

NTT Press Releases

Press Release - For immediate use December 9, 2013

Prototype High Performance SDN Software Switch Launched - Highest packet transferring performance yet achieved at 10 Gbps wire rate -

Tokyo, December 2013 - Nippon Telegraph and Telephone Corporation (NTT; TSE: 9432, NYSE: NTT) today announced the launch of a prototype high-performance SDN ([1](#)) software switch. The research leading up to its launch was carried out as part of a "Research and Development of Network Virtualization Technology" program commissioned by the Ministry of Internal Affairs and Communications. The switch provides the highest level of performance yet achieved by an SDN software switch in transferring data packets at a 10 Gbps wire rate.

While SDN has already been introduced in corporate networks, such as those at data centers, NTT has developed a prototype SDN software switch that achieves high performance even though large scale flow entries are set, as a technical element to apply SDN to wide area networks such as those of telecommunications carriers and Internet providers.

Although 100K entries are added into its flow tables and each packet header must be rewritten, this switch still transfers large packets at a 10 Gbps wire rate. This makes it one of the highest performance SDN software switches ever. After its flow tables are extended to enable handling of larger entries, it will become applicable not only to data center networks but also to wide area networks. This will enable easy development of new network services and new protocols.

Details of the prototype will be provided at Okinawa Open Days 2013 (<http://www.e-side.co.jp/opendays/2013/en.html>), held December 12-13, 2013 at the Okinawa Jichikaikan.

1. Background

Previously, network nodes had to be hardware-oriented and built with dedicated chips due to performance requirements. Today, however, CPUs, buses, NICs and so forth are becoming increasingly fast even in general-purpose servers, and software-oriented network nodes on servers have become practical if they meet the performance requirements.

There has also been increasing activity in research and development for NFV ([2](#)), in which network functions are implemented and utilized as software. This is because the implementation of software-oriented network nodes makes it quick and easy to provide new network services, new protocols and new functions on the nodes.

Meanwhile, there is a strong need for introducing SDN not only into networks within and between data centers but also into wide area networks, as SDN makes precise and quick network control possible.

Thus, there has been a strong need for a novel high-performance SDN software switch that would enable packet transferring at a 10 Gbps wire rate with more than 100K large flow entries, making it applicable to wide area networks.

2. Problems of SDN software switches

(1) Performance limitations due to processing in a single thread and in a single CPU.

Previously it was simple to implement switches in a single thread and in a single CPU. Today, however, as general-purpose servers have multiple cores in multiple CPUs, there is a strong need for high-performance multiprocessing. There is also a need to avoid negative impacts on communication; for instance the packet order reversal that occurs with parallelization.

(2) Processing time growth when large scale flow tables are set due to the need to search complicated tables.

In the SDN (OpenFlow) specification, not only "0" or "1" keys but also "don't care" keys are used to search within flow tables. It is also necessary to search pipelined tables. This makes it difficult to process packets with high performance when entries of more than 100K are set into flow tables.

3. Research results

NTT Network Innovation Laboratories (Yokosuka, Kanagawa) is currently working on research and development for SDN software nodes in the "O₃ Project (13)". This project was assigned by the Ministry of Internal Affairs and Communications as part of its "Research and Development of Network Virtualization Technology" program.

As an initial step, a prototype SDN software switch has been developed. When 100K entries, which suffice as the first target, are added into flow tables and all packet headers are rewritten, this prototype achieves 10 Gbps wire rate transferring of large packets. This makes it one of the highest performance SDN software switches ever.

The laboratories have also engaged in extensive research for future networking, using their experience with high-performance processing in communication nodes to implement a proto-type aimed for wide area networks. The effectiveness of its fundamental performance has been confirmed.

After various types of modules are implemented for adding values to networks, it will be possible for the prototype to be leveraged as a platform to develop software nodes.

This prototype's target area and target functions are shown as [Appendix item 1](#).

4. Challenges for resolving problems

This prototype achieves high-performance transferring with the development and implementation of "Flexible parallel Flow processing Framework (fff: [Appendix item 2](#))".

In general, a kernel space program is superior to a user space one in terms of processing speed. There are a number of problems with kernel space programs, however, including the need for the program to be maintained for the latest kernels. This prototype is a user space program and is implemented in parallel, with multiple threads enabling the achievement of adequate performance.

The problems described in point 2 are solved as follows:

(1) Speeding up of forwarding with parallelization (multiple threads enabled)

Flows are identified and packets in a flow are handled in a single set of pipelines for avoiding order reversal of packets. The sets of pipelines are parallelized and multi-threaded to achieve greater speed.

(2) Speeding up the looking up of large scale flow entries with an 'fff' look-up algorithm.

