

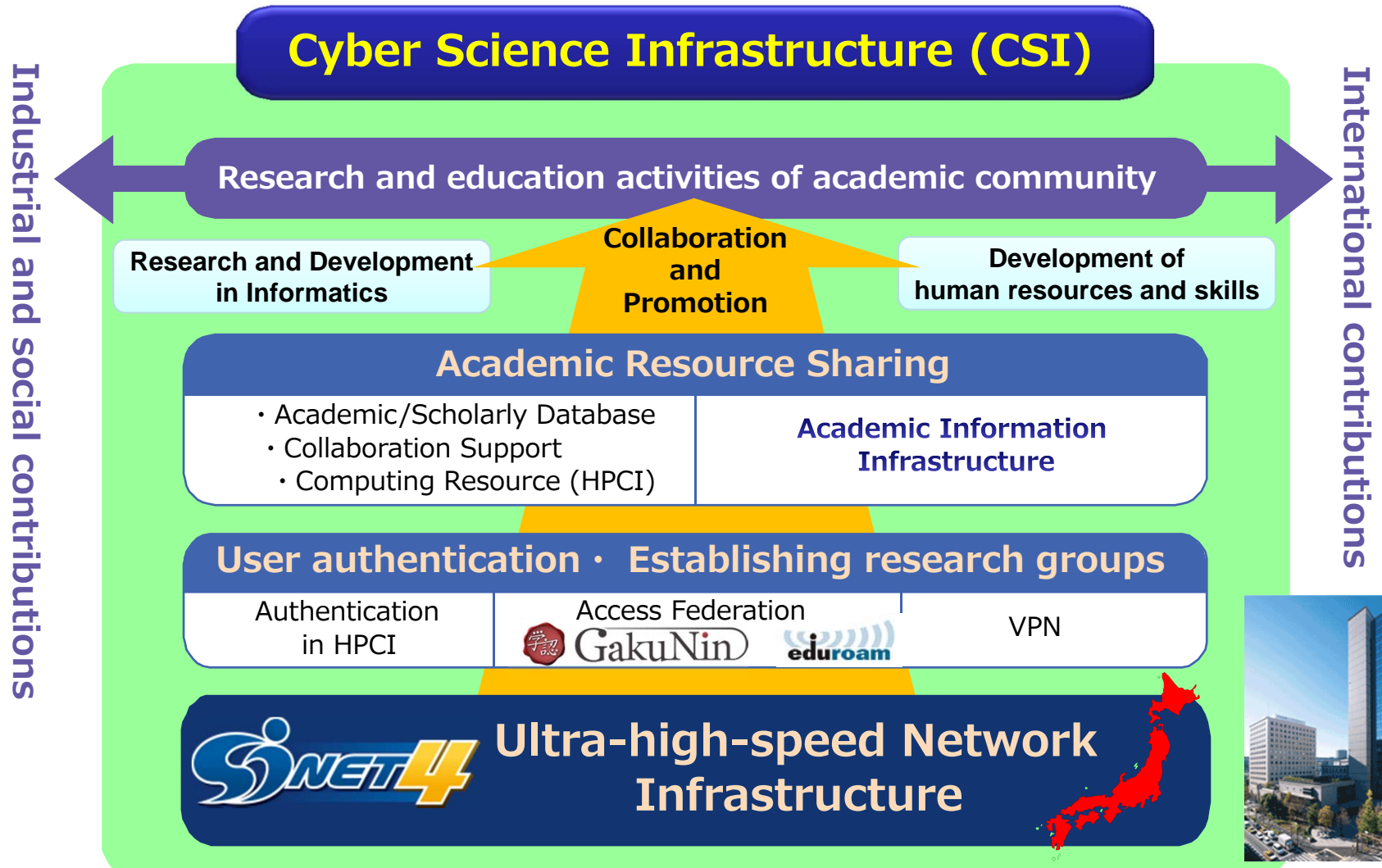


May 15th, 2013

Overview of SINET

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National Institute of Informatics (NII), Japan

What NII provides



As a Inter-University Research Institute Corporation for higher education under the MEXT (Ministry of Education, Culture, Sports, Science and Technology) of Japan

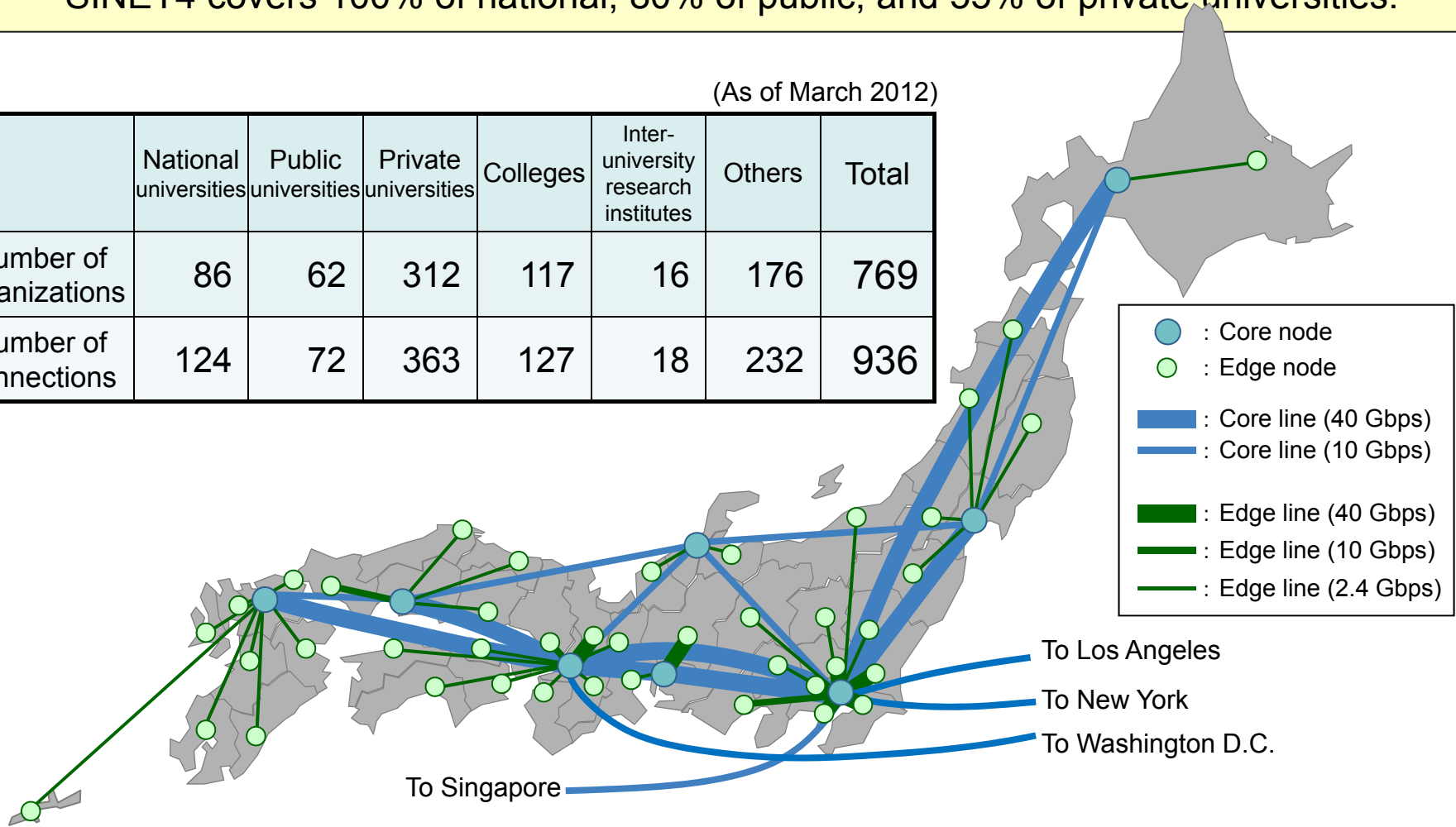


Science Information Network (SINET)

- ◆ Academic backbone network for more than 700 universities and research institutions and more than 2 million users.
 - SINET4 covers all 47 prefectures.
 - SINET4 covers 100% of national, 80% of public, and 55% of private universities.

