Evolving to a Software Defined Carrier Network

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NEC provides end-to-end solutions for carrier services

Established: July 17th, 1899
Employees: 109,000 worldwide
Sales: 3,036.8 billion Yen (FY2011 ending March 2012)

NEC Corporate Profile

Transport
- Submarine Cable system
- Land Terminal Equipment

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

Core Network
- Router/Switch
- IMS

Mobile Core
- SIP Server

Service Platform
- SDP
- OSS/BSS
- Data Centers

Enterprise

Home Services & Management
- Transport
- Access

Broadband Access (FTTH, ADSL etc)
NEC has participated in OpenFlow Community from the early stage of Clean Slate Program and has been contributing to standardization at ONF.

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tbody>
<tr>
<td>2007</td>
<td>Joined to Clean Slate Program (Jan., 2008)</td>
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<tr>
<td>2009</td>
<td>Demonstration at GENI Engineering Conference3</td>
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<td>2009</td>
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### Research and Standardization of OpenFlow

- **Research and Development (R&D):**
  - OpenFlow Switch Specification
  - Open Networking Foundation
- **Standardization:**
  - Joined to Clean Slate Program (Jan., 2008)
  - Prototype of OpenFlow Switch (Aug., 2008)
  - Demonstration at GENI Engineering Conference3
  - Campus Trial in U.S. (Oct., 2009)
- **Participation:**
  - NEC joined OFELIA
  - World’s 1st. Commercial Product of OpenFlow switch & controller
- **Fellow Projects and Organizations:**
  - OFELIA (OpenFlow in Europe)
  - Research and Standardization of OpenFlow Controller, Reference Switch

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**Note:** This information is a snapshot of the OpenFlow Community's activities and contributions from 2007 to 2013. For the most current information, please visit the official OpenFlow Community website.
Service Evolution and Growth

• More mobile broadband users
• Smart-phones, PDAs & enabled devices
• More connected devices (e.g. M2M)
• Growth of social media, e-commerce, IP-TV

Social Responsibility

• Disaster resilience
• Public safety
• Green Environment (lower power consumption)
NEC’s Carrier SDN: Value Proposition

**Infrastructure**
- Efficient resource utilization with virtualization
- Programmable, Scalable & Reliable Network
- CAPEX reduction

**Management & Orchestration**
- Flexible & automated configuration
- Centralized control & management
- OPEX reduction

**Services**
- 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.
NEC’s Carrier SDN Architecture <Overview>
NEC’s Carrier SDN Architecture < Infrastructure (Virtualized Functions) >

Management & Orchestration

SDN Controller

Infrastructure

Virtual Resources

OSS/BSS

Physical Resources

vEPC

P/SGW

MME

P/SGW

vBRAS

BRAS

P/SGW

BRAS

BRAS

BRAS
NEC’s Carrier SDN Architecture < Infrastructure (Transport) >

Management & Orchestration

SDN Controller

Infrastructure

Virtual Resources

Router Off-loading
Multiple Network Slice

Physical Resources

OSS/BSS

OpenFlow STACK

OF : OpenFlow STACK
NEC’s Carrier SDN Architecture <Management & Orchestration>

Management & Orchestration

OSS/BSS
- Billing
- Customer care
- Inventory

SDN Controller
- Orchestration
- Network Control
- Server Control

NetCracker

Customer Management

Service Management

Resource Management
- Virtual
- Logical
- Physical

Legacy

Fulfilment

Assurance
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

ProgrammableFlow Switch Family
- PF5240
- PF5248
- PF5820

Server Access/Gateway
DC Core
Commercial Deployments and Trials

**Logistics**

Nippon Express Co., Ltd.

**Healthcare**

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)
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.
NEC’s Software Defined Carrier Network

Simple & Flexible
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
Empowered by Innovation

NEC