

Technology Systems for SDN/NFV Solutions

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Abstract

SDN/NFV is a technology for improving the efficiency of operations and management by applying virtualization technology to telecommunications networks. It is expected to be adopted especially for its capability of allowing flexible actions to be taken in responding to significant increases in traffic and the diversification of service requirements of the telecom networking field. NEC has long been leading the world in tackling R&D in this field and now possesses an impressive arsenal of technologies and achievements. This paper introduces an overall description of NEC's SDN/NFV solutions for telecommunications carriers or telecom carriers, as well as of relevant technological systems.

Keywords



MANO, network function virtualization, transport SDN, Traffic Management Solution, Open Network Foundation, ETSI NFV

1. Introduction

The telecom network today is required to adapt itself to environmental changes such as increases in traffic and the expansion of applications. These environmental changes include significant increases in mobile traffic as well as the expansion of network applications. In accordance with the growth of domains such as cloud computing, IoT (Internet of Things) and OTT (Over The Top). Such network applications are expanding even more in the fields of inter-cloud connections, diverse device connections and global service provisions.

Meanwhile, the growth rate of subscribers is lower than the growth of mobile traffic and that price competition is getting more severe following the participation of MVNO (Mobile Virtual Network Operator) businesses. Such events may increase the gap between the required investment in equipment and the actual sales. In the present circumstances, we at NEC believe that the issue most likely to be of concern in the telecom networks of the future will lie in how to adapt efficiently to environmental changes.

In this paper, we introduce an overall description of

NEC's SDN (Software-Defined Networking)/NFV (Network Function Virtualization) solutions for telecom carriers, which is capable of further improving the efficiency, flexibility and degree of service advancement of telecom networks by resolving the above issues, together with its system technology.

2. Outline of SDN/NFV Solutions for Telecom Carriers

The conventional partially optimized network uses traditional specialized devices and is composed of individual systems and their operations management functions provided per network. In contrast, the NEC's SDN/NFV solution for telecom carriers employs virtualization technology. It thereby implements an overall optimization network composed of a common platform enabling resource sharing between network functions, integrated operations and an orchestration function (**Fig. 1**).

The present solutions are composed of four technologies. These are MANO (Management and Orchestration) for the integrated operation/management of the resources of the entire network, NFV (Network Function Virtualization) that virtualizes network functions and

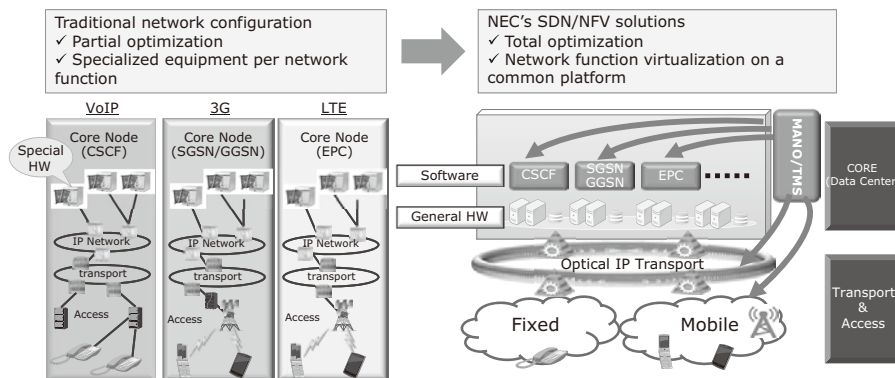


Fig.1 Diagram of SDN/NFV solutions for telecom carriers.

executes them on general-purpose servers, the transport SDN that improves the transport layer network by means of software control, and the TMS (Traffic Management Solution) that improves the network utilization efficiency of problem analysis and optimization, etc. It is these technologies that make possible further improvements in efficiency, flexibility and the service quality of the telecom networks.

3. Technologies Making Up the SDN/NFV Solutions

The following sections describe the MANO, NFV, transport SDN and TMS technologies that comprise the present solutions.

3.1 MANO

The MANO technology provided by NEC is a total orchestration function for the total operations management of services and resources in the SDN/NFV environment. In this manner smart operations management such as quick and flexible networking to meet the diversifying service requirements and automation, as well as dynamic network optimization based on the policy as shown in Fig. 2 are implemented.