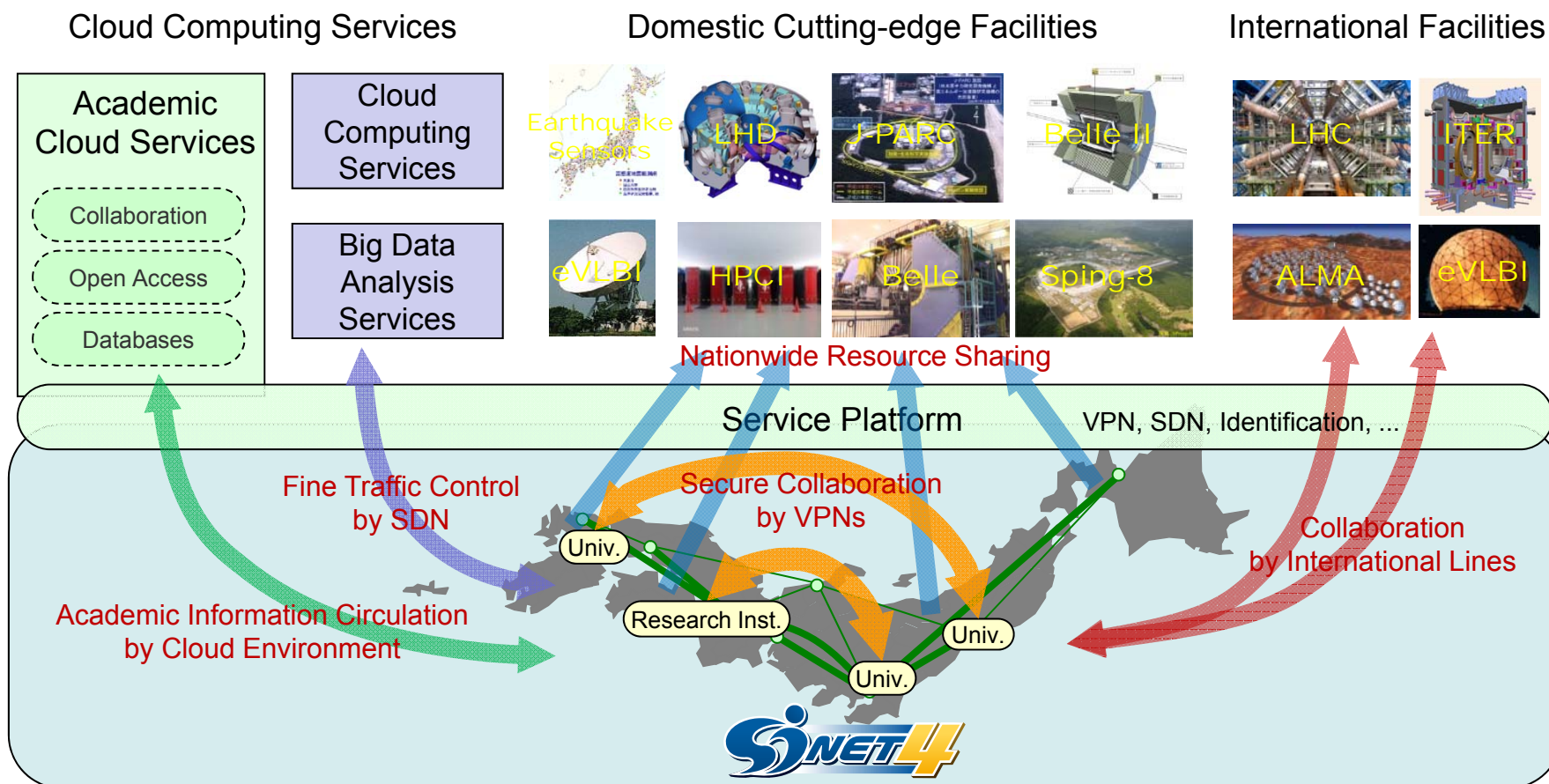
(As of March 2012)

	National universities	Public universities	Private universities	Colleges	Inter-university research institutes	Others	Total
Number of organizations	86	62	312	117	16	176	769
Number of connections	124	72	363	127	18	232	936



Advanced Infrastructure for Research and Education

- ◆ Facilitating nationwide resource-sharing of cutting-edge experimental devices, super-computers, and other research resources.
- ◆ Fostering secure collaboration among user organizations by high-performance VPNs.
- ◆ Promoting cloud computing services and upper-layer services.





SINET4 Services

◆ SINET4 needs to provide the following variety of multilayer network services.

Service Menu		Status	Note
Layer-3 Service	Commercial Internet access	✓	Via IXs and global ISPs
	IPv6	✓	Native/dual-stack/tunnel
	IPv4 full-route information	✓	
	IPv6 multicast (+QoS)	✓	
	Application-based QoS	✓	
	L3VPN (+QoS)	✓	
Layer-2 Service	L2VPN/VPLS (+QoS)	✓	Fastest growing service
	L2VPN/VPLS on-demand	Planned	For several projects
Layer-1 Service	L1 on demand	✓	Over 1,000 paths were setup/released so far
Other Service	Performance measurement	✓	
	Traffic measurement	✓	
	Private Cloud support	✓	

VPN: Virtual Private Network

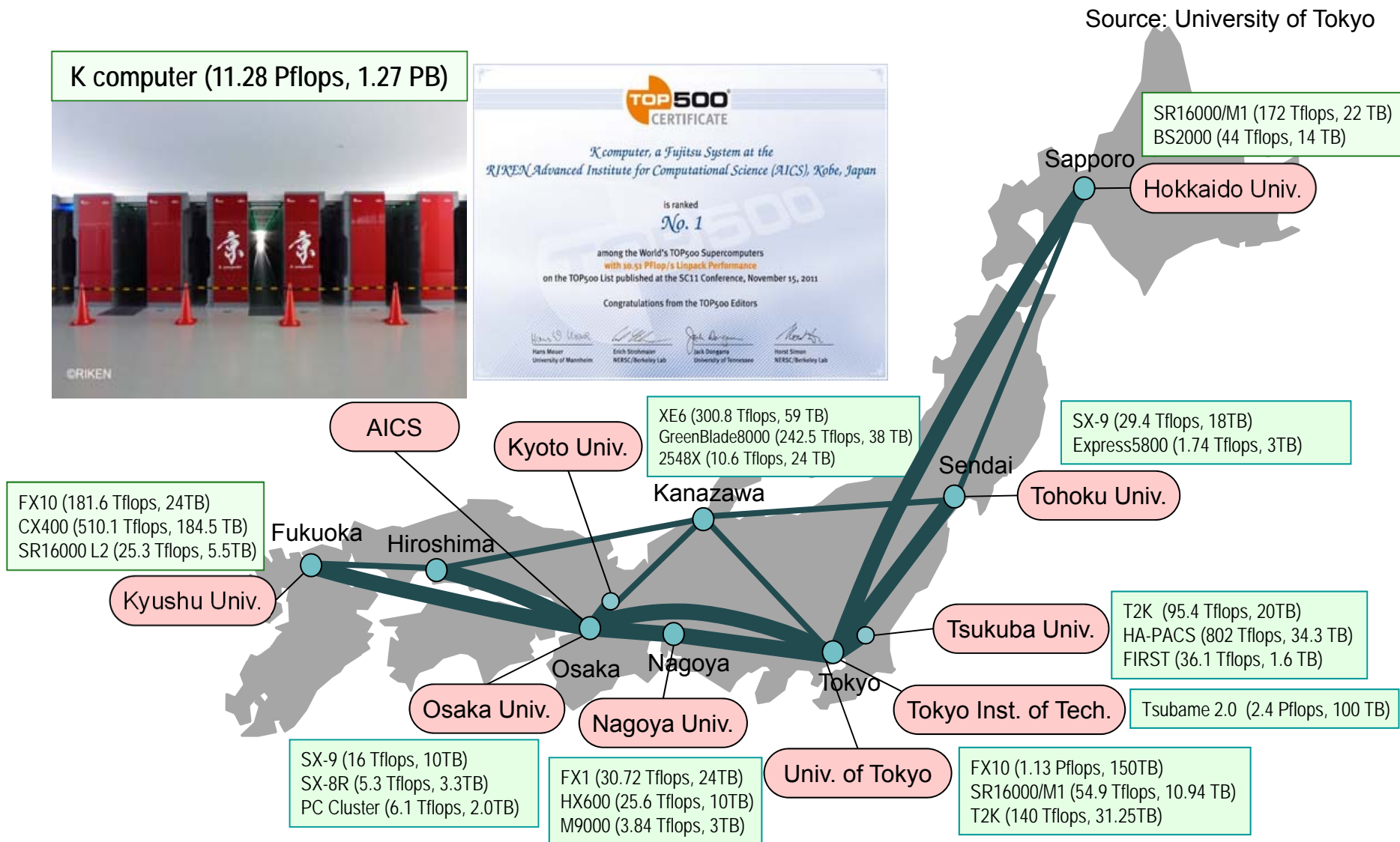


Usage Example in High-Performance Computing

◆ High-Performance Computing Infrastructure (HPCI) project enables nation-wide researchers to share supercomputers including K computer and huge data storages through high-speed SINET.

