



# Towards SINET6: Next-Generation Japanese Academic Backbone-Network

Takashi Kurimoto

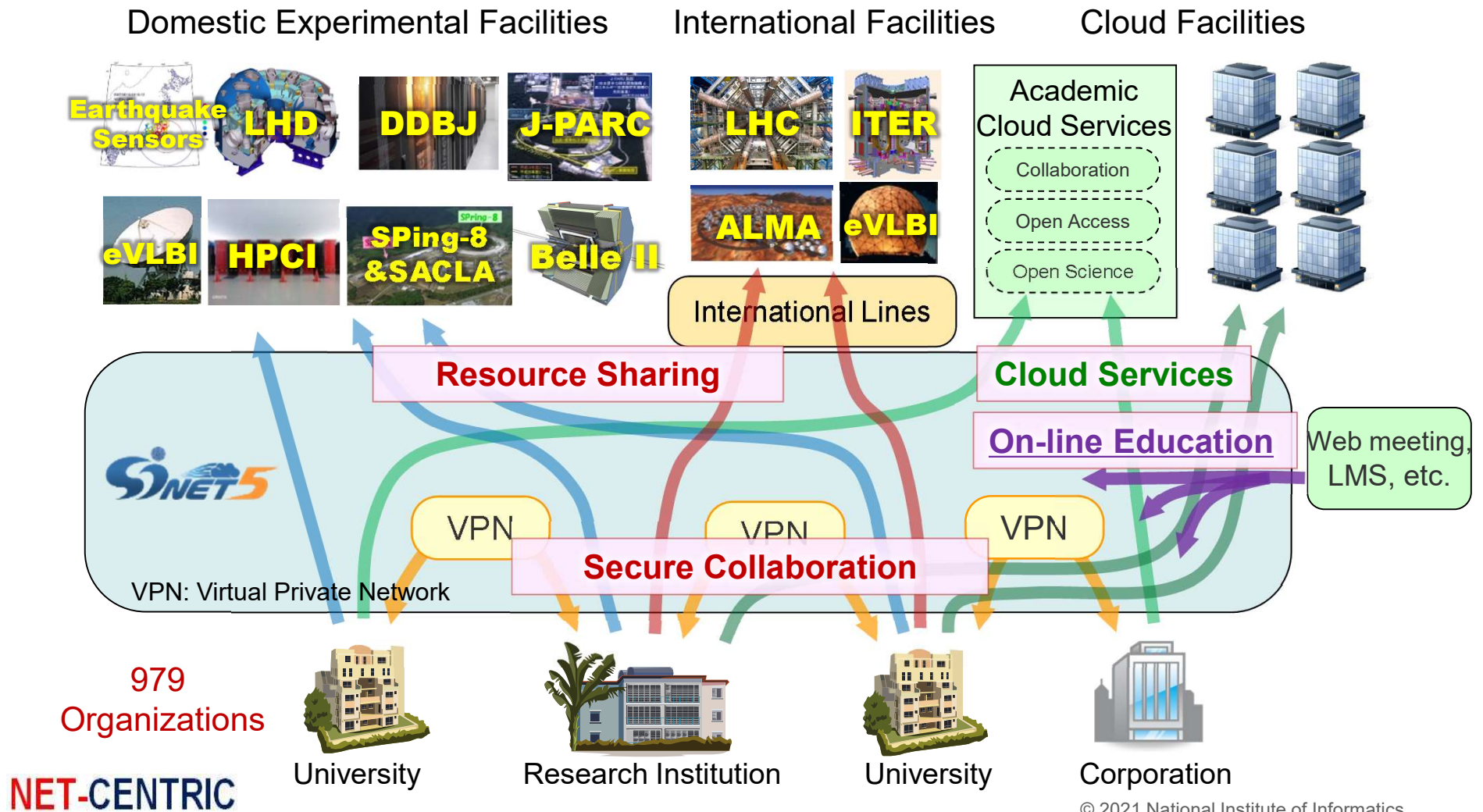
National Institute of Informatics

tkurimoto@nii.ac.jp

*[www.isocore.com/2021](http://www.isocore.com/2021)*

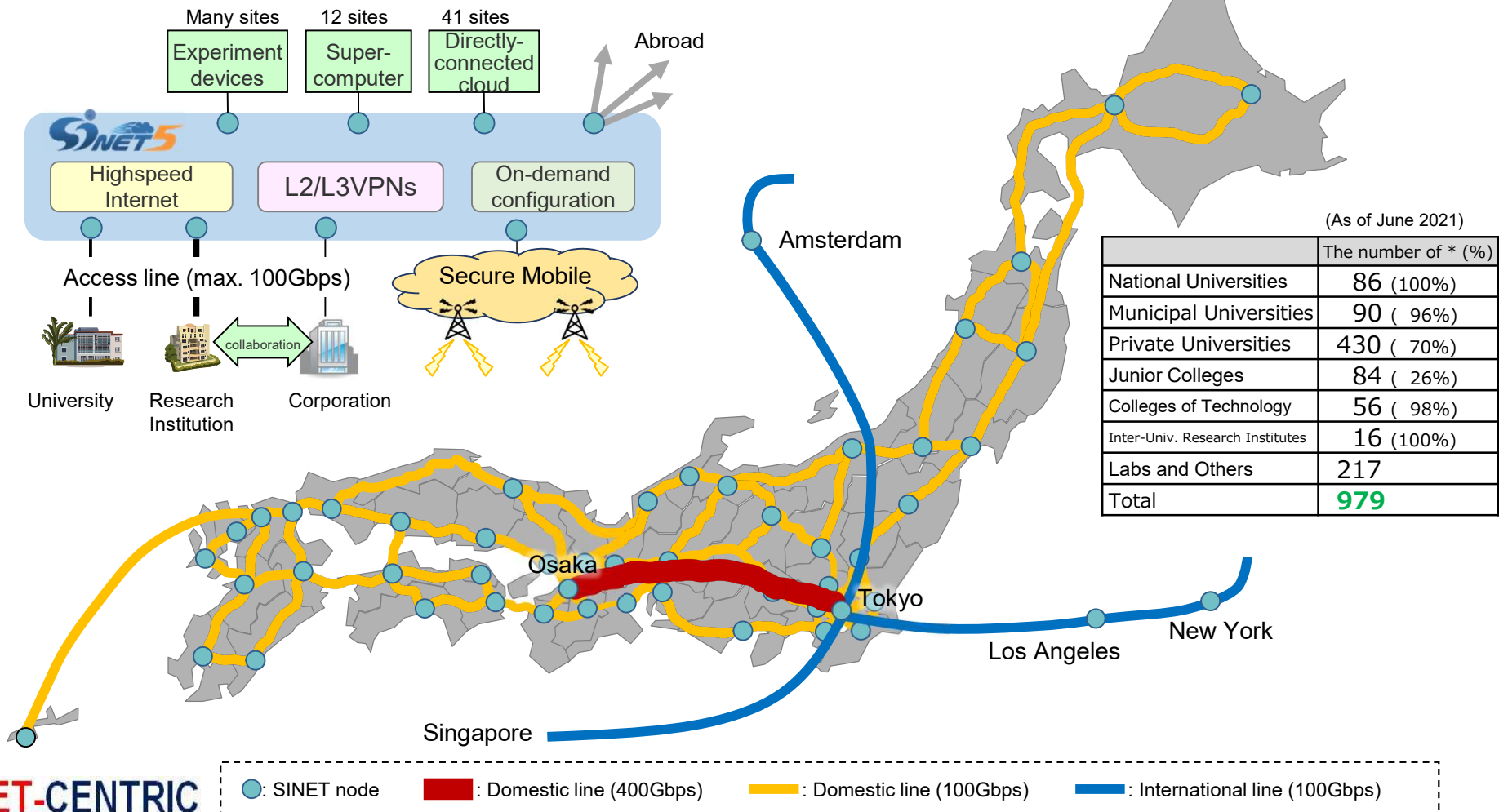
# Science Information network (SINET)

- SINET is the Japanese research and education backbone network for the use of cutting-edge research and advanced education, and so on.



# Current Status of SINET

- SINET5 connects nationwide 50 SINET nodes with 100-Gbps (partly 400Gbps) lines, and has 100-Gbps international lines to USA, Europe, and Asia.
- SINET5 provides a variety of network services to academic communities.



# International Lines and collaboration

- International line that circles the globe and providing international network services
- SINET establishes resilient international communication environment in collaboration with other NRENs such as Internet2, CANARIE, GÉANT, NORDUnet, SURFnet, and AARnet .

