



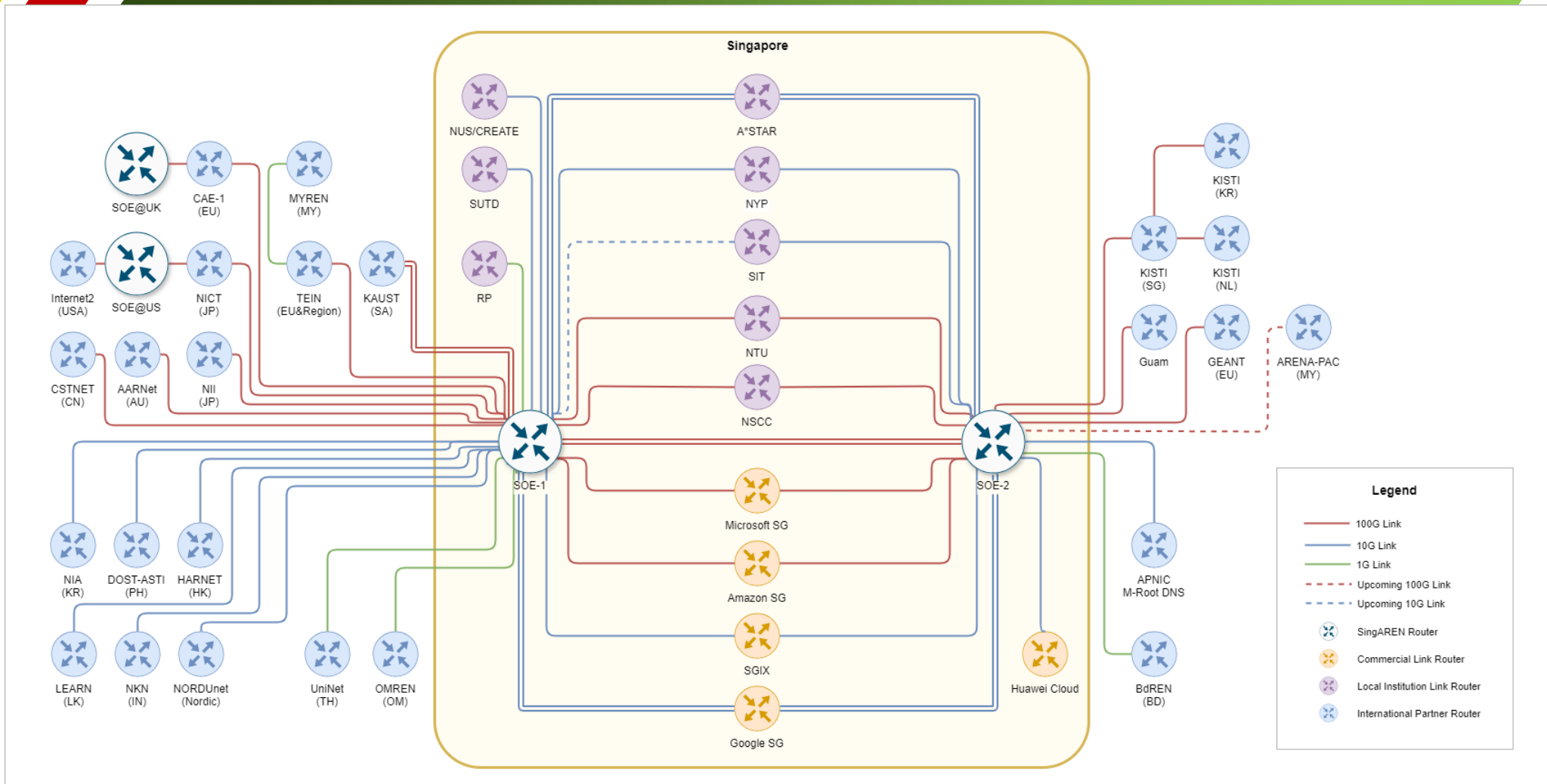
The need for international connectivity resilience

