SmartFIRE Testbed Collaboration: KR-side Plan and Progress

SmartFIRE Forum as part of Future Internet Summit 2014

Dr. JongWon Kim

Networked Computing Systems Laboratory
School of Information and Communications
Gwangju Institute of Science & Technology (GIST)
Testbeds: Wild & Organized Playgrounds

Provide Playgrounds with Resources

- Play (Experiment)
  - Configuration
  - Control
  - Visibility

DevOps

(Power Users)

(Provider)
Agile & Economic Service Realization over Software-Defined Infrastructure

Open Data + Open API + Open Resource (Compute + Storage + Networking)
Let’s Create Smart Things and Realize Smart Services

Build Open APIs with Interconnected Functions

Converged (C/N/S) SmartX Box with Programmable & Virtualized Resources

Architecture Your Smart Things with API Tools

THE INDUSTRIAL INTERNET
FIF Testbed WG
OF@Korea & FIRST, OF@TEIN (2009~2013)
FIF Testbed WG Collaboration (2009~2013)

- Leverages FIRST FI testbed project (2009~2011)
- OF@Korea Initiative (2011)
- OF@TEIN Collaboration (2012~2013)
- Preparing SmartFIRE collaboration (2013)
OF@TEIN: OF-based SDN International Testbed (2012~2013)

SmartX Racks (Type A*/B/B+/C) in 5 domestic and 7 international sites provide software-driven virtual playgrounds.
SmartFIRE-KR
(2014~2015)
Plan
SmartFIRE: EU-KR FP7 FIRE Collaboration (2013.11~2015.12)

- 6 EU partners and 5 KR partners working jointly on “Enabling SDN Experimentation in Wireless Testbeds exploiting Future Internet Infrastructure in South Korea and Europe”
KR Building Blocks

**EU-KR (SmartFIRE)**

- SmartX Rack
  - OF@TEIN SDN Tools
  - OF@TEIN Portal
  - Exp. Node (with HD camera)
  - Exp. Node (traffic generator)
  - Exp. Node
  - OpenFlow Visor
  - OpenFlow Controller
  - OpenFlow Production Switch
  - OpenFlow Switch

**OF@KOREN**
- Japan or USA
- Jeju (Jeju)
- Postech (Pohang)
- Korea U (Seoul)

**OF@TEIN**
- SmartX Racks (Type C)
- SmartX Racks (Type B)
- NIA (Seoul)
- GIST (Gwangju)
- Malaysia
- Thailand

**Last Update:** 2013-08-18

**Emulab**

**Mesh Node**

**WiseMesh**

**MOFI**

**OF@TEIN**

**C-Flow**

**System**
- Gateway Router
- Experimental Switch
- Control Switch

**Gateway**

- Dell R710 * 42
- Cisco 3750
- Cisco 4507 (48 ports * 4)
- Cisco 2900 (48 ports * 1)
EU Building Blocks

OMF

NITOS

iMinds
1. Building and Operating KR Testbeds with Common Control Framework

Task 1-1

OCF → OpenStack (OpenFlow/Cloud)

OMF (OpenFlow/Wireless Extensions)
- MOFI (ETRI)
- OF@TEIN (GIST)
- c-Flow (SNU)
- Emulab (KISTI)

Task 1-2

Simplified SmartX Rack → SmartX Box

Task 1-3

Task 1-4
2. KR-EU Federation of the facilities

Task 2-1

Task 2-2

Task 2-3

Task 2-4
3. Demonstration of pilot use-cases over Federated facilities

Task 3-1

Task 3-2
SmartFIRE-KR Project: Execution and Cooperation

SmartFIRE

UTH

UPMC
iMinds
UMU
NICTA
SIGMA

OpenLab
OFELIA
FIBRE
Utah Univ.
OF@TEIN Partners

SmartFIRE-KR

GIST

SNU
KAIST
ETRI
KISTI

TEIN4 / KOREN (NIA)
GLORIAD / KREONET (KISTI)

FIF (Testbed WG)
SmartFIRE-KR
(2014~2015)
Progress
Inter-connection of Korean Testbed Islands

- Management/Control/Data Separation
- End-to-end 1~10Gbps bandwidth provisioning
GIST Island: OF@TEIN (2012~2014)
GIST Island: OF@TEIN Infrastructure (Cont.)
SNU Island: C-flow with M-Box

• CCN Testbed (2014)
  – Content centric networking
  – CCNx over IP network

• IoT Testbed (2015)
  – IoT nodes (Raspberry Pi, Galileo) communicating via BLE (bluetooth lower energy)
SNU Island: C-flow with M-Box (Cont.)
KAIST Island: Open Wi-Fi Testbed with M-Box

• Servers (Controller, OMF)
• Core AP nodes with M-Box
• End-AP nodes with Buffalo AG300H (OVS, Click, Odin, …)
ETRI Island: MOFI Testbed
KISTI Island: EMULAB @ KREONET

Goal: Providing R&D environment
- In shared platform

Providing OS
- FreeBSD
- Centos
- Ubuntu
- Window

Users
People at Institutes and Universities

PLAN to upgrade
- for federation (currently doing)
- for larger platform including wireless nodes (later)
KISTI Island: EMULAB@KREONET
(Cont.)

Upgrade Plan

Federation

ProtoGENI S/W

Emulab S/W

Testing R&D

System / Network SW

System / Network HW

Dell R710 Server, Cisco 2950, Cisco 3750, Cisco 4507, Power controller
SmartX Box: Inter-Connected Functions inside Boxes/Sites

White Box via Open-Source H/W

Inter-Connect
M-Box for Wireless & SDN Support

- M-Box with wireless interfaces and OpenFlow OVS (open virtual switch)
S-Box for SDN & Cloud (OpenStack) Support

Simplified SmartX Rack

SmartX Box

- COMPUTE
- NETWORKING
- STORAGE

Pools of SmartX Boxes:
Massive scalability and pay-as-you-grow flexibility

VM VM VM VM VM

Open vSwitch / NICs

CPU / GPUs

SSD / HDDs
Federation Plan: OMF with Mobile Cloud Extension (V02)

OMF (OpenFlow/Wireless Extensions)

- MOFI (ETRI)
- Open WiFi+ (KAIST)
- c-Flow (SNU)
- Emulab (KISTI)

OCF ➔ OpenStack (OpenFlow/Cloud)

ProtoGENI (Wireless/Cloud)
Tentative Use Case #1: ID-based Communication and beyond
Tentative Use
Case #2: from CCN towards IoT
Futuristic Converged (SDN/NFV/Cloud) Infrastructure

Service-aware Edge

MiddleBox, ...

Wireless + Mobile

Cloud Data Centers

Cloud WAN Fabric (IP+Optical Integration)

Cloud Data Centers

Cloud DC

Wireless + Mobile

Cloud Data Centers

Cloud DC

IP??, More Switching + Simpler Routing?

Last Modified
11/02/2013
SmartX Box: Converged Resources - Workload – Diversified Functions

- Continuous Integration
- Auto Scaling
- Instant Visibility
- Flexible Control
- Zero-touch Configuration
Mobile + Cloud

Human-Defined Services

Cloud Platforms
(+ BigData + IoT + ...)

Mobile
SmartX
Things

Software-Defined Infrastructure