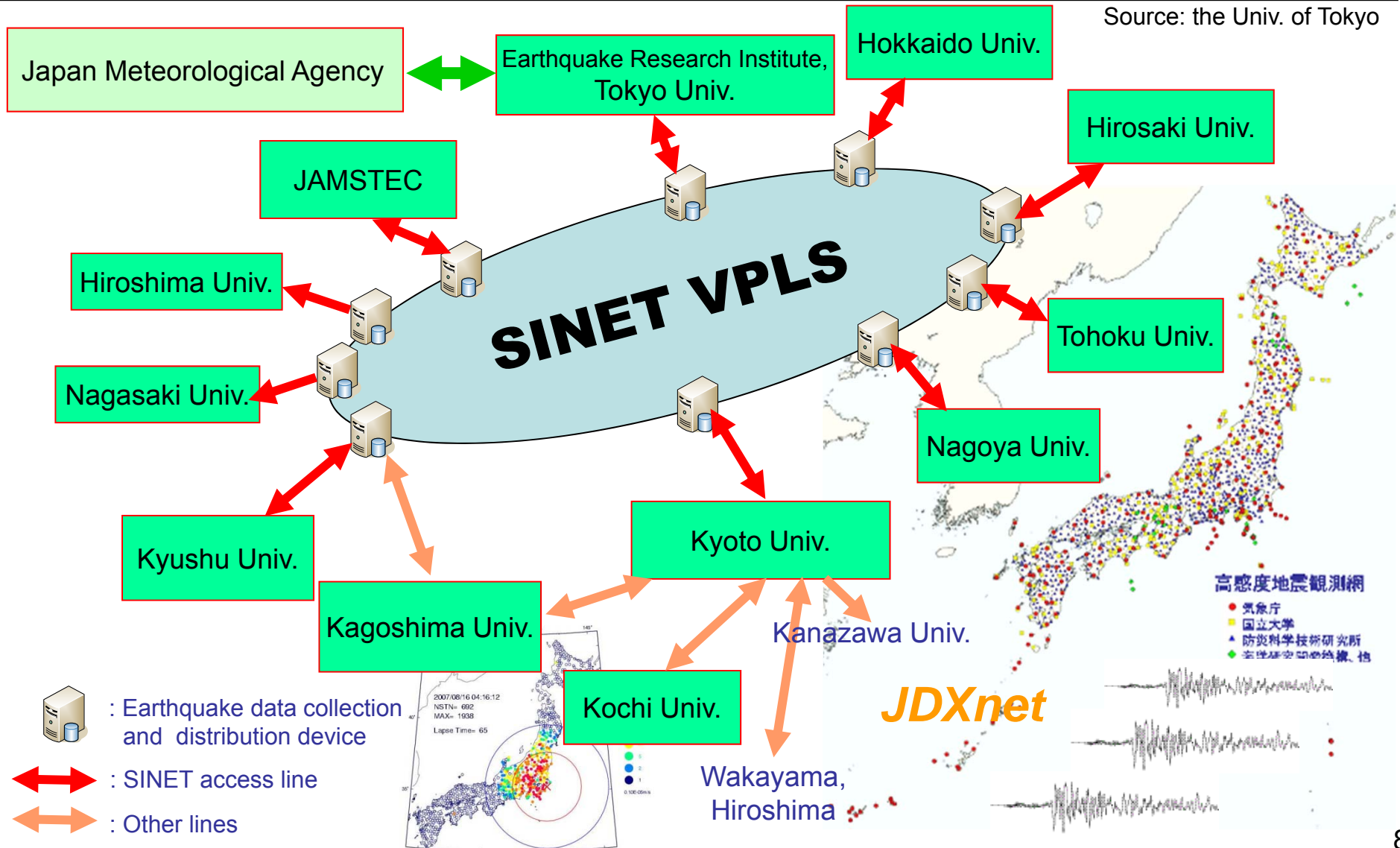
Source: University of Tokyo

K computer (11.28 Pflops, 1.27 PB)



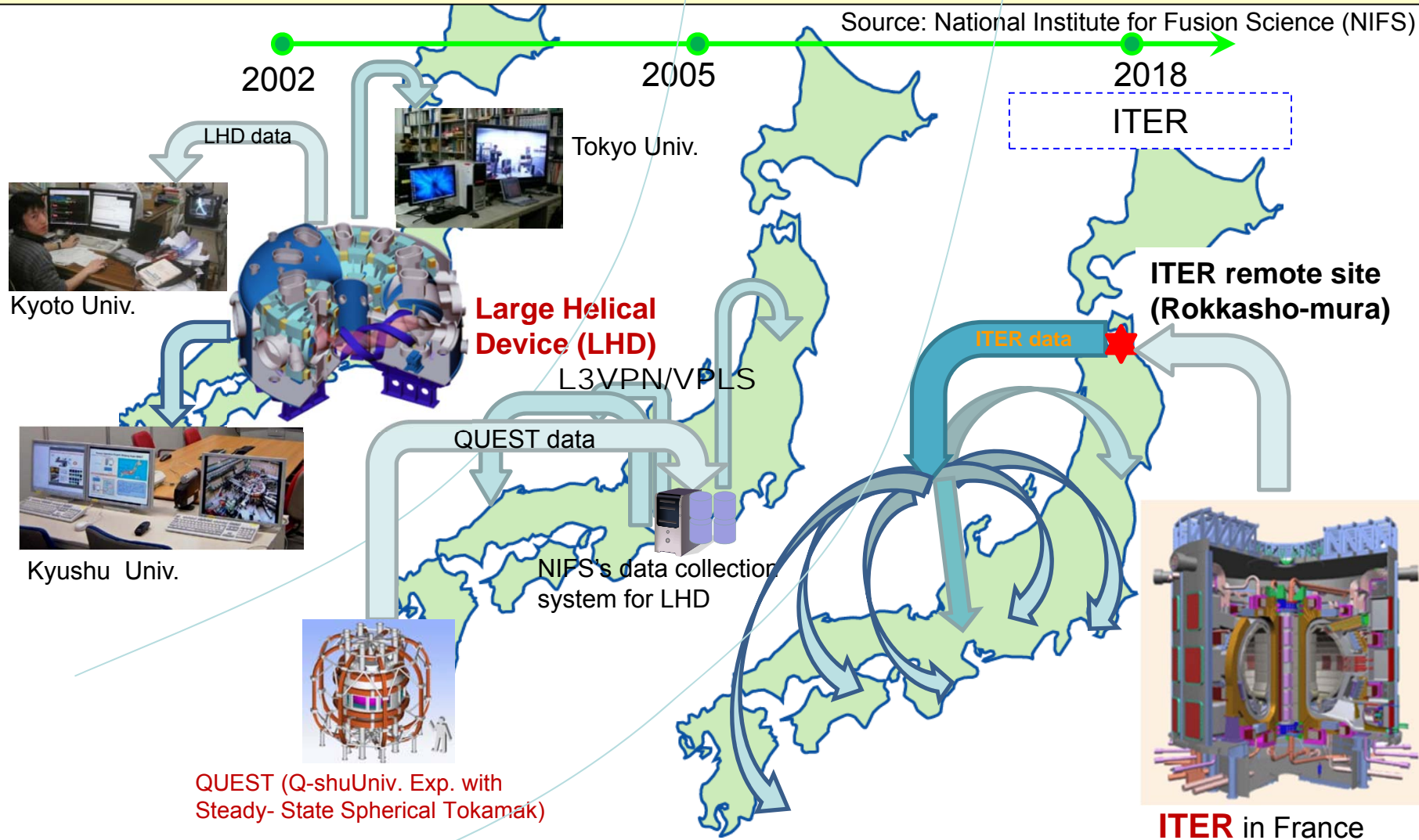
Usage Example in Seismology

◆ This project shares the data measured at each sensor by using SINET VPLS broadcast capabilities in order to determine the mechanism of the earthquakes.



SINET4 Usage Example in Nuclear Fusion Science

- ◆ Large Helical Device (LHD) and its measure data are shared among universities and NIFS through SINET VPN, and the data volume has been increasing.
- ◆ Rokkasho-mura, the remote site of ITER, is open for supercomputer simulations.