A/Prof. Francis Bu-Sung Lee

Singapore Advanced Research and Education Network

SCA 2025

March 2025



As 26 Feb 2025

400 G between SOEs

Asia-Pacific Backbone Topology

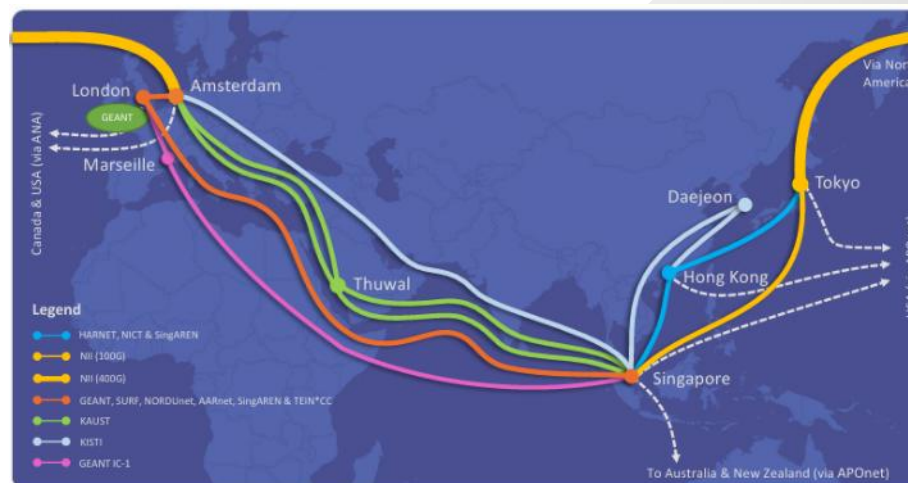
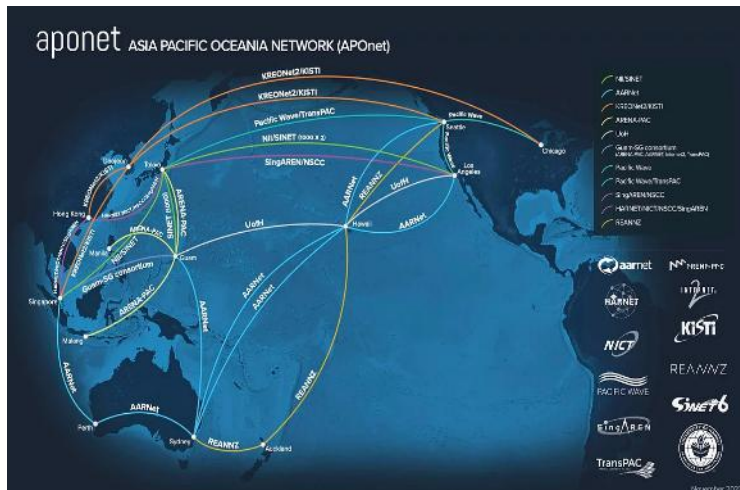


- TransPAC/PacificWAVE
- SingAREN/NSCC
- GEANT
- TEIN*CC/Asi@Connect
- HARNET/NICT/NSCC/SingAREN
- NII/SINET
- AARNet/REANZ
- ARENA-PAC
- Guam-SG consortium
- KREONet2
- KAUST
- MAFFIN
- KOREN
- TWAREN
- UH
- CSTNET
- CERNET
- ASNet
- Others

