SmartX Automation Center for OF@TEIN
Multi-point International OpenFlow Islands
2014 HPC Summer School

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Networked Computing System Laboratory
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DevOps?

Agile Development

Feedback

DevOps

Agile Operation

Release

Zero-touch Configuration

Flexible Control (forwarding, ...)

Instant Visibility
OF@TEIN: OF-based SDN Testing Infrastructure (2012~2013, GIST Consortium & KOREN/TEIN)

- SmartX Racks (Type A/B/C) in 5 domestic and 7 international sites
- Providing software-driven virtual playground for agile and economic service realization
Problem?

5 Virtual bridges
20 Physical/Virtual ports
2 NVGRE Tunnels
ETC

More than 50 commands

X 9 sites >= 450!!
Solution

Can be Automated!!

Automation Center

REST API
BASH
OVSDB
Django Webserver
Python
Cron tab

Can be Automated!!

SmartX Box (Type B+)

Int-Bridge

OVSOF Switch

OVS OF Switch

OVS Capsulator

Networked Tiled Display

Int-Bridge

OVSOF Switch

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SmartX Box (Type B+)

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SmartX Box (Type B+)
SmartX Automation Center

Configuration Control Visibility

REST API or Common Gateway Interface
Single Box (server)

Bare-metal installation
Assign Chef recipe
Triggering Chef Script

Making Network Graph
Triggering Admin Script

Making Network Graph
Triggering User Script (Experiment)

Visualize Experiment

Automation Center

Design Experiment
Configuring Box/Function/Topology

Ops
Dev

Making Network Graph

Graph Theory

Visualize Experiment

Bare-metal installation
Assign Chef recipe
Triggering Chef Script

Physical - Phy-aware Virtual - Logical

Ops - Ops+Dev - Dev
Automating Tunneling-based Interconnections (Operator view)

**Put Shape of vSW**
- Interconnection Info.
- Port name
- FlowVisor Info.
- Set fail-mode

**Information**
- Controller list
- DPID list
- Site-Capsulator list (IP, PORT)
- Allowed flows-tunnel mapping list

**Management**
- OVS-Bridge information
- Capsulator Flow table
- GRE Tunnel information
- Tunnel list

**Automation Center for TypeB+**

- Add_bridge()
- Set_FlowVisor()
- Patch_port()
- Set_DPID()
- Set_controller()
- Add_gre_tunnel()
- Add_flow_table()
- Clear_site()

Current Bridge state
Current Tunnel state
Automation Tools for Inter-connection

Openflow-aware capsulator configuration S/W

Periodically Check:
- Report Current state to Admin
- Check State of Tunnel
- Check State of FlowVisor
- Check State of OVS demon

Information:
- controller list (IP:port)
- DPID list (datapath id)
- Site-capsulator list (IP, port)
- Experimenter Report
- Active Tunnel list
- Tunnel list
- listing

Execution:
[configuration script]
- Initialize
- status checking
- Add OVS bridges
- Add interfaces
- Add controller
- Set DPID
- Tunnel configuration
  - Dell NVGRE
  - Add NVGRE
- function set
- OVS interface

Network configuration
OpenFlow flow control

...
Tunnel Status Visualization

Site to Site TCP Throughput

VM to VM TCP Throughput

Experiment Result
Site Overlay Networking: NVGRE Tunneling & Tagging/Steering/Mapping

Flow VLAN-ID Tagging for Hypervisor VMs

Flow Steering with User SDN Controllers

Flow Mapping with Admin SDN Controller

An OpenFlow Network Island

WAN

NVGRE Tunnels *
Inter-Connection SmartX Racks (Type B+)

- FlowSpace-UI SDN Controller (Closed, NOX under FlowVisor)
- User SDN Controllers (OpenFlow + OVSDB, Any under FlowVisor)
- Admin SDN Controller (Overlay Networking via OpenFlow + OVSDB, Closed, Floodlight)

SmartX Rack (Type B+) Site
- OpenFlow Network
- OVS
- NVGRE tunnels
- (L2/L3 Network)

User #1
User #2
User #n

Last Update: 2013-10-31
Supporting Multiple SDN Users with their own Controllers via FlowVisor

OF@TEIN Networking & FlowSpace Resources

OF@TEIN Admin Script

FlowVisor (v1.4)

FlowSpace Management

NOX Controller

Floodlight Controller

Floodlight Controller

Floodlight Controller
Verification over OF@TEIN Testbed

1st Developer utilizes Networking resources through NOX controller

2nd Developer utilizes Networking resources through OpenDaylight controller

Each developer can do their own experiment!!
OF@TEIN Virtual Playground Creation: Autonomic Installation & Configuration with Templates
Topology for CCN Experiment
(Openstack Icehouse)

Virtual) Network
(APP Topo.: CCN)

Virtual) Network
(User Topo.)

Physical) Network
(Admin Topo.)

Layer 2 Network

Full mesh GRE Tunnel

Br-int

VM
Application Topology of CCNX
DEMO

CCNX Experiment on SmartX Box TypeC

http://youtu.be/4n76VtMMkbM
Q&A
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