Evolving to a Software Defined Carrier Network

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Senior Vice President

NEC Corporation

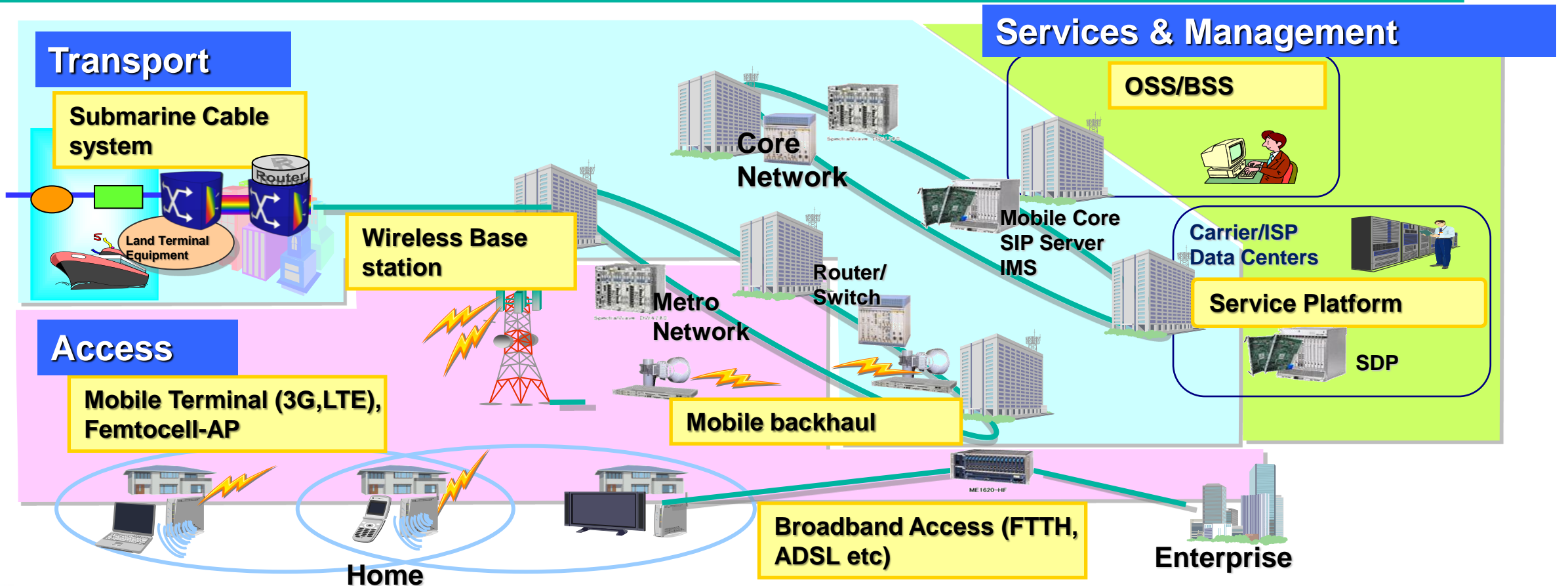# NEC & Carrier Network

NEC Corporate Profile

Established : July 17th, 1899

Employees: 109,000 worldwide

Sales: 3,036.8 billion Yen
(FY2011 ending March 2012)

NEC provides end-to-end solutions for carrier services

Services & Management

OSS/BSS

Transport

Submarine Cable system

Land Terminal Equipment

Core Network

Mobile Core SIP Server IMS

Carrier/ISP Data Centers

Wireless Base station

Router/ Switch

Service Platform

Access

Metro Network

SDP

Mobile Terminal (3G,LTE), Femtocell-AP

Mobile backhaul

ME1620-HF

Broadband Access (FTTH, ADSL etc)

