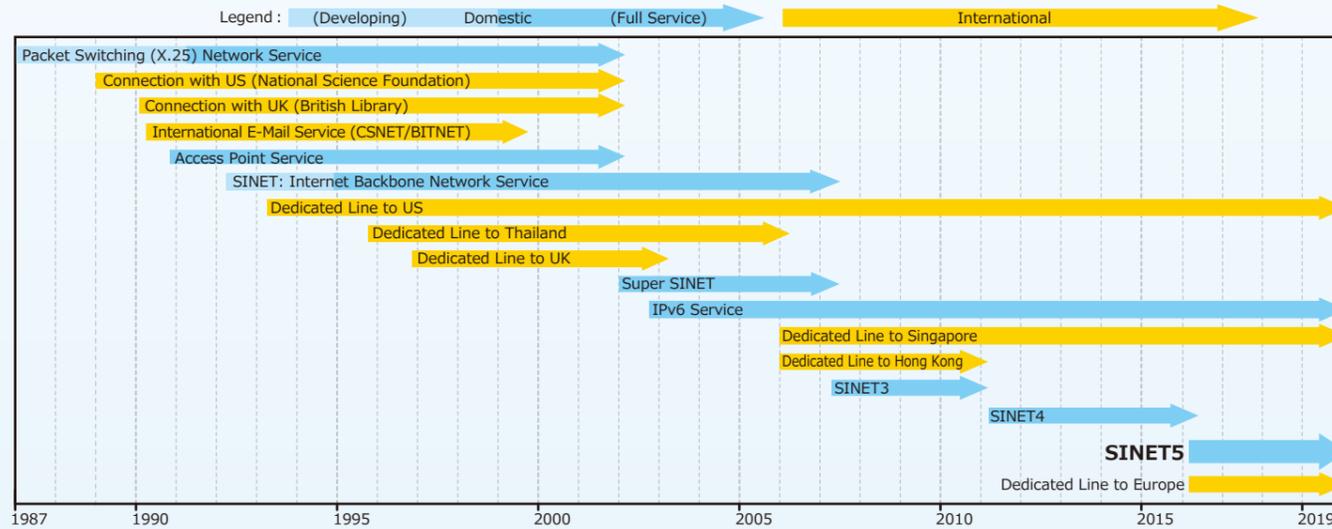


History



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.

[Please direct queries to]
 SINET Promotion Office
 Academic Infrastructure Division
 E-mail: support@sinet.ad.jp

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



Academic Information Infrastructure operated by NII

To collaborate with and promote academic research and educational activities at universities and other academic and research institutions, SINET5 offers enhanced cloud and security features and academic content, on an ultra-high-speed network.

Collaboration with and promotion of academic research & educational activities at universities, etc.

Open access and sharing of academic information <ul style="list-style-type: none"> Promoting open access to and distribution of academic information Promoting enhancement and improvement of institutional repositories at universities <p>Academic content infrastructure</p>	Support for collaboration between universities <ul style="list-style-type: none"> Encouraging collaboration and mutual use of various resources between universities via systems with unified specifications <p>Wireless LAN roaming</p>
Cloud utilization support <ul style="list-style-type: none"> Significantly reducing IT expenses and creating more sophisticated research and education environments by encouraging the effective use of cloud technologies 	Enhanced security <ul style="list-style-type: none"> Protecting information and facilitating safe authentication through the use of encryption technologies Implementing cyber-attack countermeasures through linkage with network functionality

Construction and operation of the Science Information Network

- Japanese domestic connection lines upgraded to 100Gbps nationwide
- High speed connection with overseas countries (U.S., Europe and Asia)
- Introduced the latest network technologies such as SDN, etc., to cater to diversifying needs

Ultra-high-speed, high-performance lines

Joint/shared procurement of access lines

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

Contact Info for Inquiries
 SINET Promotion Office, Academic Infrastructure Division
 E-mail support@sinet.ad.jp