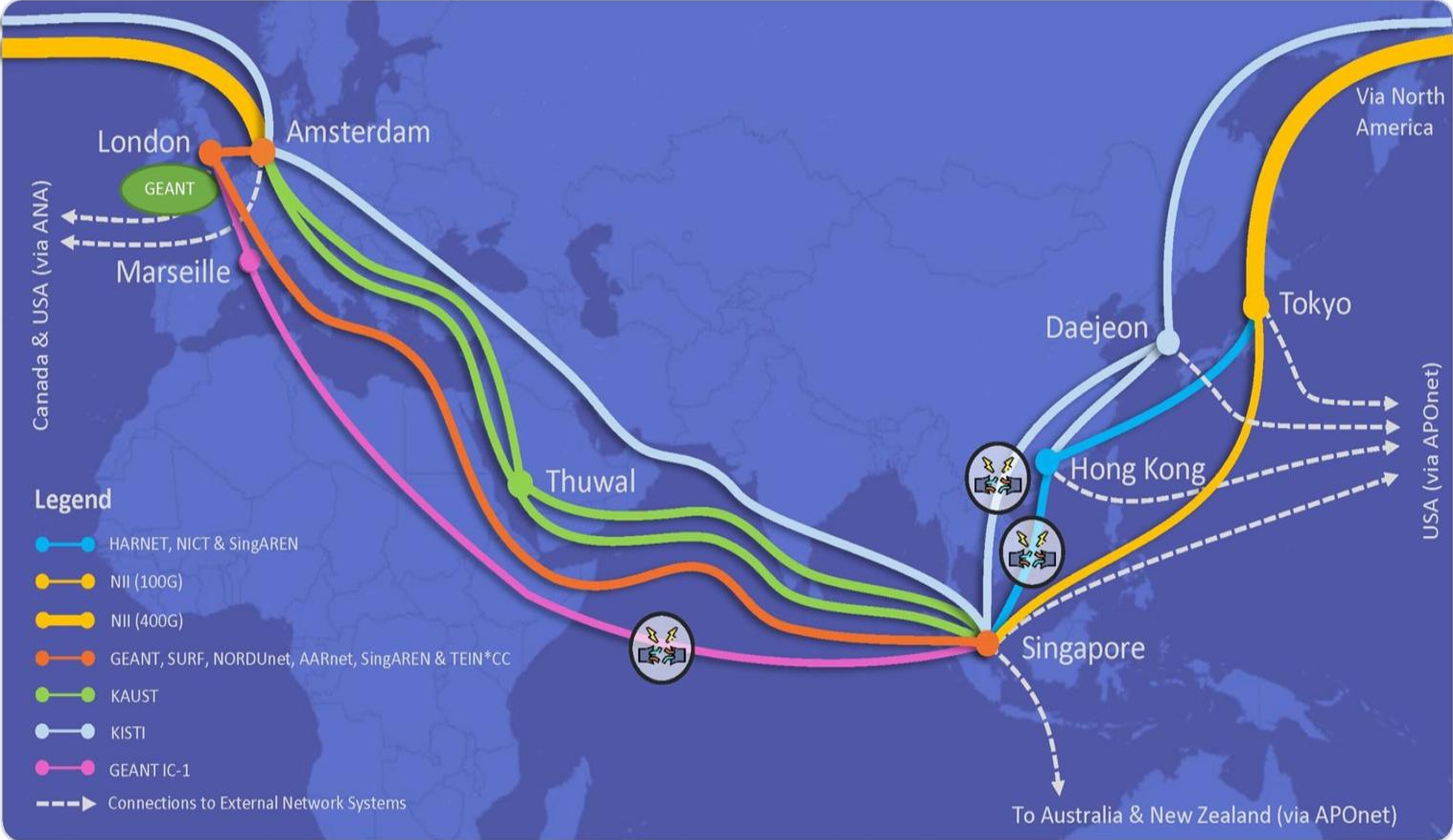
As of Jul 18th, 2024
Hiroko Osawa
(ops@jp.apan.net)

Resilient International Connectivity

- **International R&E Network Resilience**
 - **Asia-Pacific-Oceania Network (APOnet):**
 - 12-partner consortium for network resilience
 - **Asia-Pacific-Europe Ring (AER):**
 - 11-partner consortium for network resilience
 - **East Asia Resilient Backbone Network (EARBN)**
 - 6-partner consortium for network resilience



Current status



Status



Fiber Cut



Fault



Planned Maintenance

Major outages across AER in 2024

- Total of major disruptions :18 (13 outages due to fiber cuts, 3 of which is ongoing since dec 2024))
- Fiber cut Downtime:
 - Average time: 121 days
 - Shortest: 43 days
 - Longest: 223 days
- Highest number of cable cuts occurred on 27 June 2024
 - 6 fiber cuts.
 - Only 1 direct route across Indian ocean to Europe operational.

Worst day with multiple cut/maintenance

AER ASIA-PACIFIC EUROPE RING



Logos of participating organizations and networks:

- SingAREN
- NORDUnet (Nordic Gateway for Research & Education)
- HARNET
- aarnet
- NICT
- GÉANT
- SURF
- NII
- KAUST
- KiSTi
- TEIN-CC COOPERATION CENTER

