Exhibits and Demonstrations at iPOP2014

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1. Introduction

The iPOP 2014 exhibition was held in the Convention Hall at the NTT Musashino R&D Center. As shown in Figure 1, this event featured a showcase exhibition in addition to the exhibition booths set up by a total of 21 different businesses and organizations. Most of the exhibitors had come to introduce their work on Software Defined Networking (SDN) and OpenFlow technology. This article introduces the exhibit relating to the O3 (Open Organic Optima) project, where research and development is being done on the SDN technology needed for wide-area networks, and the Software Defined Transport Network (SDTN) interoperability demonstration. A brief introduction to some of the other exhibits is also provided.

2. O3 Project exhibition

The O3 Project is researching and developing SDN technology needed for wide-area networks (NWs). At this year's event, it exhibited integrated visualization technology for wide-area NWs using an abstract NW model, and unified management technology for multi-layer NWs consisting of packet/optical transport. In SDN technology for wide-area NWs, the key consideration is how to absorb the discrepancies of the diverse NWs that constitute the wide-area NW. In the O3 Project, individual NWs are represented by the abstraction of an object-oriented data model, and the operator functions that process objects aim to resolve this abstraction by extending to conform with the characteristics of the user. In the integrated visualization technology exhibited here, the topology of the NW is represented as a graph consisting of nodes, ports and links, where information about the communication and paths in each NW (Flow information, MPLS/optical paths, overlay tunnels, etc.) is abstracted as flow information. Furthermore, since these abstract NW models are used to perform inter-NW control functions such as virtualization and hierarchization, they also define control models such as Aggregator (aggregates an entire NW as a single virtual node), Slicer (splits a NW into multiple virtual NWs), Federator (integrates multiple NWs into a single entity) and Layerizer (condenses multiple layered NWs into a single hierarchy). Among the centralized management technology for multilayer networks, exhibitors presented multi-layer management control technology and optical cut-though technology aimed at packet transport NWs and optical core NWs. In the multi-layer management control technology, resource management control is performed to allocate the traffic of upper layers by searching for resources from the resource pool of lower layers to satisfy a request in response to a NW resource request from an application. In optical cut-through technology, the user is provided with low-latency communication quality by making proper use of packet and optical core NWs according to user requests, and by setting end-to-end optical direct paths where necessary. Outline descriptions of these technologies were given at the business session presentations, and at the O3 booth it was exhibited as a demonstration using panels and video footage.

3. SDTN interoperability demonstration showcase

At the iPOP2014 showcase, a 100Gb-class core metro access optical network (simulated) was built between data centers (also simulated) belonging to six businesses, and was used to demonstrate how unified transport control can be achieved using Software Defined Transport Network (SDTN) technology. Photo 1 shows the booths of each company participating in the interoperability demonstration. The optical network connecting