## Advanced North Atlantic Collaboration (June 2019)

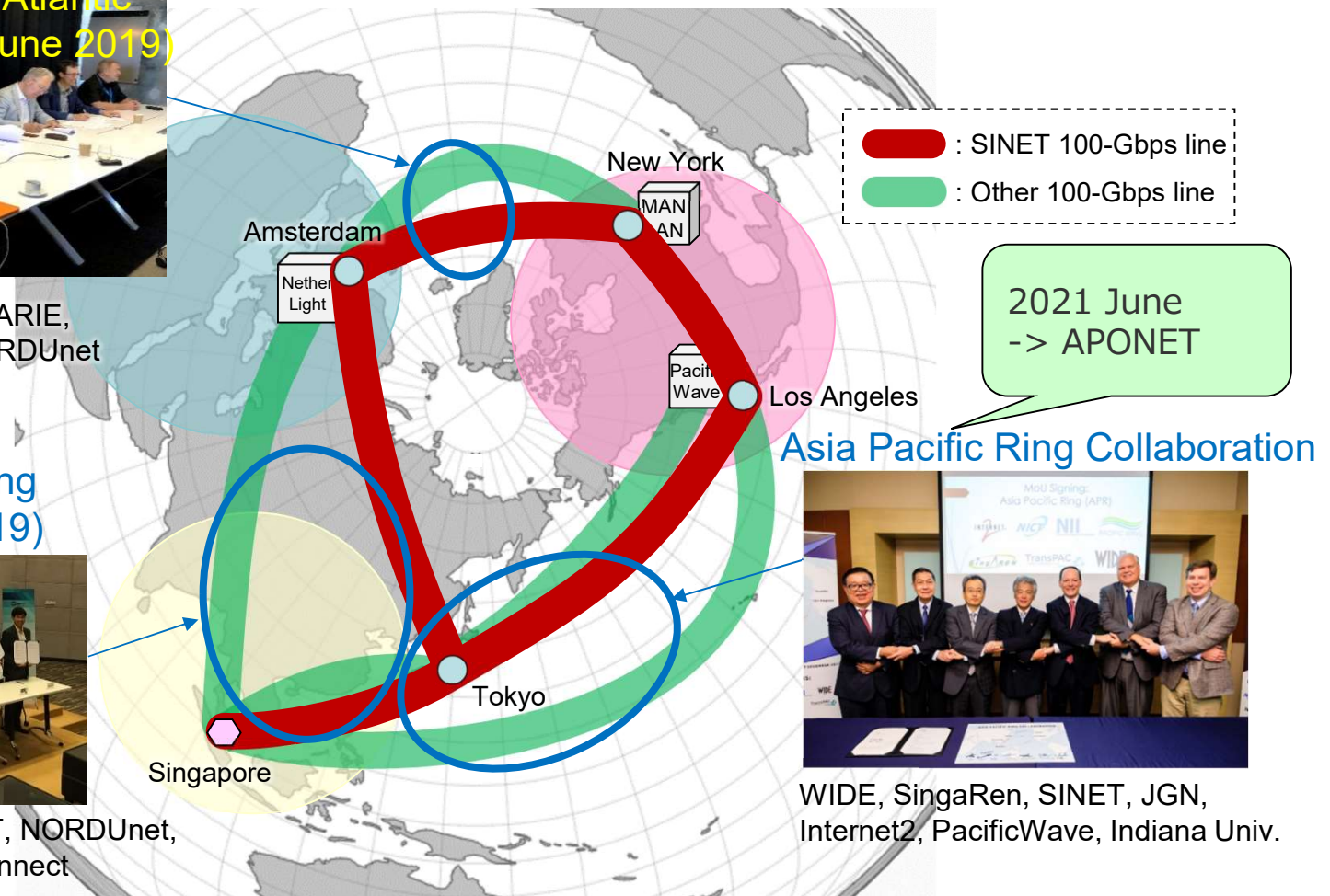


Internet2, SINET, CANARIE, GÉANT, SURFnet, NORDUnet

## Asia-pacific Europe Ring Collaboration (July 2019)



AARnet, GÉANT, JGN, SINET, NORDUnet, SingaRen, SURFnet, Asi@Connect

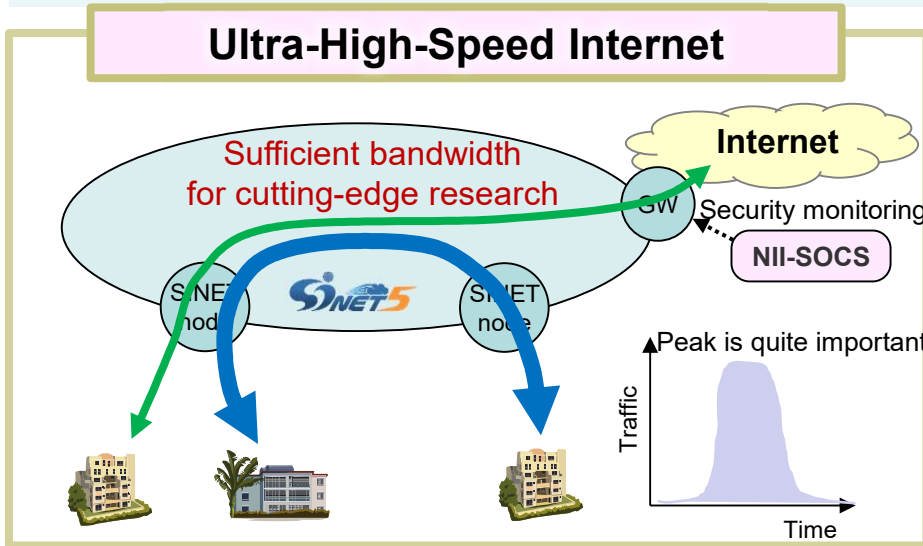


WIDE, SingaRen, SINET, JGN, Internet2, PacificWave, Indiana Univ.

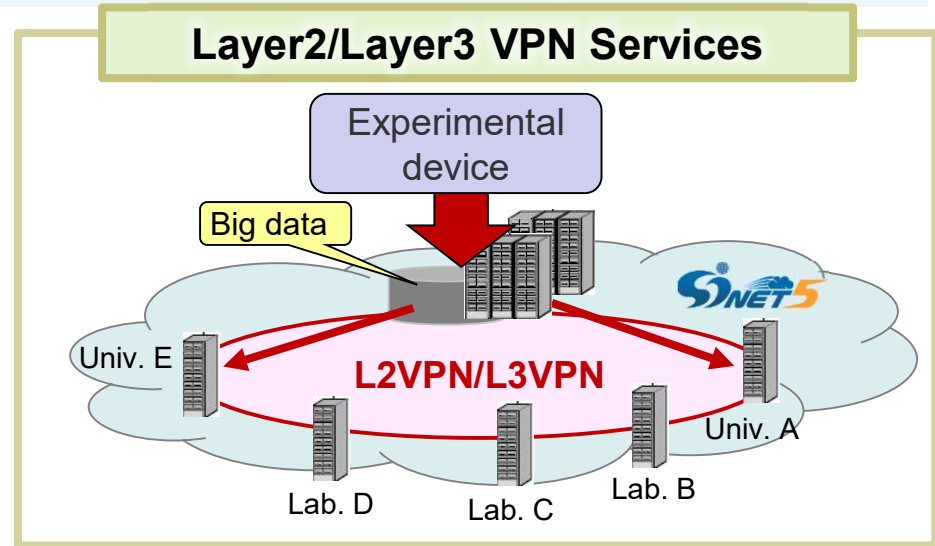
# Main Services of SINET

- SINET provides high-speed Internet and Layer2/3 VPNs for joint research projects, on-demand network configuration, data collection through secure mobile capability, etc.