A novel algorithm has been developed for speeding up the process of looking up large scale flow entries under complicated search conditions, such as the 'don't care' tolerance usually used SDN (OpenFlow) in each set of pipelines. The prototype achieves high performance in searching flow tables and the performance is not decreased much even if large scale flow entries are set into the flow tables. In addition, an 'fff' look-up algorithm is implemented with as high a cache hit ratio as possible in order to reduce the number of times the memory needs to be accessed.

5. Future Plans

The prototype will be extended to enable it to handle larger flow entries. Research and development will be promoted for achieving higher performance in applying software nodes to wide area networks. R&D will be also promoted for handling new protocols and management functions with high reliability in order to make software nodes more reliable and more operable. Hereafter, the R&D results will be expanded and will contribute significantly to advanced networking.

Notes:

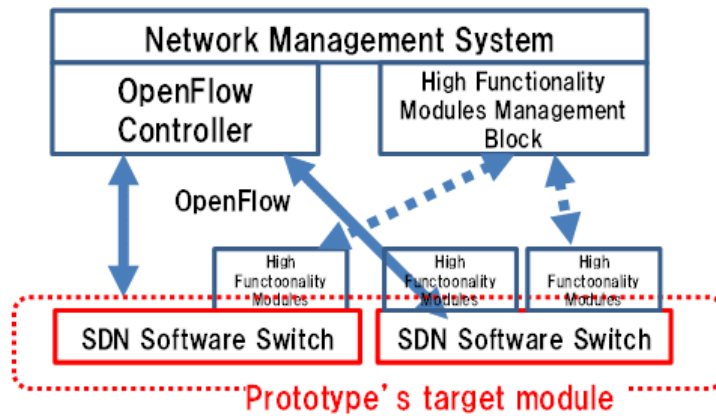
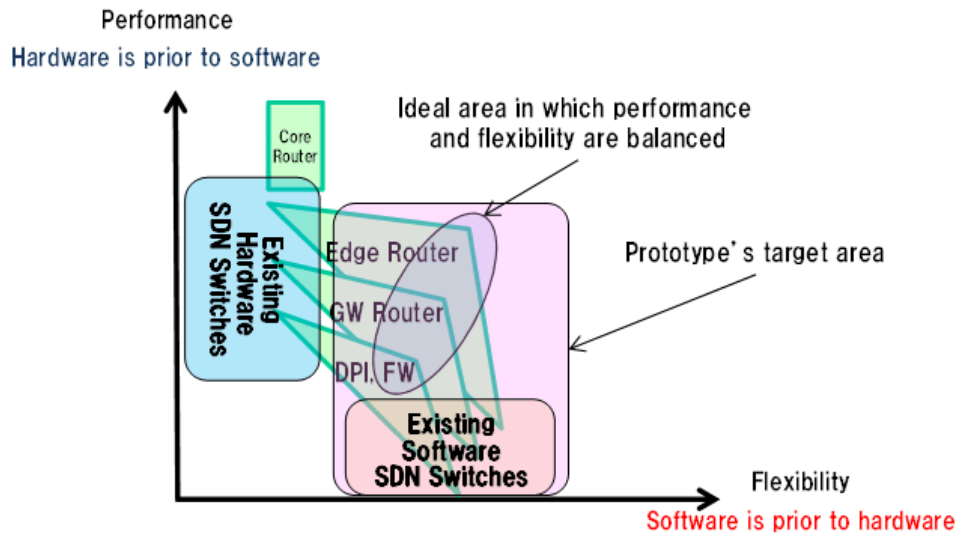
*1) SDN stands for "Software Defined Networking".

*2) NFV stands for "Network Functions Virtualization".