One of the special features of our MANO is that it widens the orchestration target from the SDN/NFV environments exclusively to the legacy environments. This versatility enables the seamless introduction of SDN/NFV while maintaining the operations management and existing operations of the entire telecom network.

We adopt the approach described above in collaboration with NetCracker Technology Corp. who have rich expertise in the field of TOMS (Telecom Operations and Management Solutions) such as the OSS (Operation Support System) and BSS (Billing Support System). In the future, we are planning to advance adaptation fur-

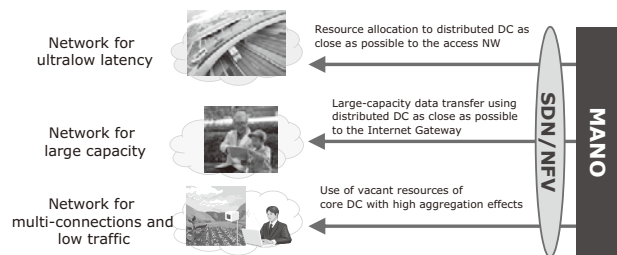


Fig. 2 Network construction/optimization according to service requirements.

ther by adding big data analysis technology, etc.

3.2 NFV (Network Function Virtualization)

At NEC, we apply the NFV technology that virtualizes network functions in a telecom network to domains that include the EPC (Evolved Packet Core), CPE (Customer Premise Equipment), IMS (IP Multimedia Subsystem), MVNO-GW and IoT.

The NFV is being standardized by the ETSI (European Telecommunications Standards Institute) in collaboration with related organizations such as the TM Forum (TeleManagement Forum). NEC proceeded to the network function virtualization even before these efforts for standardization started and is still leading the market.

The NFV technology avoids the vendor lock-in situation thanks to the use of open technology-based general-purpose servers and sharing of operations management systems. This resulted in reducing the TCO (Total Cost of Ownership), as well as increasing ease of resource sharing between network devices and a quick, flexible introduction of services compared to the traditional method using dedicated equipment.

In the future, we will extend virtualization of telecom network devices step by step in order to meet the ad-

vancing network requirements at a lower cost and with more flexibility.

3.3 Transport SDN

NEC's transport SDN technology varies the transport network configuration dynamically according to the situations such as the traffic load situation in order to improve efficiency.

The traditional transport architectures presupposes static operations. However, to deal flexibly and efficiently with increased capacity and diversification of traffic, it is critical to operate the network dynamically.

NEC has pointed out four requirements to achieve the advanced transport network. These are "automation of operations and reduction of service provision time", "securing high reliability", "identifying mutual relationships between transport and services and their linkages" and "network optimization from optical level to packet level". It is the role of the transport SDN to fulfill these requirements and enable efficient network operations.

3.4 TMS

Our TMS is a technology for implementing such topics as the "visualization of network performance and traffic", "analysis and diagnosis of weak points and of points requiring enhancement in the network" and the "optimization of networks based on diagnosis results" collectively.

Visualization of network performance and traffic cannot be achieved merely by connectivity and speed (throughput) but by measuring the user's quality of experience (QoE) and identifying the traffic properties in real time are also required, such as the type, time and location of use of the service.

When such information is visualized, the issues to be improved are analyzed based on NEC's network exper-

tise. Based on the analysis results, Traffic Management Solutions (TMS) can be applied to improve the efficiency of the entire telecom network by optimizing it in various ways; such as by preventing local overloads, improving the TCP tuning performance, paging the movie traffic and compressing content. Application of TMS optimizes the traffic according to the situation and improves the efficiency of the entire telecom network.

4. NEC's Achievements with SDN/NFV Solutions

As shown in **Fig. 3**, NEC's SDN/NFV solutions for telecom carriers have achieved a large number of PoCs (Proofs of Concept) and commercial introductions among advanced telecom carriers worldwide, including Tier1.

