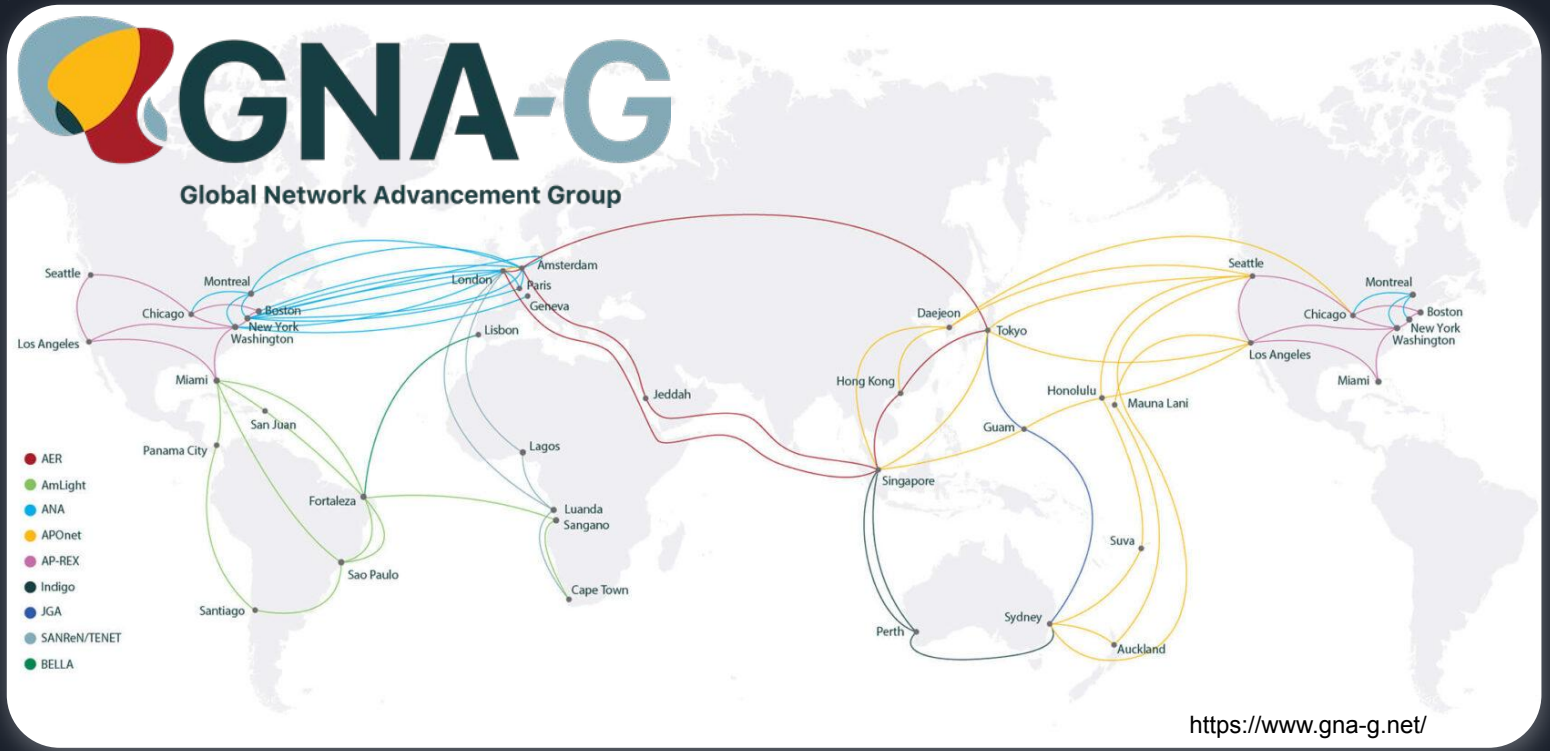
Think Global, Act Global to be More Resilient!

