

# Operation and research on GMPLS optical network testbed of JGN II

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# Agenda of this presentation

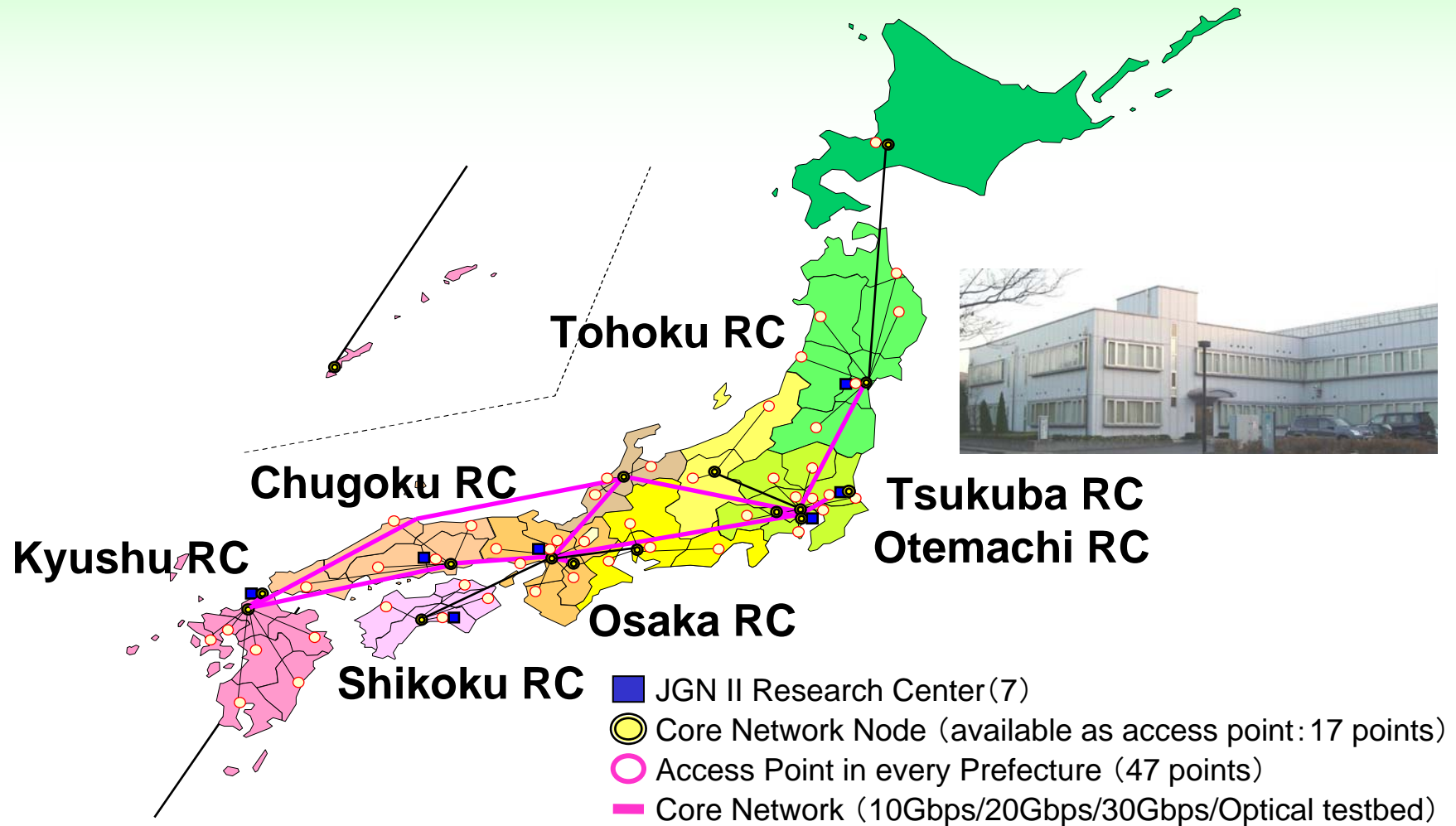
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- What's JGN II ?
- Overview of GMPLS/OXC network testbed of JGN II
- Experimental results of data transport / service over GMPLS network
  - MPLS transport over GMPLS
  - IPv6 transport over GMPLS
- Effective coordination with user and application
  - BoD (Bandwidth on Demand) service based on GMPLS technology
  - GRID over GMPLS network
- The updated evaluation results and future challenges
  - GMPLS E-NNI function
- Conclusions

# What's JGN II ?

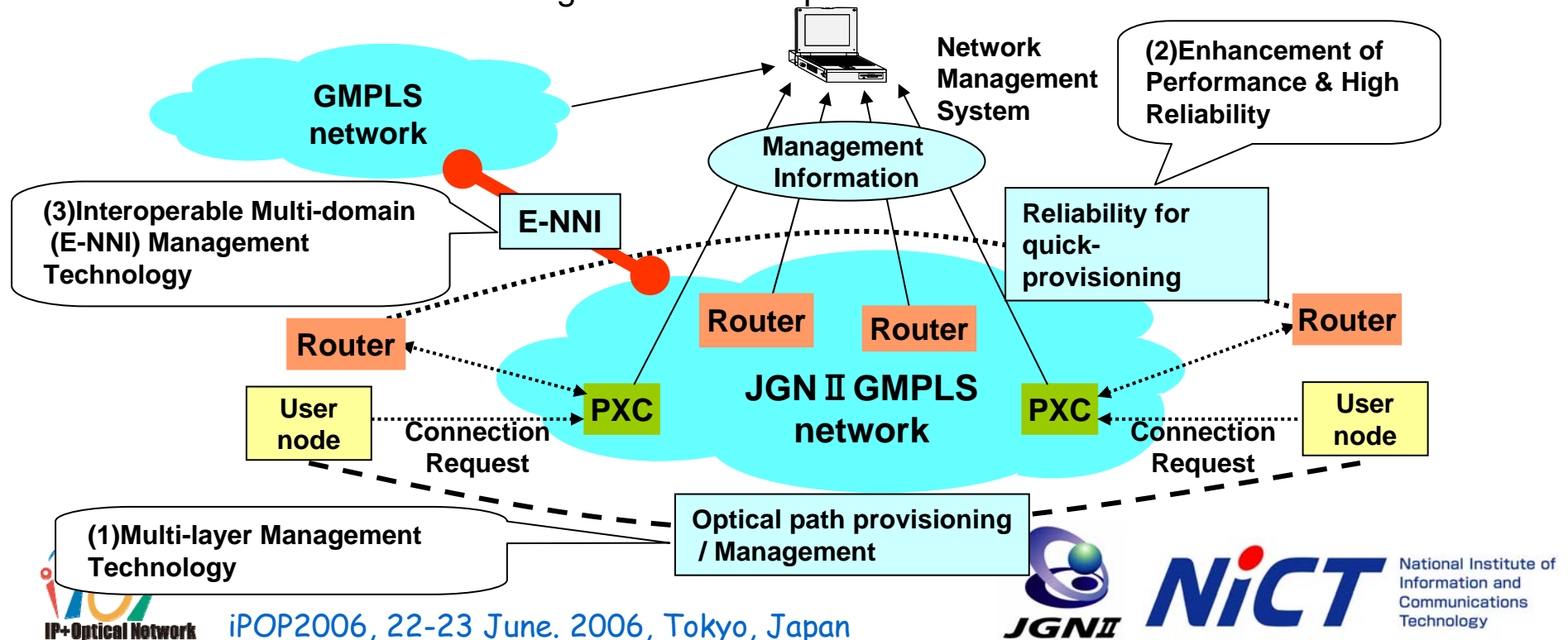
- R&D network testbed for universities, research institutions, and companies
- Non-commercial use only
- 64 access-points on every prefecture
- JGN II has been operated since April 2004 by National Institute of Information and Communications Technology (NICT).
- JGN II has some international lines (Japan-US, etc)
- An introduction of GMPLS and photonic cross connects (PXC) technologies to a backbone network for the first time in Japan.
- JGNII provides optical path service by using GMPLS and PXC technologies as well as L2 or L3 service on top of the GMPLS network.

