TOMORROW starts here.
SDN Framework to Enable a Cloud Intelligent Network

Satish Katpally
Senior Marketing Manager,
Products, Solutions and Industries Marketing (PSIM)
skatpall@cisco.com
Agenda

- Introduction

- Cloud Migration and Business Drivers

- Applications, Clouds and Open Networks: A thesis

- SDN and Cisco ONE (Open Network Environment)

- Cisco ONE:
  - onePK, Cloud Connectors, CSR1000V, Nexus 1000V: Use-cases & Roadmaps

- Summary

- Q&A
Ten ways to say Cloud

Origin Old/Middle English “clud” “weolcan” – mass of rock, a covering
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Why Cloud?
Migration to the Cloud ➔ Business Drivers

Benefits
• App Adoption:
  • Speed \(\uparrow\)
  • Degree \(\uparrow\)
  • Cost \(\downarrow\)
• Elastic Capacity \(\uparrow\)
• Premise CapEx+OpEx \(\downarrow\)

Costs
• End-user application experience
• Subscription/elastic scaling costs
• SLA/reliability

Risks
• Vendor Viability, lock-in
• Cloud Service Provider: SLA/Pricing

Investment Protection
Cloud Migration

Yesterday
- Internet
- ORACLE
- SAP

Today
- Public
  - YouTube
  - Cisco Webex
  - salesforce.com
  - rakespace
  - amazon.com
- Hybrid
  - VMware
  - citrix
  - oracle
- Private
  - citrix

Future
- Internet/WAN
- Cisco
- Oracle
- SharePoint
- Amazon.com
The Private Cloud Challenge: Virtual Desktop User Experience

Bandwidth Explosion:
Typical VDI takes 500kbps
(< 20 VDI sessions for typical WAN link)

WAN Latency:
Cloud applications require <50ms latency, IT can’t predict behavior*

LACK OF VISIBILITY, CONTROL, AND PRIORITIZATION

*Cisco Global Cloud Index, December 2011
The Public Cloud Challenge: Inefficient Security
Centralized Internet Access

Hairpinning Effect:
Backhaul of SaaS/internet traffic to DC

Drastic change in WAN traffic pattern:
90% of organizations backhaul Internet traffic*

COMPROMISED USER EXPERIENCE

*SaaS

Sales Rep at NY Branch / Mobile User
California, USA

Users

Hairpinning Effect:
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COMPROMISED USER EXPERIENCE

Salesforce

Brazil

HQ/DC

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Application Aware Networks
Network Centric Approach

Application Services Integrated into Routers/Switches
Network Aware Applications
Application Centric Approach

Custom Routing
Analytics & Topology
Dynamic QoS

Branch/User
Branch Router
VPN
Private WAN/Internet
WAN Agg Router
FW
Virtual Router
WAAS / vWAAS

Network State Available to Applications
Applications & Networks: Mutual awareness

Custom Routing
Analytics & Topology
Dynamic QoS

Simplified Cloud Deployment

Branch/User
ISR AX
TrustSec
FW, IPS
VPN
Private WAN/Internet

FW
ASR
WAAS / vWAAS
CSR
Traditional DC
Private/Public/Hybrid

AVC, WAAS, PIR
FW
FW
FW

PSORST-2001
Applications and Networks Are Mutually Aware

End-to-End Application Service Assurance
Provide an excellent experience regardless of where apps are hosted
Opening Networks to Applications
Make Network Value Available in Real-time

POLICY
Orchestration
ANALYTICS

Program for Optimized Experience
Harvest Network Intelligence

Programmability
Intelligence

Network

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Customer Insights: Network Programmability

- **Research/Academia**
  - Experimental OpenFlow/SDN components for production networks

- **Massively Scalable Data Center**
  - Customize with Programmatic APIs to provide deep insight into network traffic

- **Cloud**
  - Automated provisioning and programmable overlay, OpenStack

- **Service Providers**
  - Policy-based control and analytics to optimize and monetize service delivery

- **Enterprise**
  - Virtual workloads, VDI, Orchestration of security profiles

Diverse Programmability Requirements Across Segments for: Automation & Programmability

- Network Flow Management
- Scalable Multi-Tenancy
- Agile Service Delivery
- Private Cloud Automation
Open Networking Approaches
Evolving Paradigms: ONF SDN

What Is Software Defined Network (SDN)?

