

MPLS-IX - New IX Architecture -

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Goal of this presentation

- **Proposing a new IX architecture**
 - **Based on MPLS technology**
 - **Independent on data-link medium**
 - **Widely distributed IX environment**
 - **Hierarchical architecture and Scalability**

Agenda

- **Background**
 - Existing IXes and issues
 - LAN based IX and ATM based IX
- **IX architecture based on MPLS technology**
 - Design of new IX
 - MPLS
 - MPLS-IX architecture
- **Related information**

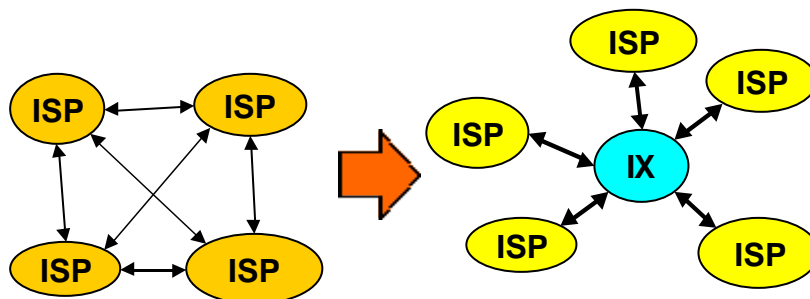
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IX - Internet eXchange

- **Interconnection points for ISPs**
 - One of method to interconnect networks
 - Points where ISPs exchange traffic efficiently
 - PAIX, MAE, NAP, LINX, NSPIX, JPIX, ...



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Features and issues of current IXes

■ Current IX features

- **Bilateral policy control**
 - Negotiate peering and routing exchange, individually
- **IX provides data-link connectivity**
 - IP routing can't provide bilateral policy control
 - Ethernet, FDDI, GbE, ATM,

■ Current IX issues

- **Impossible to use multiple data-link medium**
- **Less extensible technology**
- **Speed limitation, overhead, operational cost, ...**

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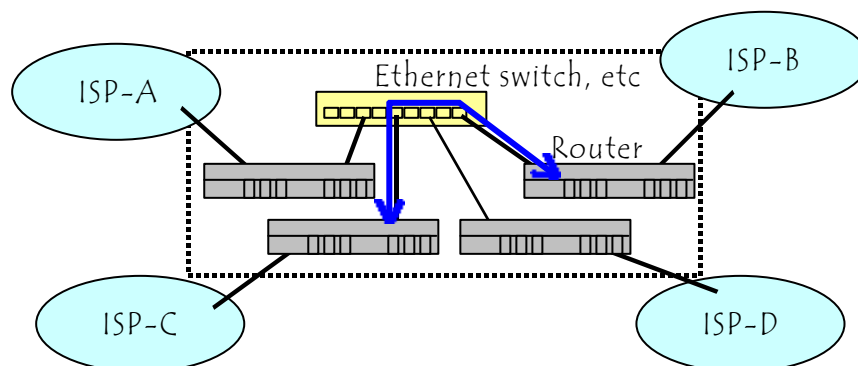
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LAN based IX

■ Interconnection over LAN segment

- **Ethernet, FDDI, and so on**



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Current IX issues (1)

- LAN - FDDI, Ethernet, GbE, ...
 - Physical cable length restriction
 - Additional routers for participants
 - Speed limitation (100Mbps is not enough)
 - Scalability problem
 - ISP must change address/mask when IX grows
 - Ownership / management policy for distributed IX
- No choice other than LAN medium