# Network, Access Points, Research Centers of JGN II

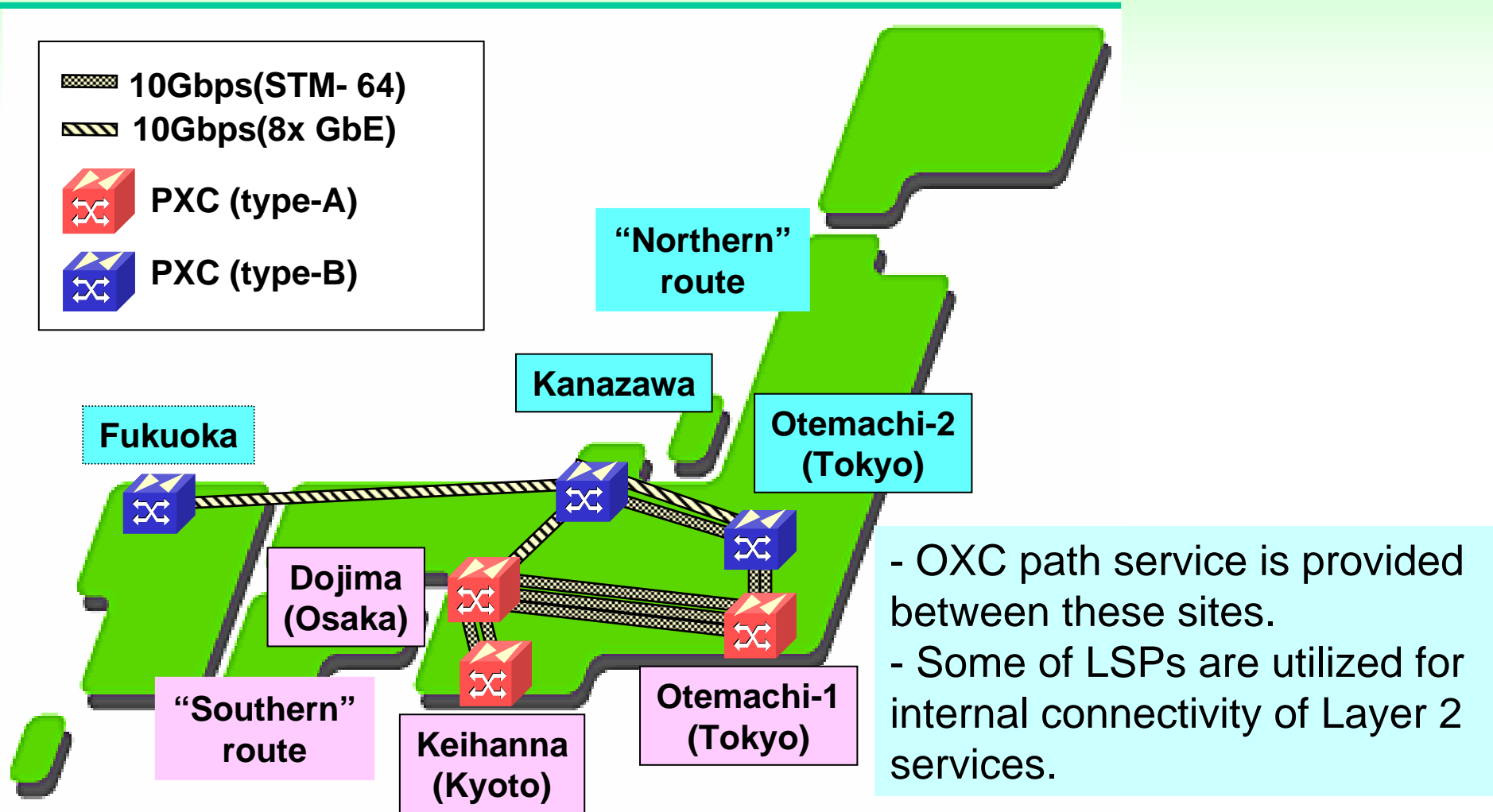


# GMPLS related research activities

- Multi-layer management technology
  - Lambda-LSP provisioning network management and control mechanism
  - Application driven network control and management technology
- Enhancement of performance and reliability of GMPLS Network
  - Reliability of control plane as well as data-plane, including line monitoring
- Interoperable multi-domain (E-NNI) management technology
  - GMPLS Interworking between multiple domains



