NETWORK ORCHESTRATION AND AUTOMATION WITH SOFTWARE DEFINED NETWORKING

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Agenda

• Software Defined Networking Technologies

• SDN Use Cases
  • OpenFlow
  • Network Function Virtualization
  • Orchestration
Software Defined Networking Technologies

Functional Definitions
Software Defined Networking – 3 Areas

SOFTWARE NETWORKING TECHNOLOGIES

OpenFlow
- Separation of control and data plane
- Control Plane – agnostic to the underlying hardware
- Network Programmability

Hardware in Software (NfV)
- Virtualization of networking components
- Commodity hardware x86
- Cost, flexibility, agility

Integration with higher-order Orchestration platforms
- OpenStack, CloudStack, vCloud Director
- API interaction with network elements
- Vendor Independence
Programmatic Control – OpenFlow
A NEW POINT OF INNOVATION FOR NETWORK FUNCTIONALITY

- The biggest innovation since Ethernet: OpenFlow
- from distributed to centralized Control Plane
- allows dramatic reduction in complexity due to End-to-End topology knowledge
- VCS further reduces management complexity
Network Functions Virtualization
A COMPOUND DISRUPTION

Virtual machine-based or Bare Metal
Leverages server performance
Open systems
Automation (Templates)

Virtualizing the networking components as a Service
- Routing, Firewall/Security, Load-balancer
- Cloud Service Provider model
- Motivation for Telcos (SP) to move to the CSP model
Overlay and Underlay

SOFTWARE NETWORKING TECHNOLOGIES

An Overlay is a virtual network built on top of an underlying network infrastructure (the Underlay)

Overlays are defined by the NVO3 Working Group

- Guarantees traffic segregation for users (tenants)
- Allows dynamic placement of end stations (VM/Servers) and does so independently of the underlay
- Supports address space independent of the tenants

Current Overlay Protocols

- VXLAN
- NVGRE
- STT
Orchestration Layer
SOFTWARE NETWORKING TECHNOLOGIES

Orchestration is a control layer above the available networking resources that allows for centralized control.

Openstack,
- Is aware of all networking resources.
- Another layer of control (e.g. DNRM)
- Uses overlay and control language like Openflow to manipulate, monitor and control
- Northbound API for higher level control
- Southbound control “neutron”

Orchestration layer
- Openstack
- Cloudstack
Network Simplification Through Innovation

**PHYSICAL / traditional**

**VIRTUAL / today**

Programmatic Provisioning, Management, and Control

The next generation Data Center Infrastructure
**Network Simplification Through Innovation**

*Ethernet Fabric is the Foundation for SDN and Virtualization*

<table>
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<th>SDN</th>
<th>Efficient Infrastructure</th>
<th>Scalable Control</th>
<th>Simplicity Through Automation</th>
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| Network Virtualization | • Virtualization-aware  
  • Flat topology  
  • Frame-based load balancing  
  • Layer 1/2/3 multipathing  
| Programmatic Control | • Fabric-level API for service creation  
  • OpenFlow support  
  • Single point of access  
| Cloud Orchestration | • Self-forming fabric  
  • Logical chassis  
  • Automatic VM discovery  
  • OpenStack plug-in  

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SDN Use Cases

SDN Will Evolve Through Value-Added Applications
WAN Network Virtualization

Traditional L2/L3VPN-IP Network with OpenFlow Overlay

- OpenFlow as an overlay to existing network
  - Allows for new revenue-generating features on top of existing production network

- Enabled by Brocade’s “Hybrid port mode”
  - OpenFlow and traditional features enabled concurrently on same router ports

- Protected Hybrid Port Mode
  - OpenFlow does not affect Traditional traffic
  - Protection in hardware
  - Allows for initial OpenFlow overlay service development without risk
Internet2
BROCADE OPENFLOW ENABLED 100G NATIONWIDE Backbone

- 49 Custom Location Facilities
- 15,500 miles of dark Fiber
- 8.8 Tbps of Optical Capacity
- Hybrid Mode with protected OpenFlow traffic
Services Creation & Insertion