Simon Green
Technical Manager (Network & Services)
SingAREN

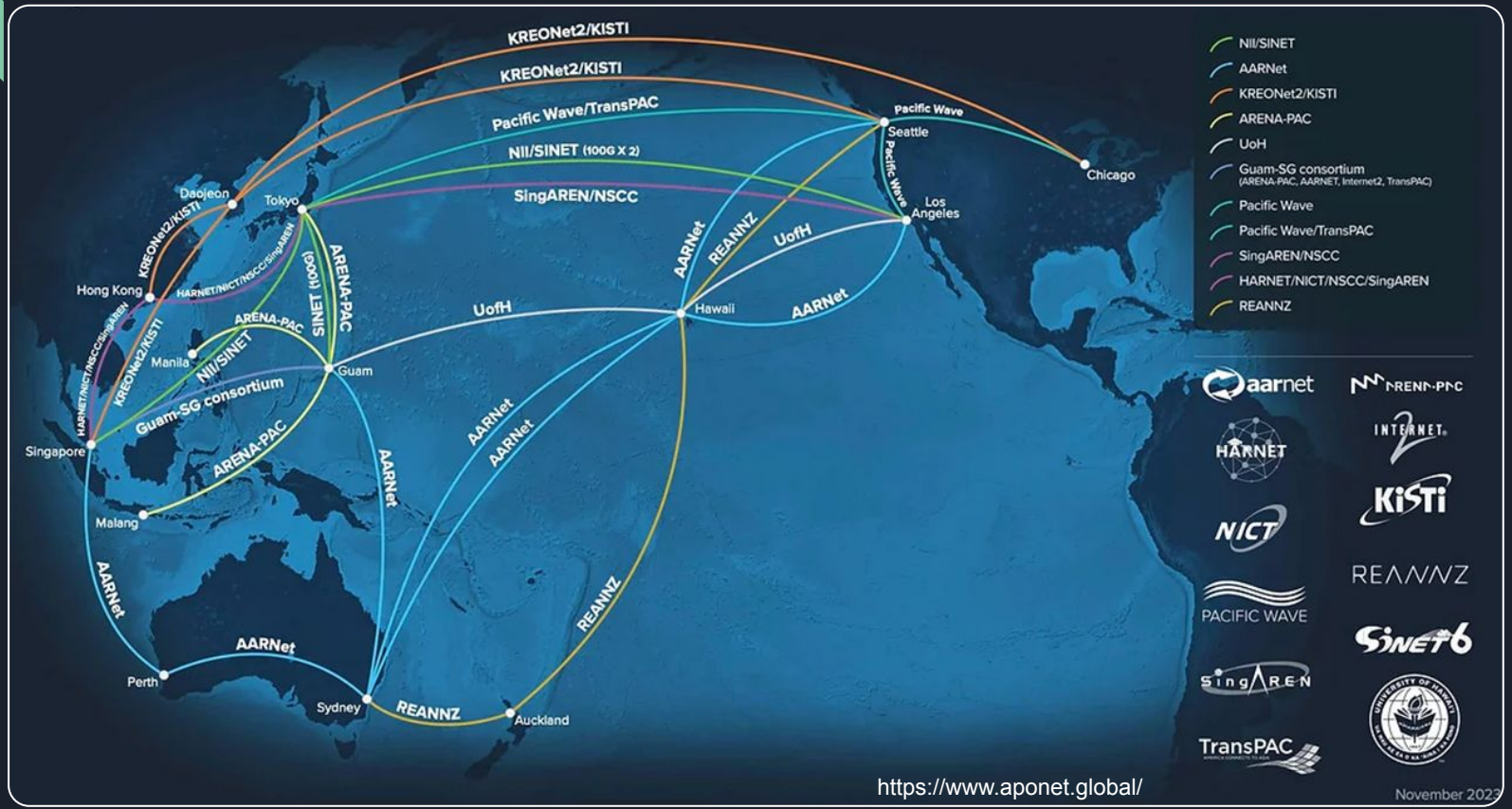
TNC24

Global Research and Education Network