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

2-1-2 Hitotsubashi, Chiyoda-ku, Tokyo 101-8430
<https://www.nii.ac.jp/>



2019.7



Science Information NETwork 5

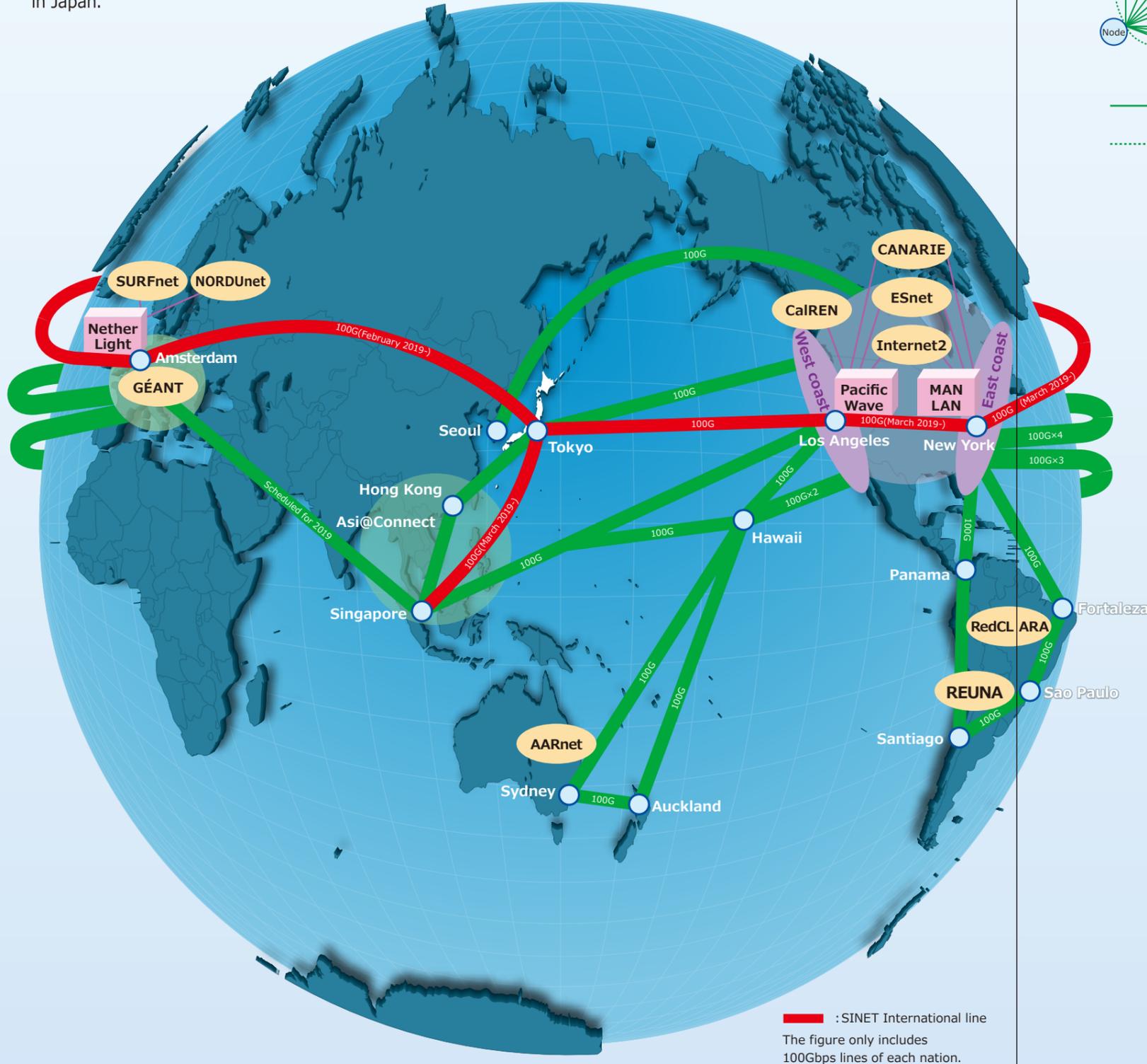
The Science Information NETwork (SINET) is an information communication network built and operated as academic information infrastructure for universities and research institutions throughout Japan. The network has nodes (network connection points) nationwide, and it is designed to promote research and education as well as the circulation of scientific information among universities, research institutions, and similar entities. In addition, SINET is also interconnected with many overseas research networks, such as Internet2 in the U.S. and GÉANT in Europe, to facilitate the circulation of research information across borders, which is necessary in advanced international research projects. SINET5 began operations in April 2016, and provides cloud computing, security and high-level academic information infrastructures to more than 900 universities and other institutions to organically share academic contents via a 100 Gbps network throughout Japan.