“…In the SDN architecture, the control and data planes are decoupled, network intelligence and state are logically centralized, and the underlying network infrastructure is abstracted from the applications…”

Source: www.opennetworking.org

Note: SDN is not mandatory for network programmability nor automation

Source: www.opennetworking.org
Cisco’s Differentiation: Multi-layered Programmability
Flexibility in Deriving Abstractions

Application Developer Environment

Management and Orchestration

Analysis and Monitoring, Performance and Security

Network Services

Control Plane

Forwarding Plane

Network Elements and Abstraction

Transport

Cisco ONE >> SDN

OpenFlow/SDN

Program for Optimized Experience

Harvest Network Intelligence

Open Network Environment

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Cisco Open Network Environment (Cisco ONE)

Industry’s Most Comprehensive Networking Portfolio

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

Applications

OPEN NETWORK ENVIRONMENT

Platform APIs

Controllers and Agents

Virtual Overlays

Cisco ONE >> SDN

www.cisco.com/go/one
Cisco ONE Enterprise Networks Architecture

**NETWORK APPLICATION LAYER**
- Cisco Prime
- Cisco ISE
- Cloud Services
- Security Services
- Mobility Services
- Application Services

**CONTROL LAYER**
- Cisco ONE Controller (Network Services APIs)
- Discovery
- Topology
- QoS
- Location
- ....

**NETWORK ELEMENT LAYER**
- Device API– One PK, OpenFlow, CLI
- Cisco Network Operating Systems (Enterprise, Data Center, Service Provider)

**ASIC DATA PLANE**

**SOFTWARE DATA PLANE**
Networking Standards are Critical

802.1 Overlay Networking Projects,
Cisco Innovations: FEX Architecture

Technical Advisory Group Chair, Working Groups:
Config, Hybrid, Extensibility, Futures/FPMOD/OF2.0

Open Source Cloud Computing project

Open Network Research Center at Stanford University

Working Groups: Quantum API
Cisco Innovations: Donabe

OpenStack API for Nexus
OpenStack Extensions

Overlay Working Groups:
NVO3, L2VPN, TRILL, L3VPN, LISP, PWE3
API Working Groups:
NETCONF, ALTO, CDNI, XMPP, SDNP, I2AEX
Controller Working Groups:
PCE, FORCES

Linux Foundation
IBM, Citrix, Microsoft, Ericsson, Brocade Juniper
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Cisco ONE: onePK
onePK for Rapid Application Development

Developer Environment
- Language of Choice
- Programmatic Interfaces
- Rich Data Delivery via APIs

Comprehensive Service Sets
Better Apps; New Services
Monetization Opportunity

Deploy:
- Directly on the Device
- On a Service Blade
- On an External Server

Network Data
Control, Extend, Scale

Data Path | Policy | Element | Route | Utility
---|---|---|---|---
Discovery | LISP | Developer | Others…

onePK Infrastructure
- IOS
- NX-OS
- IOS-XR

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Open Network Environment – Flexibility to Choose
Protocols, APIs and Deployment Models

**onePK Developer Environment**

- **Element**
  - Element Capabilities
  - Configuration Management
  - Interface/Ports Events
  - Location Information

- **Utilities**
  - Syslog Events and Queries
  - AAA Interface
  - Netflow Events
  - DHCP Events

- **Discovery**
  - Network Element Discovery
  - Service Discovery
  - Topology Discovery

