Dubrovnik, Croatia, South East Europe
20-22 May, 2013

Cisco SDN
Cisco ONE and onePK
Recap:
What should a Network look like
Your network

It works  Agile  Flexible  Easy  Secure  Cheap
What is the Problem?
Server provisioning

1995

2013
Network device provisioning

1995

ntp server 10.1.4.1
no aaa authentication login
vrf context SPAN
vrf context management
    ip route 0.0.0.0/0 10.1.51.10
vlan configuration 51
    service-policy type qos input Vlan51
vlan 1,30
vlan 51
    name DC-Management
vlan 52-58
vlan 59
    name Servers
vlan 60
    name Desktops

2013

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Why is that?

• Different scale (tens of switches, hundreds of servers)
• Additional complexity does not always compensate for time savings
• Lack of automation / scripting know-how
• Lack of consistent APIs
Did you know…?

• What “EEM” stands for?

• That your Cisco devices probably support zero-touch provisioning?

• What northbound APIs your network management tools support?

• That there is a Quantum plugin for Cisco switches?

• That you can configure network devices over Puppet and Chef?
SDN Models & Trends
Centralized vs. distributed control planes

• What is better, network devices acting independently from each other (but coordinated) or a central instance that dictates how each switch should behave?

• As usual, it depends…
Network overlays - introduction

A.k.a. “network virtualization”
Network overlays - introduction

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A.k.a. “network virtualization”
Network overlays can emulate a LAN

- Not a new concept, LAN-Emulation (based on ATM) and VPLS (based on MPLS) are some precedents
- The virtual part of it is new: the tunnel endpoints are virtual network components inside a hypervisor
- Overlays can have advantages and disadvantages: handle with care!
Is virtualization easy?

- Actually not, but in the case of server virtualization it brings more benefits than disadvantages
- Is that the case for network virtualization? The jury is still out…

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Factors that have become more time consuming or difficult since moving to a virtual server environment.

- Storage capacity and performance management: 36%
- Application-to-storage mapping (for monitoring): 29%
- Data protection tasks (e.g., backup & restore): 28%
- Storage provisioning: 25%
- Storage system upgrades or replacements: 24%
- Storage system troubleshooting: 20%
- Disaster recovery planning or operations: 16%


Impact of Server Virtualization on Storage: Growth and Complexity Are Companions to Server Virtualization

What is the impact of server virtualization on storage?

- Capacity Growth
- Troubleshooting Complexity Increased
- Density Crowding & Bandwidth
- Reduced Cost
- Needs SAN Rather Than DAS
- None

Virtualization: Necessary but also creates challenges

Source: IDC

Source: IDC 2009
Cisco ONE
the power of Choice
Evolution of the Intelligent Network

Preserve What’s Working

- Resiliency
- Scale and Security
- Rich feature-set

Evolve for Emerging Requirements

- Operational Simplicity
- Programmability
- Application aware

Evolve the Network for the Next Wave of Application Requirements
Cisco Open Network Environment

Industry’s Most Comprehensive Networking Portfolio

- Hardware + Software
- Physical + Virtual
- Network + Compute

Applications

OPEN NETWORK ENVIRONMENT

- Platform APIs
- Virtual Overlays
- Controllers and Agents

http://www.cisco.com/go/one

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Implementing Customer Use Cases

Cisco Approach: Flexibility to Choose — The Power of “AND”

- **Tightly-coupled HW-SW**
  - APIs
  - Network
  - Apps

- **Loosely-coupled HW-SW**
  - Controller
  - Device
  - Device w/ OpenFlow
  - OpenFlow
  - Other Agents

- **Overlay networks**
  - Virtual Overlays
  - Physical and Virtual
  - Network
  - Apps

**Preserve existing functionality**
Unified Fabric in the DC
Protocol independence: FC – FCoE – NFS – iSCSI – SMB3

Features
- Nexus 7000 FCoE—Industry’s highest performance Director-Class SAN platform
- MDS 9500 FC and FCoE support
- Nexus 5500 Unified Port FC and FCoE support

Benefits
- Up to 45% access layer CapEx savings
- 492% ROI for converged networks
- Investment protection with existing Fibre Channel SANs
- Dynamic ports allocation: Lossless Ethernet or Fibre Channel

