

# **SINET**

**Optical Network Testbeds Workshop 3 (ONT3)  
September 8, 2006**

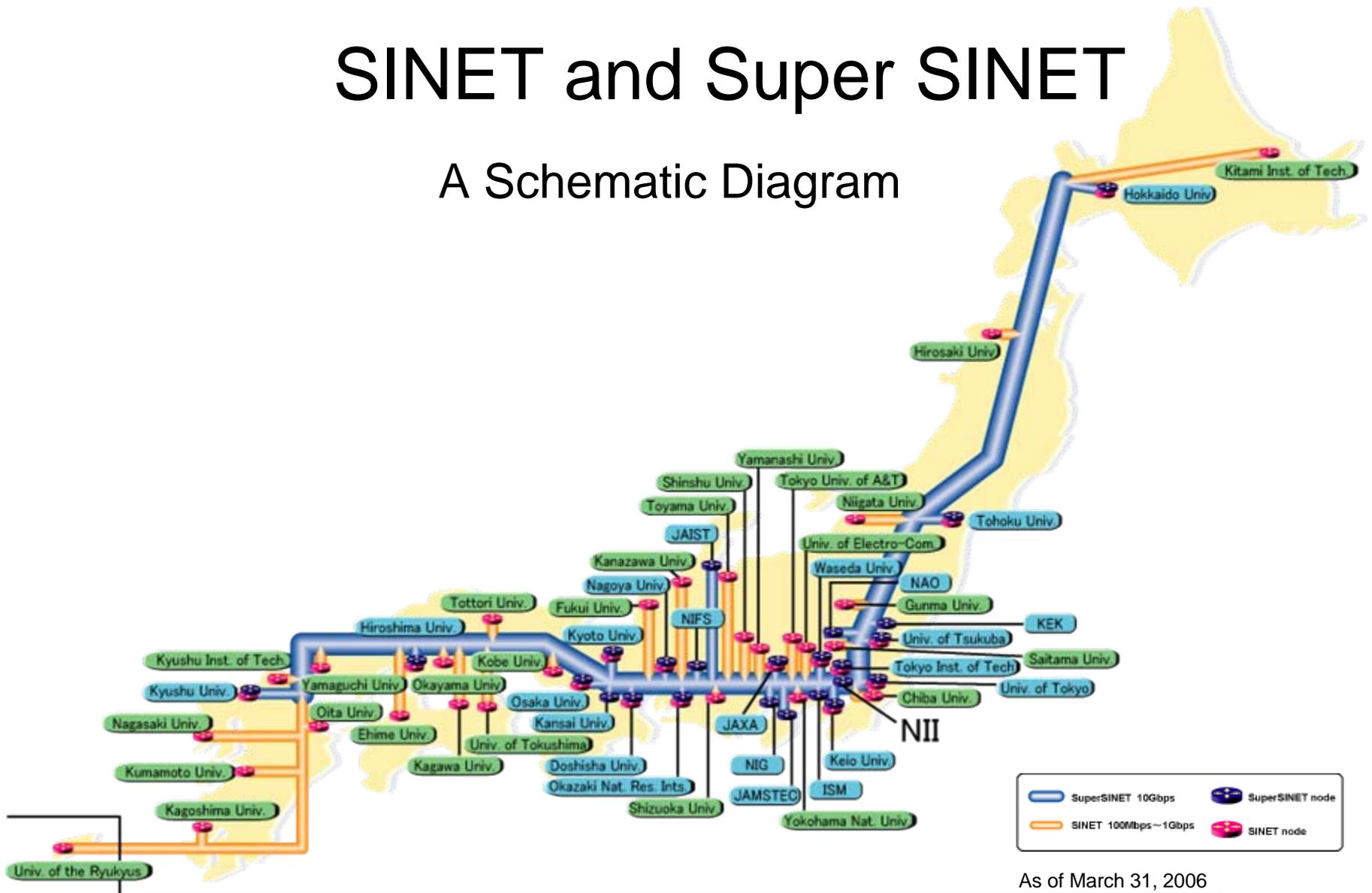
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# SINET

- The Science Information Network (SINET) has been serving as the information network infrastructure for the research and higher educational communities in Japan.
- Super SINET was built to reinforce SINET to meet the needs of advanced scientific researches.
- SINET and Super SINET together connect universities and academic research institutions in Japan, and provide a worldwide access to the Internet.
- The next generation network SINET3 is planned to be launched in April 2007, and will take over the role of current SINET and Super SINET backbone.