Enterprise

Home

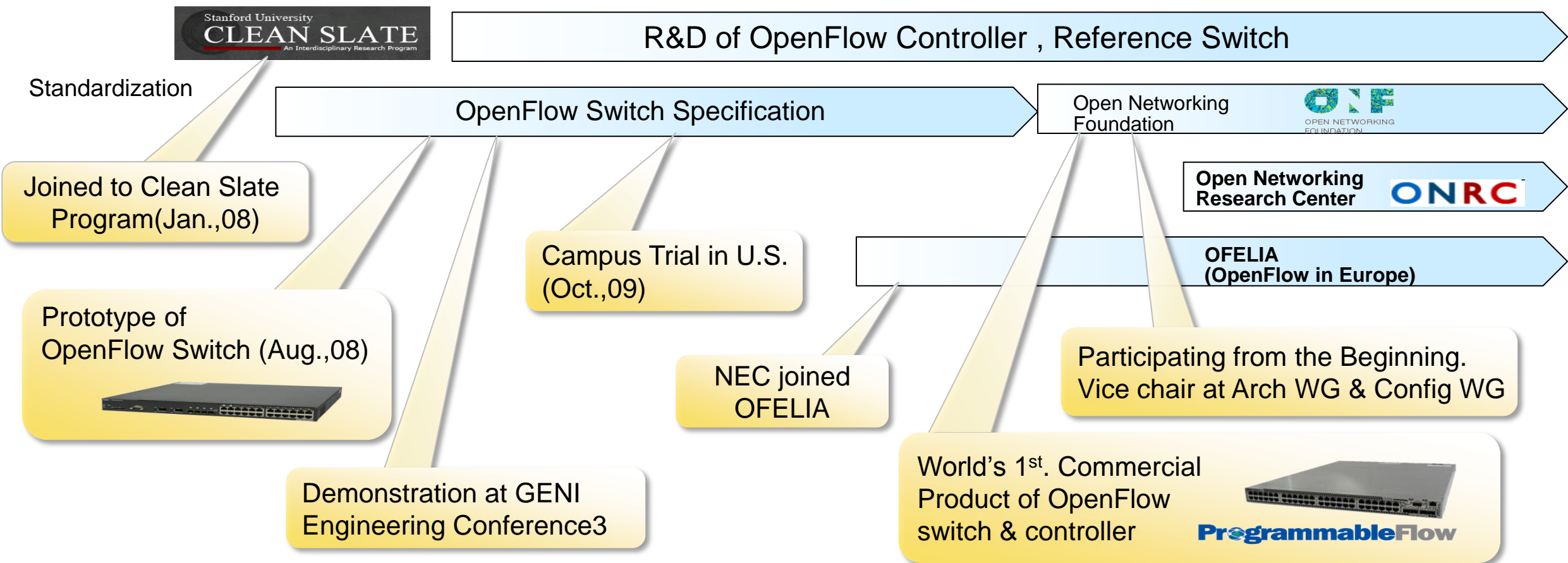Empowered by Innovation **NEC**

NEC in OpenFlow Community

NEC has participated in OpenFlow Community from the early stage of Clean Slate Program and has been contributing to standardization at ONF.

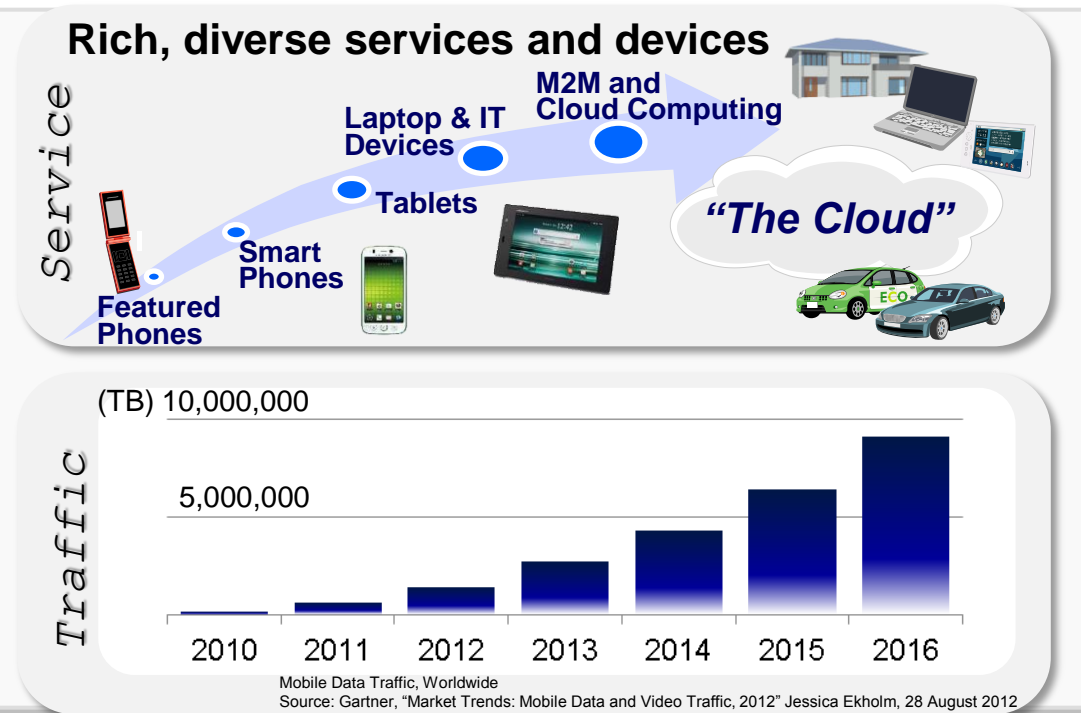2007   2008   2009   2010   2011   2012   2013

