SINET5 update

National Institute of Informatics, Japan

1 August 2016

New Directions for Academic Infrastructure

- **SINET5 plan** has been approved as one of the most important projects for research and education by the Ministry of Education, Culture, Sports, Science and Technology (MEXT).

Collaboration and Promotion in Research and Education

Resource

- Promotion of academic information circulation and open access
- Collaborative promotion of institutional repository expansion

JAIRO Cloud

Federation

- Collaborative enhancement of authentication between universities

GakuNin Federation

Cloud

- Dramatic cost reduction and enhancement of research and education environment by tailored cloud services

GakuNin-Cloud Direct Connection

Security

- Network flow analysis and dynamic control
- Raise of security level for SINET users

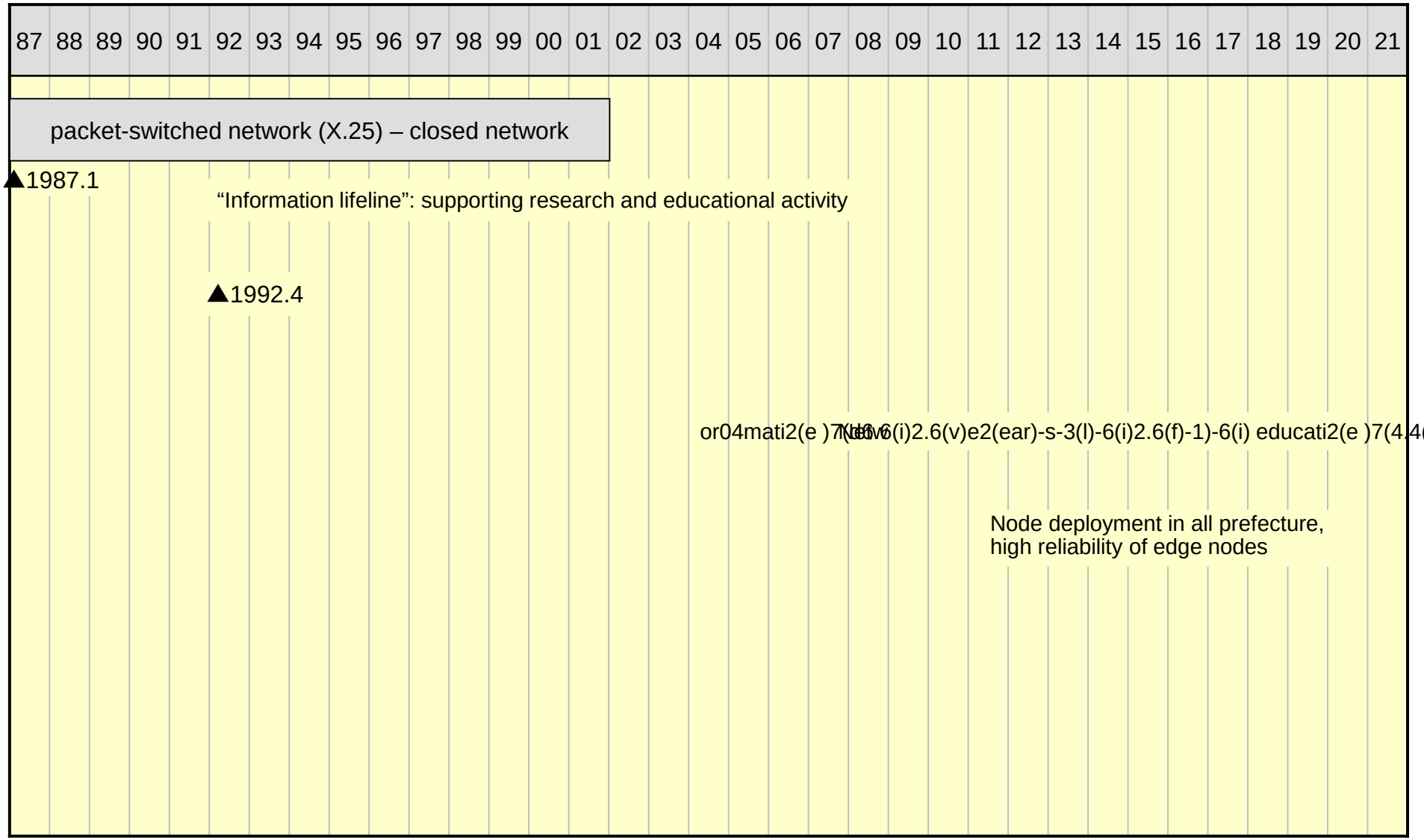
Flow Analysis

VPN

Network

- Nationwide 100-Gbps backbone network and scalable network expansion
- High-speed direct international lines to USA, Europe, and Asia
- Introduction of new technologies such as SDN in response to user needs

