October 2020

Pacific-IX Internet Exchange Key Consultations – Fiji-IX

UN-ESCAP Asia-Pacific Information Superhighway (AP-IS) initiative

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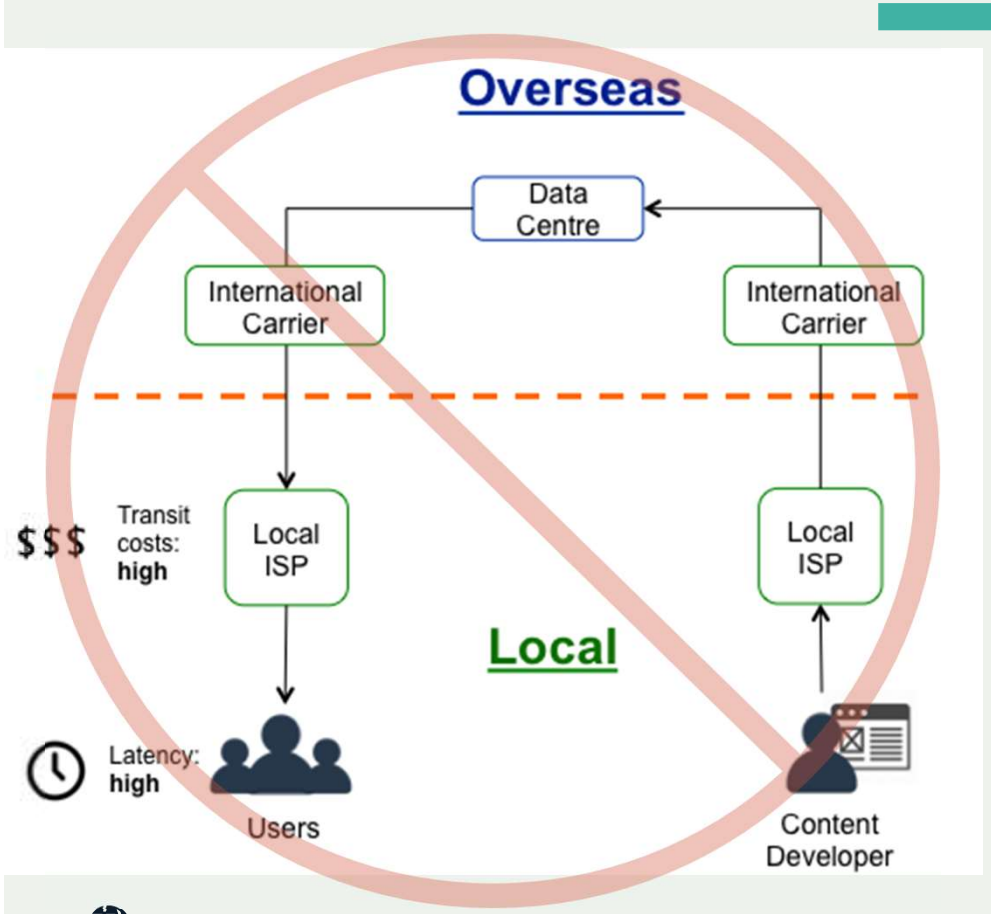
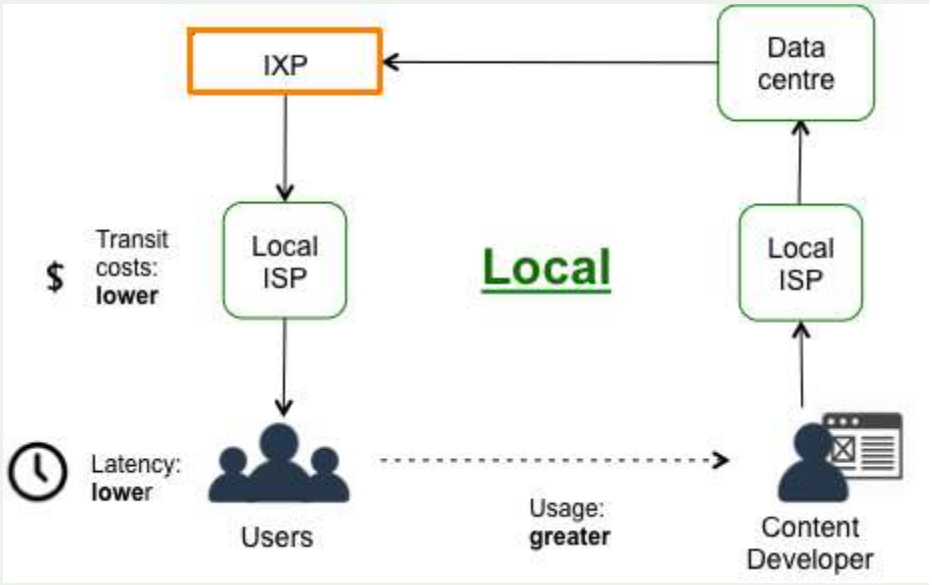
"Internet exchange points (IXPs) are a vital part of the Internet ecosystem in that they enable two users in different networks to most efficiently exchange information in the broad Internet network system.

In this way, they are analogous to regional airport hubs—airlines exchange passengers between their flights in much the same way that networks exchange traffic across an IXP."

Internet Society

An IXP reduces latency, reduces transit costs, improves performance, attracts cloud/content providers



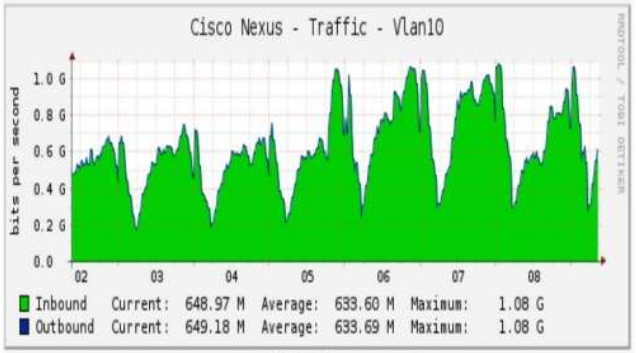


Fiji, PNG have successful National IXPs…est 2017

NICTA

PNGIXP's traffic growth

- ISP's connected to the IX provide a much better end user experience with local content being shared free across the



TELECOMMUNICATIONS AUTHORITY OF FIJI

SEARCH

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ing

- Determination
- Fiji-IX
- Forms
- Laws & Regulations
- Presentations
- Fees & Charges
- Public Notice
- Tender

PUBLICATIONS > FIJI-IX

FIJI - INTERNET EXCHANGE POINT

Fiji-IXP is Live, initially started with four ISP operators but now we have seven members peering to the IXP switch. The seven members are Vodafone Fiji Limited,Digicel Fiji Limited, Telecom Fiji Limited,FINTEL, USP, FNU and WALESI.