Research and Standardization of OpenFlow

Stanford University
CLEAN SLATE
An Interdisciplinary Research Program

R&D of OpenFlow Controller , Reference Switch

Standardization

OpenFlow Switch Specification

Open Networking Foundation

ONF
OPEN NETWORKING FOUNDATION

Joined to Clean Slate Program(Jan.,08)

Open Networking Research Center

ONRC

Prototype of OpenFlow Switch (Aug.,08)

Campus Trial in U.S. (Oct.,09)

OFELIA (OpenFlow in Europe)

NEC joined OFELIA

Participating from the Beginning. Vice chair at Arch WG & Config WG

World's 1st. Commercial Product of OpenFlow switch & controller

ProgrammableFlow

Demonstration at GENI Engineering Conference3

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Carrier Network Environment

Service Evolution and Growth

- More mobile broadband users

- Smart-phones, PDAs & enabled devices

- More connected devices (e.g. M2M)

- Growths of social media, e-commerce, IP-TV

Rich, diverse services and devices

Service

M2M and Cloud Computing

Laptop & IT Devices

Tablets

Smart Phones

Featured Phones

"The Cloud"

(TB) 10,000,000

5,000,000

Traffic

2010 2011 2012 2013 2014 2015 2016

Mobile Data Traffic, Worldwide
Source: Gartner, "Market Trends: Mobile Data and Video Traffic, 2012" Jessica Ekholm, 28 August 2012

Social Responsibility

- Disaster resilience

- Public safety

- Green Environment (lower power consumption)

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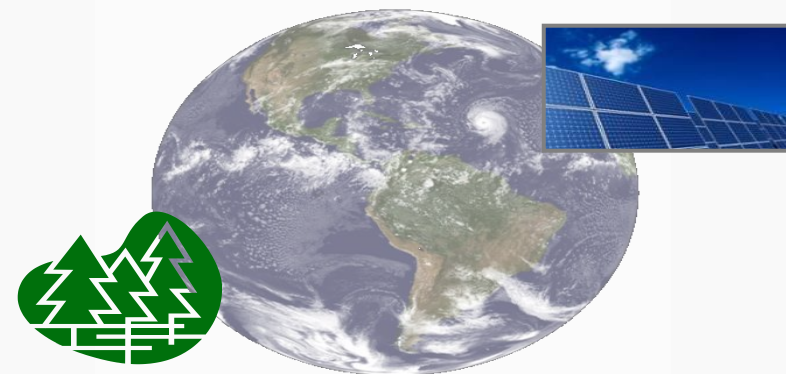
NEC's Carrier SDN : Value Proposition

Infrastructure	Management & Orchestration	Services
• Efficient resource utilization with virtualization • Programmable, Scalable & Reliable Network • CAPEX reduction	• Flexible & automated configuration • Centralized control & management • OPEX reduction	• Service velocity • Simple service provisioning • New source of revenue

Simple & Flexible

Mission Critical System	Computing Technology	Mobile Infrastructure	IP Networking	Optical Transport