# Brief overview of JGNII GMPLS network



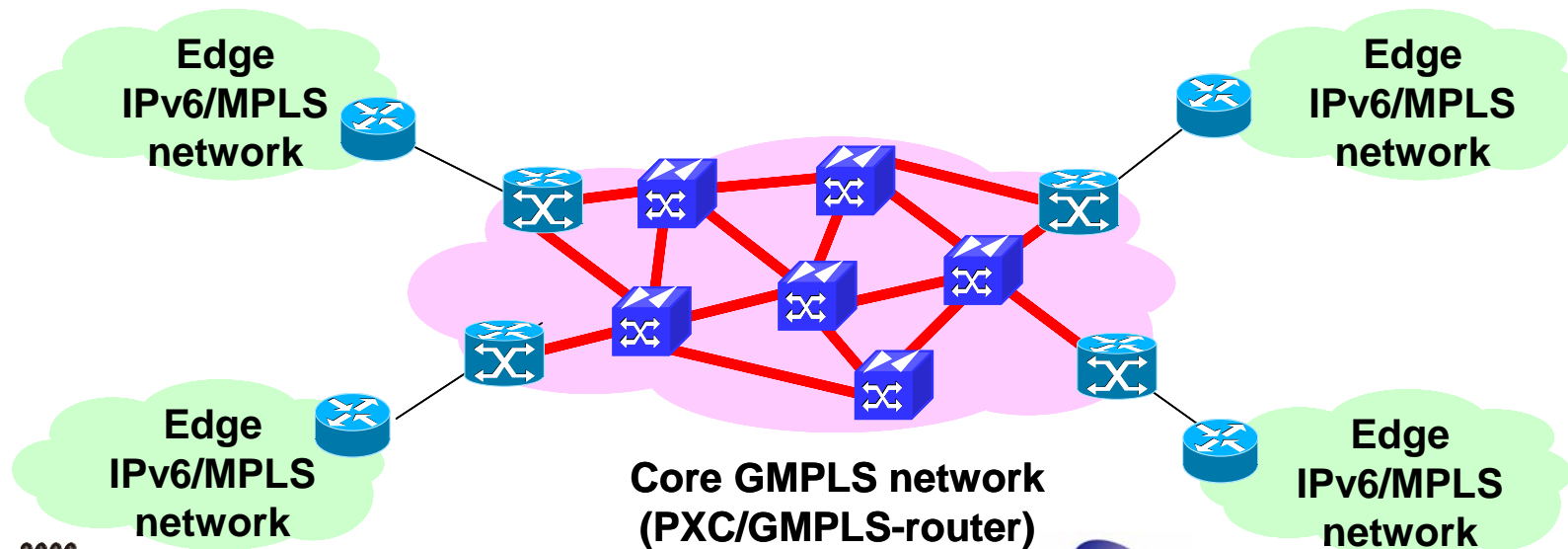
# Our activities

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- Daily operation of JGN II GMPLS network
  - Management of PXC, GMPLS-controlled routers, and the GMPLS network of JGN II
  - Provisioning and daily monitoring the GMPLS LSPs
- R&D activities
  - Investigation of operation and administration of GMPLS network using JGNII

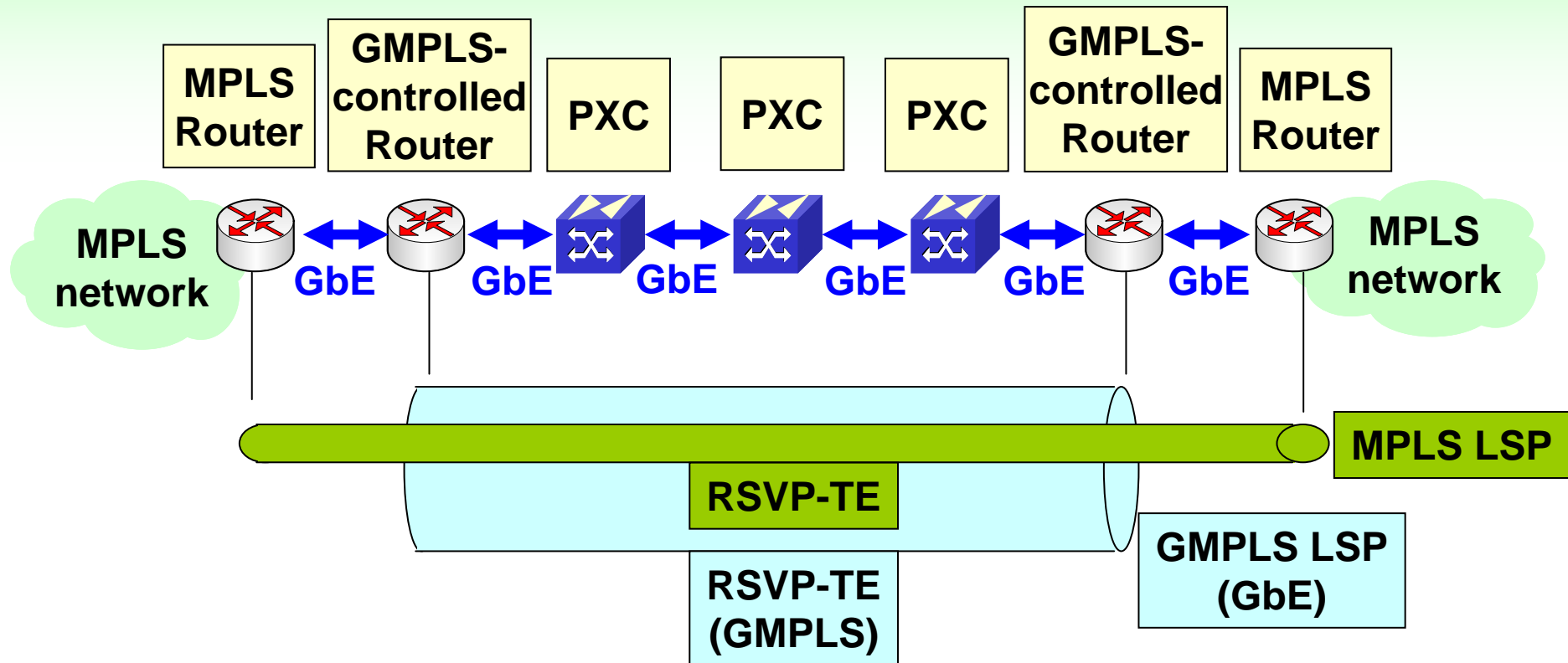
# IP/Optical integration model of JGN II

- Currently investigating network integration model in JGN II
  - Core: GMPLS network
  - Edge: IPv6/MPLS network
  - Fully-peer GMPLS model as well as overlay GMPLS model
- How to manage and operate such GMPLS-based integrating IP/Optical network for MPLS and IPv4/v6 services is our target.



