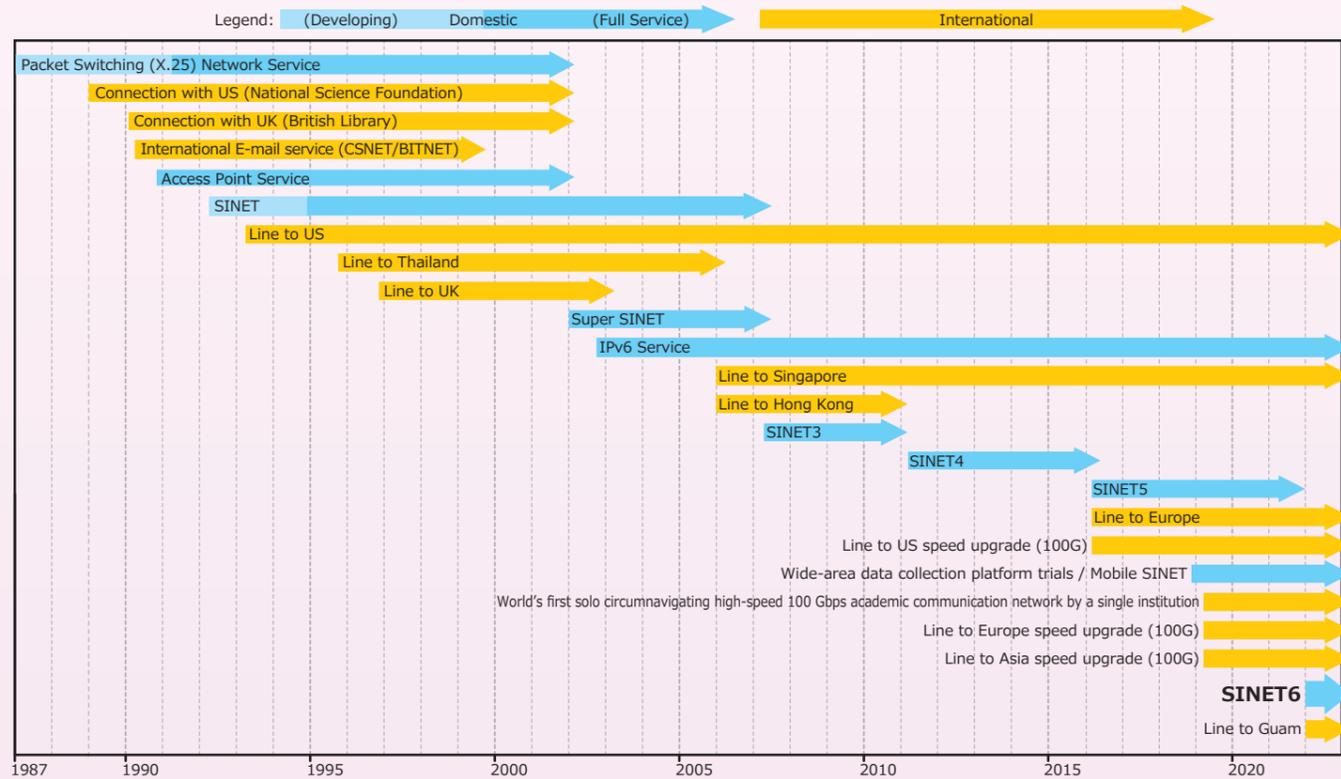


# History



## Science Information NETWORK 6

Ultra-high-speed backbone network connecting universities and research institutions nationwide (\*1)

Most Japanese domestic lines built at 400Gbps and international connection lines built at 100Gbps (\*2)

Supports large-scale international projects in collaboration with overseas research networks (\*3)

Supports research handling large-scale data and other research and education through various services

## SINET Promotion Office

The SINET Promotion Office was established in October 2007 in order to promote the use of SINET. It provides consulting on the advanced use of the network, user support, and training and promotion regarding network services, and also carries out an educational campaign. If you experience any trouble or find something you do not understand, please contact us for assistance.

[Main Activities in FY2022]  
 ●SINET6 user consultations (e-mail, phone)

### Services

#### User consultation/response

Consulting on the use of network services



#### Interviews/surveys on user requests

Solicitation of comments and requests for SINET



#### Troubleshooting of performance-related problems

Support for network service usage  
 Problems and performance improvements



#### Technology promotion and educational campaign (lectures and technological exchanges)

Presentations on using SINET, educational campaign, use cases of SINET promotion, creation of documentation, and publication of information on the Web



## NII Open Forum

The NII Open Forum was established in June 2009, as a framework to strengthen collaboration and information exchange among universities and research institutions, for the purpose of enhancing cutting-edge scientific information infrastructure as a foundation for supporting the development and growth of academic research and education.

The Forum engages in activities for quickly sharing a detailed image of education and research environments at universities and research institutions that will be realized through SINET6, and developing them together with users.