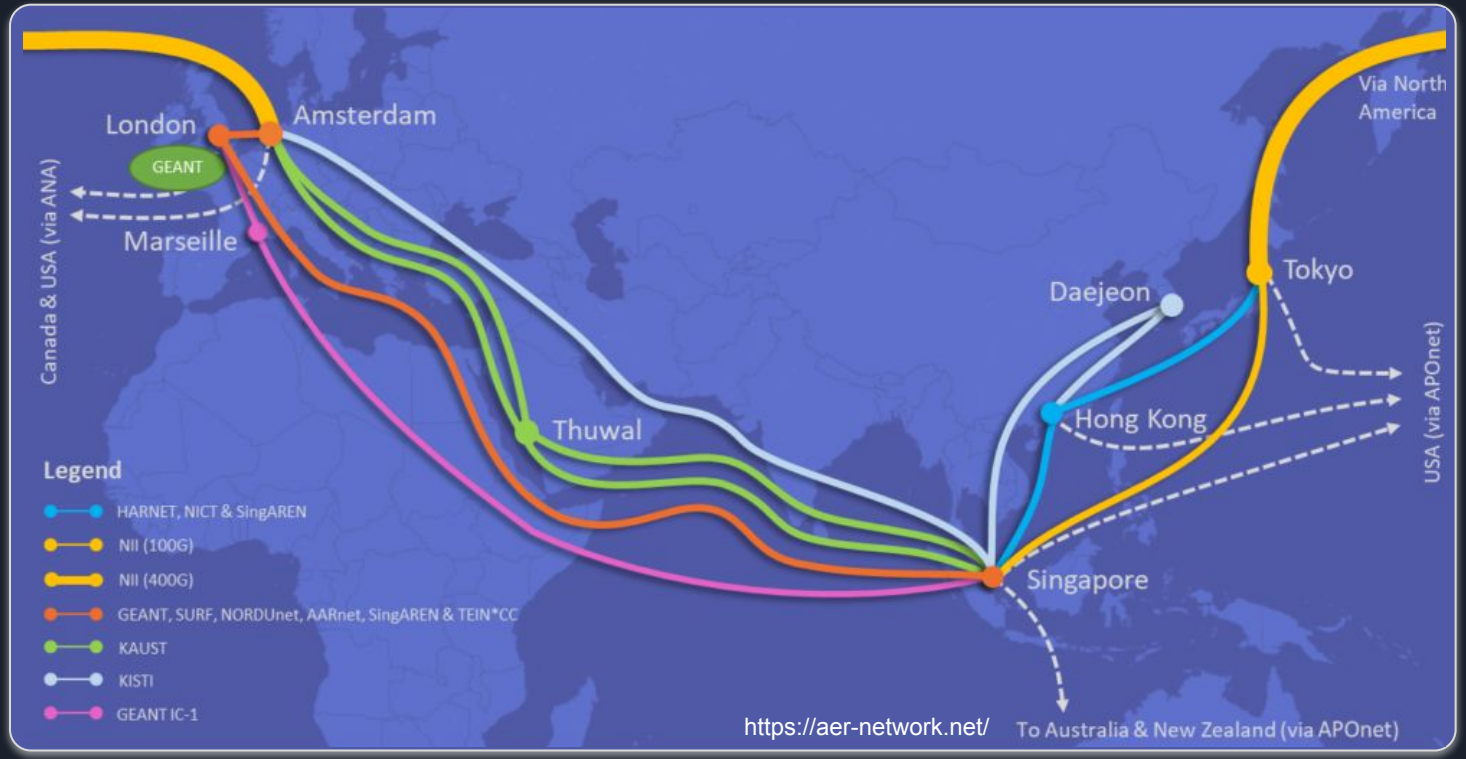
https://www.gna-g.net/

aponet ASIA PACIFIC OCEANIA NETWORK (APOnet)



