Networking The Pacific

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Network Startup Resource Center
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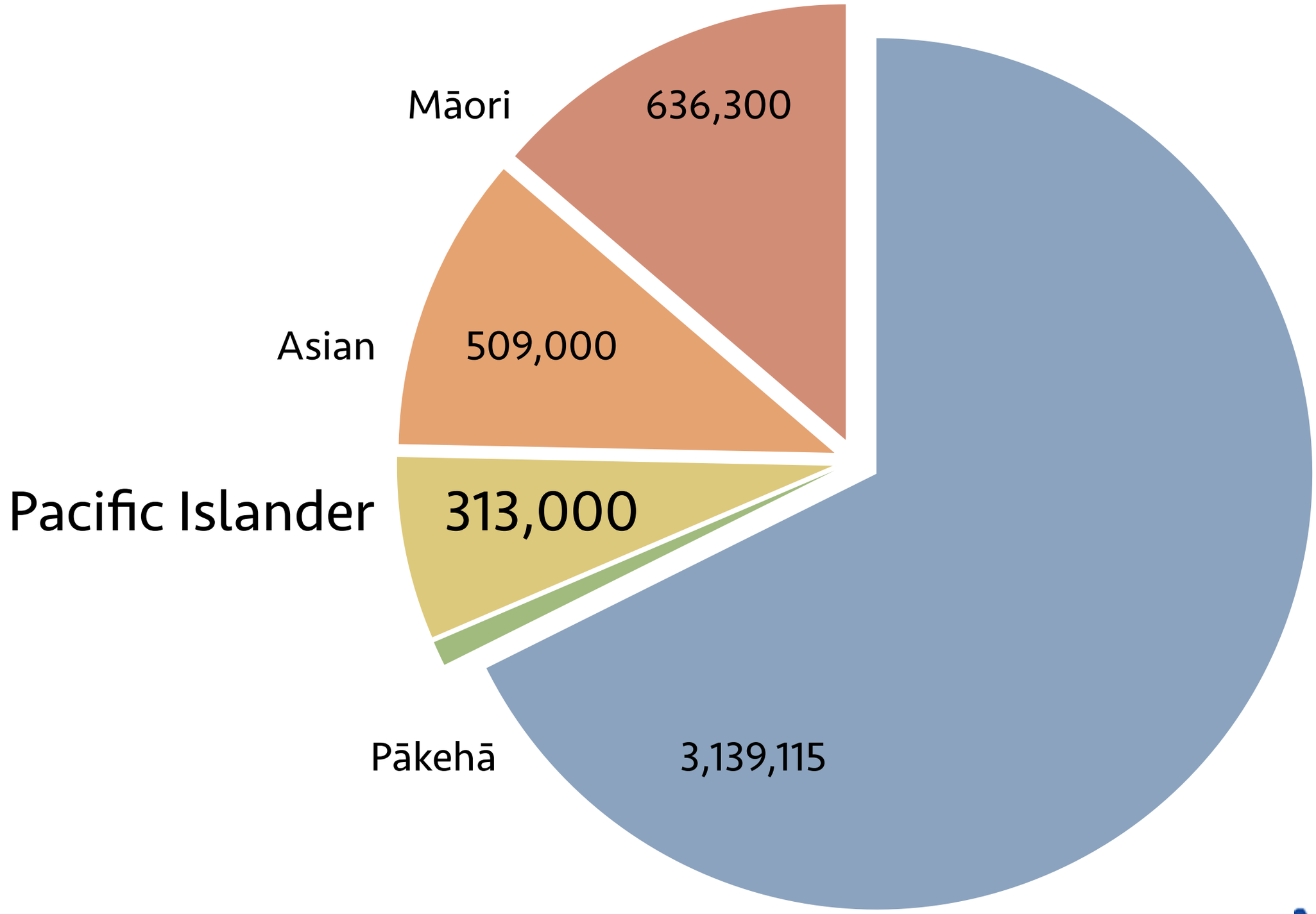
He tangata! He tangata! He tangata!



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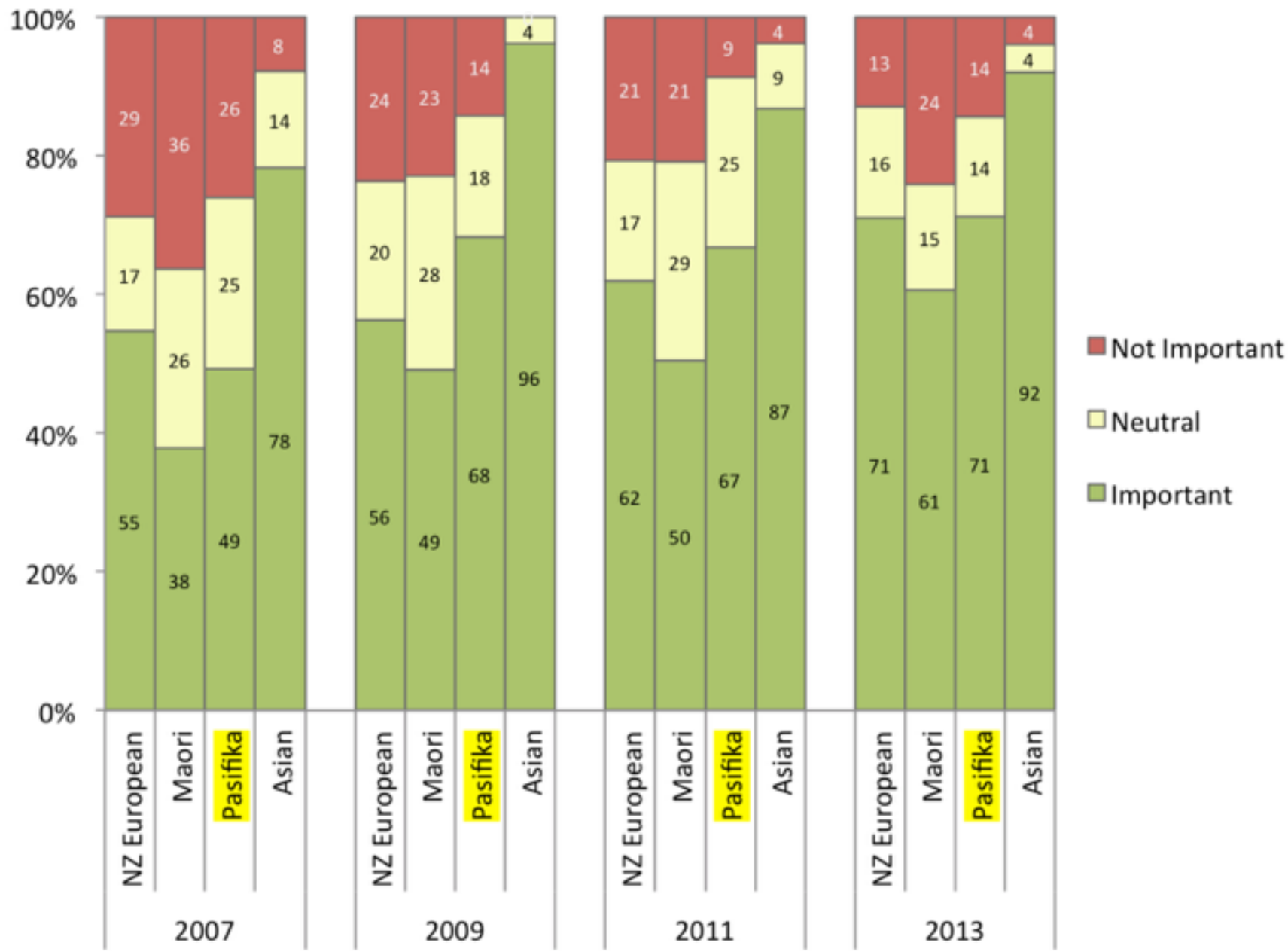
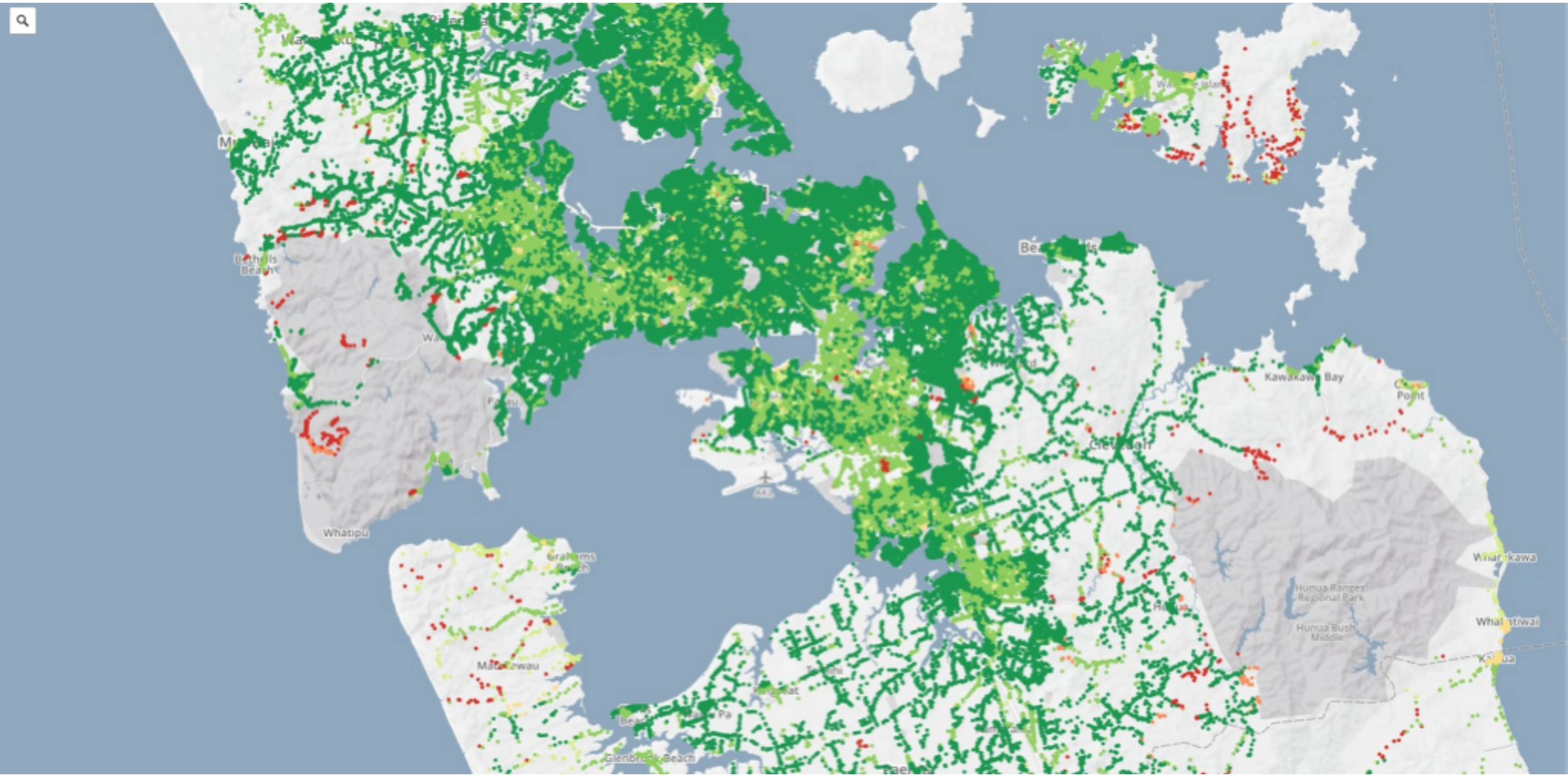
Internet is Important to Pacific Islanders in NZ



WIP/AUT Internet Trends in New Zealand 2007-2013

Internet is Affordable for Pacific Islanders in NZ



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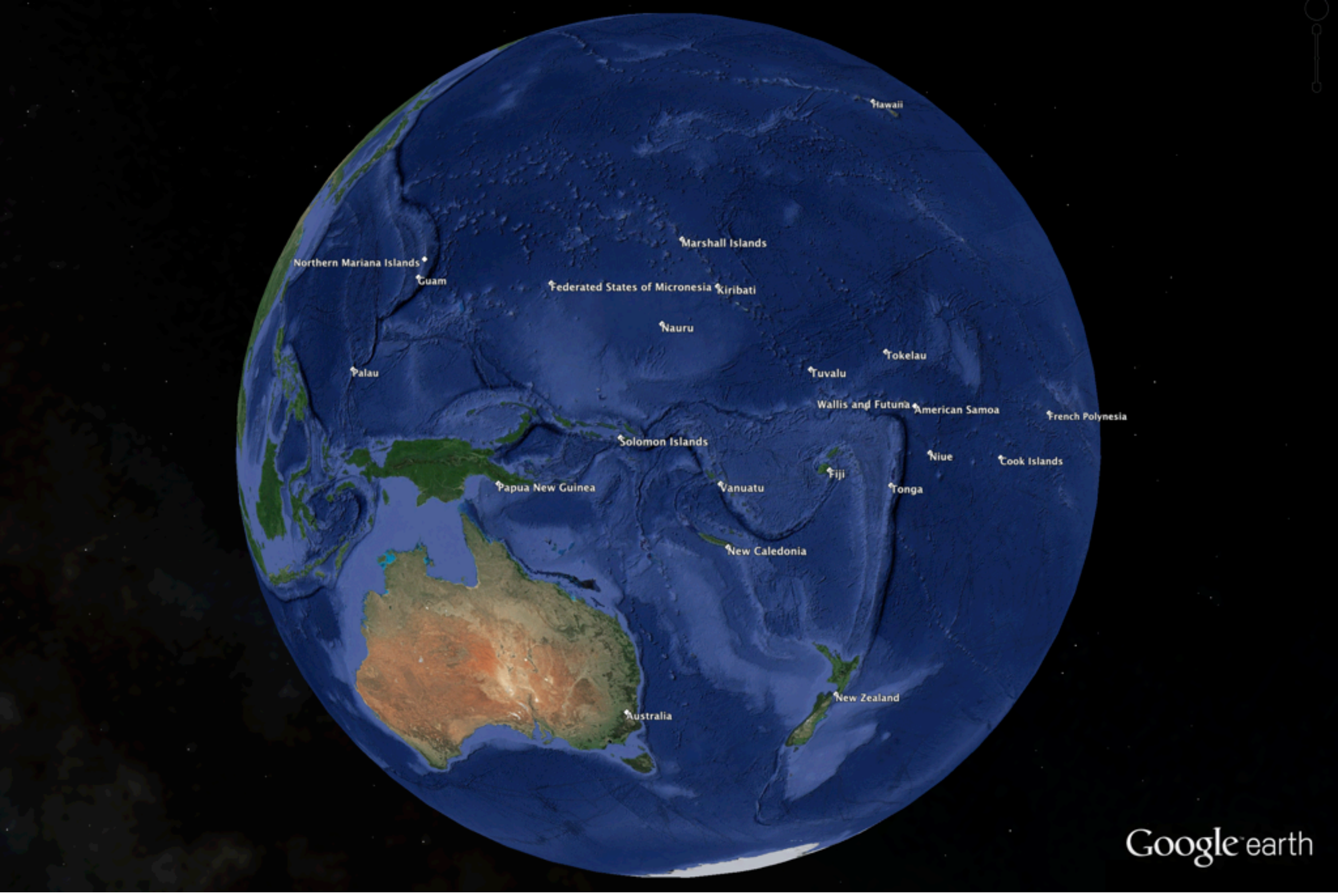

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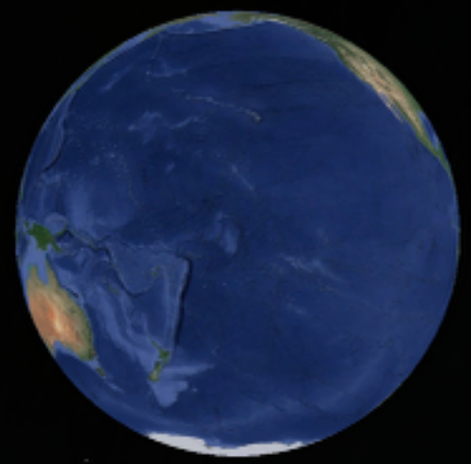
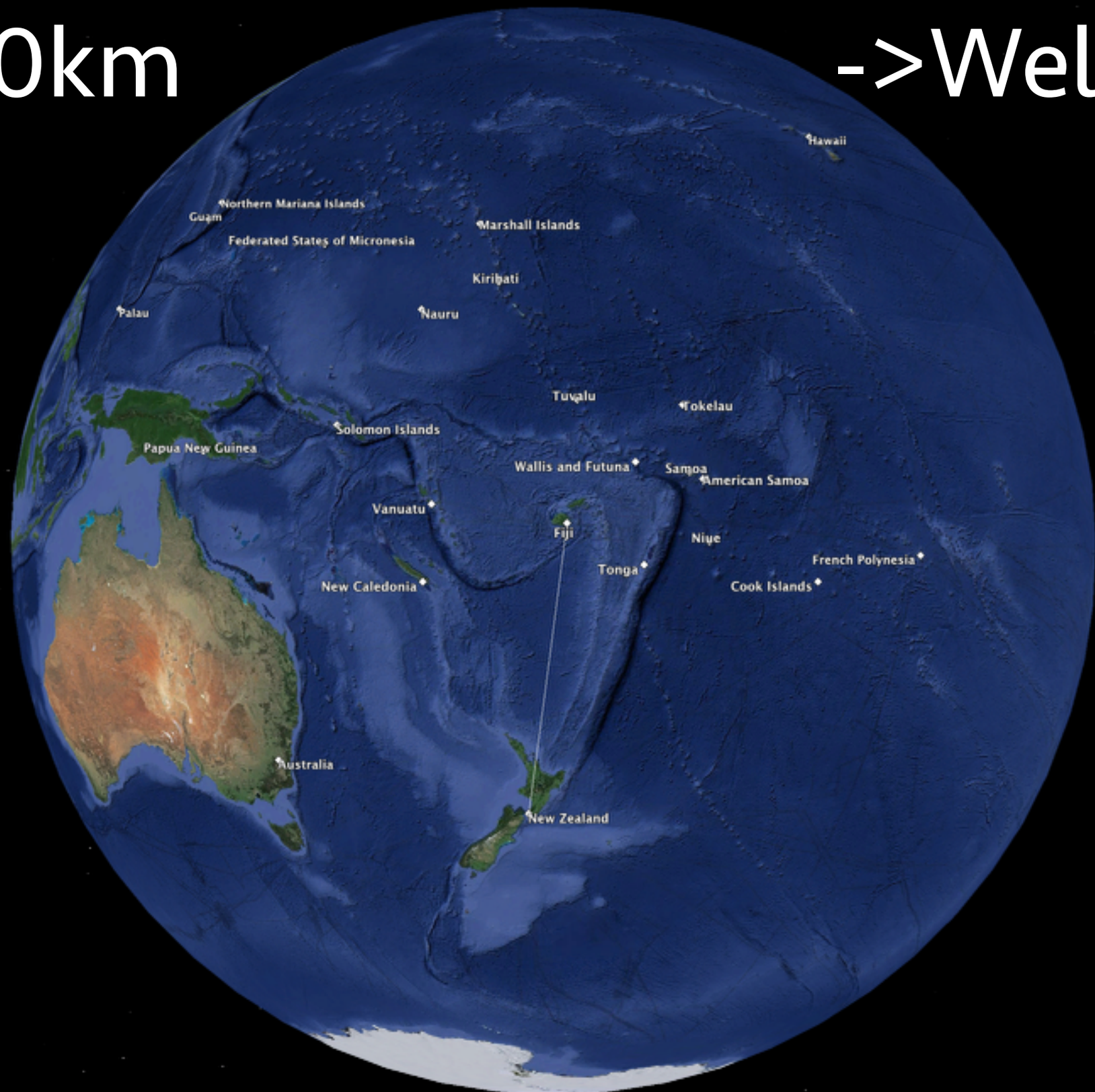
“Fiji”



“You can't get any further away before you start coming back.”