Fiji-IX Steering Committee Members - reps from Vodafone Fiji Limted, Digicel Fiji Limtied, Telecom Fiji Limited,Fintel and Telecommunications Authority of Fiji.

Benefits of having an IXP for Fiji

- Route all local traffic through the IX Switch rather than using the expensive transit links which in return saves bandwidth for the operators.
- Quality of service (QOS) have improved as route to reach the local contents is shorter thus providing the consumers an imrpoved domestic connectivity in terms of accessing locals web contents.
- Fiji-IX will enhance ICT development in Fiji as it will attract ICT professionals & developers to develop local contents and host it locally in Fiji as Fiji-IX will provide better network performance in term of accessing local contents.
- ICT is rapidly developing in the Pacific islands and Fiji wants to become an ICT hub for the Pacific islands, Fiji-IX is a framework in promoting Fiji to become an ICT hub.
- Market Development – Fiji IXP will promote local ICT service market development for co-location services (e.g., hosting, cached services, etc.) and services that require high bandwidth and low latency (e.g., real-time and multimedia services).
- Security and Privacy – Keeping local traffic "local" within national boundaries reduces privacy and security risks inherent in sending sensitive data across national borders over multiple hops.

Pacific–IXP for all Pacific Islands

Bring similar benefits to other Pacific Islands that Fiji has achieved with Fiji-IX, PNG with PNGIXP

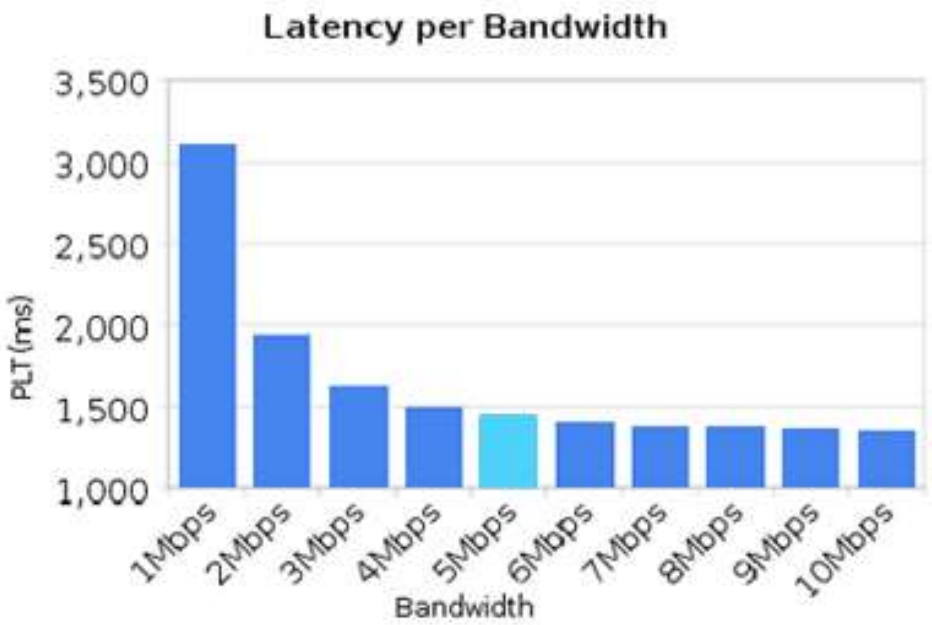
Enable Fiji carriers to benefit from interconnecting with other Pacific Islands providers

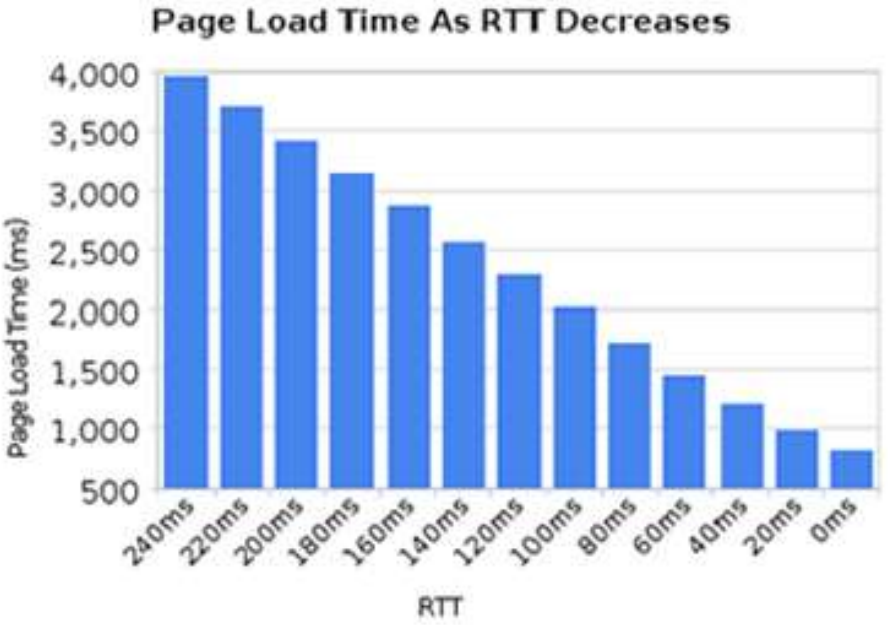
Further minimise Latency and improve performance for all Pacific Islands

Aggregate traffic demand to attract more content/cloud providers to establish Pacific Island servers to benefit all



Reduced latency improves performance, speed, and reliability





- **Upgrading 'bandwidth' per user from 5Mbps to 10Mbps results in a mere 5% improvement in page loading times!** In other words, an average consumer…would not benefit much from upgrading their connection when it comes to browsing the web.