[Main Activities in FY2022]

- Briefings on NII services (held both onsite and online)
- NII Open Forum (held online)

**NII** Inter-University Research Institute Corporation  
 Research Organization of Information and Systems  
**National Institute of Informatics**

2-1-2 Hitotsubashi, Chiyoda-ku, Tokyo, 101-8430 Japan  
 National Center of Sciences Bldg.  
<https://www.nii.ac.jp/en/>

### Contact Info for Inquiries

Academic Infrastructure Division, SINET Promotion Office  
 E-mail [support@sinet.ad.jp](mailto:support@sinet.ad.jp)  
 TEL +81-3-4212-2269  
<https://www.sinet.ad.jp/en/>



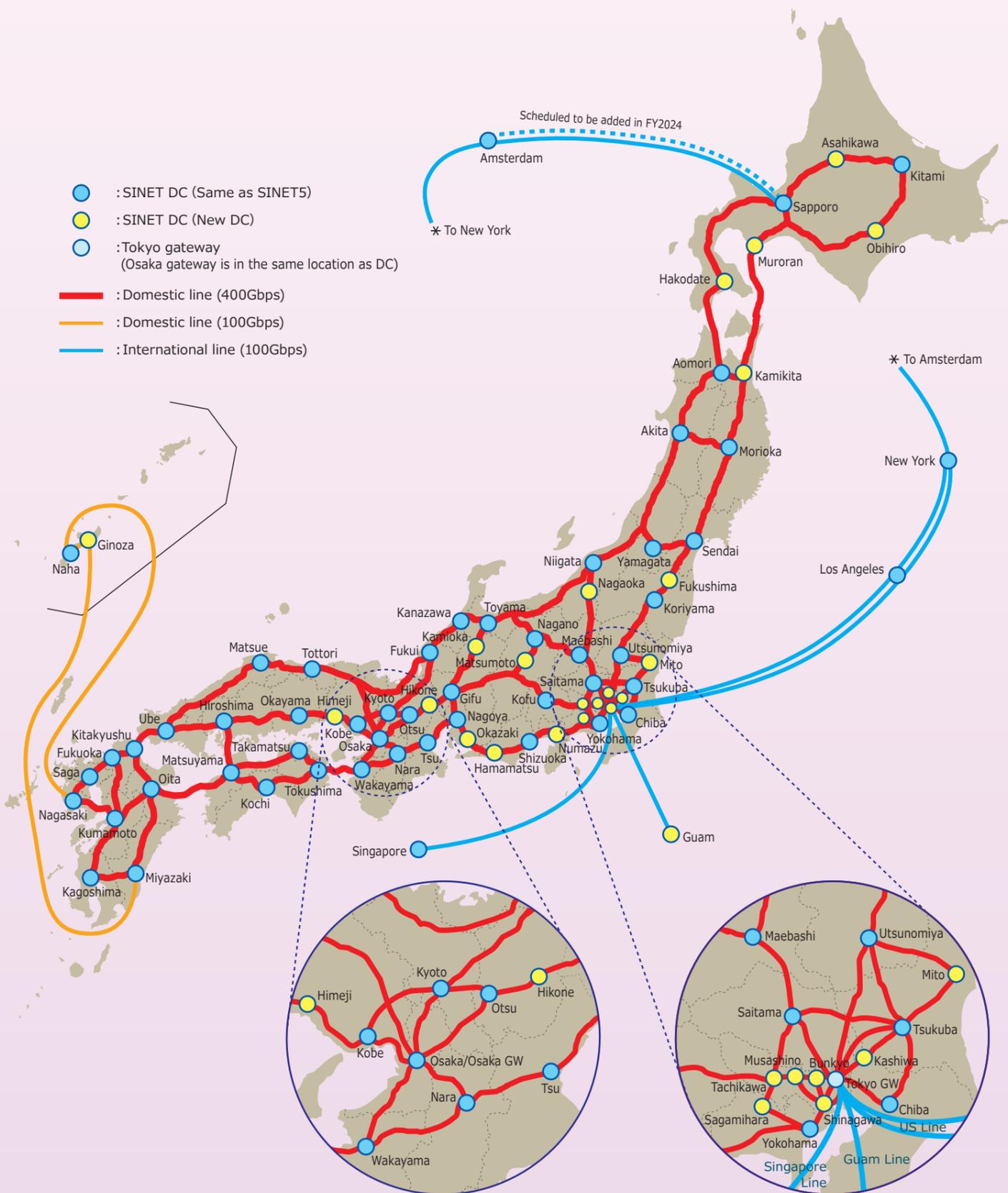
2023.02

# 2022-2023

(\*1) Backbone network: The domestic backbone network that connects the LANs at universities and research institutions with those at other universities and research institutions.  
 (\*2) 400Gbps: Network transmission speed that enables transmission of up to 400 billion bits per second—enough to transfer the contents of a Blu-ray disc (25GB) in 0.5 seconds.  
 (\*3) Overseas research networks: Examples include Internet2 in the United States and GÉANT in Europe. See figure on Page 2.

