SINET3 and beyond for future Internet
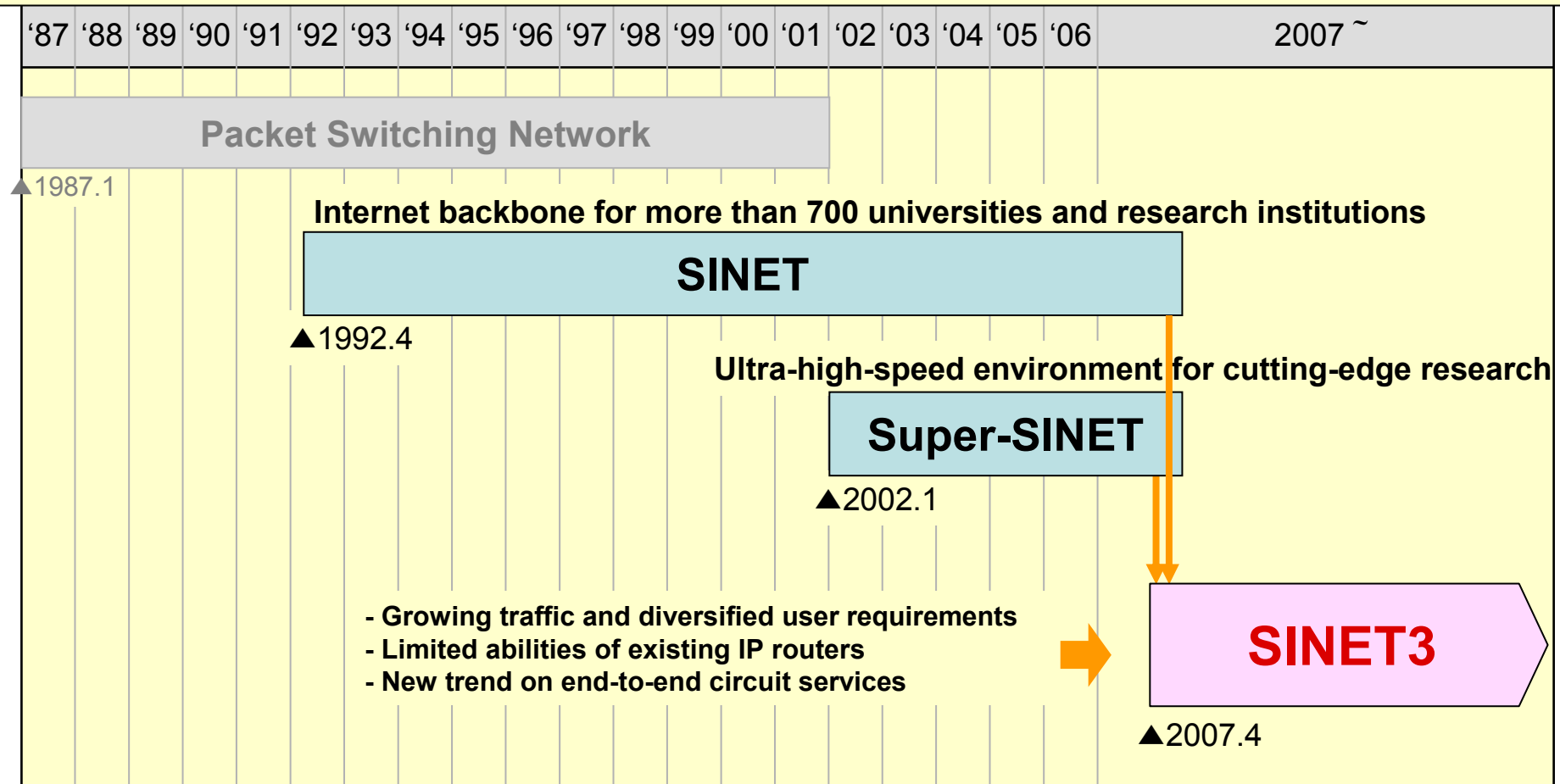
July 9, 2007