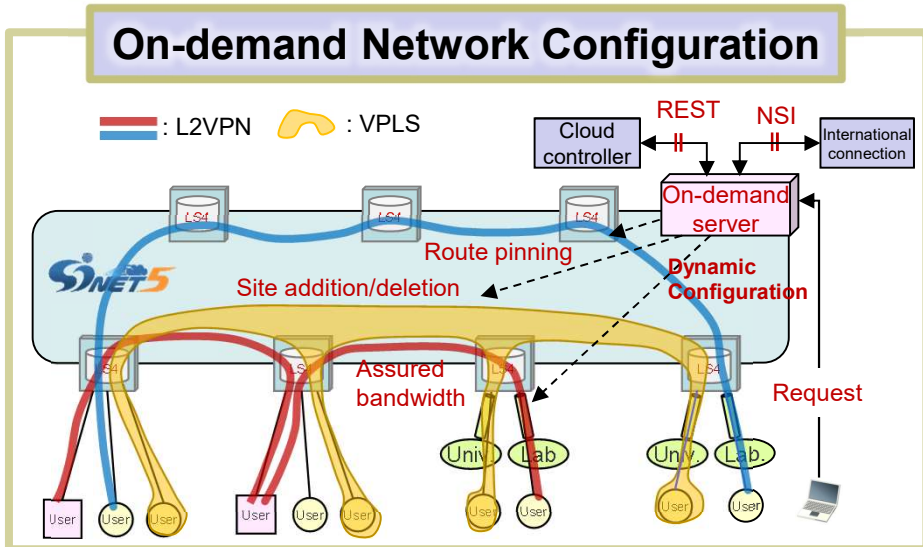
## Ultra-High-Speed Internet



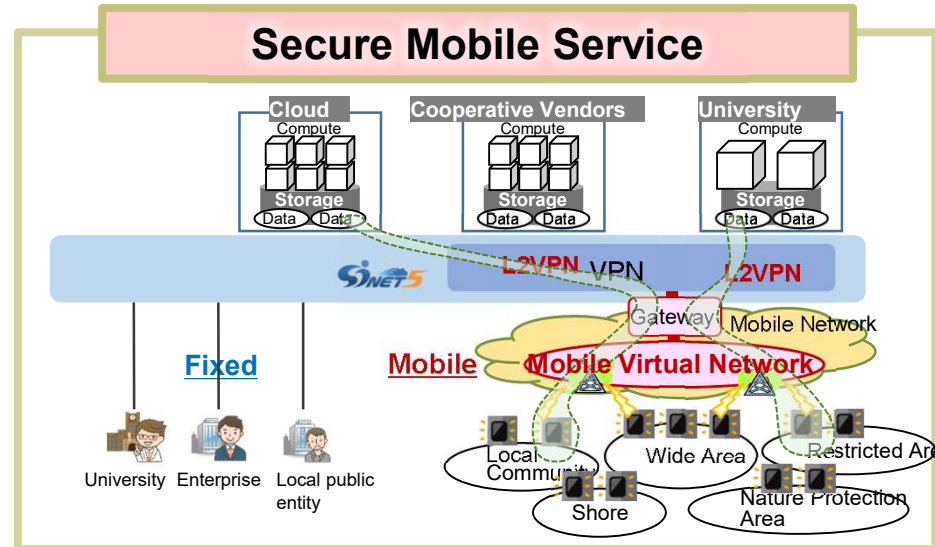
## Layer2/Layer3 VPN Services



## On-demand Network Configuration



## Secure Mobile Service



# Direction for SINET6

## User Requests

- Sufficient bandwidth
- Improved accessibility to SINET
- Enhanced mobile capability
- More attractive VPN services
- Enhanced security services
- More global connectivity
- Support of on-line education
- Contribution to Society 5.0

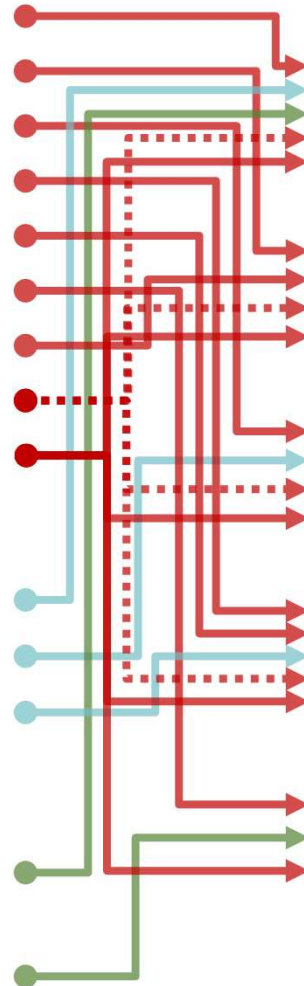
## Technical Trends

- 400GE
- 5G mobile
- NFV

## NRENs' Trends

- Renewal of networks applying 400GE in USA and Europe
- International lines to South America and Africa

## Direction for SINET6



Attain the world's highest-performance, reliable, and economical network

Improve access environment to SINET, especially univs' access line bandwidths

Build up a mobile service platform in the era of 5G

Enhance VPN, cloud, security services over SINET

Strengthen international connectivity, e.g. bandwidth and landing points

# Transition from SINET5 to SINET6

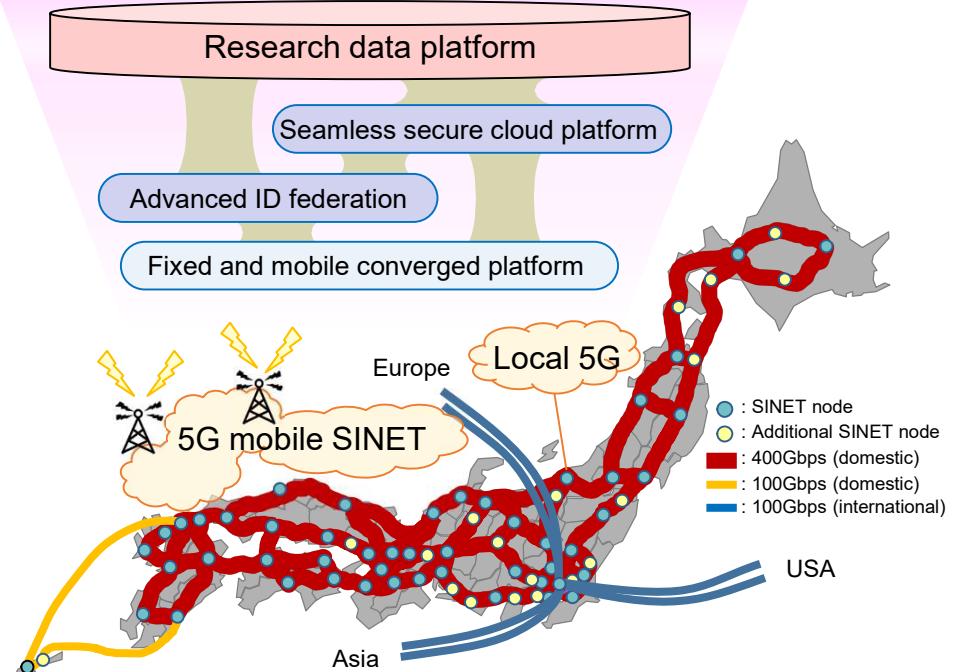
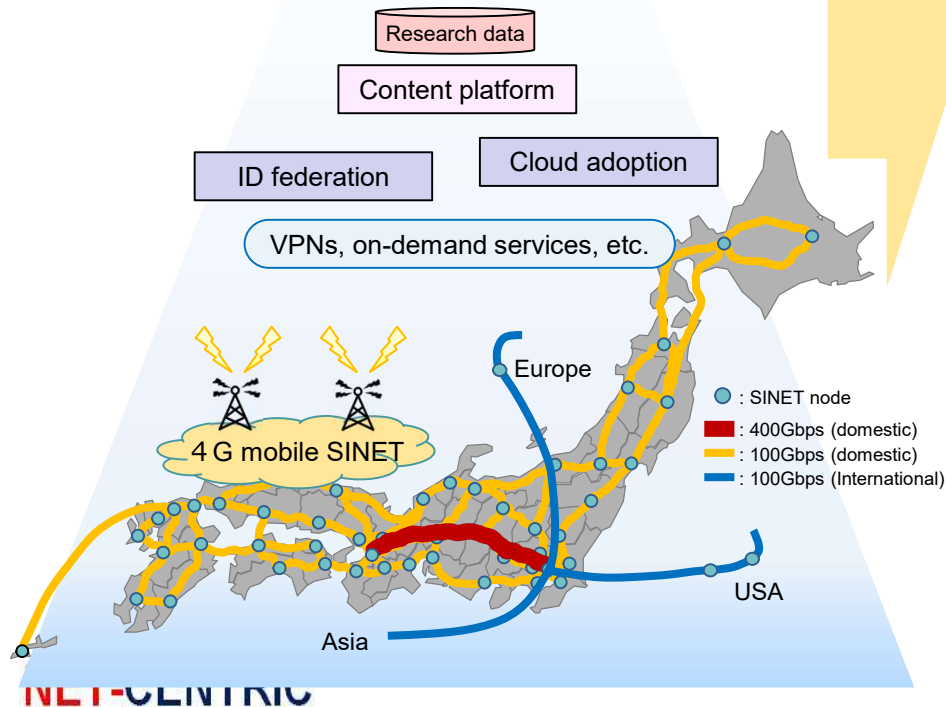
- SINET6 aims to apply 400GE nationwide, increase SINET nodes, converge fixed and mobile capabilities, enhance VPN/security services, and strengthen global connectivity.

## SINET5 (2016.4 - 2022.3)

- Nationwide 100Gbps (partly 400Gbps)
- 4G mobile SINET
- VPN services by routers
- 100-Gbps international lines

## SINET6 (2022.4 - 2028.3)

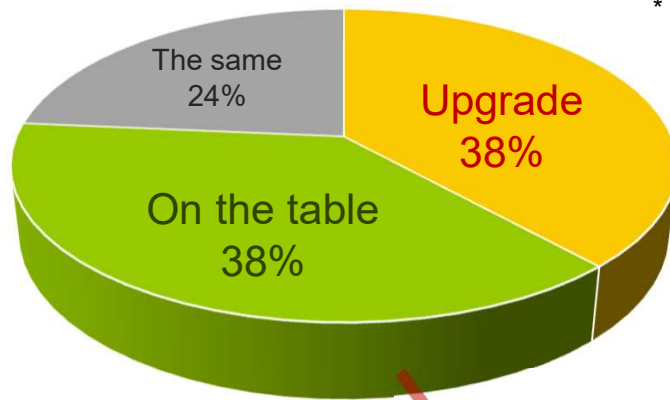
- Nationwide 400Gbps + additional nodes
- 5G mobile SINET + local 5G
- Flexible services by NFV and routers
- 200-Gbps or more international lines