Timeline



Opening Ceremony of SINET5

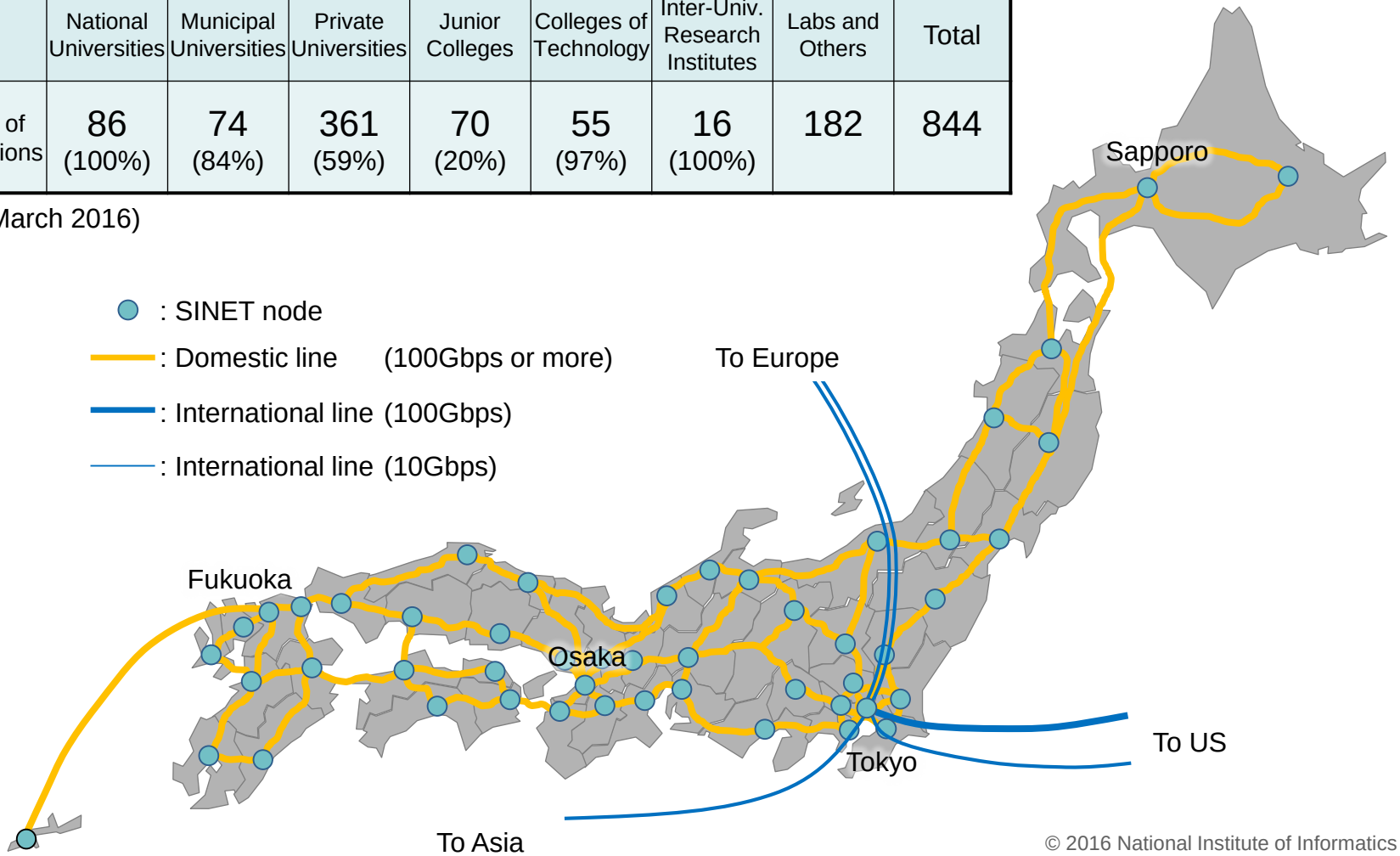
◆ Opening Ceremony of SINET5 was held in Tokyo on 25 May 2016

Science Information Network (SINET)

- SINET is a Japanese academic backbone network for more than 800 universities and research institutions, and for about 3 million users.
- SINET covers 100% of national, 84% of municipal, and 59% of private universities.