2019-2020

Network Topology of SINET5

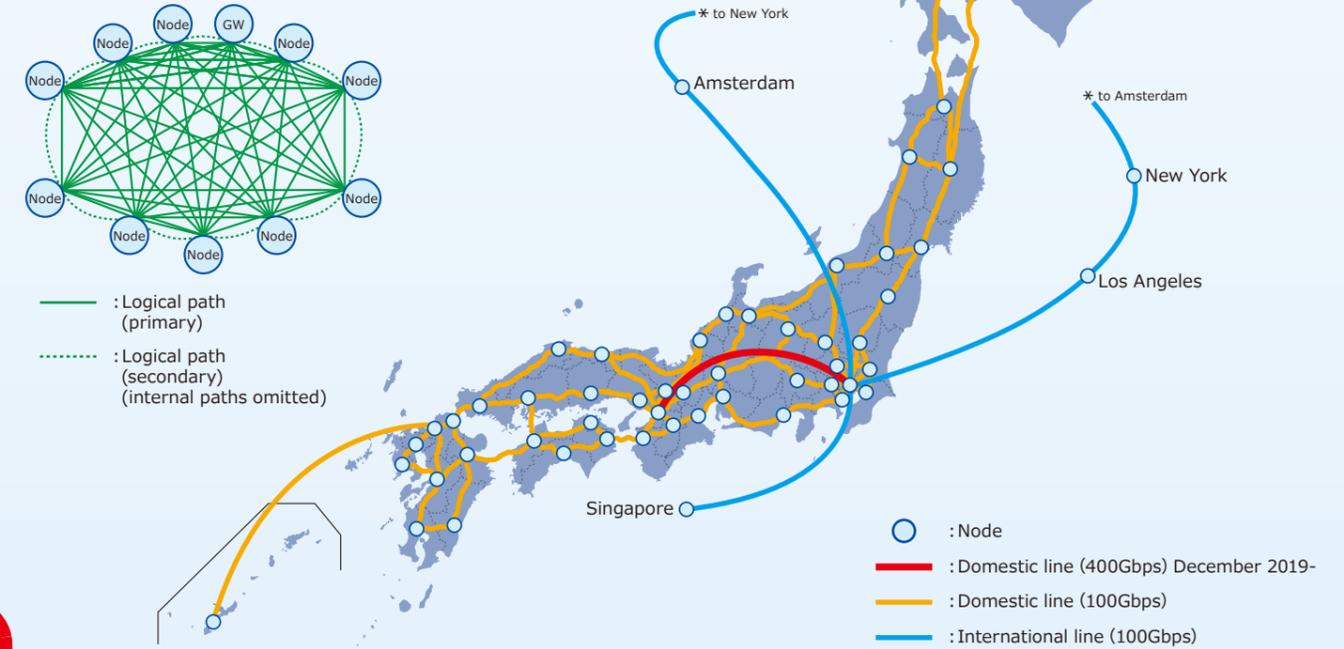
The Science Information NETWORK (SINET5) is operated to provide services for more than 900 participants that consist of universities or research centers to facilitate cloud computing, security and high-level academic communication via 100 Gbps network connection throughout Japan. SINET5 started operations of 100Gbps international lines in 2019 that connected around the globe from Japan to the U.S. West Coast, U.S. East Coast, Europe and back to Japan, and installed one 100Gbps line to Asia. SINET5 adopted a ring topology of international connection, that provides mutual backup connections between Europe and U.S. and enhances stability of communications.

This configuration also makes it possible to balance load distributions and absorb fluctuations of network demands on U.S. and Europe-bound traffic. Through collaboration with overseas partners, SINET5 offers more sophisticated data transfer environment for joint international research, that enables users to access international experimental facilities, provisions of domestic experimental facilities, and realizes high-capability linkage between facilities both overseas and in Japan.