Figure 1: Booth allocations and a photo of the event in progress

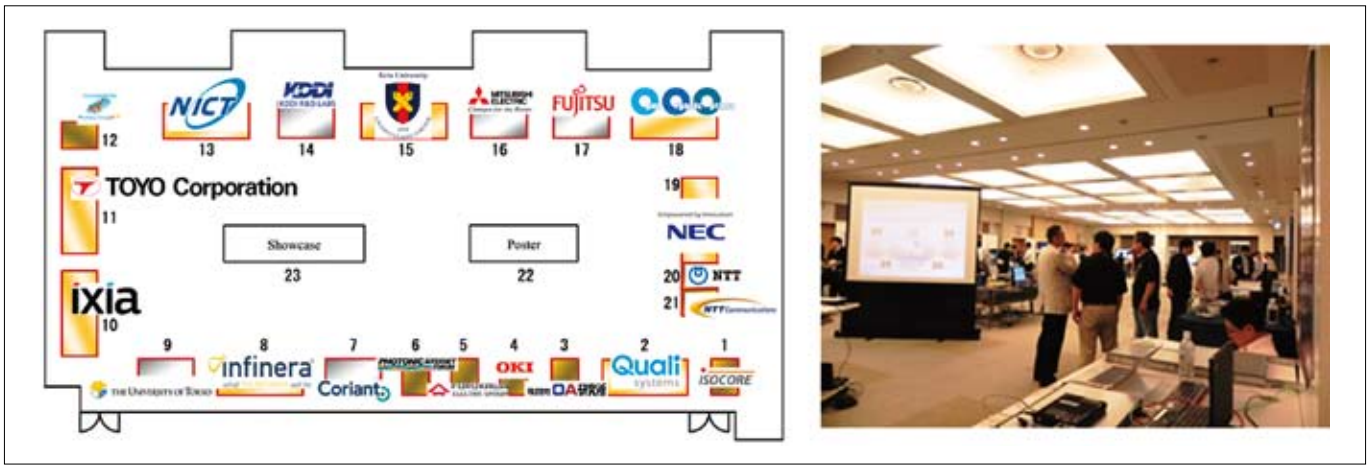

Photo 1: The O3 project exhibition

between the data centers consisted of a 100 Gbps optical wavelength division multiplexing (WDM) transmission system (provided by Mitsubishi Electric Co., Ltd.) and a 100Gbps-class optical packet/optical circuit integration node (provided by the National Institute of Information and Communications Technology) as a metro core optical network, and the access part connecting the simulated data centers (provided by Ixia and Toyo) was made from prototype next-generation optical aggregation network equipment (provided by Keio University) with elastic properties. These different types of equipment were centrally controlled by SDN/OpenFlow-based integrated control equipment (provided by KDDI R&D Labs), and the system successfully configured individual virtual optical networks according to requests (bandwidth requests) from the simulated data centers. The core, metro and access optical networks each have their own network control equipment, and supply information about their own managed physical networks to the integrated control equipment (SDN controller) as simple logical networks, enabling the control of large-scale optical networks including 100Gbps-class transport networks. The companies participating in the showcase brought actual equipment to the exhibition hall, and performed demonstrations by connecting with the booths of other companies. Details can be found online at http://www.pilab.jp/ipop2014/exhibition/whitepaper.html

4. Other exhibits

In addition to the organizations participating in the showcase and the businesses participating in the O3 project, two overseas vendors of transmission systems — Coriant and Infinera — also joined in to introduce their SDN systems called "Packet Optical SDN" and "SDN for Multi-Layer Core Networking", respectively. The overseas software vendor QualiSystems also took part, and introduced software for automating Agile networks (SDNs, cloud networks, etc.) and test environments under the theme of "Automation for Agile Infrastructure". The University of Tokyo performed demonstrations of technology including high-speed processing on real equipment by implementing Software Defined OpenFlow version 1.3 on the "FLARE" Deeply Programmable Network Node architecture. Also, Oki Electric Industry and Furukawa Electric, exhibited technologies called "SDN access area network for fixed and mobile services with virtualized PON", and "Wavelength Selective Switch", respectively.

5. Summary

The themes dealt with at iPOP have evolved over its ten-year history, starting with cooperation between optical and IP networks, and then moving on to GMPLS (Generalized Multi-Protocol Label Switching) control, data planes such as MPLS-TP (Transport Profile) and 100Gbps optical transmission, and then network control based on SDN. But although these technologies have changed, it is expected that technical developments will continue to be made in the enhancement of networks through collaboration between data planes and control/management planes. The idea of OpenFlow with a separate D-plane and C-plane is thought to have provided the idea that it is possible to make independent advances in each area of expertise in hardware and software. In the future, we can expect independent developments in each technical field. For example, to cope efficiently with increasing levels of traffic as on the Internet, the further increases in capacity of transmission technologies such as 400Gbps optical transmission and 400Gbps packet transport are mainly the result of advances in hardware technology. On the other hand, to adapt flexibly and promptly to increasingly diverse services, it is expected that SDN/NFV technologies that implement software-defined data planes and network functions in commoditized switches and servers will be further enhanced by incorporating software technology cultivated from cloud technology. Having passed its ten-year milestone, iPOP is expected to continue driving the evolution of new network technology for the next ten years.

Photo 2: Booths of companies participating in the SDTN interoperability demonstration using 100Gbps-class optical network equipment

Ixia Communications K.K. | TOYO Corporation | Mitsubishi Electric Corporation | National Institute of Information and Communications Technology (NICT) | Keio University | KDDI R&D Laboratories, Inc.