# SINET and Super SINET

## A Schematic Diagram



As of March 31, 2006

National	Public	Private	Junior Colleges	Specialized Training Colleges	Inter-Univ. Res. Inst. Corp.	Others	Total
80	51	274	66	41	14	182	<b>708</b>

# SINET3: Background

## Current Situation

- Growing demand for higher bandwidth in the whole network; increasing number of high-end IP routers
- Diversified user requirements for network services and capabilities; especially requirements of shared IP backbone and end-to-end dedicated connectivity
- Emerging flexible networking technologies such as next generation SDH/SONET, and GMPLS

## Next Step

- To provide a greater variety of network services on the infrastructure, including shared backbone service as well as end-to-end dedicated services
- To provide a more enhanced network environment for leading-edge R&D applications
- To respond more flexibly to changes in user requirements



**Next Generation SINET (SINET3)**

# Main Service Features of SINET3

- **Multi-layer services**
  - Layer 3 (IP)
  - Layer 2 (Ethernet)
  - Layer 1 (lambda or dedicated line)
- **Bandwidth on demand (BoD)**
  - Maximum 10Gbps bandwidth on demand
  - Ensuring complete quality of service through layer 1
- **Wide-area virtual private networks**
  - L3VPN and L2VPN
  - L1VPN (planned)
- **Prioritized services**
  - Application-based priority control
  - High-quality multicast including P2MP MPLS
- **Secure and highly available**
  - Secure capabilities
  - Performance monitoring and surveillance

# High-Level Network Architecture of SINET3

## ◆ User-Oriented Service Control Platform

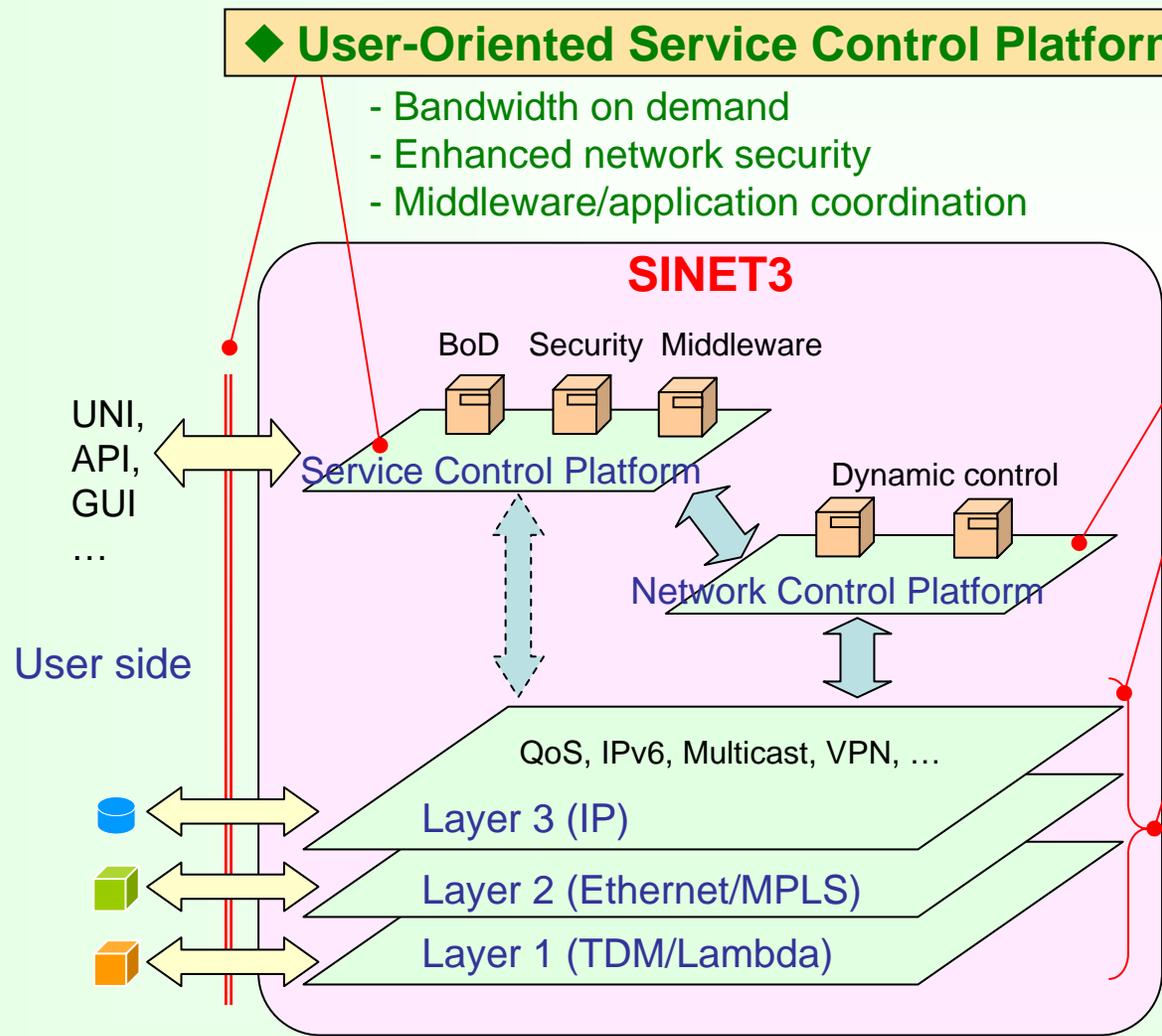
- Bandwidth on demand
- Enhanced network security
- Middleware/application coordination

