OpenStack Networking Services and Orchestration
## A Brief History of Networking

<table>
<thead>
<tr>
<th>Scale</th>
<th>Architecture</th>
<th>Compute</th>
<th>Network</th>
</tr>
</thead>
<tbody>
<tr>
<td>Billions/Tri</td>
<td>Open Virtualized SW-defined</td>
<td>Mobile Cloud-based</td>
<td>“The NEW IP” = Network for the 3rd platform</td>
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<tr>
<td>Trillions</td>
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<tr>
<td>Millions</td>
<td>Proprietary Standards-influenced HW-driven</td>
<td>Client/Server PCs</td>
<td>IP, LAN/WAN</td>
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<tr>
<td>Thousands</td>
<td>Closed Highly proprietary</td>
<td>Mainframe Systems</td>
<td>Systems Network Architecture (SNA)</td>
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### Intelligent Industry Solutions

<table>
<thead>
<tr>
<th>1st Platform</th>
<th>Mainframe</th>
<th>Terminal</th>
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<tbody>
<tr>
<td>2nd Platform</td>
<td>LAN/Internet</td>
<td>Client/Server</td>
</tr>
<tr>
<td>3rd Platform</td>
<td>Mobile Broadband</td>
<td>Big Data/Analytics</td>
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</table>

### Mobile Devices and Apps

- **PC**
- **LAN/Internet**
- **Client/Server**

### Sources:
- IDC.
Characteristics of Cloud Applications

- **Traffic Patterns**
  - East-west traffic, server to server

- **Scale**
  - Millions to billions of endpoints

- **Agility**
  - Infrastructure, workloads, and endpoints powered-up and on-boarded in hours

- **Open and Flexible**
  - Open platform, open design, open architecture to run different applications on same infrastructure

- **Resilience**
  - Redundant and highly available
Brocade Open Solution

Orchestration
Orchestration and Provisioning

Application
Network Apps

Control
Network Controller

Virtual Infrastructure

Network
Network Virtualization

Network Functions
Layer 2-7 Functions

Server
Virtual Machines

Storage
Software-Defined Storage

Physical Infrastructure

Network
Compute
Storage

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Brocade Solution for OpenStack Networking Services
What Is OpenStack?

Enterprise and Service Provider clouds: Open source, easy-to-learn interface

- **Compute**
  - On-demand VM provisioning
  - Create and manage VM images

- **Networking**
  - Create networks/routers
  - Assign IP addresses

- **Storage**
  - Create storage for VMs and arbitrary files
Main OpenStack Projects

Brocade focus: Neutron (Networking) and Cinder (Storage)
# OpenStack Current Investment

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<tbody>
<tr>
<td>VDX Port Profile</td>
<td>VDX and ICX ML2 Plugin</td>
<td>VCS/VDX SVI</td>
<td>MLX ML2, SVI plugin</td>
</tr>
<tr>
<td>SAN FC</td>
<td>SAN FC</td>
<td>SAN FC</td>
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<tr>
<td>vRouter*</td>
<td>vRouter</td>
<td>vRouter*</td>
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<td></td>
<td></td>
<td>VPNaaS</td>
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<td></td>
<td></td>
<td>FWaaS</td>
<td></td>
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<tr>
<td>vADX* (LBaaS)</td>
<td>vADX (LBaaS)</td>
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Scalable and Open Cloud APIs

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OpenStack Community Participation

OpenStack ODL Integration
• ODL mechanism driver for MD-SAL

Layer 2 Gateway
• VTEP support on VCS

Layer 3 Services
• VPN, FW frameworks

Service VM (Tacker)
• VM Lifecycle Management for NFV

Edge VPN
• Inter-DC connectivity with MPLS/VPLS on Brocade MLXe
Tacker is an official OpenStack project building a Generic VNF Manager (VNFM) and a NFV Orchestrator (NFVO) to deploy and operate Network Services and Virtual Network Functions (VNFs) on an NFV infrastructure platform like OpenStack. It is based on ETSI MANO Architectural Framework and provides a functional stack to Orchestrate Network Services end-to-end using VNFs.
ETSI NFV Architecture

- OSS/BSS
  - EMS(s)
  - VNF
- VNF
  - Virtual Computing
  - Virtual Storage
  - Virtual Network
- NFVI
  - Virtualization Layer
  - Computing HW
  - Storage HW
  - Network HW

“MANO”

- Network Service Orchestration
  - Brocade VNF Manager
- OpenStack

NFV Management & Orchestration
Brocade VNF Manager 1.0

- **Tacker**: OpenStack project for VNF Lifecycle Management
- **Brocade VNF Manager UI**: Google Material Design based application
- **BSC Configuration Driver**: Mount instantiated VNFs in BSC
- **OpenStack**: OpenStack Liberty Release support with Ansible based installation for Tacker

This diagram illustrates the integration of various components:

- **VNF Manager UI**
- **BSC Configuration Driver**
- **NETCONF/YANG**
- **Tacker**
- **OpenStack**
- **Brocade SDN Controller**

The VNF Manager UI interacts with the Brocade SDN Controller through NETCONF/YANG, and Tacker is involved in managing the lifecycle of VNFs.
VNF Catalog

Repository of VNF Descriptors (VNFDs)

- VNF definition using TOSCA templates
  - Describes the VNF attributes
  - Glance image IDs
  - Nova properties - Placement, CPU Pinning, NUMA policy, etc
  - Performance Monitoring Policy
  - Auto-Healing Policy

- Support for multiple VMs per VNF (VDUs)

- APIs to on-board and maintain VNF Catalog
VNF Life Cycle Management

Instantiation and Termination of VNF’s

• Deploy VNFs from the VNF Catalog

• Pluggable infra driver framework
  - HEAT Driver uses in-built TOSCA to HEAT convertor
  - Instantiates one or more VMs described in TOSCA

