



REALNZ

eResearch NZ 2022

INTERNATIONAL NETWORK

Supporting global collaborations

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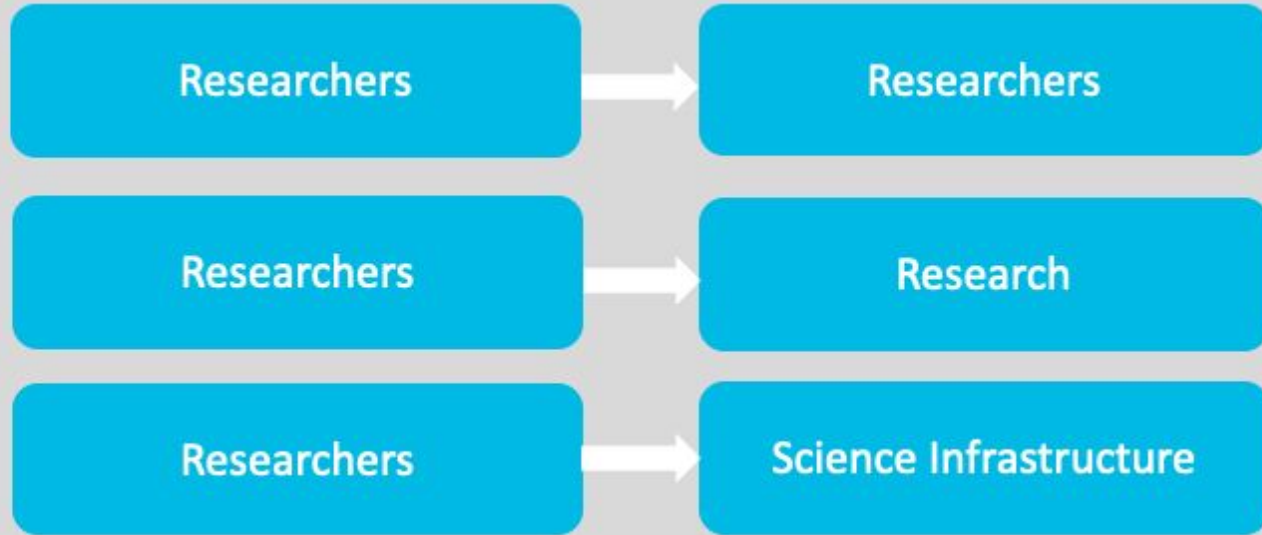
REANWZ



AUT

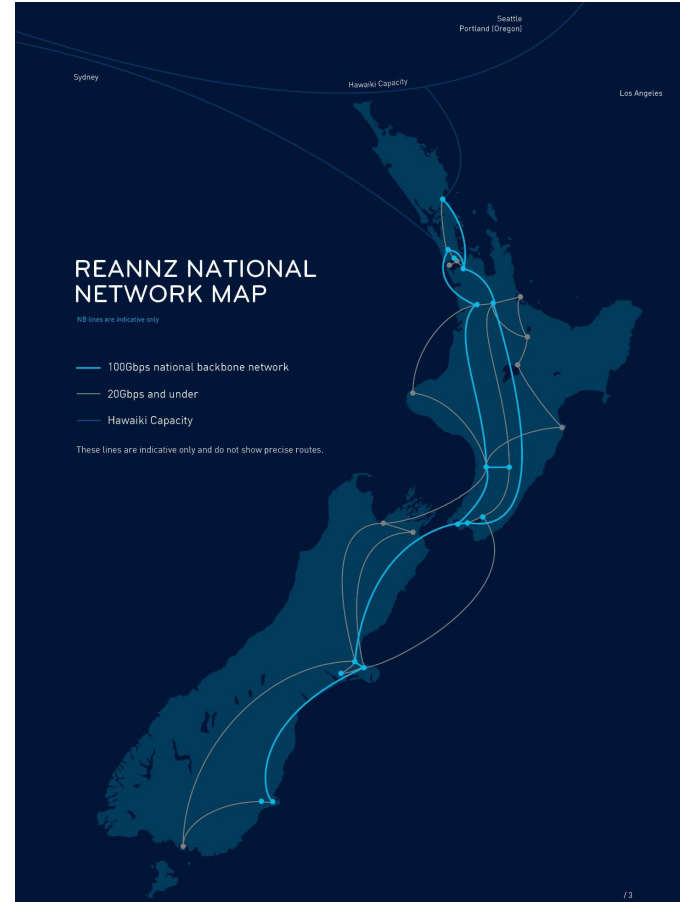
WHAT WE DO

REANNZ's is a **connector**



REANNZ NETWORK

- 100Gbps of National backbone
- Points of presence(PoPs) throughout New Zealand
- Members connected to at least one of the REANNZ PoP



INTERNATIONAL NETWORK

WHAT MAKES UP AN INTERNATIONAL NETWORK?

- Physical links to other countries eg Subsea Cable Systems.
- PoP - Point of Presence of REANNZ active networking gear
- Peering with other Network Operators which provide direct access to them and their customers.
- Dedicated links with large content providers
- R&E NREN Peering – Provides direct access to the various other Research Networks around the globe.
- IP Transit – A commercial service that provides a way to reach all internet connected destinations that we can't get to via one of the above. (Fills in the gaps)

INTERNATIONAL NETWORK

WHY DO WE NEED ONE?