Status



Fiber Cut



Fault

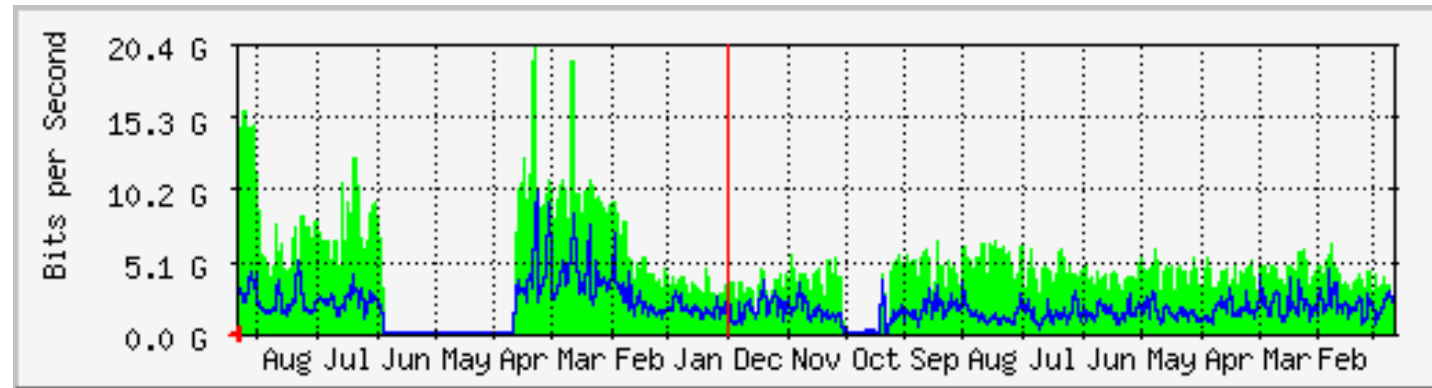


Planned Maintenance

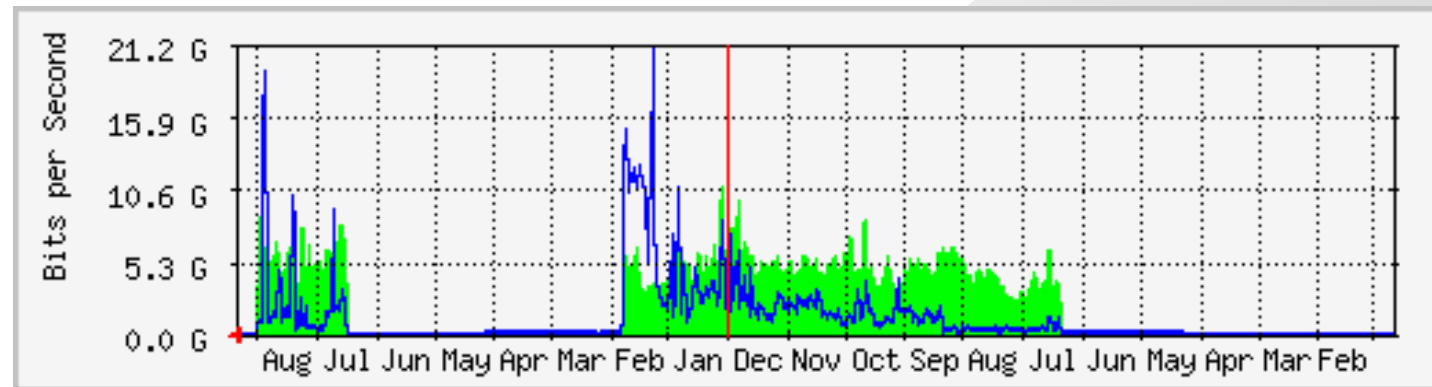
27 June 2024

SG to Europe links

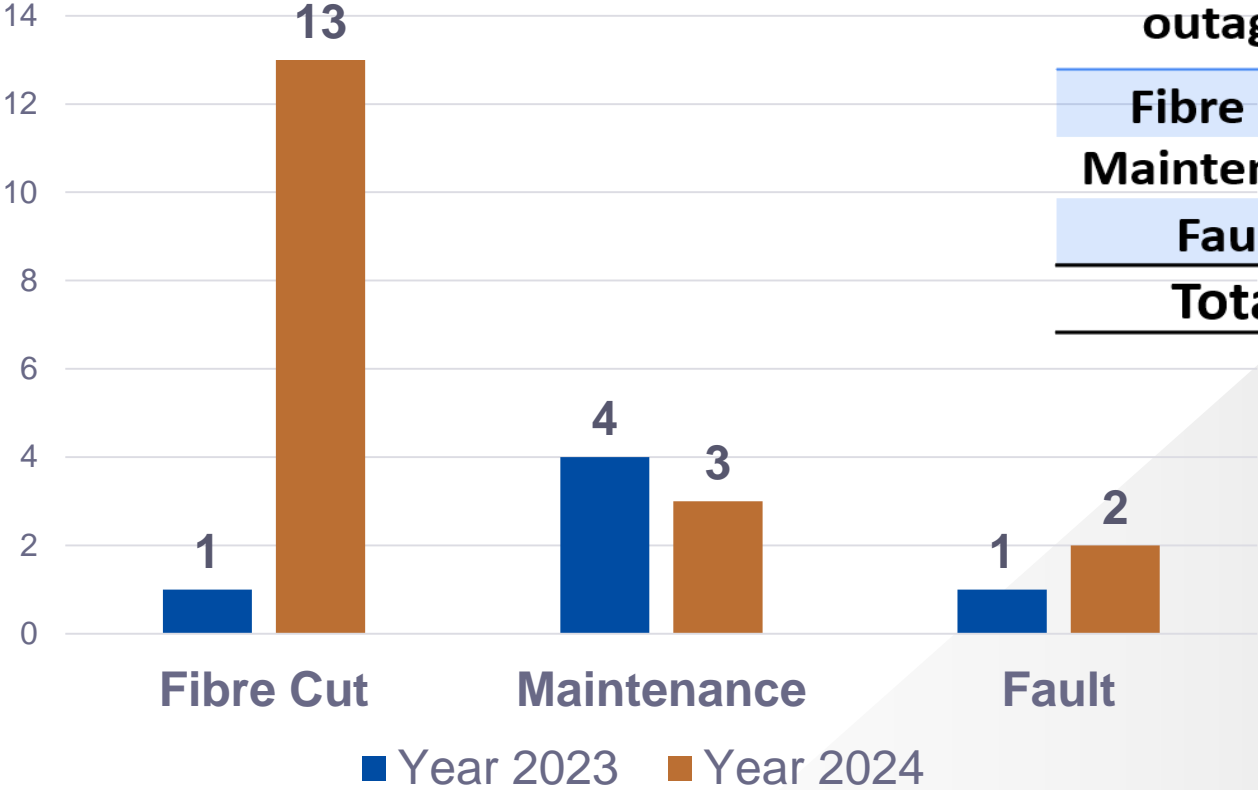