2,600km ->Wellington



Fiji

Google earth

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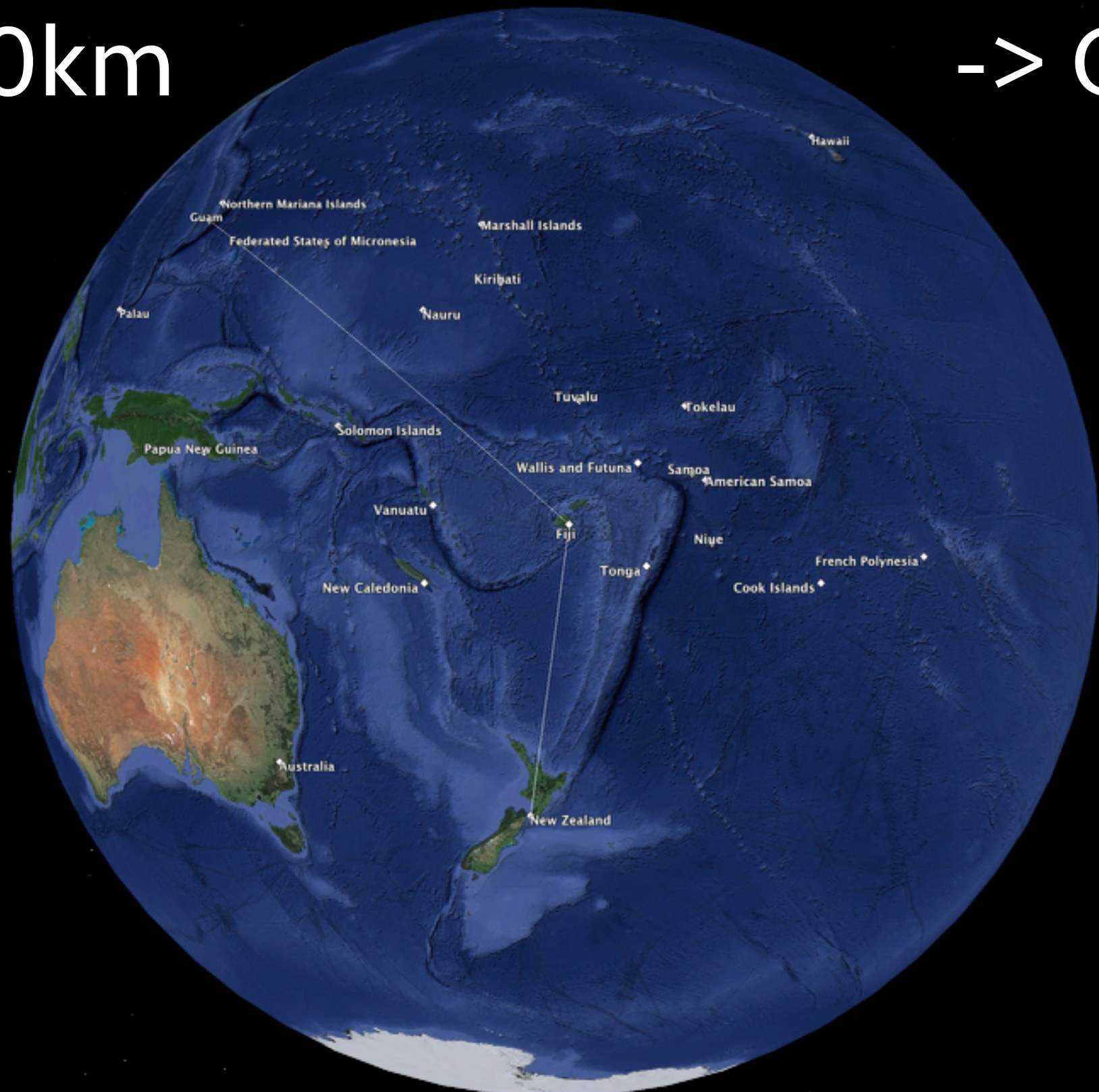
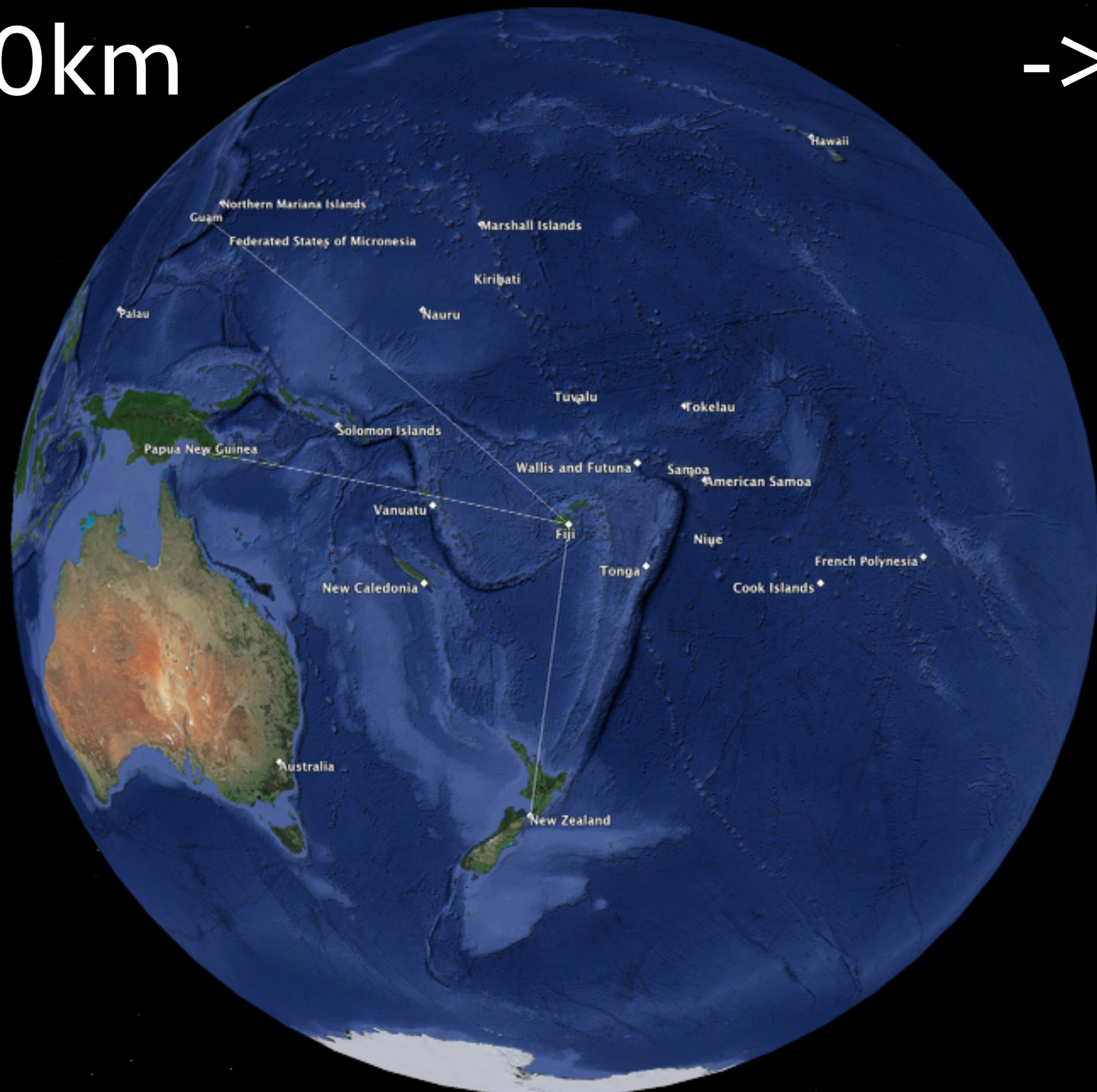
5,000km -> Guam



Fiji

Google earth

3,900km -> PNG

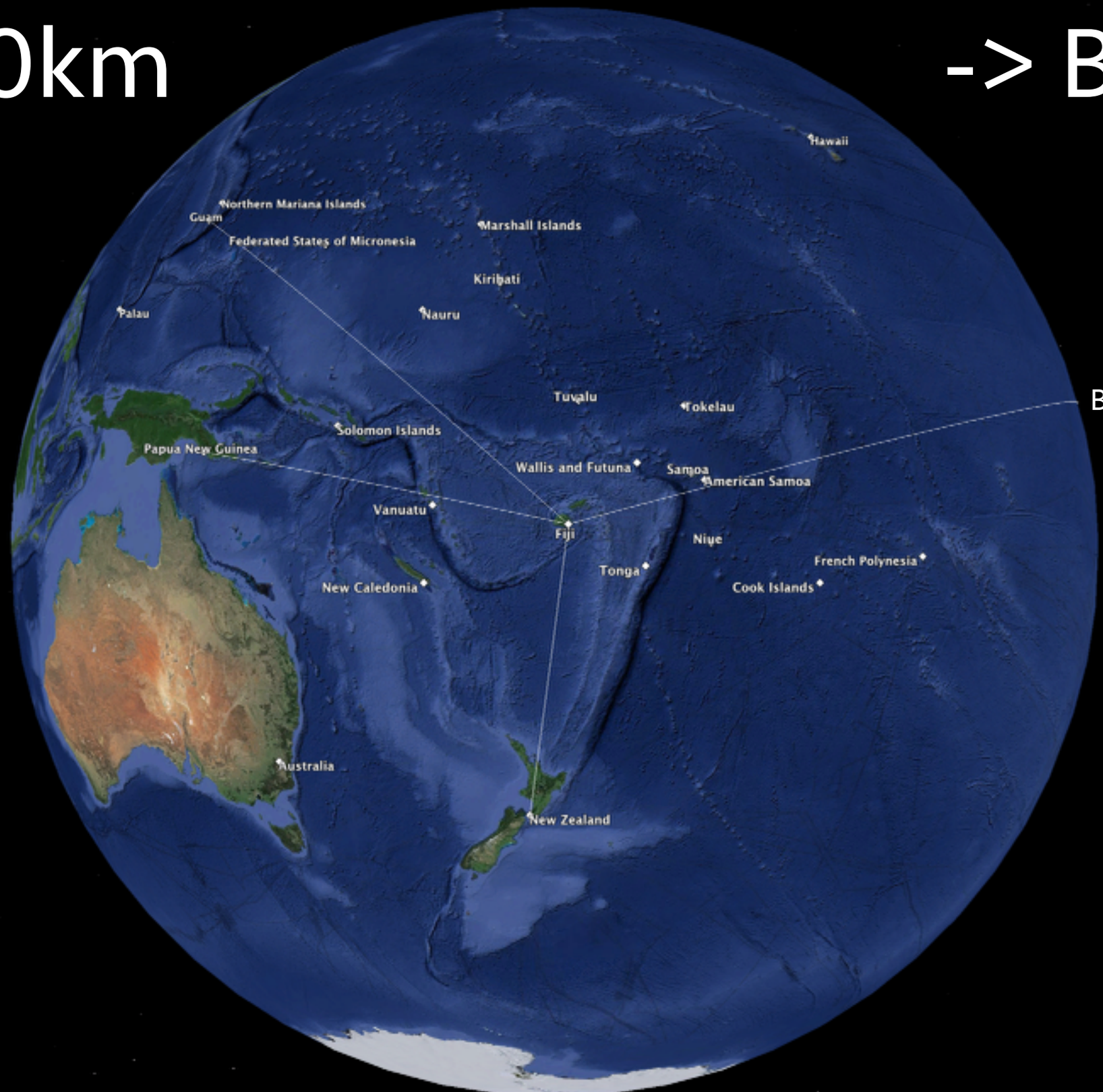


Fiji

Google earth

10,900km

-> Belize



Fiji

Google earth

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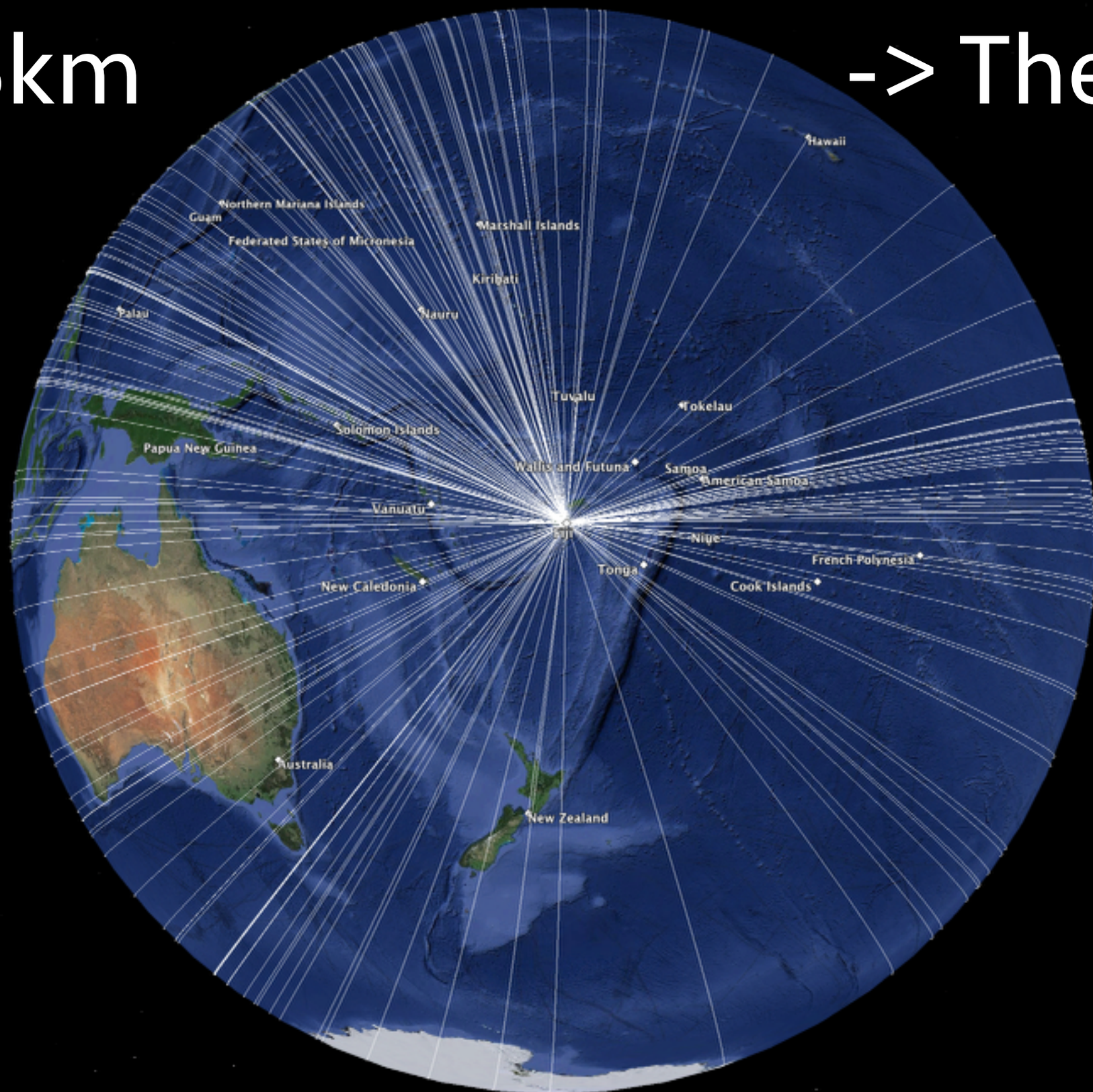
14,176km -> The World



Fiji

Google earth

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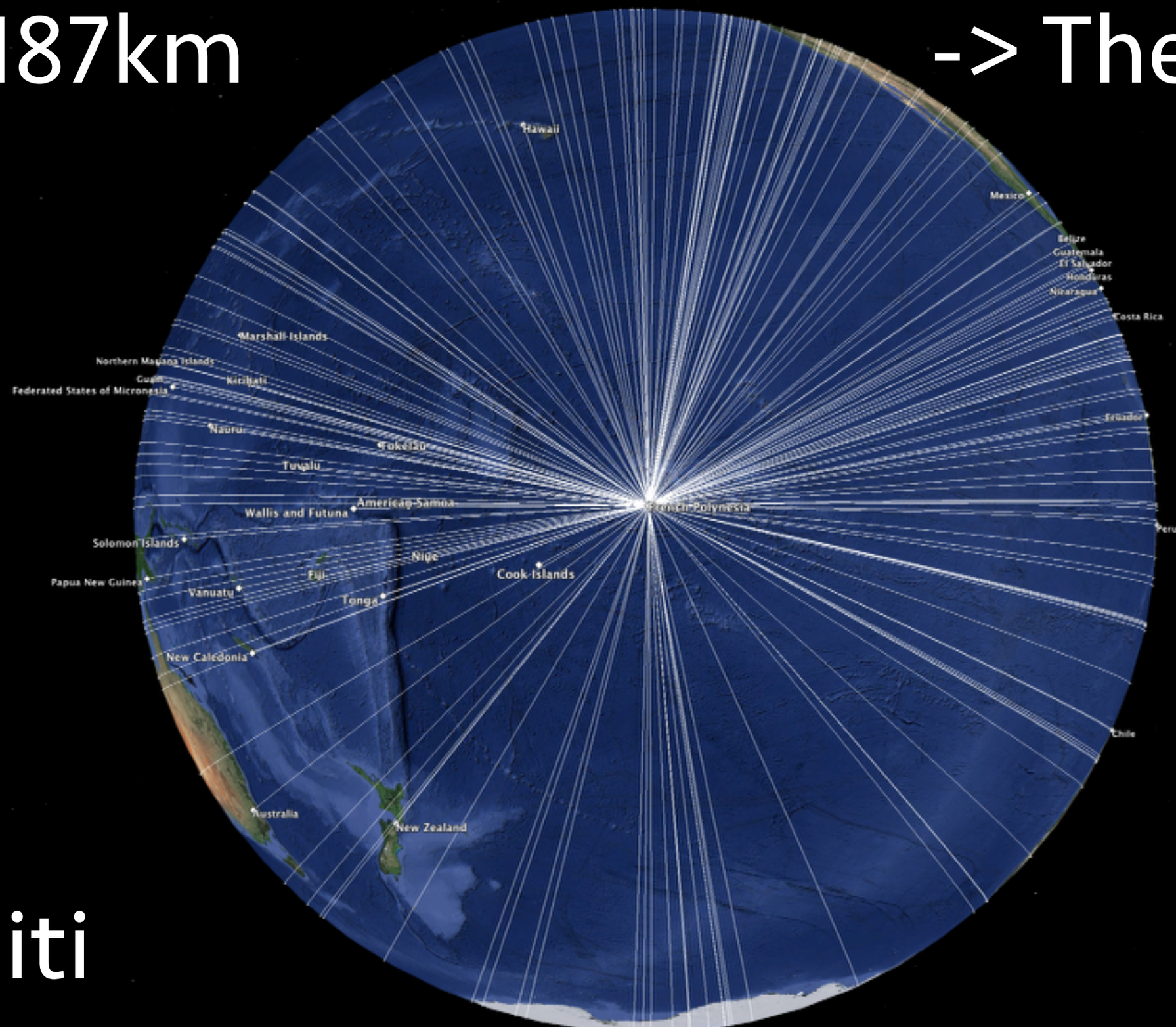
15,187km -> The World



Tahiti

Google earth

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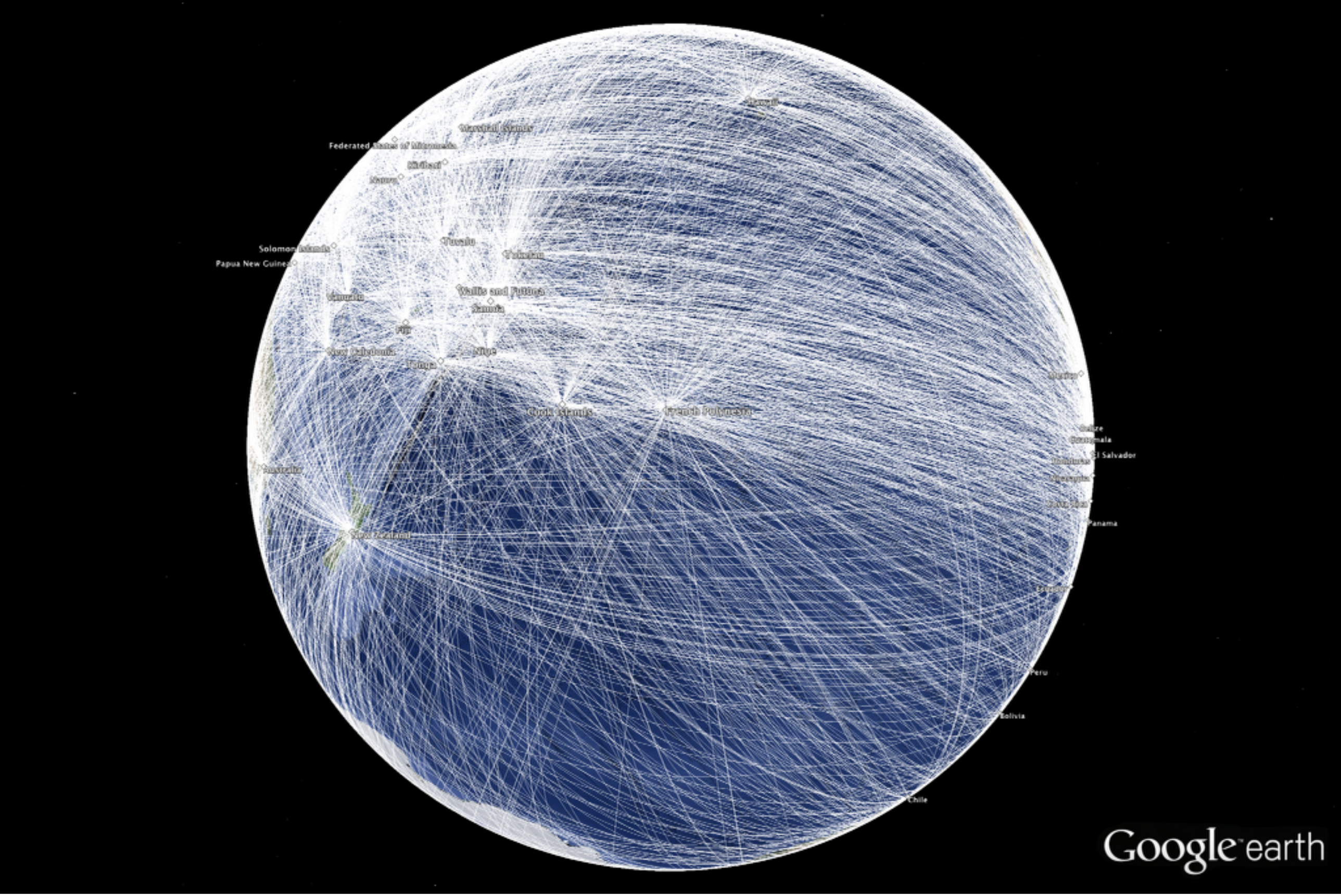

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15,227km

-> The World

Rarotonga, Cook Islands
As Far Away As You Can Get

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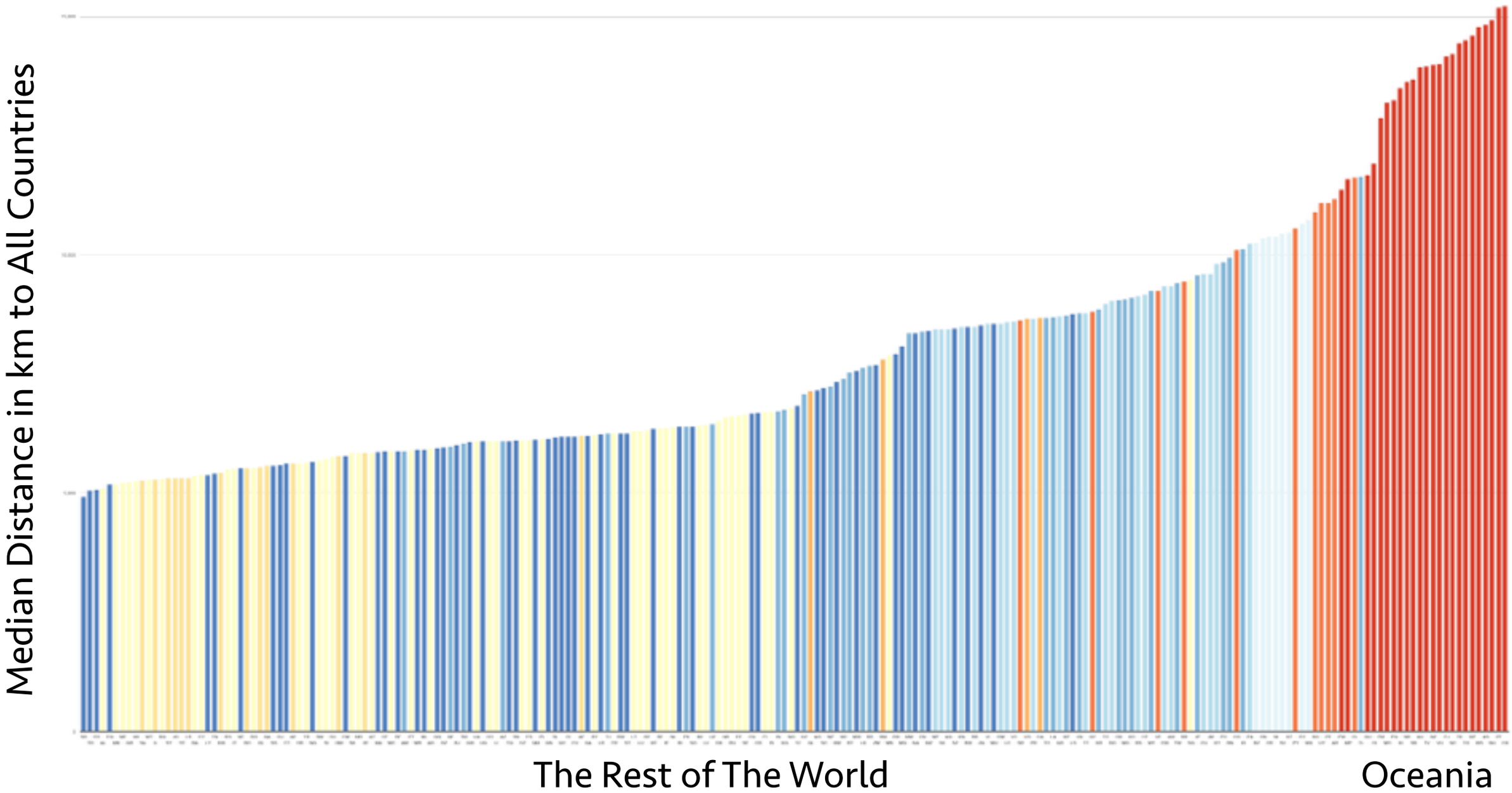
Pacific Countries Are A Long Way Away