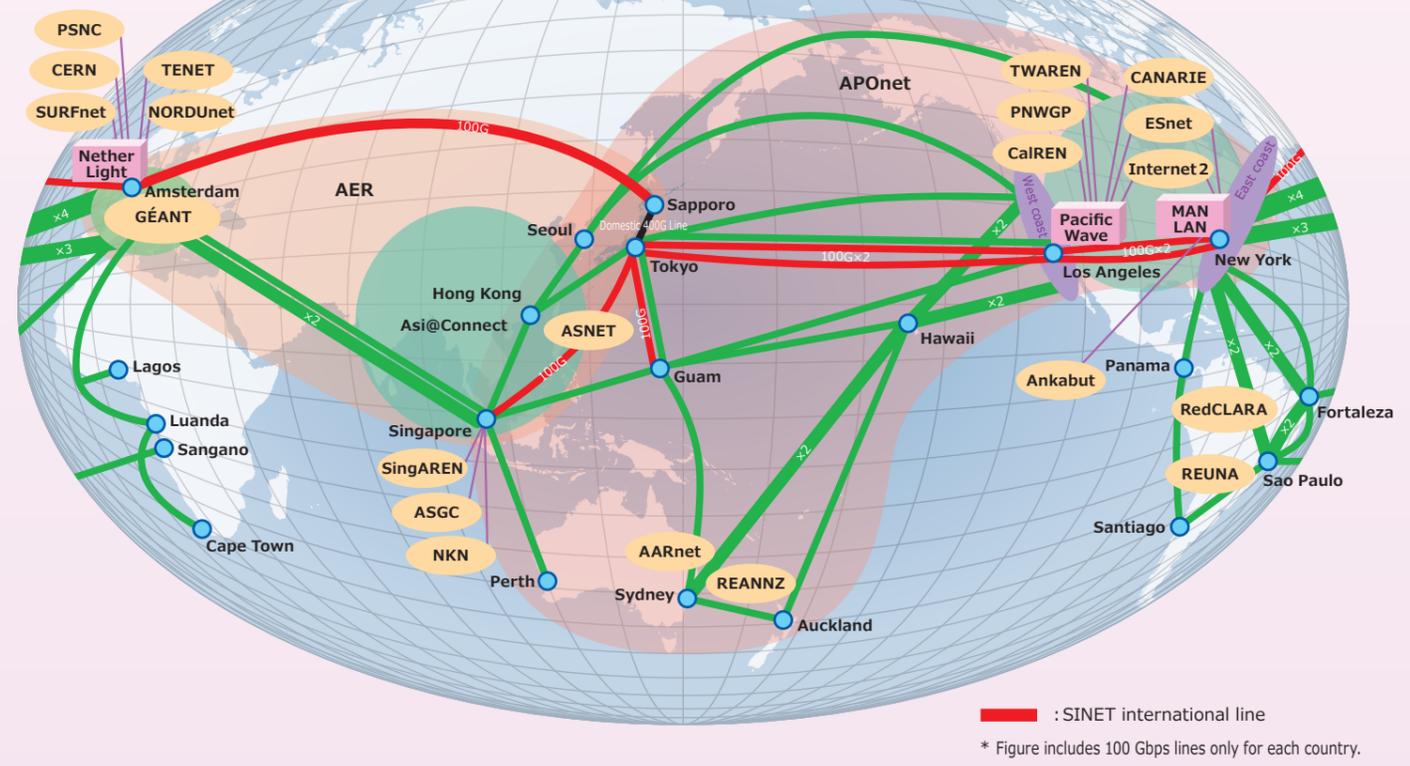
# Network Topology of SINET6

SINET6 is an ultra-high-speed, low-latency and scalable network that consists of optical fiber lines that follow the shortest paths to connect network nodes, and the latest cutting-edge transmission devices. At the same time, redundant optical fibers enhance the reliability of network. It also minimizes the delay between arbitrary points by connecting nodes in a fully-meshed topology.



## Interconnection with Overseas Research Networks

SINET is interconnected with many overseas research networks, to facilitate the smooth circulation of research information across international borders.

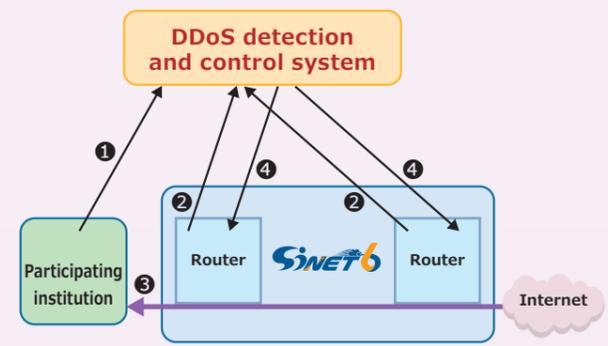


## SINET6 New Services

### Automatic DDoS Mitigation Service

Address ranges and detection conditions are registered in advance, and detection and packet drop are performed automatically when communication patterns match the specific conditions.

