Interoperability activities for photonic networks in Japan

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Abstract — This paper details the leading edge photonic GMPLS inter-carrier interface interoperability testing of Layer-2 switching and Path Computation Element. These activities are promoted by the Interoperability Working group of the Kei-han-na Info-Communication Open Laboratories.

Index Terms — GMPLS, interoperability, multi-vendor, field trial

I. INTRODUCTION AND FRAMEWORK OF KEI-HAN-NA INFO-COMMUNICATION OPEN LAB.

Generalized Multi-protocol Label Switching (GMPLS) [1] is a set of network control protocols to realize the next generation high performance transport network.

The National Institute of Information and Communications Technology (NICT) Kei-han-na Info-Communication Open Laboratory [2] is promoting interoperability and new protocols for GMPLS.

The Open Lab. was established in 2003 with the objective of carrying out research and development activities. Figure 1 shows an organization of the Kei-han-na Info-communication Open Lab. The Open Lab owns research facilities including GMPLS enabled IP routers, GMPLS enabled Time Division Multiplexing (TDM) cross-connect systems (XCs), the 10 Gbit/s high-performance network infrastructure, and access point to the JGN II network (now JGN II-plus network). Belong to the New Generation Network Sub Committee, the interoperability working group is operated. The active members of the working group are as follows.

- NTT
- KDDI R&D Labs.
- NEC
- Fujitsu/Fujitsu Lab.
- Mitsubishi Electric
- Hitachi/Hitachi Communications Technologies
- Anritsu
- Keio University
- Oita University
- NICT

The research and development target of the working group is the control and transport interface in the photonic transport network layer between carriers. This interface is called the External Network to Network Interface (E-NNI). The working group works with three projects (PJs).

PJ21: 10GE-LANPHY over OTN technologies
PJ22: GMPLS E-NNI and all optical network control protocol
PJ23: New Generation 100GE transmission and control

II. THE-STATE-OF THE ART ACTIVITIES

A. Inter-Carrier PCE-based Path Computation[3] by PJ22

The interoperability test on Path Computation Element communication Protocol (PCEP) is performed among four venders/carriers. The activities include single domain, single PCE environment and inter-carrier PCE-based diverse path communication as shown in Fig.2.

Inter-carrier diverse route set up process is as follows;

STEP-1: The primary path is set up using two PCEs.
STEP-2: The ingress AS’s PCE receives “Path Key” from the other AS’s PCE.
STEP-3: The disjoint diverse path is set up using the Path Key ID and the Exclusive Route Object.
The future target is more sophisticated inter-carrier traffic engineering using PCEs.

Figure 2: Inter-carrier diverse PCE-based path computation

B. New generation Ethernet Transport and Control Technologies by PJ23

Ethernet is one of the most promising technology for next generation backbone network. The Open Lab covers both physical and control, architecture and transmission technologies. To apply Ethernet transport technology to the carrier backbone network, enhancement of the traffic engineering (TE) technology, reliability, manageability, and operation, administration, and maintenance (OAM) technology are needed. To meet these requirements, we are researching on the new generation Ethernet transport network.

This June, we had succeeded the layer-2 switch capable (L2SC) multi-carrier, multi-domain Automatically Switched Optical Network (ASON)/GMPLS interworking. This was demonstrated at iPOP2008 [4] sponsored by the Photonic Internet Lab. (PIL) [5] and ISOCORE [6]. L2SC is GMPLS based Ethernet virtual LAN (VLAN) tag control method. The Internet Engineering Task Force (IETF) is now discussing the L2SC for applying the provider backbone bridge traffic engineering network (PBB-TE).

Figure 3 shows a high-level schematic diagram of the demonstration. There are three domains. NICT provides the ASON overlay model domain, NICT, Keio University, and KDDI Lab. provide the GMPLS peer model domain, and KDDI Lab. Provides the GMPLS peer model domain. Two types of GMPLS architecture, that is ASON/GMPLS or overlay/peer model is interworking, though the E-NNI [7]. This L2SC ASON/GMPLS and GMPLS/GMPLS interworking demonstration is the first trial in the world.

III. WORKING GROUP ACTIVITIES

The working group has more than 22 International Standard Contribution and 12 International Journal and Conference activities. Especially, 10GE-LANPHY over OTN was including ITU-T G. supplement 43. In addition, 3 times of open demonstration of PCE and L2SC technologies in the international conference and exhibitions.

IV. CONCLUSION

IP+Optical technology is the key for future high-performance backbone networks. To realize this key technology, NICIT is supporting the interoperability research consortium at Kei-han-na Open Lab. This consortium is determined to develop a practical GMPLS inter-carrier interface. A recent advance is the PCEP interoperability test and the L2SC GMPLS controlled multi-domain Ethernet VLAN path setup trial. As a next step of the interoperability activity, we will challenge the inter-carrier diverse PCE-based path computation and the nationwide L2SC GMPLS field trial.

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