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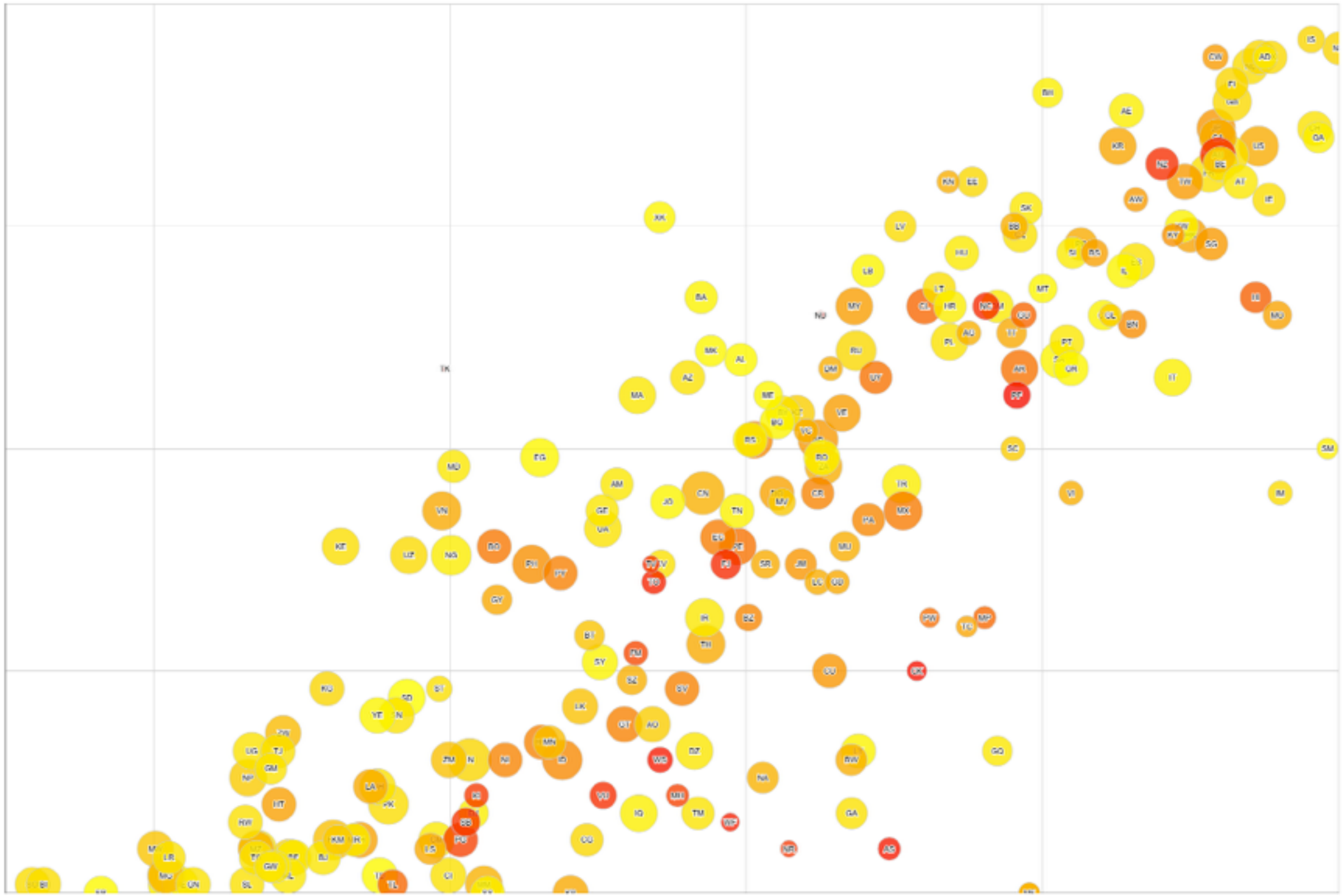
Internet Uptake



GDP Per Capita

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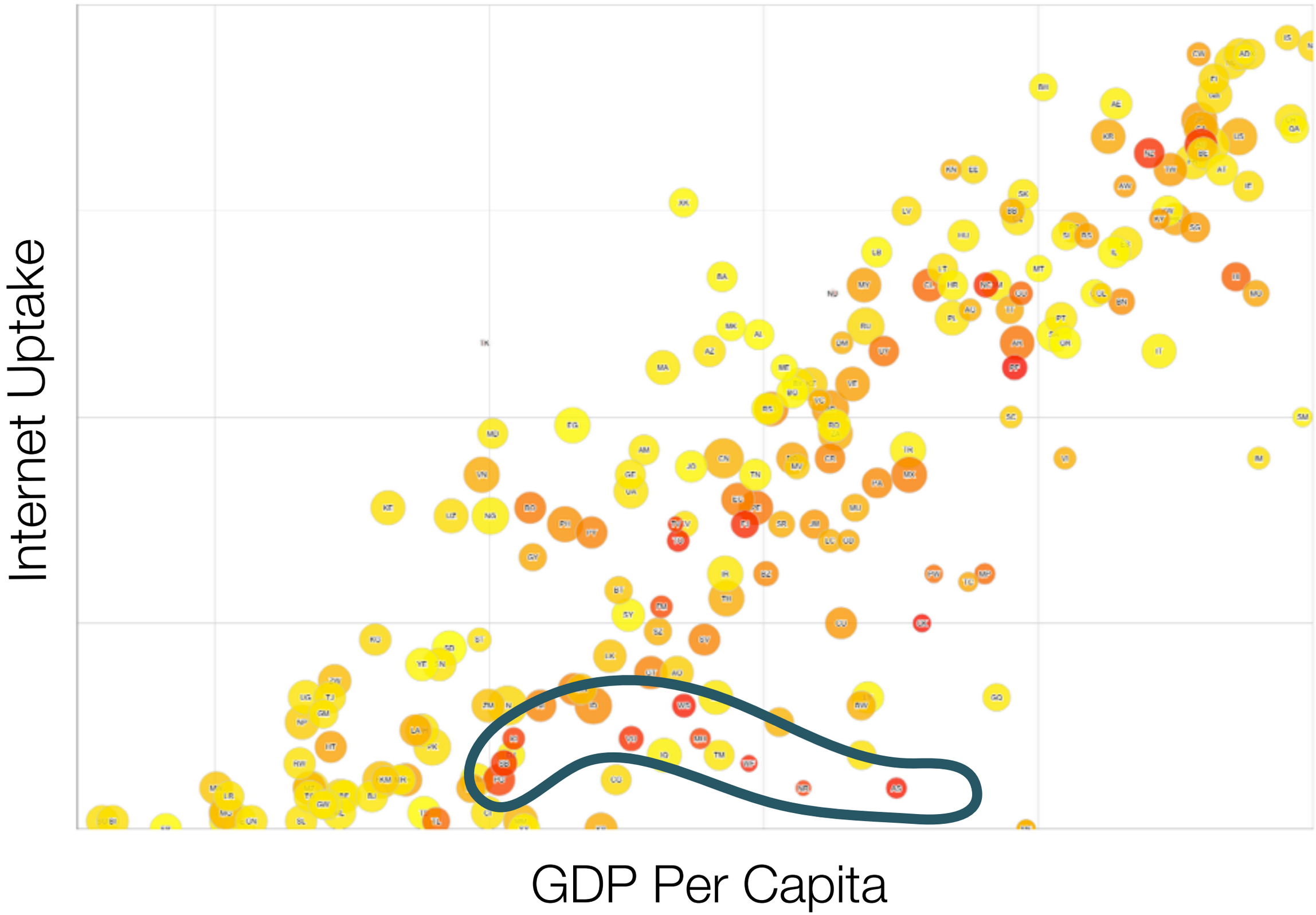
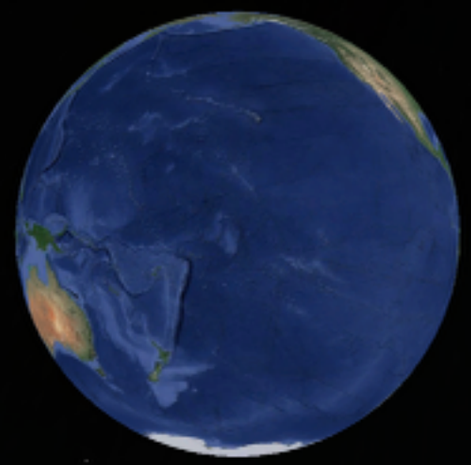
NSRC
Network Startup Resource Center


Internet Uptake
GDP Per Capita

A Brief, Non-Exhaustive Survey of Submarine Fibre & Pacific Islands



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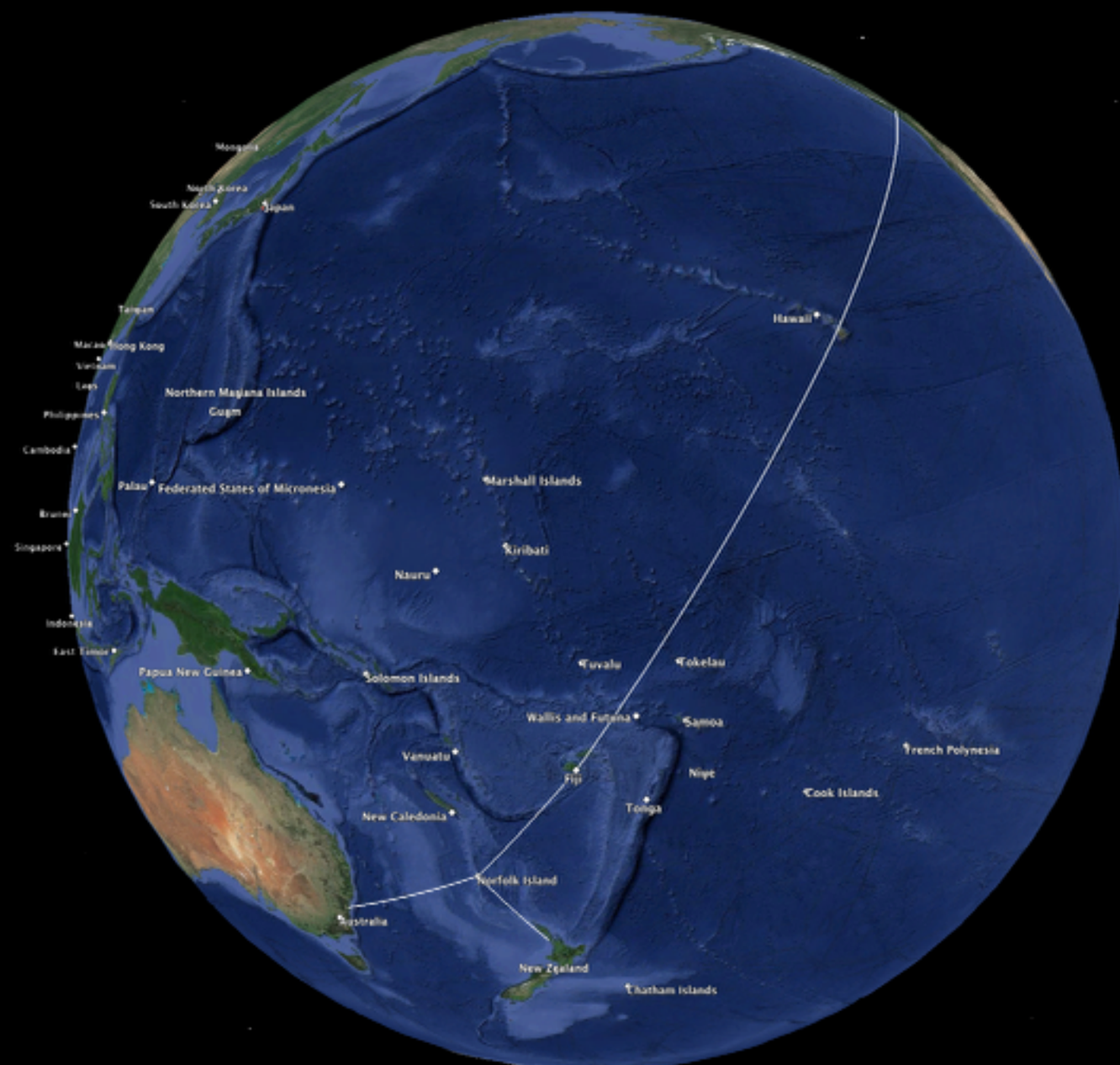
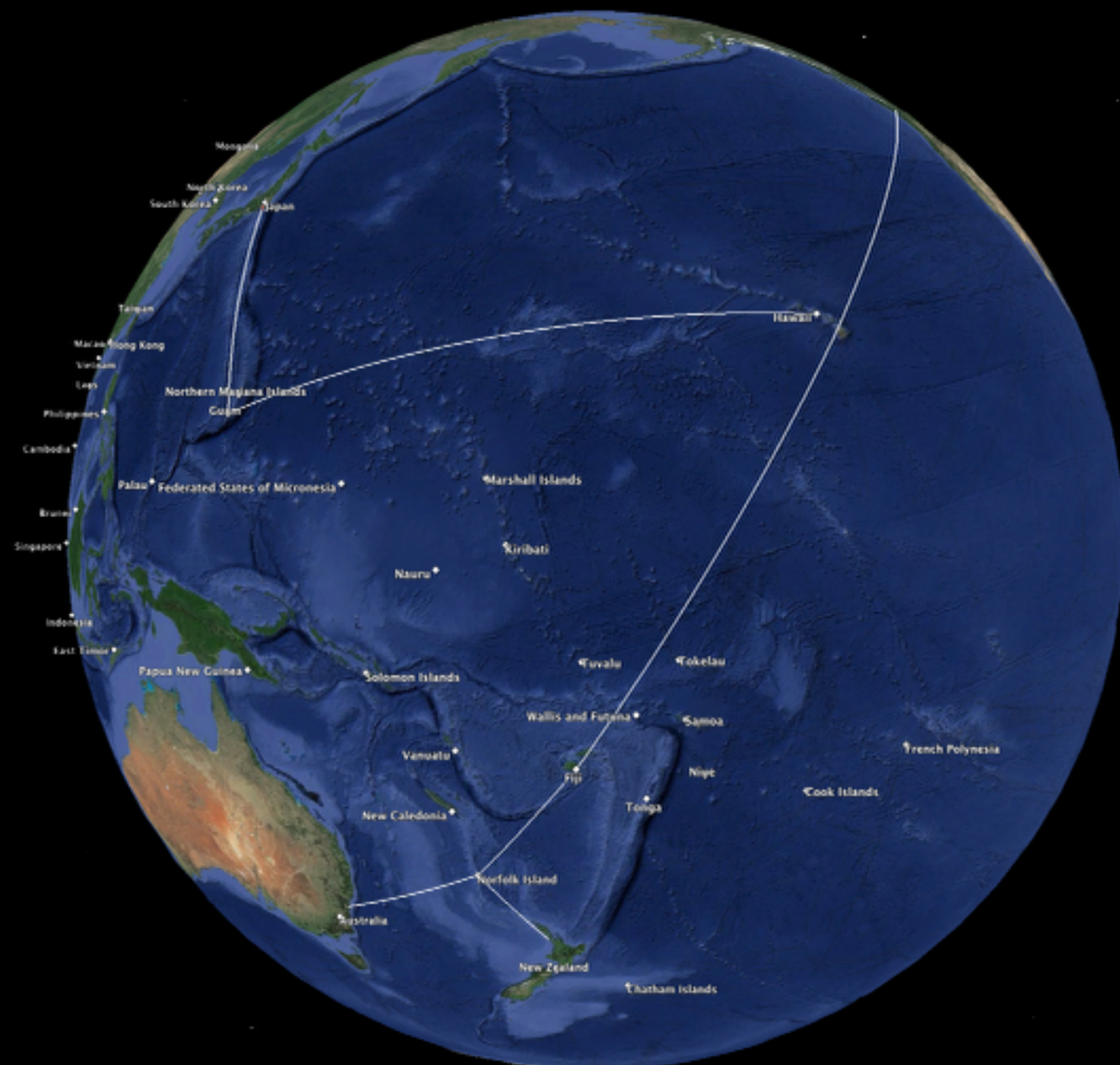
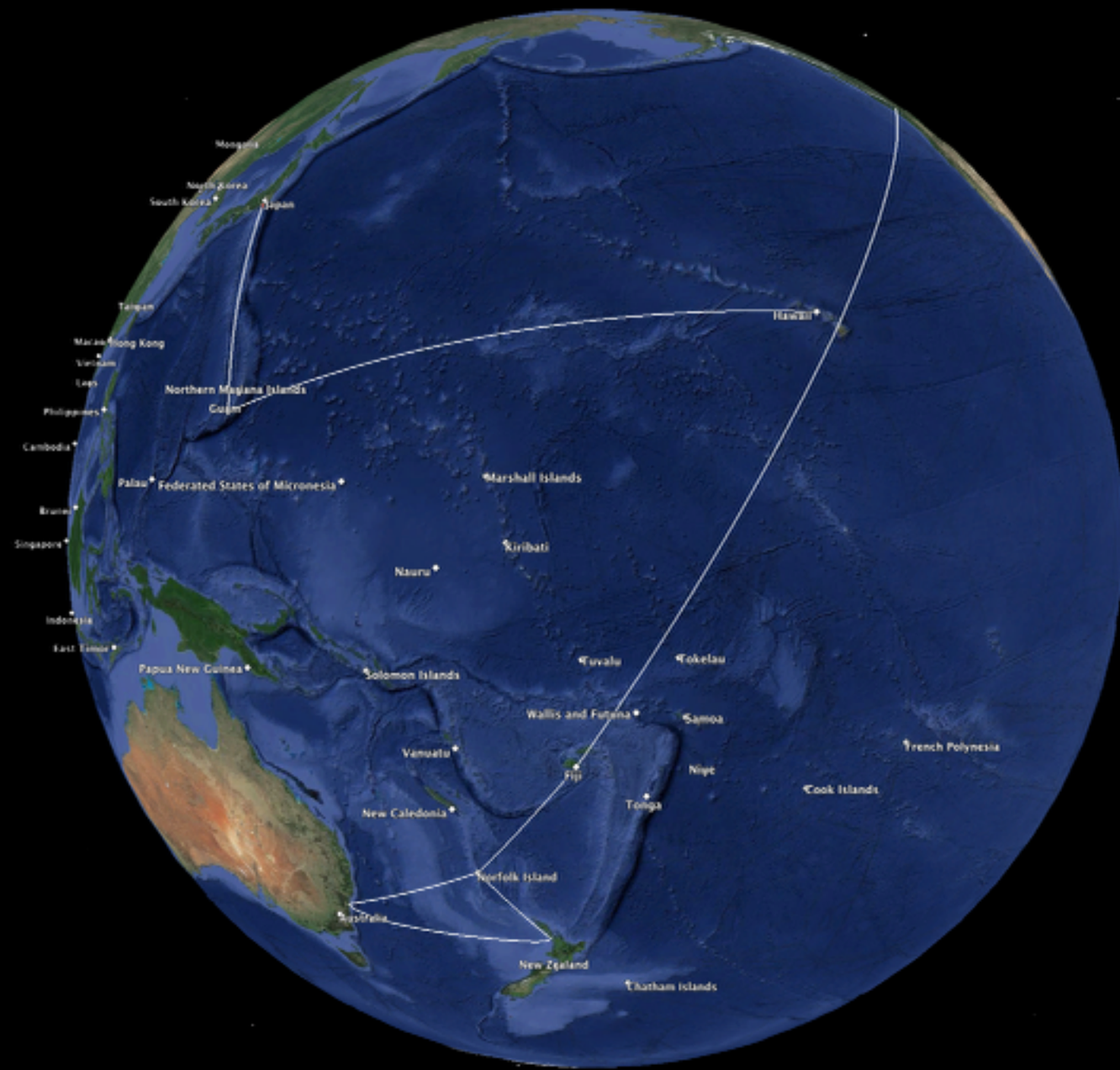
In the Beginning



