OF@TEIN SmartX Box

The Detail Architecture and Deployment

TEIN 4 Network Monitoring Application Workshop 2015

Contact: OF@TEIN Admin Team
ops@oftein.net
1. SmartX Box Hardware
   • SmartX Change from Rack to Box
   • SmartX Hardware Management
   • SmartX Specifications and Design

2. SmartX Box Deployment for OF@TEIN
   • OF@TEIN Physical Infrastructure
   • OF@TEIN Logical Infrastructure
   • OF@TEIN Distributed Multi-region Deployment
   • OF@TEIN Operator vs. Developers Network Topology

3. SmartX B* for OF@TEIN SDN-Cloud Playground
   • SmartX B+ into B* Upgrade Requirements
   • SmartX B+ Box Design and Management
   • SmartX B* Box Design and SDN-Cloud Management requirements
   • SmartX B* Box Software and Customized Configuration

4. OF@TEIN SDN-Cloud Live demo
   • Prepared ping experiment demonstration
SmartX Box Hardware

- SmartX Hardware Changes (Rack to Box)
- SmartX Hardware Management
- SmartX Specification (B/B+/B*) & Design
Change From SmartX Rack to SmartX Box

SmartX Rack (Type B)

- Remote Power Management
- Capsulator (IBM x3650-M4)
- Management/Worker (Dell R710)
- OF Switch (HP-3500)

SmartX Box (Type B+/B*)

- Network
- Storage
- Compute

Remote Power Management

Capsulator (IBM x3650-M4)

Management/Worker (Dell R710)

OF Switch (HP-3500)
SmartX Box Hardware Change

• Simplified hardware configuration

- Remote Power Management
- Capsulator (IBM x3650-M4)
- Management /Worker (Dell R710)
- OF Switch (HP-3500)

Type B

IBM x3650-M4

Type B+/B*
<table>
<thead>
<tr>
<th></th>
<th>Type A Mgmt</th>
<th>Type A OVS</th>
<th>Type B Mgmt</th>
<th>Type B*</th>
<th>Type C</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model</strong></td>
<td>IBM x3650 M4</td>
<td>IBM x3650 M4</td>
<td>Dell R710</td>
<td>IBM x3650 M4</td>
<td>Intel ONP</td>
</tr>
<tr>
<td><strong>CPU</strong></td>
<td>Intel(R) Xeon(R) CPU E5-2630, 2.3Ghz, 6-cores</td>
<td>Intel(R) Xeon(R) CPU E5-2630, 2.3Ghz, 6-cores</td>
<td>Intel(R) Xeon(R) CPU E5540 x2, 2.53GHz, 4-cores*2</td>
<td>Intel(R) Xeon(R) CPU E5-2609, 2.4Ghz, 4-cores</td>
<td>Intel(R) Xeon(R) CPU E5-2690 v2, 10-cores x2</td>
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<tr>
<td><strong>RAM</strong></td>
<td>16GB (8x2GB), 1333MHz</td>
<td>32GB (8x4GB), 1333MHz</td>
<td>32GB (8x4GB), 1333MHz</td>
<td>12GB (3x4GB), 1333MHz</td>
<td>96GB (12x8GB), 1600Mhz</td>
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<tr>
<td><strong>HDD/SDD</strong></td>
<td>146GBx2</td>
<td>146GB+500GB</td>
<td>320GB(2x160GB)</td>
<td>300GB</td>
<td>800GB SSD x2 (RAID 0) / 2TB SATA x2 (RAID 1)</td>
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<tr>
<td></td>
<td>C1: same spec</td>
<td>Intel 82571EB(1G)x2</td>
<td></td>
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</tbody>
</table>
SmartX Box Hardware: Remote Power Management

- IBM Integrated Management Module (IMM)
  - Based on Intelligent Power Management Interface (IPMI)
  - Power control
SmartX Box Hardware: **Remote Console Display**

- IBM Integrated Management Module (IMM)
- Remote console (Keyboard, Video, Mouse)
SmartX Design: (Rack) Type B vs. (Box) B+ / B*
OF@TEIN SmartX Box Deployment

- OF@TEIN Physical Infrastructure
- OF@TEIN Logical Infrastructure
- OF@TEIN Distributed Multi-region Deployment
- OF@TEIN Operator vs. Developers Network Topology
OF@TEIN Logical Infrastructure

SmartX Automation Center
[Provision + Control]

SmartX Operation Tower
[Visibility + Data lake]

SmartX Access Center
- Connection Nodes -
[Remote access + Authentication]

GIST

UM, HUST, Chula, ITB, ASTI, NUST

Operator

Developer

Management + Control

Datapath

OF@TEIN Data Plane

VXLAN Tunnel

OF@TEIN Control Plane

Web (OpenStack, OpenDaylight/Controller)
SSH (Chef, Script)

Web (Zenoss, sFlow)
Java (Exp UI, Tapping)

Web-VNC (OpenStack)
SSH (VM Access)

P M C

V D

SMARTX GIST

KOREN

*REN

SMARTX (Remote)

Web
- VNC (OpenStack)
SSH (VM Access)

Developer

Operator
OF@TEIN Distributed Multi-Region Cloud Deployment

GIST (Gwangju)

OpenFlow FlowVisor
OpenFlow/SDN Controllers
Multi-Cloud Controller
Access Center

KOREN

TEST

OF@TEIN

Preginet
Philippines

TW
Taiwan

VN
Vietnam

ERNET
India

InheREN
Indonesia

PKS
Pakistan

THAI
Thailand

MYREN
Malaysia (UM)