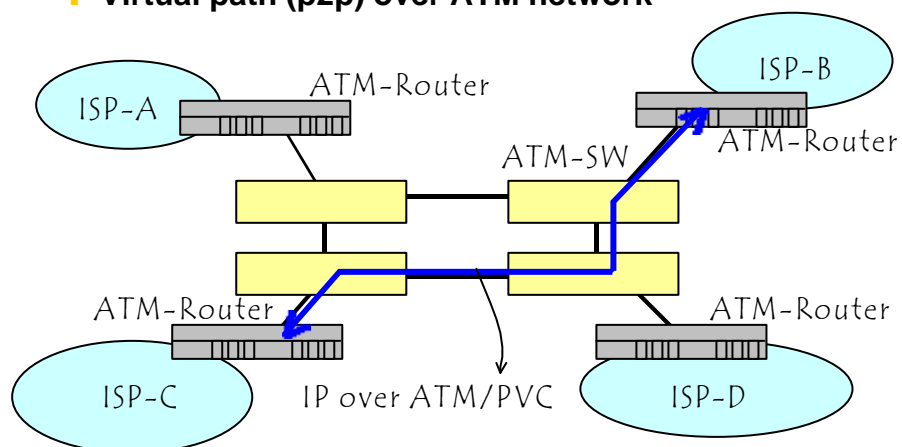
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ATM based IX

- Interconnection over ATM/PVC
 - Virtual path (p2p) over ATM network



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Current IX issues (2)

- **ATM - PVC based IXes**
 - | ATM overhead (Cell Tax, up to 20%)
 - | Switching speed problem (< POS)
 - | Configuration / operational cost of PVCs
 - | Many configurations in ATM switches
 - | Configuring Manually or half-automatically
 - | Only ATM interface is allowed to connect
 - | ATM routers and ATM links are required

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Design of new IX architecture

- **Goal:**
 - | Independent on data-link medium
 - | No more `only Ethernet', or `only ATM'
 - | Of course, we want to use POS!
 - | Allowing to connect with DS3 or even T1
 - | No limitation of interface speed
 - | ATM is historical
 - | OC-192 or OC-768 POS
 - | Widely distributed IX architecture
 - | No more additional routers in IX points
 - | Hierarchical architecture

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Design of new IX architecture

■ Goal: (Cont'd)

- Scalability
 - | Distributing IX points
 - | No more renumbering
- Easy policy control
 - | Of course, bilateral policy control is required
- Less operational cost
 - | No more PVC configuration

Using **MPLS** technology

MPLS

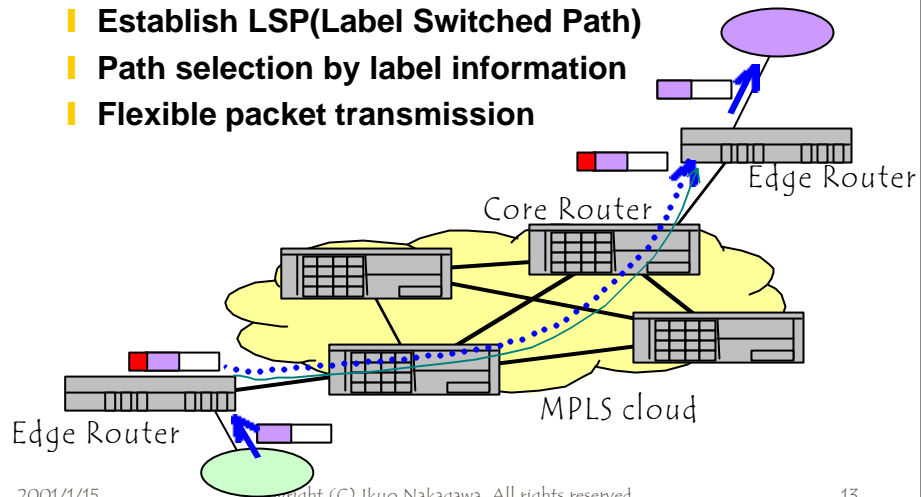
■ Multi-Protocol Label Switching

- One of label switching technology (layer 2.5)
- Many standards in IETF
- Transmit packets with label information
- Flexible routing with LSP(Label Switched Path)
- Independent on lower layer (L2) medium
- Independent on upper layer (L3) protocols
- Traffic engineering
- Supported by many routers

MPLS

Multi-Protocol Label Switching

- Establish LSP(Label Switched Path)
- Path selection by label information
- Flexible packet transmission



