

## NEC Innovation Series

# The Networking Revolution: OpenFlow Brings Change

Network virtualization, as exemplified by the new OpenFlow standard, promises far-reaching changes in the ICT world. NEC is the global leader in the implementation of this new technology

NEC's ProgrammableFlow® technology, a world first, promises to revolutionize the way networks are designed and managed. Based on an open standard protocol developed with Stanford University, it delivers multiple benefits to its adopters.

The advantages of SDN (Software-Defined Networking) include flexibility, security and reliability, together with simplification of the network management life cycle. As the market leader in this field, NEC has plans for ProgrammableFlow® to extend throughout the data center, and beyond.

## Open Up the Box!

For NEC's Hiroyuki Watanabe, "current networking products are basically closed boxes, meaning that the software inside them cannot be changed or modified by the users." His vision is to open up the hardware used in networks to allow custom applications to be run on it, increasing its responsiveness,

flexibility and efficiency, and optimizing the technology investment of the enterprise. When functionality is configured and controlled via software, rather than through physical configuration and deployment, networks provide SDN.

OpenFlow, an open source SDN protocol, provides a platform on which such an open architecture can run, making networks



Hiroyuki Watanabe,  
General Manager, Enterprise Solutions Operations Unit

as flexible as the rest of the data center, and able to respond to changing demands. For example, a data center housing many tenants may need to alter a network's topology as new tenants are added, or as the needs of existing tenants change.

In an OpenFlow network, the switches route network traffic according to the rules set up in a "flow table" inside the switch. Software commands issued from a central controller may be used to rewrite these tables, allowing instant changes to the network architecture. Furthermore, this is an open inter-manufacturer protocol, thus one command set can be used to modify the configurations of hardware from different makers.

## Go with the (Open) Flow

At the end of 2006, Stanford University and NEC came together in a joint research project, with NEC's Dr. Atsushi Iwata working alongside Stanford professor Nick



Atsushi Iwata, Ph.D.,  
Deputy General Manager, Cloud System Research Laboratories

McKeown to develop ideas that led to these new paradigms. NEC saw this new approach to networks as an opportunity to create new markets. Iwata admits that NEC's decision to go with this new technology was "a bet, but it has paid off."

Out of this initiative came the OpenFlow standard, to which NEC has added value with its ProgrammableFlow® architecture, providing users with an integrated, comprehensive networking platform. Being the first to commercialize OpenFlow products, NEC has been able to bring to market a range of devices (hardware and software switches, and a dedicated controller) that allow users to perform on-the-fly reconfiguration of the networks through modification of their network devices' behavior. In addition to hardware, the ProgrammableFlow® solution includes an easy-to-use graphical interface, allowing easy, intuitive planning and implementation of changes to a network, even when the network is spread across different sites.

NEC's lead in SDN has been widely recognized by industry experts. "SDN promises to remake networking by delivering unprecedented network virtualization and rich, application-driven programmability and agility," says Rohit Mehra, Vice President of Network Infrastructure at IDC Corp. "NEC has demonstrated tremendous leadership in OpenFlow-based SDN with its ProgrammableFlow® networking technology, which provides full-function benefits to IT organizations that are looking for the next generation of networking."

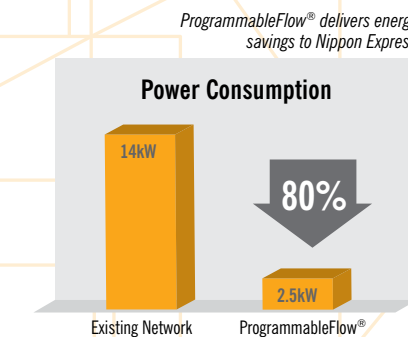
## Proven Customer Benefits

A major international ICT and cloud services provider, NTT Communications (NTT Com), is using ProgrammableFlow® technology in this way. Operating data centers around the world, NTT Com must be ready to reconfigure resources used by its customers on an almost instant basis, together with delivering a reliable, state-of-the-art service. With ProgrammableFlow® technology, a central controller can reconfigure a network that spans continents.

ProgrammableFlow® has helped logistics leader Nippon Express reduce initial hardware costs to about half those of a legacy system, and significantly reduce rack space and power usage. The ProgrammableFlow® network now enables in-house network management, eliminating the need for outsourcing.

Kanazawa University Hospital has centralized the network management of departments with varying network policies. By managing the overall ProgrammableFlow® network traffic from a single location, MACs (moves, adds and changes) throughout the whole installation have become quicker and more efficient.

NEC's Watanabe also points to another



advantage of an open network: the usual "refresh equipment cycle" of three to five years is now broken. Since an SDN's topology and architecture are software-defined, they can be revised and reworked, with simplified change management procedures, at any time without massive capital expenditure. This can happen whenever an organizational change occurs within the enterprise, or when new units are added.

## The Future Is Open

Iwata looks forward to an open networking future, where network applications are written and deployed on an open platform in the same way that computer applications are deployed over an operating system, with networks that sense traffic and reconfigure themselves automatically, even in the event of disaster. Such an intelligent network with centralized control could be self-routing, self-optimizing and self-healing. NEC is working with a variety of global partners to develop such networks, and is releasing into the public domain several enhancements of the OpenFlow standard.

Such networks may find uses outside data centers and cloud services. Watanabe explains: "ProgrammableFlow® solves so many problems, some of which our customers are unaware. We're listening to them, and based on their needs, we're using ProgrammableFlow® to develop and provide solutions that exceed their expectations." These customers include communications carriers, whose "carrier-class" networks must incorporate diverse forms of traffic, with continually changing demands. Open networks, such as NEC's ProgrammableFlow®, can meet these demands, and, thanks to their open architecture, future, as yet unknown needs. — Hugh Ashton

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