## ◆ Adaptive Network Control Platform

- Dynamic resource control
- Resilient network control
- Performance monitoring

## ◆ Hybrid IP and Optical Network

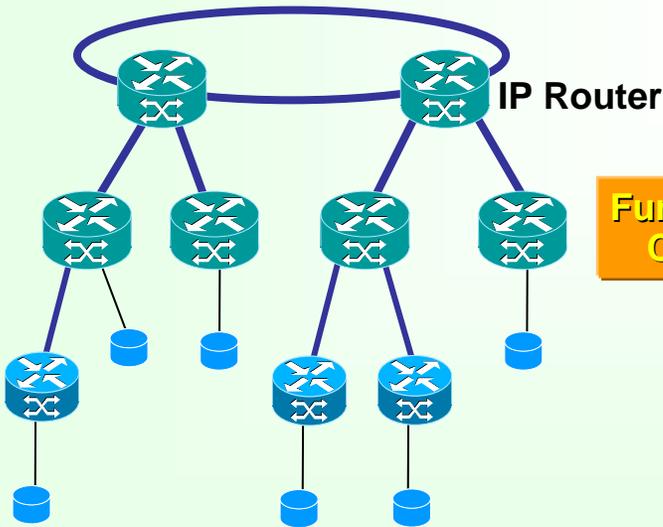
- Multiple layer network services
- Flexible layer 1 path setup
- Virtual private networks
- High-quality multicast
- IPv4/IPv6 dual stack and QoS
- 40Gbps+ backbone circuits



# Fundamental Change of Network Structure

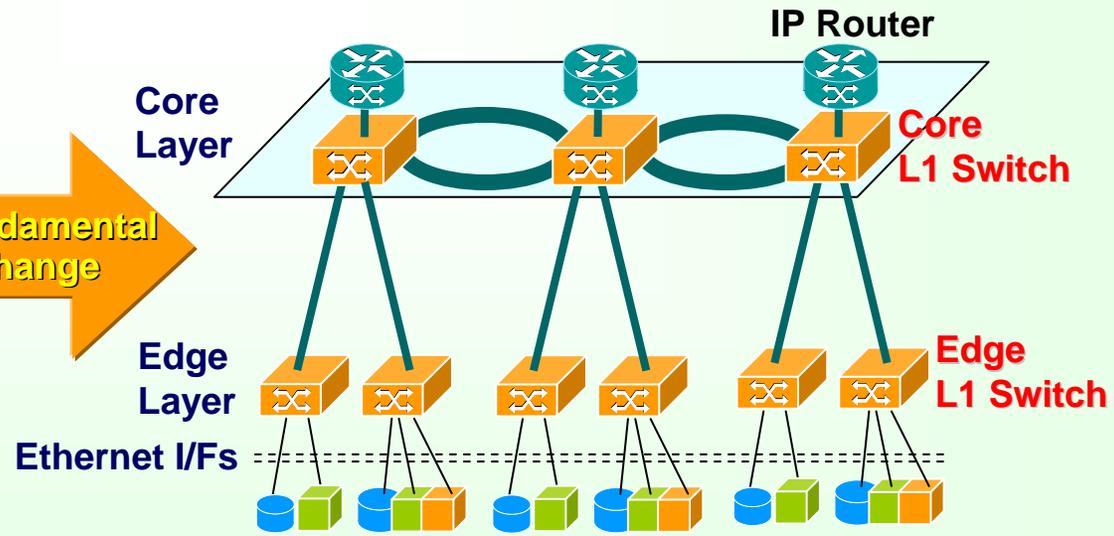
- Two tier structure with edge and core layers.
- The edge layer consists of edge layer 1 switches with Ethernet interfaces to accommodate users' equipment.
- The core layer consists of core layer 1 switches and high-performance IP routers and constitutes a nationwide reliable backbone network.

