Operational Experience on GMPLS Optical Network Test Bed of Japan Gigabit Network II

Shuichi Okamoto

Tomohiro Otani*

Tatsuzo Koga

Tsukuba JGNII Research Center

*KDDI R&D Laboratories, Inc.

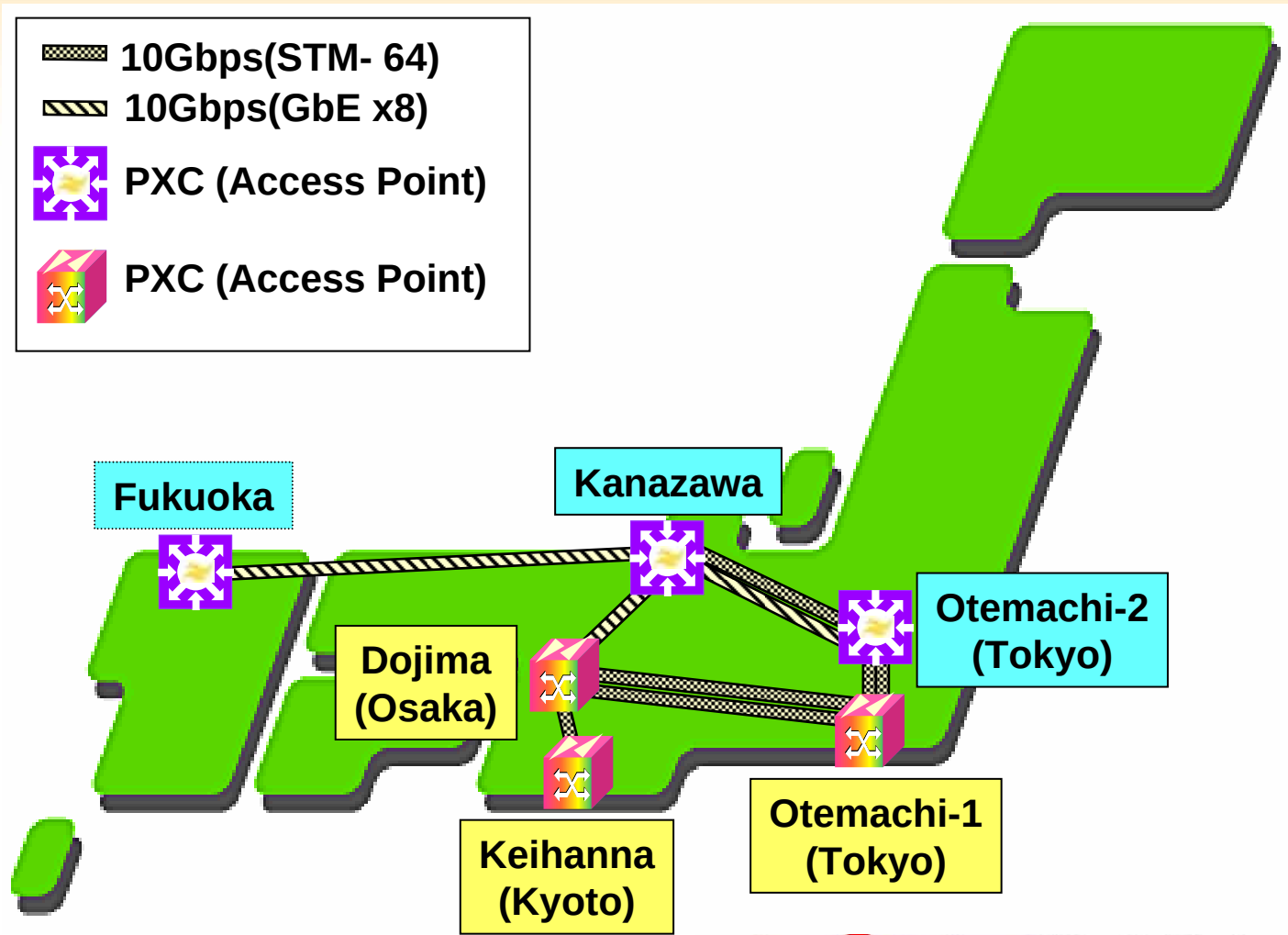
Overview of this presentation

- What's Japan Gigabit Network II (JGNII) ?
- Multi-service operation test on JGNII network
  - IPv6/MPLS transport over GMPLS LSP on JGNII GMPLS network
- GMPLS coordination with higher layer applications
- Operator's request for GMPLS developers
- Conclusion