CAE-1 link



Geant-SG



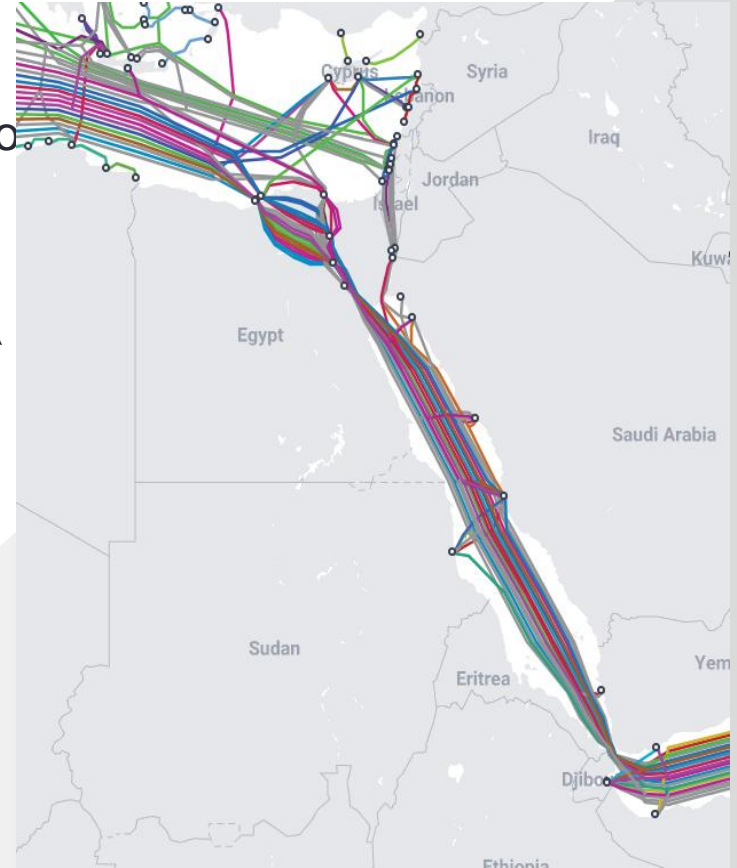
Major Outages in year 2023 vs 2024



Type of outages	2023 Count	2024 Count
Fibre Cut	1	13
Maintenance	4	3
Fault	1	2
Total	6	18