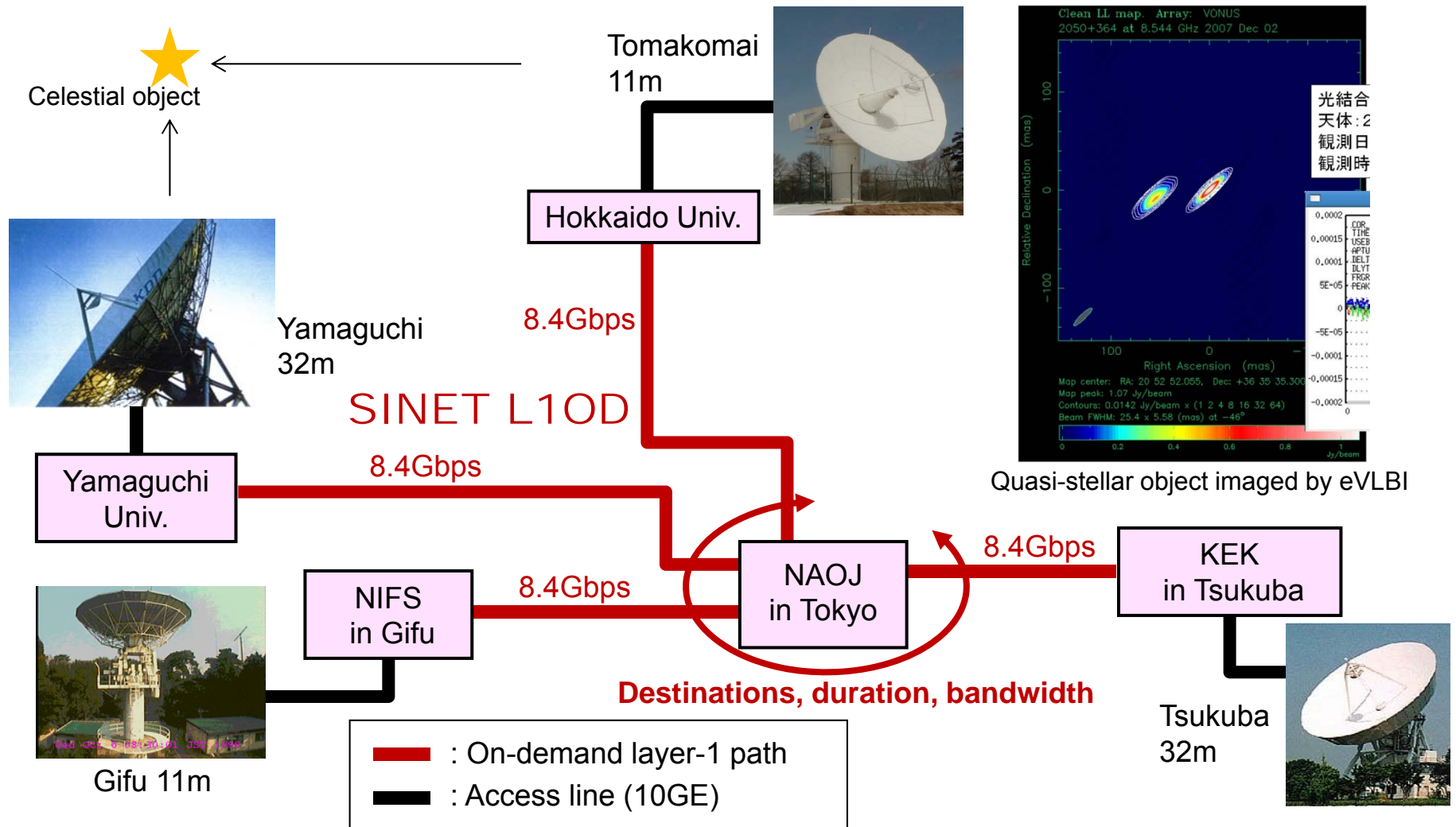


Usage Example in Astronomy

◆ Astronomical eVLBI transfers huge amounts of measured data (over 8 Gbps) by using on-demand layer-1 paths which are established between remote antennas and NAOJ.

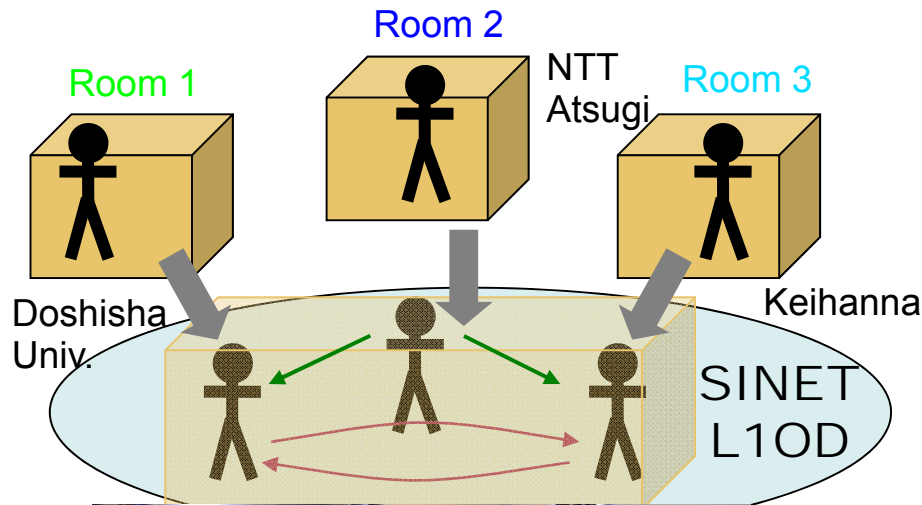
* VLBI: Very Long Baseline Interferometry

Source: National Astronomical Observatory of Japan (NAOJ)

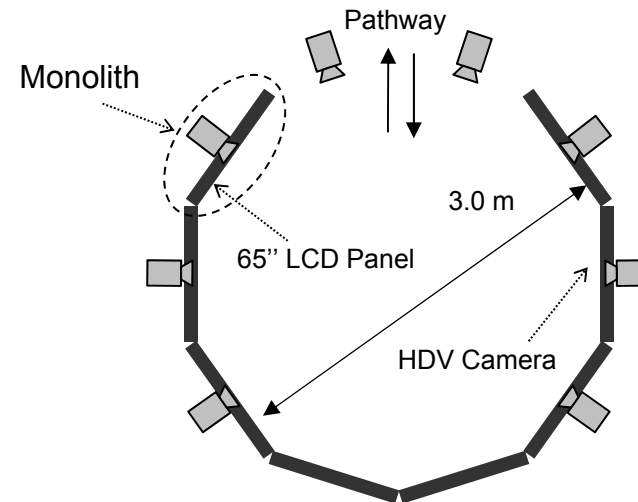
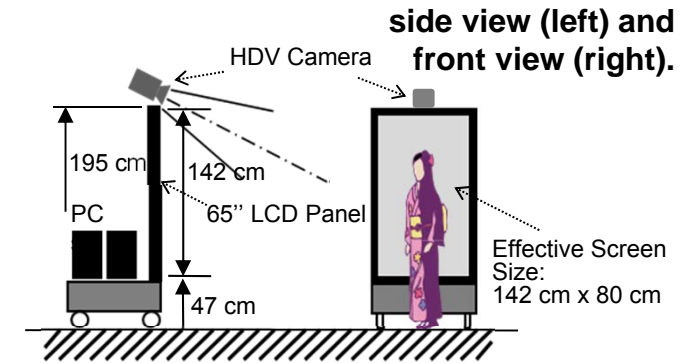


◆ **t-Room** — a room-sharing video system that allows people at different sites to feel as if they are in the same room — needs bandwidth of 300 Mbps and small delay variance for 8 high-definition videos, voices, and control signals.

Source: Doshisha University



“Monolith” Building Module:



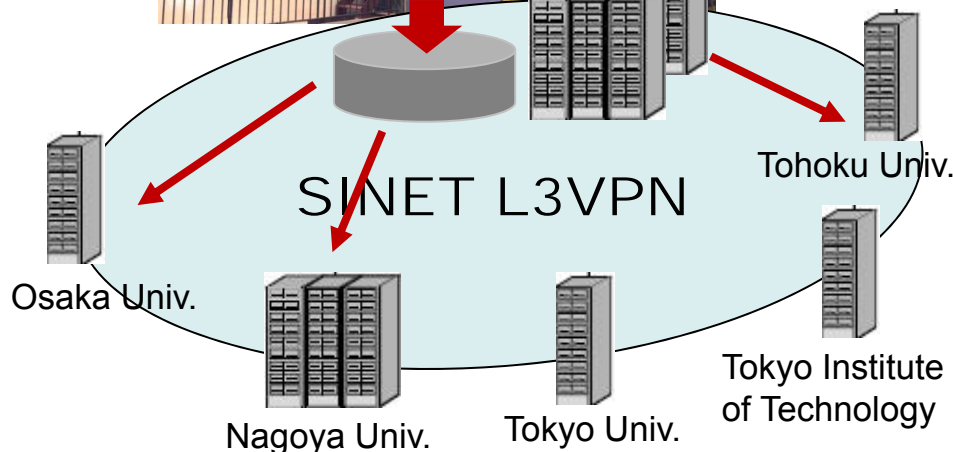
Usage Example in High-Energy Physics

- ◆ High-energy physics needs a very-high-speed network with VPN capabilities in order to securely transfer large amounts of data between research sites.
 - Belle experiment used SINET L3VPN to share measured data. “Belle II” will start in 2015.
 - ATLAS experiment for Large Hadron Collider (LHC) in Switzerland needs International collaboration through SINET international lines in order to globally share measured data.