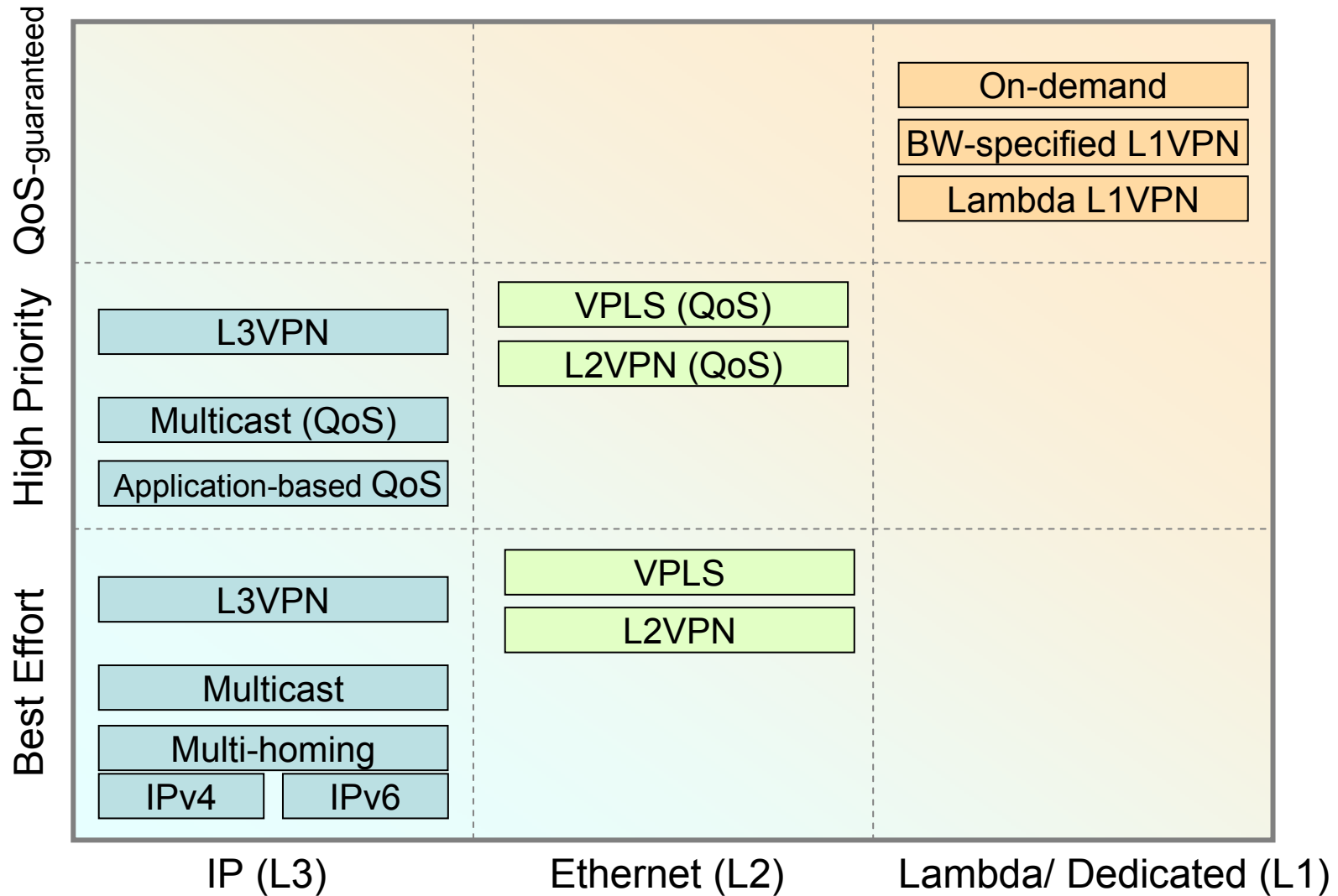**Shigeki Yamada**

National Institute of Informatics (NII)

Evolution of Japanese Academic Networks

◆ SINET3 is the integrated successor network to two academic networks, SINET and Super-SINET, to provide a rich variety of services economically and flexibly.

◆ SINET3 started its operations in April 2007 and completed the migration in May 2007.

'87	'88	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06	2007 ~

Packet Switching Network

▲1987.1

Internet backbone for more than 700 universities and research institutions

SINET

▲1992.4

Ultra-high-speed environment for cutting-edge research

Super-SINET

▲2002.1

- Growing traffic and diversified user requirements
- Limited abilities of existing IP routers
- New trend on end-to-end circuit services

SINET3

▲2007.4

Service Categories in SINET3

◆ SINET3 emphasizes four service aspects: transfer layer, security (VPN), quality-of-service (QoS), and bandwidth on demand.