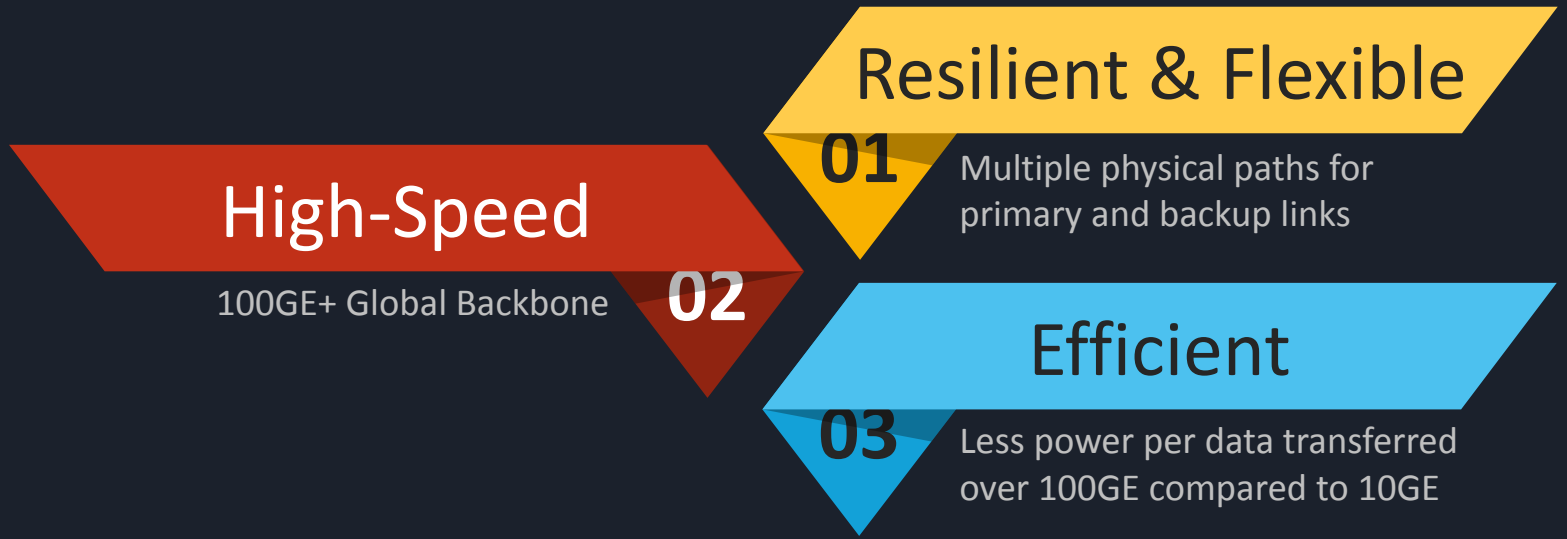
https://www.aponet.global/

AER
ASIA-PACIFIC EUROPE RING



https://aer-network.net/

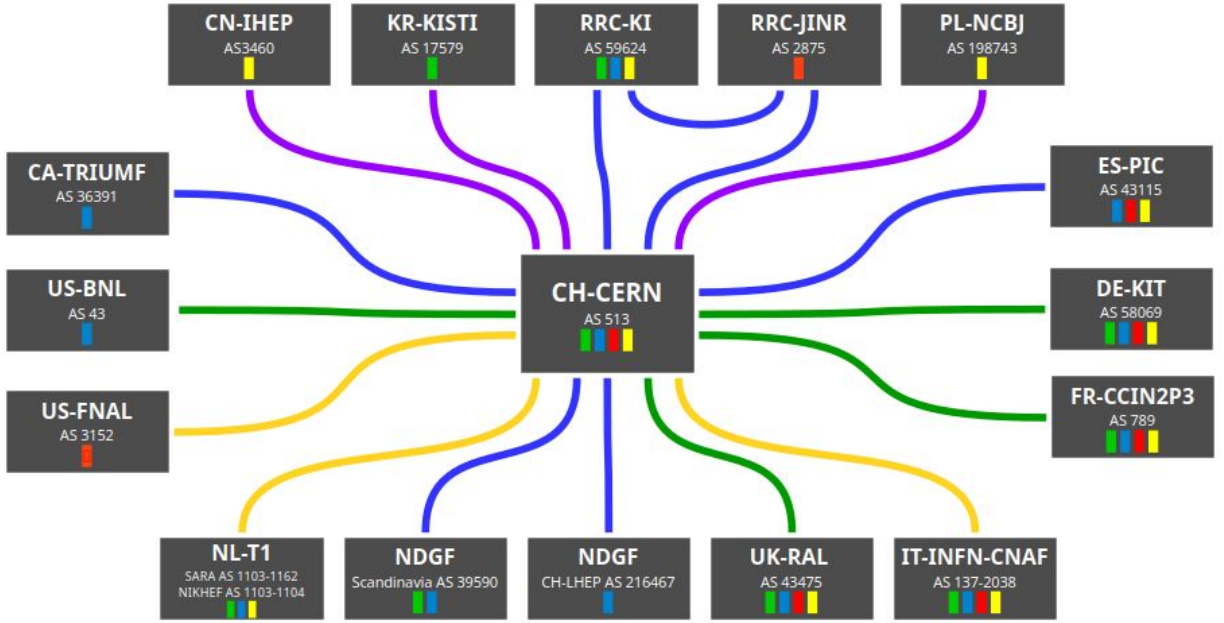
Benefits of the Global Research and Education Network



