

NEC SDN Solutions - NEC's Commitment to SDN

SDN is the new concept of controlling networks using software. It is now attracting international attention as an approach to achieve advanced ICT systems that can quickly and flexibly cope with changes in social and corporate environments. This paper introduces, as part of the efforts NEC has made so far, our history for SDN, from the initiation of research to the provision of the world's first OpenFlow-compatible products. Also discussed in this paper is NEC SDN Solutions, a package of SDN solutions for the problems of customers such as enterprises, government offices and telecommunications carriers.

HAYANO Shin-ichiro

Senior Expert
SDN Strategy

SATOH Yasunori

Assistant Manager
SDN Strategy

1. Introduction

Software-Defined Networking (SDN) technology is creating new value by achieving advanced ICT systems. This is also helping to bring about new markets. This paper discusses our commitment to SDN up till now and introduces NEC SDN Solutions, a package applicable to a wide range of customers that clarifies the benefits to each system user and organizes them in a menu.

2. NEC's Commitment to SDN up to the Present

Our commitment to SDN is shown in **Fig. 1**. We have been participating in the Clean Slate Program at Stanford University since January 2008, taking part in the development of the OpenFlow protocol and leading the way in research since the original conception of SDN architecture.

As an extensive contributor to the research and development of this standard, we have also actively participated in various industry specification groups, such as the ONF (Open Networking Foundation), as well as in OpenFlow development communities. More recently, we have been playing a dynamic

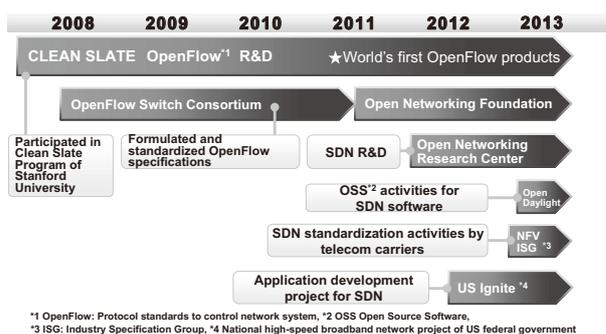


Fig. 1 NEC's commitment to SDN up to the present.

role in the OpenDaylight Project, whose objective is to release open source software that achieves SDN, while also being active in NFV (Network Functions Virtualization).^{*1} This group investigates the architecture of network virtualization - which is closely related to SDN - for telecommunications carriers, with a view to supporting the promotion and dissemination of SDN.

^{*1} NFV (Network Functions Virtualization) is the subject of one of the Industry Specification Groups of ETSI (European Telecommunications Standards Institute).

Once the utilization of OpenFlow technology became practicable, in 2011, we introduced both a controller and a switch as products for the first time in the world, under the name “UNIVERGE PF Series”.

NEC is now also offering various SDN products based on our long-standing experience in corporate and data center markets. Having made the UNIVERGE PF Series compatible with OpenFlow for the first time in the world, we succeeded in making it compatible with the latest version of OpenFlow (1.3.1) and are now offering this latest version while greatly enhancing additional functions. Moreover, we have released WebSAM - management software for integrated cloud administration that works together with the UNIVERGE PF Series - in order to focus on product line extensions that help achieve simple operation. Our products have been highly praised by experts at network computing events such as Interop Las Vegas and Interop Tokyo in 2011 and 2012. As exemplified in these instances, we are continuing to develop automation technology by combining our products with operation-oriented software.

3. Policies to Cope with SDN

NEC has been deploying our SDN business while placing our main emphasis on providing products for data center operators.

In order to expand the applicable markets for SDN, which integrates IT and networking technologies, we are packaging our products by specifying the provided functions and benefits as a solutions menu, so that they can be offered to customers ranging from telecommunications carriers to diverse enterprises and government offices.

NEC has developed various SDN solutions by optimally using following three advantages; (1) the leading SDN technology and products to which we have been committed thus far, (2) our wide-ranging system know-how and software engineering resources in both IT and networking, and (3) the cases we have worked on with our leading-edge customers and our extensive client database. We believe that having these three advantages simultaneously is our great strength in the SDN market and we are proposing solutions for various ICT problems by making the best possible use of these advantages.

Using our leading-edge SDN technology and the strength and experience we have gained so far, our deployment of solutions goes beyond data centers to include various solutions for comprehensive ICT systems for offices, factories and the WANs that connect them, so that we can expand our SDN business.