	IP (L3)	Ethernet (L2)	Lambda/ Dedicated (L1)
QoS-guaranteed			On-demand / BW-specified L1VPN / Lambda L1VPN
High Priority	L3VPN / Multicast (QoS) / Application-based QoS	VPLS (QoS) / L2VPN (QoS)	
Best Effort	L3VPN / Multicast / Multi-homing / IPv4 / IPv6	VPLS / L2VPN	

High-level Network Architecture

◆ High-level network architecture is composed of a transport network, an adaptive network control platform, and a user-oriented service control platform.
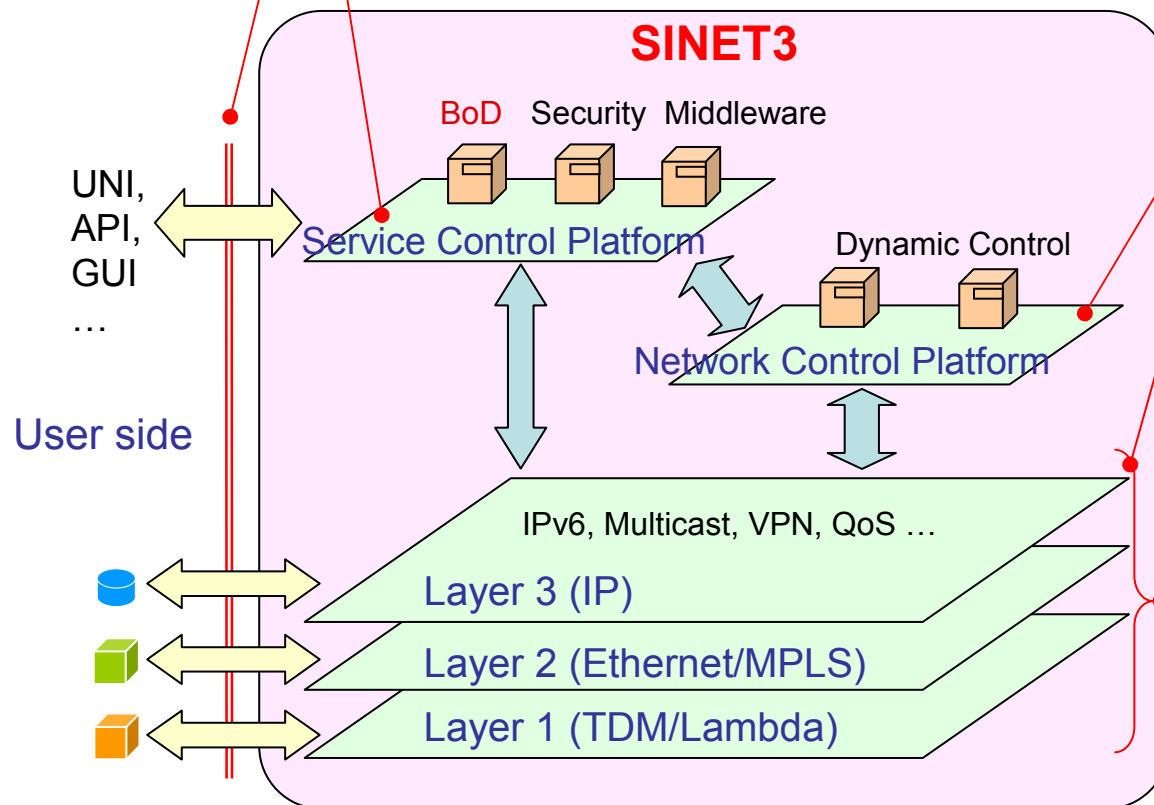
◆ User-oriented Service Control Platform

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

◆ Adaptive Network Control Platform

- Dynamic resource control
- Resilient network control
- Performance monitoring
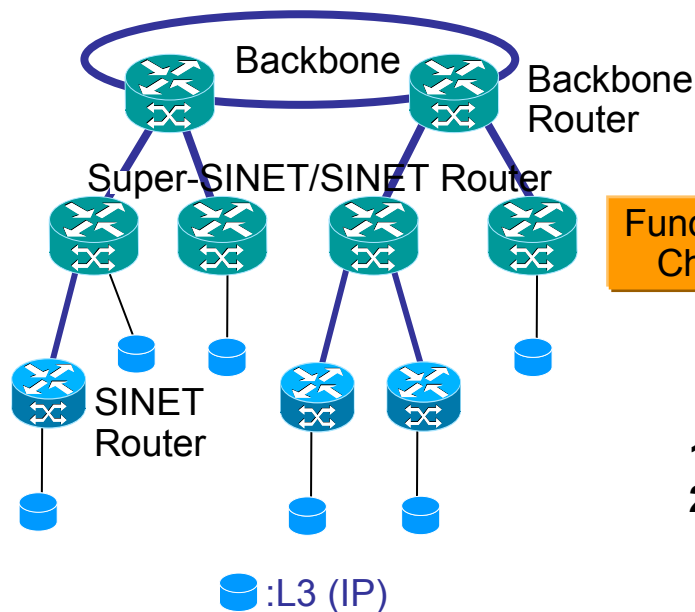
◆ Hybrid Optical and IP/MPLS Network