- However, the latency graph tells an entirely different story. **For every 20ms improvement in latency, we have a linear improvement in page loading times.**

(Source: Ilya Grigorik, www.igvita.com)



AP-IS Subregional implementation in the Pacific

AP-Information Superhighway Master Plan 2019-2022:

- Strategic Initiative #2: Establish sufficient IXPs to minimize transit costs, improve Internet speed and latency across all Pacific Island Nations

AP-IS Subregional Mtg, Nov 2018

- Pacific Delegates developed a Pacific AP-IS Subregional Plan
- ESCAP requested to investigate feasibility of a Pacific Islands IXP

AP-IS Steering Committee, August 2019, Bangkok

- Pacific delegates agreed for the establishment of a working group to assess the feasibility of a Pacific IXP

AP-IS Pacific-IXP Working Group#1, December 2019, Fiji

- Internet Society Feasibility Study identified a Pacific Islands IXP was feasible – anchored in Fiji, Samoa, New Zealand

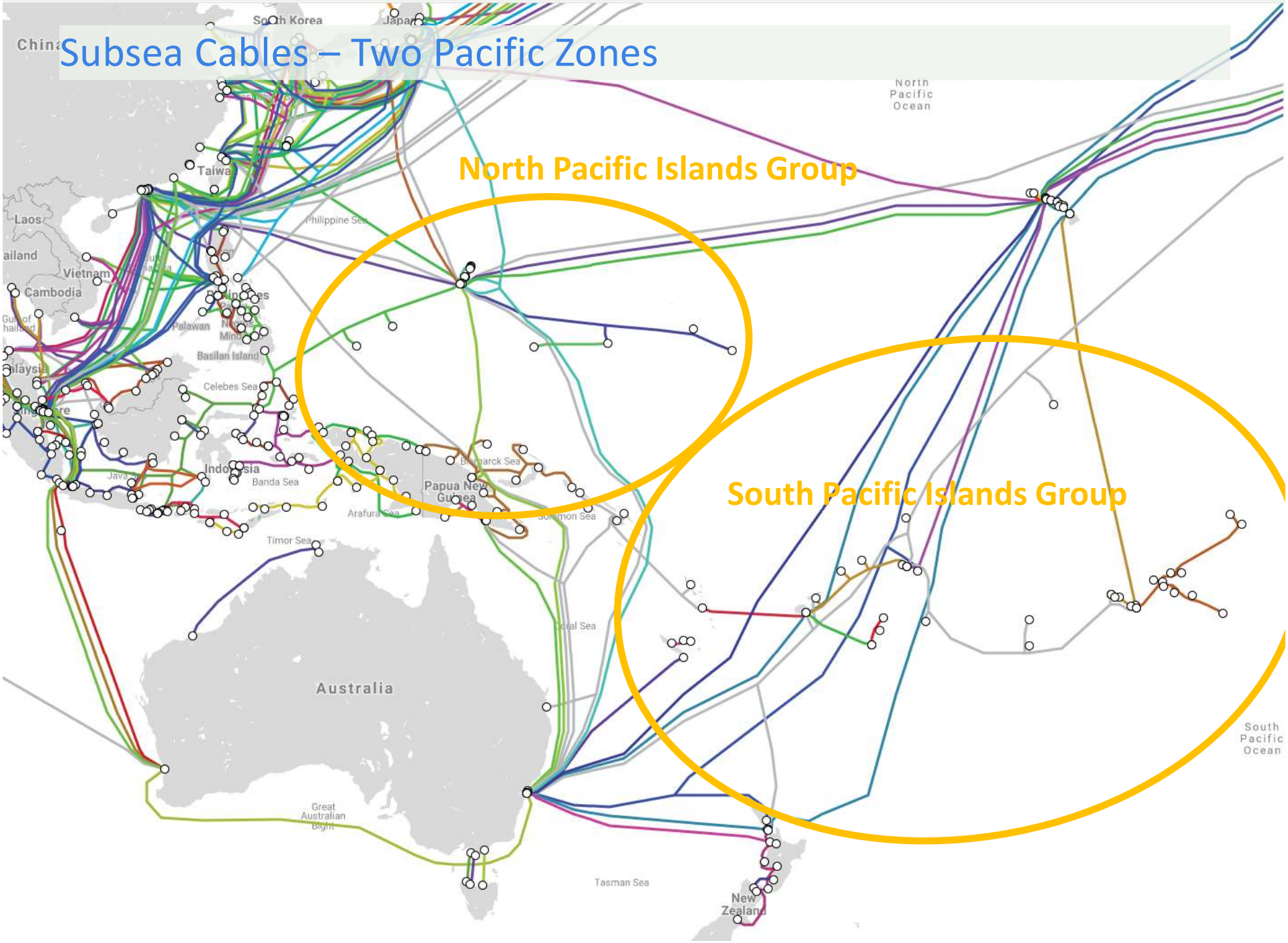
AP-IS Pacific-IXP Working Group#2, August 2020, (virtual)