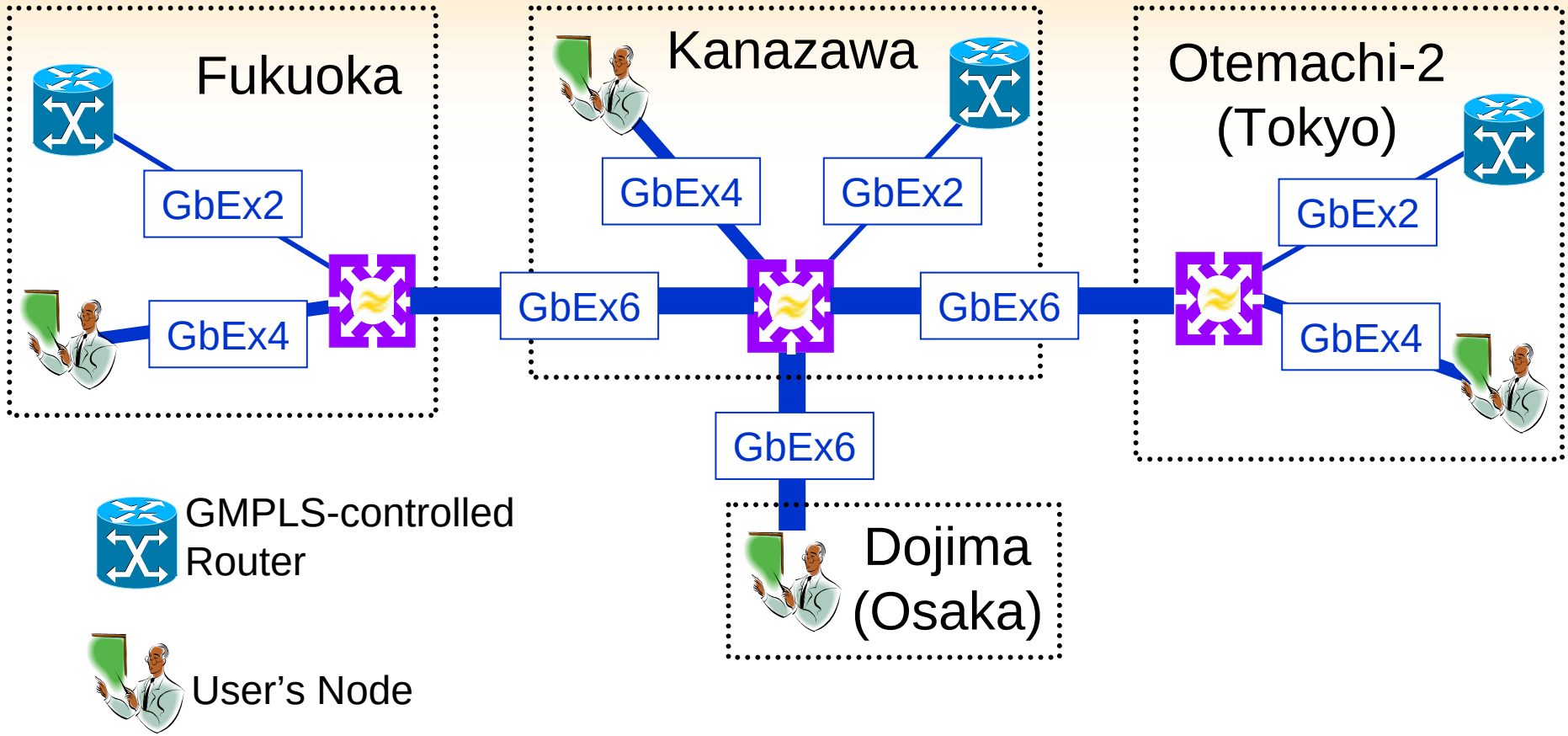
What's Japan Gigabit Network II (JGNII) ?