Cloud Extension

Last Update: 2015-07-31
OF@TEIN Operator vs. Developer SDN Topology

Developer #1  Developer #2  Developer #n

Developer SDN Controllers

FlowVisor

Operator Controller
[SDN + Cloud Controller]

SmartX Box
Central/Hub Sites

SmartX Box
Remote Sites

Last Update: 2013-10-31
SmartX B* Box for OF@TEIN SDN-Cloud Playground

- SmartX B+ into B* Upgrade Requirements
- SmartX B+ Box Design and Management
- SmartX B* Box Design and SDN-Cloud Management requirements
- SmartX B* Software and Customized Configuration
**SmartX B+ into B* Upgrade Requirements**

1. VM (prepared) images limitation and limited customization
   - Default XEN image fixed resource and difficult to customize
   - OpenStack (Cloud) Flavor provide adjustable resource and image customization

2. Additional better GUI experiences
   - Scripting fast but difficult to understand for new users
   - Additional GUI for supporting “common” script/API-based configuration

3. Extend with Cloud Environment/Functionality
   - VM images (instances) properly handled by Cloud platform
   - Some SDN and Cloud project/tools are shared (e.g. OpenvSwitch)
   - Multi-cloud environment required programmable network

4. Built up “SDN-Cloud” SmartX Box
   - One box with SDN and Cloud functionalities
SDN SmartX B+ Box Design

XEN Hypervisor

VM#1

VM#2

VM#3

VM#4

SDN Function

Control

Management

Power/IMM

Data (OF)

Data (Tunnel)
SDN SmartX B+ Function Implementation
SDN-Cloud SmartX B* Function Design

Cloud Functions
- NOVA
- NEUTRON
  - br-ex
  - br-int
  - br-vlan

SDN Functions
- OPENVSWITCH
  - br1
  - br2
  - brcap
  - brtap

Control (VM Access)
Data (VM Traffic)
Visibility (Tapping)
Capture Interface

OpenFlow Extension
VXLAN Tunnel
<table>
<thead>
<tr>
<th>Software</th>
<th>Version</th>
<th>Features</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td><strong>OpenStack</strong></td>
<td>Stable Juno</td>
<td>Keystone</td>
<td>Centralized Account Management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Horizon</td>
<td>Centralized Dashboard (Web UI)</td>
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<tr>
<td></td>
<td></td>
<td>Nova</td>
<td>Instances (VMs) management</td>
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<tr>
<td></td>
<td></td>
<td>Neutron</td>
<td>Instances Networking Configuration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Glance</td>
<td>Image Storage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cinder</td>
<td>Volume Storage</td>
</tr>
<tr>
<td><strong>Open vSwitch</strong></td>
<td>2.0.2 (Packages)</td>
<td>OVS Switch</td>
<td>Operator/Developers SDN Switches Configuration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OVSDB</td>
<td>Centralized management/control SDN switches Configuration</td>
</tr>
<tr>
<td><strong>OpenDaylight</strong></td>
<td>Stable Hydrogen</td>
<td>Controller</td>
<td>Centralized Policy/Rules Management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>REST API</td>
<td>Specific Call format through standard interface</td>
</tr>
</tbody>
</table>
Centralized Identity (OpenStack Keystone) and Dashboard (OpenStack Horizon)

Region: GJ-TEST
- SmartX-B* TEST

Region: GIST
- SmartX-B* GIST

Region: MY
- SmartX-B* MY

Region: MYREN
- SmartX-B* MYREN

Central Management
- OF@TEIN Cloud Centralized Management
- Swift Proxy
- Keystone
- Horizon

Edge Site 1
- Controller/Compute/Network
- Openstack

Edge Site 2
- Controller/Compute/Network
- Openstack

Edge Site 3
- Controller/Compute/Network
- Openstack

Edge Site 4
- Controller/Compute/Network
- Openstack
SDN-Cloud SmartX B* Tenant Network
VLAN-based Tenant Network (OpenStack Neutron)
SDN-Cloud SmartX B* Virtual Network
VLAN-based network Slicing (FlowVisor + OpenvSwitch)
Flow Table Entry
OpenFlow 1.0

Examples:
- Forward packet to a port list
- Add/remove/modify VLAN Tag
- Drop packet
- Send packet to the controller

Send to correct Destination (site/region)
SDN-Cloud Live Demonstration

- OpenStack instances (VM) configuration
- OpenDaylight SDN configuration
- Instances (VMs) external incoming and outgoing verification
- VM-to-VM (instances) communication
policy abstractions that are integral parts of cloud applications. Moreover, the emergence of the software-defined networking (SDN) paradigm provides a new opportunity to closely integrate application provisioning in the cloud with the network through programmable interfaces and automation. We describe the architecture and implementation of Meridian, an SDN controller
VM-to-VM (Instances) Communications Demonstration

- OpenStack Nova
- Developer Controller (Open)
- FlowVisor
- INTERNET
- Developers
- OF@TEIN
- GIST
- GJ-TEST
- NEUTRON
- OPENVSWITCH
- NOVA
- Power/IMM Management
- VXLAN
- Data (OF)
- Data (Tunnel)
- Control
- br
- br-cap
- br-int
- br-vlan
- br-ex
- Tap
- VM#1
- VM#2
- VM#3
- VM#4
Thank You!

Contact : ops@oftein.net