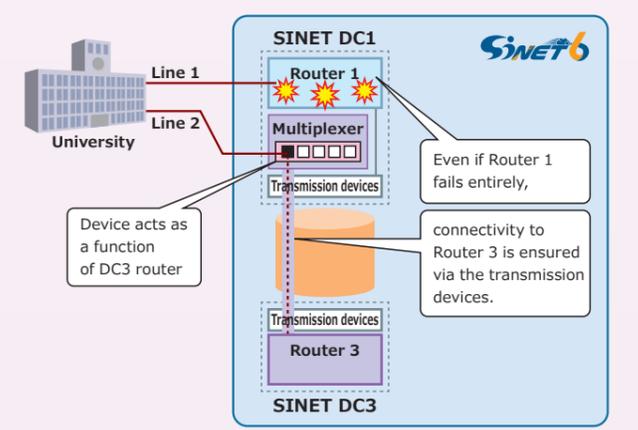
- Notify and control attacks quickly**
- 1 Institution registers the address to be monitored and the control method at the time of detection (participating institution)
  - 2 Information collection and monitoring from routers (SINET)
  - 3 DDoS attack occurs
  - 4 Detects DDoS and activates packet drop control (SINET)



### Data Center Connection Redundancy Service

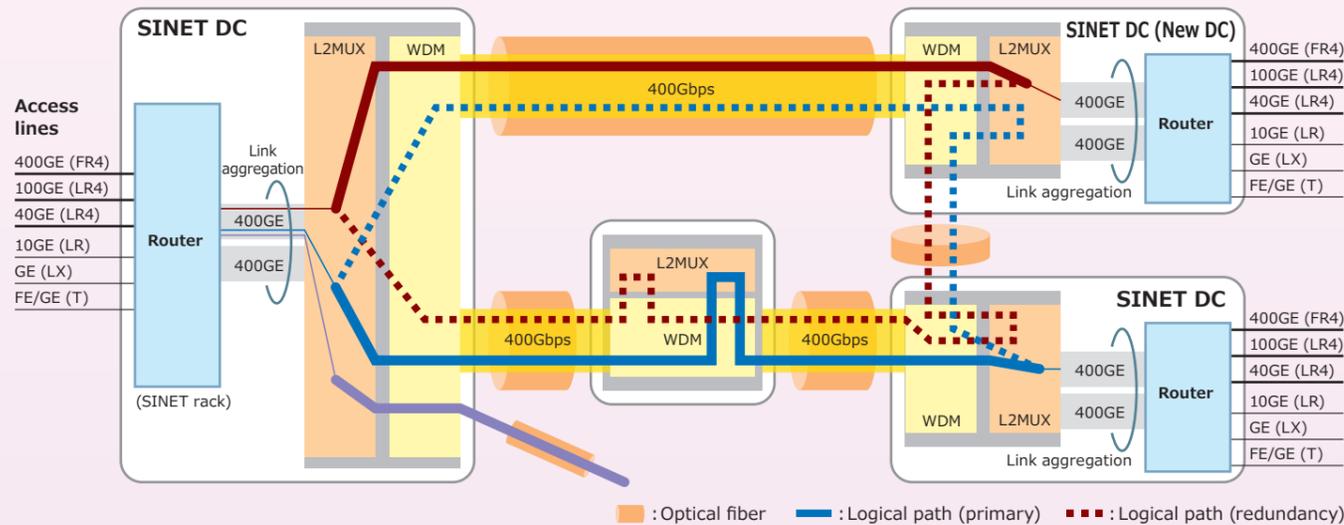
The Data Center Connection Redundancy Service provides communication with alternate data center routers when connection failures occur, without the need to connect multiple connection lines to separate data centers.

- Build multiple connections at low cost**
- Two access lines connected to SINET DC1
  - Line 2 is accommodated in a separate data center router via SINET DC1 (As a general rule, connection speed for Line 2 is 10Gbps or less)

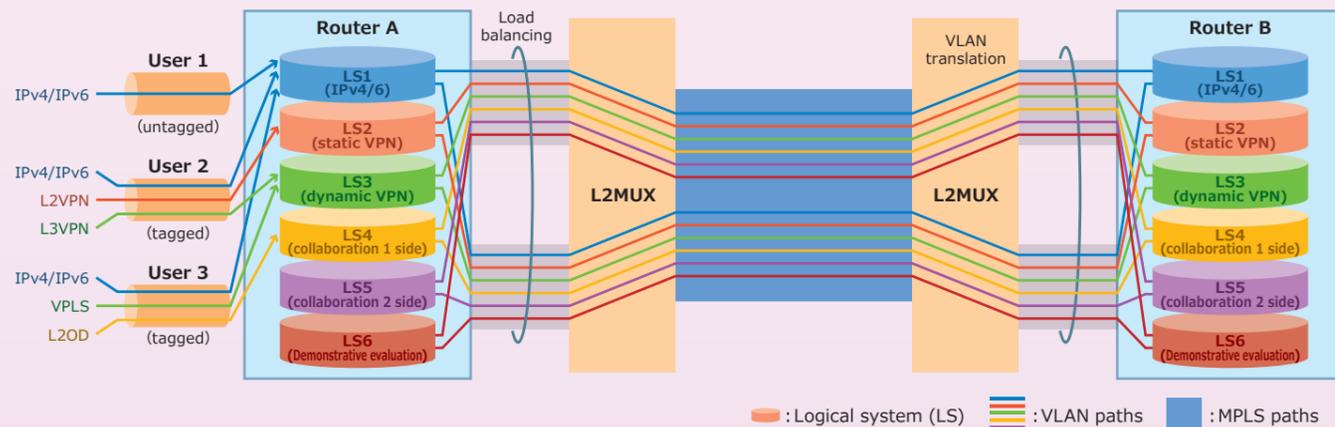


# SINET6 Architecture

Transmission devices (L2MUX) are connected to the router with two or more 400Gbps links and carry out load balancing. Sections between each L2MUX are connected by both wavelength and logical paths, with redundant logical paths (primary and redundancy) being used to ensure high availability.