- While Domestic infrastructure is primarily about connecting our members to the REANNZ Network, International PoP's are all about connecting things that our members want to reach outside of NZ eg content/cloud providers, Research Institutes / Uni's... etc
- Having our own PoP at strategic locations internationally allows for greater end to end control of traffic and a better member experience.
- Allows us to form unique partnerships with other NREN's around the world.

INTERNATIONAL NETWORK

NREN 'CLUB' BENEFITS

- NREN – Each country tends to have one.
- Being an NREN allows us to form unique relationships with various other NREN's globally to facilitate data intensive research.
- Can easily contact the other NREN's to troubleshoot problems which is a lot more difficult with commercial operators.
- NREN's are far more outcome driven for their Membership meaning they can focus on what's right instead of commercial constraints.

INTERNATIONAL NETWORK

HAWAIIKI CABLE

- REANNZ are an anchor tenant on this cable system.
- Went live 2018.
- Provides us with 50Gbps to both Australia and the USA.
- Our Bandwidth increases yearly over the course of the 25 year contract ending up at over 2Tbps.
- Lands at Mangawhai north of Auckland.





INTERNATIONAL NETWORK

AUSTRALIA - SYDNEY

- We have 2 Sydney PoPs.
- Resilient capacity back to NZ using different Sub Sea Cable Systems (Hawaiki + Hawaiki partner).
- We connect to Peering Exchanges, R&E - AARNET and large Cloud Providers onsite.
- IP Transit Service.



SYDNEY – PHYSICAL CABLES



INTERNATIONAL NETWORK

USA - HAWAII

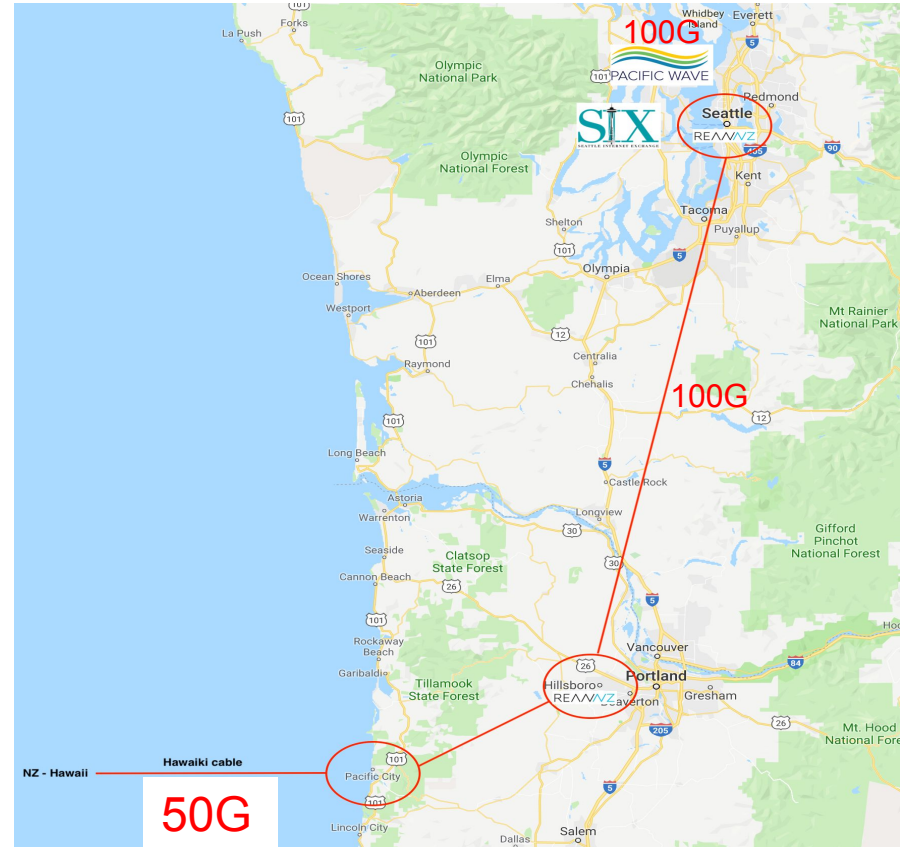
- PoP located within the Hawaiki CLS.
- 'Breaks' into our existing 50G Hawaiki capacity that runs through Hawaii (NZ to Mainland USA)
- Includes connection to the University of Hawaii which extends our reach to Guam.



INTERNATIONAL NETWORK

USA

- 50G of Hawaiki Capacity extended from NZ all the way to our Seattle PoP.
- We previously closed our Oregon PoP and instead now pass through it transparently.
- IP Transit connected to Seattle PoP.
- Seattle provides access to Global R&E Networks via Pacific Wave.



The map illustrates the network topology of the Pacific Wave project, showing connections between major hubs in the Pacific Rim and North America. Key hubs include Tokyo, Guam, Seattle, Sunnyvale, Los Angeles, Chicago, New York, and DC Area. The map highlights various network links, including JGN (Seattle & Tokyo), TransPAC/Pacific Wave, GEMNet2, REANNZ, AARNET, UH, PIREN, SingAREN/Internet2, TWAREN/TANET, CERNET, IGA, CNIS/AREN, TransPAC, and others. The map also shows connections to Europe and the Middle East via CANARIE and ANA.