NEC's technology innovation for 114 years.
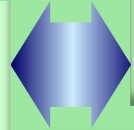
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NEC's Carrier SDN Architecture <Overview>

Management & Orchestration

OSS/BSS

SDN Controller

Infrastructure

Virtual Resources

Physical Resources

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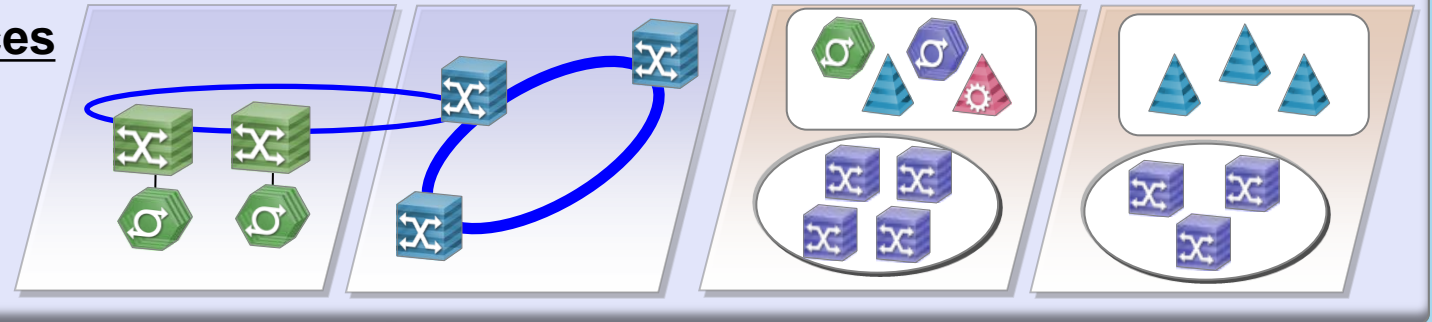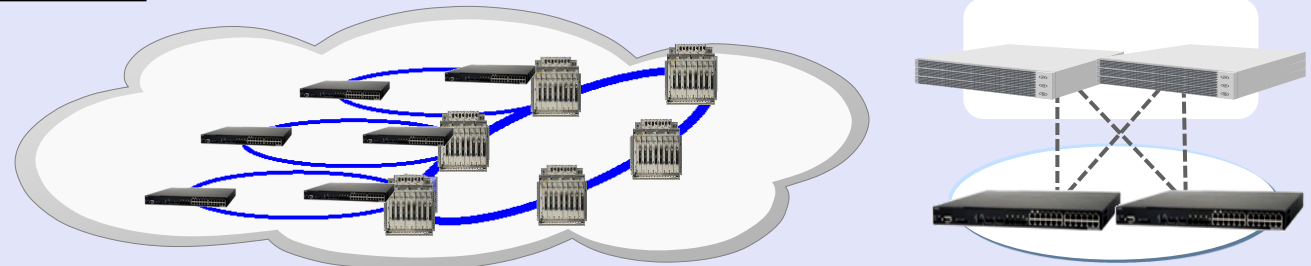
NEC's Carrier SDN Architecture < Infrastructure (Virtualized Functions) >

Management & Orchestration

OSS/BSS

SDN Controller

Infrastructure

Virtual Resources

vEPC

P/SGW | MME | P/SGW

vBRAS

BRAS | BRAS | BRAS

Physical Resources

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NEC's Carrier SDN Architecture < Infrastructure (Transport) >

Management & Orchestration

SDN Controller

OSS/BSS

Infrastructure

Virtual Resources

Router Off-loading
Multiple Network Slice
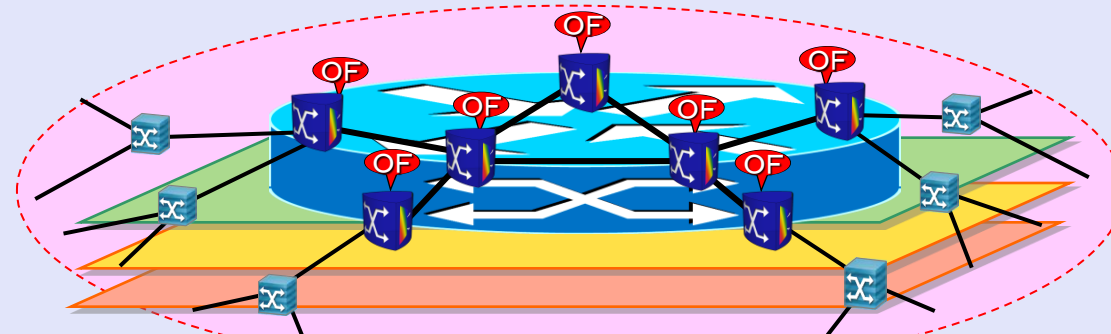
OF : OpenFlow STACK