Eu-Asia connectivity

- **Diversity, Redundancy and Community**
 - Circuits on as many diverse paths as possible
 - Circuits on different cable systems
 - Supportive community - stronger together than by o
- Diversity difficulties between EU and Asia systems pass the same channel



Polar Connect

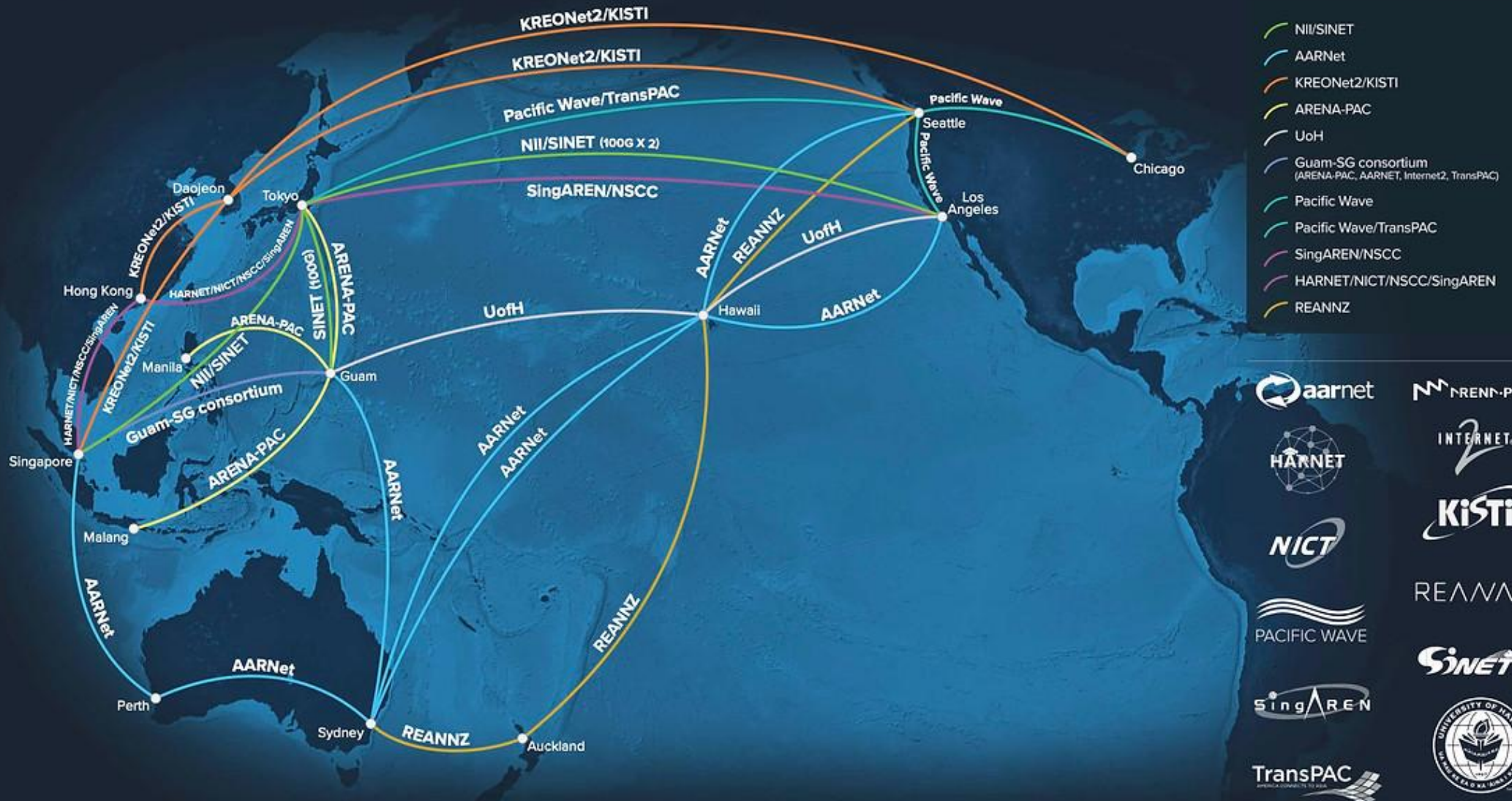
Vision 2030



 Polar Connect
 Far North Fiber

NORDUnet
Nordic Gateway for Research & Education

aponet ASIA PACIFIC OCEANIA NETWORK (APOnet)