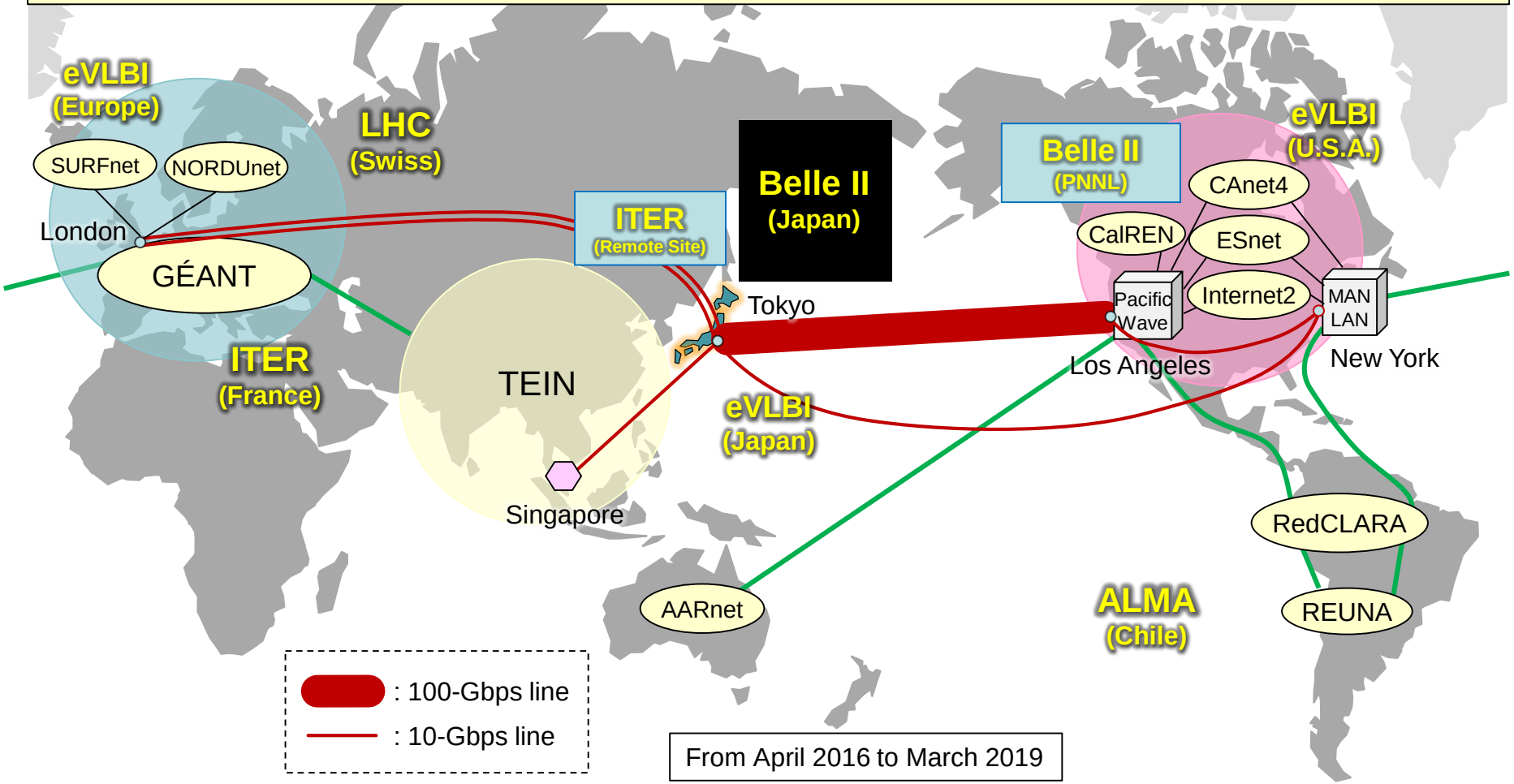
	National Universities	Municipal Universities	Private Universities	Junior Colleges	Colleges of Technology	Inter-Univ. Research Institutes	Labs and Others	Total
Number of Organizations	86 (100%)	74 (84%)	361 (59%)	70 (20%)	55 (97%)	16 (100%)	182	844