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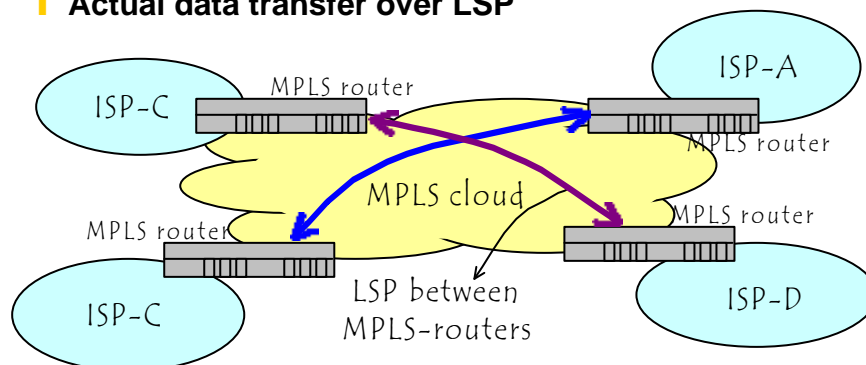
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MPLS-IX overview

Peering over LSP (Label Switched Path)

- LDP (Label Distribution Protocol) signaling
- Establishing BGP4 session over LSP
- Actual data transfer over LSP



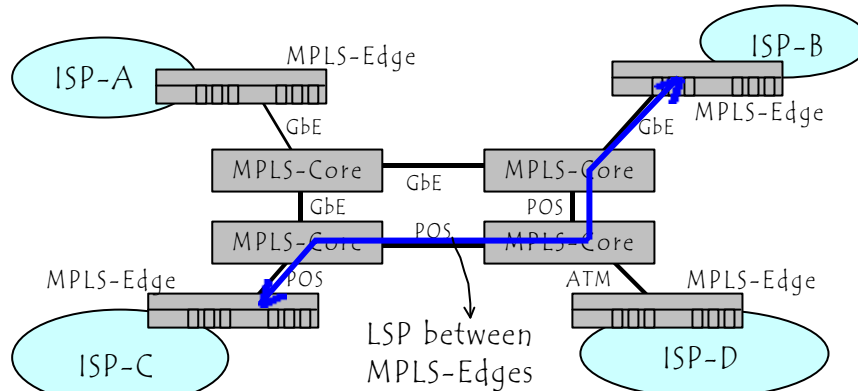
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IX based on MPLS technology