- Economics and Operational Models Study

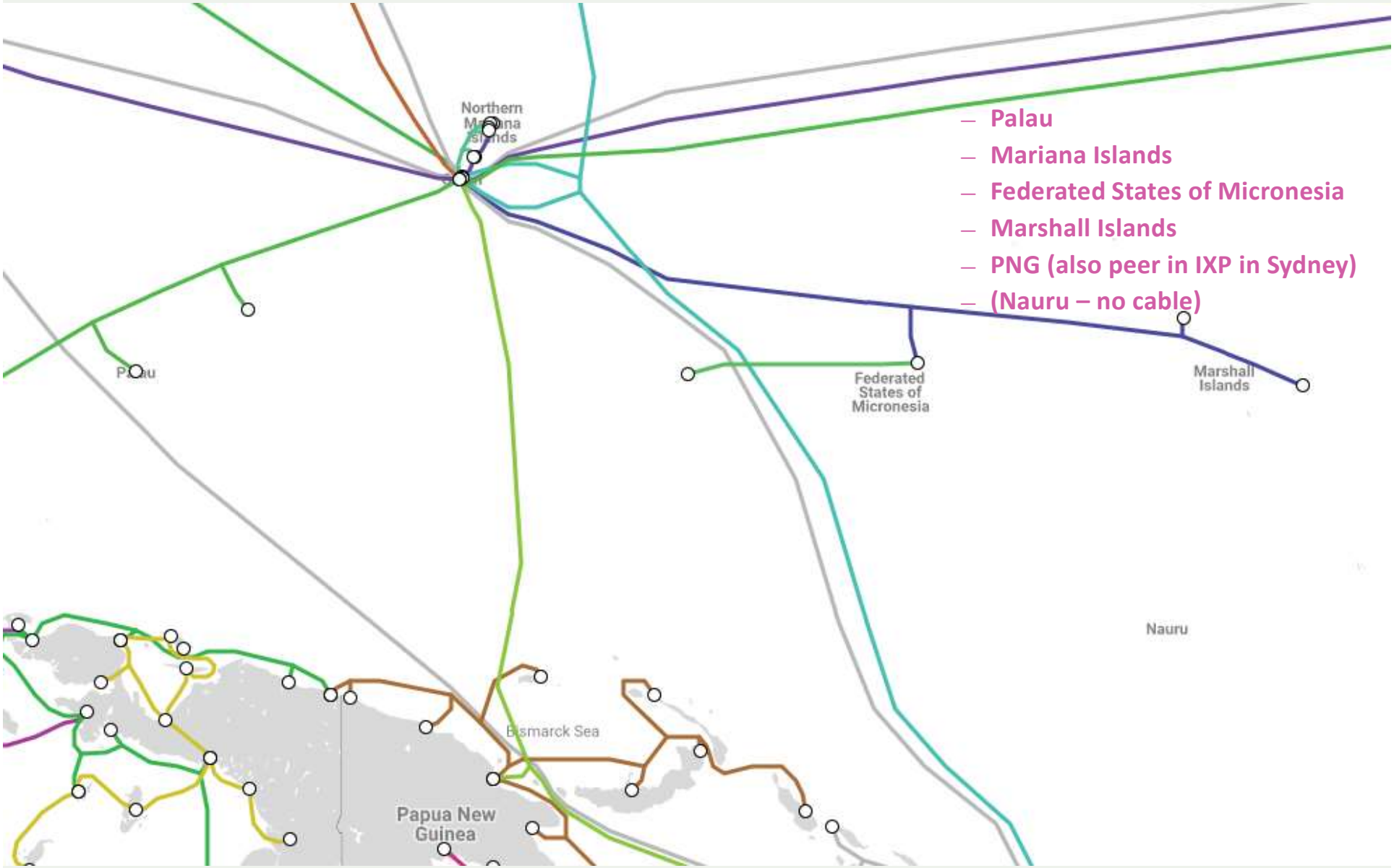
UNITED NATIONS ESCAP
Economic and Social Commission for Asia and the Pacific

Feasibility Study - Optimising location of South Pacific Region IXP

Subsea Cables – Two Pacific Zones

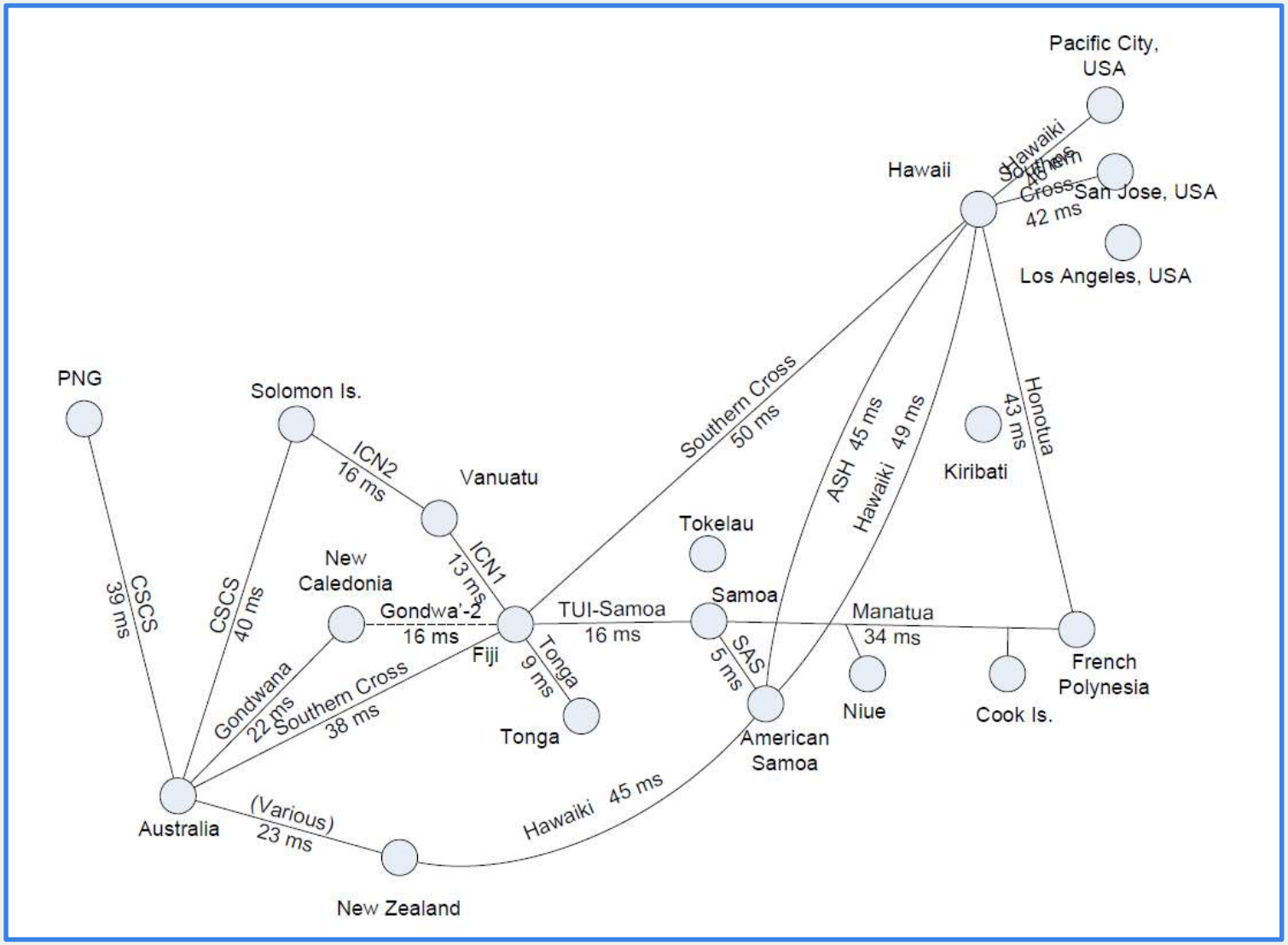


Northern Group – All can connect to Guam, and GU-IX/MARIIX



- Palau
- Mariana Islands
- Federated States of Micronesia
- Marshall Islands
- PNG (also peer in IXP in Sydney)
- (Nauru – no cable)

Southern Islands Group - Subsea Cable topology graph with round-trip latency per segment