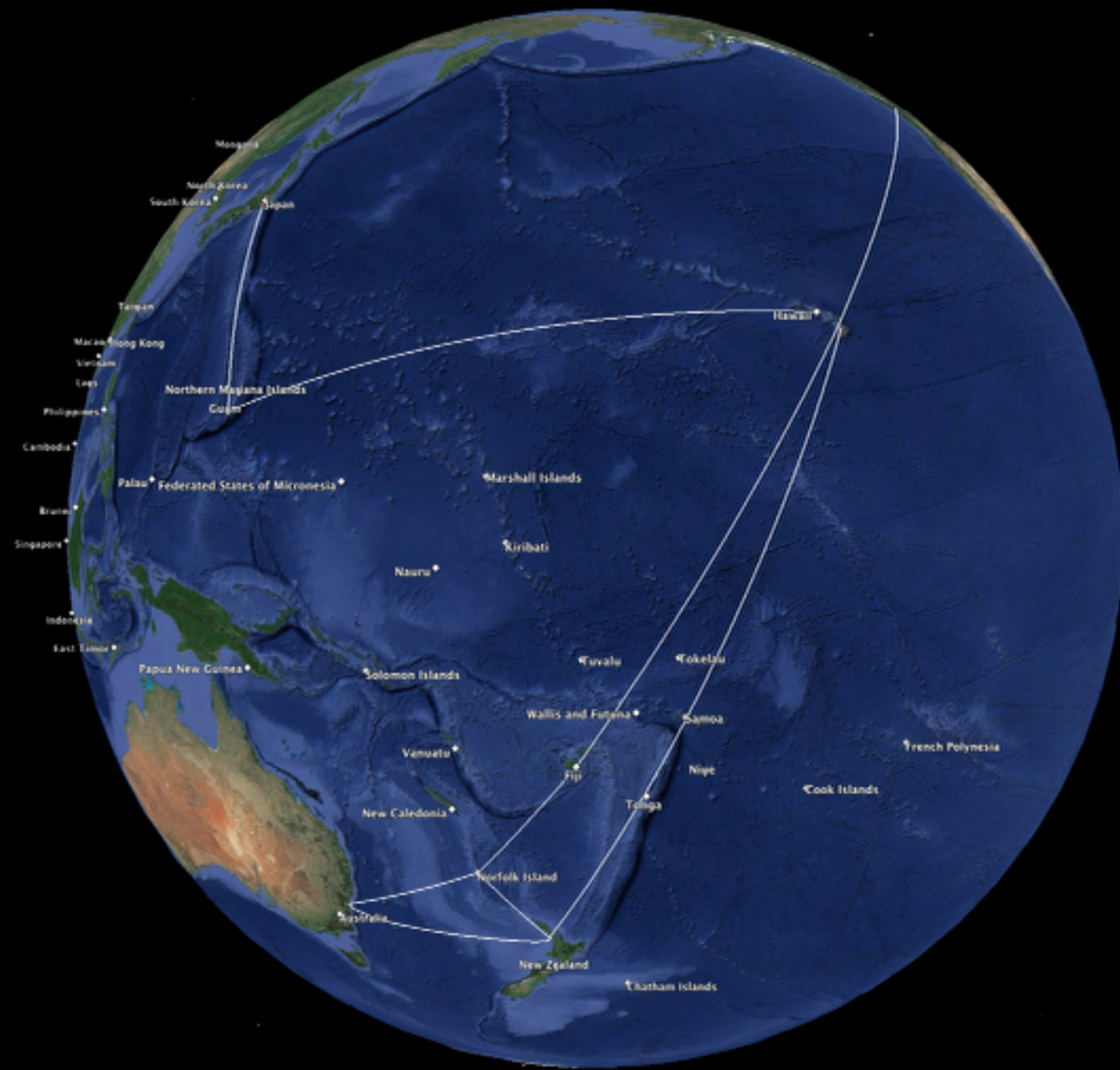
1988: TransPacific Cable 3



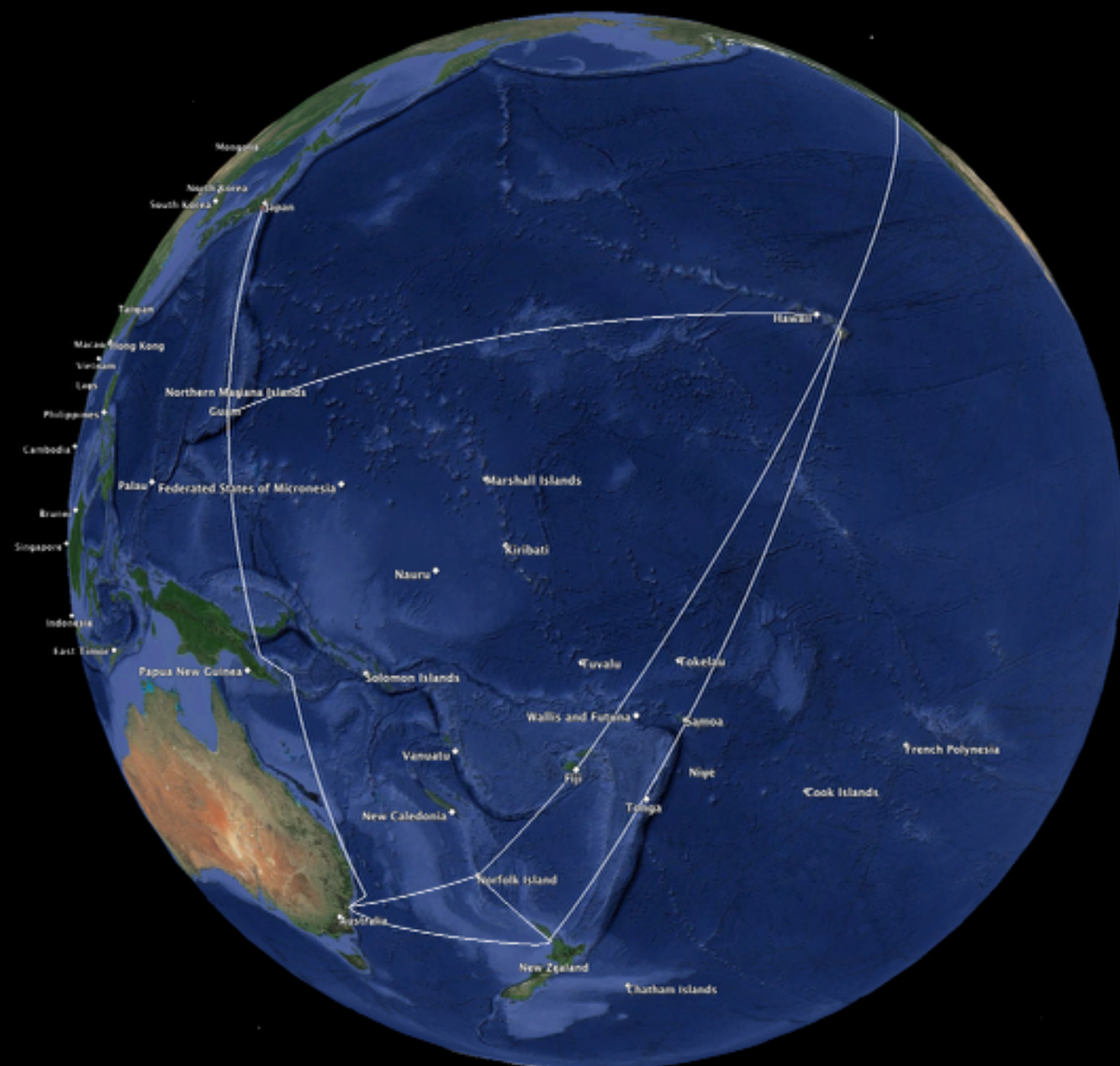
1992: Tasman 2



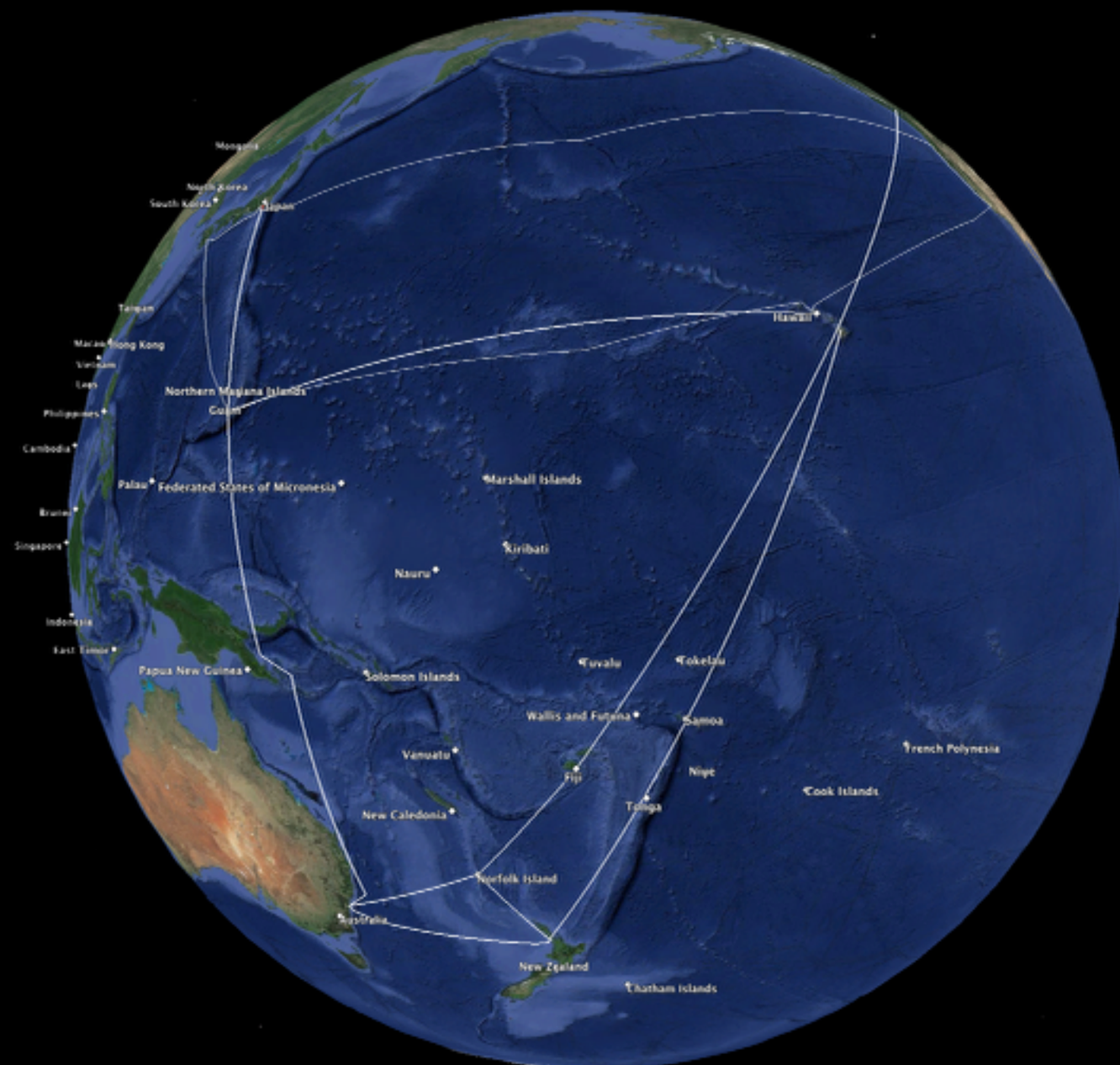
1993: PacRim East



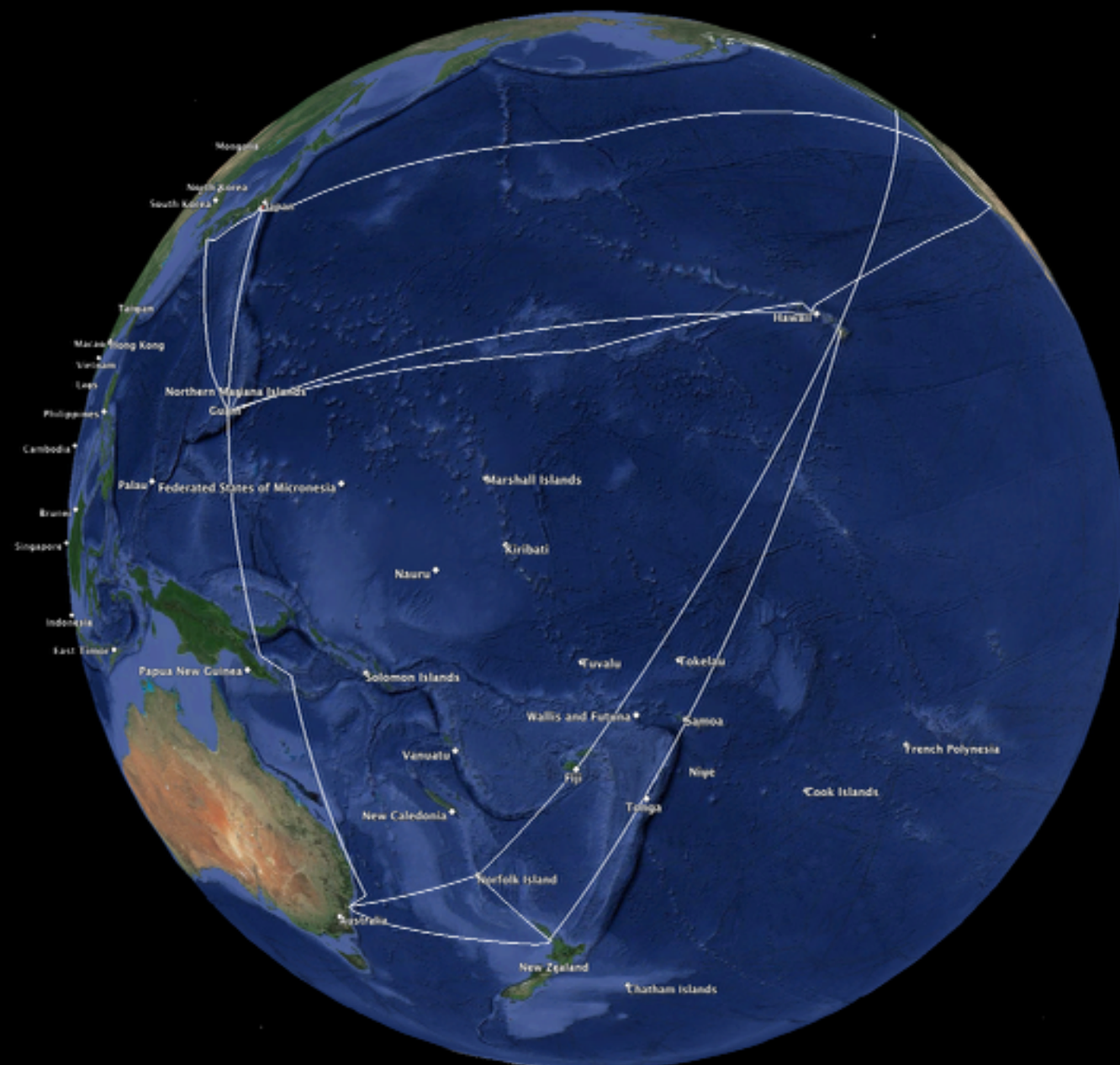
1993: PacRim West



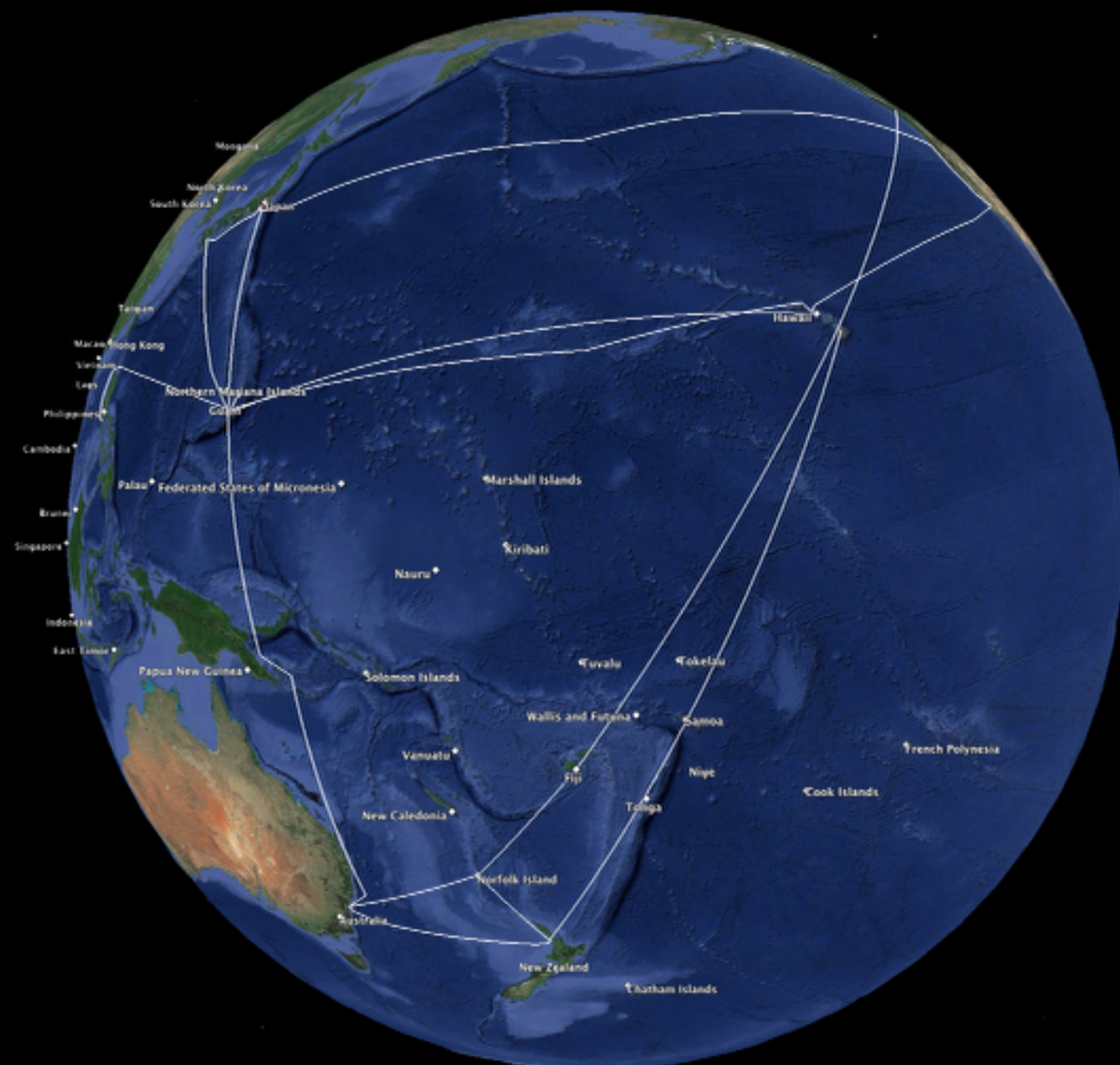
1996: TransPacific Cable 5



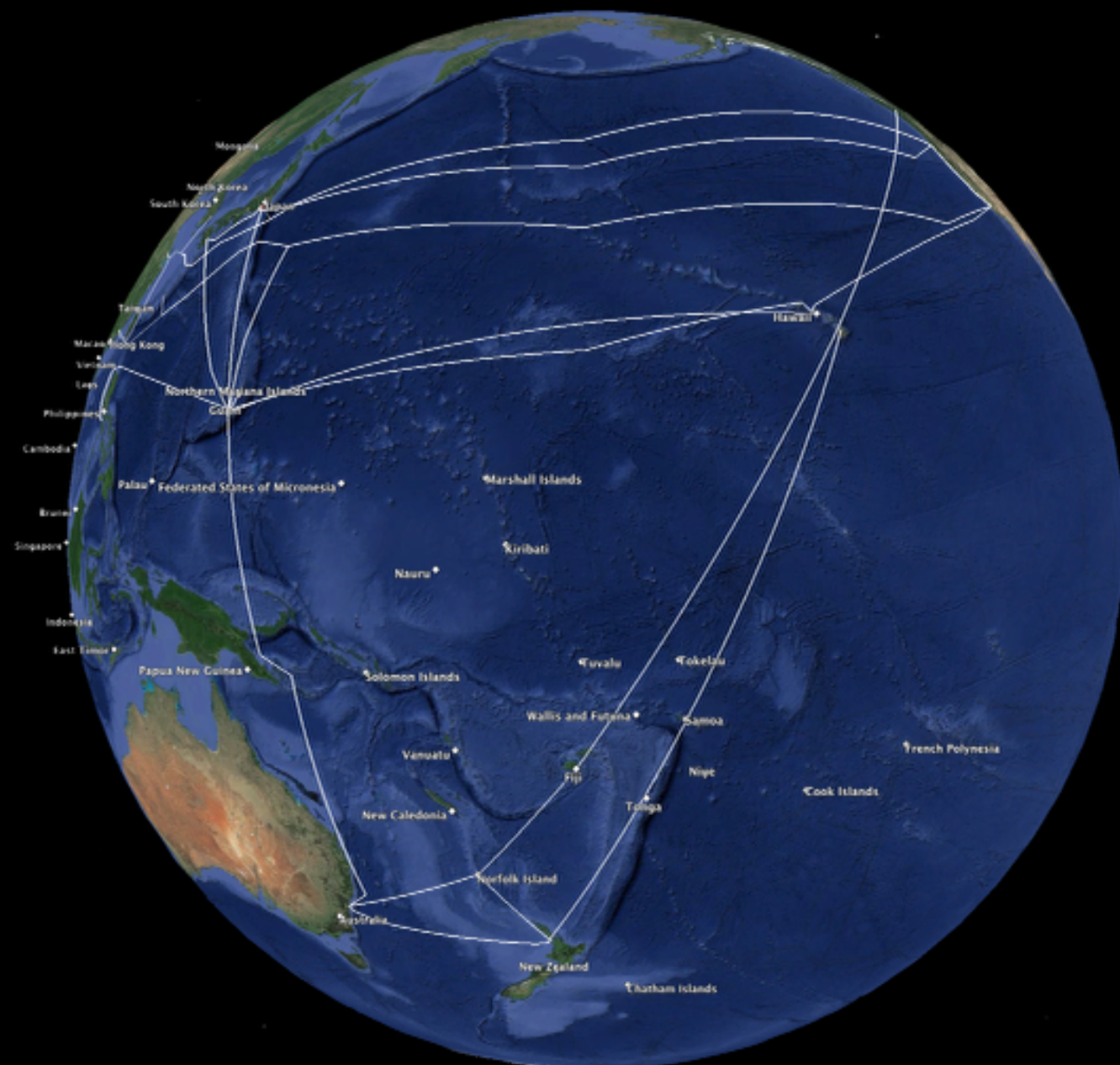
1997: Mariana Guam



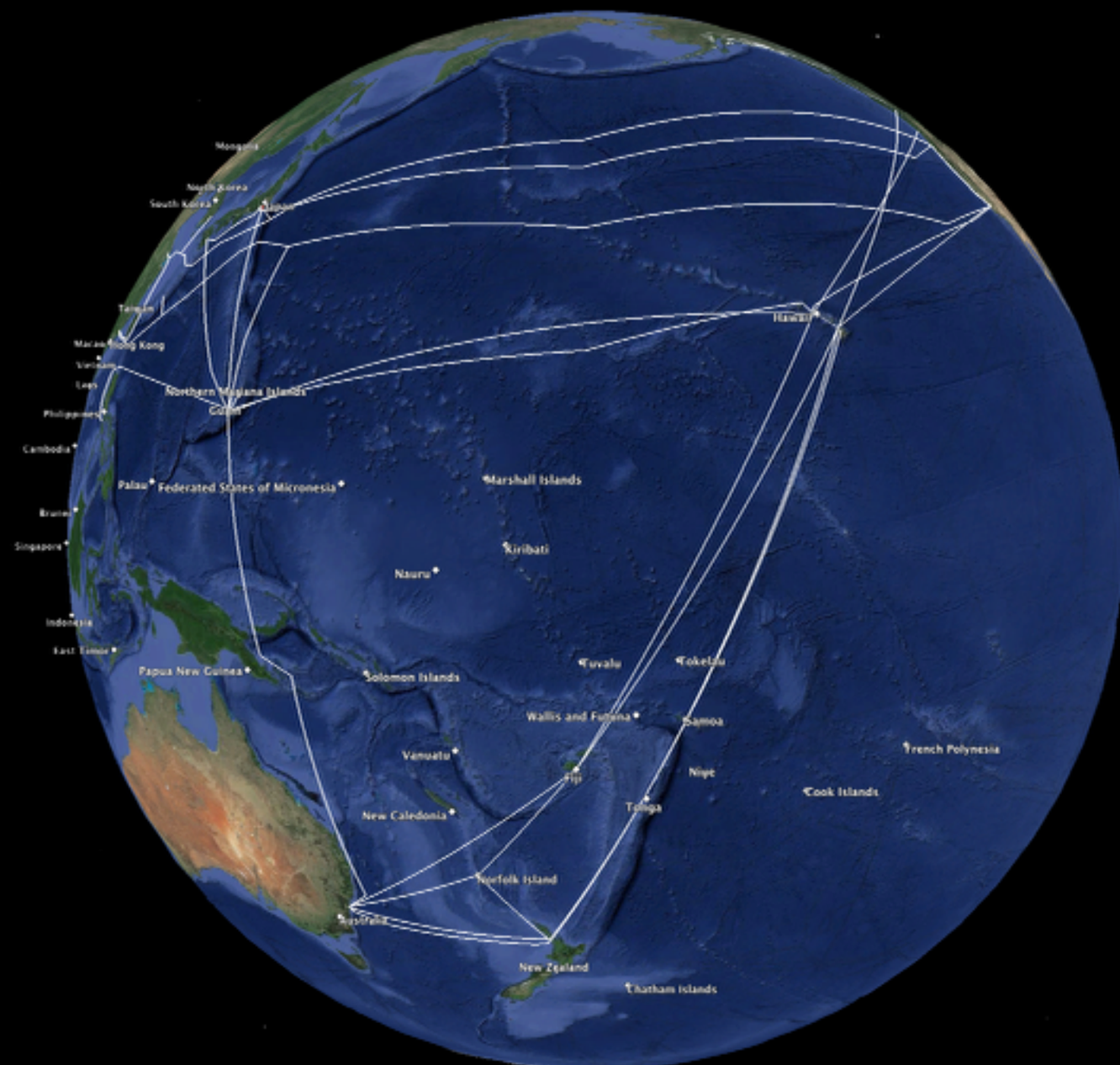
1999: Guam Philippines



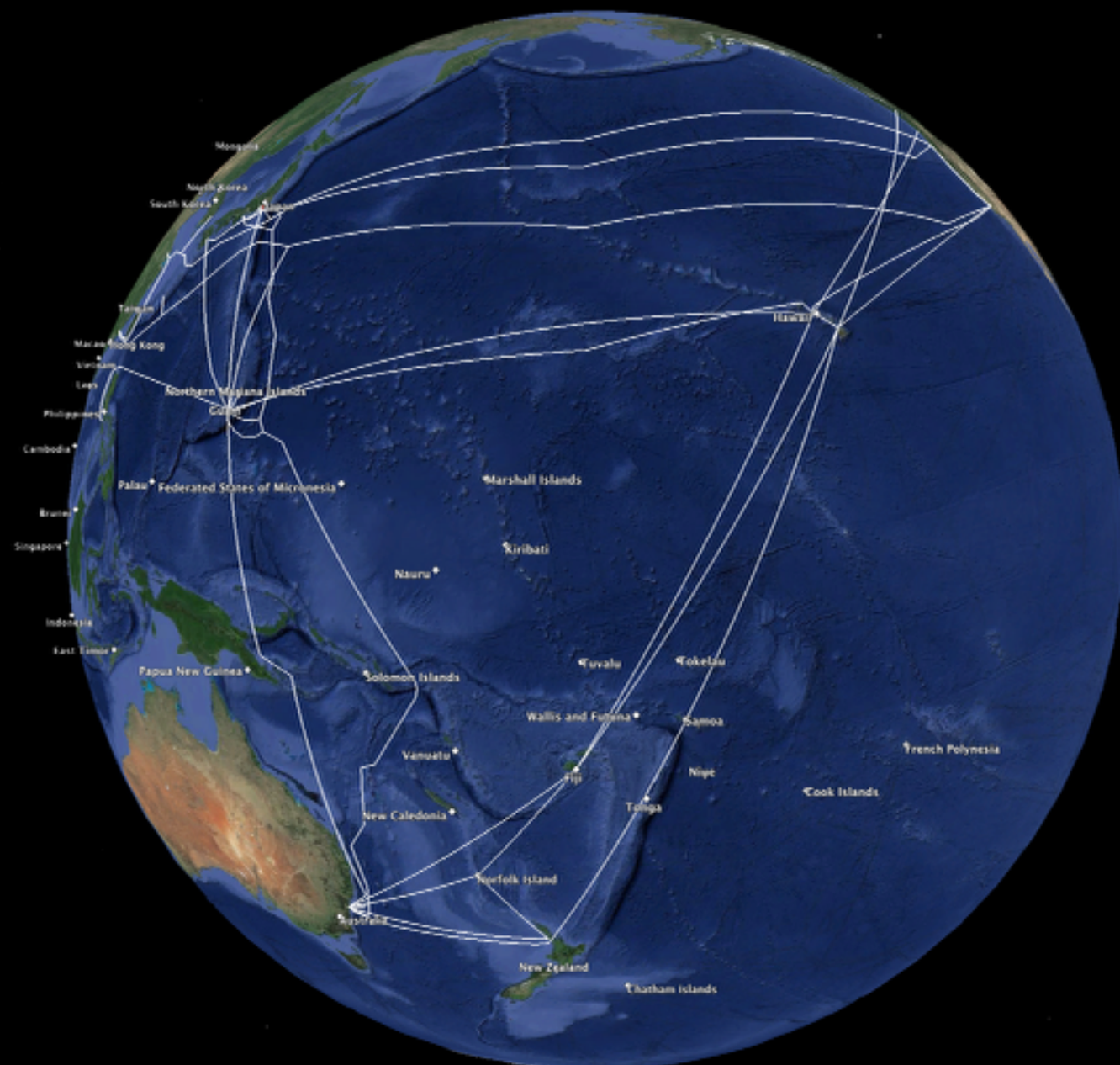
2000: China US Cable



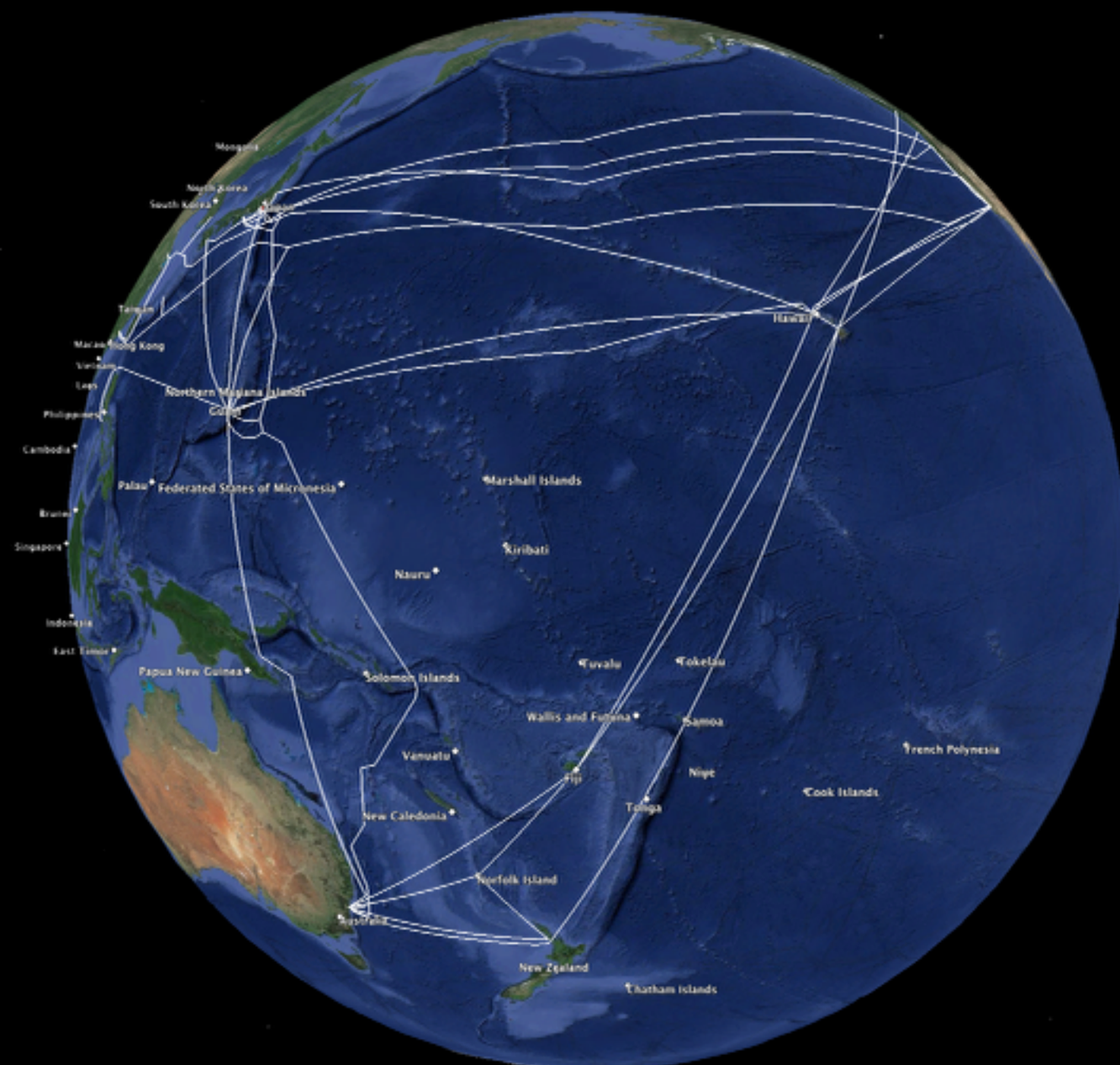
2000: Southern Cross Cable



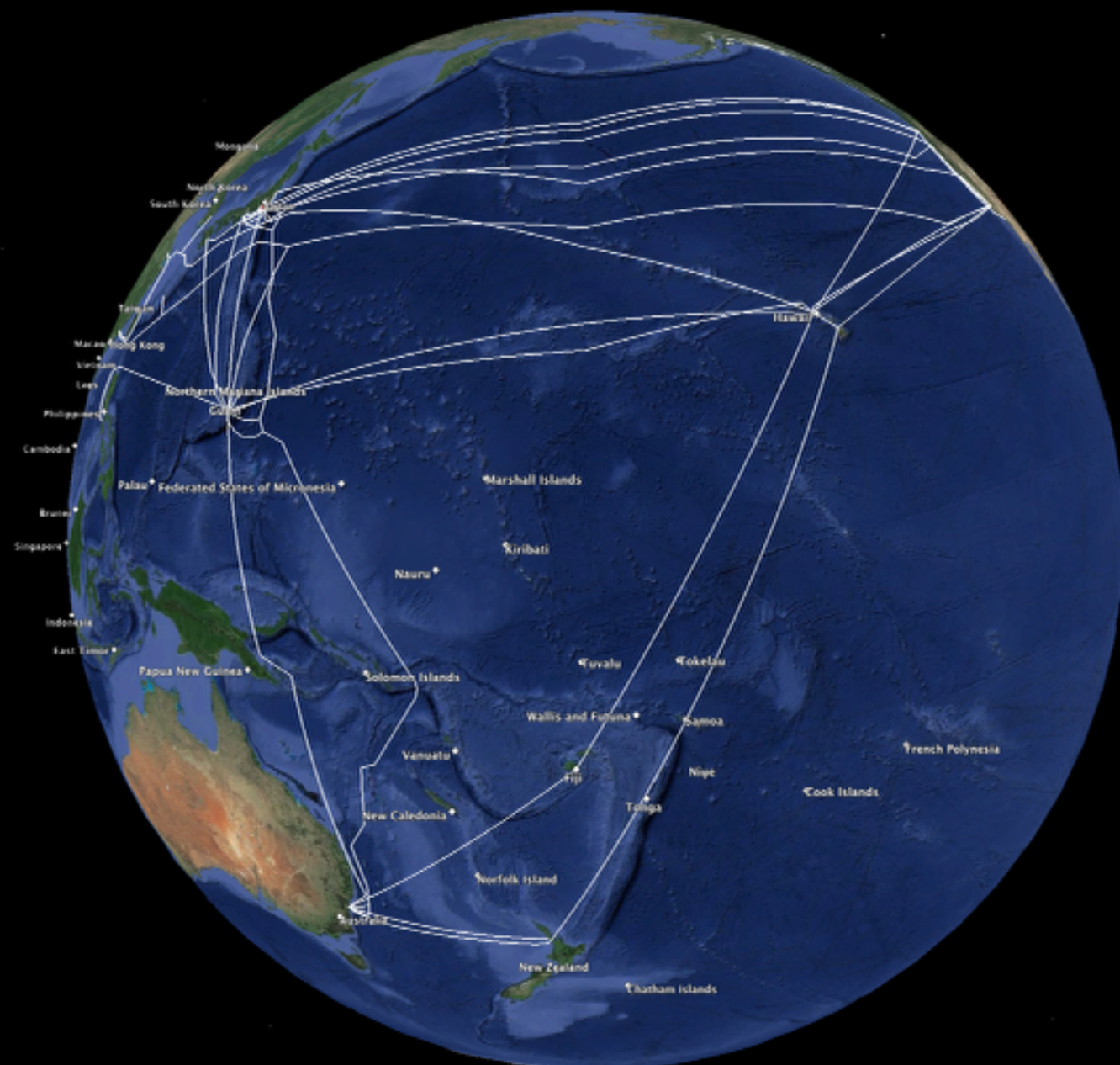
2001: Australia Japan Cable



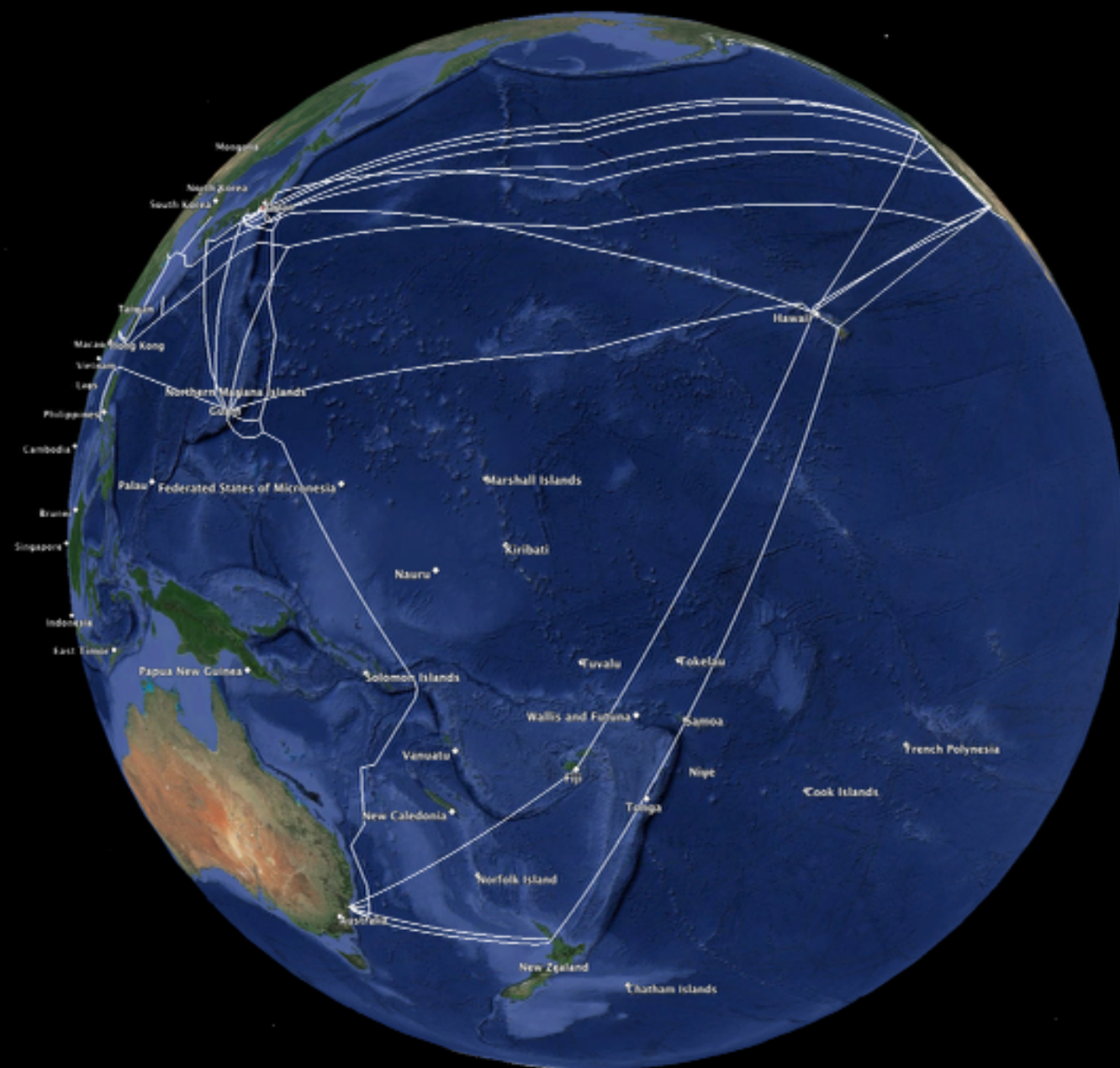
2001: Japan US Cable



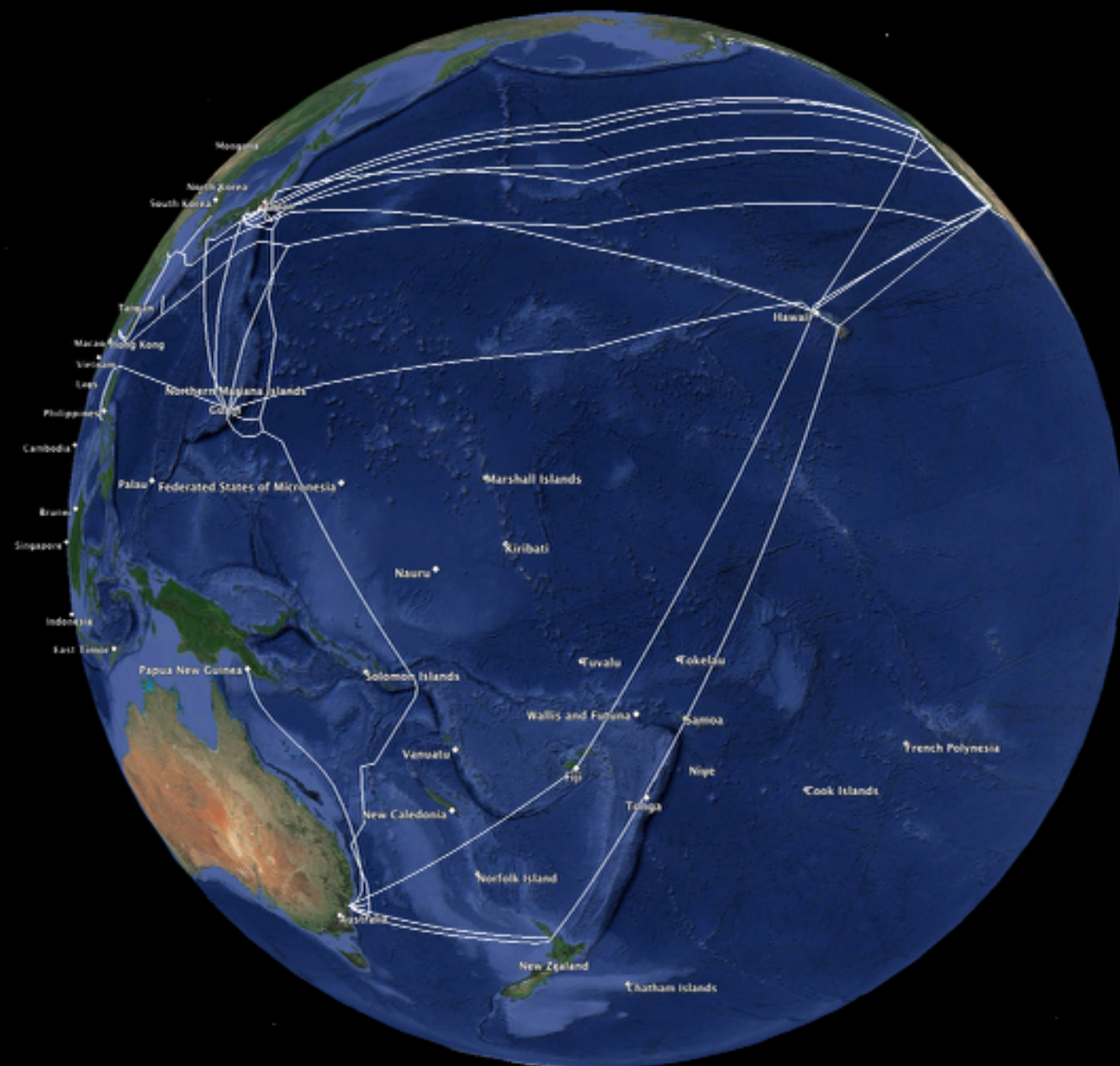
2002: VNSL Transpacific



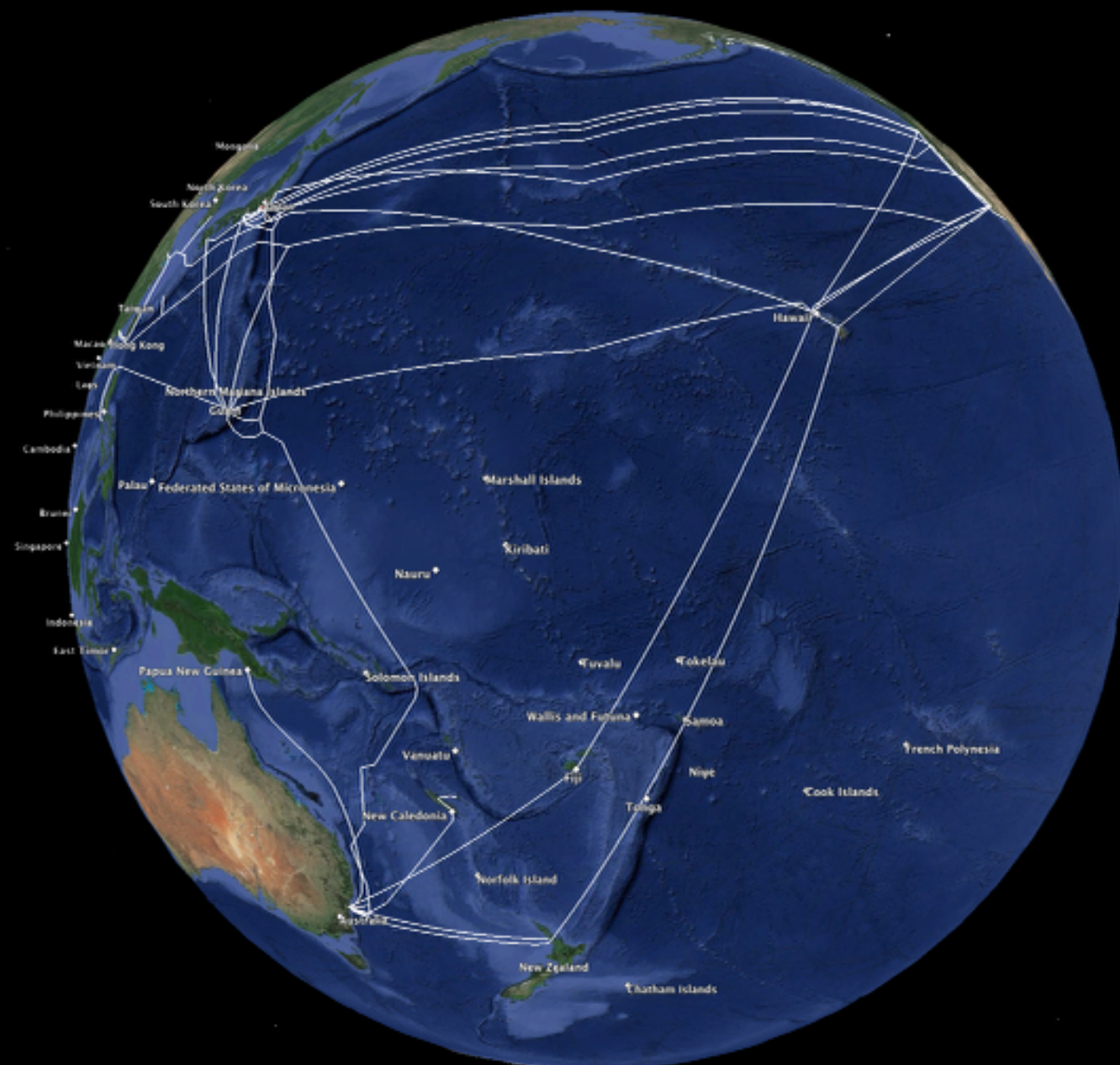
2001-2005: -PacRim Cables



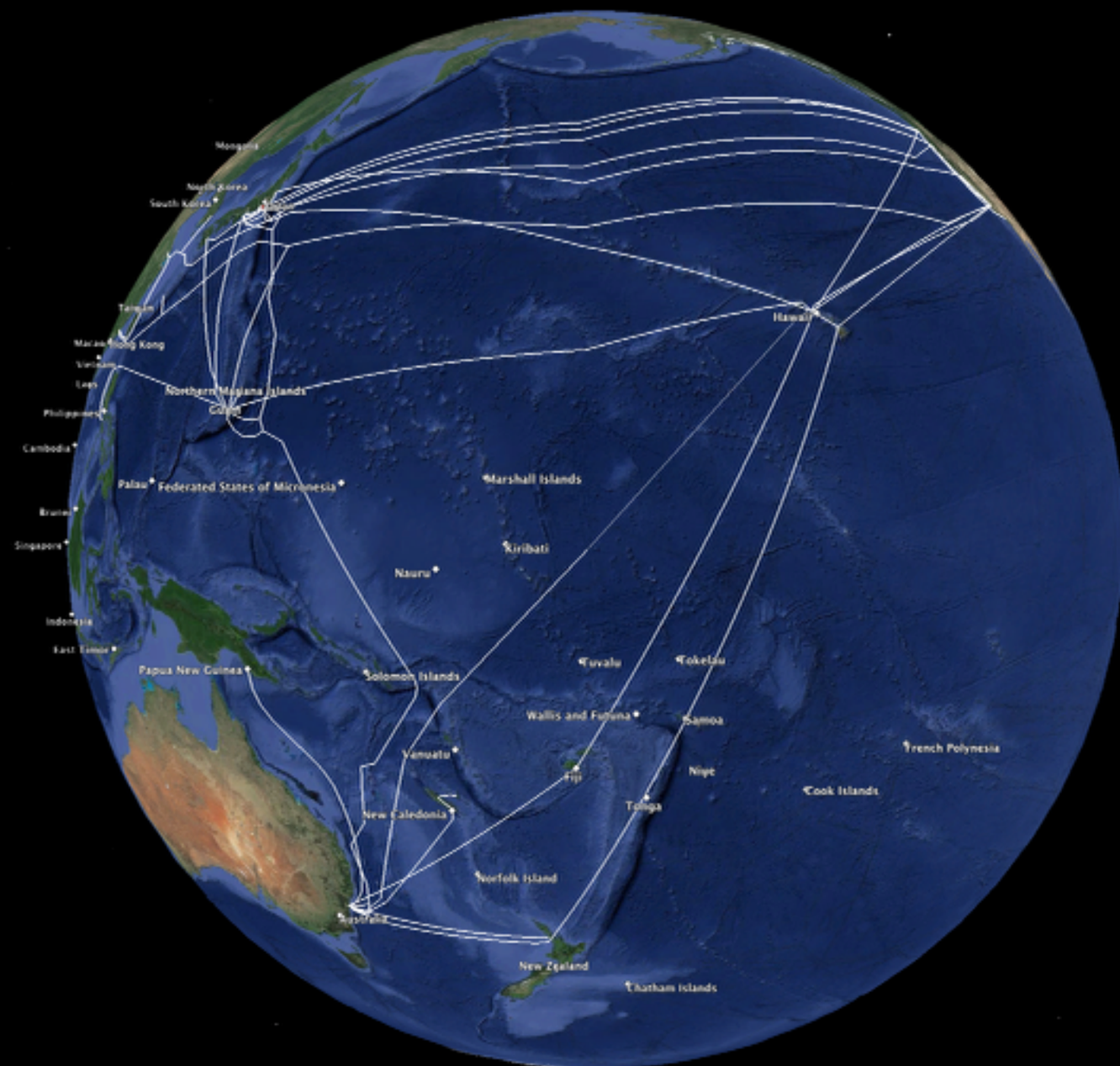
2006: Australia PNG Cable



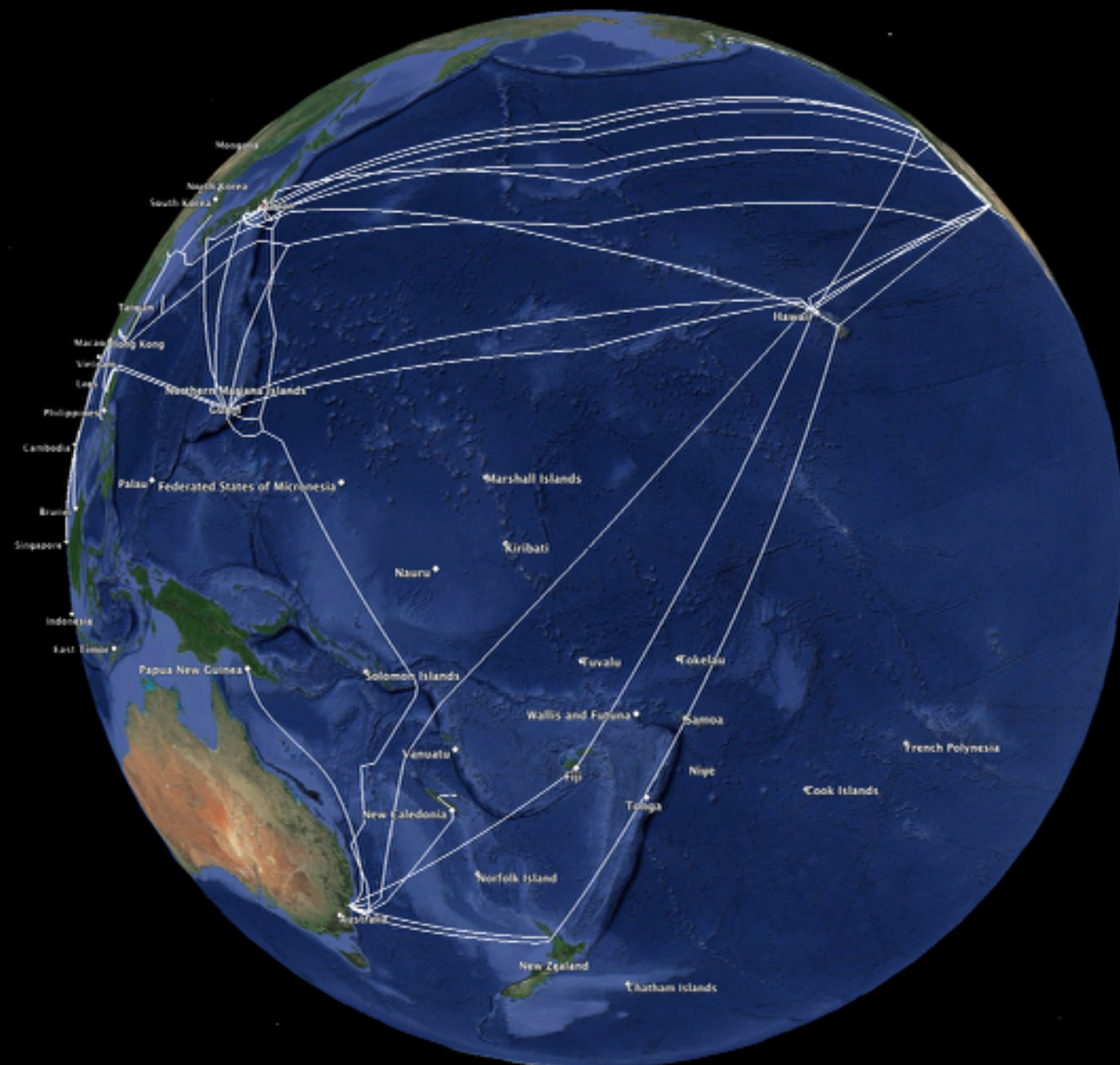
2008: Gondwana



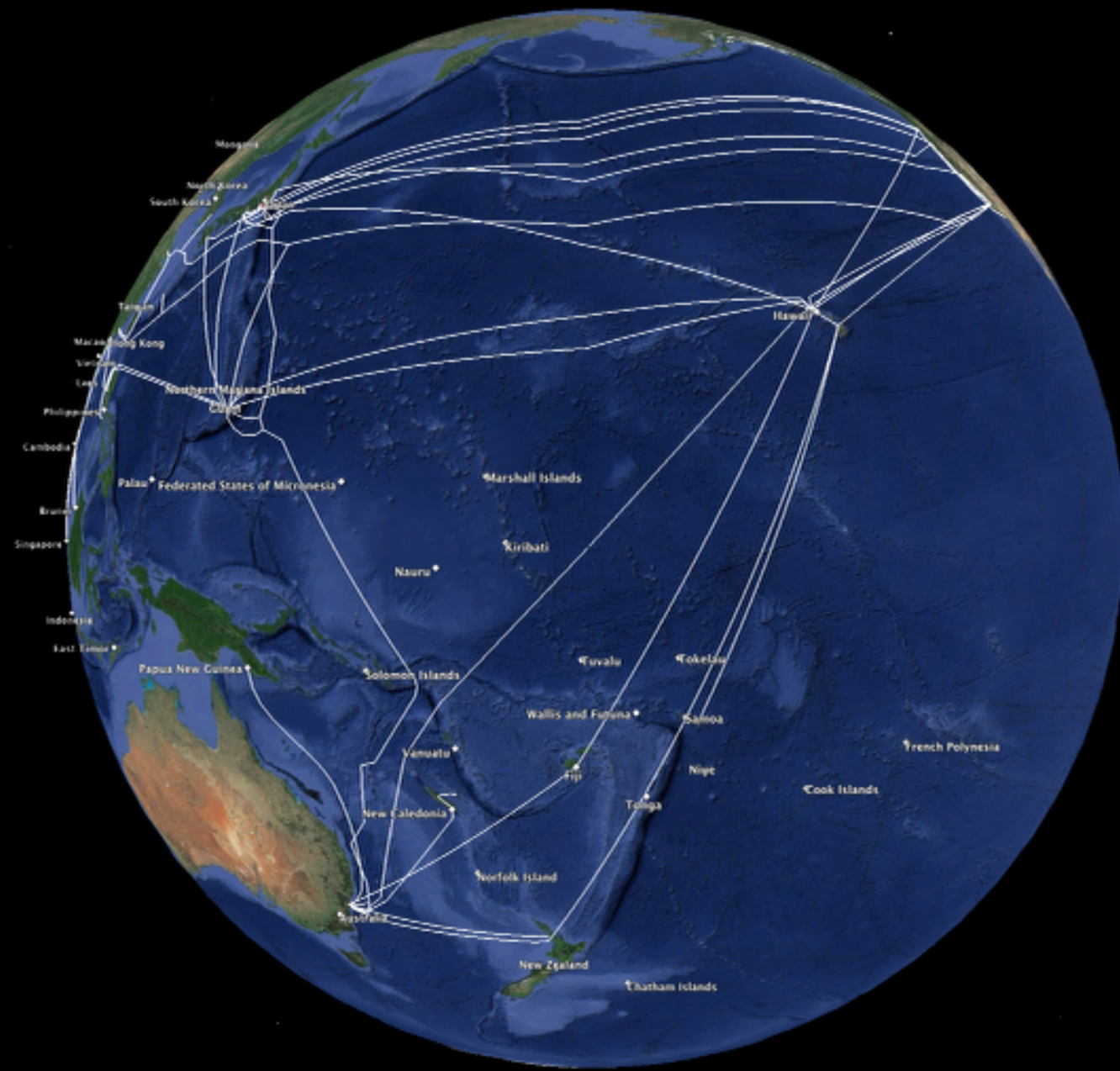
2008: Telstra Endeavour



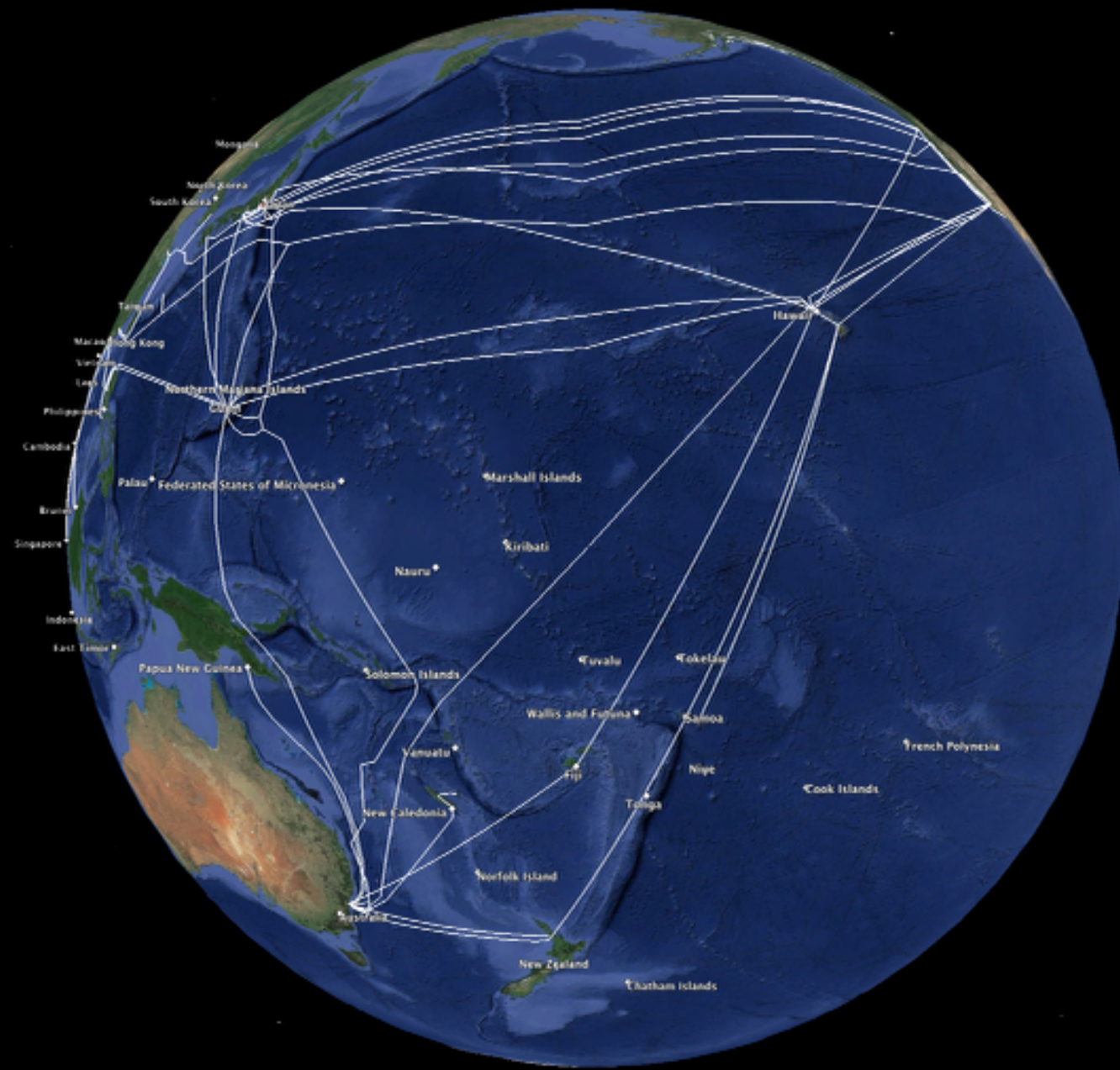
2009: Asia America Gateway



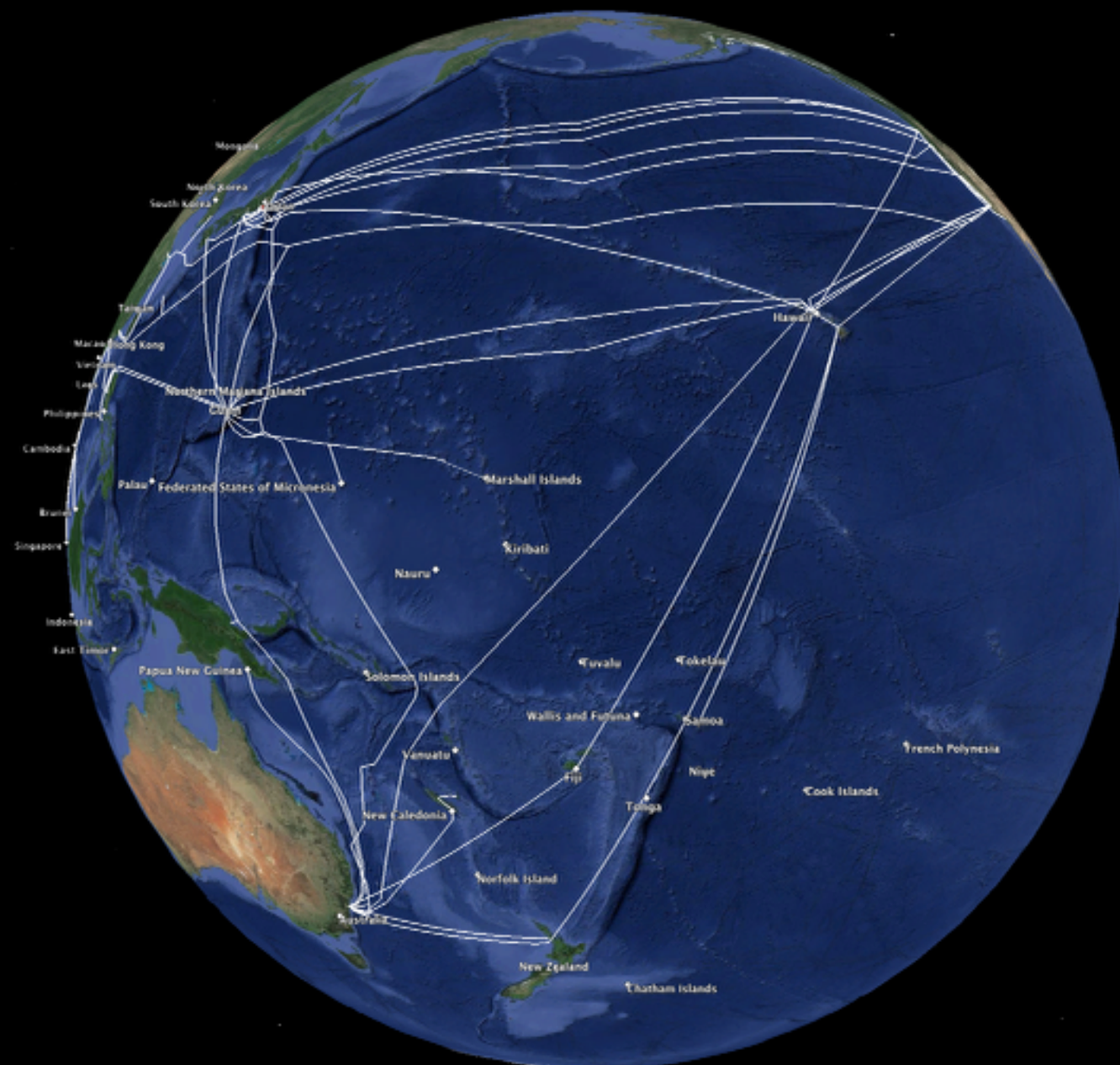
2009: American Samoa Hawaii



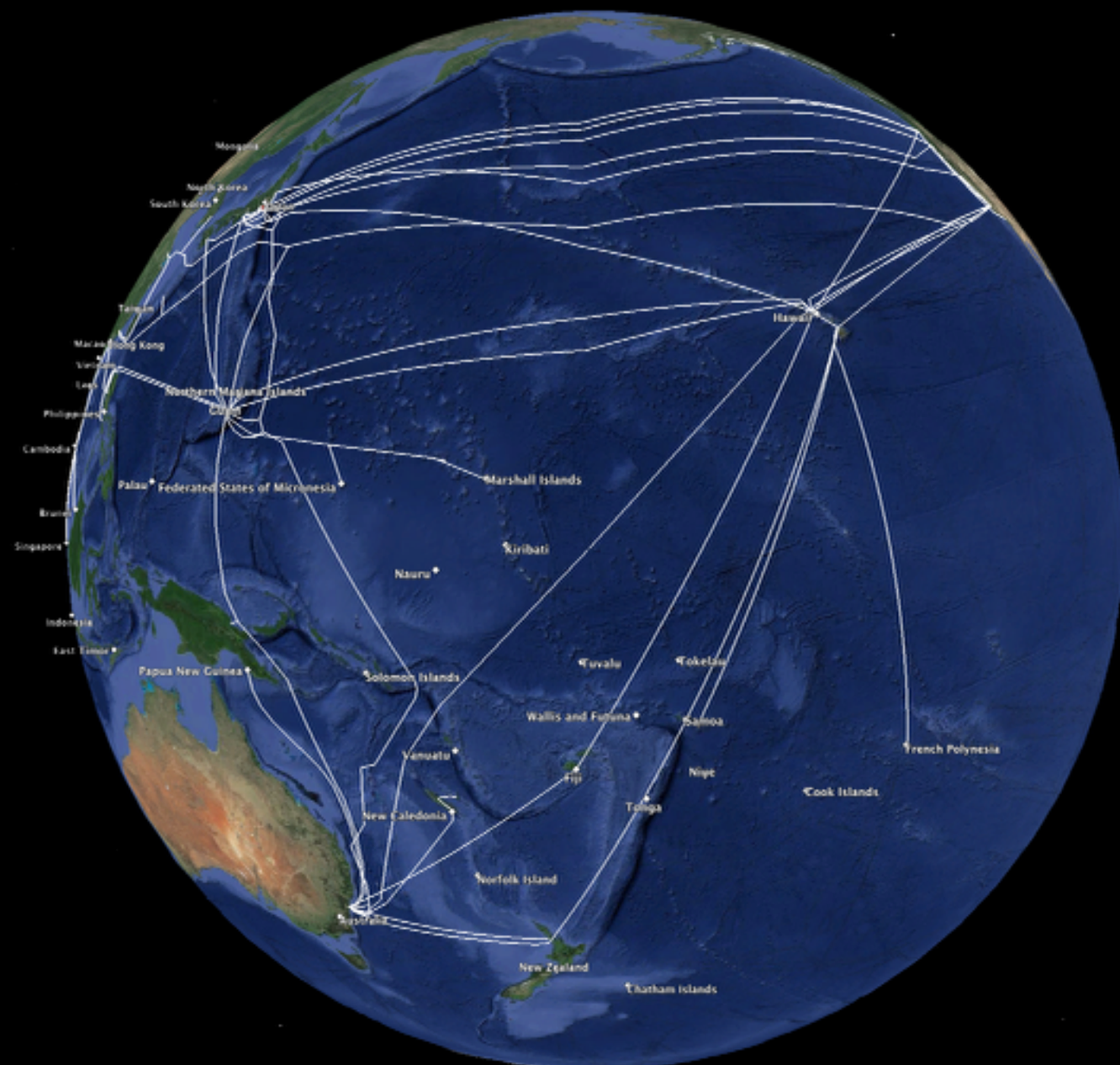
2009: Pipe Pacific Cable 1



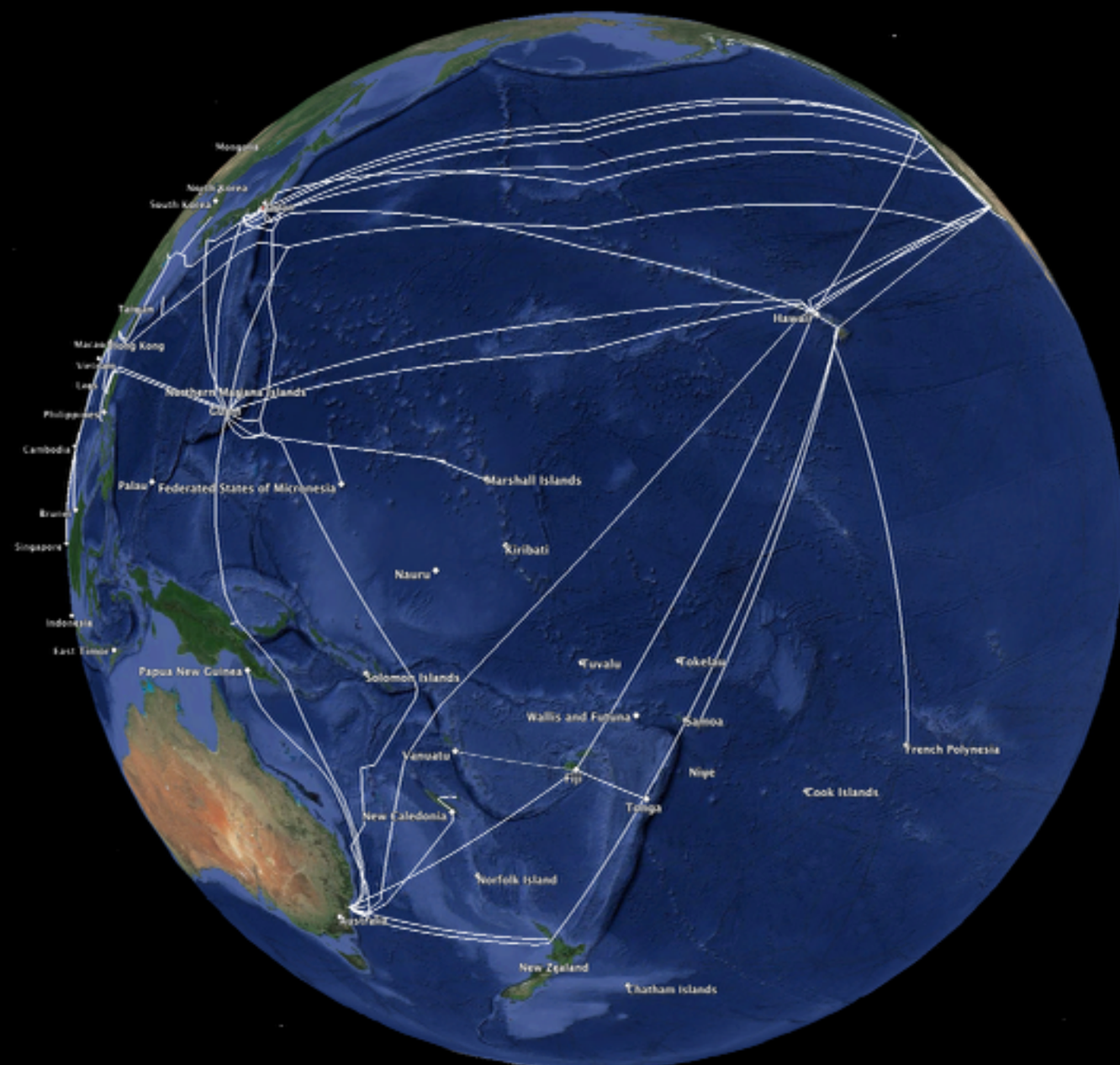