Physical Resources

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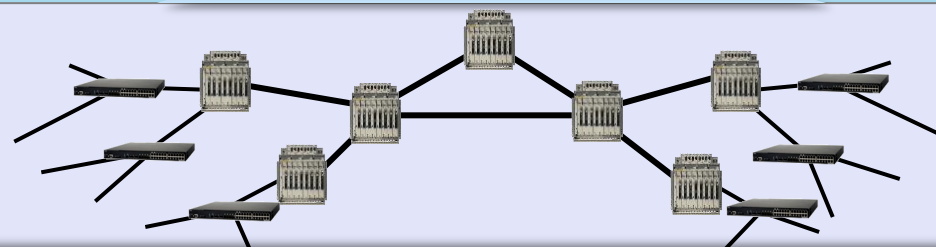
NEC's Carrier SDN Architecture <Management & Orchestration>

Management & Orchestration

OSS/BSS

| Billing | Customer care | Inventory |

NetCracker

SDN Controller

Orchestration

Network Control

Server Control

Customer Management

Service Management

Resource Management

SDN

Virtual

Physical

Logical

Physical

Legacy

Fulfillment

Assurance

Infrastructure

Virtual Resources

Physical Resources

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Award Winning "ProgrammableFlow"

> **NEC has released World's first SDN products, ProgrammableFlow controller/ switches, adopting OpenFlow.**
> **ProgrammableFlow products have won fine awards (Interop Las Vegas).**
> - **The Best of Interop 2011 for Infrastructure**
> - **The Best of Interop 2012 Grand Prize**
> - **The Best of Interop 2012 for Management, Monitoring, and Testing**

ProgrammableFlow Controller

PF6800
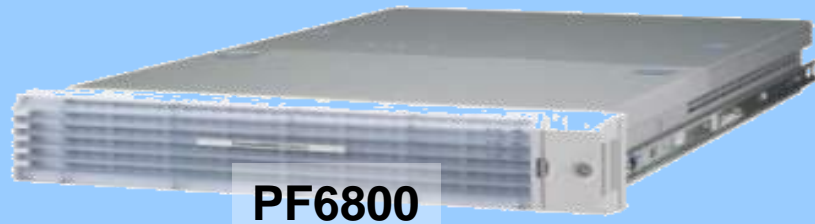
ProgrammableFlow Switch Family

PF5240

PF5248

PF5820

Server Access/ Gateway

DC Core

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Commercial Deployments and Trials

Logistics

Nippon Express Co., Ltd.

Helthcare

Kanazawa University Hospital

R&D

Large scale SDN TESTBED "RISE"

Collaboration with Carriers

NEC Corporation and TELEFÓNICA to collaborate in the development of network virtualisation. (February 21, 2013)

NEC and Portugal Telecom partner in network virtualization
- Joint evaluation of Software Defined Networks for datacenters and carrier networks (April 15. 2013)

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Use Case : NTT Communications

NTT Communications
Enterprise Cloud service

NTT Communications adopted NEC's ProgrammableFlow products as part of its Enterprise Cloud service.