Selection Criteria – IXP Location

Diversity/Redundancy for Reliability

- Location should have at least two, ideally more, cable paths using different cable systems

Minimise Latency for best performance

- Location should minimise aggregate latency from the collection of all Pacific Island Members

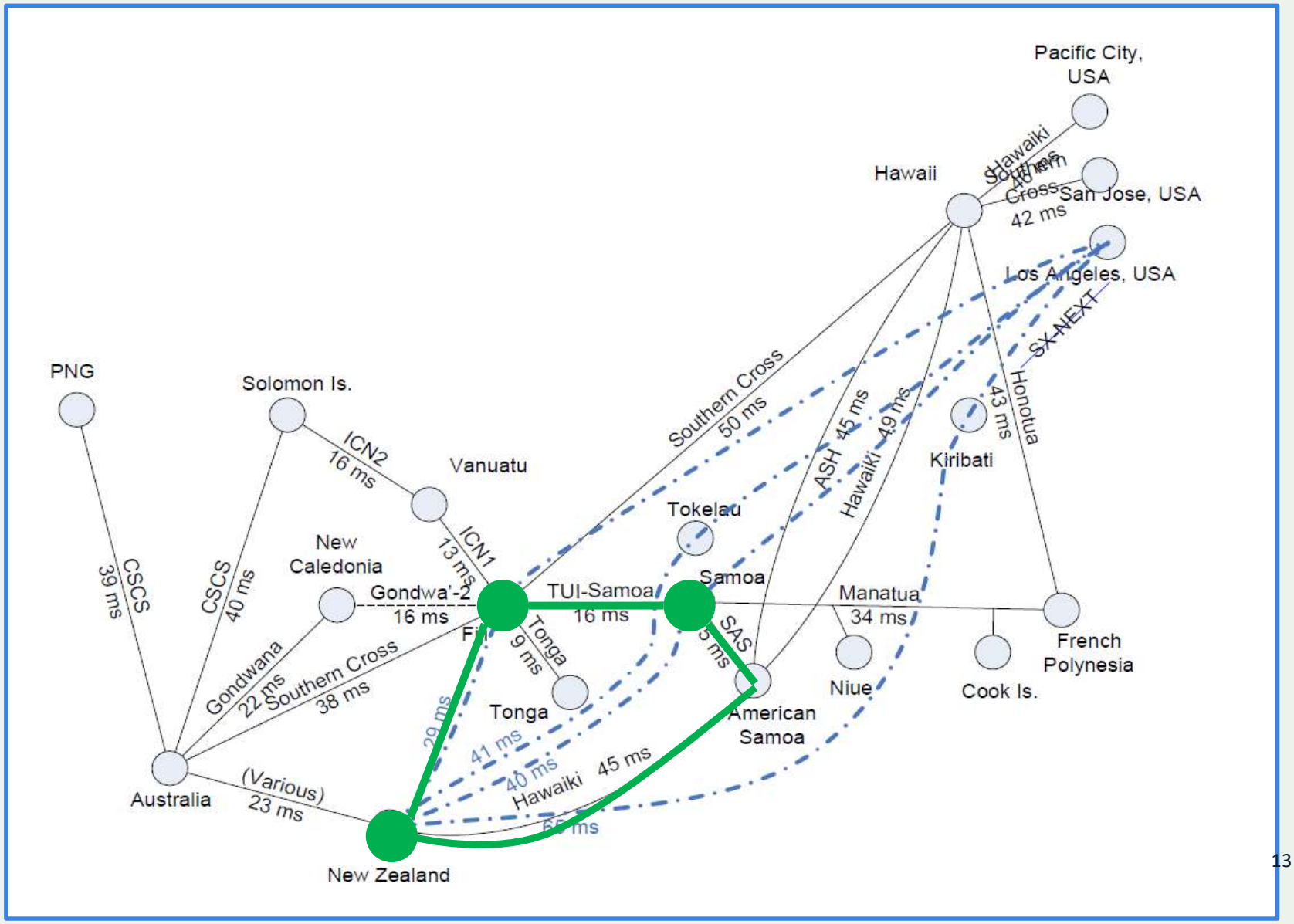
Low Cost Backhaul

- Abundant and low cost to connect from Landing Stations to the IXP datacentre (terrestrial fibre), ideally with infrastructure-based competition



(KIXP - Kenya)

Consider Distributed IXP – linked switches in Fiji, Samoa, New Zealand, forming a diverse loop using diverse cables…



Consider NZ, Fiji, Samoa as possible IXP locations

- Find lowest-latency path from each country to target location
- Calculate 'Weighted Average Latency' - Weighting by 'Internet Users' per country
- Identify location for IXP that minimises average latency across all paths

Country	Population	Internet Users		Latency to NZ	Weighted Latency
Fiji	926276	425680		29	11.24
New Caledonia	282754	201000		45	8.24
French Polynes	290373	195275		74	13.16
Solomon Is	660121	69859		58	3.69
Vanuatu	288037	66613		42	2.55
Samoa	201316	58508		40	2.13
Tonga	106398	42552		38	1.47
American Sam	50826	17000		45	0.70
Kiribati	109367	14649		65	0.87
Cook Is	11700	5160		66	0.31
Niue	1618	1090		44	0.04
Tokelau	1285	805		41	0.03
TOTAL	2930071	1098191		54.08	**44.42**
					NZ

Almost identical benefit, whether IXP is in Fiji or Samoa

Average Latency ~ 27 milliseconds

Weighted Average Latency ~16 milliseconds

Consider NZ, Fiji, Samoa as possible IXP locations

- Find lowest-latency path from each country to target location
- Calculate 'Weighted Average Latency' - Weighting by 'Internet Users' per country
- Identify location for IXP that minimises average latency across all paths