- Multi-layer accommodation
- Enriched VPN
- Enhanced QoS
- High availability
- Flexible resource assignment
- 40 Gbps (STM-256) lines

SINET3

BoD   Security   Middleware

Service Control Platform

Dynamic Control

Network Control Platform

UNI, API, GUI …

User side

IPv6, Multicast, VPN, QoS …

Layer 3 (IP)

Layer 2 (Ethernet/MPLS)
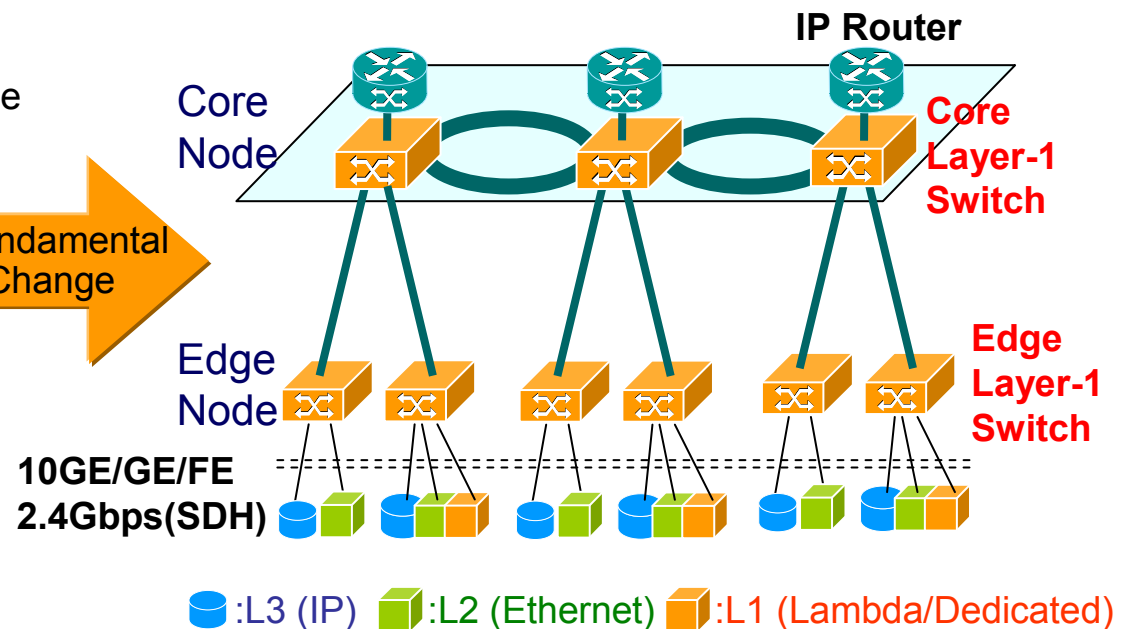
Layer 1 (TDM/Lambda)

Network Structure of SINET3

◆ SINET3 has two-layer structure with edge and core nodes.

◆ Edge node is an edge layer-1 switch with layer-2 multiplexing, which is located at a university or research institution and accommodates multiple layer equipment with 10GE/GE/FE or 2.4Gbps (SDH) interfaces.

◆ Core node is composed of a high-end IP router and a core layer-1 switch located at a public data centre.

SINET/Super-SINET

Backbone

Backbone Router

Super-SINET/SINET Router

SINET Router

Fundamental Change

SINET3

IP Router

Core Node

Core Layer-1 Switch

Edge Node

Edge Layer-1 Switch

10GE/GE/FE 2.4Gbps(SDH)

:L3 (IP)