(As of March 2016)



International Lines of SINET5

- SINET5 has direct international lines to USA, Europe, and Asia.
  - USA: 100-Gbps line to Los Angeles, 10-Gbps line to New York, and 10-Gbps backup line
  - Europe: Two 10-Gbps lines to London for small latency
  - Asia: 10-Gbps line to Singapore

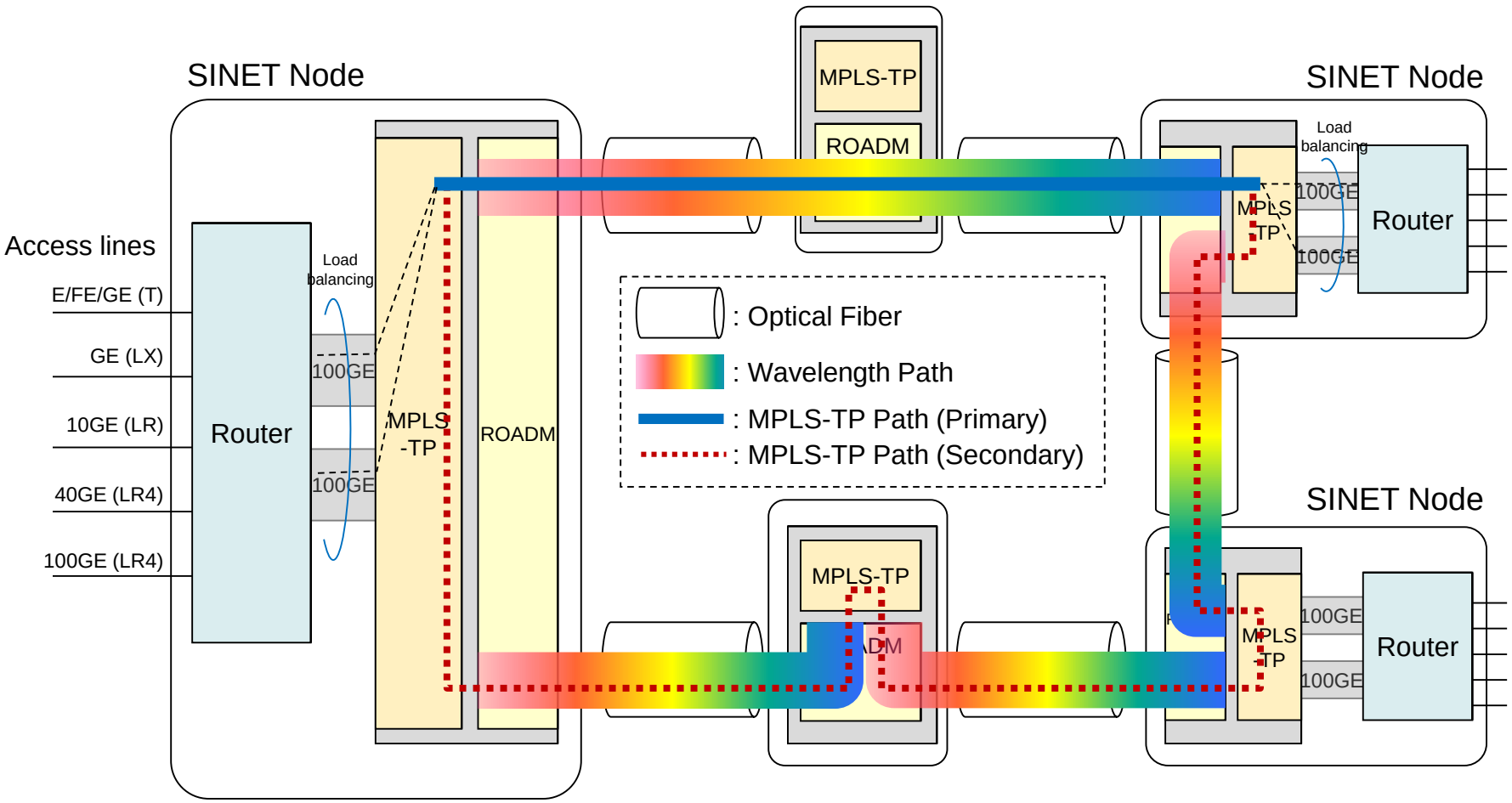


High-Performance, Reliable, and SDN-friendly

- SINET5 directly connects each pair of IP routers by the smallest-latency MPLS-TP path and the disjoint path to it. This fully-meshed topology creates a high-performance, reliable, and SDN-friendly backbone network.