2010: Hantru 1



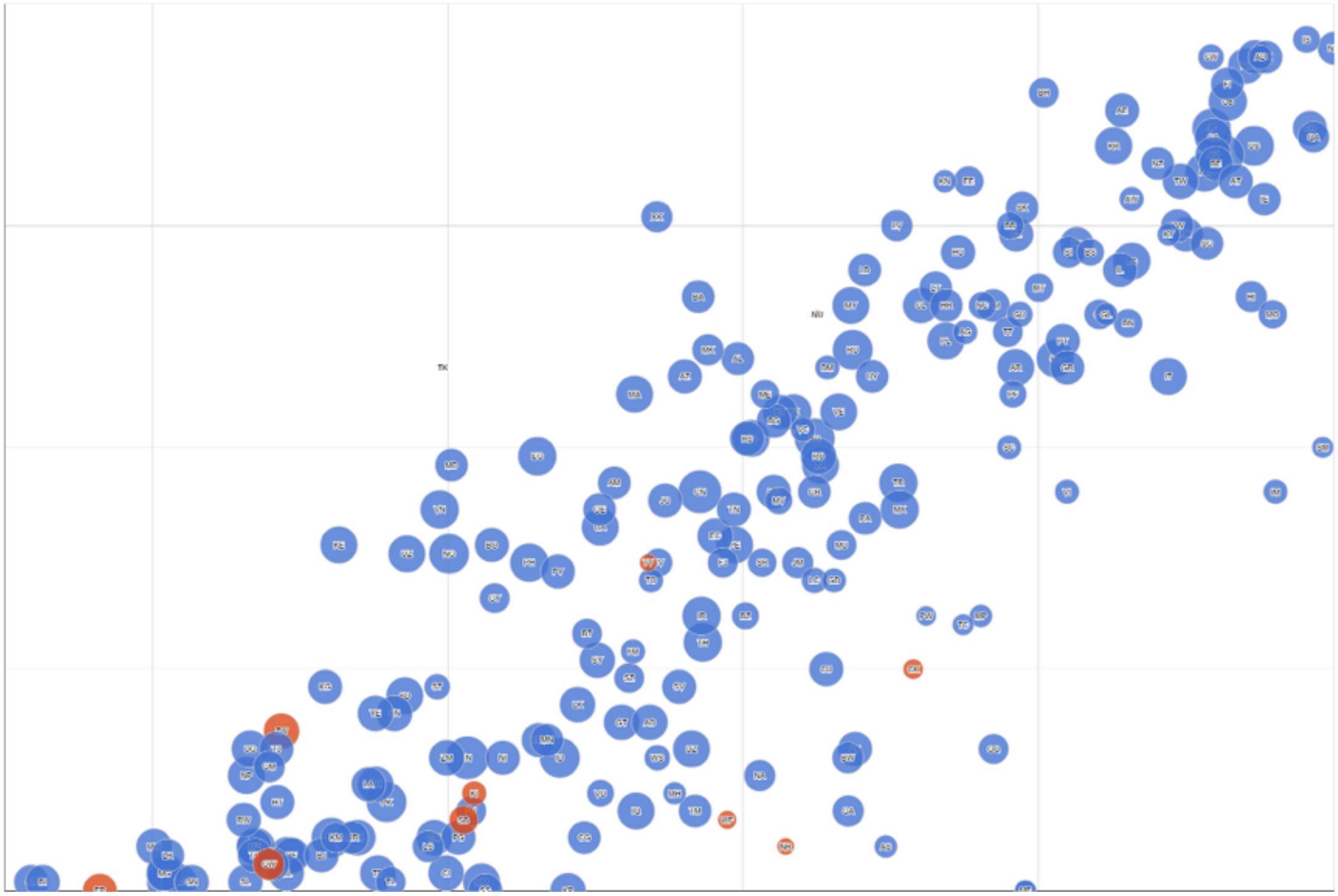
2010: Honotua



2013-2014:Fiji, Tonga, Vanuatu



Internet Uptake



GDP Per Capita

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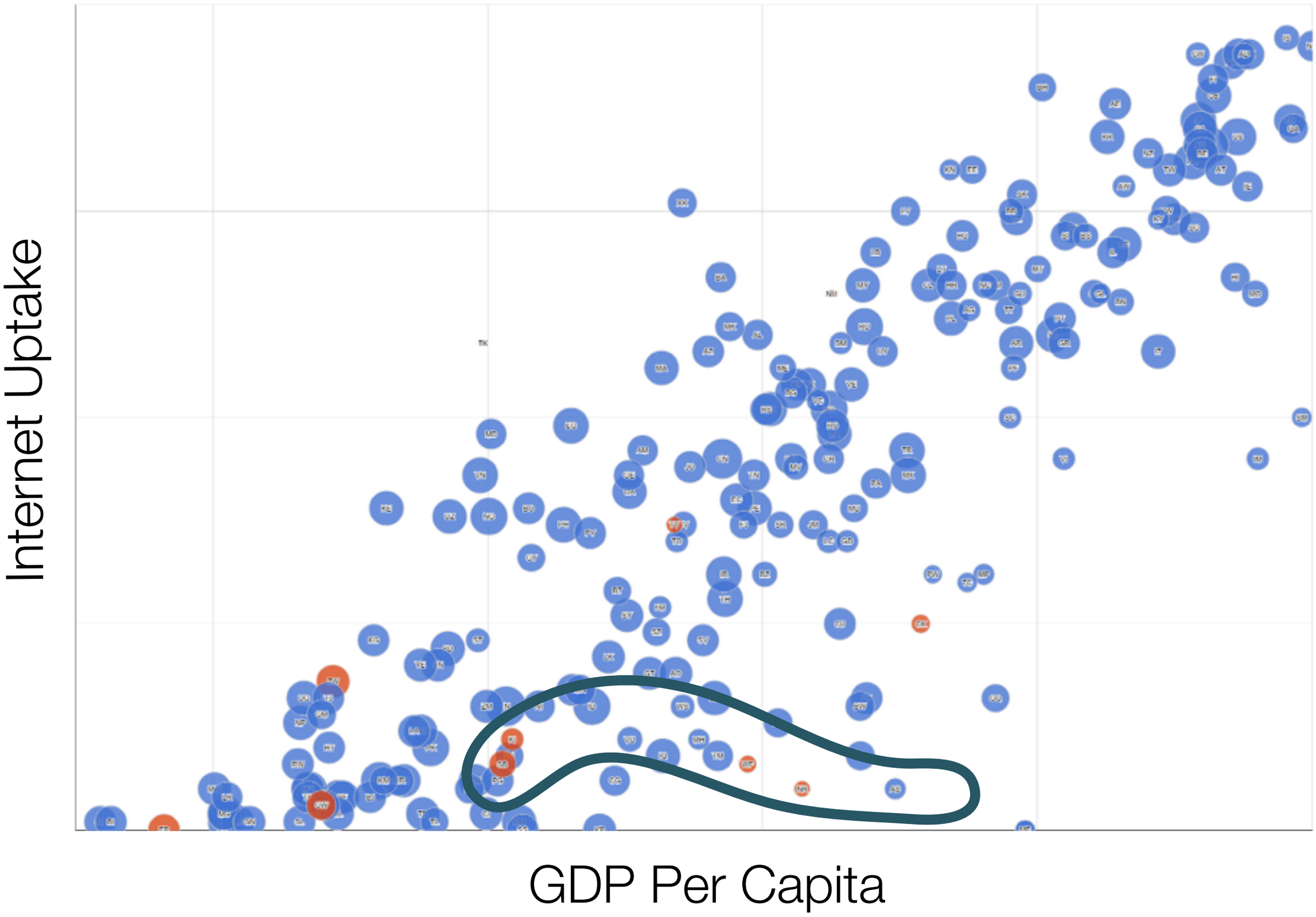
Internet Uptake
GDP Per Capita

Look, Up In The Sky

NAVSTAR 70 (USA 251)
GALILEO-PM2
GALILEO-PM3
NAVSTAR 71 (USA 256)
NAVSTAR 72 (USA 258)
CHINASAT 7
INTELSAT 10
RSS 9
ASTRA 2A
TDRS 10
TDRS 11
BEIDOU 10
BEIDOU 1C
BEIDOU 2
BEIDOU G4
INTELSAT 8 (PAS 8)
SUPERBIRD 4
OPTUS D1
OPTUS C1
OPTUS D2
INTELSAT 5 (PAS 5)
AMC-5 (GE-5)
ESATI-2
BRIZE-M R/B
ISAT-2A
JCSAT 8
JCSAT 5
MTSAT 2
KIZUNA
ETS-8
PALAPA C2
BREASAT-2
BRAZILSAT B3
INMARSAT 4-F1
EXPRESS 2A
APSTAR 1A
INMARSAT 2-F4
SBIRS GEO 1 (Space Based Infrared System Geosynchronous 1, USA 230)
GALAXY 6
THAISAT 2
ESTAR 4
COSMOS 2345
NAVSTAR 69 (USA 248)
ROBELOS 1
THAISAT 1
METEOSAT 4 (MOP 1)
SKYNET 4B
GOES 2 AKM
INMARSAT 2-F1
TELECOM 2A
INTELSAT 2-F2
EXPRESS 1
GORIZONT 4
RADUGA 4
INMARSAT 5 AKM
SATCOM K2
CHINASAT 5 (SPACENET 3)
SATCOM 2R
INTELSAT 1-F1 (BCS 1)
SUPERBIRD A
NAVSTAR 66 (USA 232)
TELECOM 2D
INTELSAT 4-F3
ISAT 2C
TELECOM 2B
INTELSAT 6
COSMOS 1894
COSMOS 2209
ARECS A
ASTRA 1C
OPTUS B1 (AUSSAT B1)
GALAXY 8
INSAT 1
INSAT 2C
NAVSTAR 10 (USA 203)
NAVSTAR 11 (USA 207)
NAVSTAR 9 (USA 178)
NAVSTAR 6 (USA 11)
NAVSTAR 11 (USA 90)
NAVSTAR 11 (USA 10)
