Interoperability effort for ubiquitous GMPLS controlled optical networks
- Activities of the Kei-han-na Open Labs. -

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Agenda

- Kei-han-na Info-Communication Open Laboratories.
- Activities of the interoperability Working Group
  - 10 GbE-LAN PHY direct mapping over OTN
  - Inter-Carrier PCE based path computing
  - ASON/ GMPLS interworking
  - L2SC Multi-domains interworking
- Summary
Kei-han-na Info-Communication Open Laboratory Overview

- Established at 2003
  - To establish a global-standard info-communication sectors in Japan “Kansai” region through industry, academia, and government collaboration.
  - National Institute of Communication Technology (NICT) provides rental lab space and rental research facilities.
    - IP routers, TDM-XC
    - Access point to the JGN2-plus network

Creating new industries and services
Human resource development
Organization of the Kei-han-na Info-Communication Open Laboratory (2006-)

General Assembly of the Council

Board of Directors

Secretariat

Operation and Research Committee

Sub Committees

Planning and Publication

New Generation Network

Human Communications

Universal & Robot City

Working Groups (WGs)

Interoperability WG2.0

PJ21: 10GE LAN-PHY over OTN technologies

PJ22: GMPLS E-NNI and all optical network control protocol

PJ23: New generation 100GE transmission and control

Photonic

Network Application
Interoperability WG 2.0 R&D items

- Ethernet based transmission network hierarchy

- New Generation Ethernet transmission and control
  - 40GE & 100GE over OTN technologies
  - Terabit LAN
  - GMPLS controlled Ethernet
    - will be demonstrated at EXHIBITION

- GMPLS E-NNI and all optical network control protocol
  - Multi-layer inter-carrier E-NNI
  - Inter-Domain/Inter-Carrier PCE
    - will be demonstrated at EXHIBITION

- All optical network control for ROADM and PXC
10GbE-LANPHY direct mapping technology over OTN

- "OTN (Optical Transport Network)" has been standardized at ITU-T.
  - Bit rate is optimized for SDH/SONET.
- Simple 10GbE signal directly mapping into OTN is required.
  - Interoperability test at Kei-han-na site with 10 carriers/vendors.

Data transfer by using simple protocol stack
Interoperability testing of over-clocked 10GbE-LANPHY/ OTN

- Joining 10 carriers/vendors
- Interoperability test items
  - Connectivity (100% throughput, latency < 10μsec)
  - Alarm generation and monitor
    - Link Fault Signaling of 10 GbE LAN-PHY
    - Basic alarm and monitor of OTN

TRPN: Transponder (10 GbE-LAN <-> OTN)
REG: Regenerator
Inter-Carrier PCE-based Path Computation[1]

- Inter-carrier diverse route set up for WDM networks
  - Primary path calculation with Path Key ID
  - Secondary path calculation with XRO

ERO: Explicit Route Object
XRO: Exclude Route Object

ERO with Path Key ID
XRO with Path Key ID

Ingress

Egress
ASON/ GMPLS interworking in Lambda Networks [2][3]

- Signaling Interworking
  - ASON E-NNI <-> GMPLS signaling gateway (GW)

- Routing Interworking
  - BGP-TE extension
    - End-point information (address, interface ID, switching capability, and adaptation information)

![Diagram showing interworking between ASON and GMPLS domains](image)

**ASON** domain

- **UNI**
- **LSC Network**

**GMPLS** domain

- **E-NNI**
- **GW**
- **LSC Network**
- **BGP-TE**

[Image: Diagram showing interworking between ASON and GMPLS domains]
BGP-TE - Scalability Problem?

- draft-ietf-softwire-bgp-te-attribute-03.txt @ Sept. ‘08
  - Within AS (use for iBGP)
  - The scope and applicability of this attribute currently excludes its use for non-VPN reachability information.
- AS should be separated between IP/MPLS networks and non-IP (e.g. GMPLS) networks.
  - No eBGP peer between IP/MPLS networks and GMPLS networks.
L2SC Multi-domains interworking [4][5]

- GMPLS controlled Ethernet
  - Not PBB-TE
- Tag-VLAN vs. Port-VLAN
  - Tag-VLAN only, Port-VLAN only, and Mixed Tag and Port-VLAN
- Label swapping at each node
  - Indicates Tag/Port, VLAN-ID, Physical Port - Keio/NICT
  - Indicates pointer of preconfigured data - KDDI
    - Type-3 Label ERO Sub-Object is used.
First Demonstration @ iPOP2008
New Trial(1): BGP-TE interoperability

- Proprietary BGP-TE implementations
  - Align with draft-ietf-softwire-bgp-te-attribute-xx
- Interworking with BGP-TE and OSPF-TE
  - Extension of Node Attribute TLV or L1VPN LSA
New Trial(2): E-NNI less signaling GW

- Signaling interworking between E-NNI and [I-NNI (RSVP-TE)][6] | GMPLS RSVP-TE] becomes popular technique.
  - Signaling GW is located in the GMPLS domain.
- Signaling GW located in the ASON domain is also possible.
Summary

- Activities of the Kei-han-na Info-Communication Open Lab. Were described.
  - Interoperability testing of over-clocked 10GbE-LAN PHY over Optical Transport Network
  - Inter-Carrier PCE based diverse path calculation
  - ASON and GMPLS domains interworking
  - Multi-domain GMPLS controlled Ethernet

- Inter-Domain/Inter-Carrier interoperability is one of the most important work for deploying the IP/Ethernet over Optical Network services.
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References