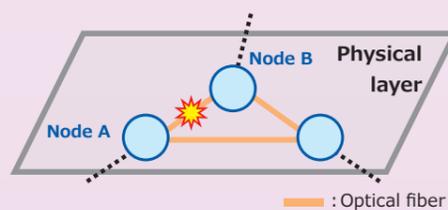
Routers set logical systems (LS) for each group of services. Individual LSs are connected by VLAN connections.



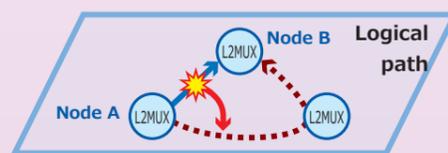
## High Availability of SINET6

### Backbone path redundancy

Each node is connected to another by at least two or more alternative optical fiber routes, ensuring continuity of transmission even in the event of an optical fiber being severed.



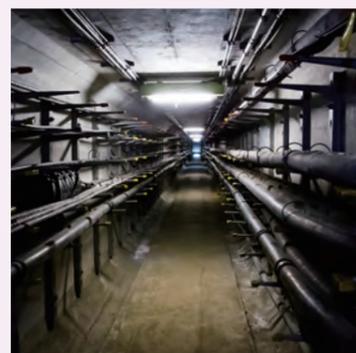
Nodes are directly connected by logical paths. If the primary (active) path is severed, transmission is automatically diverted to another route via an alternate logical path.



Communication between Node A and Node B during system failures

### (Reference) Cable Tunnels

In order to protect them from earthquakes and other disasters, major optical fibers are installed inside underground tunnels called cable tunnels (or todo in Japanese).



# SINET6 Network Services

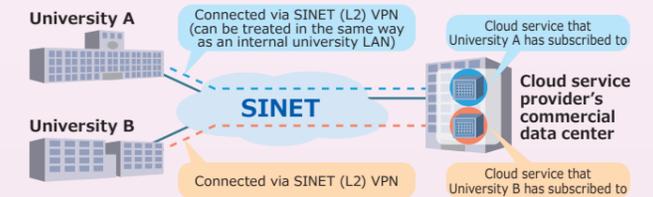
In order to expand and enhance network service functionality and build secure, advanced research environments for universities and research institutions, SINET6 offers an expanded range of user-oriented services, including virtual university LAN and L2 on-demand services.

Service menu	
L3 services	Internet Connection (IPv4 & IPv6) Full Route Provision IP multicast (+QoS) QoS for each application L3VPN (+QoS)
	L2 services
	Mobile SINET
	Redundancy of access lines
Stabilization of network operations Next-generation network functions	Automatic DDoS Mitigation Service SINET Edge
	Enhanced transfer performance

## Framework for Secure Use of Cloud Services

In order to enable secure use of upper-layer services (e.g. e-mail and storage), SINET6 adopts a framework where cloud service providers' commercial data centers are logically and directly connected to universities by L2VPNs.

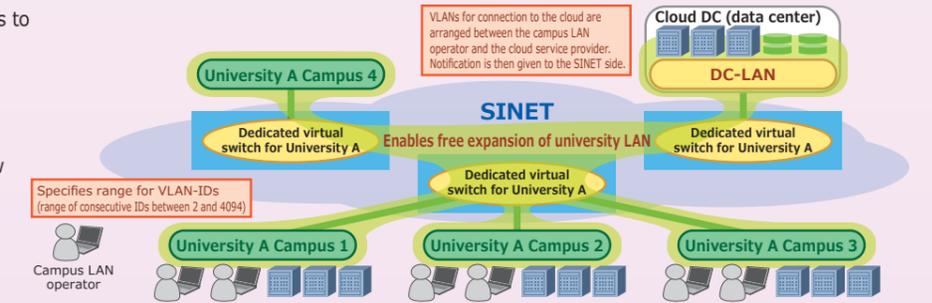
\* In order to use the service, the participating institution must sign an individual contract with the cloud service provider.



## Virtual University LAN Services

SINET enables free expansion of university LANs to connect to multiple campuses and clouds.

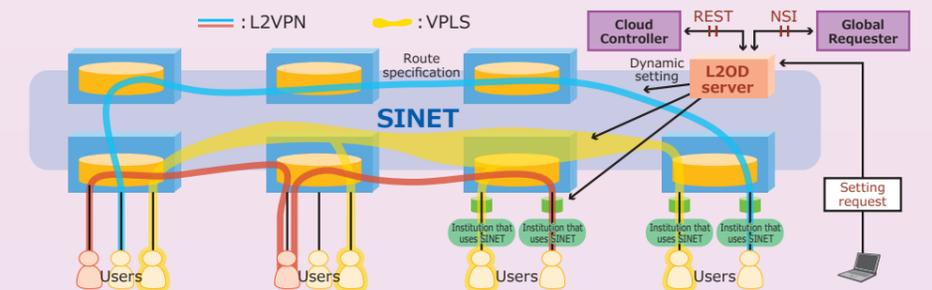
- User side: Specifies range of VLAN-IDs. VLAN-IDs for connection to the Internet/ L2 & L3 VPNs are specified separately. Negotiations with NII for addition of each new VLAN-ID are unnecessary, enabling flexible operation by participating institutions.
- SINET side: Automatically recognizes VLAN-IDs at SINET nodes and automatically connects between multiple points.