# Access Lines of Universities (Questionnaire Result)

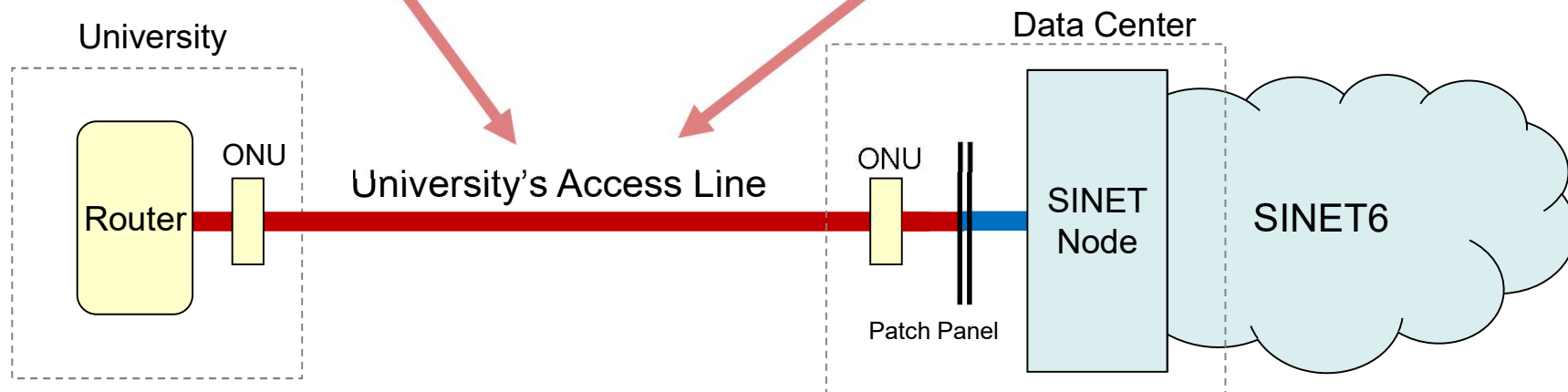
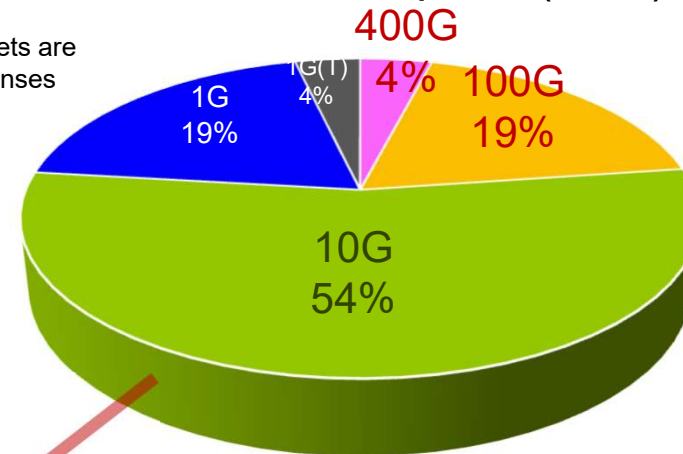
- The percentage of possible speed upgrade and on the table is 76.
- 400-Gbps and 100-Gbps access lines are expected to become popular in SINET6.

Possible Speed Upgrade (619\*)



\* The numbers in brackets are the quantities of responses

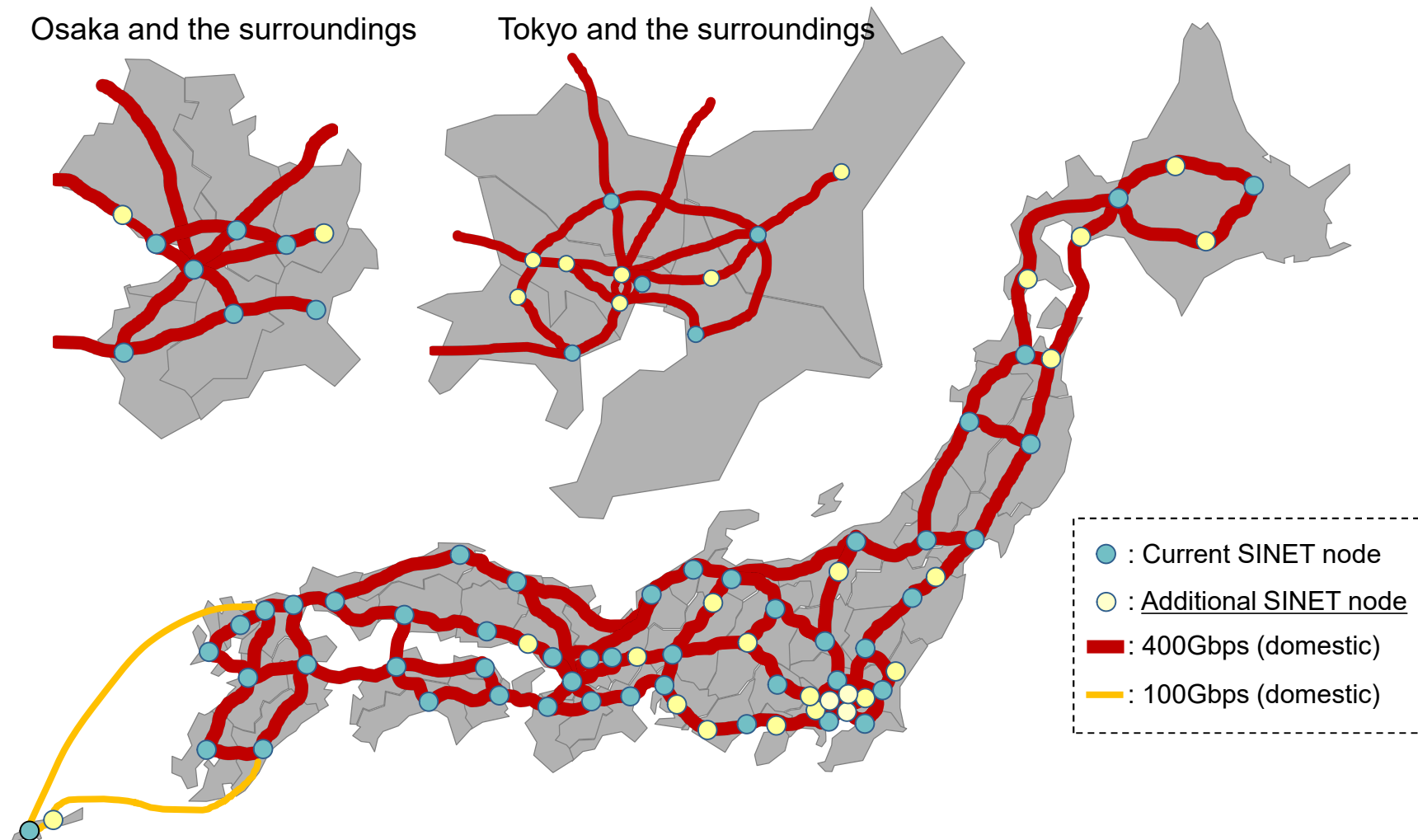
Planned Line Speed (272\*)