DOVE-A
DOVE-B
OPS 5113 (NAVSTAR 1)
NAVSTAR 32 (USA 117)
INTELSAT 8 (PAS 8)
TUCH 5A
TUTE 172A (GE 23)
INMARSAT 3-F2
BEIDOU 1C
Milstar DFS-4 (USA-152, Milstar 2-F2) (Military Strategic and Tactical Relay, Advanced Extremely High Frequency satellite-1, USA 214)
OPTUS B1 (AUSSAT B1)
TELECOM 2D
NAVSTAR 66 (USA 232)
INTELSAT 4-F3
ISAT 2C
TELECOM 2B
RADUGA 16
INTELSAT 6
COSMOS 1894
COSMOS 2209
ARECS A
INTELSAT 1-F1 (BCS 1)
SUPERBIRD A
SATCOM 2R
CHINASAT 5 (SPACENET 3)
SATCOM K2
INMARSAT 5 AKM
GORIZONT 4
RADUGA 4
INTELSAT 2-F1
EXPRESS 1
INMARSAT 2-F1
TELECOM 2A
INTELSAT 2-F2
GOES 2 AKM
INMARSAT 3 AKM
INMARSAT 3B
NAVSTAR 69 (USA 248)
NAVSTAR 10 (USA 203)
NAVSTAR 11 (USA 207)
NAVSTAR 9 (USA 178)
NAVSTAR 6 (USA 11)
NAVSTAR 11 (USA 90)
NAVSTAR 11 (USA 10)
DOVE-A
DOVE-B
OPS 5113 (NAVSTAR 1)
NAVSTAR 32 (USA 117)
INTELSAT 8 (PAS 8)
TUCH 5A
TUTE 172A (GE 23)
INMARSAT 3-F2
BEIDOU 1C
BEIDOU 2
BEIDOU G4
SUPERBIRD 4
OPTUS D1
OPTUS C1
OPTUS D2
INTELSAT 5 (PAS 5)
AMC-5 (GE-5)
ESATI-2
BREEZE-M R/B
ISAT-2A
JCSAT 8
JCSAT 5
MTSAT 2
KIZUNA
ETS-8
PALAPA C2
BREASAT-2
BRAZILSAT B3
INMARSAT 4-F1
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APSTAR 1A
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SBIRS GEO 1 (Space Based Infrared System Geosynchronous 1, USA 230)
GALAXY 6