Major Outages & Disruptions in 2024(APOnet)

Type of outages	Count
Fibre Cut	6
Maintenance	7
Fault	6

Plot of the fault locations of Subsea fault/fiber cut



Slide provided by Hirotaka Sato and his team, KDDI

Meta Project Waterworth



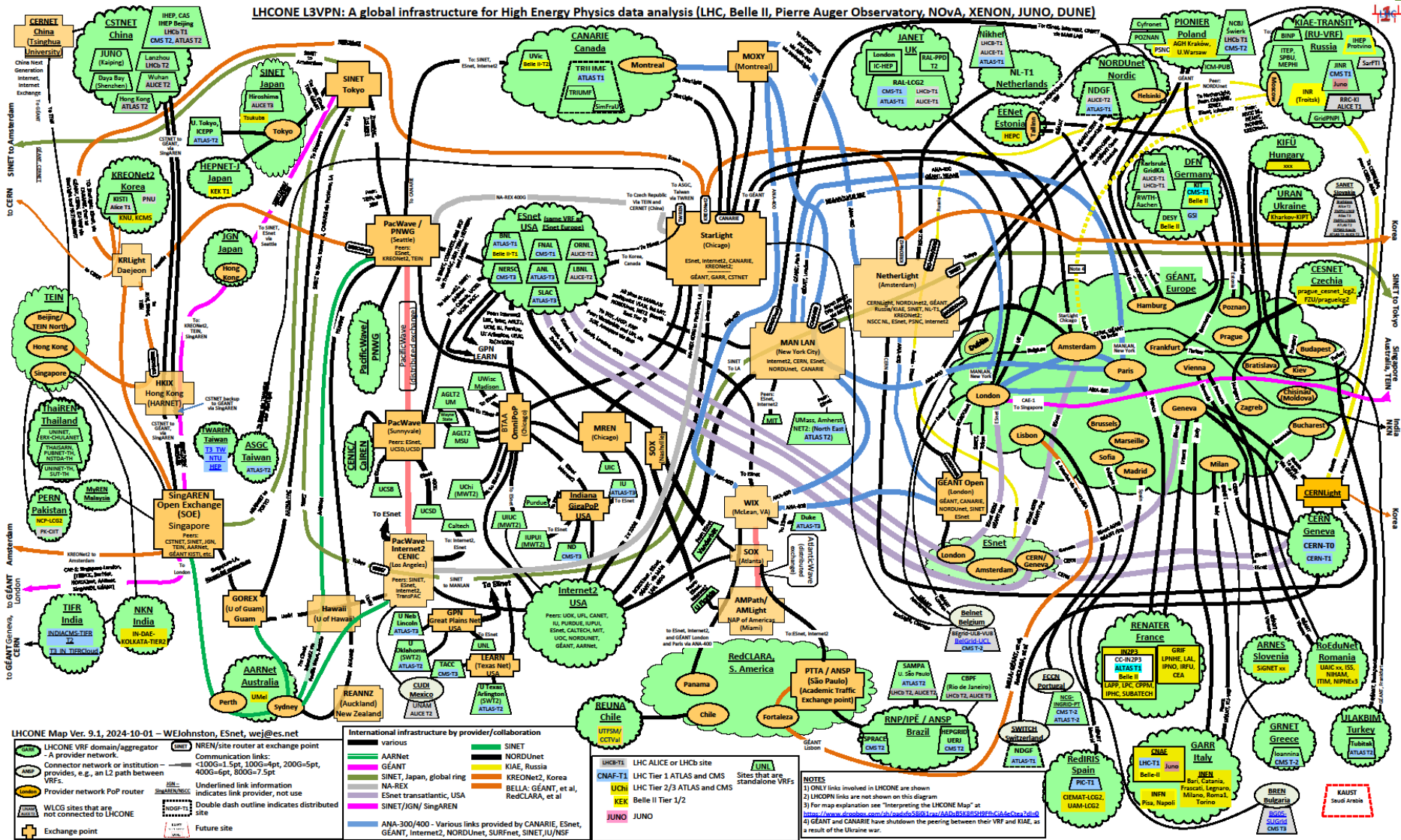
Meta's map showing its proposed new cable route