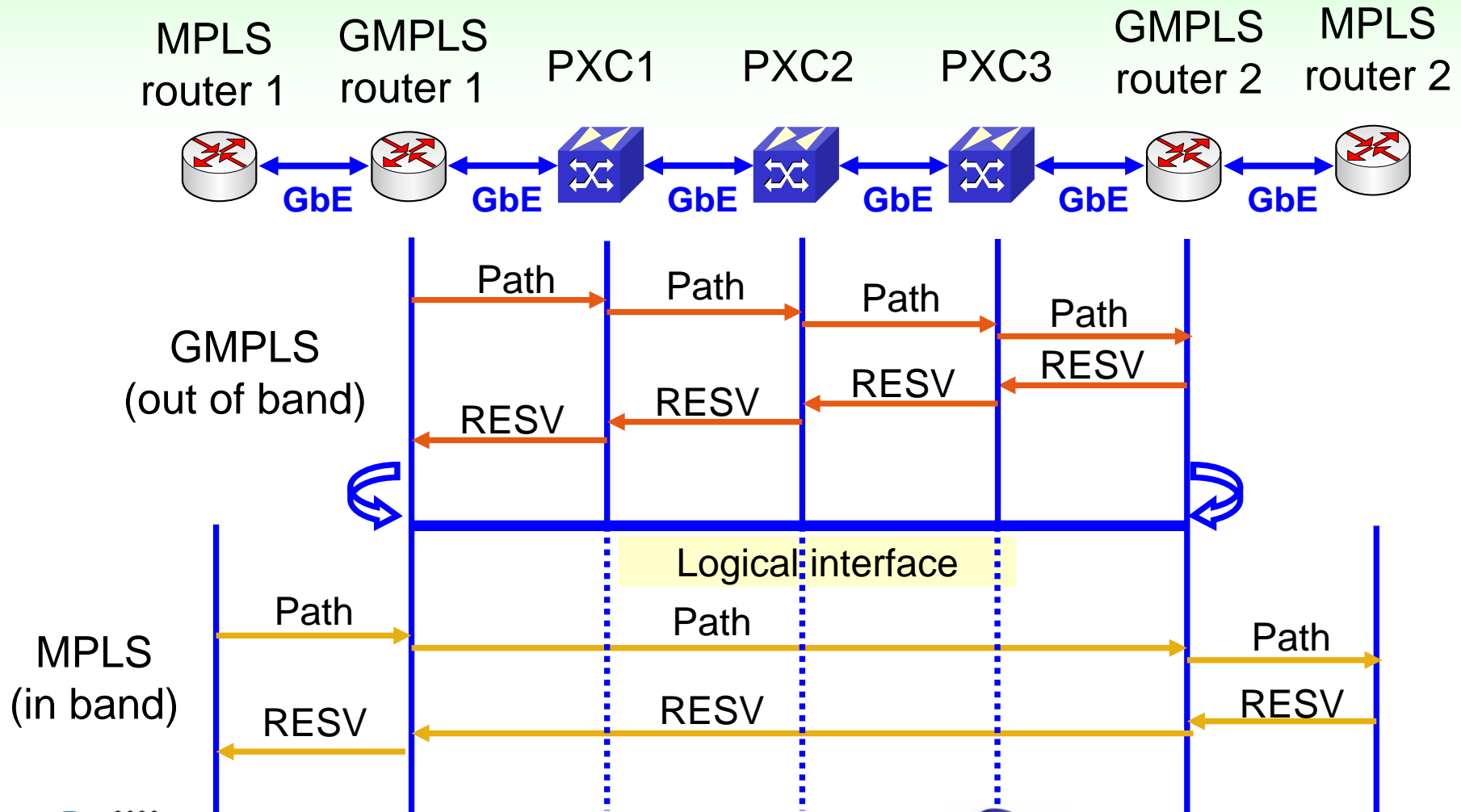


# MPLS LSP over GMPLS LSP

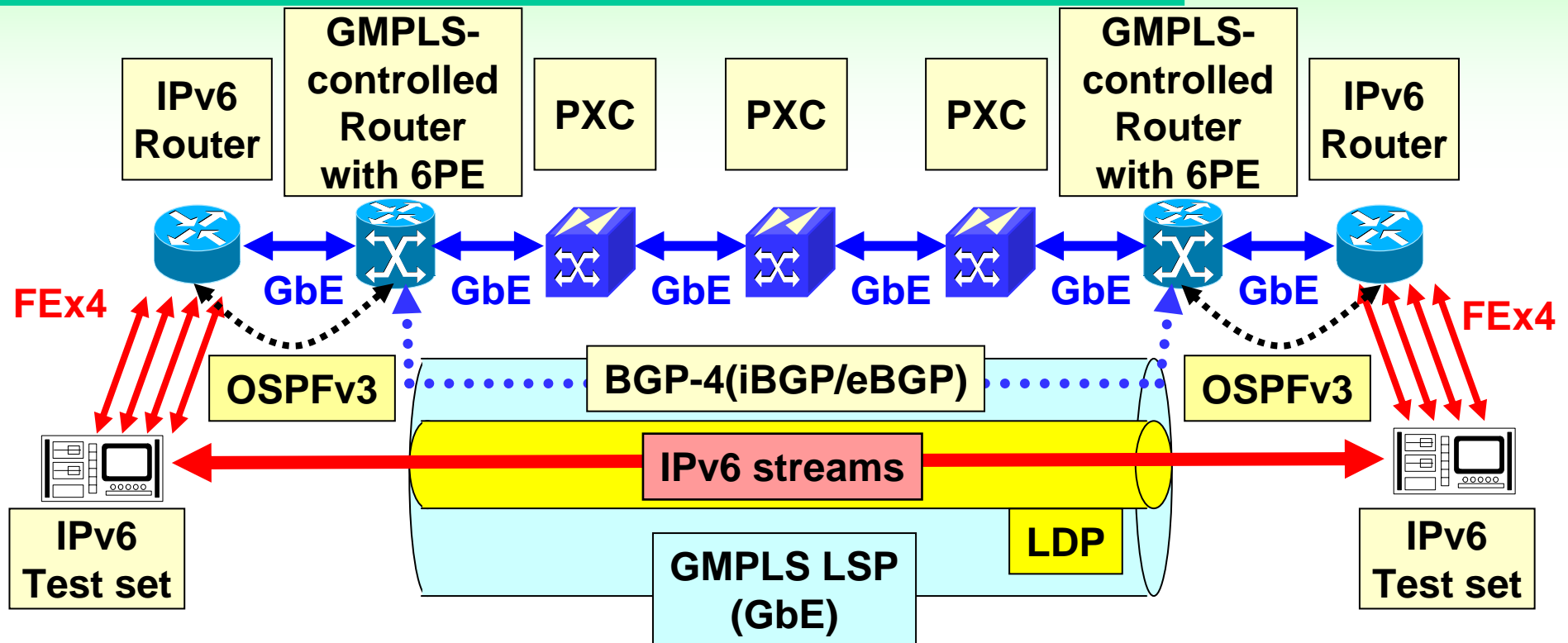


- MPLS LSPs could be set up over a GMPLS LSP even with the same routers.
- The MPLS service has already been provided to the MPLS network testbed called Distix.