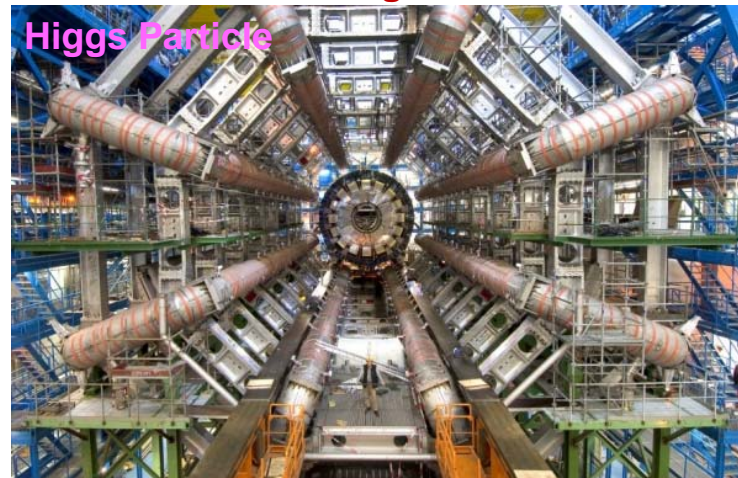
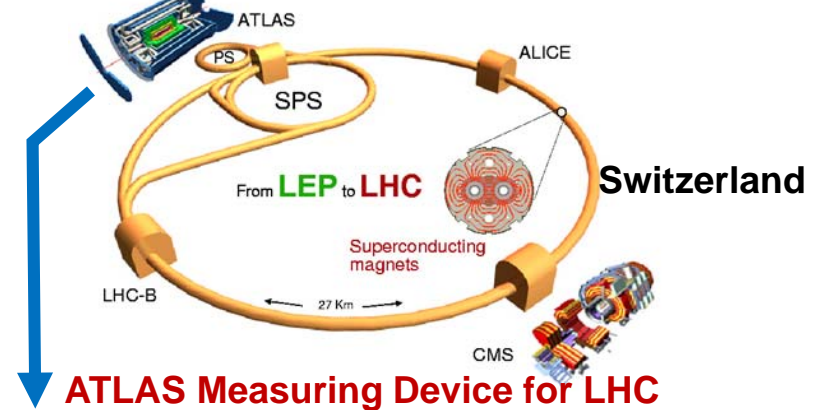
Belle Measuring Device for KEKB



Tsukuba



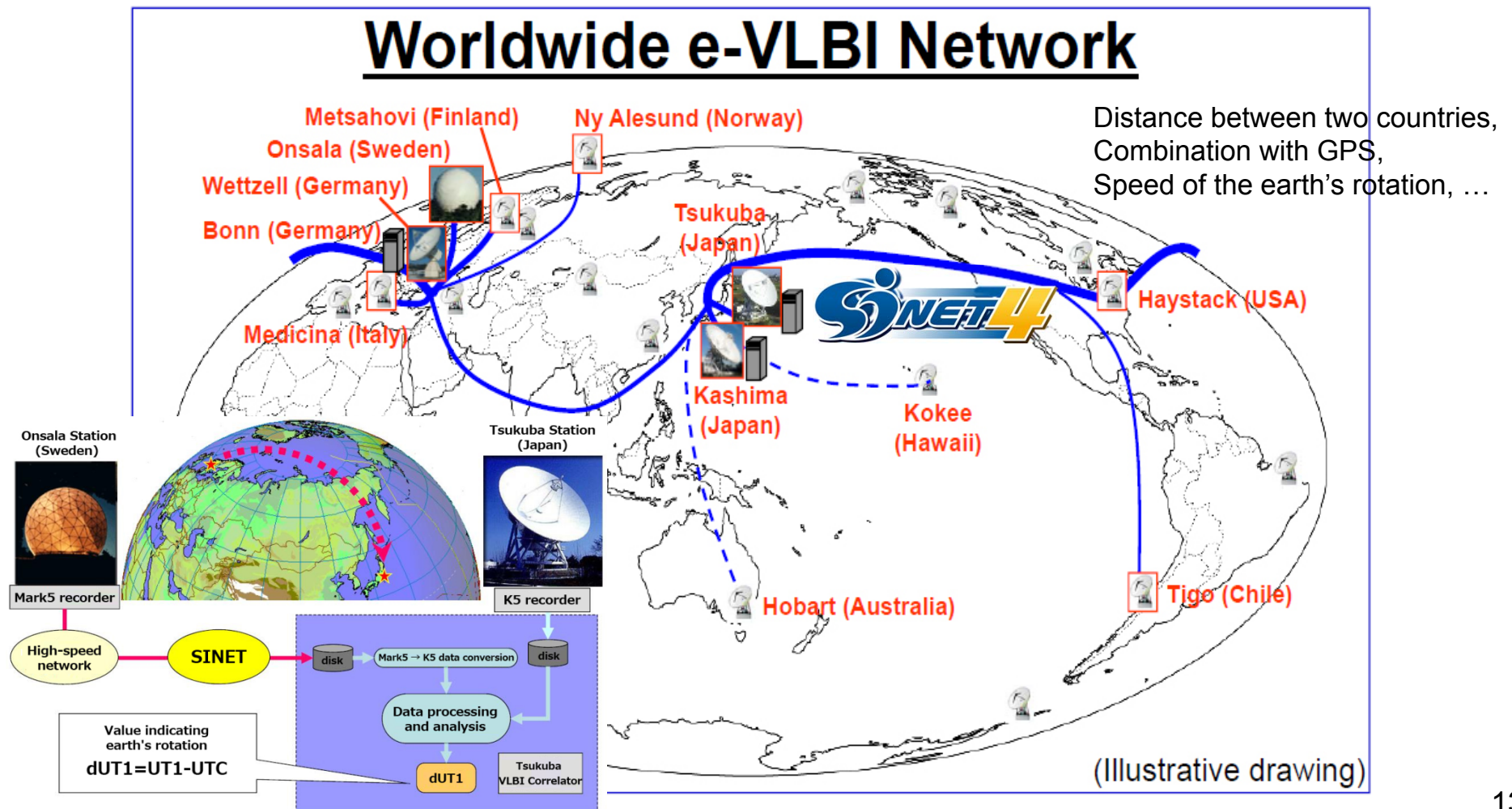
Source: High Energy Accelerator Research Organization (KEK)



Usage Example in Geodesy

- ◆ Geodesic eVLBI forms a global virtual telescope through international collaboration and monitors plate motions, locates Japan's position in the world, and monitors the orientation of the earth.