- Virtual interconnection over LSPs
- Independent on data-link medium

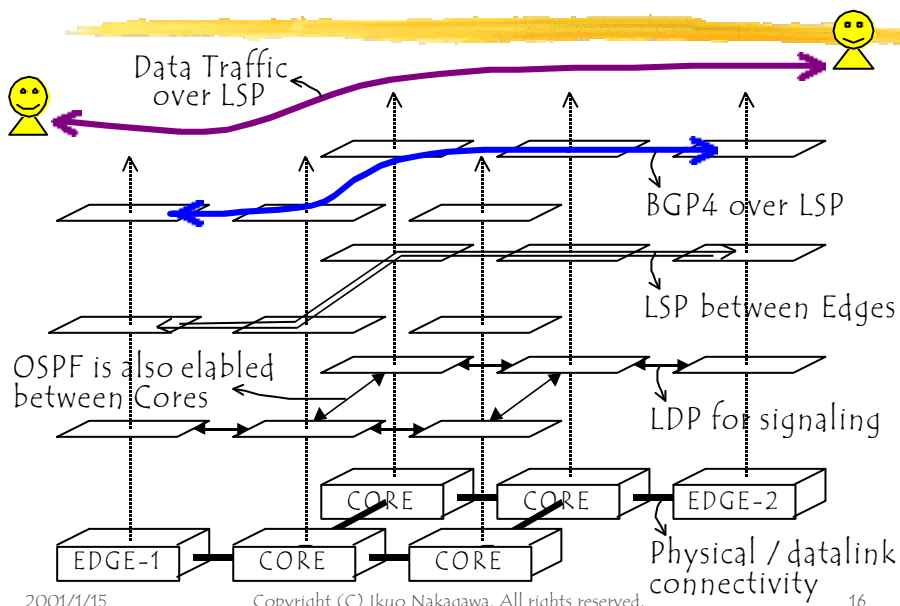


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MPLS-IX architecture



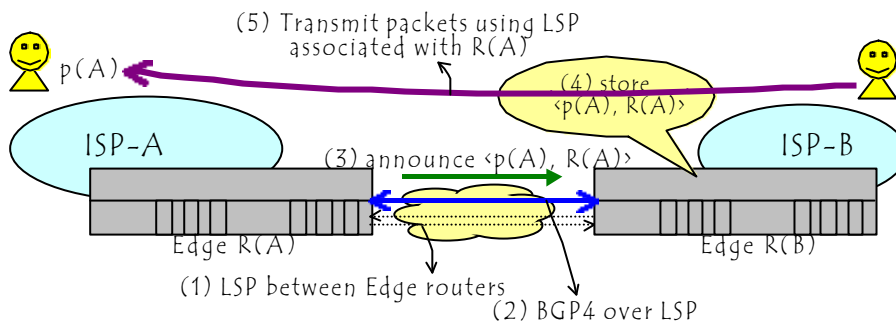
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Packet transmission over LSP

- Only LSP per peer (not per route) is required
 - Only one LSP associated with host route R(A)
 - transmit packets over LSP of R(A) if next-hop of p(A) is R(A)



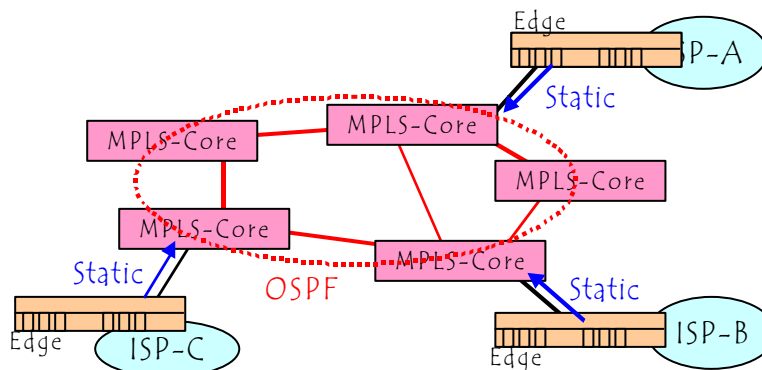
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Routing inside MPLS-IX

- Only host routes is required in Edge routers
 - Static routing in participants' (Edge) routers
 - OSPF or ISIS between Core routers



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Key features of MPLS-IX

■ Independent on data-link medium

- POS, ATM, GbE, FDDI, PPP, and any media
 - OC-192 or OC-768 POS is okay
 - No need to negotiate about interface with peer

■ Widely distributed IX

- Widely distributed interconnection network
 - POS would be great for Core-Core interface
- Participants can connect with any interface
 - No more additional routers or space required

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Key features of MPLS-IX (Cont'd)

■ Flexibility

- MPLS backbone is a kind of IP network
- Hierarchical architecture
- Flexible to extend MPLS network
(No need to renumber address/mask)

■ Operational benefit

- Core routers have only topology information
- Only host routes and BGP4 configuration required inside participants' (Edge) routers

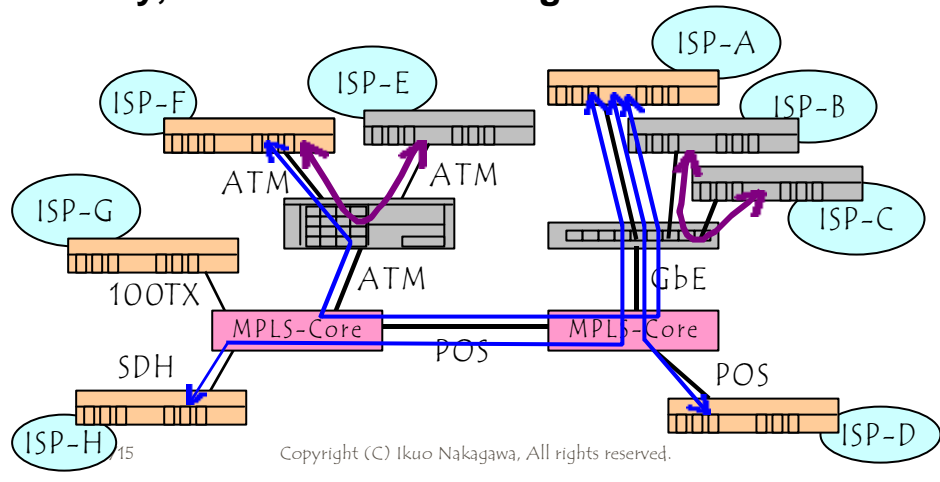
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Interconnection with existing IXes