- R&D network test bed for universities, research institutions, and companies
- Non-commercial
- JGNII has been operated since April 2004
- An introduction of GMPLS and photonic cross connects (PXCs) technologies to a backbone network for the first time in Japan
- JGNII provides an optical path service by using GMPLS and PXC technologies as well as L2 or L3 services.

Brief overview of JGNII GMPLS network



OXC path service on JGNII GMPLS network(1)



OXC path service on JGNII GMPLS network(2)

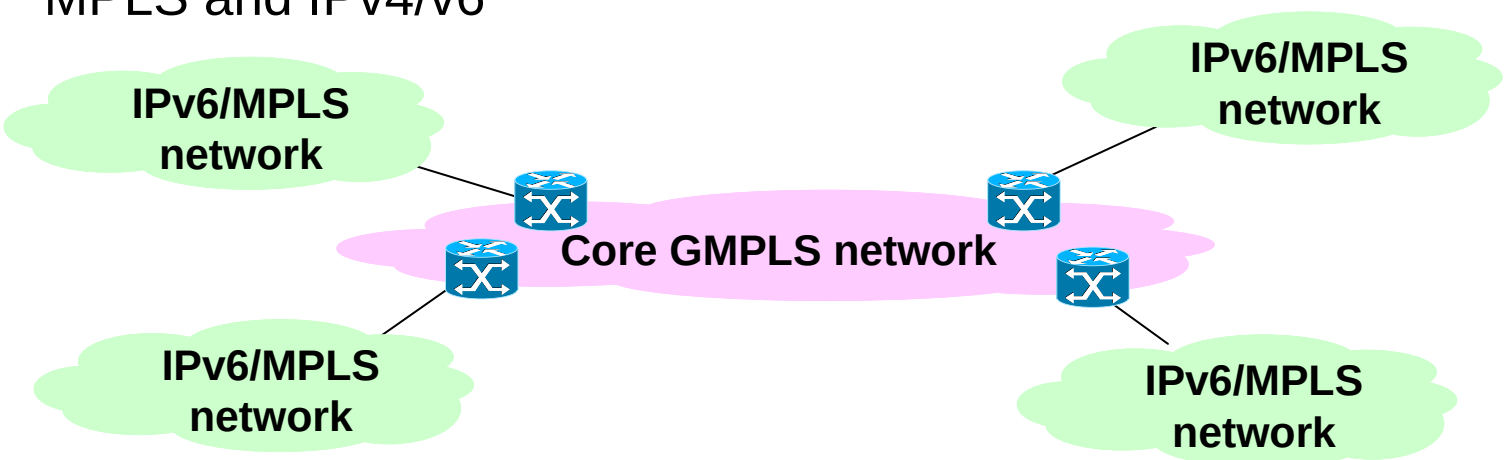
- Demand-based or user-oriented connection by JGNII OXC service
  - Large bandwidth
  - Fixed delay
  - Low jitter
  - Quick provisioning