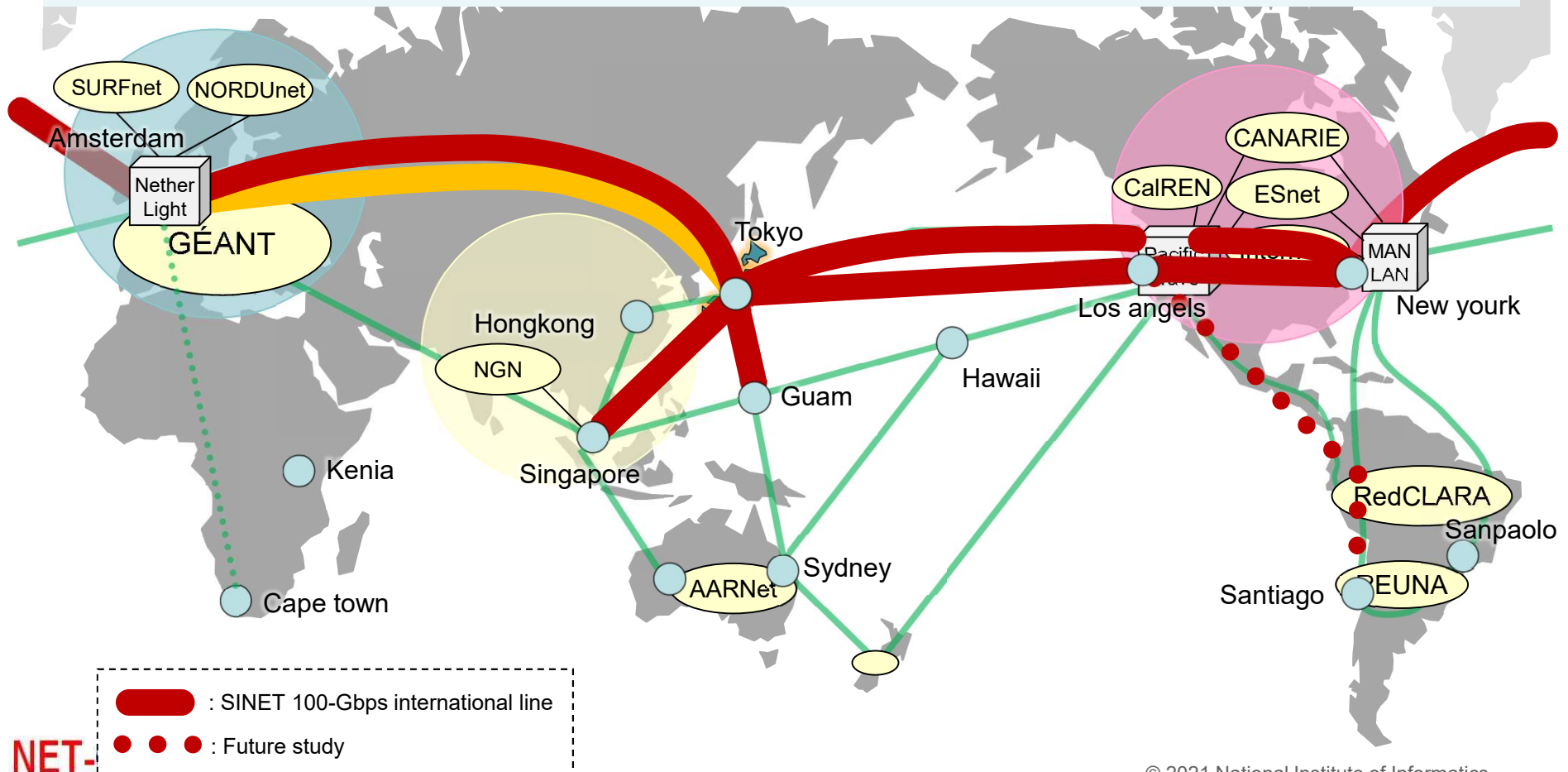
# Network Topology and Bandwidth

- SINET6 will cover all the prefectures with 400Gbps or more excluding Okinawa .
- SINET6 will place 70 SINET nodes in order to improve the accessibility for users.



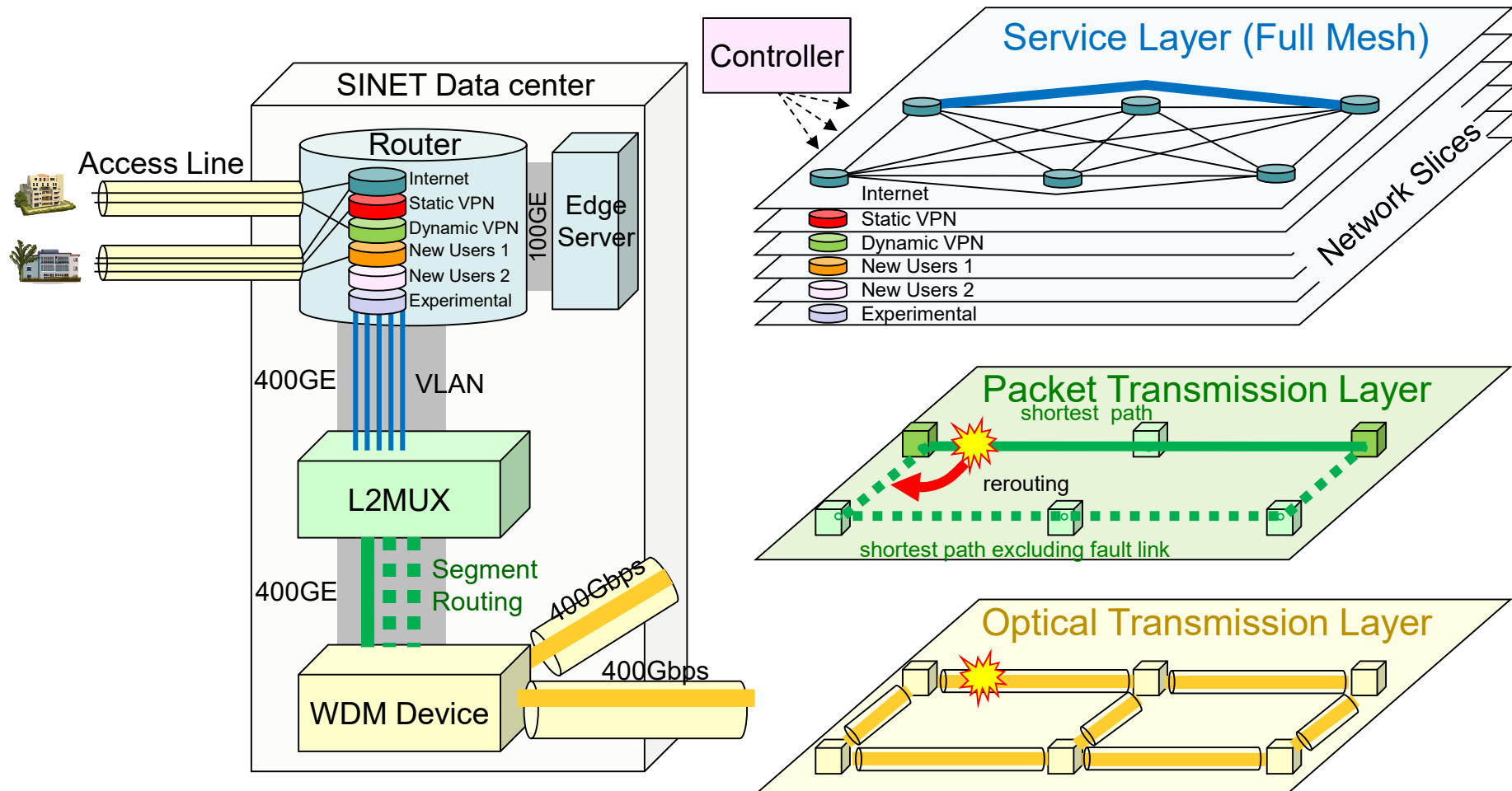
# International Lines of SINET6

- SINET will increase the bandwidths of USA, Europe and Asia lines.
  - USA: Los Angels and New York, 100Gbps x 2 (in 2022)
  - Europe : Amsterdam, 100Gbps x 2 or more (around 2024)
  - Asia: Singapore and new Guam line, each 100Gbps (in 2022)
  - Other area: Oceania and south America, considering the marine cable status



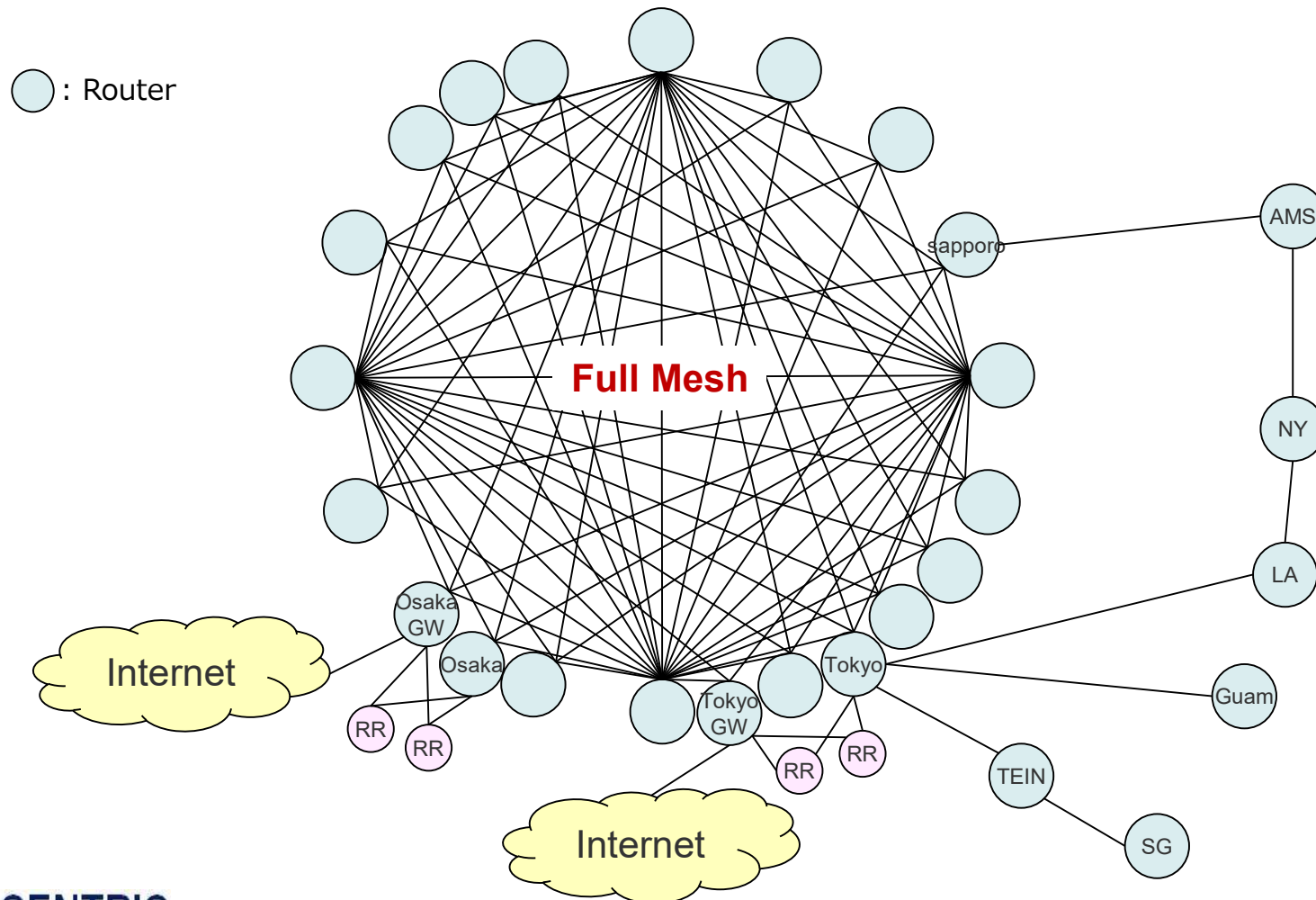
# Network Architecture of SINET6

- SINET6 follows the architecture of SINET5 dedicated to high-performance and high-reliability.
- Service layer has six network slices logically separated.