- Interconnect multiple L2 IXes
- Say, data-link medium migration

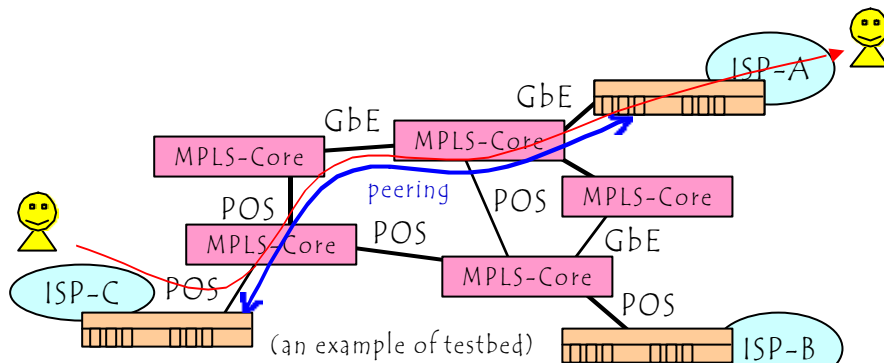


Possibilities of MPLS-IX

- Many useful MPLS features
 - Traffic Engineering
 - QoS/CoS - DiffServ features
 - Interconnection between MPLS Domains
 - Source address routing by RSVP
 - Solution to multi-home sites
 - etc...

Related project (1)

- Collaborative research with U of Tokyo
 - Dr. Esaki and some WIDE members
 - Design and basic experience of MPLS-IX



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Related project (2)

- RIBB (Regional Internet Backbone)
 - 24 sites, distributed in Japan
 - Dr. Hayashi and many network engineers
 - Since May 1999
 - Using JGN (Japan Gigabit Network)
- Research of next generation service architecture
 - End-user services
 - High speed access line technologies
 - High speed backbone architecture (MPLS-IX, etc)

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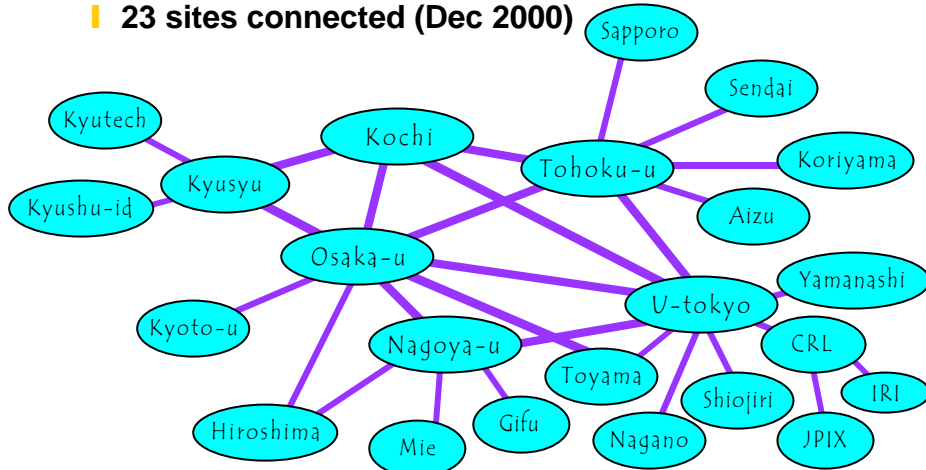
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Related project (2)

■ RIBB Phase-II topology

■ 23 sites connected (Dec 2000)



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