## Layer 2 (L2) On-demand Services

Users can establish L2VPN/VPLS on-demand, based on the connection points and start and end times (from short-term to long-term) they specify. Below is an image of how this service works when in use.

- L2VPN (P-to-P connection): allows optional specification of bandwidth and route
- VPLS (MP-to-MP connection): allows optional addition and removal of connection points

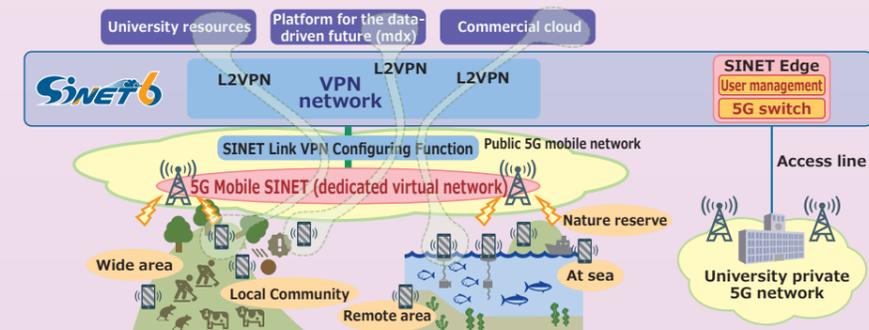


## Mobile SINET

To send and receive valuable research data generated in remote areas, at sea, and in other locations where a wired network is unavailable, the service offers a secure communication environment connected directly to SINET over public 5G mobile networks. A new trial was launched in April 2022 in preparation for full-scale deployment of the service.

There is also a plan to support the private 5G networks operated by universities.

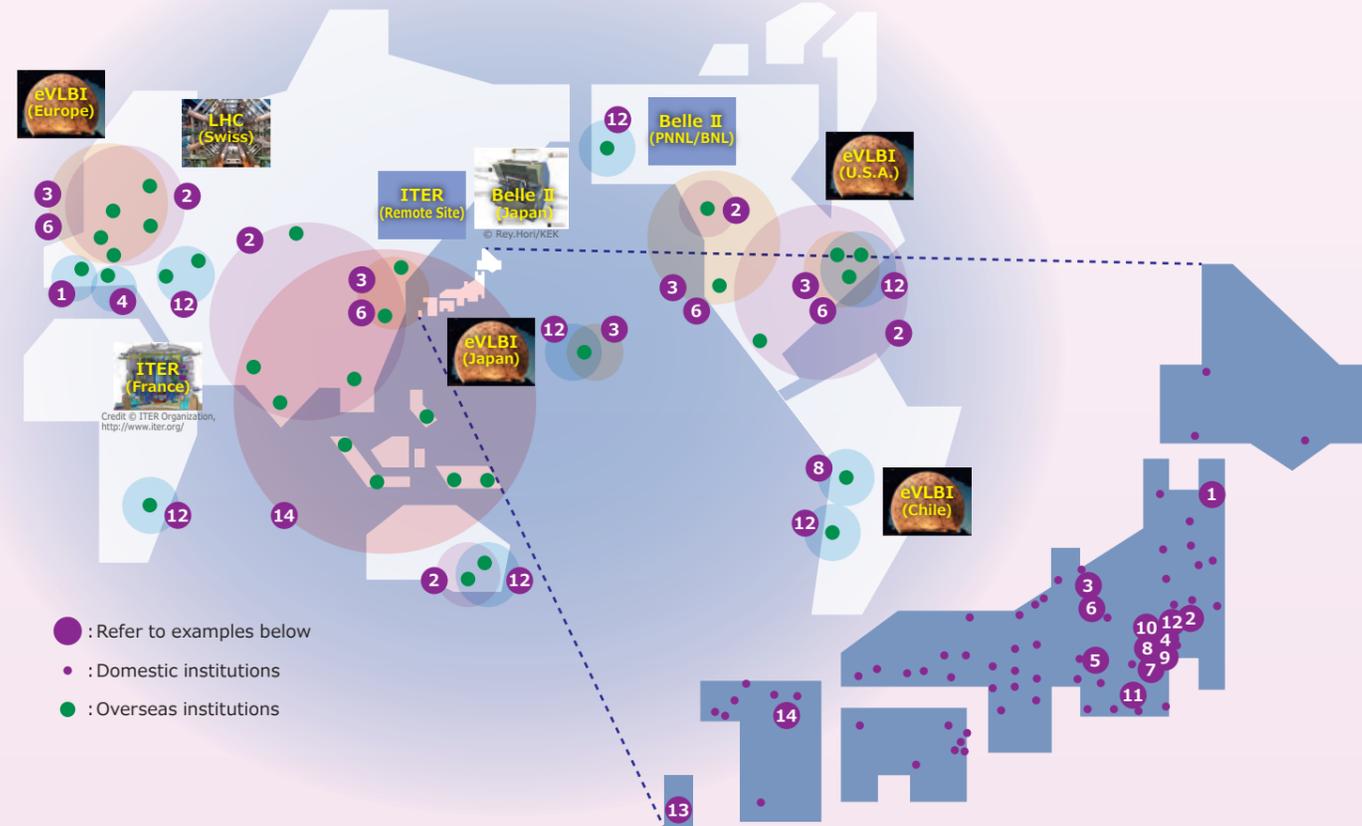
Please direct queries to :  
Mobile SINET representative wadci@sinet.ad.jp



# Use Cases

SINET has been utilized as academic information infrastructure essential for scientific research and education in a broad array of areas in Japan. For details of SINET use cases, please visit the SINET website.