Country	Population	Internet Users	Latency to NZ	Weighted Latency	Latency to Fiji	Weighted Latency	Latency to Samo	Weighted Latency	Latency to closest	Weighted Latency
Fiji	926276	425680	29	11.24	0	0.00	16	6.20	0	0.00
New Caledonia	282754	201000	45	8.24	60	10.98	32	5.86	32	5.86
French Polyne	290373	195275	74	13.16	50	8.89	34	6.05	34	6.05
Solomon Is	660121	69859	58	3.69	29	1.84	45	2.86	29	1.84
Vanuatu	288037	66613	42	2.55	13	0.79	29	1.76	13	0.79
Samoa	201316	58508	40	2.13	16	0.85	0	0.00	0	0.00
Tonga	106398	42552	38	1.47	9	0.35	25	0.97	9	0.35
American Sam	50826	17000	45	0.70	21	0.33	5	0.08	5	0.08
Kiribati	109367	14649	65	0.87	94	1.25	105	1.40	65	0.87
Cook Is	11700	5160	66	0.31	42	0.20	26	0.12	26	0.12
Niue	1618	1090	44	0.04	20	0.02	4	0.00	4	0.00
Tokelau	1285	805	41	0.03	70	0.05	81	0.06	41	0.03
TOTAL	2930071	1098191	54.08	**44.42**	41.75	**25.55**	41.25	**25.36**	**26.67**	**15.99**
				NZ		**FIJI**		**SAMOA**		**All THREE**

Almost identical benefit, whether IXP is in Fiji or Samoa

Average Latency ~ 27 milliseconds

Weighted Average Latency ~16 milliseconds

Benefits of Distributed IXP

- **Fairness – reduced costs for those countries not directly hosting a node**
- **Economies-of-scale through aggregation of trunks between nodes**
- **Optimised latency reduction: in-country traffic stays in-country as well as in-region**
- **Loop provides diversity even if a cable breaks**
- **NZ is a major node with existing global transit backbones, Akamai/Cloudfront/AWS caches for 'quickstart' performance benefits**

Next Steps

- ESCAP secretariat to set up an intergovernmental Working Group to discuss and agree on the operational principles and modalities of the Pacific IXP
- Build Detailed Not-For-Profit Break-even Financial Model
  - Estimate Cable Capacity Required between nodes
  - Determine Capacity Costs between nodes
  - Cost Recovery Options – sharing costs equitably - Flat membership charges??
- Agree Detailed Design

- Pacific IXP is feasible – sufficient countries have sufficient cables and sufficient independent ISPs to interconnect on multiple paths
- Establish country IXPs to keep internal traffic internal
- Interconnect country IXP switches to form a pan-Pacific IXP mesh/ring
- If Pacific IXP is set up in either Fiji or Samoa:
  Average Latency between members ~ 42 ms
  Weighted Average Latency between members ~26 ms
- If Pacific IXP is set up in Fiji, Samoa AND New Zealand:
  Average Latency to IXP node ~ 27 ms
  Weighted Average Latency between members ~16 ms
- North Pacific members should consider joining IXPs in Guam

Pacific-IXP – Economics and Operations Options Study

Andrew Khoo, Edgeconnect.io, August 2020

Existing IXPs in Pacific Islands

Fiji-IX and PNGIXP – both est 2017, being expanded

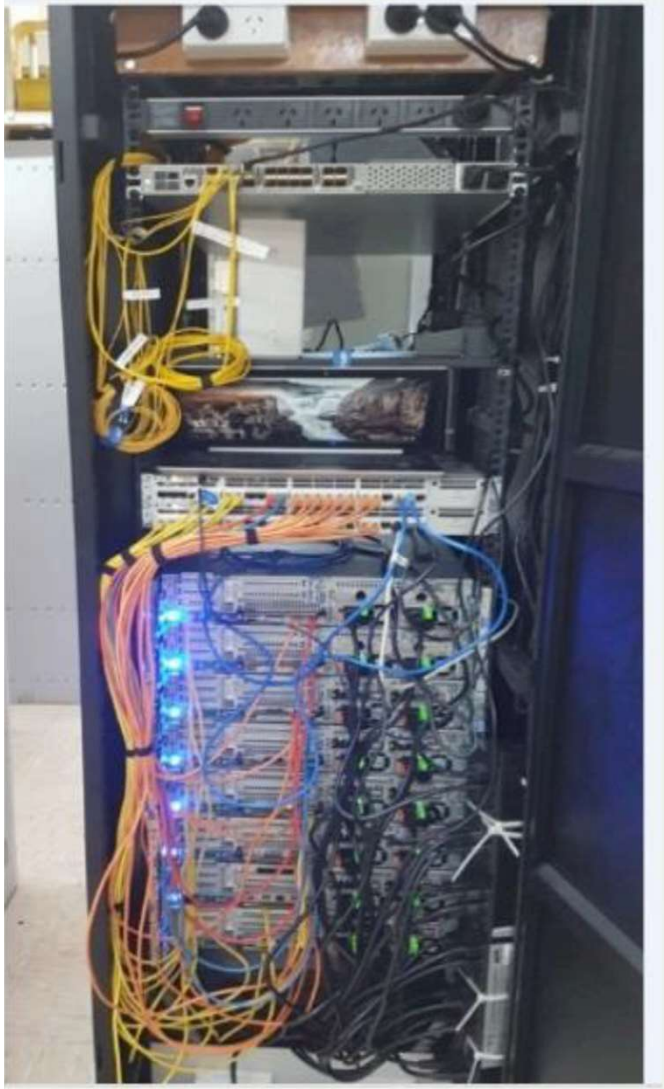
- **Not-for-Profit** – operational cost divided amongst members
- Fiji-IX Members are Carriers (4), Universities (7), plus one OTT provider, PNGIXP has 20 signatories and Google OTT caching
- Fiji-IX reviewing governance structure, developing agreement to grow and enable CDNS to join