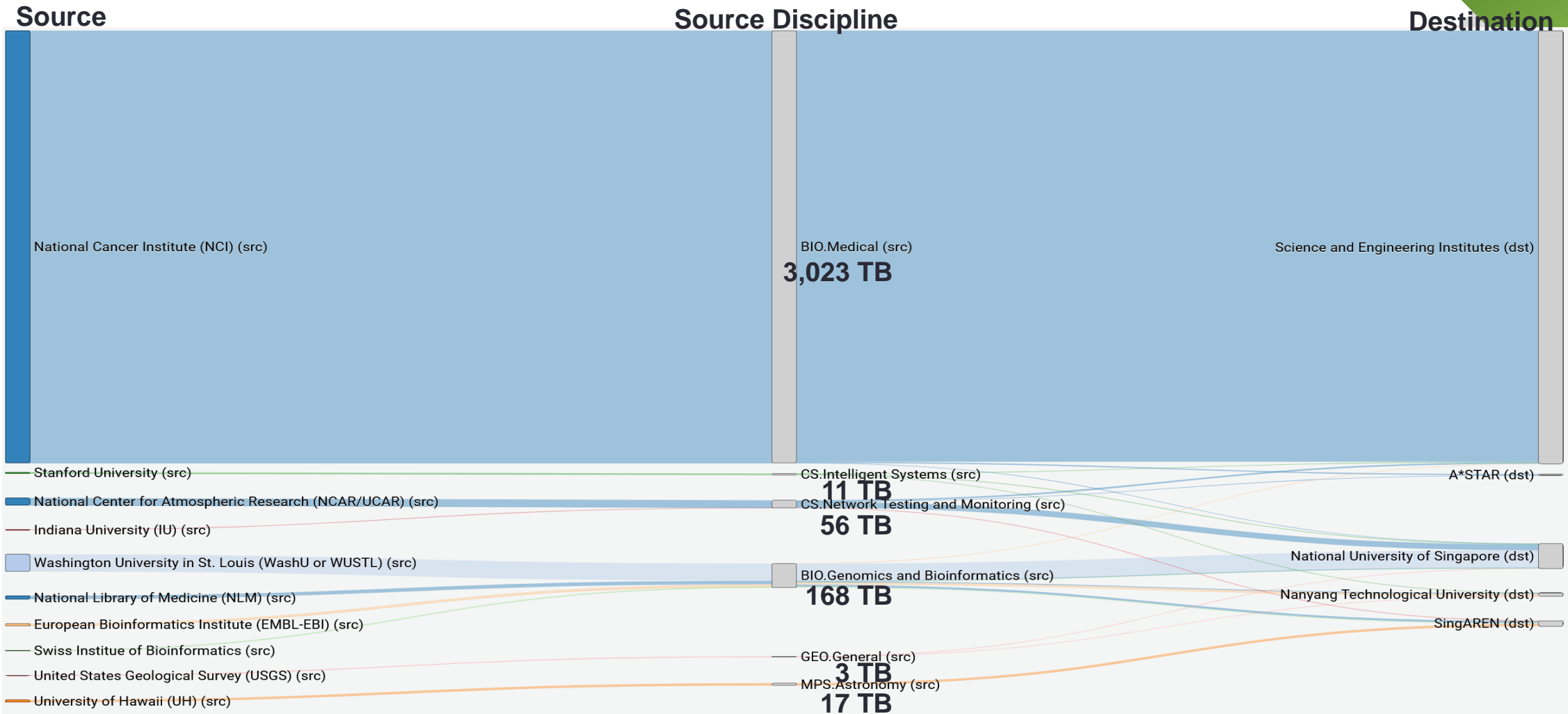
Applications

LHCOne network map

LHCONE L3VPN: A global infrastructure for High Energy Physics data analysis (LHC, Belle II, Pierre Auger Observatory, NOvA, XENON, JUNO, DUNE)



Top Science Talkers – Past 90 days (13 Sep 2024)





THANK YOU

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