# MPLS/GMPLS Signaling Sequence



# IPv6 over GMPLS: Procedures and results



- IPv6 stream transport between IPv6 test sets each other

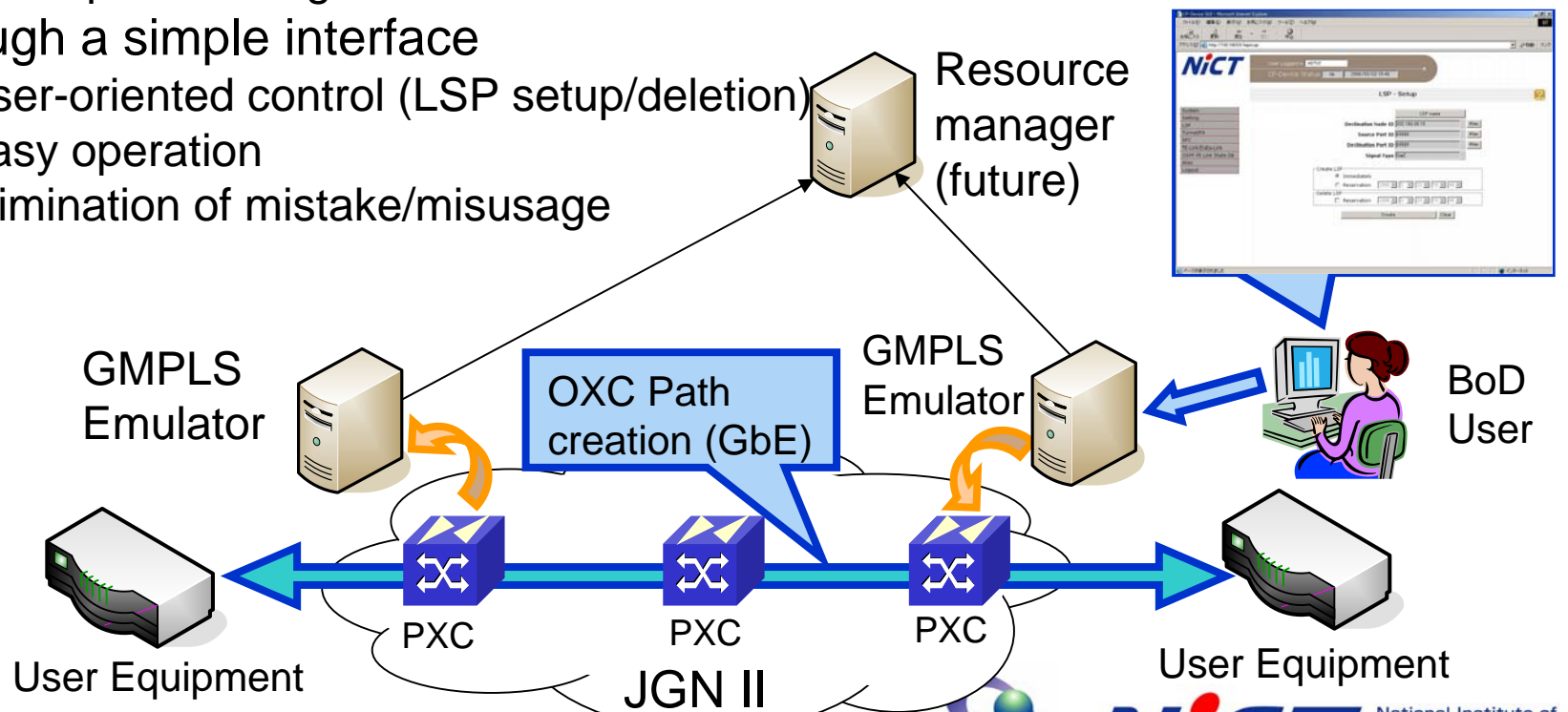
# Effective coordination with user and application

- BoD (Bandwidth on Demand) service based on GMPLS technology
  - High quality network service with user-oriented scheme
  - GMPLS technology is suited for BoD service
  - Simple and user-friendly service
- GMPLS networks resource control --- driven by GRID applications
  - Introduction of network resource management system (NRM) in order to coordinate between Grid resource scheduler (GRS) and network resources
  - Need to define interfaces between GRS and NRM
- Network operators' acceptable GRID service model
  - The controllability of network resources can be limited by NRM.

# BoD service based on GMPLS technology (1)

- BoD service based on GMPLS technology
  - Large bandwidth (GbE/10G)
  - Fixed and low delay
  - Low jitter
  - Quick provisioning
- Through a simple interface
  - User-oriented control (LSP setup/deletion)
  - Easy operation
  - Elimination of mistake/misusage