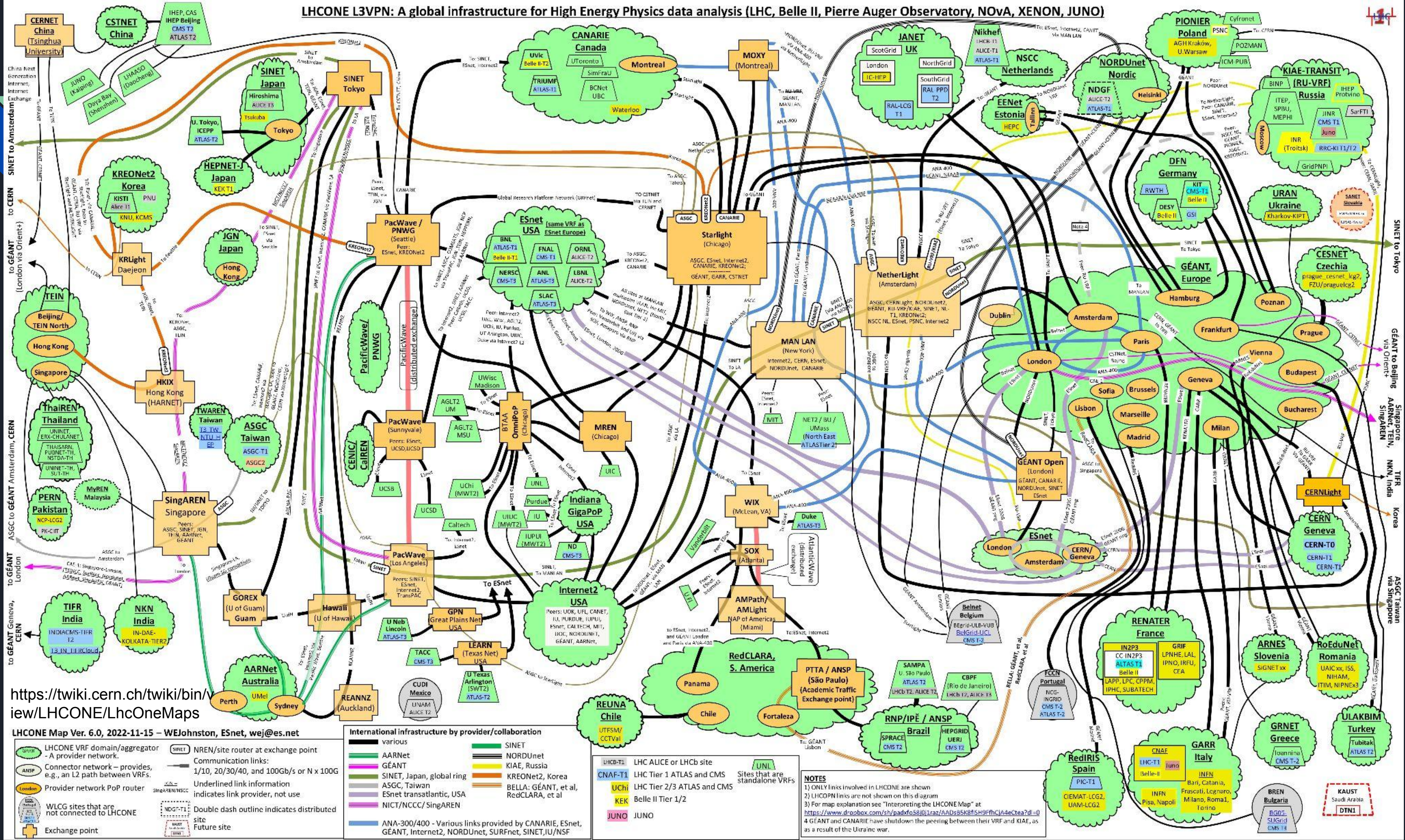
Enabling Day-to-Day Research Projects & Demonstrations

- Large Hadron Collider Networks (LHCOPN & LHCONE)
- Remote Robot Telesurgery Demo
- OpenScience Data Federation
- SCinet Network Research Exhibition (NRE) Demos
- and more!