:L3 (IP)   :L2 (Ethernet)   :L1 (Lambda/Dedicated)
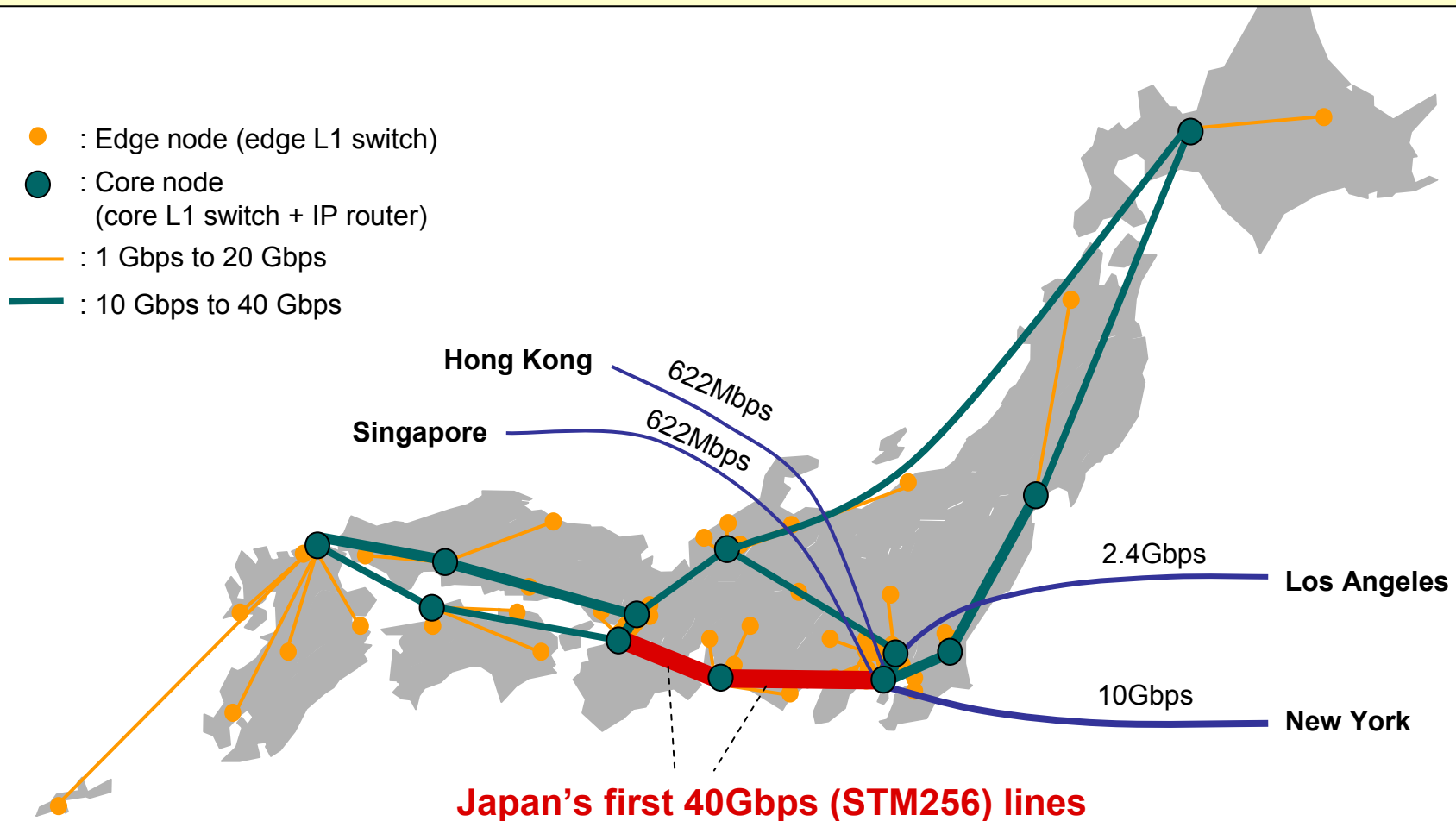
Accommodation of Multi-layer Services

◆ L3 and L2 traffic are accommodated in the shared bandwidth by L2 multiplexing and transferred to IP router, where each traffic is encapsulated by MPLS labels as needed.

◆ L1 traffic is assigned a dedicated bandwidth and separated from L3/2 traffic.

◆ The bandwidth of L2/3 (or IP/MPLS) traffic can be hitlessly changed by LCAS.