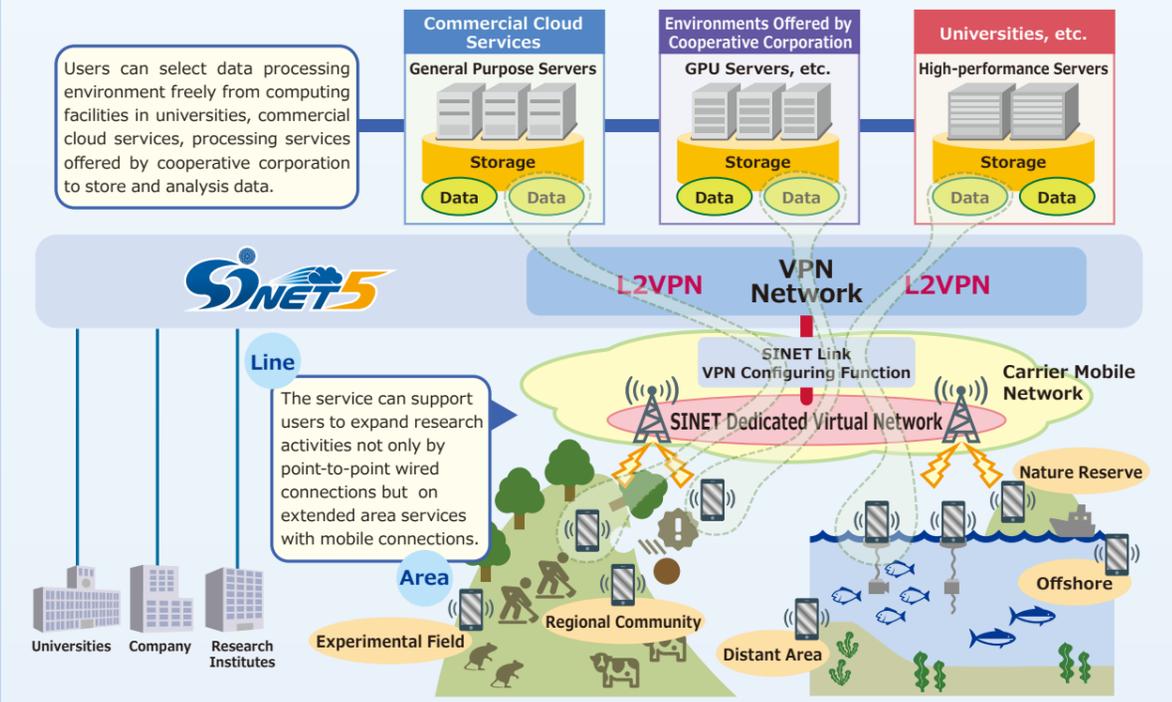
Domestic Network Topology

SINET5 an ultra-high-speed, low-latency and scalable network that consists of optical fiber lines that make the shortest paths between network nodes and the latest cutting-edge transmission devices. In addition, redundant optical fibers enhance the reliability of network. It also minimizes the delay between arbitrary points by connecting nodes in a full-mesh network. In December 2019, a 400Gbps line will be launched between Tokyo and Osaka, which have the largest traffic.



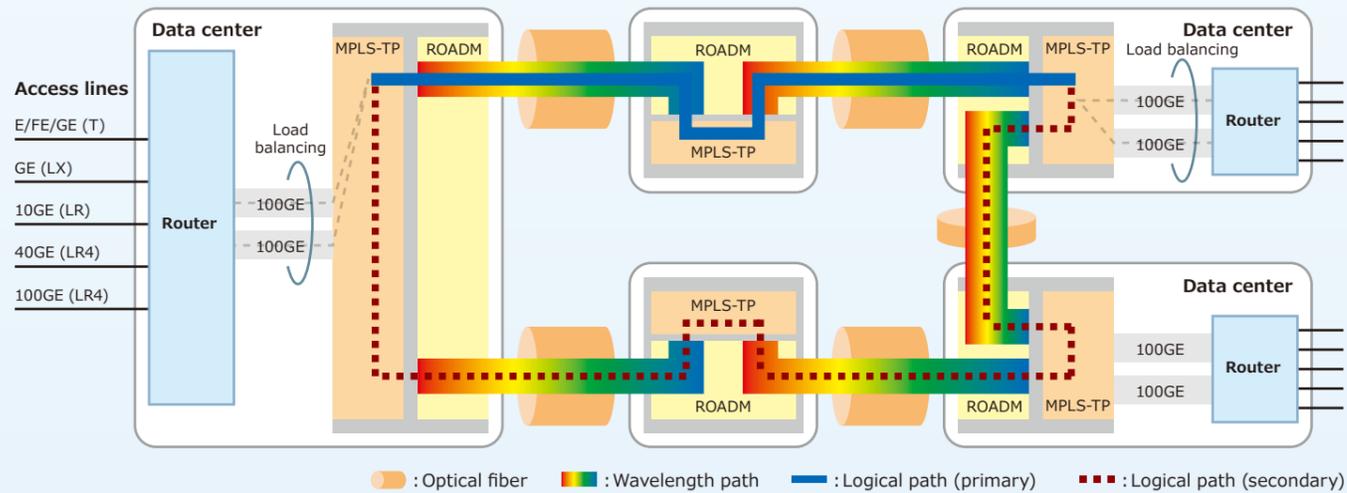
The Wide Area Data Collection Infrastructure <https://www.sinet.ad.jp/en/wadci-e>

In December 2018, SINET5 launched new experimental service "The Wide Area Data Collection Infrastructure". The service allows users to collect research data from various areas that could not be connected by wired network lines by using the mobile network provided by mobile carriers. In conjunction with secure network services (L2 VPN), research data can be collected and stored safely. User networks can connect to various data processing environments that realize one-stop and wide-ranging research processes.

