now respond to changing application needs via policy-based automation within minutes or even seconds."
Focus: Virtual Application Functions
Application-Driven Dynamic Policy

1. Client A calls client B
2. Client sends call setup info to App server
3. App Server calls APIC-EM to setup policy
4. QoS policy enabled on network device
5. Call ends
6. Client sends call teardown info to App server
7. App Server calls APIC-EM to delete policy
8. QoS policy removed from network device
Example: Dynamic Policy for Citrix Clients

**Problem:** How to provide dynamic application-specific Policy to Citrix XenDesktop users?

**Solution:** Use Citrix NetScaler’s integration with APIC-EM:

1) APIC-EM discovers network and endpoints
2) NetScaler detects start of (video) data transfer
3) NetScaler requests QoS Policy via APIC-EM’s API
4) APIC-EM validates, deploys, and reports the change
Problem: How to capture Application Flow Information along a complex wireless, wired path?

Solution: Leverage APIC-EM – the SDN Controller for Enterprise
**Problem:** In a Hospital, Multicast is used for critical Medical Equipment as well as Patient Entertainment and Media – data privacy is a key concern. How to visualize the relevant multicast information?

**Solution:** Harvest information from the network and create custom, augmented displays

1) Collect relevant Topology, Inventory and Host information from APIC-EM
2) Augment with Multicast tree(s)
3) Use NeXt UI to for visual representation
4) Share with operational staff

See: http://www.anyweb.ch
**Example: Dynamic Admission Control**

**Problem:** How to consistently and predictably implement dynamic call admission control (DAC) policies on top of an IP network, across campus and branches, supporting multiple communication and collaboration technologies?

**Solution:** Leverage DNA and APIC-EM capabilities to integrate with communication and collaboration controllers

1. Define Admission Control Policies in Netwrapper
2. Integrate with Communication Controllers (Skype4Business, Cisco CUCM, …)
3. Integrate with APIC-EM NIB and Easy QoS
4. Communicate and Operate with predictable QoS and SLA

Focus:
Virtual Management Functions
Example: Hybrid Services – Cisco IT

**Problem:** How to consistently monitor and troubleshoot a growing set of business critical hybrid services (on-premise + cloud-based)?

**Solution:** Detect and Alert via ThousandEyes Probes:
- Leverage existing Cloud-based Probes
- Deploy Mac Mini Probes into key Locations
- Deploy Virtual Probes into key Locations (IOS XE Virtual-Service on ISR 4451)
- Reduce MTTR -43% and MTTR -8%

See: blog.thousandeyes.com/troubleshooting-cloud-services-cisco
Focus: Virtual Network Functions
Virtualizing the Branch

Today’s Branch on Hardware

Router
Firewall
Wireless
WAN Opt
Proxy/Cache

Diverse Management, Costly, Complex Refresh Operations

Virtual Branch with Cisco Enterprise NFV

Automated, Orchestrated Policies, Simplified Service Agility
Focus on virtualization has been in the cloud and DC where between management console, VMs and hypervisors:

- Near infinite bandwidth
- Near zero latency
- Straight IP

Over the WAN this is not the same:

- WAN BW is not infinite
- WAN latency is not sub millisecond
- WANs have tunneling, encryption, and labeling
- Management of the hypervisor can be dependent on a VM and its stability
Cisco Enterprise NFV
Network services in minutes, on any platform

Enterprise Service Automation (ESA) on APIC-EM & PI

Virtual Router (ISRv) – IOS-XE
Virtual Firewall (ASA)
Virtual WAN Optimization (vWAAS)
Virtual Wireless LAN Controller (vWLC)
3rd Party VNFs

Network Functions Virtualization Infrastructure Software (NFVIS)

ISR 4000 + UCS E-Series
ENCS
UCS C-Series

Lightweight Virtual Network Functions in Service Containers

IOX Fog Director

Cisco Connect
Power in Software
NFVIS Software Stack

- **Linux Platform**
- **Drivers Interface**
- **NFVIS Virtualization Layer** – Hypervisor & vSwitch
- **Orchestration API**
- **Plug-n-Play Server**
- **Console/SSH**
- **YANG**
- **APIC-EM/Prime**
- **Device Web Portal**
- **Orchestration API**
- **CLI**, **NETCONF**, **REST**
- **HTTPS**
- **Health Monitor**
- **Virtualization Layer – Hypervisor & vSwitch**
- **Interface Drivers**
- **Linux**
- **Platform Drivers**
- **Plug-n-Play Client**
- **Console/SSH**
- **YANG**
- **APIC-EM/Prime**
- **Device Web Portal**
Service Chaining in Enterprise NFV

- Solution allows for NETWORK services to be chained
  - Single chain per host assumed in phase 1
  - To be extended in later phases
- Applications are assumed not to be chained
- Typical VNF chains considered:

1. **Routing / VPN**
2. **WAN Opt.**
3. **Firewall**
4. **vWAAS**
5. **IPS/IDS**
Enterprise Service Automation

1. Discover Devices to be used
2. Define Branch locations
3. Design a Profile & select functions
4. Pick validated topologies
5. Map to Branches

- 105 Devices: Assigned 5, Unassigned 100
- 905 Branches: Provisioned 0, Unprovisioned 905

Matching Templates:
-(vBranch-ISRv-FW-
- Virtual-ISRv-ASA
- Virtual-ISRv-Only
- Virtual-CSR-ASA
- Virtual-CSR-Only

Assign template and attributes
Platforms for the Branch
Cisco Network Virtualization

Traditional

**Physical Router**

Cisco® 4000 Series ISR

- Centralized services
- Fixed integrated services
- Conservative

**Physical Router Virtual Services**

4000 Series ISR + UCS® E-Series

- Upgradable hardware
- Deterministic routing performance

Enterprise NFV

**Virtual Router Virtual Services**

Enterprise Network Compute System (ENCS)

- Elastic routing and services
- Router / Server Hybrid

**Virtual Router Virtual Services**

UCS C-Series

- Elastic routing and services
- Performance
- Early adopter

Cisco ONE™

- Access to Ongoing Innovation
- License Portability
- Investment Protection
Conclusion & Summary
Conclusion & Summary

• Simplification through abstraction
• Automation of repeating tasks
• Consistent policy enforcement
• Events trigger controller actions
• Virtualization of network, applications and management
Multumesc!