Source: Geographical Survey Institute

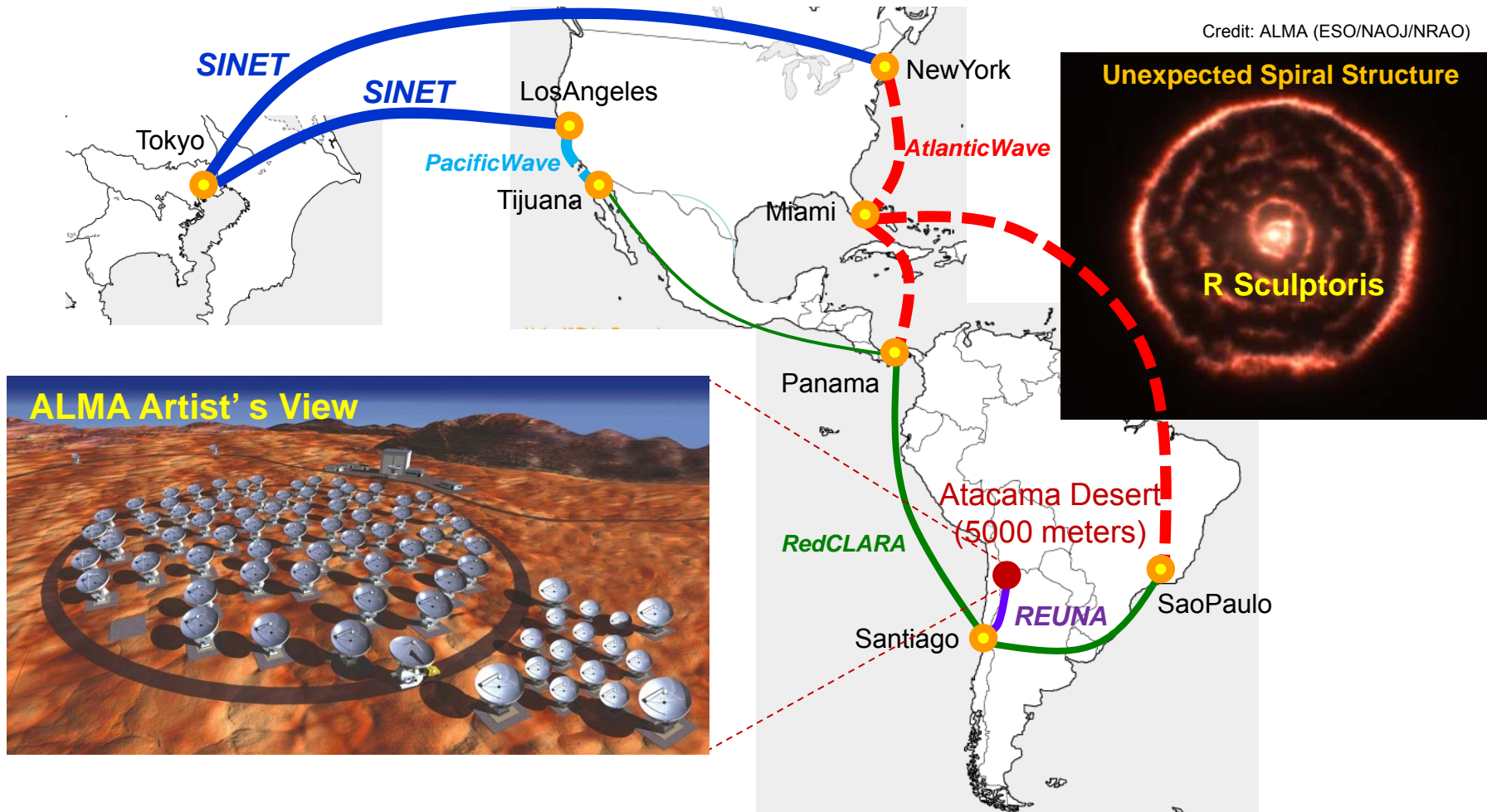


Usage Example in ALMA Telescope

- ◆ The ALMA project is a global partnership of Europe, North America and East Asia (led by Japan) in cooperation with Chile to operate a ultra-high performance radio telescope consisting of 66 high-precision antennas. The Initial operation started by using 16 antennas in September 2011.

ALMA: Atacama Large Millimeter/submillimeter Array

Source: National Astronomical Observatory of Japan (NAOJ)

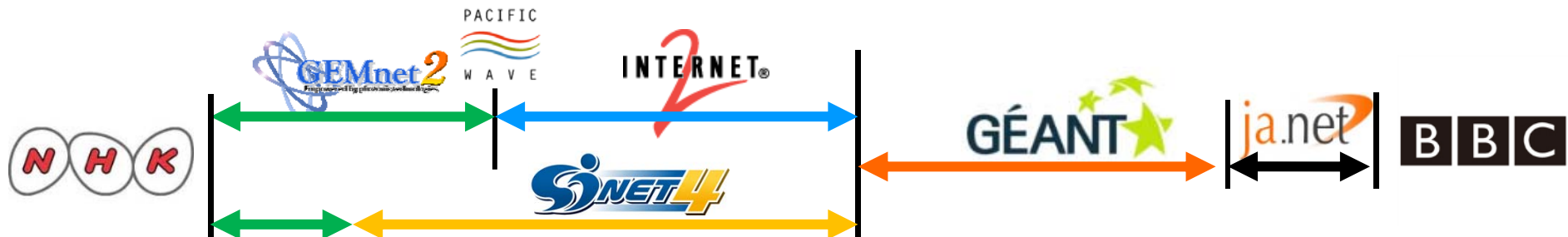
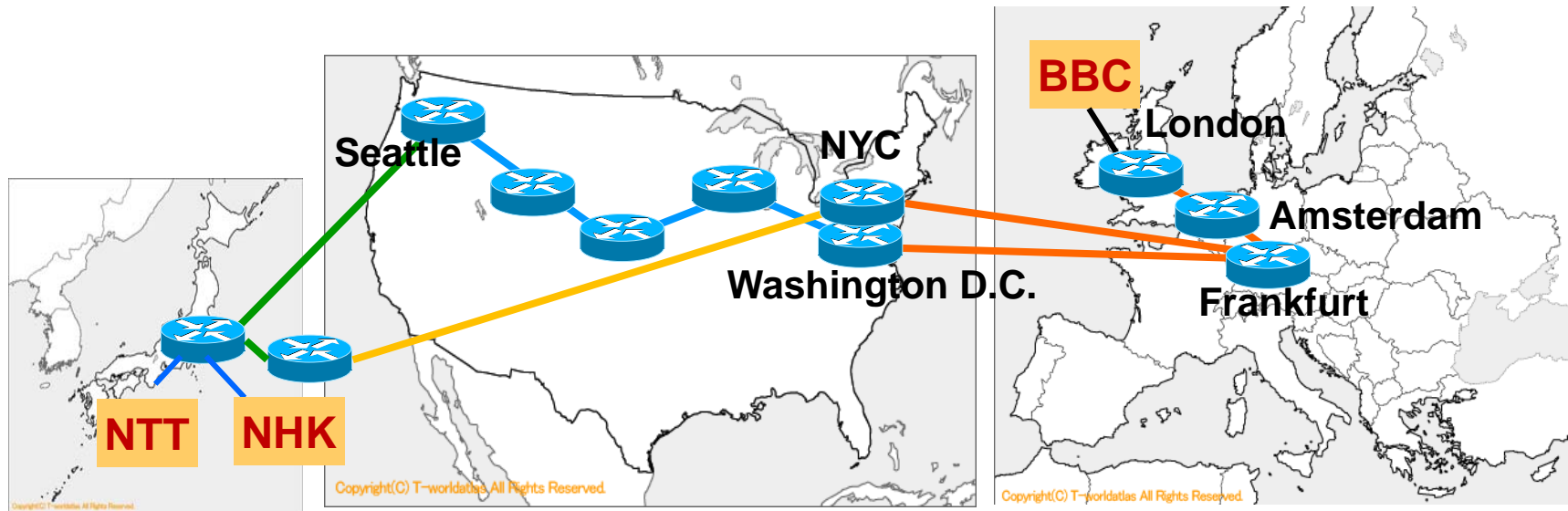




Usage Example in Super Hi-Vision

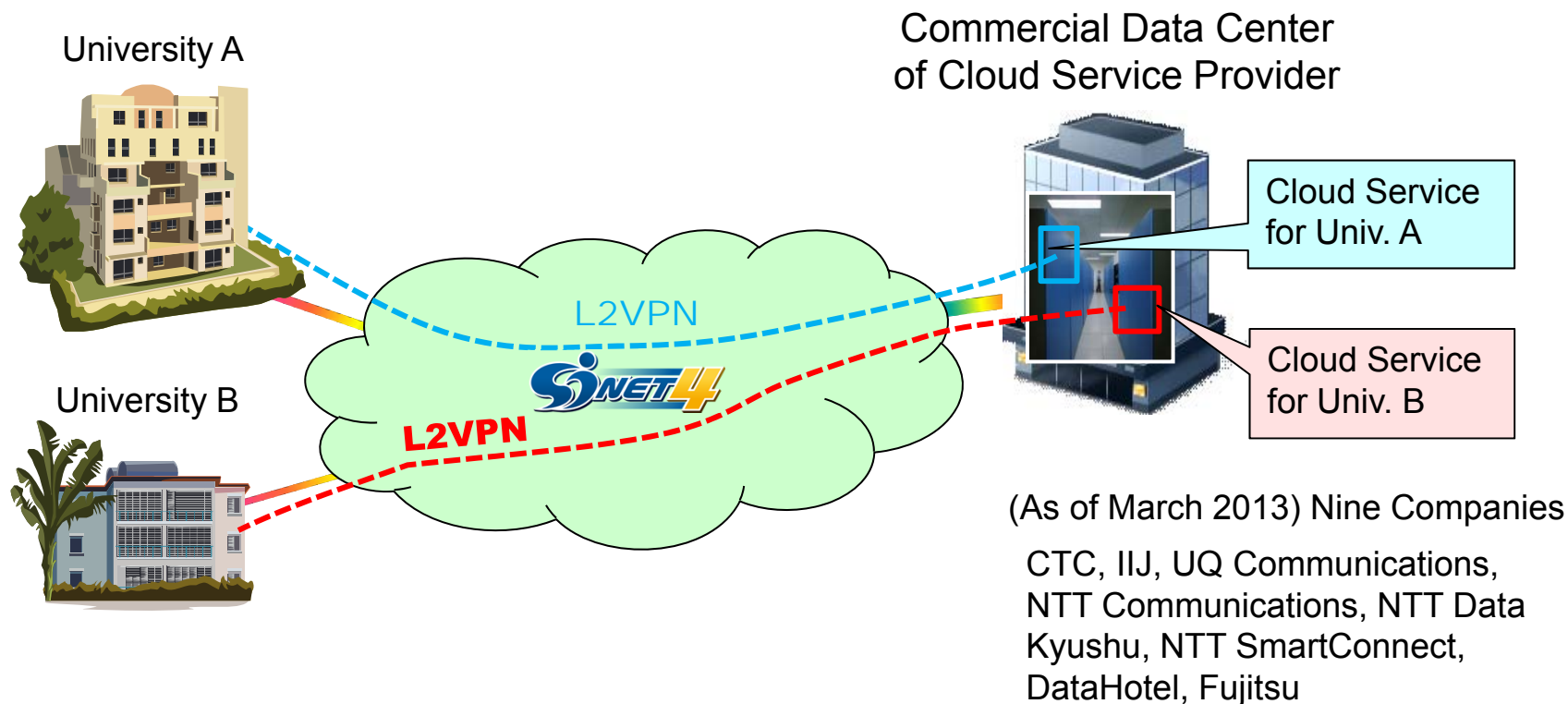
- ◆ Experimental transmission of Super Hi-Vision (which has 7680 x 4320 pixels, 16 times higher than standard Hi-Vision) was done between London and Tokyo on August 2012.