**SINET/ Super-SINET**



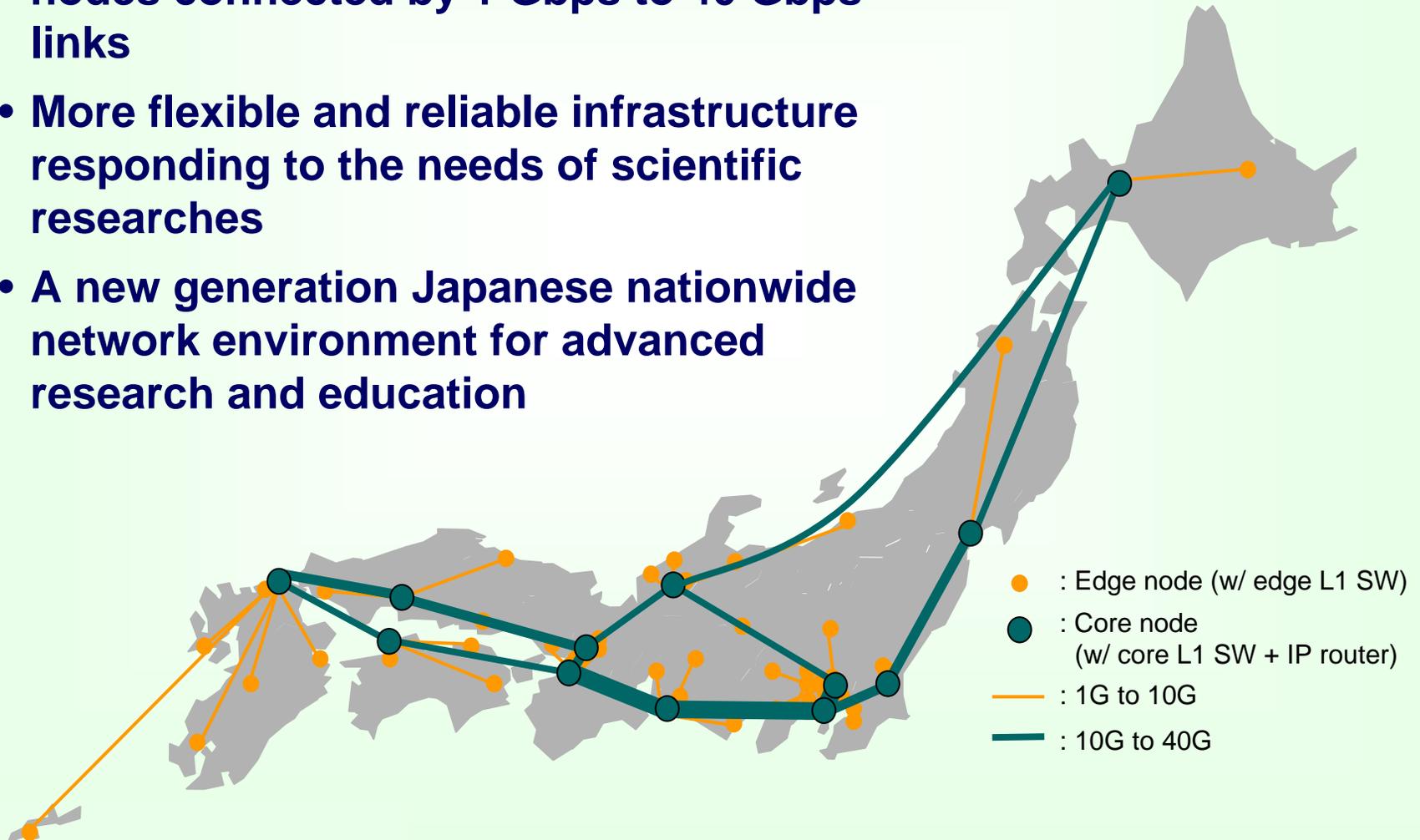
**Fundamental Change**

**SINET3**



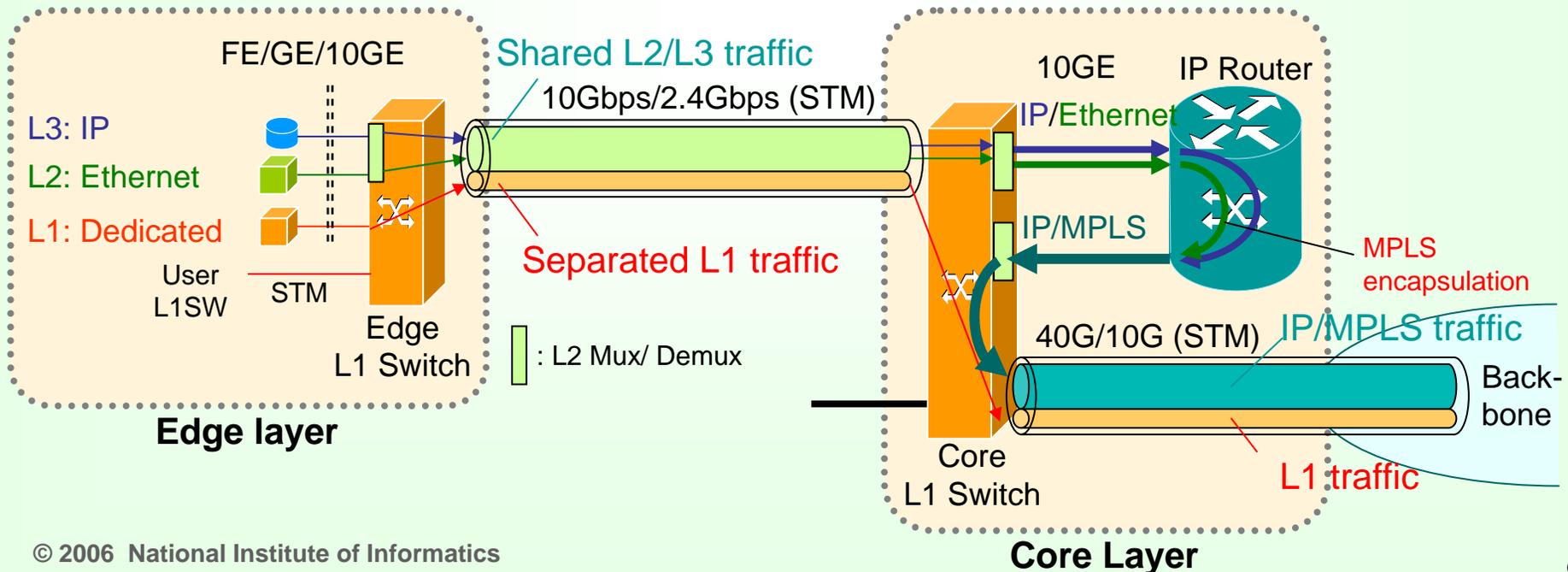
# Nationwide Multi-layer Network

- More than 60 edge nodes and 12 core nodes connected by 1 Gbps to 40 Gbps links
- More flexible and reliable infrastructure responding to the needs of scientific researches
- A new generation Japanese nationwide network environment for advanced research and education



# Traffic Accommodation for Layers 1 to 3

- **Edge layer 1 switch:**
  - Users' L1/L2/L3 traffic is accommodated and transferred to a 10Gpbs(STM) line.
  - L1 traffic is assigned a dedicated bandwidth and separated from L2/L3 traffic.
  - L2/L3 traffic shares the remaining bandwidth by L2 multiplexing.
- **Core layer 1 switch:**
  - L1 path is switched internally.
  - L2/L3 traffic is forwarded to and received back from IP router.
- **IP Router:**
  - IP/MPLS traffic is forwarded. L2 traffic is encapsulated using MPLS.