4. Solutions Provided by NEC

4.1 NEC SDN Solutions

Fig. 2 shows the structure of NEC SDN Solutions, which

embodies the values SDN has to offer, and its solutions menu. NEC SDN Solutions uses ProgrammableFlow technology based on OpenFlow, the basic protocol for these products, to provide ideal solutions for each of three categories: NEC Enterprise SDN Solutions for enterprises and government offices, NEC Telecom Carrier SDN Solutions for telecommunications carriers and NEC Data Center SDN Solutions for the data centers used by enterprises, government offices and telecommunications carriers.

4.2 SDN Solutions for Enterprises and Data Centers

Designed for whole corporate systems, our SDN solutions for enterprises and data centers allow a company’s entire ICT system to progress to a more advanced stage by using SDN, while being applicable to various locations such as data centers, office buildings, branches and factories scattered over many regions across a country.

A schematic diagram of an application of these solutions is shown in Fig. 3. First, the following solutions are offered to enterprises:

(1) Office/data center connection optimization solution

Optimizes the usage of WAN lines between data centers

NEC SDN Solutions			
Target Market	Applicable Area	Solution	Product
NEC Enterprise SDN Solutions	Network optimization	- Optimized connections between offices and data centers - LAN optimization	Integrated operation management software WebSAM WebSAM VDC Automation
	Security	-Access authentication	
	Mobile	-	
NEC Data Center SDN Solutions	Operation/management	- Automated IaaS operation	UNIVERGE Cloud network platform “UNIVERGE PF Series”
	Integration	- Data center network integration	
NEC Telecom Carrier SDN Solutions	Network management	- Integrated operations/management	Technology ProgrammableFlow
	Network infrastructure	- Network function virtualization - Transport	

Fig. 2 NEC SDN Solutions menu.

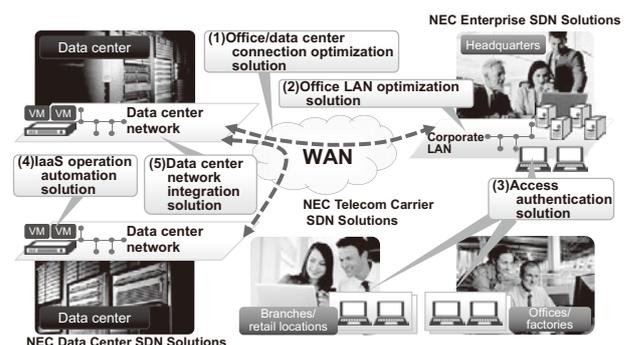


Fig. 3 Application of NEC SDN Solutions to enterprises and data centers.

and between data centers and offices, as well as their operation and management.

(2) Office LAN optimization solution

Virtualizes the division and group networks on the LANs of office buildings to help implement integrated management.

(3) Access authentication solution

Applied to office buildings and other business centers to help strengthen integrated security as well as to manage system usage.

In the meantime, the following two solutions have been designed for and are provided for data centers:

(4) IaaS (Infrastructure as a Service) operation automation solution

Applied to ICT resource management in data centers to help implement integrated operation and management of IT and networks.

(5) Data center network integration solution

Applied to networks in data centers to help virtualize individual system networks and implement integrated management between systems.

As shown in Fig. 4, we will further strengthen the following commitments when providing SDN solutions for enterprises and data centers:

- Research and development of advanced SDN-related technologies
- Development of human resources competent in both IT and networking and accumulation of know-how
- Introduction of leading SDN products and collection of demonstration cases

In order to strengthen these commitments, we will assemble an SDN-dedicated task force to better cope with greatly expanding SDN usage by developing new solutions as well as by developing engineers and improving their expertise.

4.3 NEC Telecom Carrier SDN Solutions

Our SDN solutions for telecommunications carriers offer three benefits, based on the concept of “Simple & Flexible” as shown in Fig. 5.

They are (1) efficient resource utilization for “Infrastructure,”

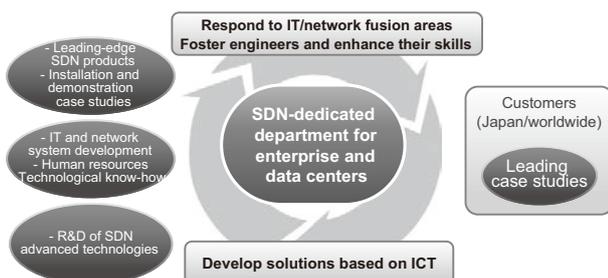


Fig. 4 Policies to enhance the provision of solutions for data centers.

(2) automated settings for “Management and Orchestration,” (3) prompt and flexible provision of services for “Services.”

To better address the needs of telecommunications carriers, we are focusing on the three SDN solutions shown in Fig. 6: Integrated Operation/Management Solutions, Transport Solutions and Network Virtualization Solutions.