Samoa IX – under development

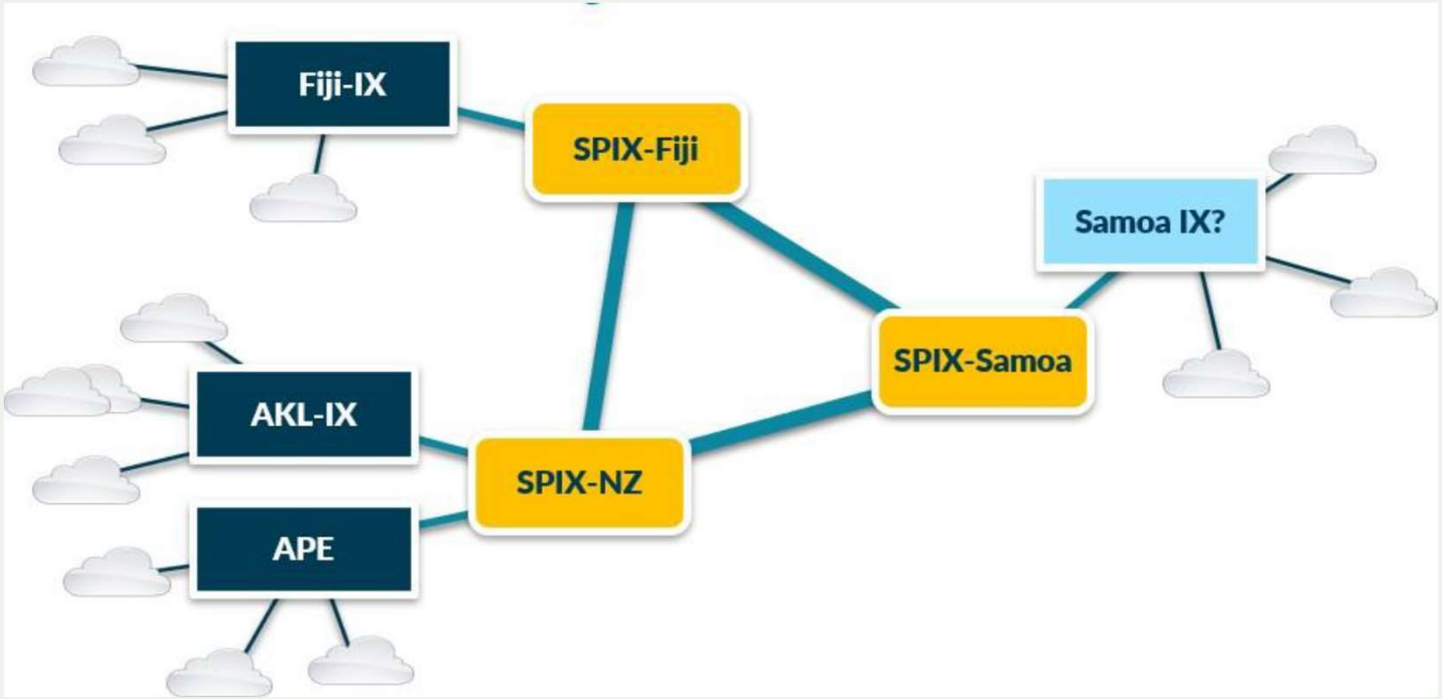
- MCIT developing policy
- Location selected near National University of Samoa
- Planned launch 2021

NZ – Three Major IXs

- NZIX – **not-for-profit, carrier-neutral**, 80+mems
- CityLink ExchangeNET – Commercial, multi-city
- Megaport MegaIX – Commercial



Topology



Nodes administratively distinct from national IXs

- Enables independent connection and peering policies

Nodes co-located with existing National IX fabrics in same or close building

- Members may save costs utilising same fibre links to connect to both
- NZ Node likely to be optimum in

Initially, nodes operated by members staff under secondment – longer term employ engineers as traffic grows

Budget and Establishment

Establishment

- Leverage APNIC support and 'IXP Development Package' to minimise costs to set up – **APNIC and Internet Society will support**

Operations Costs

- **Infrastructure – colocation rental, power, insurance** – might be supported by national IXs
- **Staffing – First 12 months staffed by members engineers,** then review workload
- **Staffing** – Min 2 – Administrative/Marketing, and Technical/Engineer
- **International Bandwidth**
    - equal costs born by each member, for first 12 months, then review utilisation
    - Approach cable operators to subsidise or donate bandwidth for regional development

Operating Principles

All participants should be stakeholders (members) including facilities providers

Transparency to all participants - traffic statistics available to all members

All participants are treated the same - size shouldn’t matter

Equal costs shared by participants (perhaps on port basis)

Operated as a not-for-profit to benefit all members regardless of nation

October 2020

Questions?

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Questions for Industry in Fiji

Regulation in Samoa

- **Would this IXP in Samoa be classified as a "Telecommunications Service Provider"?**
- **Would a Pacific-IX node in Samoa require a telecommunications license?**
- **Are there any other telecommunications regulations or reporting requirements we should to be aware of?**

Participants

To spread the costs widely and minimise cost to each member, it would be beneficial if as many types of organisations as possible were able to connect and participate.

- **Are there likely to be any regulatory restrictions on types of organisation permitted to connect and become a member of the Pacific-IX infrastructure? Will members need to be holders of telecommunications service provider licenses, or may non-license-holders connect also?**

Questions for Industry in Fiji

Structure

- Pacific-IX is proposed to be managed as a separate organisation to Fiji-IX national IXP, and carry international "Pacific-Islands-local" traffic – although most of the Fijian members are likely to be similar
- **Are Fiji-IX members supportive in principle with Fiji hosting a critical node in the proposed multi-site Pacific-IX?**
- **Are Fiji-IX members supportive of the model of Pacific-IX as a not-for-profit industry entity, or would you prefer a different structure?**

Oversight and Reporting

- **How would Fiji-IX prefer to be involved with the establishment or operation of Pacific-IX?**
    - (e.g. actively part of Steering Committee, or at arms-length with regular reporting, or another model?)

Questions for Industry in Fiji

Memorandum of Understanding

- Given all that we have covered today, would the Committee of Fiji-IX be willing to express support for the Pacific-IX project in a joint Fiji, Samoa and New Zealand 'Memorandum of Understanding' to be drafted?

- Given all that we have covered today, would Industry in Fiji be willing to support the **Minister for Communications** expressing support for the Pacific-IX project **on behalf of the Fijian Government** in a joint Fiji, Samoa and New Zealand 'Memorandum of Understanding' to be drafted?

Thank you.