# L1 Switch Technologies

- **Next generation SDH/SONET:**

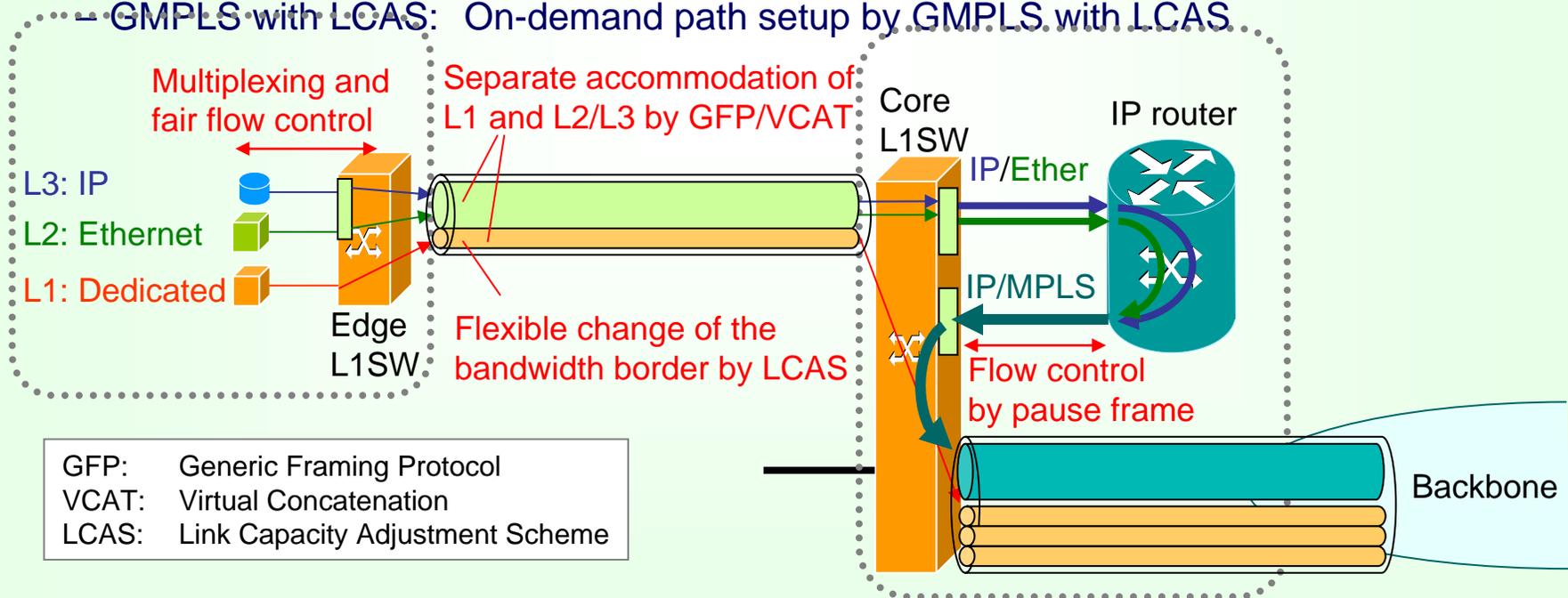
- GFP/VCAT: Separate accommodation of L1 traffic and L2/L3 traffic
- LCAS: Flexibly change the bandwidth border between L1 and L2/L3

- **L2 Multiplexing and Flow Control:**

- Bandwidth sharing: Flexible and reliable bandwidth sharing between Ethernet interfaces
- Flow control: Bandwidth control with pause frame