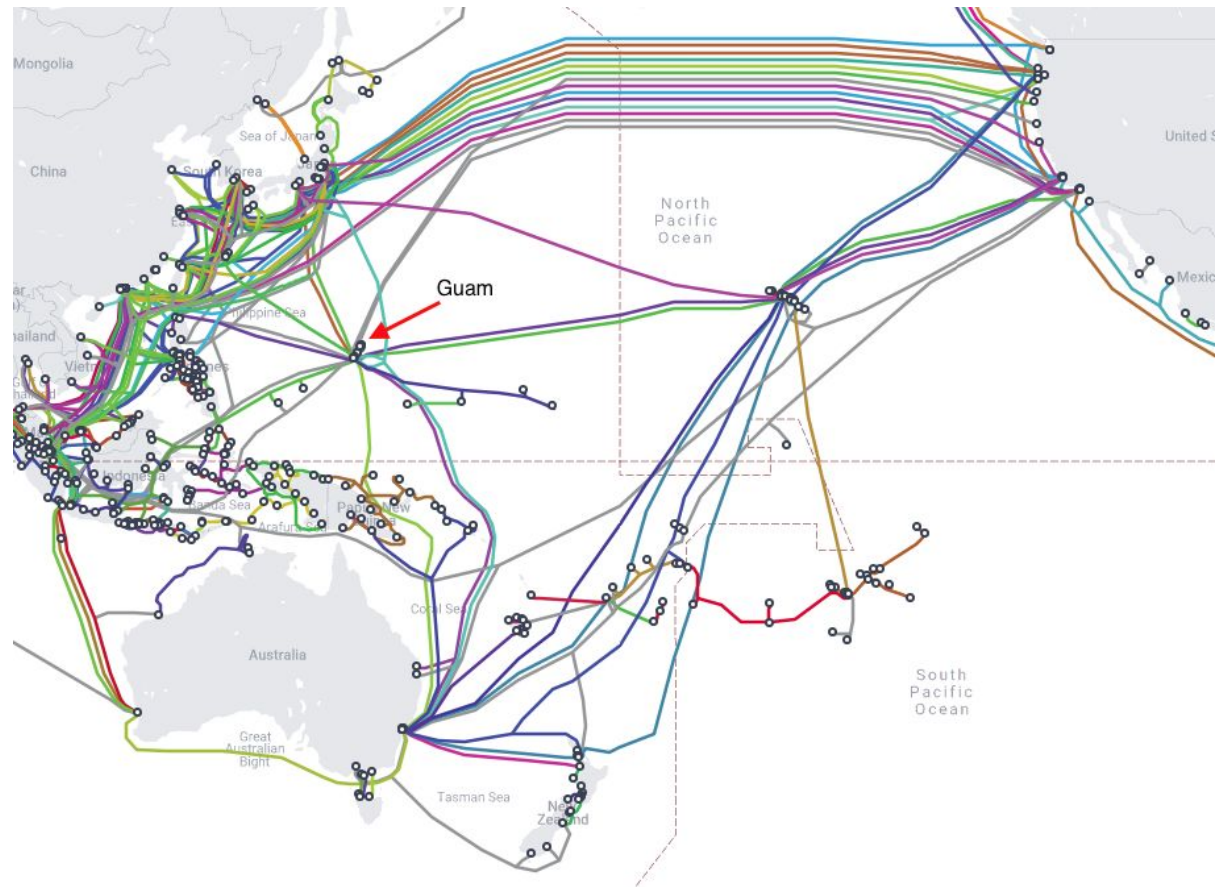
INTERNATIONAL NETWORK

GUAM

- Guam is a landing point for multiple Sub Sea Cable Systems.
- GOREX (Guam Open Research & Education eXchange) is also present offering rich NREN connectivity especially into Asia.
- 20G of resilient capacity via Hawaiki partner service back to Sydney providing resiliency for our R&E traffic.
- Kindly hosted by UH.