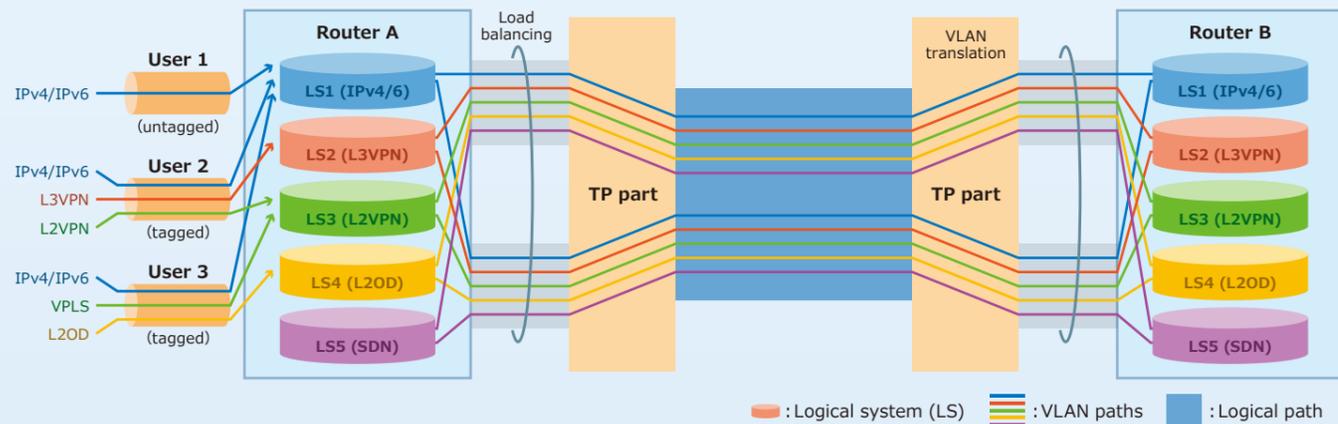


SINET5 Architecture

The MPLS-TP of transmission devices is connected to routers with two or more 100Gbps links and carries out load balancing. Sections between each MPLS-TP are connected via ROADMs (Reconfigurable Optical Add/Drop Multiplexers) by both wavelength and logical paths, with dual logical paths (primary and secondary) being used to ensure high availability.

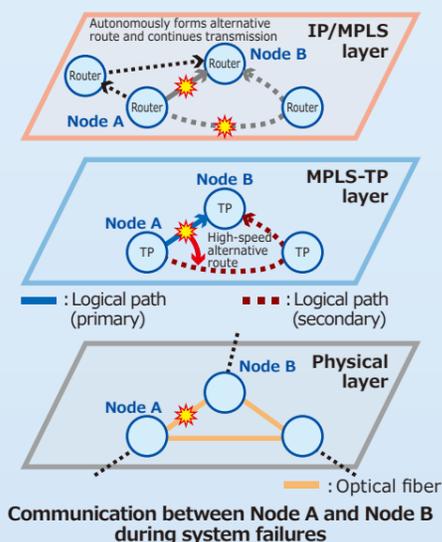


Routers set logical systems (LS) for each group of services. Individual LSs are connected by VLAN connections.



High Availability of SINET5

- 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.
- 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 secondary 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.
- 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.



(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).



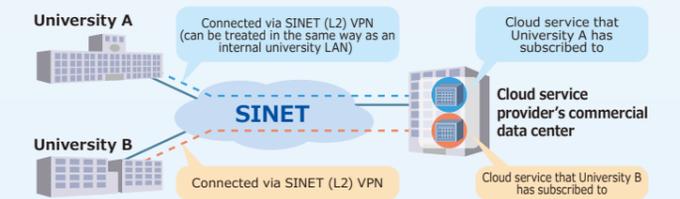
SINET5 Network Services

In order to expand and enhance network service functionality and build secure, advanced research environments for universities and research institutions, SINET5 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	L2VPN/VPLS (+QoS) University LAN Virtualization L2 on-demand (Basic) L2 on-demand (International collaboration: NSI) L2 on-demand (Cloud system collaboration: REST)
L1 services	Leased-wavelength Line
The Wide Area Data Collection Infrastructure	Secure mobile connections Provision started in December, 2018
Redundancy of access lines	Multihoming Link aggregation Redundant trunk group service
Stabilization of network operations	DDoS Mitigation function Security measures function
Next-generation network functions	NFV service In trial phase
Enhanced transfer performance	Performance measurement High-speed file transfer supporting 100Gbps