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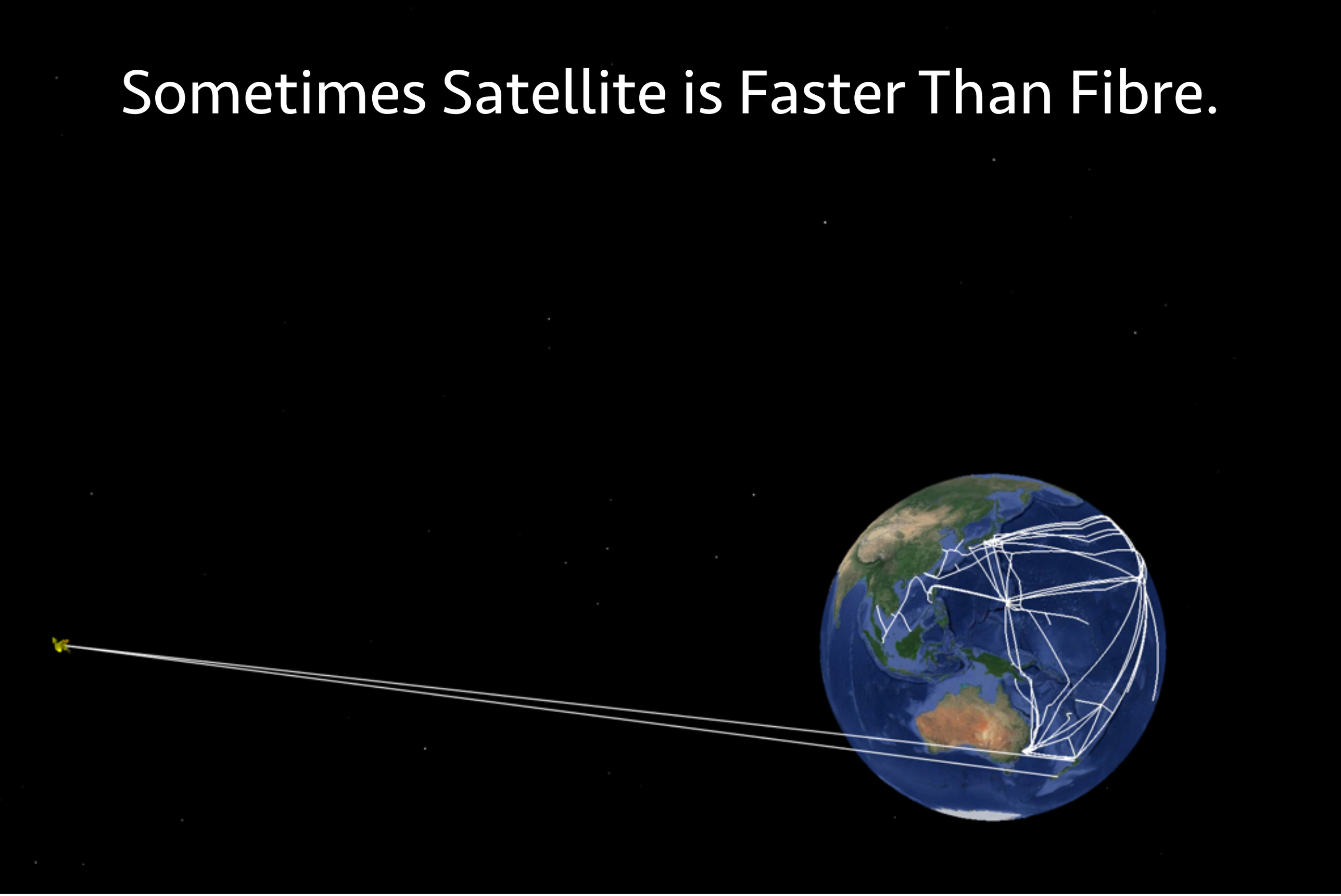
NAVSTAR 69 (USA 248)
ROBELOS 1
THAISAT 1
METEOSAT 4 (MOP 1)
SKYNET 4B
INMARSAT 3B
INMARSAT 3 AKM
GOES 2 AKM
INMARSAT 2-F1
TELECOM 2A
INTELSAT 2-F2
EXPRESS 1
GORIZONT 4
RADUGA 4
INMARSAT 5 AKM
SATCOM K2
CHINASAT 5 (SPACENET 3)
SATCOM 2R
INTELSAT 1-F1 (BCS 1)
SUPERBIRD A
ARECS A
COSMOS 1894
COSMOS 2209
RADUGA 16
INTELSAT 6
TELECOM 2B
INTELSAT 4-F3
ISAT 2C
GALAXY 8
INSAT 1
NAVSTAR 66 (USA 232)
TELECOM 2D
OPTUS B1 (AUSSAT B1)
ASTRA 1C
INTELSAT 10
RSS 9
ASTRA 2A
TDRS 10
TDRS 11
BEIDOU 10
BEIDOU 1C
CHINASAT 7
INMARSAT 3-F2
TUTE 172A (GE 23)
TUCH 5A
INTELSAT 8 (PAS 8)
OPTUS
SUPERBIRD 4
OPTUS D1
BEIDOU G4

Sometimes Satellite is Faster Than Fibre.



Sometimes Satellite is Faster Than Fibre.

Satellite Math

- IPStar is 36,000 km Up
- c = 300,000 km /sec
- Albany Timaru RTT: 480ms

This Isn’t One Of Those Times

Fibre Math

- Albany to Timaru: 1240km
- c = 200,000 km /sec
- Albany Timaru RTT: 12.4ms

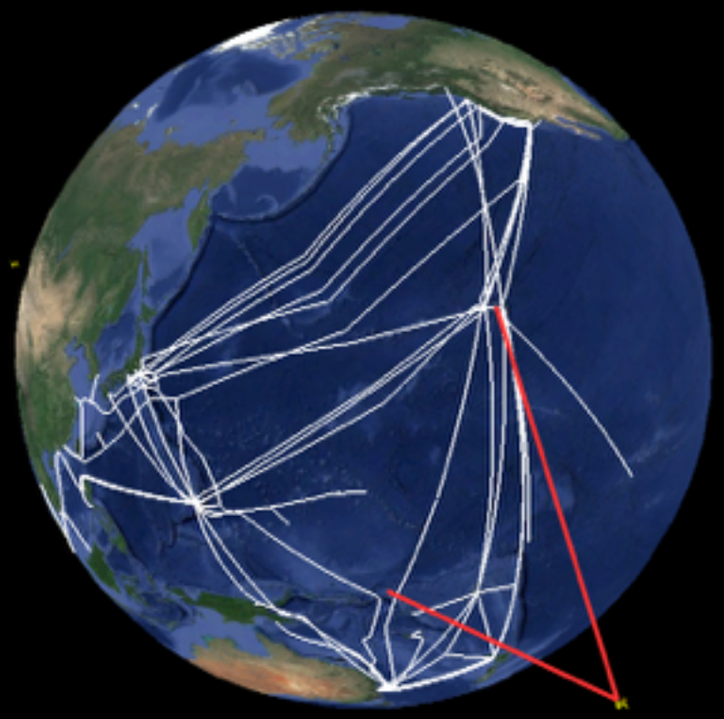
This Is One Of Those Times

Satellite Math

- O3b is 8,060 km Up
- c = 300,000 km /sec
- Honiara/Hawaii RTT: 107ms

Fibre Math

- Honiara/Hawaii: 11,150km
- c = 200,000 km /sec
- Honiara/Hawaii RTT: 111.5ms

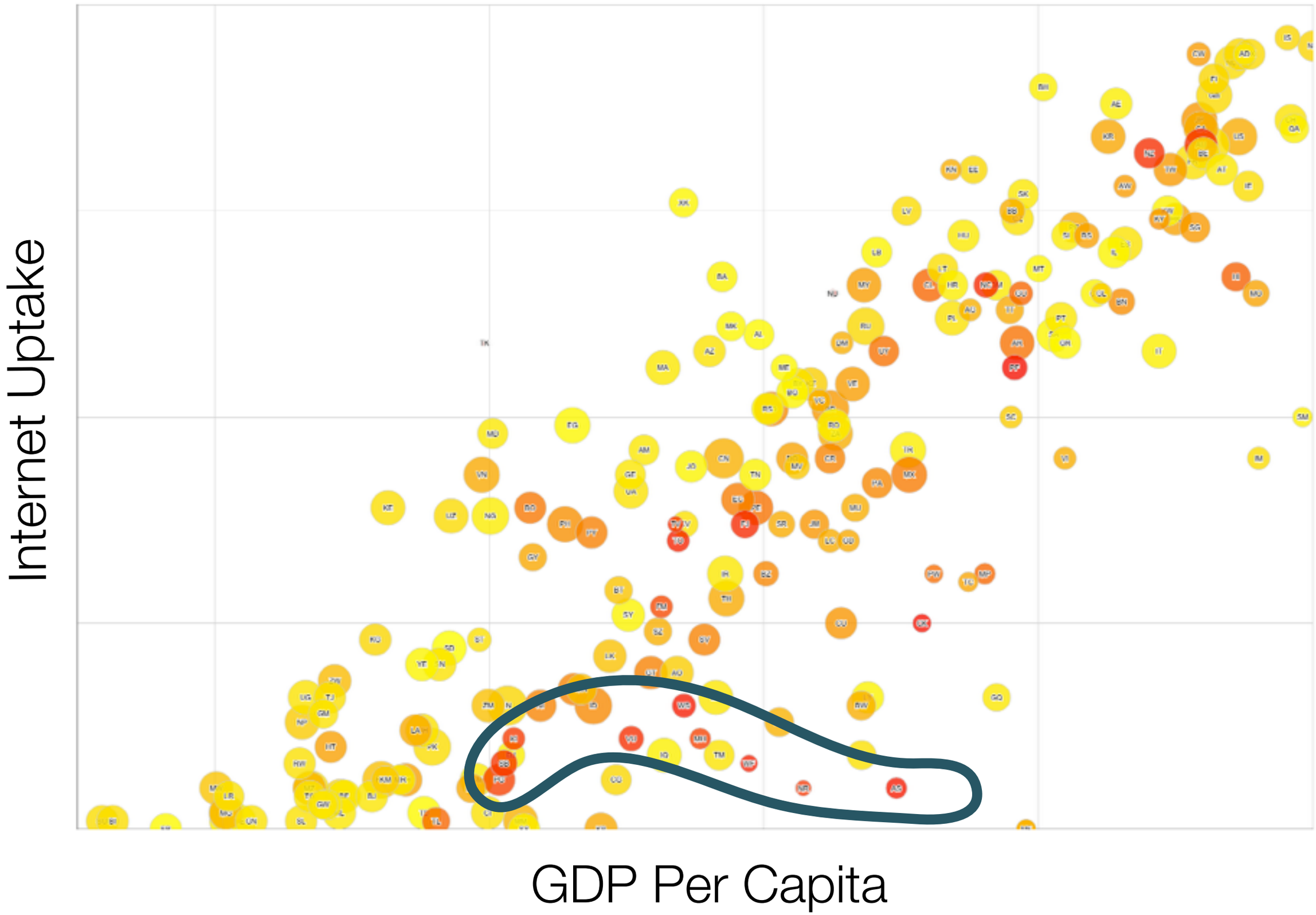


There’s Heaps of Fibre

Satellite is now Awesome

(and getting even better)