LHCOPN

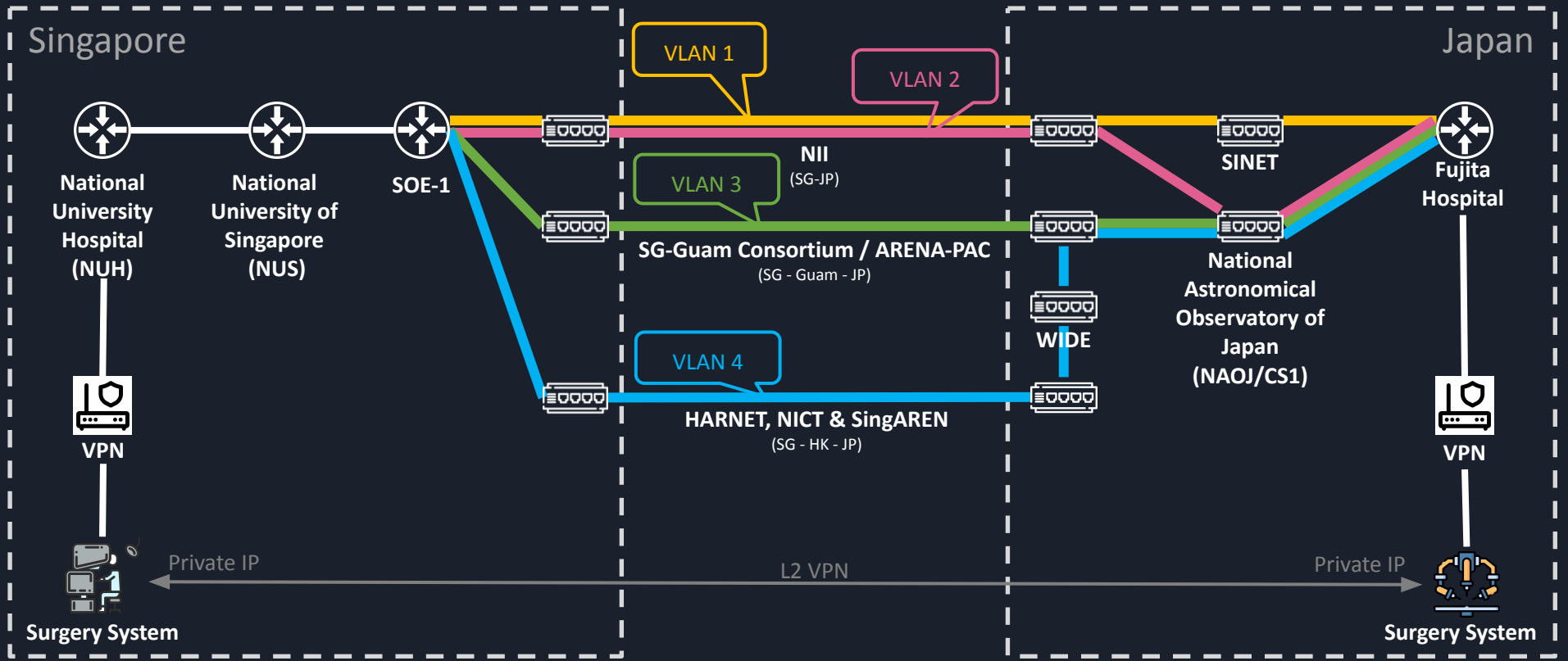


https://twiki.cern.ch/twiki/bin/view/LHCOPN/OverallNetworkMaps



https://twiki.cern.ch/twiki/bin/view/LHCONE/LhcOneMaps

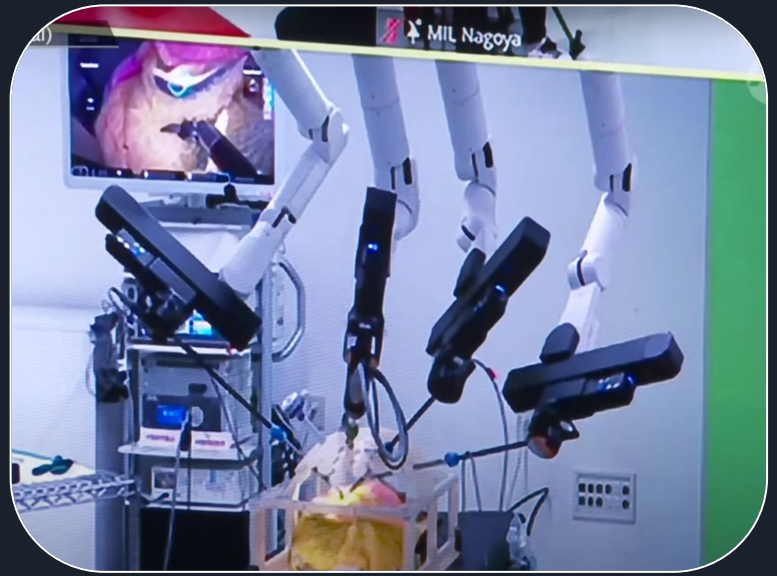
Robotic Telesurgery Trial - Network Plans



Robotic Telesurgery Trial

Singapore and Japan Clinician-Scientists Collaborate on Groundbreaking Telesurgery Trial Spanning over 5,000km in Nov 2023

Singapore - Controlling Unit

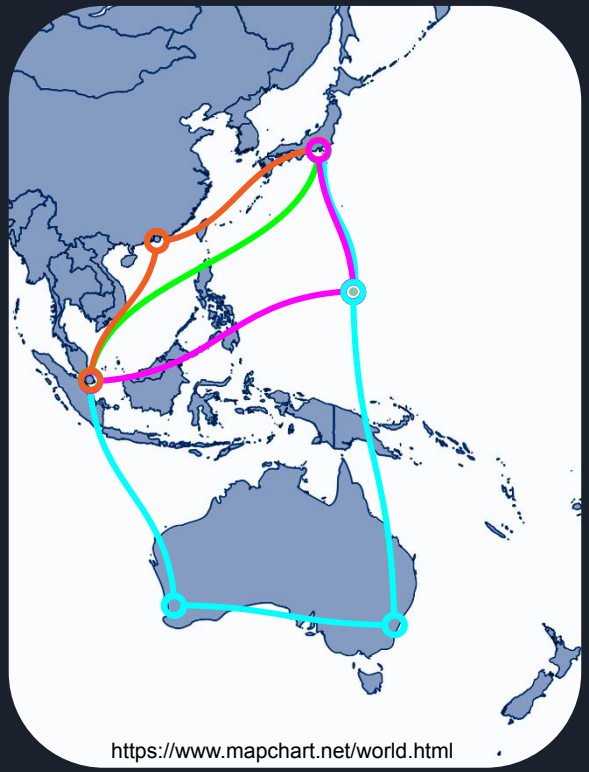


Japan - Robotic Operation Unit

https://www.channelnewsasia.com/watch/clinician-scientists-singapore-and-japan-carry-out-telesurgery-trial-video-3838491