Framework for Secure Use of Cloud Services

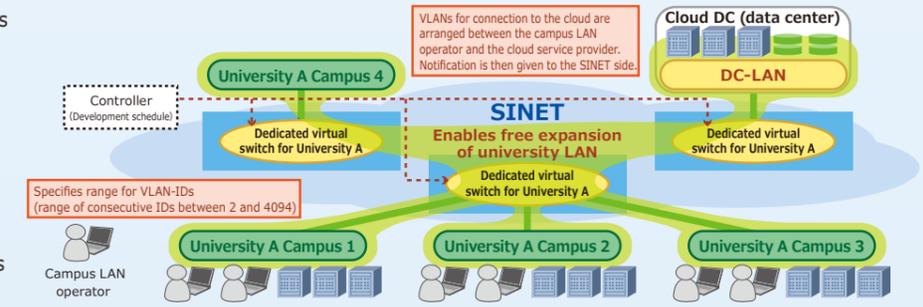
In order to enable secure use of upper-layer services (e.g. e-mail and storage), SINET5 adopts a framework whereby the lines that connect cloud service providers to SINET are prepared by the cloud service providers themselves.



Virtual University LAN Services

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

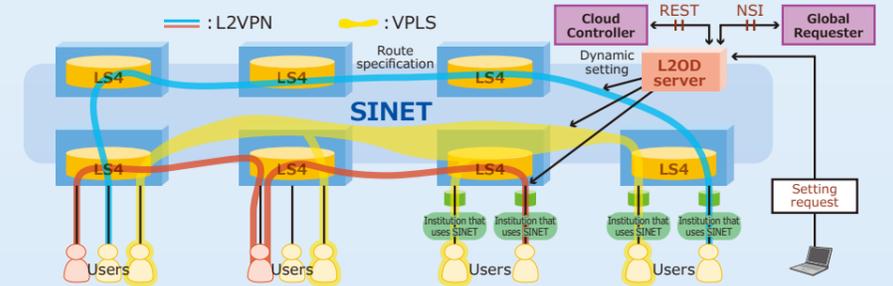
- User side: Specifies range of VLAN-IDs. VLAN-IDs for connection to Internet/L2 & L3 VPN are specified separately. Use procedures for addition of each new VLAN-ID are unnecessary, enabling flexible operation by participating institutions.
- SINET side: Automatically recognizes VLAN-IDs at SINET nodes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



Layer 2 (L2) On-demand Services

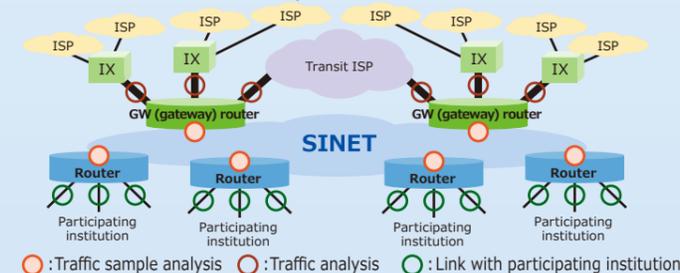
Users can connect to L2VPN/VPLS on-demand, based on the connection points and start and end times (from short-term to long-term) they specify. Below is an image of how this service works when in use.

- 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



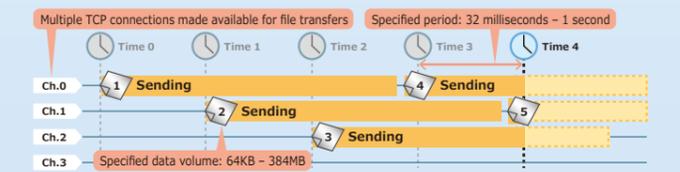
Increased Stability of Backbone Operation

There are plans to enhance the traffic analysis functionality of the SINET backbone (i.e. the portion connecting the transfer side with external networks)