Source: NTT Laboratories



Facilitation of “Private Cloud”

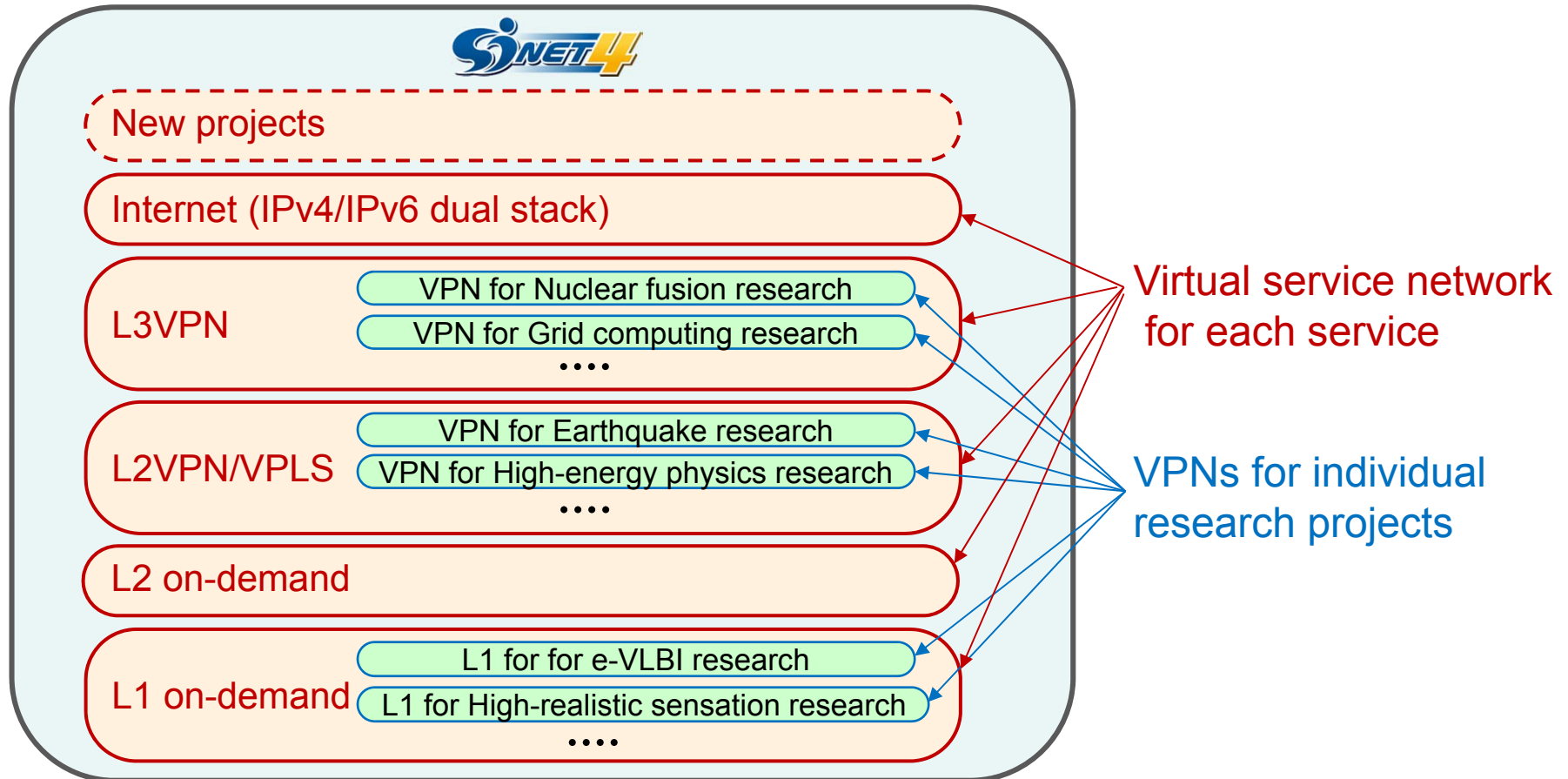
- ◆ Universities can economically construct “Private Cloud” environment with SINET.
- NII allows cloud service providers who support universities’ activities to directly connect to SINET4.
- In principle, each university uses L2VPN in order to connect its campus LAN to service provider’s equipment.





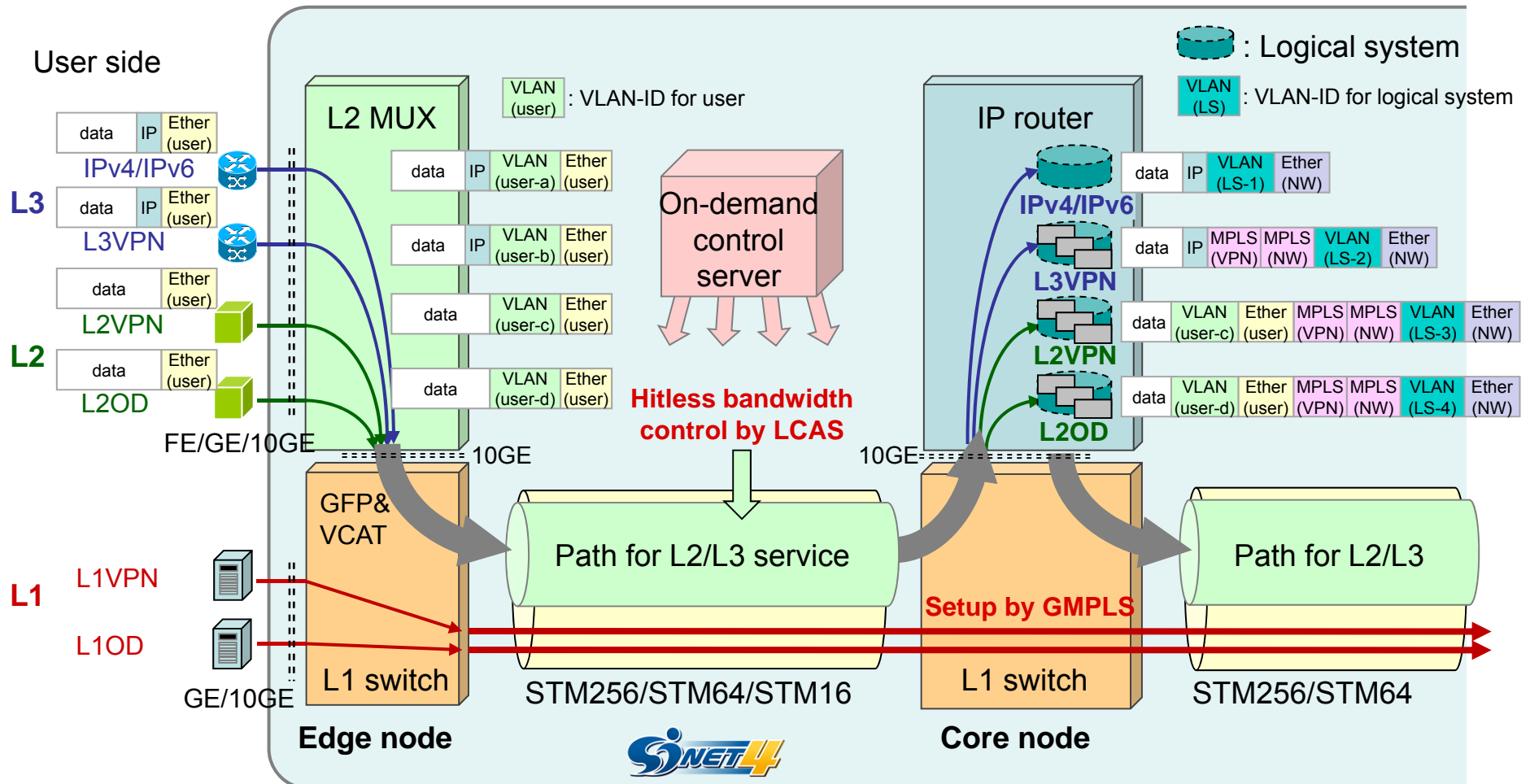
Multilayer Network Service Provision

- ◆ SINET4 provides a variety of multilayer network services on a single network platform.
- ◆ It forms virtually separated service networks for each service group, in order to allow each network service to grow independently and to avoid any instability due to functional upgrades or failure recovery actions of co-existing network services.