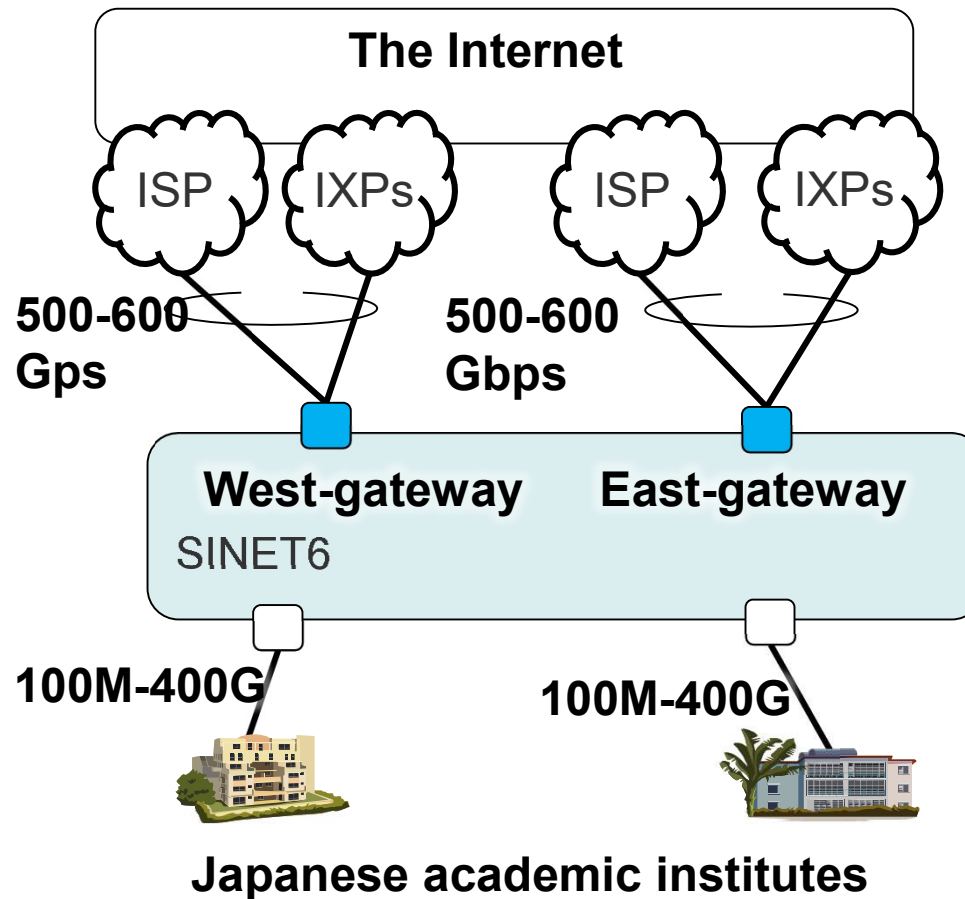
# Service Layer Topology

- Each service layer has a full-mesh topology. Logical routers are connected directly with each other to attain highest performance.



## Commercial Internet capacity of SINET6

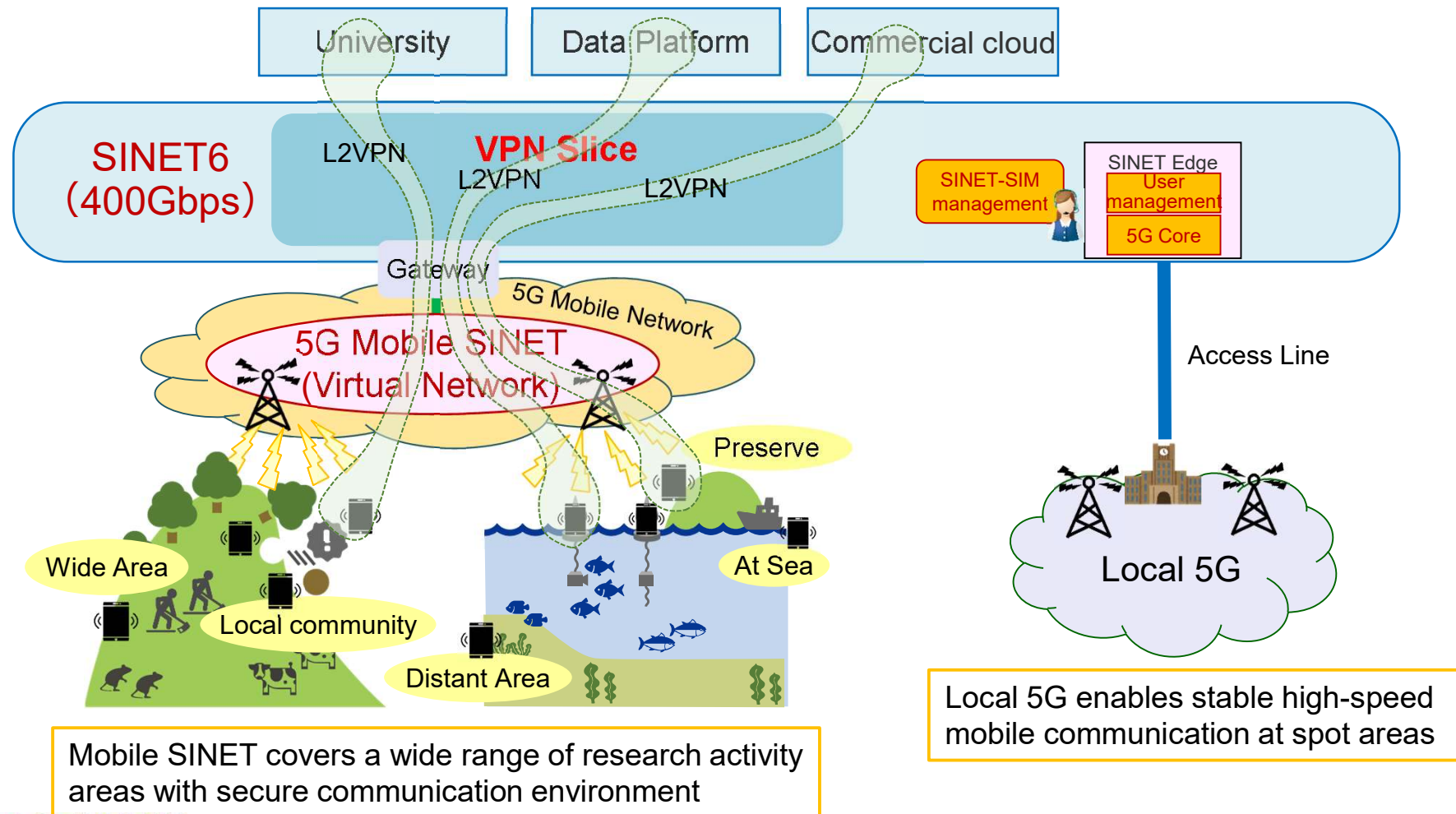
- SINET6 connects to Japanese ISP and IXP in two gateway routers.
- Total amount of the Internet access capacity is up to 1.2Tbps.



# Data Collection by 5G + 400Gbps

Plan in SINET6 period

- Capabilities of mobile SINET will be extended from 4G/3G to 5G/4G/3G .
- SINET6 will support local 5G by implementing 5G core functions on SINET edge.

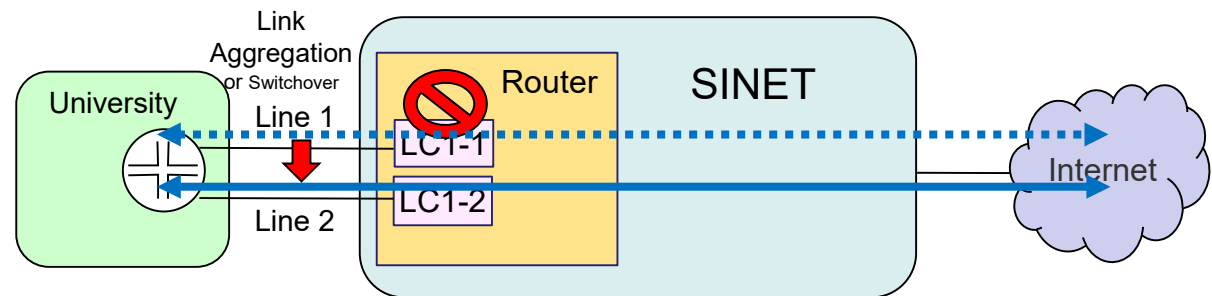


# Higher Service Availability for Universities

- Growth of on-line education requires higher service availability than ever before.
- SINET6 plans to enhance the service availability by preparing line multiplexers to connect access lines to routers at other sites.