Cisco DCNM: Single Pane of Glass Visibility Across LAN & SAN
Network Scale and Flexibility
NX-OS Innovation Enhancing L2 with L3

Layer 2 Strengths
- Simple configuration
- Flexible provisioning
- Low cost

Layer 3 Strengths
- All links active
- Fast convergence
- Highly scalable

Supported on Nexus 7000, 5000 and 2000
Scalable to Over 12,000+ 10GbE Non-Blocking Ports

Massively Scaleable Layer 2 Domains—Fast Convergence for Layer 3 Domains
Simplifying DC Infrastructure
Fabric Extender Technology Decouples Scale and Complexity

Distributed Modular System
Fixed Backplane

Cross-Bar and Supervisor

Fabric Extenders
(Remote Line Cards)

Distributed Data Center Fabric
10GbE / 40GbE Ethernet for the Backplane

Available on UCS and Nexus
Implementing Customer Use Cases

Cisco Approach: Flexibility to Choose
— The Power of "AND"

- Tightly-coupled HW-SW
- Loosely-coupled HW-SW
- Overlay networks

Preserve existing functionality
Evolving how we interact with the network
New Tools for New Users and New Use Cases

Traditional Approach

- CLI
- SNMP
- HTML
- XML
- AAA
- CDP
- Syslog
- Netflow
- Routing Protocols
- Span

New Paradigm

- App
  - C
  - Java
  - Python
- Rich Actions, Rich Events, Rich Environment

Anything you can think of
Choose the Hosting Model that Suits Your Platform and Your Application

On An External Server
- Plentiful memory/compute
- Higher latency and delay
- Supported on by all platforms

On A Hardware Blade
- Dedicated memory/compute
- Low latency and delay
- Requires modular hardware blade

On the Router
- Shared memory/compute
- Very low latency and delay
- Requires modular software architecture
Use Case: automatic troubleshooting

New Switch

Cable Error: G0/3 to G0/1 on N3K-main. Should be G0/3 to G0/3 on N3K-main.

Fixed it.

Cabling Verified. Starting interface config
Use Case: Latency Based Routing
Yes, It’s Secure

- Digital Signing Certification Process
- CLI Control Resource Allocation
- Isolation Resource Consumption
- Admin Security
- Code Isolation Strong Typing
- AAA (PKI) Encryption (TLS)
- Runtime Security
- Container Security
- Code Security
- onePK

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Cisco Cloud Connectors
The application in your network

The Requirement
iSCSI cloud storage for the branch

How
Cisco ISR G2 with Cisco UCS E-Series
Amazon Storage Gateway plus Amazon S3

End Customer Benefits
Access to extremely affordable cloud storage as low as $0.01 per GB per month
Single box solution for all business needs and lower TCO

Partner Benefits
Differentiate storage services vs. competition
Additional opportunity to monetize
Cisco Cloud Connectors
A rich ecosystem
Other APIs for programming and automation
Already in your network!

- OpenStack Quantum plugin for automated configuration of physical and virtual networks
- REST and Web Services APIs in Cisco Prime for network automation
- REST API in Nexus 1000v for virtual network automation
- XML API in UCS for server automation, including plugins for Perl, Powershell, and .NET
- TCL and Python scripting on a wide variety of platforms
Zero-touch provisioning

- Zero-touch provisioning is already possible for many Cisco devices like routers or Catalyst/Nexus switches.
- The network devices will get the right software and the right configuration in an automated way.
- onePK enables configuration of network devices by config engines such as Puppet or Chef.
Implementing Customer Use Cases

Cisco Approach: Flexibility to Choose — The Power of "AND"

Preserve existing functionality
Did you say “OpenFlow”? 