• Terminate VNF will delete all VMs associated with VNF instance
VNF Monitoring

VNF Self-Healing

• Health check starts as VNF becomes ready
• Ongoing network connectivity check
• Auto-restart on failure – based on VNFD policy
• Extendable Vendor and Service specific Health Monitoring Driver framework

<table>
<thead>
<tr>
<th>VNF Name</th>
<th>Description</th>
<th>VNF ID</th>
<th>Status</th>
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<tbody>
<tr>
<td>Firewall Blocker</td>
<td>Intrusion protection, service isolation</td>
<td>80ea0e64-47c1-4e47-a405-8ebdfe94bfff</td>
<td>Active</td>
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<tr>
<td>Load Balancer</td>
<td>Elastic round-robin distribution</td>
<td>bfa0d7fa-5c06-441d-89bf-8363c936eb84</td>
<td>Active</td>
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<tr>
<td>vRouter</td>
<td>BSC vRouter 5600</td>
<td>c79a65eb-8249-4d78-8370-c69bb1e546fc</td>
<td>Error</td>
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<tr>
<td>vRouter</td>
<td>BSC vRouter 5600</td>
<td>f6306875-2ee4-4ea9-9a1b-1454e47f4905f</td>
<td>Active</td>
</tr>
</tbody>
</table>
DC/Cloud Architecture

Physical and virtual network

- Multitenant support
- VLAN isolation
- Inter-VLAN routing

- Flat topology, east-west optimized
- All links active, L1/2/3 multipathing
- Fabric managed as one logical switch
- VM-aware

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- Compute Nodes connected to VDX
- Eth1 on compute Nodes connected to data-ports on VDX
- Brocade ML2 drivers hosted on controller.
Brocade vRouter

L3 tenant router

- External Gateway support for VMs
- Floating IP support for VMs
- Automatic SNAT/DNAT rules using External Gateway
- Brocade 5600 and 5400 support
Brocade vRouter Firewall Plugin

Overview

• Create tenant perimeter firewall to filter traffic between private and public networks

• Firewall deployed in the tenant router
  – Only in Brocade vRouter VM
  – Multiple firewalls per tenant supported
  – Associating firewall with router supported

• Between trusted and untrusted zones
  – Trusted zone: Router interfaces connected to private networks
  – Untrusted zone: External gateway interface connected to public network
Brocade VPNaasS—IPsec VPN

Neutron VPN commands—Site 1 / 2

- Create IKE policy
  neutron vpn-ikepolicy-create ike0

- Create IPsec Policy
  neutron vpn-ipsecpolicy-create esp0

- Create VPN Service
  neutron vpn-service-create --name vpnsvc0 router1 left-subnet

- Create Site-to-Site VPN connection using above ike, ipsec policies, and vpn-service definitions
  neutron ipsec-site-connection-create --name sitel-to-2 --vpnservice-id vpnsvc0 --ikepolicy-id ike0 --ipsecpolicy-id esp0 --peer-address 192.168.110.31 --peer-id 192.168.110.31 --peer-cidr 17.1.0.0/24 --psk secret
VPNaaS Demo
Data Center/Cloud Architecture

Physical and virtual network

- Multitenant support
- VLAN isolation

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Data Center/Cloud Architecture

Physical, virtual, and DC interconnect network

- Multitenant support
- VLAN isolation
- Inter-VLAN routing

- Experimental
- DC interconnect

MLX ML2 Plugin
MLX VE Plugin
MLX Edge VPN Plugin

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OpenStack LBaaS

- LBaaS (Load-Balancing-as-a-Service) is an advanced service of OpenStack Neutron Server
- Supports vendor-neutral LBaaS data models and REST APIs to drive the load balancing of requests
- LBaaS v2 data model support in Kilo Release
- Features:
  - Load balancing between services on VMs
  - Load balancing methods (e.g., round-robin / least connections)
  - Session persistence
  - Health monitoring (TCP / HTTP / HTTPS)
  - Connection limit
  - SSL offload/termination
Fiber Channel Storage Orchestration

Fibre Channel SAN Zone/Access Control Manager

- Simplified active zone set management by automatically detecting the zone configuration and SAN context, and applying the changes to currently active zone set without manual intervention
  - Add or Update a zone
  - Remove a zone
  - Read or Get a zone

- Introduce Fibre Channel Zone Manager for zone lifecycle management
  - Fibre Channel Zone Manager for zone lifecycle mgmt. when fabric zoning is enabled for FC volumes

- Fibre Channel Zone Driver interface to enable SAN providers to add support for pluggable implementations
Bridging between Virtual and Physical Networks (Liberty, October 2015)

VXLAN to VLAN Gateway

- Use OpenStack to bridge between VXLAN and VLAN
- Underlay is VCS fabric
- Comply with L2GW spec
  - https://github.com/stackforge/networking-l2gw
Use case: Overlay tunnels on Brocade VDX switches (use OpenStack to create tunnels)

OpenStack PoC
1. Create tunnels between leaf switches as needed
2. Create tenant VMs and VLANs
3. Map VLANs to VNIs
Intra-DC with Overlays (Demo May 2015)
Inter-Data Center Orchestration

(Liberty, October 2015)

- Private WAN
- Carrier Ethernet Leased Lines
  Examples: AT&T, VZ, FT

VPLS Interconnect

VPLS-BGP Core
Comprehensive Data Center & Inter-DC Solution

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<td>ADC LBaaS SAN FC</td>
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<td>vRouter</td>
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<td>Brocade vADC</td>
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* AVAILABLE AS PRIVATE PLUGIN.
Thank You

www.brocade.com/openstack