Transmission Devices and Service Nodes

- The ROADMs connect adjacent /distant nodes with wavelength paths, and the MPLS-TP devices establish disjoint MPLS-TP paths between each pair of nodes.

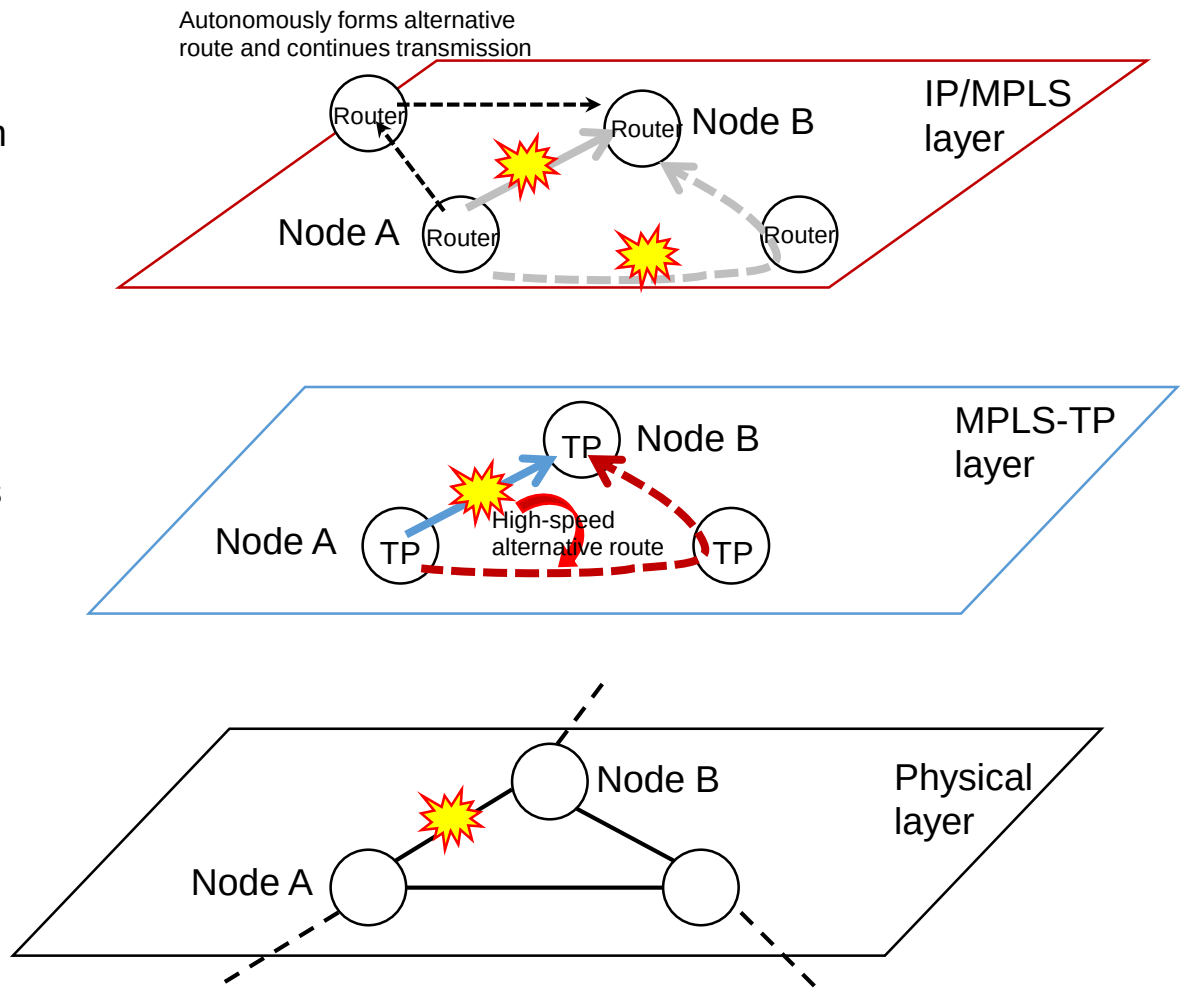


Multi-layered High Reliability

3. Even in the event that both of the logical paths (i.e. primary and secondary) between two nodes are interrupted, routers autonomously form an alternative route within a few seconds, limiting the impact on user transmissions as much as possible.

