THE REVOLUTION TOWARDS SOFTWARE-DEFINED NETWORKING

Transforming Networking with Open SDN

Guido Appenzeller
April, 2013
JOIN THE REVOLUTION TOWARDS OPEN NETWORKING

**Independence** from closed, proprietary systems

**Freedom** of choice in vendors

**Power** of centralized network control
CLOSED & PROPRIETARY NETWORKING EQUIPMENT

Vertically Integrated Systems Have Changed Little Over the Past 15 Years

Provisioning and Management
- Static, manual configuration
- Low feature velocity

Operating Systems
- Few API’s, only CLI (closed OS)
- Not externally programmable

Hardware Systems
- Lock-in to a particular vendor

System Silicon
- Slow innovation cycles
- Expensive, no economies of scale

Feature 1

Proprietary Network OS

Proprietary System

Proprietary Silicon

Feature 2

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CONTRAST WITH SERVER EQUIPMENT: 2013
Open Architecture – Choice of Vendors – Innovation Velocity – Low TCO

- Network Boot
- Central Configuration
- Automated Patch Mgmt

Provisioning & Management
- Network Boot
- Centralized Configuration & Mgmt

Operating System
- Open or closed source
- Virtualized or bare metal
- Many support models

Hardware Systems
- Fierce competition
- Branded or “white box”

System Silicon
- Competition and rapid innovation

Linux | Windows
VMware | KVM | Xen

Dell | HP | Super Micro

Intel | AMD
EVOLUTION OF NETWORK PROVISIONING: 1996-2013

1996

Router> enable
Router# configure terminal
Router(config)# enable secret cisco
Router(config)# ip route 0.0.0.0 0.0.0.0 20.2.2.3
Router(config)# interface ethernet0
Router(config-if)# ip address 10.1.1.1 255.0.0.0
Router(config-if)# no shutdown
Router(config-if)# exit
Router(config)# interface serial0
Router(config-if)# ip address 20.2.2.2 255.0.0.0
Router(config-if)# no shutdown
Router(config-if)# exit
Router(config)# router rip
Router(config-router)# network 10.0.0.0
Router(config-router)# network 20.0.0.0
Router(config-router)# exit
Router(config)# exit
Router# copy running-config startup-config
Router# disable
Router>

Terminal Protocol: Telnet

2013

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Terminal Protocol: SSH
EVOLUTION OF SERVER PROVISIONING: 1996-2013
RELATIVE EVOLUTIONARY PATH: COMPUTE VS. NETWORKING
WHAT IS SDN?

Wikipedia Definition:

„A communications protocol that gives access to the forwarding plane of a network of a switch or router over the network.”
EVOLUTION TOWARDS AUTOMATED NETWORK PROVISIONING
Architecture of Software-defined Networking (SDN)

LEGACY CLOSED, DISTRIBUTED NETWORKING ARCHITECTURE

Source: Stanford OpenFlow Team
EVOLUTION TOWARDS AUTOMATED NETWORK PROVISIONING
Architecture of Software-defined Networking (SDN)

Source: Stanford OpenFlow Team
THE ULTIMATE DESTINATION: OPEN SDN ARCHITECTURE

Industry Standards, Open APIs and Open Source
WHAT’S NOT SDN?
IN A WORLD OF SDN-WASHING...

What’s not SDN?

Xsigo Systems was an information technology and hardware company based in San Jose, California, US that provided Data Center Fabric and I/O virtualization solutions to companies and enterprises. Several prominent and global Information Technology systems and service providers, including Microsoft and Oracle, have acknowledged Xsigo Systems as a prominent solution provider for data center I/O virtualization.

“Oracle Buys Xsigo
Extends Oracle's Virtualization Capabilities with Leading Software-Defined Networking Technology for Cloud Environments”

Redwood Shores, Calif. – July 30, 2012
IN A WORLD OF SDN-WASHING...

What’s not SDN?

Vyatta

From Wikipedia, the free encyclopedia

This article relies on references to primary sources. Please add references to secondary or tertiary sources. (June 2011)

Vyatta manufactures software-based virtual router, virtual firewall and VPN products for Internet Protocol networks (IPv4 and IPv6). A free download of Vyatta has been available since March 2006. The system is a specialized Debian-based Linux distribution with networking applications such as Quagga, OpenVPN, and many others. A standardized management console, similar to Juniper JUNOS or Cisco IOS, in addition to a web-based GUI and traditional Linux system commands, provides configuration of the system and applications. In recent versions of Vyatta, web-based management interface is supplied only in the subscription edition, however, all functionality is available through KVM, serial console or SSH/Remote protocols. The software runs on standard x86-64 servers.

“With Vyatta, Brocade makes a low-risk, high-reward bet on SDN Brocade's acquisition of open source networking software company Vyatta could prove to be a key move in the SDN battle with Cisco.”

Network World, 11/05/12
ESSENTIAL ELEMENTS FOR NETWORK REVOLUTION

All Elements of an Open Network Architecture Are Available Now
CONFIGURING NETWORK SEGMENTS: LEGACY VS. SDN

Legacy VLAN configuration vs. SDN Integrated OpenStack Horizon UI

VLAN Configuration

```
switch(config)# vlan10
switch(config-vlan)# name USER
switch(config-vlan)# exit
switch(config)# vlan 20
switch(config-vlan)# name SERVER
switch(config-vlan)# exit
switch(config)# vlan 30
switch(config-vlan)# name MANAGEMENT
switch(config-vlan)# exit
...
```

Slow, Manual Provisioning
- Lengthy CLI script development
- Maintenance window delays

OpenStack Tenant Network Creation

Instant Provisioning
- Clicks of buttons in UI
- Automated SDN provisioning

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BIG SWITCH NETWORKS: OPEN SDN STACK

Open Source Software and Commercial Products

Application Plane

- Open i/f
- Rest API

Control Plane

- Floodlight
- OpenFlow

Data Plane

- Indigo
- Switch Light
  - Switch Light for Broadcom
  - Switch Light for Linux

projectfloodlight.org
bigswitch.com

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Blogposts

**Introducing Project Floodlight** - Mar 25, 2013

*Contributed by Paul Lappas, Head of Open Source @ Big Switch Networks.*

I'm incredibly happy to announce some really exciting things that are happening in open source at Big Switch Networks. Today we announced the launch of a commercial version of Indigo Agent, which is a fully deployable thin switching software platform called Switch Light, and a revamped open source site: ProjectFloodlight.org. In this posting I wanted to explain how...
WHERE IS SDN TODAY?
“We always overestimate the change that will occur in the next two years and underestimate the change that will occur in the next ten. Don't let yourself be lulled into inaction.”

Bill Gates
THE EVOLUTION OF SDN NETWORK APPLICATIONS

**Campus Backbone:**
- Dynamic ACLs
- Network Access Control

**WAN:**
- Dynamic Route Selection
- Dynamic SLAs

**DMZ / Network Perimeter:**
- Centralized ACL Mgmt
- Service Chaining

**DC ToR and Fabric:**
- Route Multipathing
- Service Insertion

**Virtual Edge:**
- Cloud Orchestration
- Dynamic Workload Segmentation
SDN APPLICATION USE CASES

- MulL-Tenant Public/Private Cloud
- Overlay Fabrics
- OpenFlow Fabrics
- Security Service Insertion
- Campus Network Access Control
- WAN/Campus Traffic Engineering
- Dynamic Service Delivery – ISP and Enterprise
- Bandwidth on Demand – Burst, Time of Day, etc.
- QoS – Latency and Jitter guarantees
- Dynamic Access Control List Enforcement – DMZ, DC, Backbone...
THANK YOU