- **Developer**
  - Debug Capabilities
  - Tracing Interfaces
  - Management Extensions

- **Policy**
  - Interface Policy
  - Interface Feature Policy
  - Forwarding Policy
  - Flow Action Policy

- **Routing**
  - Protocol Change Events
  - RIB Table Queries

**RICHNESS OF FEATURES**

- **OpenStack**
  - Quantum API
    - Interface descriptions
    - L2 network provisioning
    - L3 and IP Addr. Mgmt. - coming

- **OpenFlow**
  - Packet classifiers
  - Marking
  - Copy/Punt Inject
  - Statistics

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**PSORST-2001**

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onePK

Use-case: Cloud Services Automation

Customer 1
- ISR with onePK and Cloud Connector

Customer 2
- ISR with onePK and Cloud Connector

onePK helps automate and optimize Cloud Services

xaas Provider
- ASR 1000 with onePK
- Storage
- Compute
- Network
What is a Cisco Cloud Connector?

**Cisco Cloud Connector Definition**

Software residing on, or integrated with, Cisco Enterprise routers to enable or enhance a cloud service

**Type I: Native**

Integrated in IOS & IOS-XE

**Type II: Hosted**

Independent Software Vendors’ (ISV) and Cisco software hosted on ISR compute platforms

**Type III (Future): Scripted**

Python Scripts running in individual containers with capabilities such as HTTP Proxy
Available Cloud Connectors

Identity

Ping Identity

Document Management

xerox

Business Continuity

Infoblox

Storage

Maginatics

ctera

panzura

amazon.com

Unittrends

Asigra

Transportation

Setel Hellas

Virtualization

vmware

desktop

atlantis

Collaboration

Cisco HCS

cisco

webex

Identity

Digital Signage

industry weapon

digital signage made easy

Virtualization

Security

SecureLogix

cisco

ScanSafe
Ping Identity: How it Works

- Cisco Cloud Connector
- HTTP Proxy
- onePK DPSS

onePK
Identity Cloud Connector
HTTP Proxy
onePK DPSS

LAN

WAN

onePK
Cisco Cloud Connector VM
VM
VMware ESXi Hypervisor
UMS E-Series Blade
Cisco ISR-G2

Cisco Public
Cisco ONE: Controller
Cisco ONE Software Controller
Industry’s Most Extensible Controller Architecture

Multiple published APIs for popular languages and software (Eg: OpenStack)

Modular architecture allows rapid adoption of evolving controller functionality while minimizing operational disruption

Extensible protocol support ensures continuous adoption of emerging standards
New Controller Applications
Extending and Customizing with Cisco ONE Portfolio

Previously Announced

Network Slicing
Dynamic network partitioning of the network using logical associations provided by ONE Controller’s centralized view

Phase 2 Apps

Network Tapping
Ability to monitor, analyze, and debug network flows using conventional network switches

Custom Forwarding
Using unique parameters such as low latency to program specific forwarding rules across the network

Improved economics and more flexibility

Tie network behavior to business rules

All Controller Apps are in Customer PoC
Infrastructure as a Service (IaaS)
Changing the Cost Economics and Business Responsiveness of IT

Pay-For-Use Pricing, Rapid Provisioning, Elastic Scalability
**Cisco Cloud Services Router (CSR) 1000V**

Extending Enterprise WAN to Provider-hosted Clouds

<table>
<thead>
<tr>
<th>Secure Connectivity</th>
<th>Tenant Scalability</th>
<th>Traffic Control</th>
</tr>
</thead>
</table>
| • Globally uniform VPN policies  
• Scalable and reliable VPNs  
• Automatic topology updates | • Reduced VLAN dependence  
• End-to-end MPLS WAN  
• Full range of network services | • Shortest path from any location  
• Interception and redirection  
• Classification and prioritization |

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Cisco CSR 1000V

Cisco IOS Software in Virtual Form-Factor

Cisco IOS XE Cloud Edition
- Selected feature set of Cisco IOS XE
- Virtual Route Processor (RP)
- Virtual Forwarding Processor (FP)