NTT Com's new Enterprise Cloud provides global cloud resources that enterprise customers can easily control and manage to optimize its' ICT costs and support the global expansion of corporate operations.
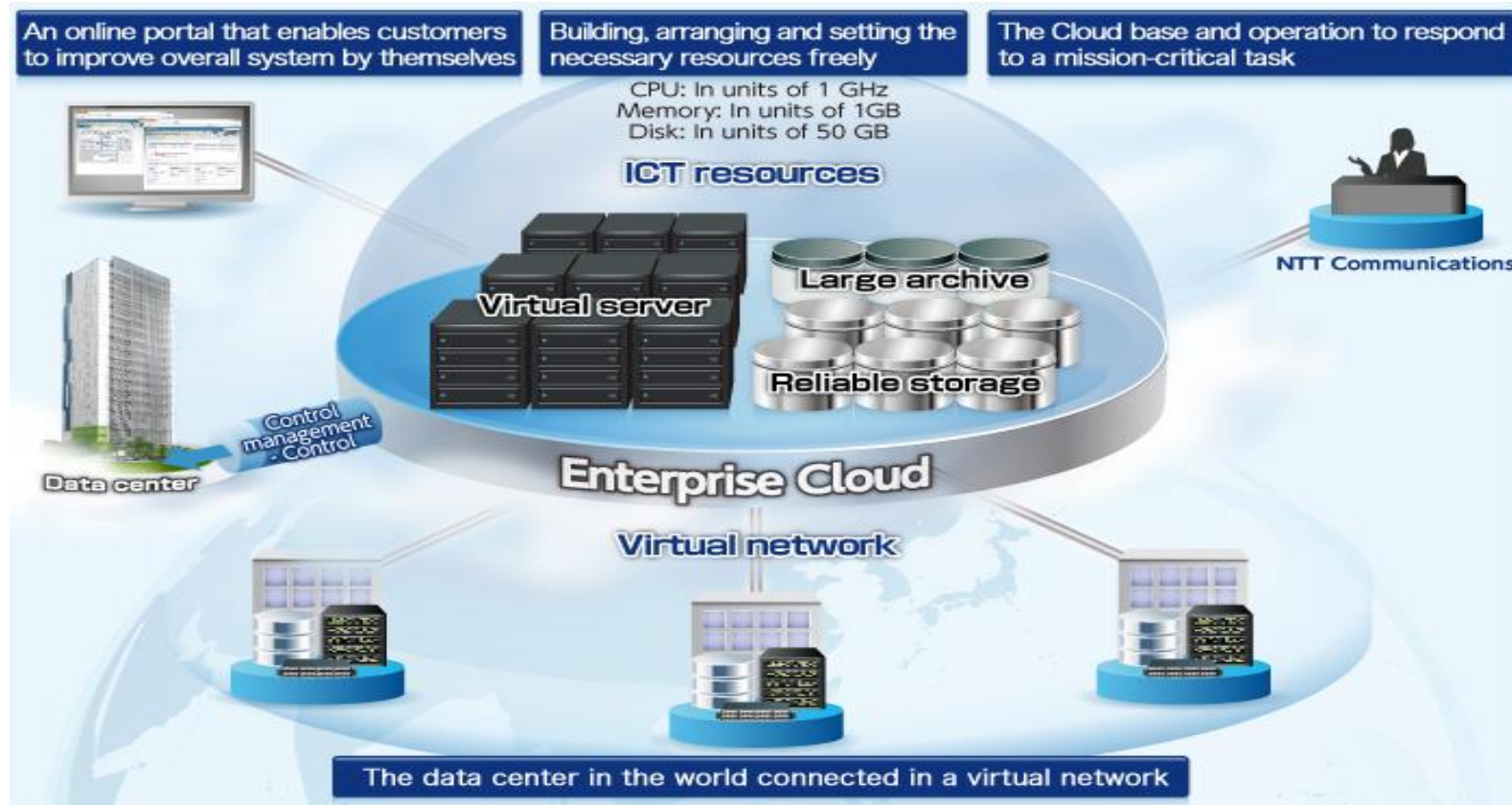
[Reference] : NTT Communications http://www.ntt.com/bhec_e/

Live streaming of "Snow festival 2013 in Sapporo (Japan)"