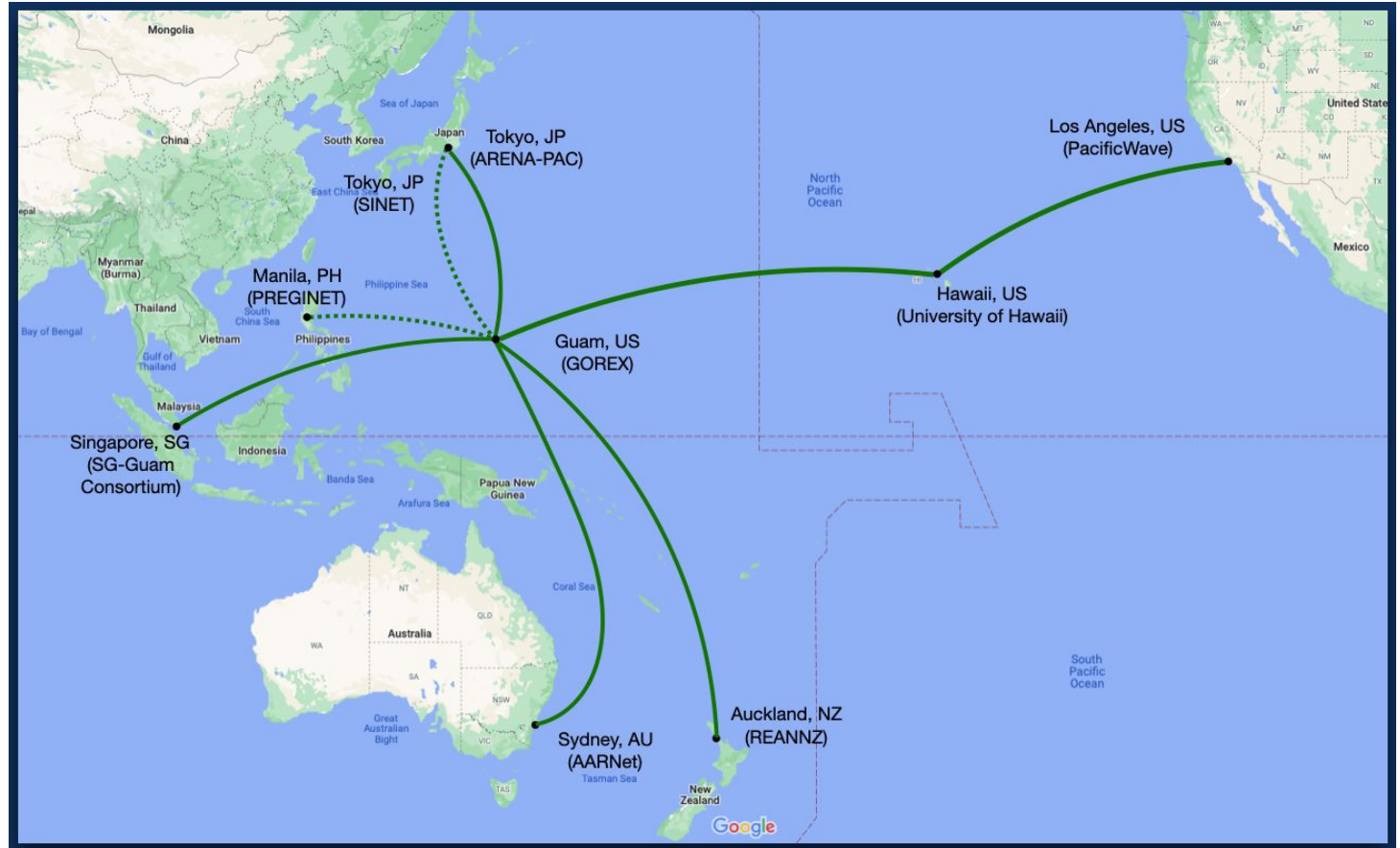
GUAM CABLES



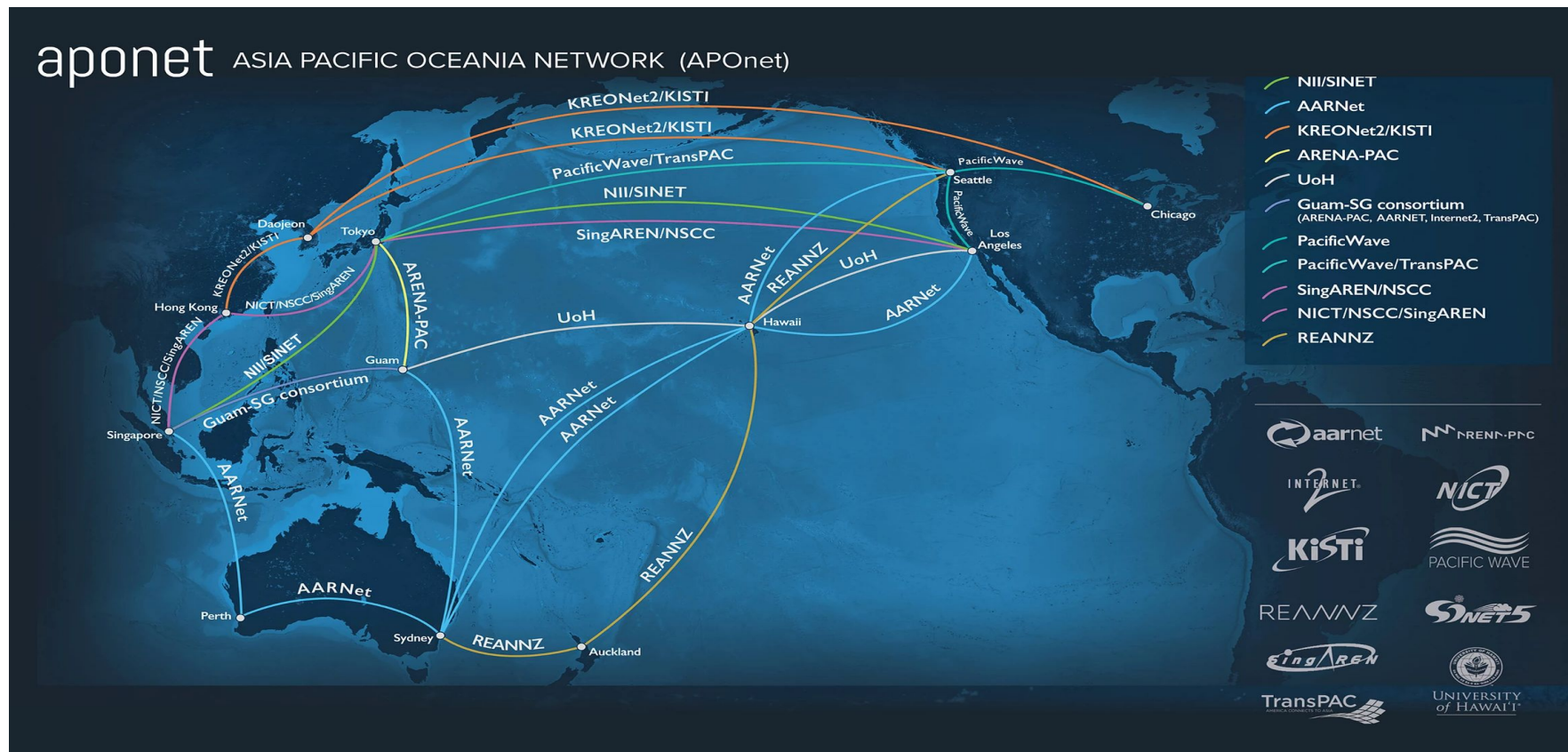
GOREX OVERVIEW

AARNet
ARENA-PAC
PacificWave
REANNZ
UH
UoG
SingAREN

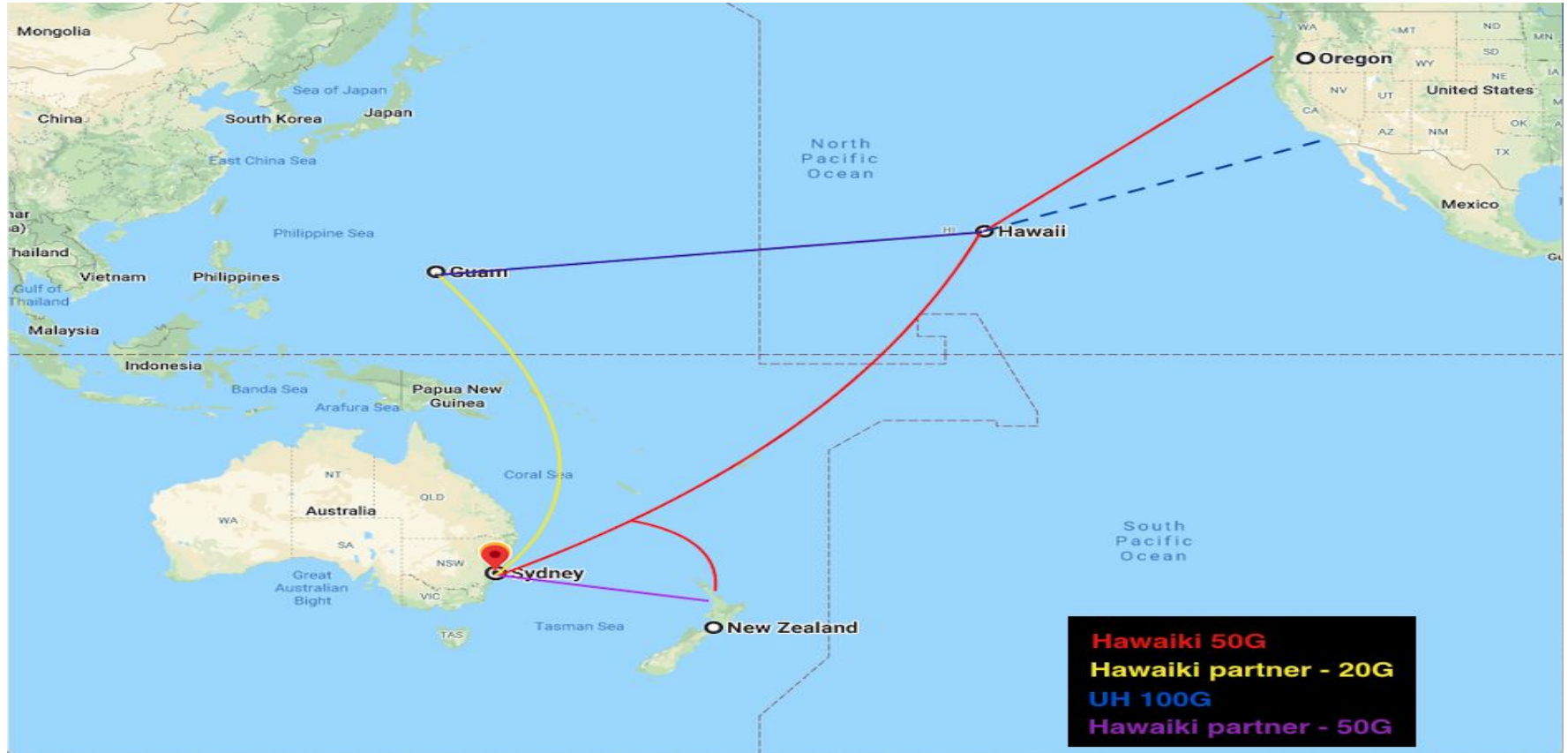
SINET/NII
PREGINET

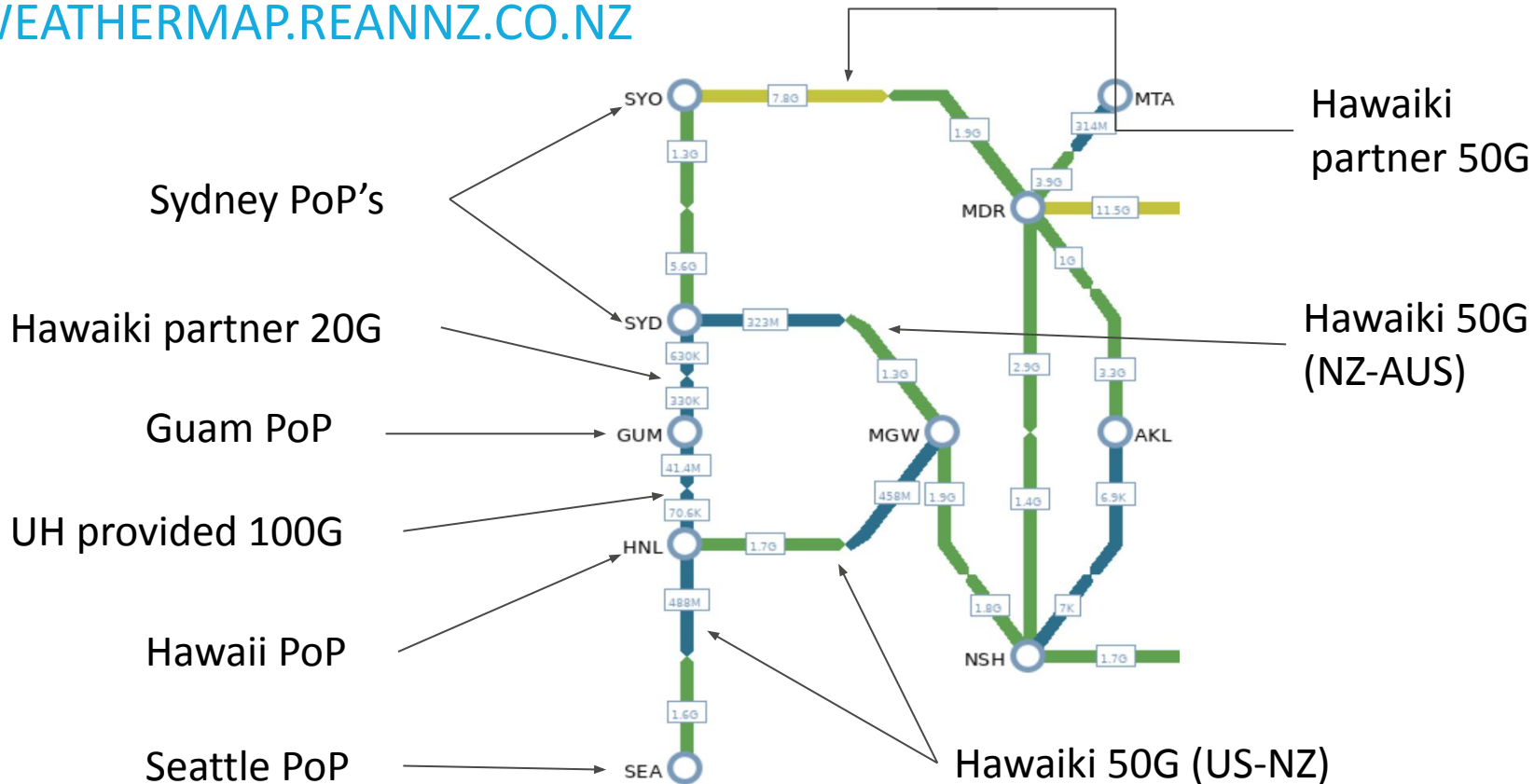


WHAT DOES THIS ALL LOOK LIKE PUT TOGETHER?



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INTERNATIONAL NETWORK

EXAMPLE - AUT

AUT often transfer large amounts of data over to NASA from their Warkworth Radio Telescope Observatory.

Let's take this example and look at how the traffic passes through our Network.

Warkworth radio telescopes are part of the international network of radio telescopes – next slide.



AUT's Warkworth 30-m radio telescope



International VLBI Observation Network.
(From https://www.gsi.go.jp/ENGLISH/page_e30214.html)