<https://www.sinet.ad.jp/en/>



L1: L1VPN L2: L2VPN/VPLS L3: L3VPN od: On-demand D: IP Dual I: International connection

## High Energy Physics and Nuclear Fusion Science

1	I	SINET Speeds Up Japan-Europe Collaboration in International Research on Nuclear Fusion	Institutions: National Institute for Fusion Science, Japan Atomic Energy Agency
2	L3 I	The "Belle Experiment": A Major Contribution to Confirmation of the Theory of Kobayashi and Maskawa, Nobel Laureates in Physics	Institutions: High Energy Accelerator Research Organization (KEK), Tohoku University, Tokyo Institute of Technology, The University of Tokyo, Nagoya University, Osaka University, etc.
3	L2 L3	Neutrino Research	Institutions: Kamioka Observatory (ICRR, The University of Tokyo), J-PARC, domestic and overseas researchers
4	I L3	Distributed analysis of enormous amounts of data produced by the LHC accelerator	Institutions: The University of Tokyo, High Energy Accelerator Research Organization (KEK), University of Tsukuba, Waseda University, Tokyo Institute of Technology, Tokyo Metropolitan University, Nagoya University, Kyoto University, Kyoto University of Education, Shinshu University, Okayama University, Hiroshima Institute of University, Nagasaki Institute of Applied Science, CERN, etc.
5	L2 L3	Nuclear Fusion Research for a Clean Future Energy	Institutions: National Institute for Fusion Science (NIFS), University of Tsukuba, Kyushu University

## Space Science and Astronomy

6	L2	Cosmic Rays observation and research	- Large-scale Cryogenic Gravitational wave Telescope "KAGRA", Large water Cherenkov detector "Super-Kamiokande" - Institutions: The Institute for Cosmic Ray Research (University of Tokyo), Osaka City University, Niigata University
7	I L2	Asteroid Explorer "Hayabusa 2"	Institutions: The Institute of Space and Astronautical Science (JAXA)
8	L3	The ALMA Project and SINET	Institutions: National Astronomical Observatory of Japan
9	od	Optically Connected VLBI Observation Using SINET L1 On-demand Service	Institutions: National Astronomical Observatory of Japan (NAOJ), Hokkaido University, Yamaguchi University, National Institute for Fusion Science (NIFS), High Energy Accelerator Research Organization (KEK)
10	L1	Studying the Sun with the Solar Observation Satellite Hinode	Institutions: Institute of Space and Astronautical Science (ISAS), NAOJ, and solar physics researchers worldwide

## Environmental Science, Meteorology, Earth Science

11	D I	A Computer Network Enabling an Increasing Volume of Data	Institutions: National Institute of Genetics
12	I	International Sharing of Extra-Large Volumes of Data from VLBI Observations	Institutions: Geospatial Information Authority of Japan and observatories worldwide

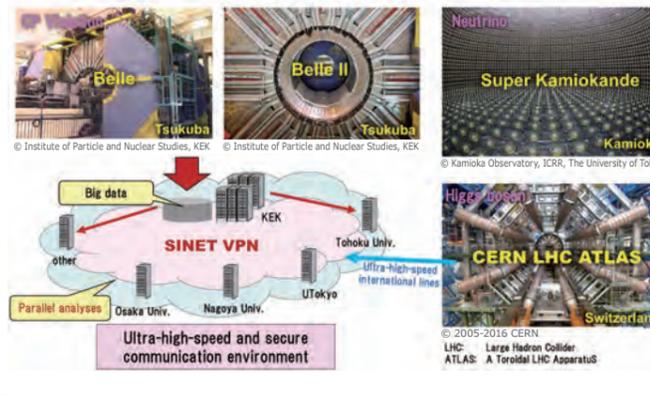
## Remote Learning and Communications

13	I	International Remote Lectures Using SINET	Institutions: University of the Ryukyus, Keio University, the Academic Arm of the United Nations, University of Hawai'i, University of the South Pacific, Asian Institute of Technology, National University of Samoa
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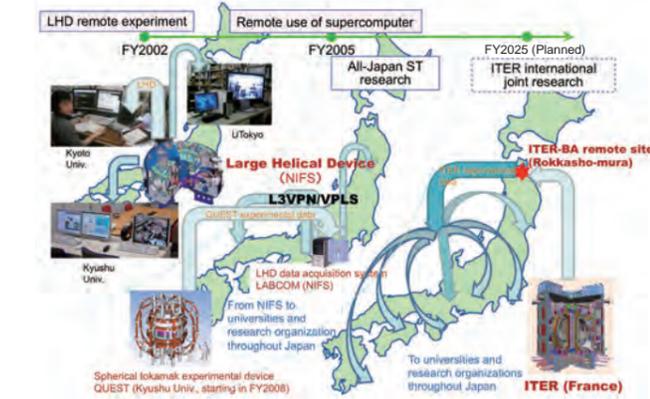
## Telemedicine