High-speed File Transfer Software

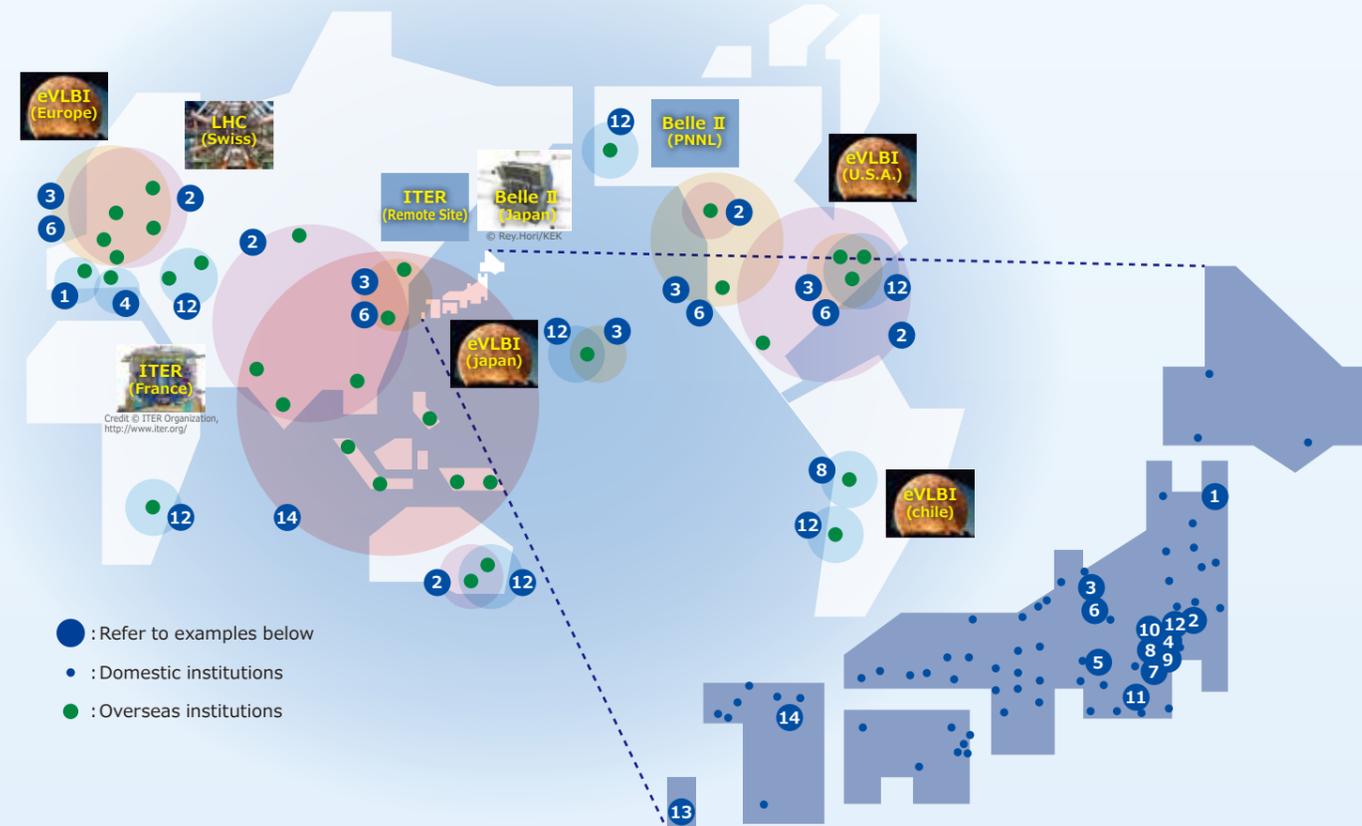
Even where the network is congested, or in high-latency environments such as with overseas-oriented transfers, SINET enables users to specify a transfer speed (= specified volume of data / specified period) and send files at high speed. When sending files, SINET avoids connections that are already being used to send data, and utilizes open connections.