What’s the Problem?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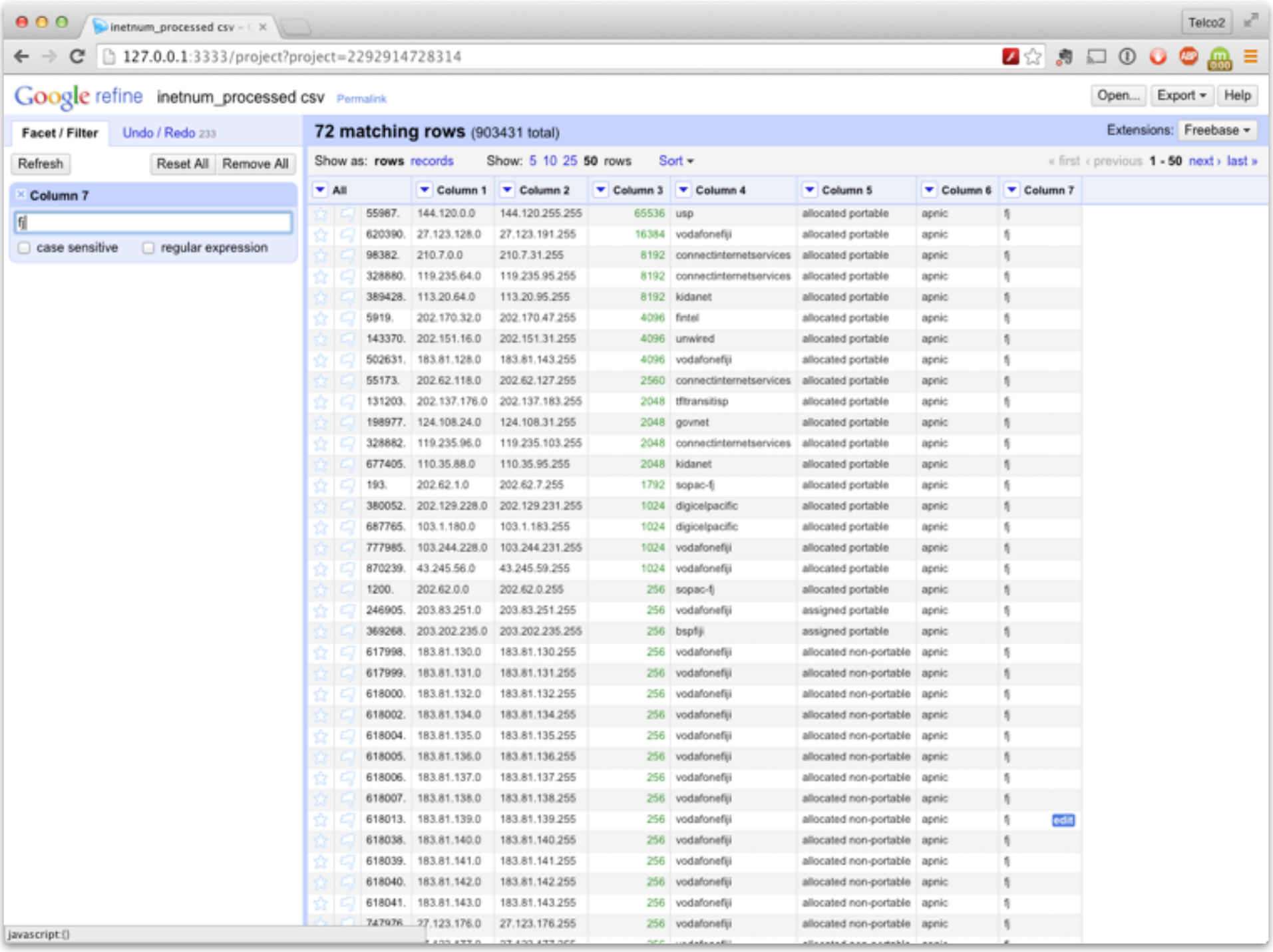
Carrier Investigation

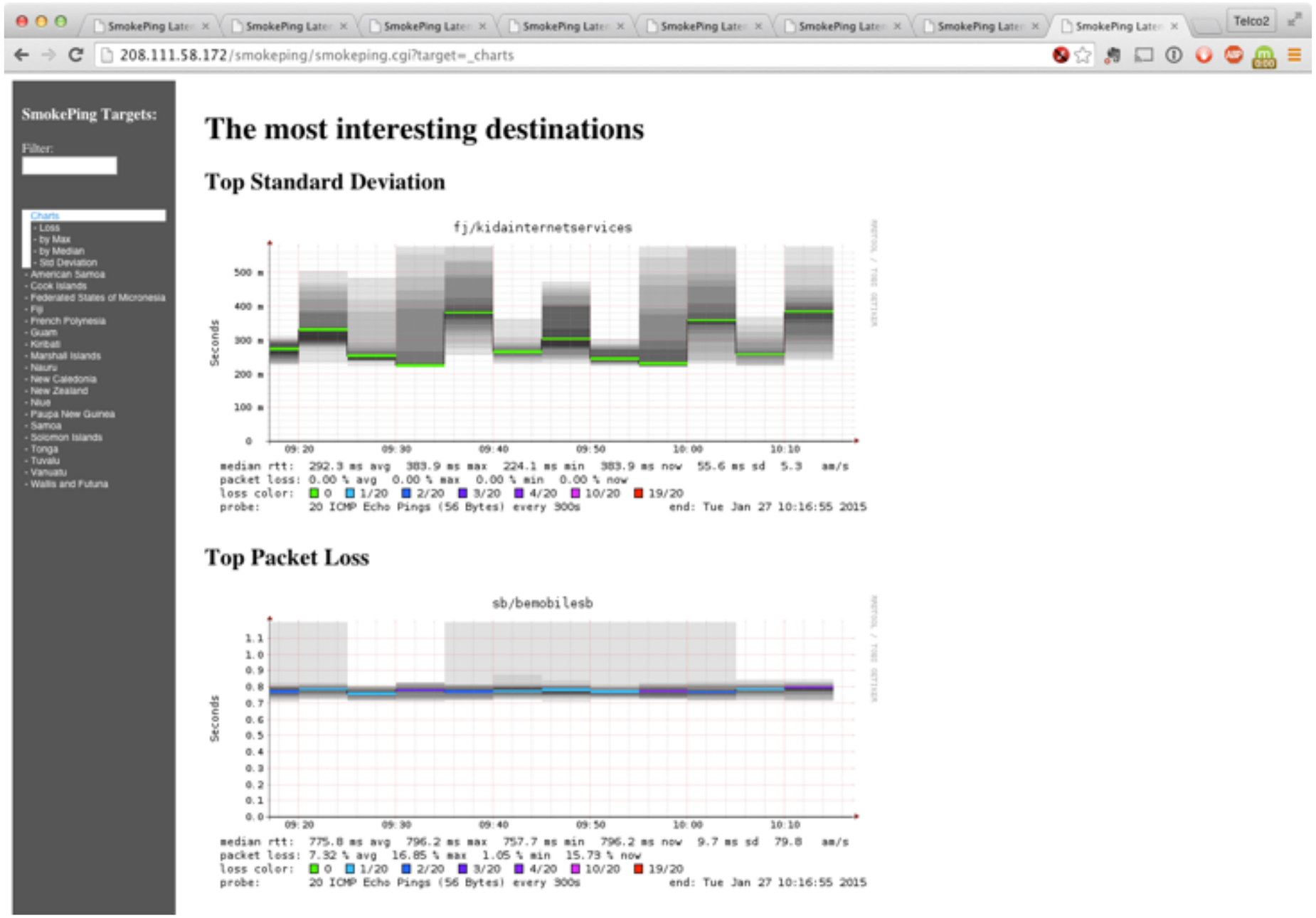


Price Investigation

Residential Broadband			
Plan	Monthly	2 Year Contract	3 Year Contract
Bluelink Wireless Internet (256kbps)	$90.00	$75.00	$60.00
Bluelink Wireless Internet (384kbps)	$115.00	$90.00	$75.00
Installation is a one time fee of $150.00			

MoanaTV Cable High Speed Broadband Internet			
Plan	Basic Cable	Internet	Monthly Total
Broadband Gold (768kbps)	$45.99	$70.00	$115.99
Broadband Platinum (1 Meg.)	$45.99	$105.00	$150.99
Installation is a one time fee of $150.00			

Performance Investigation



American Samoa

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BlueSky American Samoa

- HFC, Wireless, Cellular Operator
- Same Parent as ASH Cable
- Competes against ASH Customers
- ASH FY13 = US $5.8m (800mbps at $600/mbps)
- 768kbps Cable Subscribers Pay US $70/month

BlueSky Performance

Location	Distance	Best RTT	Actual RTT	Ratio
Tokyo	7,617	76.17	240	3.15
Singapore	9,552	95.52	300	3.14
Sydney	4,397	43.97	270	6.14
Ireland	15,435	154.35	280	1.81
Sao Paulo	12,613	126.13	290	2.30
North Virginia	11,330	113.3	190	1.68
Oregon	8212	82.12	140	1.70
Hawaii	4144	41.44	60	1.45
Overall Performance Indicator:				2.67

Nauru

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CenPacNet Nauru

Location	Distance	Best RTT	Actual RTT	Ratio
Tokyo	5,042	50.42	823	16.32
Singapore	7,016	70.16	740	10.55
Sydney	4,051	40.51	628	15.50
Ireland	14,134	141.34	930	6.58
Sao Paulo	15,500	155	981	6.33
North Virginia	12,258	122.58	851	6.94
Oregon	8650	86.5	816	9.43
Hawaii	4669	46.69	838	17.95
Overall Performance Indicator:				11.20

Marshall Islands

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MINTA

- MINTA: Marshall Islands National Telecoms Authority
  - 1gbps on Hantru-1, /22 from APNIC
  - Fibre + Wireless “Ring” Backbone
  - GeoStationary Satellite or Wireless to Some Islands
  - 512kbps ADSL Subscribers Pay US $70/month

MINTA Performance

Location	Distance	Best RTT	Actual RTT	Ratio
Tokyo	4,646	46.46	69	1.49
Singapore	7,487	74.87	146	1.95
Sydney	5,018	50.18	168	3.35
Ireland	13,304	133.04	336	2.53
Sao Paulo	15,579	155.79	353	2.27
North Virginia	11,340	113.4	238	2.10
Oregon	7717	77.17	197	2.55
Hawaii	3850	38.5	219	5.69
Overall Performance Indicator:				2.74

Vanuatu

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Telsat

- Sub-155mbps on ICN cable @ $600/month
- Upstream via Fibre is same $$ as via VSAT
- Shifting Contracted VSAT Capacity to In-Country Links
- Peers at VIX & Gets Free CDN
- 512kbps Wireless Subscribers Pay US $35/month

Telsat Performance

Location	Distance	Best RTT	Actual RTT	Ratio
Tokyo	6,370	63.7	251	3.94
Singapore	7189	71.89	170	2.36
Sydney	2596	25.96	59	2.27
Ireland	15,783	157.83	363	2.30
Sao Paulo	14369	143.69	415	2.89
North Virginia	13325	133.25	280	2.10
Oregon	9854	98.54	249	2.53
Hawaii	5676	56.76	274	4.83
Overall Performance Indicator:				2.90

Solomon Islands

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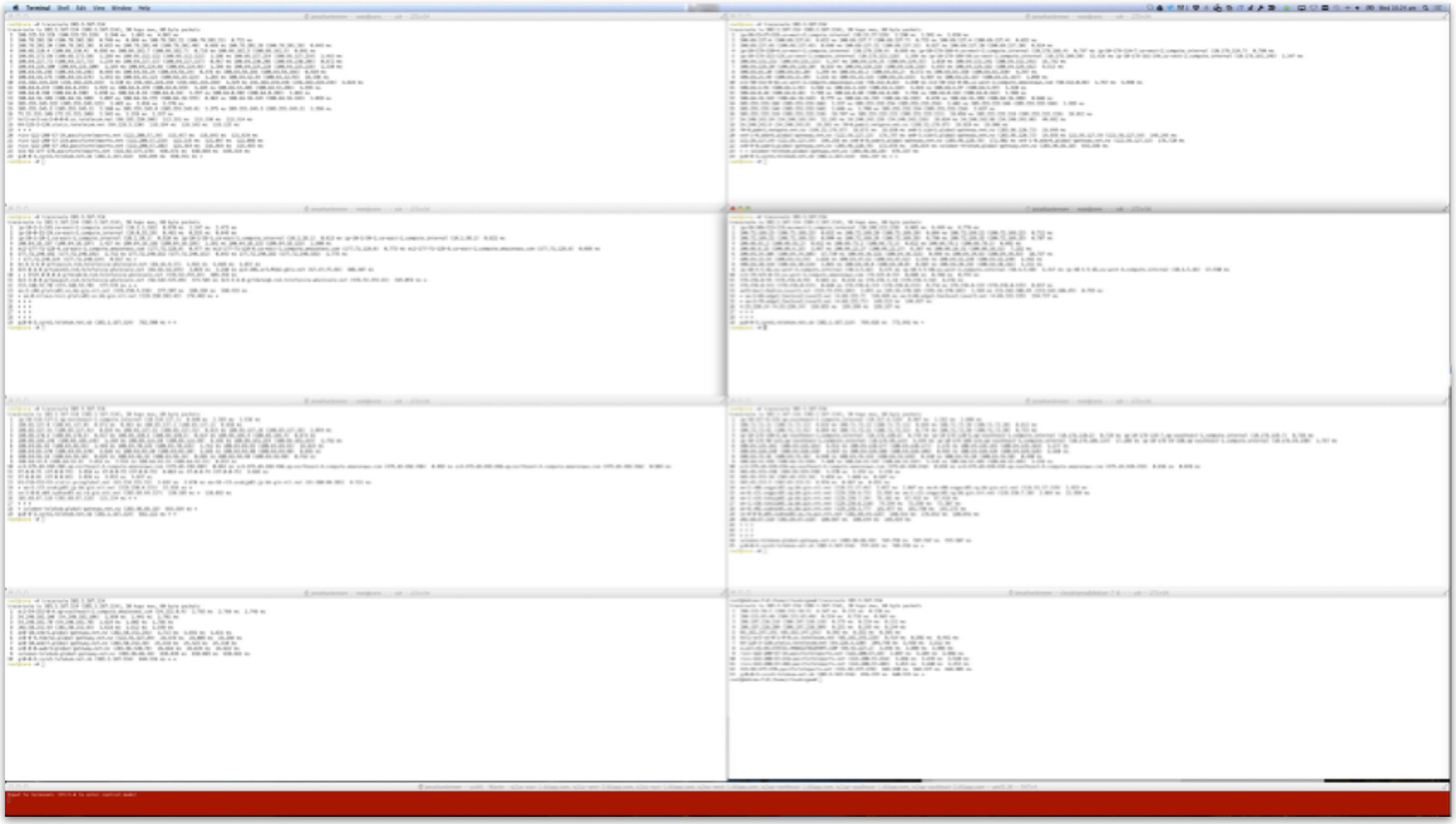
Solomons Telekom

- Our Telekom ADSL & Wi-Fi
  - Four Satellite Carriers - Soon to be Five with O3b
  - Nokia DSLAMs, Huawei 3G RAN, Ruckus Wi-Fi
  - Resell Speedcast VSAT that doesn’t touch their core
  - Wi-Fi Pre-Pay US $35 per 250mb
  - Mobile even more expensive.

Our Telekom Performance

Location	Distance	Best RTT	Actual RTT	Ratio
Tokyo	5,455	54.55	685	12.56
Singapore	6,337	63.37	742	11.71
Sydney	2,863	28.63	643	22.46
Ireland	15,029	150.29	774	5.15
Sao Paulo	15,363	153.63	800	5.21
North Virginia	13,515	135.15	651	4.82
Oregon	9,915	99.15	683	6.89
Hawaii	5,865	58.65	656	11.18
Overall Performance Indicator:				10.00

Some Traceroutes



Our Telekom Performance

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North Virginia	13,515	135.15	651	4.82
Oregon	9,915	99.15	683	6.89
Hawaii	5,865	58.65	656	11.18
Overall Performance Indicator:				10.00

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BeMobile Performance

Location	Distance	Best RTT	Actual RTT	Ratio
Tokyo	5,455	54.55	608	11.15
Singapore	6,337	63.37	671	10.59
Sydney	2,863	28.63	664	23.19
Ireland	15,029	150.29	833	5.54
Sao Paulo	15,363	153.63	863	5.62
North Virginia	13,515	135.15	771	5.70
Oregon	9,915	99.15	702	7.08
Hawaii	5,865	58.65	714	12.17
Overall Performance Indicator:				10.13

Papua New Guinea

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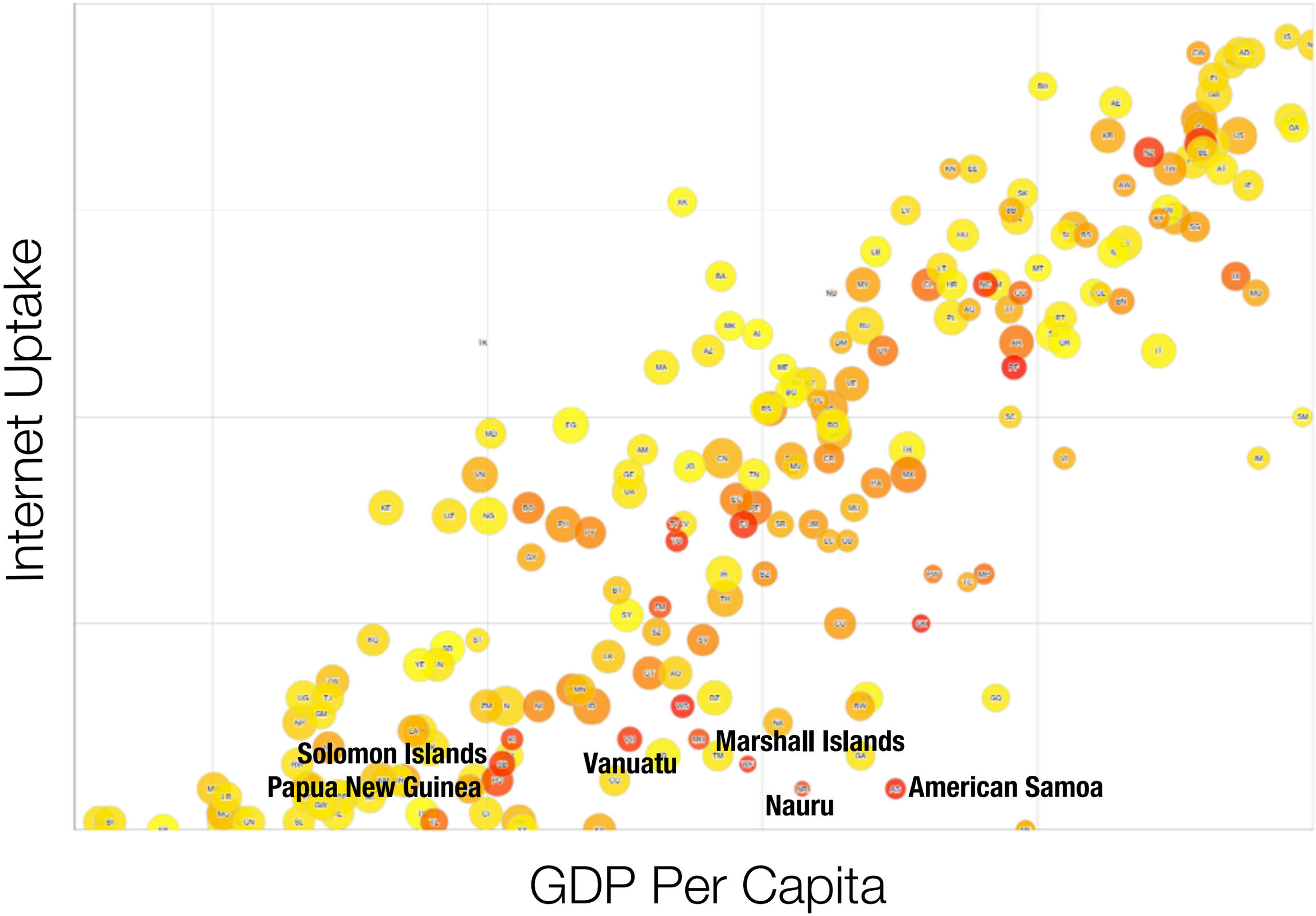
Digicel PNG

- 2G/3G Carrier
- Pre and Post-Paid Cellular Voice and Data
- US $35 for 1.6GB mobile data

Digicel PNG

Location	Distance	Best RTT	Actual RTT	Ratio
Tokyo	5,085	50.85	264	5.19
Singapore	4,955	49.55	181	3.65
Sydney	2,750	27.5	60	2.18
Ireland	14,671	146.71	354	2.41
Sao Paulo	16,069	160.69	391	2.43
North Virginia	14,559	145.59	278	1.91
Oregon	10,926	109.26	248	2.27
Hawaii	7,069	70.69	250	3.54
Overall Performance Indicator:				2.95


Internet Uptake
Solomon Islands
Papua New Guinea
Vanuatu
Marshall Islands
Nauru
American Samoa
GDP Per Capita

Pacific Interconnectivity

- Focus on Transit to the nearest big market(s)
- No regard for other Pacific Island countries
  - Vanuatu -> Suva traffic routes via Australia
- Typically no peering or interconnection on islands
- In PNG two carriers take two different fibres out
- Vanuatu Exchange works - due to government help

Interconnectivity Issues

- NZ to Hawaii $/mbps == NZ to California $/mbps
- Vanuatu-Suva cheap, but no good transit ex Suva
- Domestic transit in Fiji, Hawaii is very expensive
- Peering is difficult in Hawaii, impossible in Fiji
- Stopping along the way for big carriers is expensive
- Pacific Interconnectivity today = Market Failure

Real Issues for The Pacific

- Communications between islands suffer
- Communications on-island suffer (WS,FJ,SB,etc..)
- Education Networks performance suffers
- Sub-optimal routing benefits few.
- Market failure compounded by regulatory failure
- High costs could be affecting Internet uptake

Potential Next Steps

- Document Pacific Economic, Social, & Educational Ties
- Monitor Interconnectivity to/from ~ 60 Pacific networks
- Determine Regional Routing Inefficiencies
- Analyse Benefits of Regional Peering Points
  - Does every country need an exchange? Maybe not.
- Develop a Strategy for Improving Interconnectivity

Thank You!

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