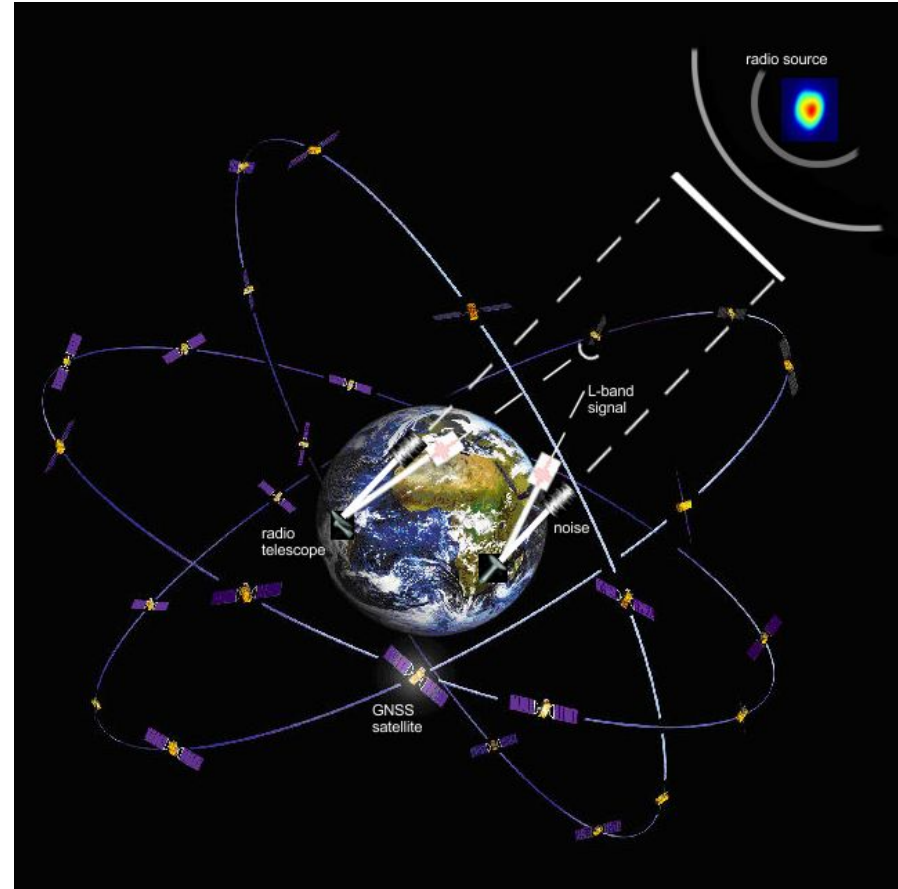
INTERNATIONAL NETWORK

EXAMPLE - AUT

Regular joint observations of quasars to determine:

- The International Celestial Reference Frame – the basis of any space flight (NASA, ESA, JAXA, and other space agencies);
- The Earth rotation and orientation parameters (complex and irregular);
- Plate tectonic motion;
- Important correction for GNSS (GPS, BEIDOU, GALILEO, GLONASS, QZSS)

Large amount of data sent to correlation and data analysis centres (e.g. NASA-USNO)

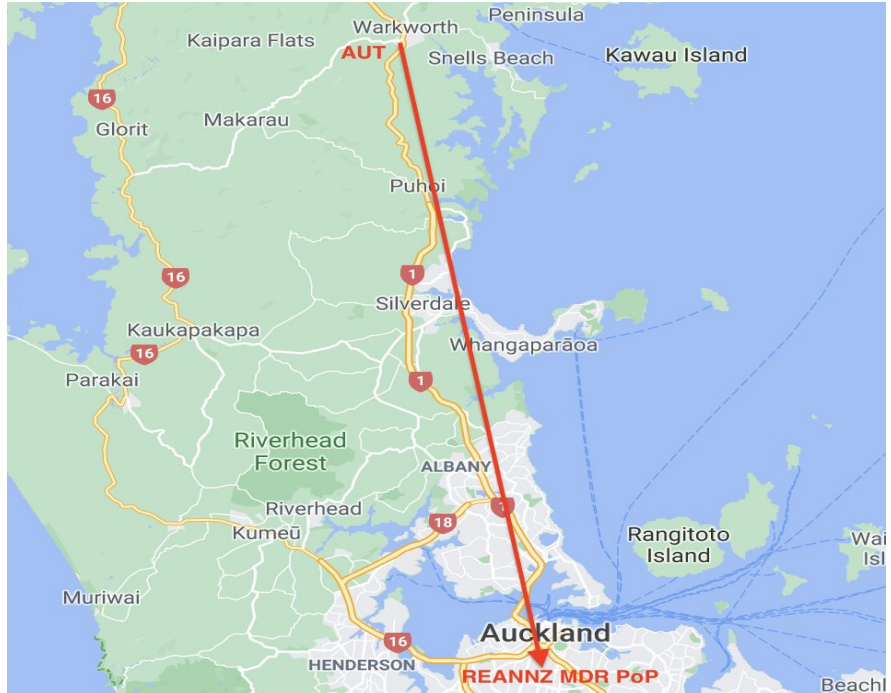


INTERNATIONAL NETWORK

EXAMPLE - AUT

First the traffic enters our Network at our MDR (Auckland CBD) PoP from AUT's Warkworth research site.