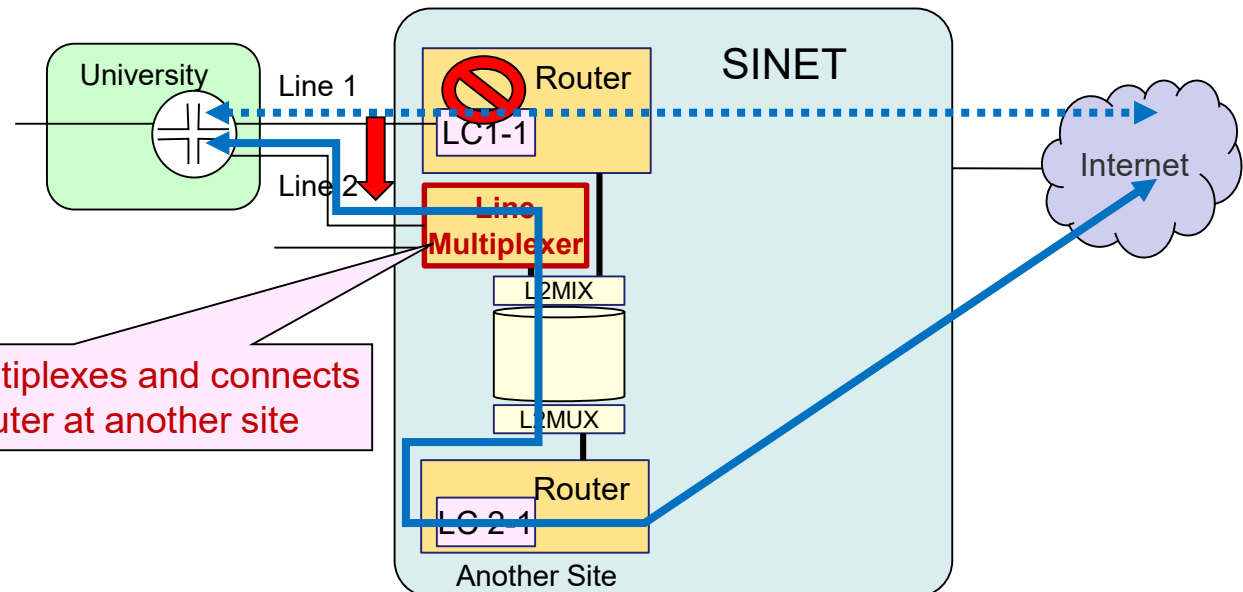
## Current Style

University connects two access lines to two different line cards of a router.



## New Style

University connects two access lines to two routers at different sites.



Line multiplexer multiplexes and connects access lines to a router at another site

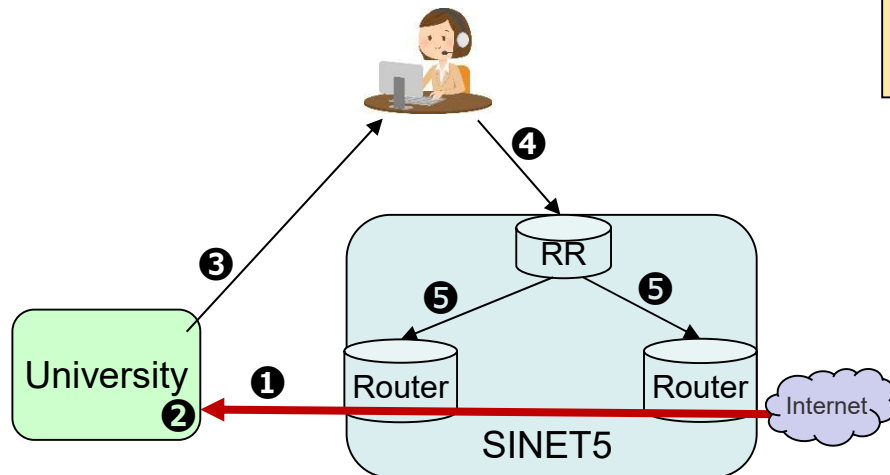
# DDoS Mitigation

- SINET5 has provided DDoS mitigation service by using BGP FlowSpec.
  - Mitigation needs to be active after receipt of the request from victim university. This needs several hours from the request to DDoS mitigation.
- SINET6 would like to provide more prompt mitigation service.

## Current Situation

Several hours from request to mitigation

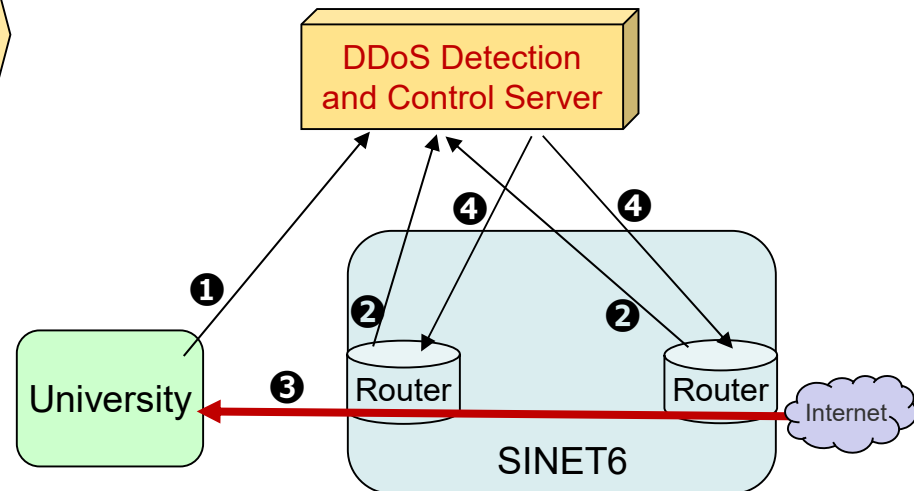
- ① DDoS attack
- ② DDoS detection (Univ.)
- ③ Request of DDoS mitigation (Univ.)
- ④ Configuration for RR (SINET)
- ⑤ Packet drop by BGP FlowSpec (SINET)



## New DDoS Mitigation

10 seconds from detection to mitigation

- ① Address registration for DDoS detection (Univ.)
- ② Monitoring (SINET)
- ③ DDoS attack
- ④ Packet drop by NETCONF (SINET)