- NEC designed the network and NEC's OpenFlow is used for RISE
- TV broadcast and LIME (IPTV Standard) 4K stream was successfully transmitted to inside Japan, Singapore and other countries as well.
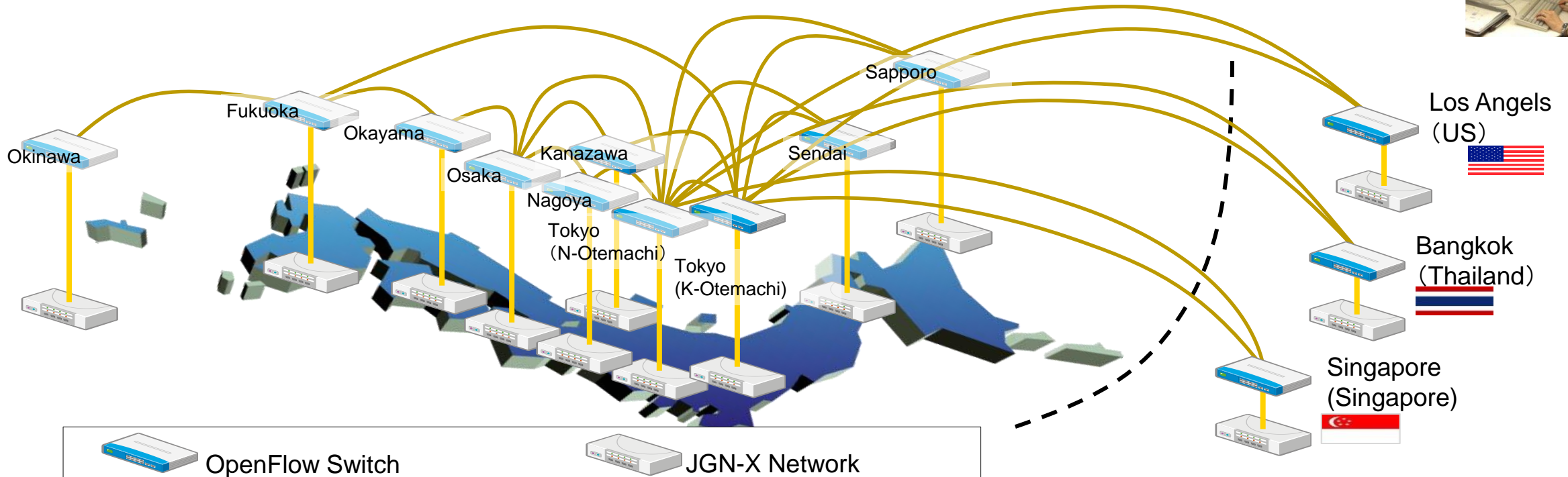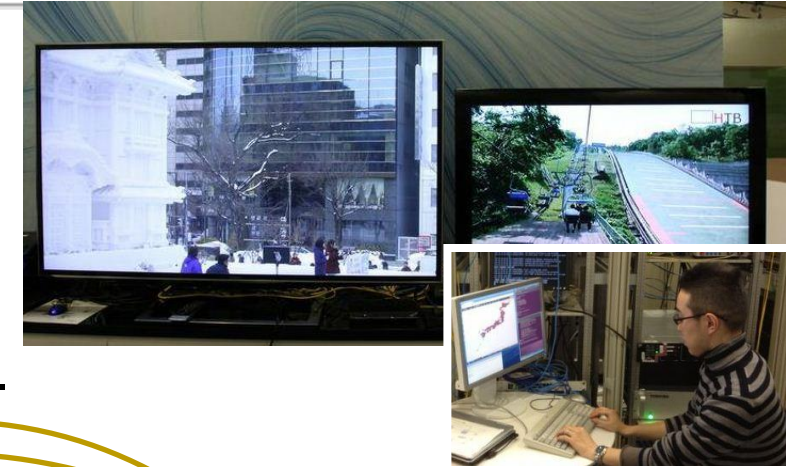- On-demand streaming network was provided in short preparation time.

Figure. RISE OpenFlow Network

Okinawa
Fukuoka
Okayama
Osaka
Kanazawa
Nagoya
Tokyo (N-Otemachi)
Tokyo (K-Otemachi)
Sendai
Sapporo
Los Angels (US)
Bangkok (Thailand)
Singapore (Singapore)

OpenFlow Switch
JGN-X Network

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NEC's Software Defined Carrier Network

Simple & Flexible

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NEC Group Vision 2017

To be a leading global company leveraging the power of innovation to realize an information society friendly to humans and the earth

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Empowered by Innovation

NEC