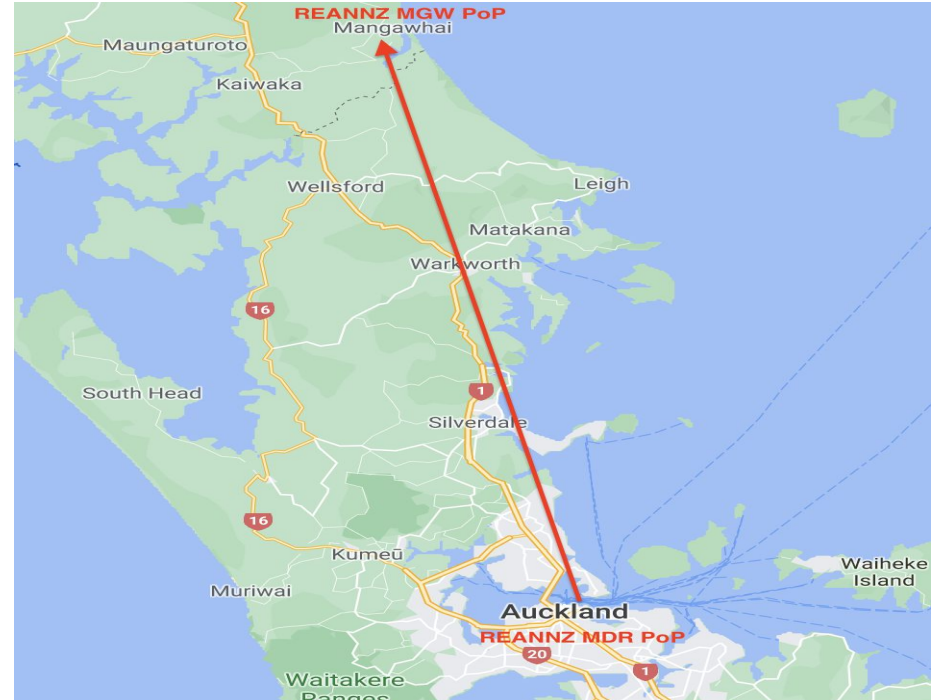
Our Networks now knows the destination of this traffic and has selected the optimal path via Hawaii that it should use.



INTERNATIONAL NETWORK

EXAMPLE - AUT

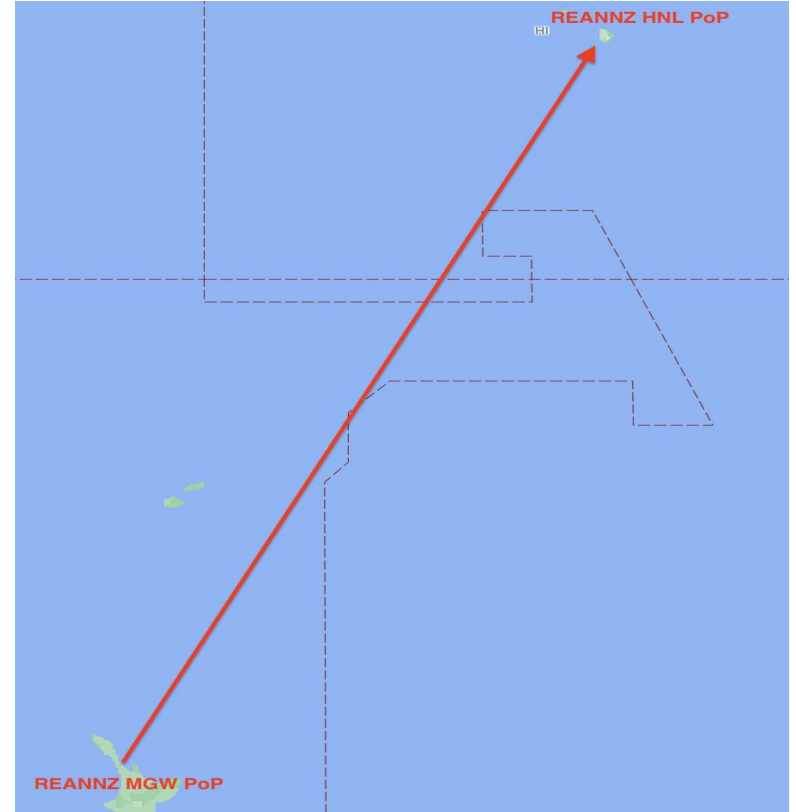
Next traffic is sent to up to our Mangawhai PoP which is where our Hawaiki International Connectivity comes in connecting us to Sydney and the USA.



INTERNATIONAL NETWORK

EXAMPLE - AUT

Traffic is now sent from Mangawhai to our Hawaii PoP via the Hawaiki Sub Sea Cable System.

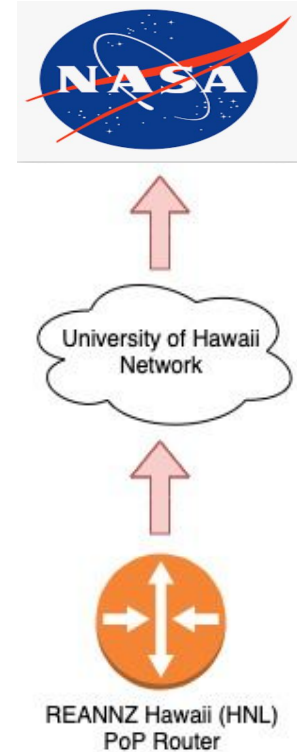


INTERNATIONAL NETWORK

EXAMPLE - AUT

Once in Hawaii we hand this traffic over to the University of Hawaii who sends the data over Internet2 to NASA.

We have other paths available as well however this is currently the preferred route.



Top Flows Sent by Auckland University of Technology

Flows

341

Total Volume

1.5 TB

By Volume

Destination Organization	Total Volume ▾	Largest Flow	# Flows
<u>National Aeronautics and Space Administration</u>	1.5 TB	13.4 GB	332.0

By Rate ▾

Destination Organization	Peak ▾	Average	# Flows
<u>National Aeronautics and Space Administration</u>	1.3 Gb/s	1.0 Gb/s	332.0



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