Activities on Tsukuba JGNII Research Center

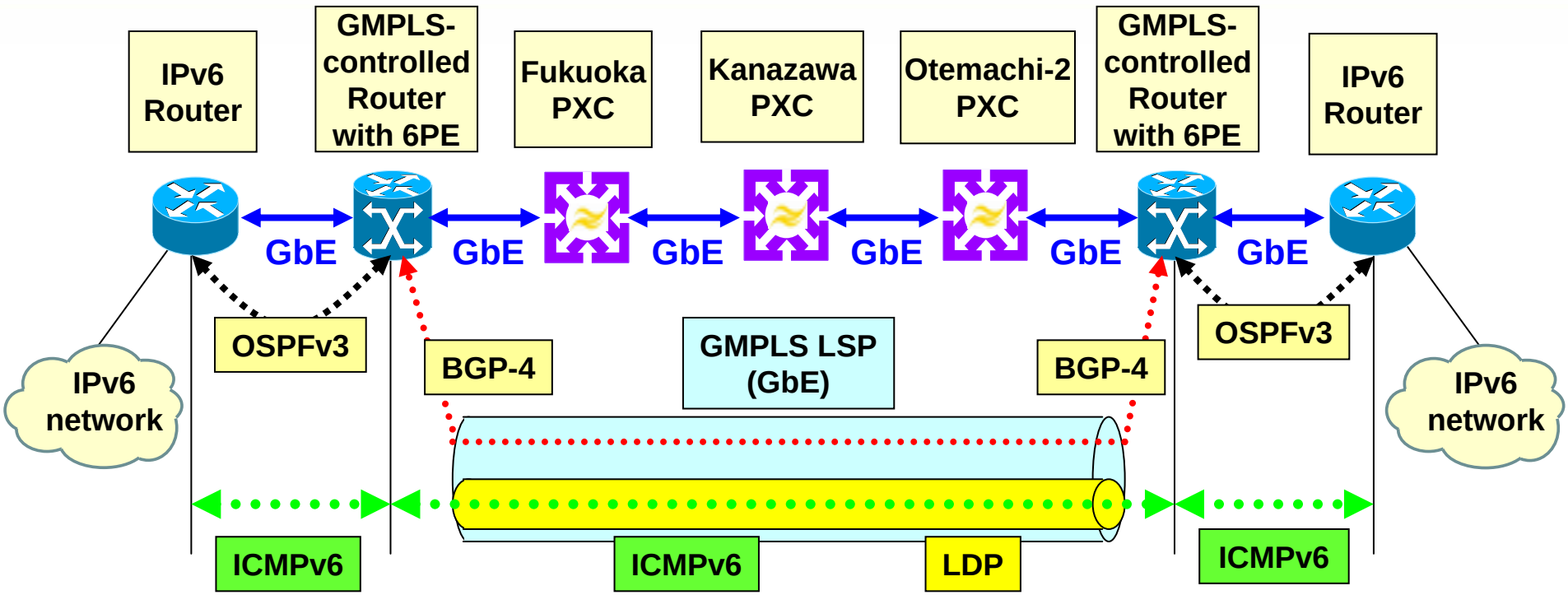
- Operation of GMPLS network
  - Management of PXCs, GMPLS-controlled routers, and the GMPLS network of JGN II
- R&D activities
  - Investigation of operation and administration of GMPLS network using JGNII

Multi-service operation test on JGNII GMPLS network

- Background
  - Next generation network model
    - Core: GMPLS network
    - Edge: IPv6/MPLS network
  - GMPLS-controlled optical network is expected to improve the efficiency of operation for providing higher layer services such as MPLS and IPv4/v6