- SDN automates
  - Traffic steering to achieve desired pipeline of services
  - Customization of services according to customer needs
- Optimizes use of network resources
  - No need to steer traffic through traffic steering appliances
SDN Approach to Network Analytics
Unlocking Advanced Operational Intelligence

• Why network analytics is important
  • Real-time network statistics collection & alerting
  • Summarization of normal and abnormal traffic
  • Detect network performance issues in advance of customer complaints

• Use cases
  • Internet/Mobile traffic analysis: Facebook, Youtube, Email, ...
  • Big Data analysis
  • Detection of unlawful content
  • ...
Data Center Network Virtualization
Scalable Cloud Services

- Tunnels enable physical network abstraction (logical network)
  - VxLAN, NVGRE, STT
- Software Switches (vSwitches) connect virtual machines
- ToR servers connect physical machines
- SDN Gateways enable scalable connectivity into the logical network
Layer 2-4 DDoS Attack Detection/Mitigation

2. DDoS
SDN application
QoS action rate-limit, re-mark etc.

Open APIs (REST etc.)

3. SDN Controller
(OpenDaylight etc.)

OpenFlow, Vendor
Specific etc.

1. External Collector
(sFlow-RT etc.)
Large flow
Recognition

sFlow

Future Mode of Operation

DDoS Attacks – Layer 2-4
large flow!
examples below

a. UDP Flood (DNS, SNMP,
NTP etc.) Attack -
<Destination IP address>,
UDP Protocol, UDP Port

b. Classic Large flow (IP 5
tuple), e.g. P2P

OpenFlow-hybrid – QoS
actions independent of
forwarding

Early SDN deployments
Empowering SDN

- Vyatta Software Routers keep traffic local
- Deploy additional routers under orchestration control
Virtual Data Center
Vyatta as a Tenant Edge Router

- **Tenant A**
- **Tenant B**
- **Tenant C**
- **Compute Resources**
- **Ethernet Fabric Layer**
- **Core Layer**
- **Tenant Edge Router**

- **Site A**
- **Site C**
- **Site to Site VPN**
- **Internet**
- **Web traffic (port 80/443)**

Secure multi-tenant DC
Virtual Private Cloud
Enterprise Data Center

Public Cloud
Vyatta as a Secure Virtual Cloud Gateway Router

• IPSec & SSL VPN
• Advanced Routing
• L3 or L2 extension to VPC
Vyatta Use Cases

Data Center in a Box
Cloud Orchestration—OpenStack
ENABLING NEW LEVELS OF INNOVATION

- Open source cloud management framework for private and public clouds
- Created by Rackspace and NASA in July 2010
- Allows any organization to create and offer cloud computing capabilities using open source software
Cloud Orchestration - Multitenant Provisioning
OpenStack and Brocade APIs

- Brocade’s entire data center portfolio supported in OpenStack
- Open device APIs based on NETCONF (today) and RESTful APIs (mid-2014)
- Brocade VCS fabric automation and OpenStack orchestration dramatically decrease time-to-deploy network capacity
Brocade VCS & VMware NSX

Solution Overview and Components

1. **VCS Fabric:**
   Efficient, resilient network foundation

2. **VXLAN Gateway:**
   Bridges virtual and physical infrastructure (VDX 6740/6740T)

3. **VMWare NSX:**
   Network provisioning and automation
Load Balancing as a Service with OpenStack

- Provision and decommission pools of load balancing resources (LBaaS) on-demand
- Deliver LB services and provide data mobility across private and public clouds seamlessly
OpenStack Powered Cloud Solutions
Ecosystem Delivering Enterprise-class Cloud Deployments

OPENSTACK ECOSYSTEM

Rackspace’s Private Cloud
Certified, Managed, Supported Stacks

Enterprise-grade OpenStack Distro

“Raw” OpenStack Open Source

Brocade Plugins

Brocade API Extensions

Compute

Brocade Networks

Storage

Support

Software

System Integration

Hardware
Software Defined Data Center (SDDC)
EVOLVING THE ON-DEMAND DATA CENTER
Questions?
Thank you!

http://www.software-defined-network.com/