2. Where two nodes are connected by two logical paths (primary and secondary) and the active path is severed, transmission rapidly switches over to the alternative route via the reserve logical path, and communication continues with no packet loss. Dual logical paths are arranged in an alternative redundancy route configuration, ensuring that the two paths do not affect one another.

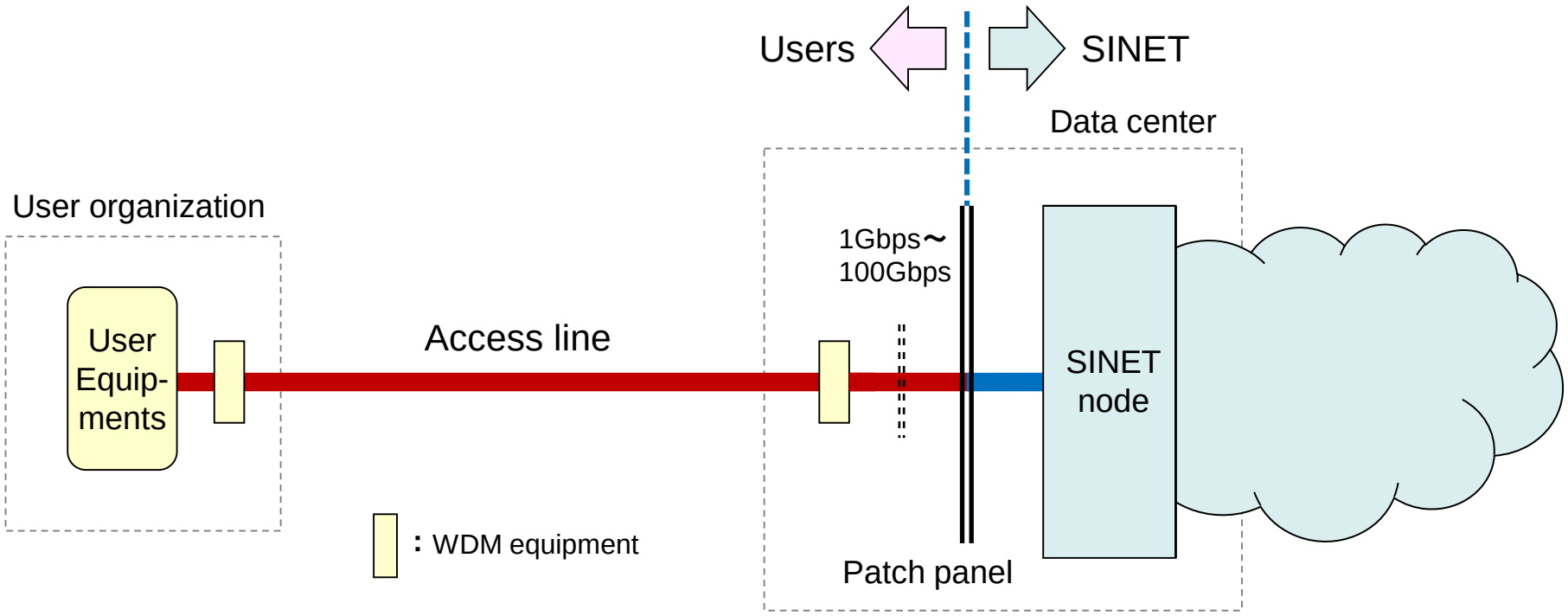
1. Each node is connected to another by at least two or more alternative optical fiber routes, increasing the SINET5's resistance to network failures in the event of optical fibers being severed.