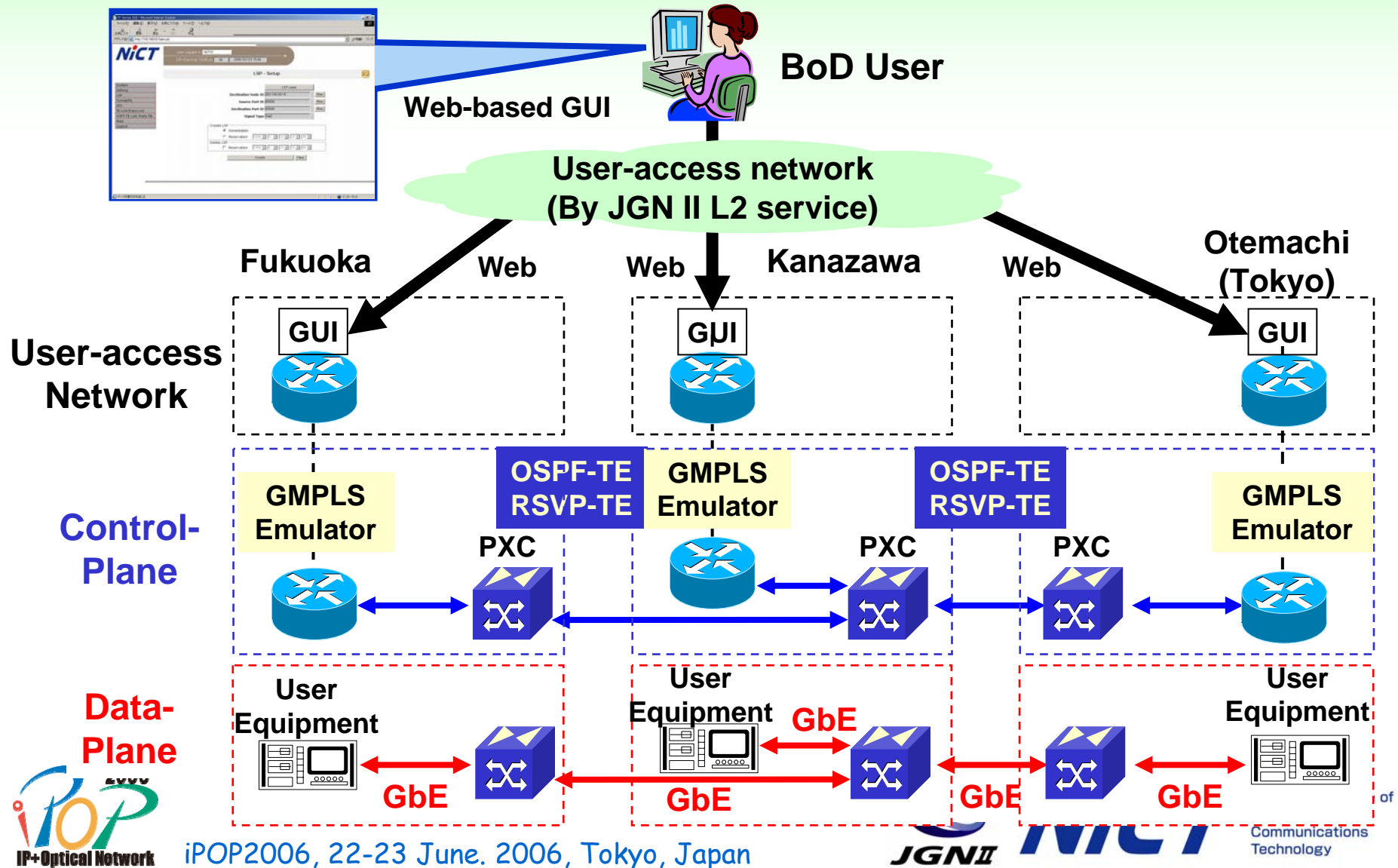
Desired service information  
(location, time, date, capacity)



# BoD service based on GMPLS technology (2)

- GMPLS emulator on JGN II GMPLS network
  - Emulating GMPLS routing (OSPF-TE) & signaling (RSVP-TE) protocols same as a GMPLS router
  - Working as a GMPLS peer-model node
  - No data-plane (as data-plane, user equipment is directly connected to OXCs)
- Evaluating web-based GUI (Graphical User Interface) function for GMPLS emulator
  - The BoD user accesses the GMPLS emulator through the GUI.
  - Simple & easy operation for the BoD user
  - Taking away the topology of core GMPLS network from the BoD user
  - Limitation of available resources (nodes, data-plane ports, etc) in order to cut off the user's mistake and misuse

# Experiment of BoD service : Configuration



# Experiment of BoD service : Procedures

**User: Access the GUI through the web browser**



**User: Input parameters, or call up the combination of parameters**



**GMPLS emulator: Set up the GMPLS LSP by using RSVP-TE signaling from the parameters**



**GUI of GMPLS emulator: Inform user of the result of setting up the GMPLS LSP**



**User: Available the service**



# Experiment of BoD service : Web-based GUI

CP-Device GUI - Microsoft Internet Explorer

ファイル(F) 編集(E) 表示(V) お気に入り(A) ツール(T) ヘルプ(H)

お気に入り 更新 戻る 進む 中止

アドレス(D) http://192.168.5.5/login.cgi

**NiCT**

User Logged in HDTV1

CP-Device Status Up 2006/03/23 15:46

LSP - Setup

HELP

LSP name

Destination Node ID 202.180.38.15 Alias

Source Port ID 69888 Alias

Destination Port ID 69889 Alias

Signal Type GigE

Create LSP

Immediately

Reservation 2006 3 23 15 45

Delete LSP

Reservation 2006 3 23 15 45

Create Clear

System

Setting

LSP

Tunnel/FA

SPC

TE-Link/Data-Link

OSPF-TE Link State DB

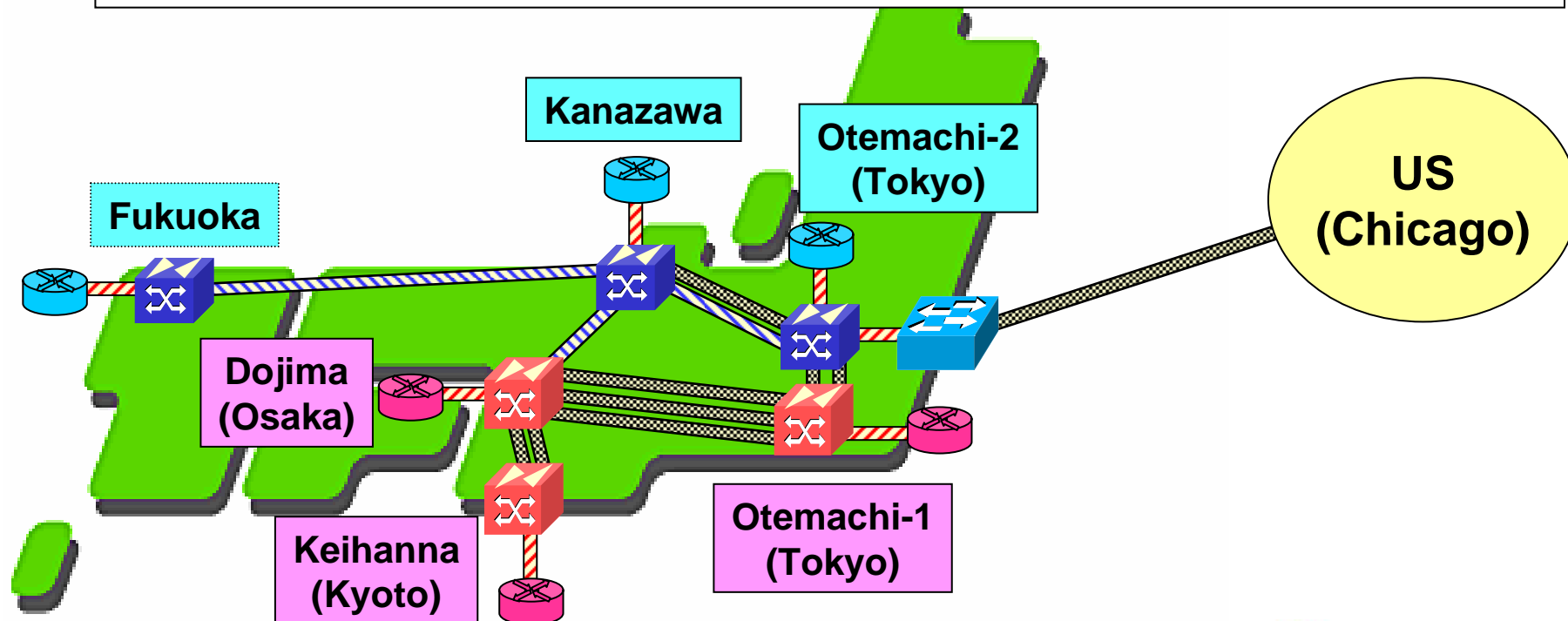
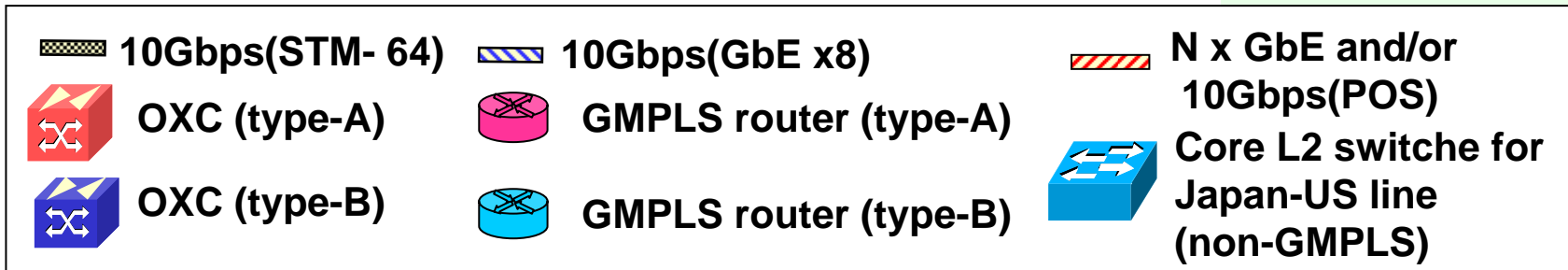
Alias