Resiliency Showcase

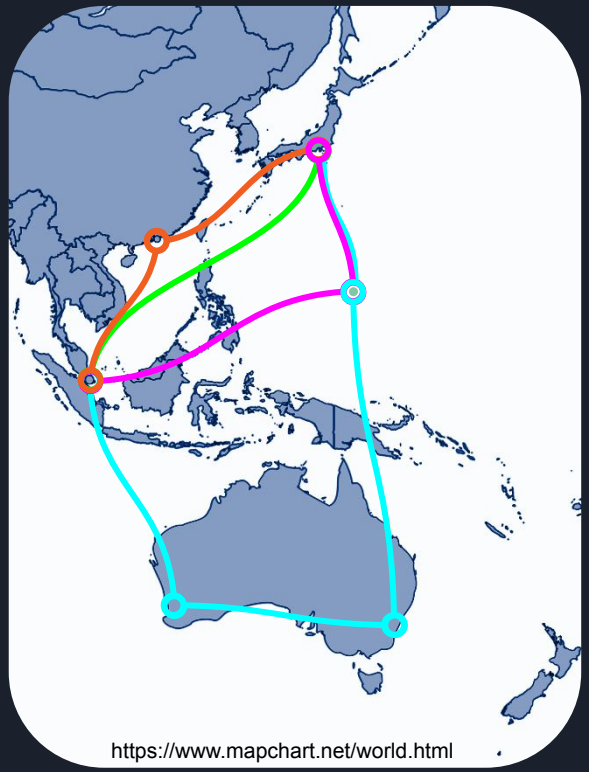
Singapore - Japan Backbone



Resiliency Showcase
Singapore - Japan Backbone

APAN-JP/SINET Singapore - Japan Backbone

Path Priority	Path	Circuit Owner(s)
1	Singapore - Hong Kong - Japan	HARNET / NICT / NSCC / SingAREN
2	Singapore - Japan	SINET
3	Singapore - Guam - Japan	SG-Guam Consortium SINET (Guam-JP)
4	Singapore - Australia - Guam - Japan	AARNet SINET



Resiliency Showcase
Singapore - Japan Backbone

Primary Backbone Path

Singapore - Hong Kong - Japan

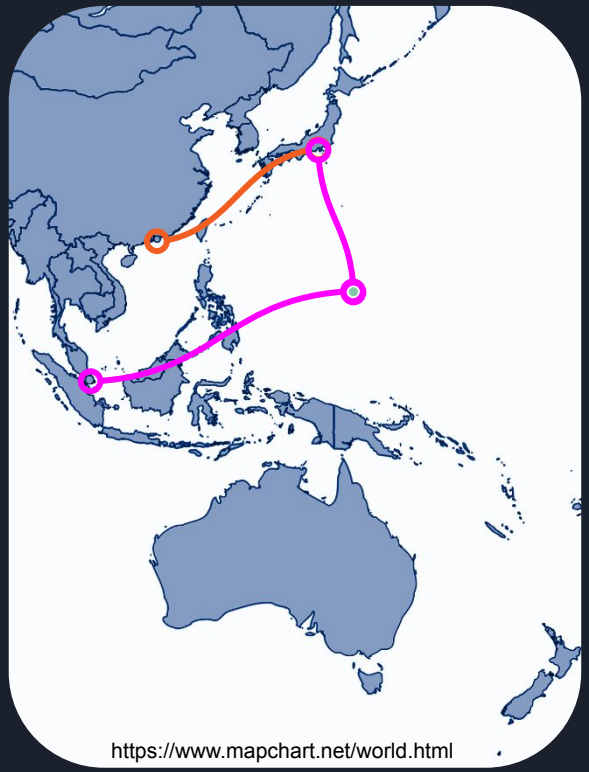
(HARNET / NICT / NSCC / SingAREN)

Resiliency Showcase
Singapore - Japan Backbone

Affected Circuit (Downtime)	Singapore - Hong Kong (late Jan - Apr 2023 - 90 days)
Failover Link	Singapore - Japan (SINET)
Access to Japan and Hong Kong	Yes

Resiliency Showcase
Singapore - Japan Backbone

Affected Circuit (Downtime)	Singapore - Hong Kong (late Jan - Apr 2023 - 90 days) Singapore - Japan (start Feb - end Feb 2023 - 30 days)
Failover Link	Singapore - Guam - Japan (SG-Guam Consortium + SINET)
Access to Japan and Hong Kong	Yes



Resiliency Showcase
Singapore - Japan Backbone

Potential Third Link Failover Case

Possible Affected Circuits (Downtime)	SG-HK SG-JP SG-Guam-JP
Failover Link	SG-AU-Guam-JP (AARNet + SINET)
Access to Japan and Hong Kong	Yes

