Playing with Software-Defined Infrastructure

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Agile & Economic Service Realization over Software-Defined Infrastructure
Open ICT Infrastructure

Open Data + Open API + Open Resource (Compute + Storage + Networking)

(Network $$ightarrow ightarrow$$ p+v Networking)
Software-Defined Infrastructure
Unified, Programmable & Virtualized Resources

Workload Abstraction / Fluidity

Compute

Workload Distribution

Virtualization

Security

Data Duplication

Path Diversity

Networking

Templates

Orchestration

Virtualization & Provisioning

Raw

Compute

Storage

Network Connectivity

Network Services
Let’s Create Smart Things and Realize Smart Services

Build Open APIs with Functions

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

Architecture Your Smart Things with **API Tools**

**THE INDUSTRIAL INTERNET**

- Things, Objects, Processes
- Connect
- Function, Service, Value

**Functions Plug-in**
Industrial Internet, Smart Planet, Internet of Everything

Industrial Internet

Smart Healthcare  Smart City  Smart Factory
Smart Work / Gov.  Smart Transportation  Smart Grid (Energy)
Smart Home

Smart Things => Smart X Service

Platform Challenges for Reliable, Safe, Agile, and Economic Services

Open, Software-Defined, Virtualized BIG Cloud Machines

Continuous Integration

Optical vCompute  Mobile vNetworking  Data Center vStorage

Virtualized Functions + Security
Futuristic Convergent Networks

Service-aware Edge

Cloud WAN Fabric

(IP+Optical Integration)

Wireless + Mobile

Cloud Data Centers

Cloud DC

Wireless + Mobile

Cloud Data Centers

Cloud DC

IP??, More Switching + Simpler Routing?

Last Modified 11/02/2013
Cloud: Rapid Expansion & Competition

- Hyper-scale 50% by 2017 (Gartner)
- Servers: from 20% (2013) to 40% (2017) (Quanta)
- Hyper-scale 40% by 2019 (IDC)

- **Amazon AWS**
- **Google Cloud Engine**
- **Microsoft Azure**
- **VMware Hybrid**
- **OpenStack** (RH, IBM, HP, Dell, ...)
  + Network Operator Cloud (AT&T, NTT, ...)

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* Cisco Global Cloud Index

* The Cloud Spectrum

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*Actually Delivered*  
*Aspirational*
Cloud/NFV/SDN Convergence (Ericsson)
ONF’s OpenFlow-based SDN
NFV Architecture Framework & Use Cases
SDN-coordinated End-to-end Interconnection for Mobile Cloud Services

SDN-Coordinated Flow Steering with NFV @ Edge

Flow Tag/Steer/Map
Agile & Economic Services over Auto-Scaled Convergence Boxes
Unified Infrastructure with Convergence Resource Pools

Carrier-Grade NFV? Five 9's

Small VNF Paradigm assisted by “magical” virtual networking of distributed flow-steering at scale
SmartX Box: Design and Prototyping with OpenFlow + OpenStack Leverage

Simplified SmartX Rack

- SmartX Box

 COMPUTE
 NETWORKING
 STORAGE

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

CPUs / GPUs
SSD / HDDs

Open vSwitch / NICs
Configuration/Control/Visibility Challenges & Open APIs via Inter-connected Functions

Zero-touch Configuration
Flexible Control (forwarding, ...)
Instant Visibility
Collective Analysis

DevOps

Compute
Networking
Storage
OF@TEIN Virtual Playground Configuration

Autonomic Installation & Configuration with Templates

Configuration

Chef

Box/Functions/Topology

Templates

VM

Configuration

Control

Visibility

A Virtual Playground

SmartX Box (Type C)

Box/Functions/Topology Templates

Physical Network

Overlay Tunnels

VM

NOVA

Neutron

Swift

Cinder

Open vSwitch

CPUs/SSD

GPUs/HDDs

Web Server

Traffic generator
OpenDaylight SDN Controller

API-Driven vs Model-Driven SAL

ODP Lab: Ericsson, Huawei, ...
Toward SDN-based Coordination of Agile & Economic Service Creation Process

Applications = Composed Services

Control of service composition process

Resource awareness

Provisioning phase

.Execution phase
Representing Service Realization with Data (Policy – Service – Function) & Resource (Converged, Programmable, Virtualized)

Data Model

Data Service Engine
Balanced Service Composition based on Programmable (and Virtualized) Resources

Service

Resource

Cloud Computing

Software Defined Networking

Networking Services

Computing Services

Storaging Services

Service Composition Process

User

Contents

Resource-aware Modeling, Monitoring, and Adaptation

Programmable & Virtualized Resource Substrates

SmartX Nodes

Flow 1
Flow 2
... Flow f

Networked Computing Systems Lab
Thank you!
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