- **GMPLS:**

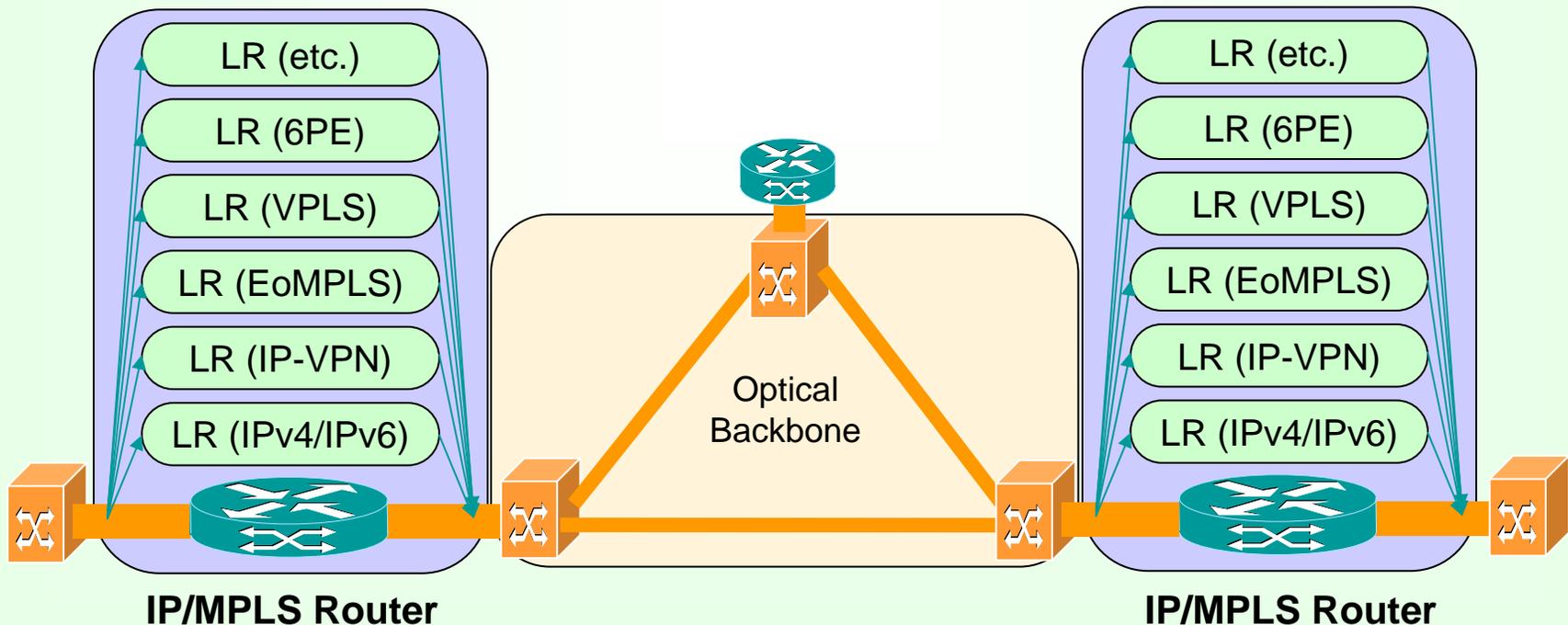
- GMPLS with LCAS: On-demand path setup by GMPLS with LCAS



GFP:	Generic Framing Protocol
VCAT:	Virtual Concatenation
LCAS:	Link Capacity Adjustment Scheme

# IP Router Technologies

- **Converged IP/MPLS platform for layers 2 and 3:**
  - MPLS-based services: IP-VPN, 6PE, and P2MP for L3, EoMPLS and VPLS for L2
  - IP-based services: IPv4/IPv6 dual stack, application-based priority control, and multicast
- **Logical router (LR):**
  - Logically separated accommodation of different network services on an IP router
  - Independent routing, signalling, and forwarding
- **Reliable capabilities:**
  - Non-stop packet forwarding, graceful restart, and protection/restoration



# Further Study

- **International collaboration for L1 interconnection (Including the control plane for L1 path setup)**
- **User control Interface for L1 path setup such as GMPLS-UNI and UCLP**
- **Path Computation Element (PCE) for multi-layer network control**
- **Layer 1 Virtual Private Network (L1VPN)**
- **...**

# Time-line

- **Apr. 2006 :** Procurement process started
- **Sep. 2006:** Equipment selection  
Transport selection
- **Apr. 2007:** In service to limited sites
- **Jun. 2007** (planned): In service to every site

# Summary

- SINET3, the next generation backbone network, is forthcoming.
- Multi-layer architecture is introduced to meet the diversified requirements.
  - More dedicated (or end-to-end) services will be provided in multiple layers.
  - Shared IP backbone service will remain as the basic service for the majority.
- More sophisticated control and management plane functionalities are for future study.

***Thank you very much!***