Logout

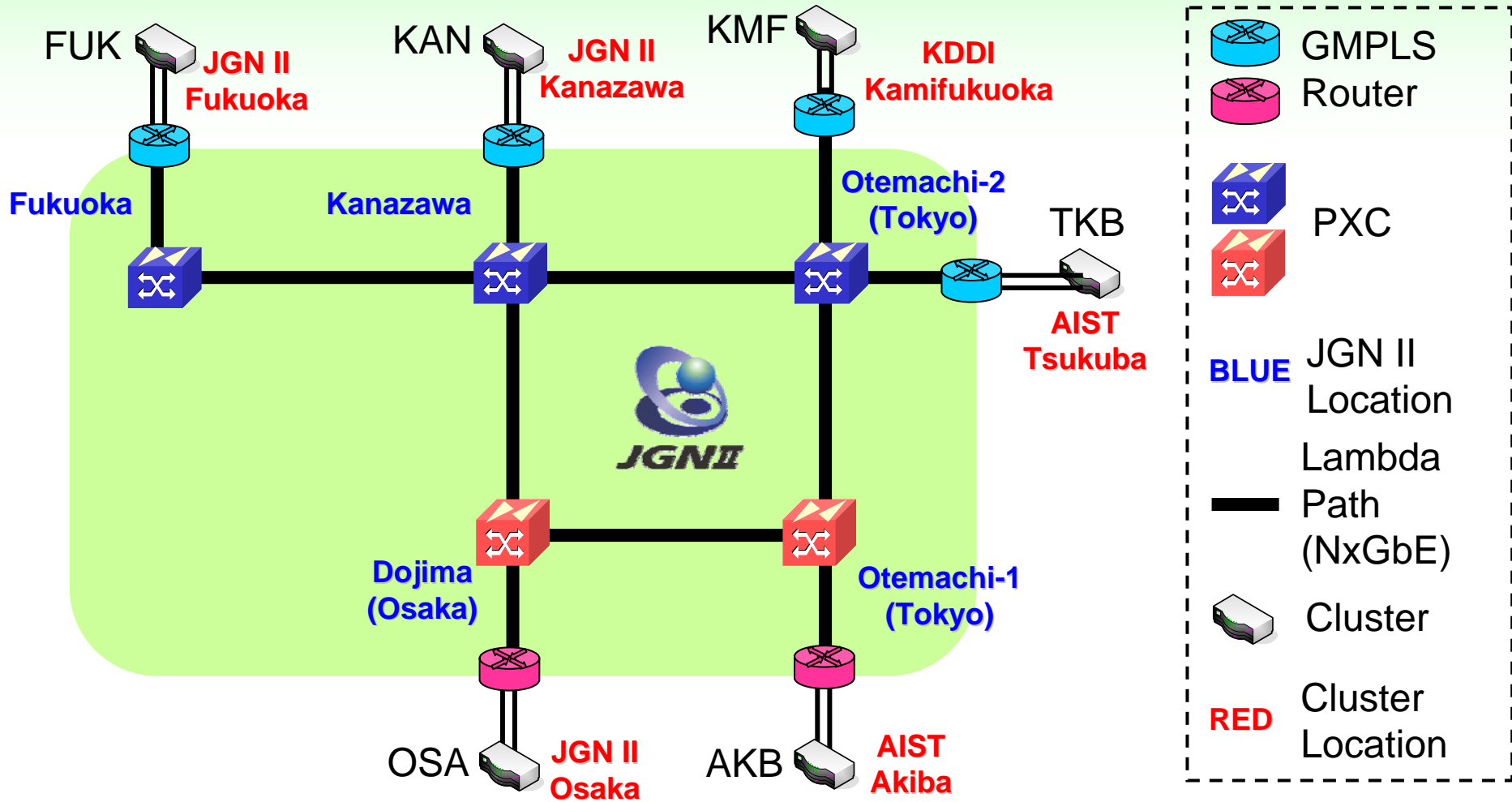
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# Detail topology of JGNII GMPLS network