MPLS: Multi-Protocol Label Switching, LCAS: Link Capacity Adjustment Scheme
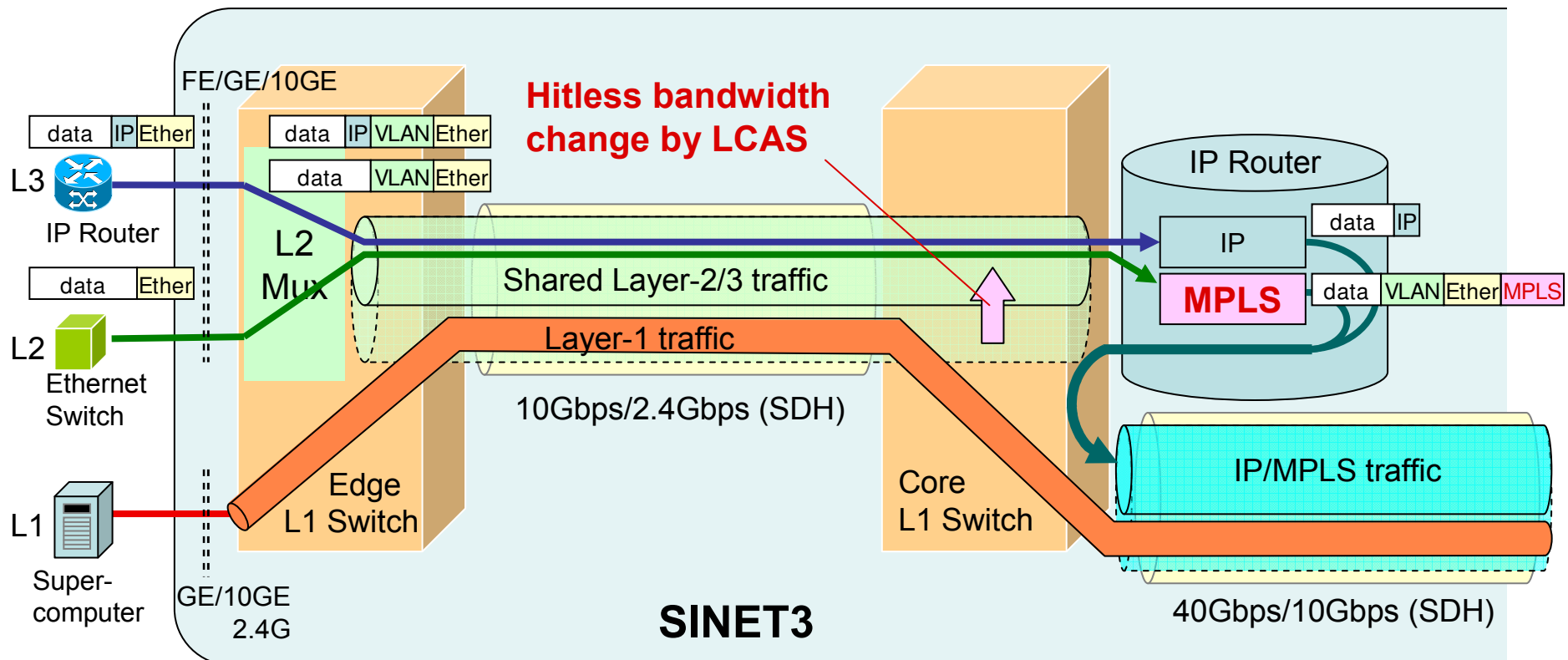
Network Topology of SINET3

◆ It has 63 edge nodes and 12 core nodes (75 layer-1 switches and 12 IP routers).

◆ It deploys Japan's first 40 Gbps lines between Tokyo, Nagoya, and Osaka.

◆ The backbone links form three loops to enable quick service recovery against network failures and the efficient use of the network bandwidth.

● : Edge node (edge L1 switch)

● : Core node
  (core L1 switch + IP router)

── : 1 Gbps to 20 Gbps

── : 10 Gbps to 40 Gbps

Hong Kong   622Mbps

Singapore   622Mbps

2.4Gbps   Los Angeles

10Gbps   New York

Japan's first 40Gbps (STM256) lines

Possible Contributions to Future Internet Technologies from SINET3 (Personal View)

◆ The objective of SINET3 is to provide users with diversified and effective services in a stable and reliable manner.

◆ Accordingly, NII has employed the latest but stable network components and integrates them into the SINET: SINET3 and beyond may continue to be a daily use network infrastructure rather than an R&D testbed network.

◆ New network architecture design requires both a top-down approach and a bottom-up approach.

◆ The top-down approach seeks the technologies that can satisfy the future requirement from applications and users. The bottom-up approach first seeks innovative technologies and then considers what the innovative technologies can do for the future internet.

◆ NII may be oriented more to the top-down approach because we have accumulated many requirements from daily use to cutting-edge applications and from ordinary users to network professionals.

◆ NII will also collaborate with NICT for future Internet technologies.