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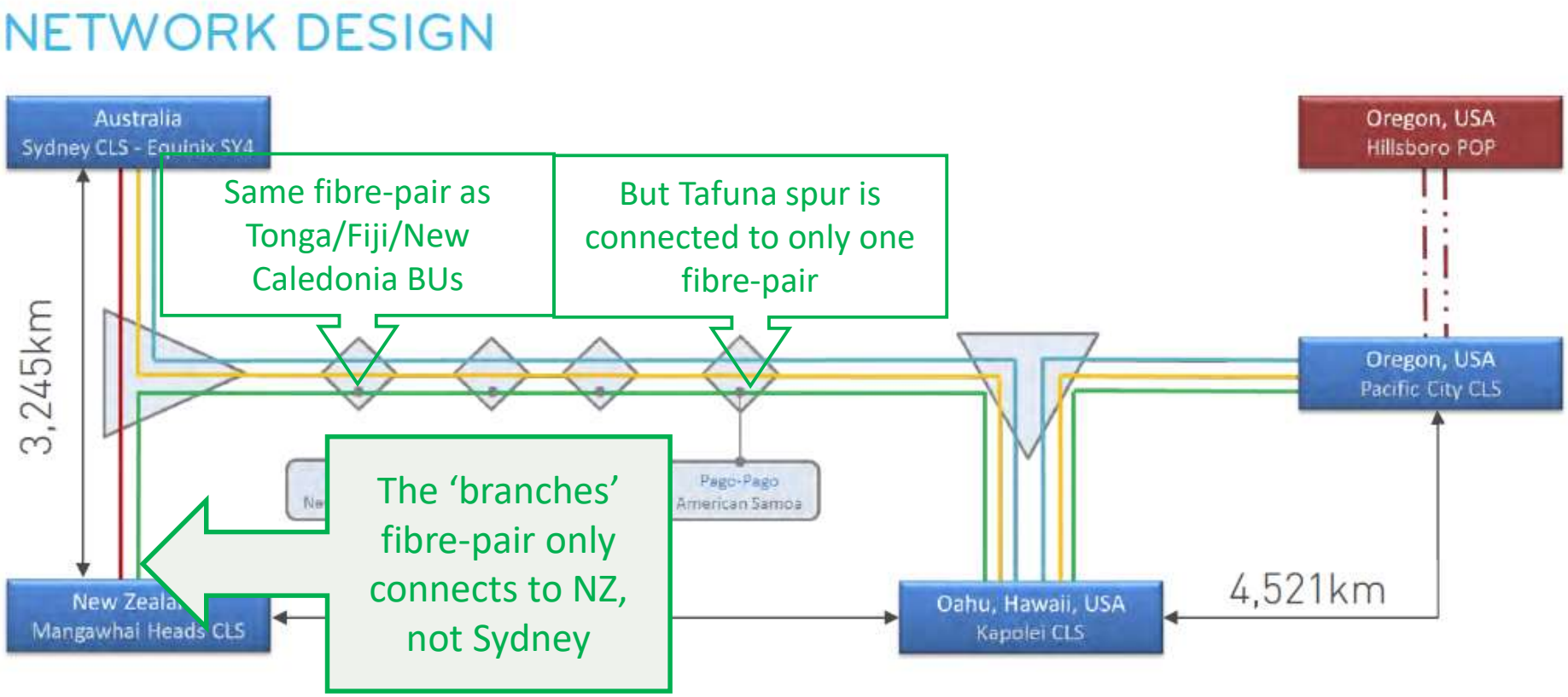
Subsea cable maps can be deceiving



Map shows

- Main trunk cable joins USA, Hawaii, Sydney, New Zealand
- Branch Units and spurs to American Samoa
- Unused Branch Units offshore Fiji, Tonga, New Caledonia for future use
- **Easy to assume spurs (American Samoa) can connect to Sydney, NZ, Hawaii and Fiji/Tonga/NC if short stubs are built – can connect any-to-any**

But ‘Straight Line Diagram’ shows American Samoa (and the other BUs) cannot connect to Sydney – wrong fibre pair

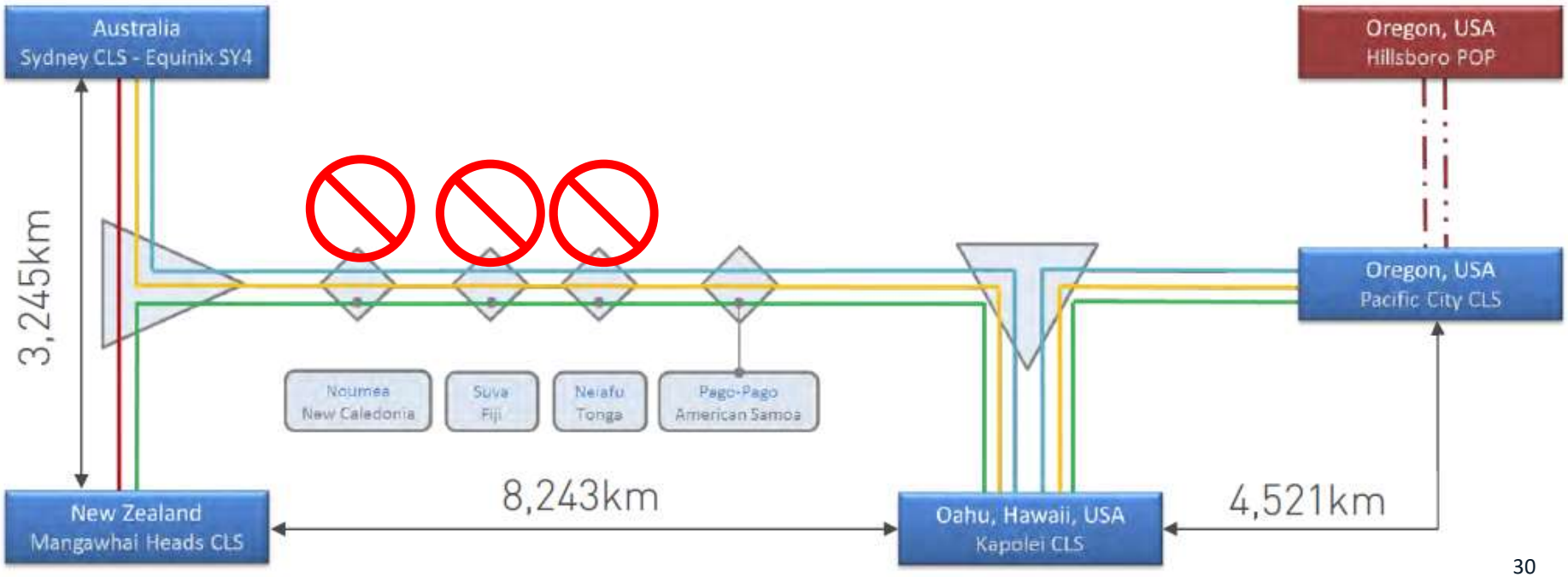


But – each spur is allocated on a different ‘wavelength’ – spurs can only see New Zealand and Hawaii

– American Samoa and new ‘Tomoo’ New Caledonia cannot connect directly

SX-NEXT is same design

NETWORK DESIGN



Southern Cross NEXT (RFS 2022)

Kiribati, Tokelau, Fiji will not connect directly, only to New Zealand or USA under this design



Add Southern Cross NEXT…Fiji, Samoa, Tokelau, Kiribati cannot connect directly, only hairpin through NZ or USA