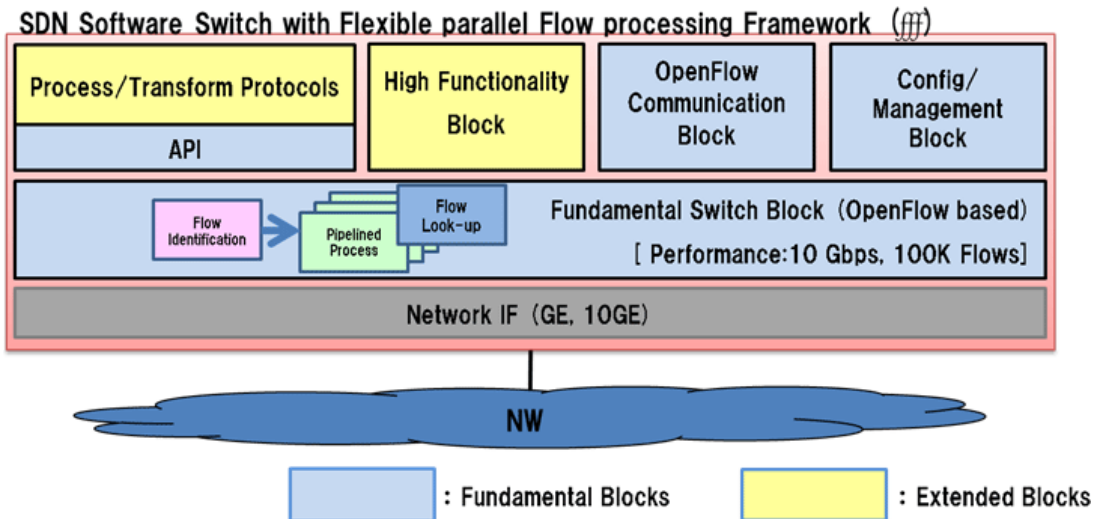
*3) O₃ stands for the overall concepts of this project: open, organic and optima. In June 2013, five companies (NEC Corporation, Nippon Telegraph and Telephone Corporation, NTT Communications Corporation, Fujitsu Limited and Hitachi, Ltd.) began to work jointly on research and development for conducting verification tests. Aiming to verify and commercialize these technologies, the five companies will promote the sharing and standardization of the research results globally. For example, the project will open a website for providing related information in FY 2013. In addition, the project will make some of the results available to the public and provide them to domestic and overseas telecommunications carriers, service providers and vendors in FY 2014.

Appendix

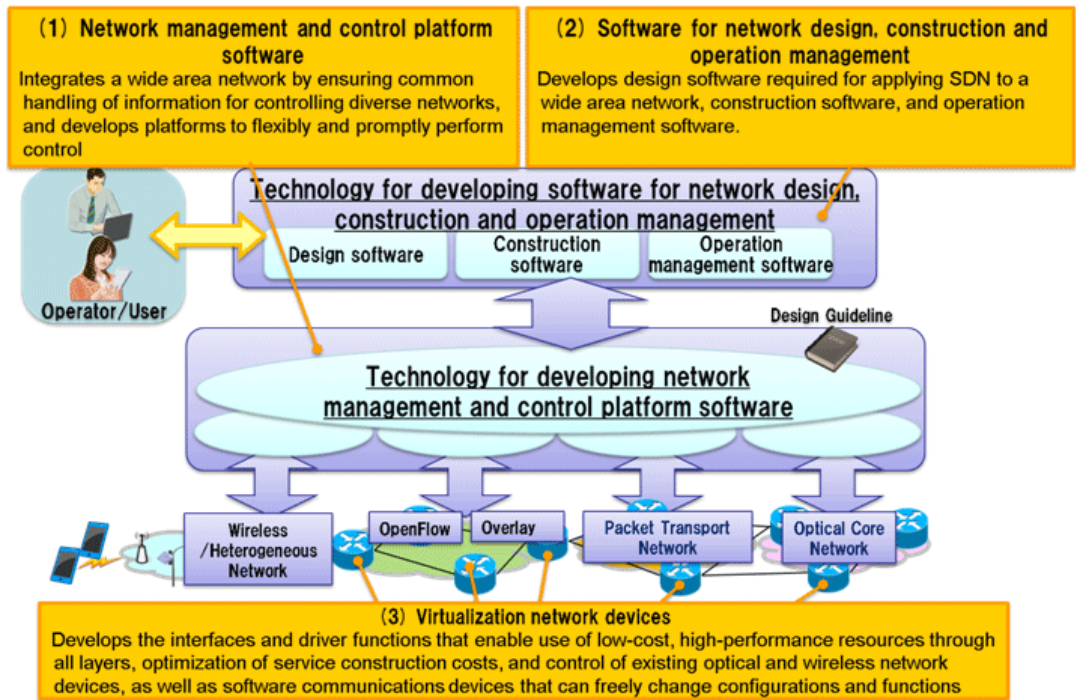
1. Target Area and Function of This Proto-type



2. An Architecture of This Proto-type



3. Overview of O₃ Project



Contact:

Nippon Telegraph and Telephone Corporation

NTT Science and Core Technology Laboratory Group, PR Section
a-info@lab.ntt.co.jp

Information is current as of the date of issue of the individual press release.
Please be advised that information may be outdated after that point.

[NTT Press Releases Index](#)

NTT Press Releases

[▶ Latest Press Releases](#)

▼ [Back Number](#)

[▶ Japanese is here](#)

**Search Among
NTT Press Releases**

January ▼ 1997 ▼ -

November ▼ 2021 ▼