14	D od	Promoting International Telemedicine Using Academic Networks	Institutions: Kyushu University, universities in Asia
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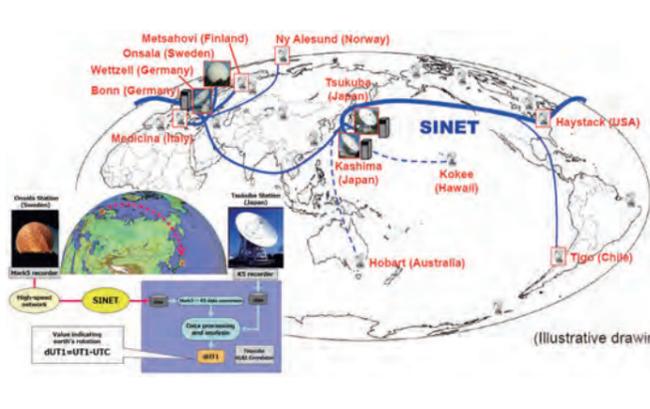
## High energy research



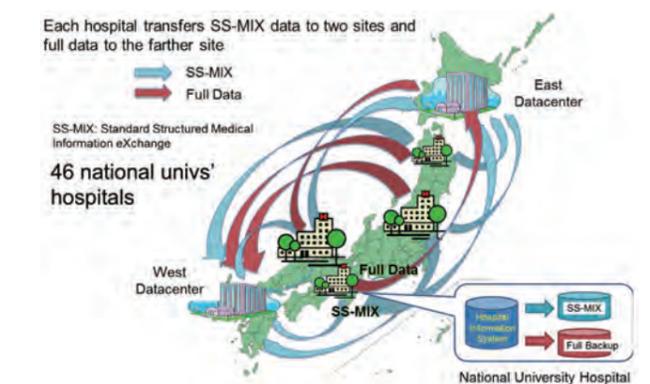
## Nuclear fusion science research



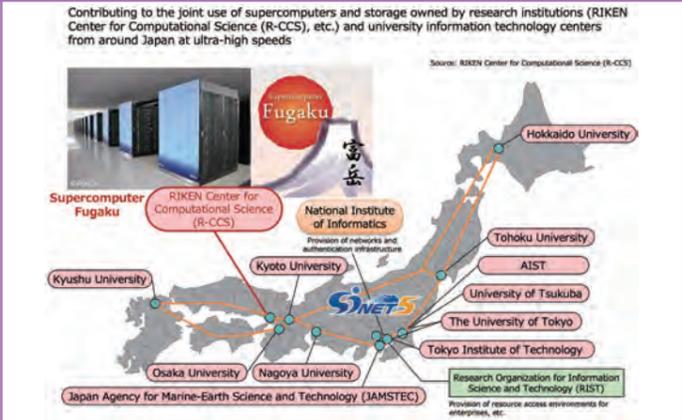
## Geodetic research



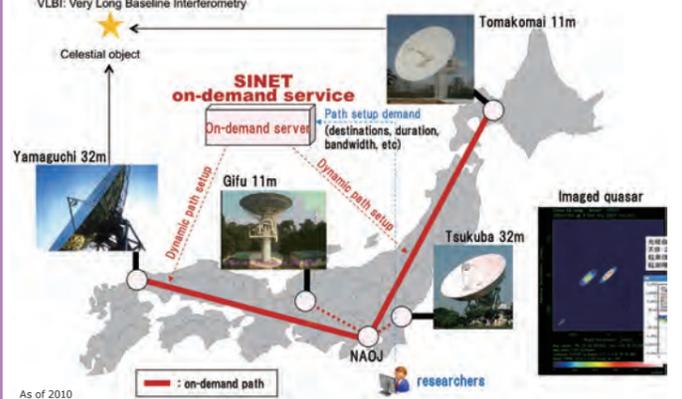
## Medical Information Backup



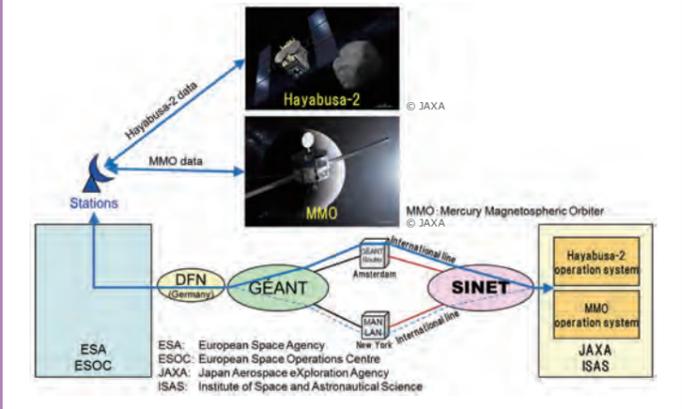
## HPCI (High Performance Computing Infrastructure)



## Astronomy research



## Hayabusa-2 (Asteroid explorer)



## Mutual backup of international connection line