Virtual Private Cloud/Data Center Gateway
- Optimized for single tenant use cases

Agnostic to Other Infrastructure Elements
- Multi-Hypervisor *(see Roadmap)*
- Virtual switch agnostic
- Server agnostic
Cisco Virtual Networking and Security Services

Cloud Provider’s Data Center

Cloud Network Services

Tenant A

CSR 1000

vWAAS

ASA 1000V

Department A

VSG

Department B

Nexus 1000V

Multi-Hypervisor

Physical Infrastructure

WAN Router

Switches

Servers

WAN

Switches

Servers

Physical Infrastructure

CSR 1000V

- WAN Gateway
- IOS Networking

vWAAS

- WAN Optimization
- Application Traffic

ASA 1000V

- Edge Firewall
- Protocol Inspection

VSG

- Zone-based Firewall
- VM-level Control

Nexus 1000V

- Distributed Switch
- NX-OS Consistency

Ecosystem Services

- Citrix NetScaler VPX ADC
- Imperva Web App. Firewall

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Cisco ONE Virtual Overlays: Use-case

Nexus 1000V InterCloud to Burst to Public Cloud – Extending Enterprise Experience to Cloud
Cisco ONE Solution Framework

Client
- Application
  - Application and Service Workflows
  - Network Programmable Interface (NPI) Controllers, Collectors
  - onePK / Programming Agents
  - onePK / Programming Agents

Network
- Programming and Managing of Virtual Resources
  - Service Chaining and Resource Automation

Data Center
- Programming and Managing of Physical Resources

MASKING NETWORK COMPLEXITY
OPEN AND PROGRAMMABLE
CONSISTENT OPERATIONAL EXPERIENCE
## Cisco ONE Solution Framework

### Client
- **Web APIs and Client Plug-ins**
- **Application**
  - Ubicity • Imperva • Starview

### Network
- **Network Programmable Interface (NPI) Controllers, Collectors**
  - ONE Controller • Cariden • Meraki • Cloupia • Virtuata • vCider

### Data Center
- **Physical Infrastructure**
  - ISR • ASR 1K • ASR9K • C3K • C6K • N3K • N7K
- **Virtualized Infrastructure**
  - CSR 1000V • N1KV • InterCloud • vNAM • nLight
- **onePK / Programming Agents**
  - Services and Support
  - MASKING NETWORK COMPLEXITY
  - OPEN AND PROGRAMMABLE
  - CONSISTENT OPERATIONAL EXPERIENCE

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**Ubicity**
- Imperva
- Starview

**onePK / Programming Agents**
- CSR 1000V
- N1KV
- InterCloud
- vNAM
- nLight

**physical Infrastructure**
- ISR
- ASR 1K
- ASR9K
- C3K
- C6K
- N3K
- N7K
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Network is critical to Cloud Migration

- Business Drivers → Cloud Migration
- Networks & Applications → Mutually Aware
- Open Networks → Harness Network Value
Cisco ONE >> SDN

- Cisco ONE vs SDN
- Cisco ONE Pillars
  - Platform APIs: onePK, OpenFlow, and more
  - Controller and Agents: ONE Controller
  - Virtual Overlays
- ONE Enterprise Networks Architecture
Cisco ONE: Cloud Services

- Cisco ONE: onePK API
  - Cloud Connectors

- Cisco ONE: Virtual Overlays
  - Nexus 1000V, vPath
  - CSR1000V, AppNav
  - ASA 1000v, VSG
  - vWAAS

- IaaS Cloud Services
  - Virtual Networking
  - Security
For more information

- Cisco.com/go/one
- Cisco.com/go/onepk
- Cisco.com/go/cloudconnectors
- Cisco.com/go/csr1000v
Thank you.
Contact: skatpall@cisco.com
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