Technical Design of SINET4

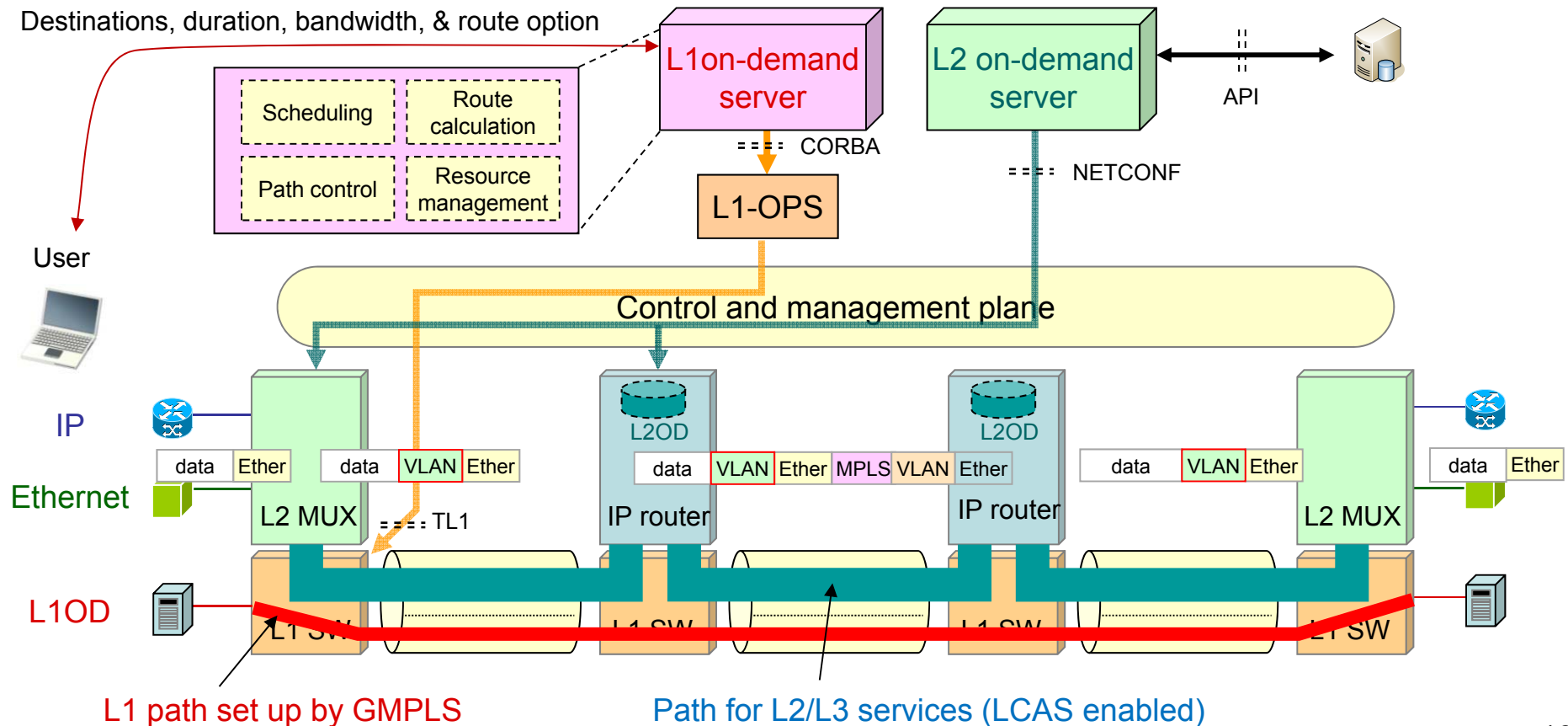
- ◆ SINET4 combines advanced networking functions in order to provide multilayer network services with dynamic resource assignment. On-demand control servers were developed for dynamic layer-1/2 paths and flexible bandwidth assignment.





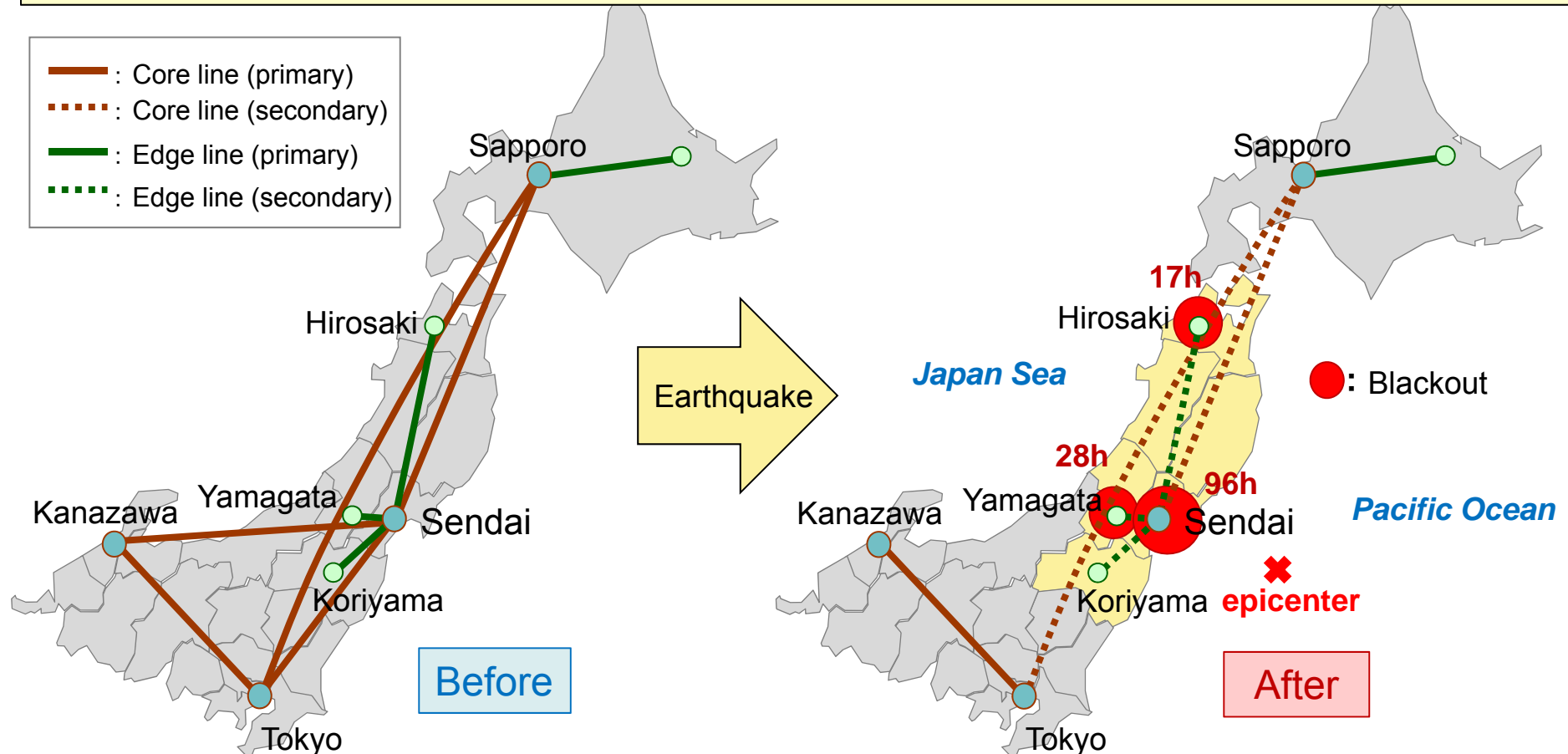
Design for Layer 1/2 On-demand Services

- ◆ SINET provides L1 on-demand (L1OD) services, where users can specify the destinations, duration, bandwidth, and route option via Web pages.
- ◆ L1OD server receives user requests, performs path calculation, and triggers L1 path setup. It also triggers L1 switches to do LCAS operation as needed.
- ◆ SINET also provides L2 on-demand services with Application Programming Interface.



Impacts of Great East Japan Earthquake

- ◆ SINET4 did not stop the service operation thanks to its reliable network design.
 - Nodes were not damaged and continued to work even in areas where the blackout lasted for long periods of time (96 hours in Sendai).
 - Lines were severely affected, but the backbone could keep the routes by surviving secondary circuits between arbitrary nodes; and none of areas was not isolated.



Thank you very much!