Specifically, we have undertaken more than 30 PoC, field trials and commercial introductions both inside and outside Japan, including the vEPC (virtualized Evolved Packet Core) for MPT Myanmar and NTT DoCoMo and the vCPE (virtualized Customer Premises Equipment) for Telefônica Brasil (Vivo). During 2016 and subsequently, the trend in commercial introductions is expected to accelerate as the maturity of the SDN/NFV field progresses.

5. Activities Related to Standardization and the Open Source Community

Since the ONF (Open Networking Foundation) was established and the OpenFlow standardization and community activities were revitalized in 2011, the SDN/NFV technology has been standardized and has employed open architecture step by step as shown in **Fig. 4**. In 2013, the ETSI NFV ISG (Industry Specification Group) for elaboration of industry standard specifications of NFV was established, and in 2014 the OPNFV (Open Platform for NFV) for building open source based NFV reference

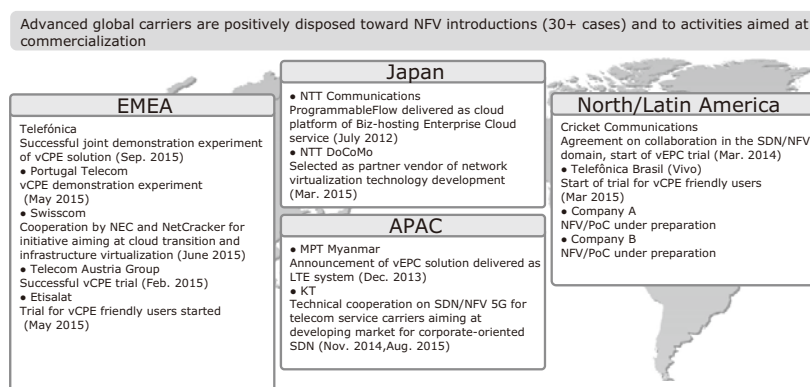


Fig.3 Achievements of NFV solutions.

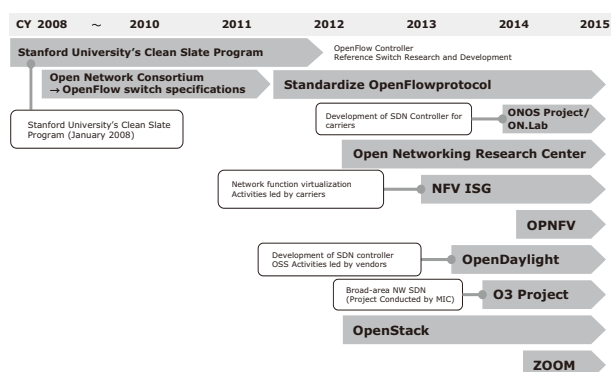


Fig. 4 Trends in SDN/NFV-related standardization organizations and open source communities.

platform was established, respectively under the leadership of the telecom carriers.

At NEC, we are positively participating in and contributing to the standard organizations and open source communities by focusing on bringing about progress in the SDN/NFV technology and by obtaining an industry wide approval consensus.

6. Conclusion

In the above, we described SDN/NFV solutions for telecom carriers and the technological features adopted by them. When network devices become more flexible by using the SDN/NFV technologies, they can be subjected to advanced control and optimization by MANO and TMS so that any telecom network issues can be solved when handling large amounts of traffic by meeting the diverse terminal and communication requirements. The trends and actual achievements of PoC, commercialization and standardization also set promising expectations for the potential advantages of the technologies described above and for further market introductions and expansions.

At NEC, we intend to continue to contribute to the optimization and advancement of the entire telecom network by applying the technologies described above.

* OpenFlow is a registered trade mark of Open Networking Foundation.

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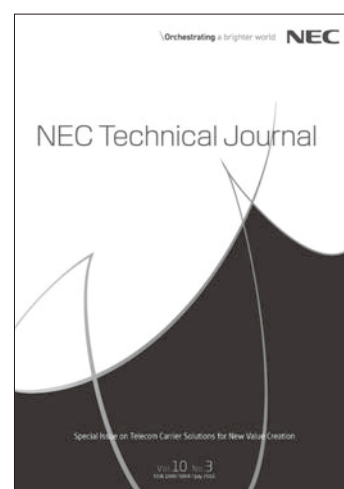
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