- Cisco implements OpenFlow agents on top of onePK 
- OpenFlow is one particular onePK agent: there are others 
- Evolutionary approach: get the stability of existing networks, plus the flexibility of OpenFlow
Cisco ONE Controller
Industry’s Most Extensible Controller

- REST
- OSGi
- More Coming

Advanced Functionality

- Cisco Apps
- Customer Apps
- ISV Apps
- Open Src Apps

Core Functionality

- Northbound: Published open APIs with more to follow
- More Southbound interfaces to follow

- Ex. Custom Routing (low latency based), Network Tap

Network Slicing Function

- Scale-out architecture, Highly Available
- Provides consistent management, troubleshooting and security
- Modular Java-based architecture
- More Coming

Network Infrastructure
Cisco “ONE” Controller
Example Applications

Network Slicing

Matrix Switch for flexible traffic mirroring

Troubleshooting
Open Daylight Project

- Open Source project that will deliver a network controller supporting multiple northbound and southbound APIs
Open Daylight Project

• Extensive industry support
Yet another programmability example

Deutsche Telekom Selects Tail-f as Provider of Software-Defined Networking (SDN) in TeraStream Project

April 11, 2013

• “Traditional” APIs are still an option
Implementing Customer Use Cases

Cisco Approach: Flexibility to Choose — The Power of “AND”

- Preserve existing functionality
Data Center requirements

Any workload anywhere

- Operational flexibility to deploy any host anywhere:
  Across Subnets, PODs, Data Centers, Organizations
- High BW, multi-path, deterministic latency, large scale
- Multi-tenant networking
- Programmability

Workload Mobility

Workload Distribution

Workload Segmentation
Handling Workloads in the Data Center
Choosing the right tools …

Inter-Site (DCI & WAN)
- Move a workload across PODs/sites
- Distribute a workload across PODs/sites

Intra-Site
- Move/Distribute a workload within a site
- Interconnect tiers of a virtual App
Hybrid Overlays: Virtual + Physical Networks

- Hypervisors introduce an additional tier in the network: The virtual Access (virtual Switch)
- **VMs** connect to the virtual Access
  - **Host overlays** start at the virtual Access
  - Virtualization based resiliency: **Single attached sites**
- **Physical hosts** connect to the physical Access
  - **Network overlays** start at the physical Access
  - Network resiliency: **Site multi-homing**
- A hybrid overlay allows the combination of physical and virtual resources

**Host overlays must evolve in order to include physical end-points successfully**
L2 overlays for Workload Moves
Distribution and DC Geo-Dispersion?

There are better suited tools: OTV and LISP
Overlays and Underlays

Robust Underlay/Fabric
- High Capacity Resilient Fabric
- Intelligent Packet Handling
- Programmable & Manageable

Flexible Overlay Virtual Network
- Mobility: Track end-point attach at edges
- Scale: Reduce core state
  Distribute and partition state to network edge
- Flexibility/Programmability
  Reduced number of touch points

Seek well integrated overlays and underlays
Cisco virtual overlay solution

• Based on the Nexus 1000v framework
• Multi-hypervisor (VXLAN and NVGRE)
• Supports L2 and L3 Virtual Private Cloud
  The public cloud looks like an extension of your DC
  The public cloud looks like a branch
• Rich ecosystem of L4-L7 services, including Imperva, Cisco and Citrix
• REST API for easy automation
• Natively supported by most orchestration engines
• Integrated with the physical network
Summary
Summary: Open Network Environment
Cisco Innovations Summary

- **onePK Developer Kit**
  - Complete developer’s kit for multiple Cisco Platforms, Servers, Blades
  - Rapidly develop test and deploy Applications.
  - Phased availability across IOS, IOS-XR and NX-OS platforms

- **Controllers + Agent Support**
  - Controller SW (with OpenFlow and onePK support)
  - OpenFlow 1.x support
  - Engage with universities & research for campus slicing use case

- **Overlay Network Solutions**
  - Multi-hypervisor support on Nexus 1000V (incl. OpenSource hypervisor)
  - OpenStack and REST APIs on N1KV for rapid tenant provisioning
  - VXLAN-VLAN gateway (for bridging traditional environments)
  - Virtual or Physical Network Services

- **Programmatic APIs**
- **Controllers and Agents**
- **Virtual Overlays**
# Cisco Innovations Summary

Your network should look like this

<table>
<thead>
<tr>
<th>Best practices</th>
<th>API: onePK</th>
<th>FabricPath</th>
<th>Zero-touch deployment</th>
<th>Security on all layers</th>
<th>Modular Investment protection</th>
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<td>TAC support</td>
<td>Cloud connectors</td>
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<th>Features</th>
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<td>Secure</td>
<td>Cheap</td>
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OR
Thank you.