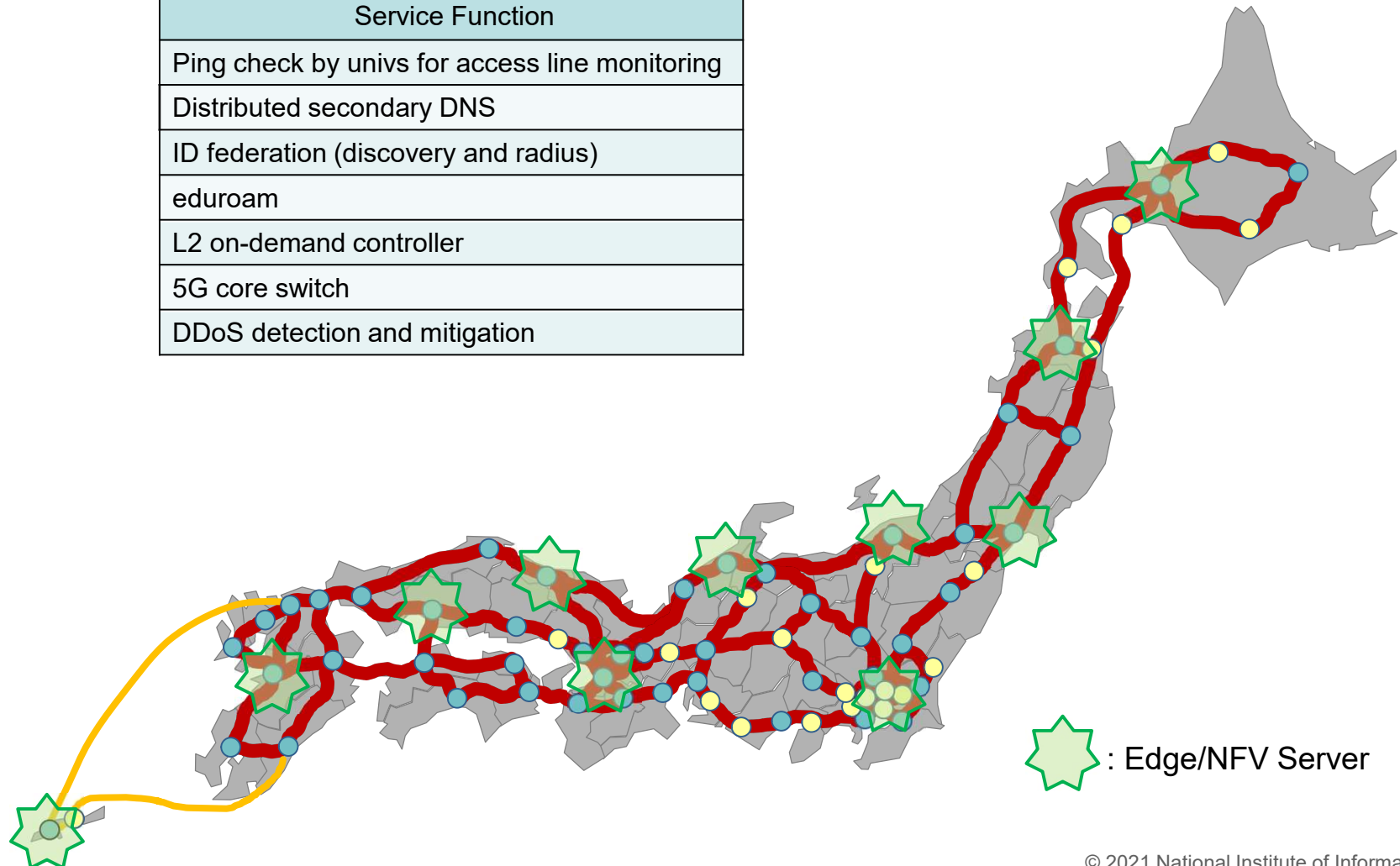




# Network services with Edge Server

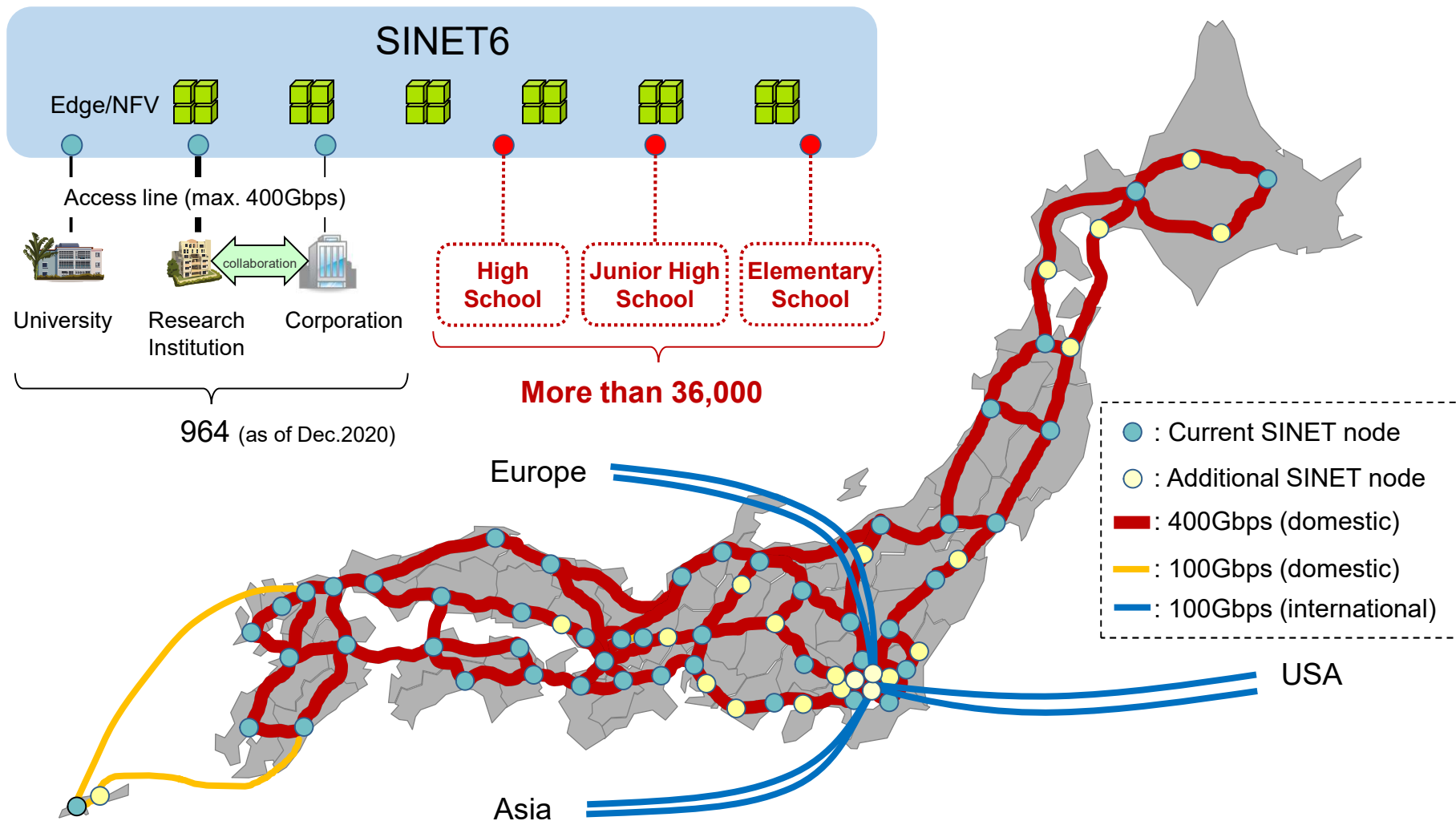
- SINET will place edge servers at 11 sites nationwide in order to provide the following services with one-way delay of less than 2 msec.

Service Function
Ping check by univs for access line monitoring
Distributed secondary DNS
ID federation (discovery and radius)
eduroam
L2 on-demand controller
5G core switch
DDoS detection and mitigation



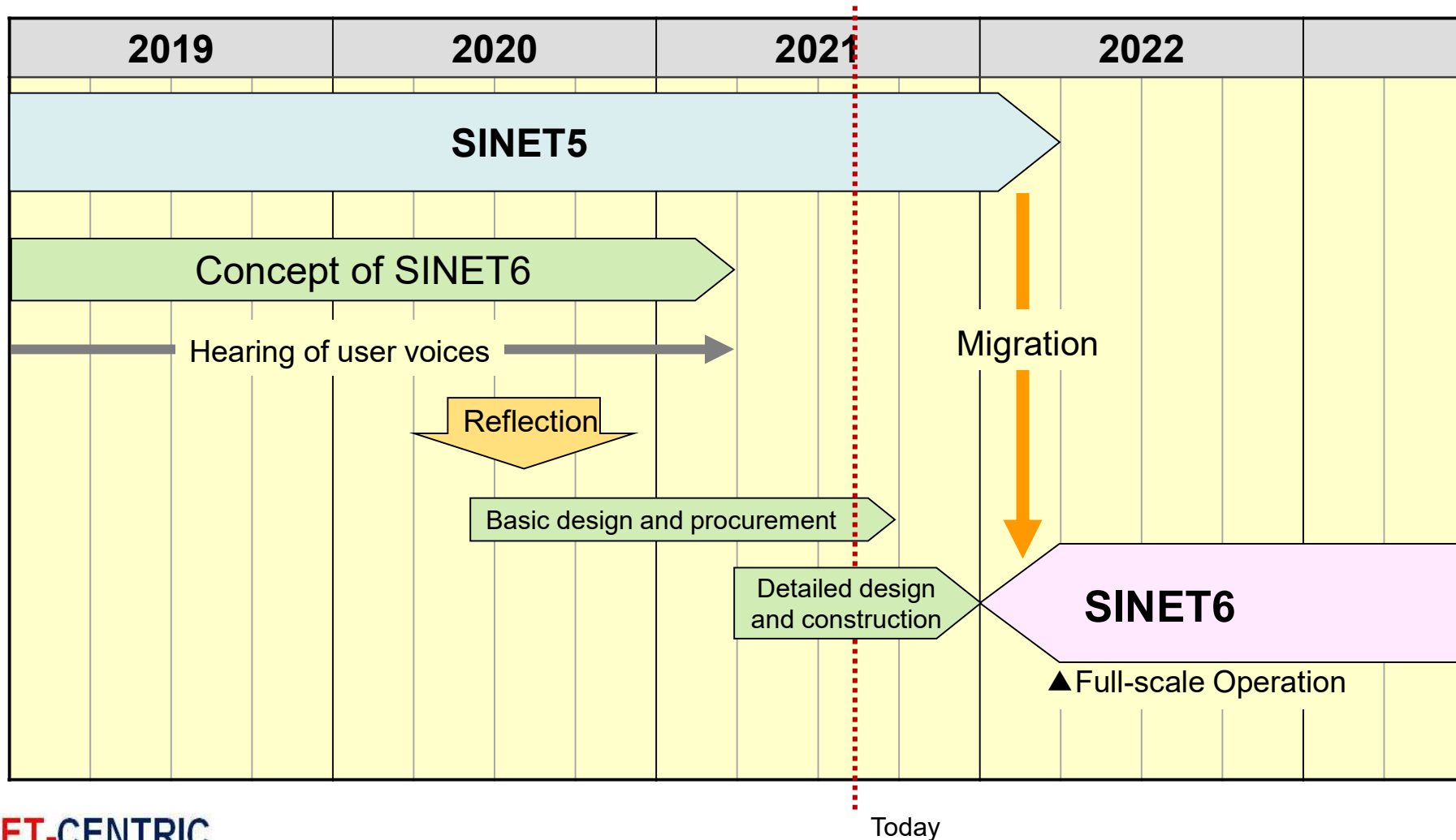
# Accommodation of K-12 Schools

- SINET is asked to be open to K-12 schools in 2024 or later in order to support the government's "GIGA School" plan. SINET needs to accommodate lots of access lines.



# Timeline

- A series of procurements were started from 2020 and today almost completed.
- The migration from SINET5 to SINET6 will start in January 2022.





**• Thank you for your attention!**