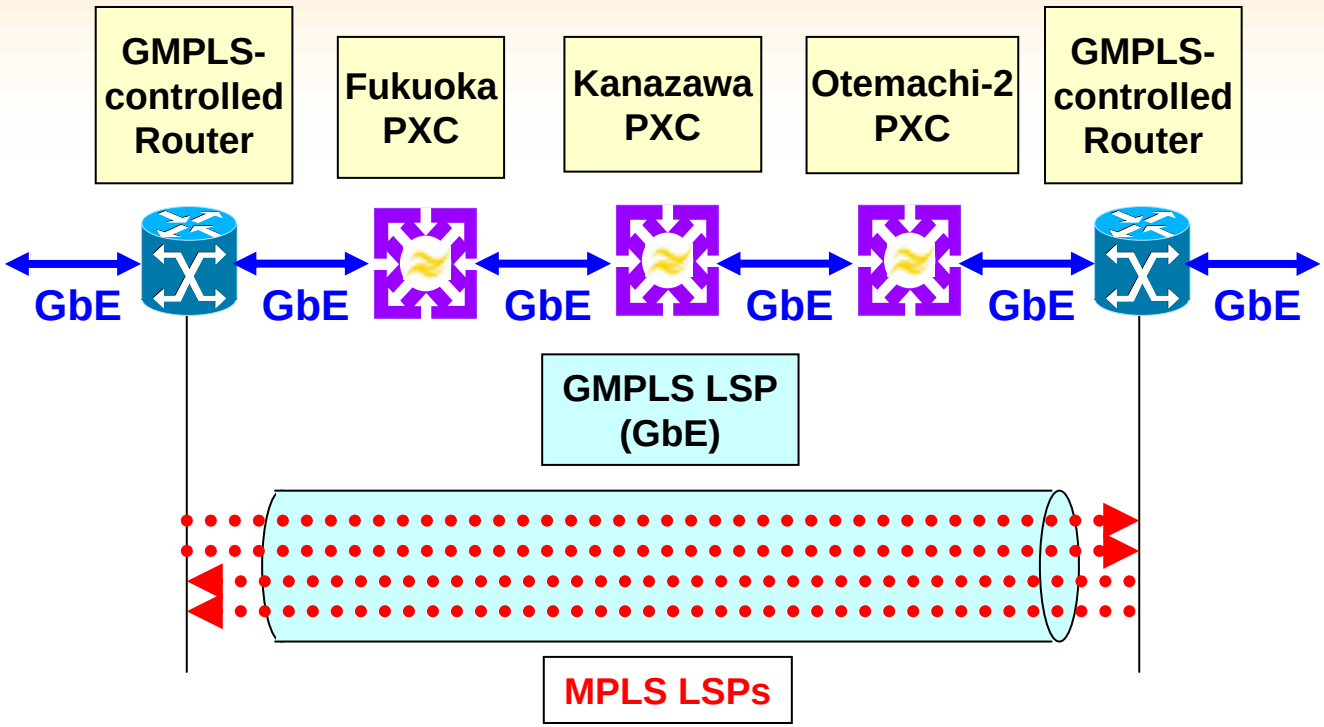
IPv6 over GMPLS: Experimental system



IPv6 over GMPLS: Procedures and results

- GMPLS LSP (GbE) creation between GMPLS routers
- IPv6 transport over GMPLS network
  - Assisted by the 6PE (IPv6 Provider Edge) function on GMPLS routers
    - An iBGP (BGP-4) session over GMPLS tunnels
    - A LDP session encapsulating IPv6 packets over GMPLS tunnels
  - IPv6 packets can be transmitted over GMPLS network
- OSPFv3 with GMPLS routers
  - Interoperability under the multi-vendor environment
  - Reachability confirmed by ICMPv6

MPLS LSP over GMPLS LSP



- MPLS LSP can be set up over GMPLS LSP with same GMPLS routers

Multi-service operation: Future issue and challenge

- Investigation of IPv6 network addressing and advertisement of IPv6 routing information
- Study for management method of GMPLS optical paths associated with other higher layer services (IPv6, MPLS, etc)
- etc

GMPLS coordination with higher layer applications

- Optical networks and IP networks are dominant functions in core networks.
- Increase of users requiring large-bandwidth (Grid, HDTV transport, etc)
- Nowadays optical network and IP network:
  - operated separately, and operator-based (manual operation)
  - requiring many days to start the service
  - not suited for demand-based use
- GMPLS technologies can set up optical paths autonomously and very quickly

GMPLS technology is the solution

Operator's requests for GMPLS developers

- GMPLS manager tool (management of PXCs, Routers, and any other GMPLS nodes)
  - Graphical & integrated
  - "Operator-friendly"
  - Quick response responding to quick provisioning
  - Integration of multi-layer network management
- Scheme for easy configuration
  - Many TE-links and LSP on GMPLS network
  - Risk of configuration error
- Much More INTEROPARABILITY!
  - Control plane
  - Management plane

Conclusion

- We have reviewed JGNII network test bed as well as its GMPLS network.
- Experiment of IPv6/MPLS transport over GMPLS networks
  - IPv6/GMPLS
  - MPLS/GMPLS
- JGNII GMPLS network is ready for providing IPv6/MPLS services.