Integrated Operation/Management Solutions consists of three functions: OSS/BSS (Operation Support System/Business Support System), SDN Service Controller and TMS (Traffic Management System). The OSS/BSS handles the operation and management of communications related to customers, assets and charging.

The SDN Service Controller carries out resource control and cooperative control of transport networks and network functions virtualization. The TMS optimizes traffic control and monetization. Thanks to these functions, the integrated operation, automated management and optimized control of SDN can be achieved.

Built for data transfer, Transport Solutions features functions to allocate multiple virtual networks to physical network resources as well as to improve network resource efficiency through control and integrated management from the SDN Service Controller. This will help achieve flexible and efficient

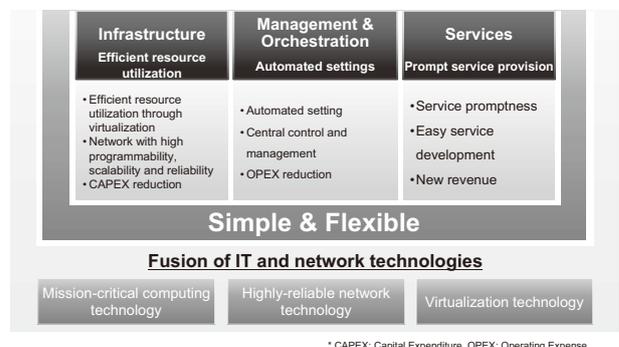


Fig. 5 Benefits of SDN solutions for telecommunications carriers.

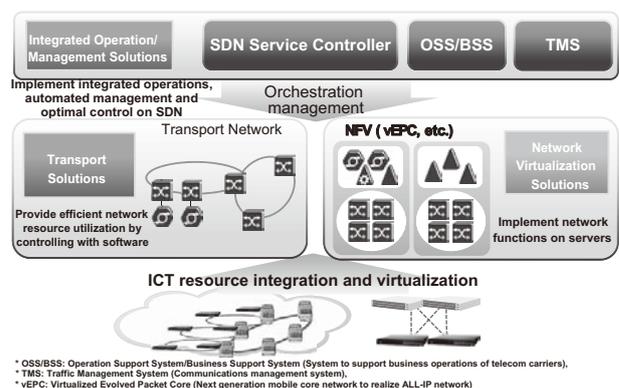


Fig. 6 SDN solutions for telecommunications carriers.

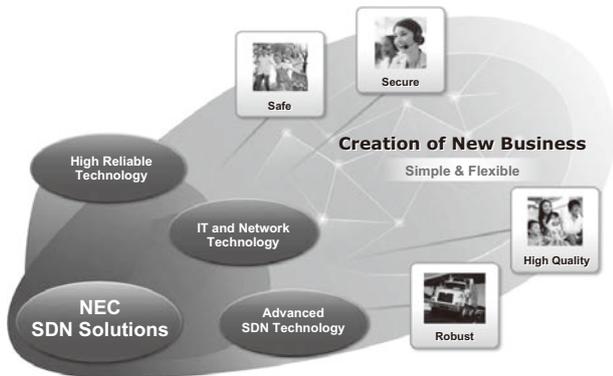


Fig. 7 NEC SDN Solutions.

provision of services.

Designed to realize various network service functions through the utilization of software on servers, Network Virtualization Solutions accomplishes the virtualization of network functions proposed in NFV, including access authentication and connection control of subscribers in fixed-line and mobile networks. More flexible connections between multiple servers are possible when our UNIVERGE PF Series products are used.

5. Conclusion

Through NEC SDN Solutions, the concept of which is summarized in **Fig. 7**, we are committed to providing flexible and simple ICT solutions that integrate information technology and networking technology, based on our experience in these technologies as well as on our state-of-the-art technology and leadership in SDN.

By using these ICT solutions - which are safe, secure, high-quality and robust - we will support the creation of new businesses while quickly and flexibly meeting the demands of businesses our customers want to launch.

* OpenFlow is a trademark or registered trademark of Open Networking Foundation.

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NEC SDN Solutions
<http://www.nec.com/en/global/solutions/sdn/>

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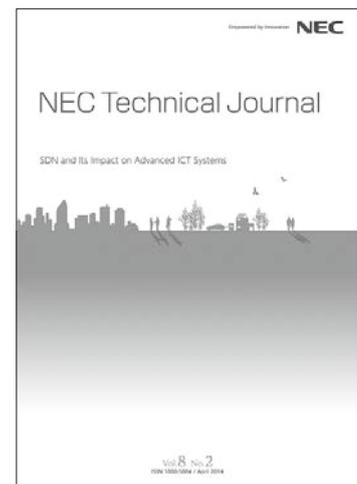
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