Communication between Node A and Node B during system failures

Joint Procurement of Access Lines

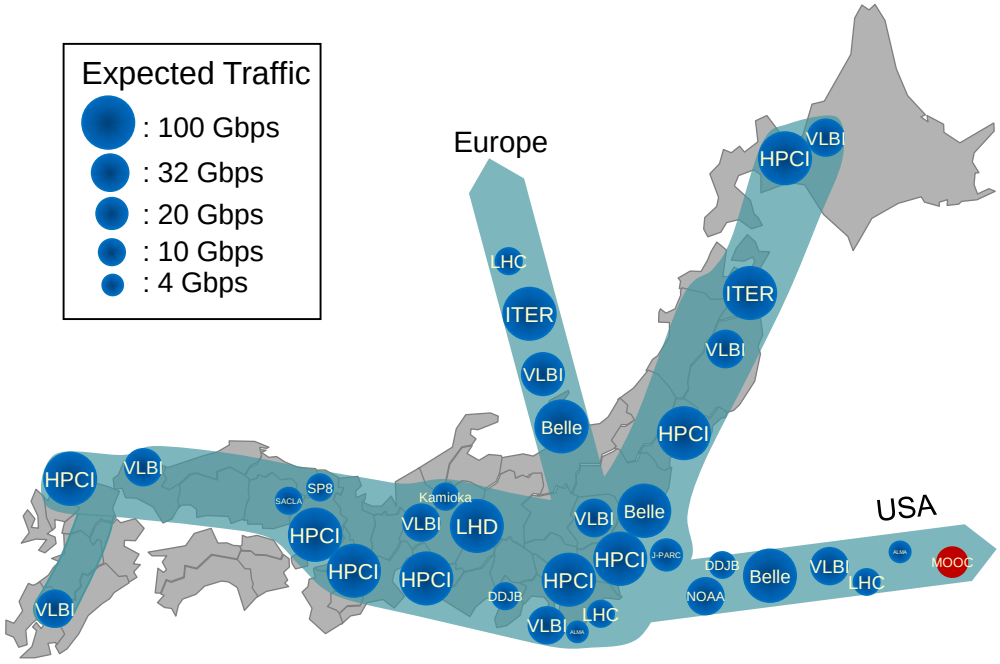
- To achieve higher bandwidths with lower cost, we employ dark fiber + WDM device combination for access lines.
- Flexible acceleration is possible by adding the WDM interfaces as necessary.



Traffic Demands for SINET

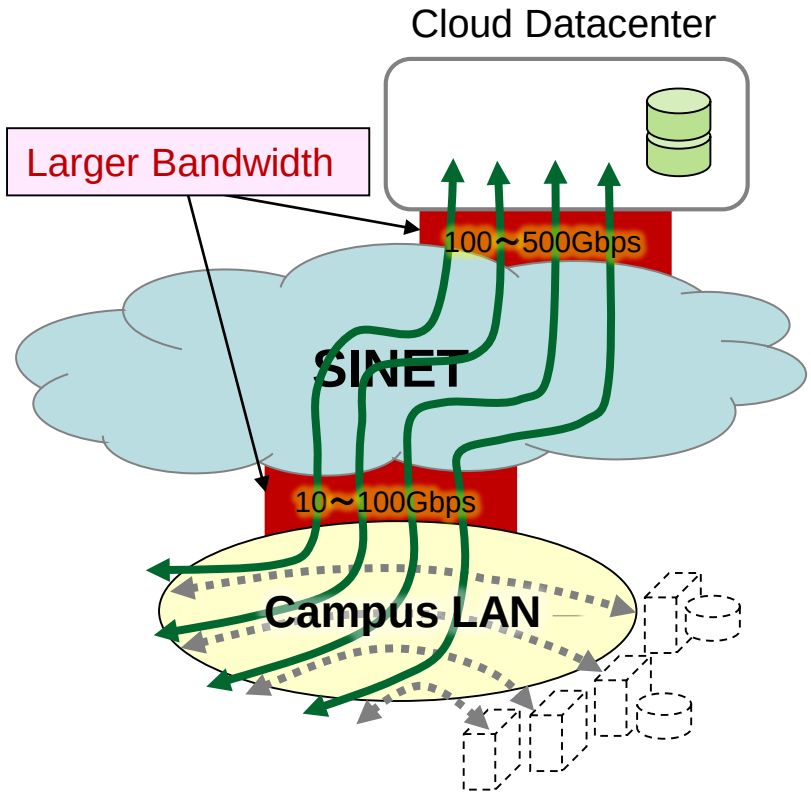
- The traffic volumes from research projects and cloud services are expected to steadily grow nationwide. SINET5 needs to prepare sufficient network bandwidth for these purposes by taking into account the end-to-end performance.

Demands from Research Projects



The traffic volumes in various research fields have been steadily growing.

Demands from Cloud Services



On-premise computing resources are relocated to cloud datacenters.

Usage of VPN Services

◆ VPN services have been very popular.