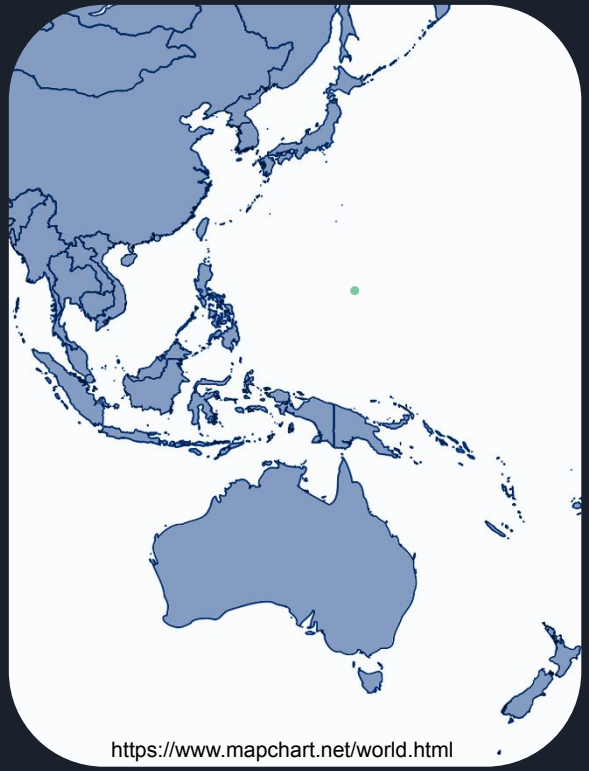
Network System Challenges

Varying Operating Procedures per System

Each network system needs to determine the processes and tools to manage the system successfully

Additional Setup for Resiliency

Operators need to be open with users and determine resiliency requirements



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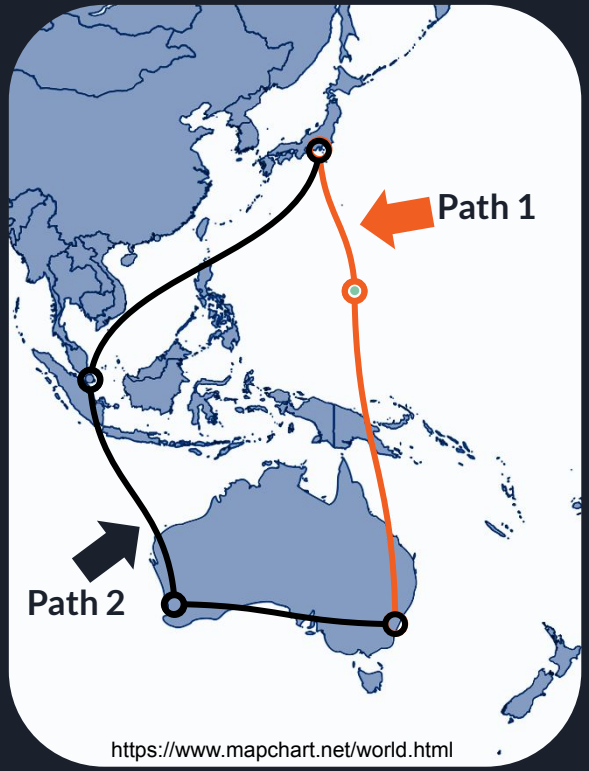

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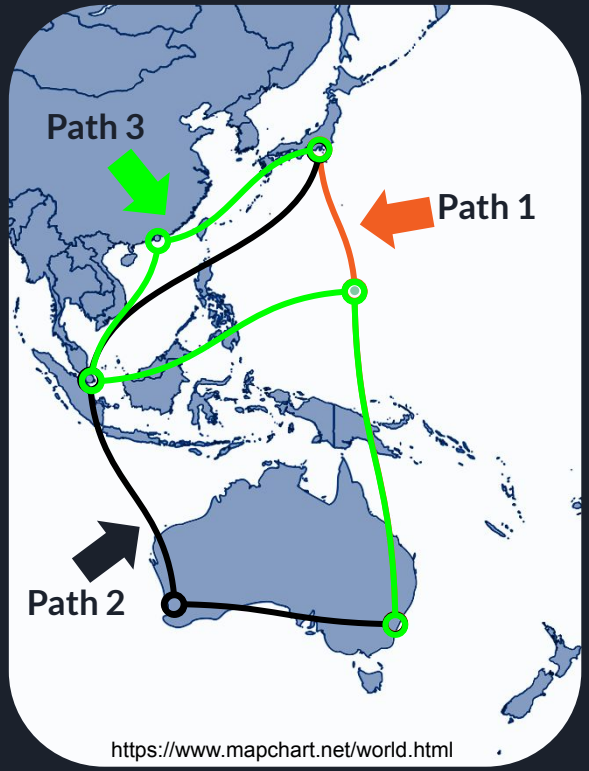

Future Work & Discussion

400GE international backbone
More diverse paths

Standardisation of operations between network systems

System-wide automation

Thank You!