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/>



- : Refer to examples below
- : Domestic institutions
- : Overseas institutions

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	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	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

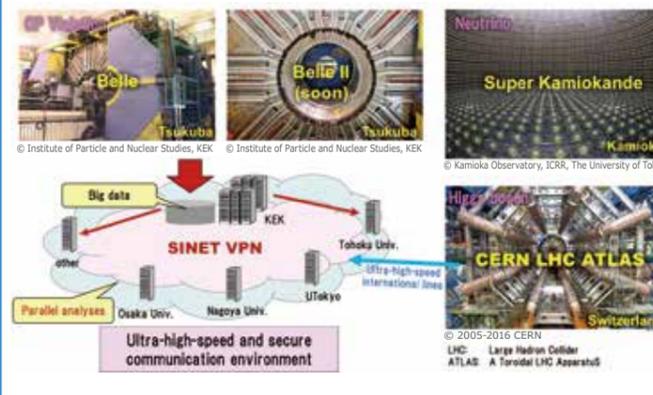
Remote Learning and Communications

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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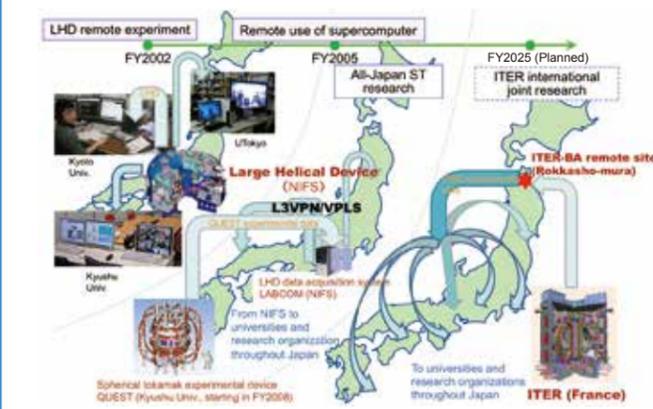
Telemedicine

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



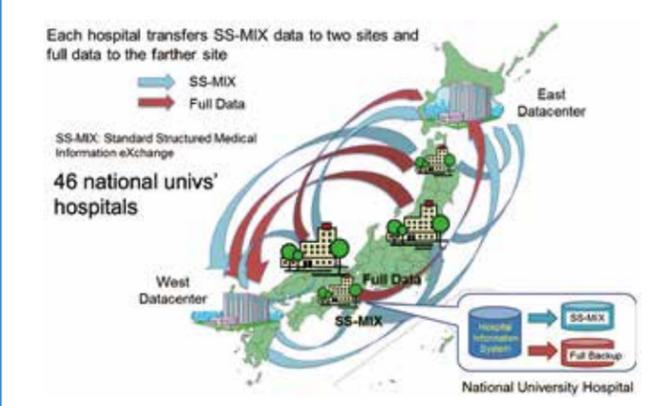
Nuclear fusion science research



Geodetic research



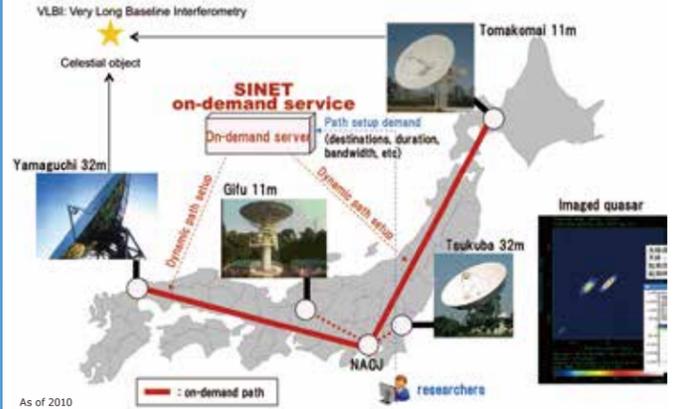
Medical Information Backup



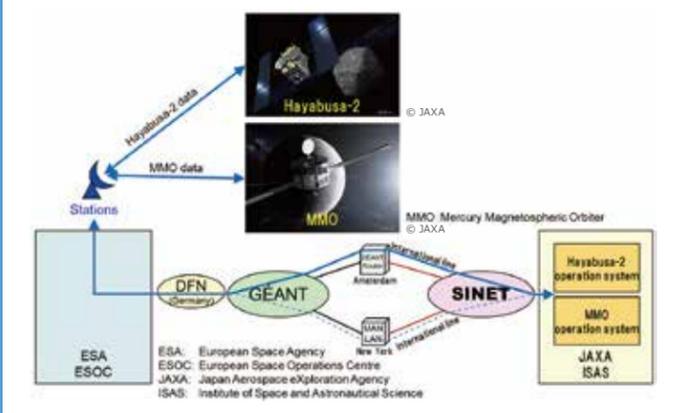
HPCI (High Performance Computing Infrastructure)



Astronomy research



Hayabusa-2 (Asteroid explorer)



Data transfer collaboration with NRENs