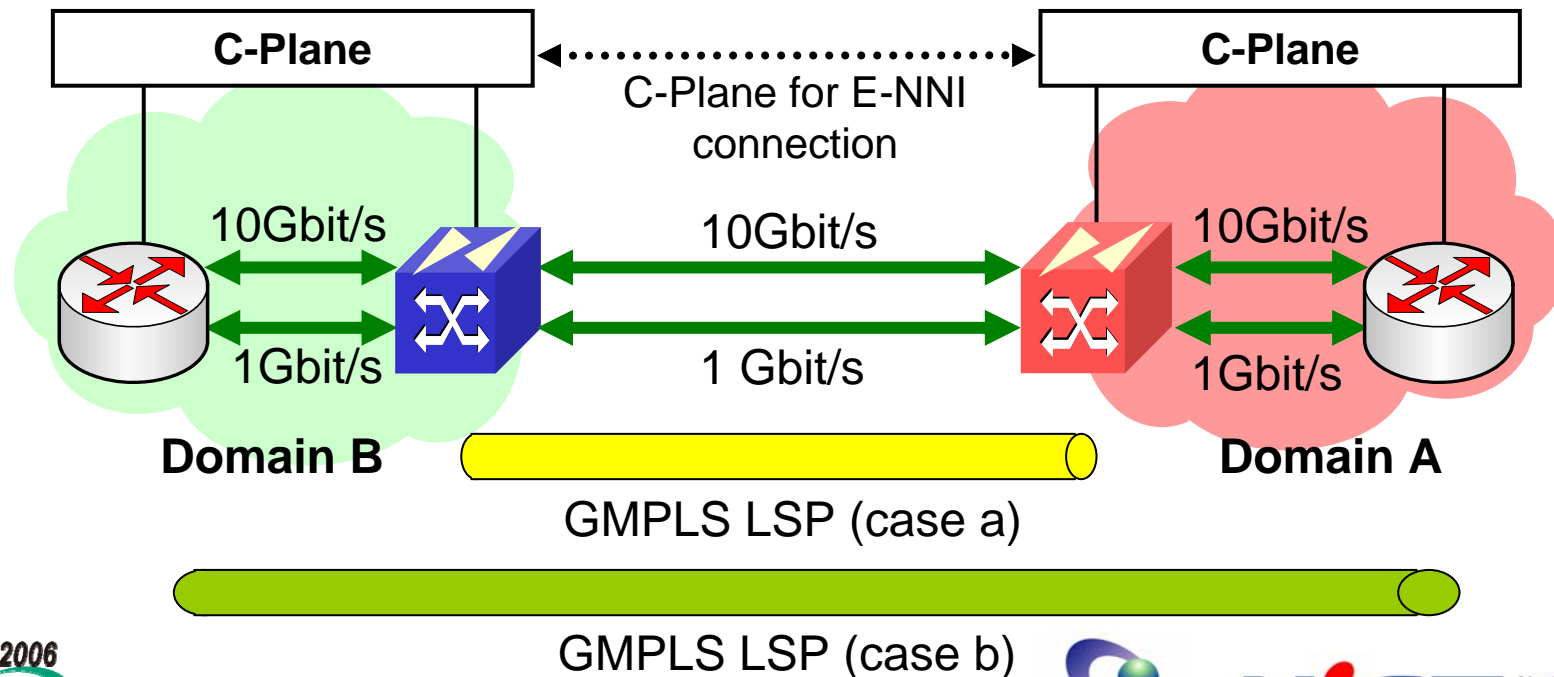


# GRID over GMPLS network: Network configuration in iGRID'05



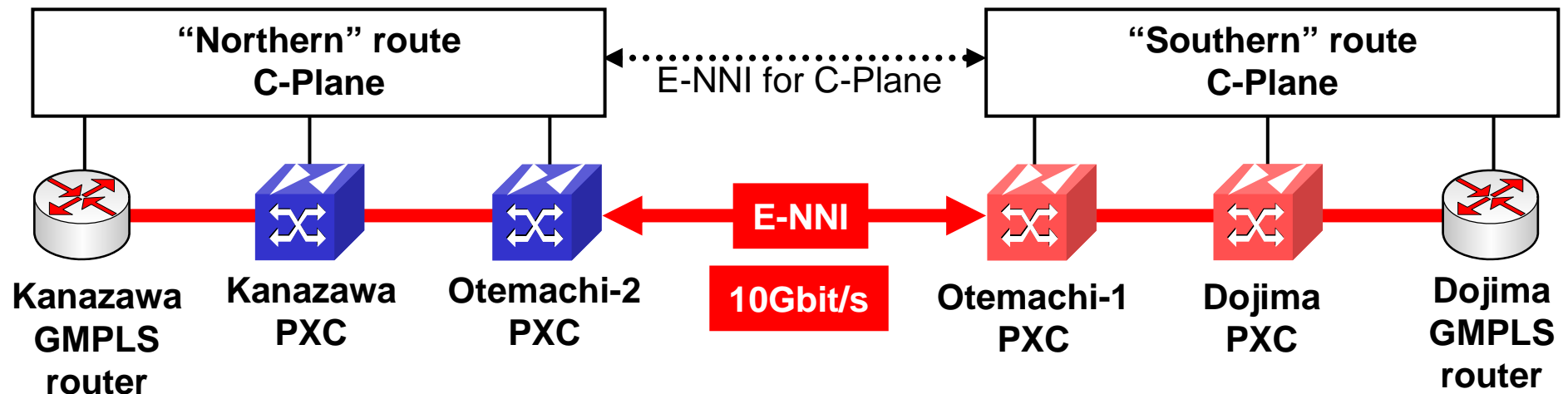
# Evaluation of GMPLS E-NNI function (1)

- GMPLS multi-domain (E-NNI) connection on JGN II GMPLS network
  - GMPLS E-NNI signaling
  - GMPLS E-NNI routing
  - C-Plane construction suited for E-NNI connection



# Evaluation of GMPLS E-NNI function (2)

- GMPLS E-NNI signaling
  - Using RSVP-TE signalling
  - LSP was successfully created over multiple domains by fully setting the explicit route.
- GMPLS E-NNI routing
  - Static routes were configured on domain-border nodes.
  - Dynamic routing mechanisms between domain border nodes : Under investigation
    - BGP-4
    - PCE



# Conclusions

- JGN II network testbed, especially focusing on GMPLS/PXC was introduced.
- Experimental results of data transport over GMPLS network
  - MPLS over GMPLS
  - IPv6 over GMPLS
- The effective coordination with user and application was shown.
  - BoD service based on GMPLS technology
  - GRID over GMPLS network
- The updated evaluation results and future challenges were also introduced.
  - E-NNI function
- JGNII GMPLS network is ready for providing OXC path service as well as IPv6/MPLS services to the users.

Thank you !!



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**NiCT**

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