

Pacific Internet Exchange Point: Internet Service Providers Online Survey

Declaration and Disclaimer

This Report has been prepared by Dr Paul Brooks of Internet Australia for the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP), in support of the Asia-Pacific Information Superhighway initiative. In preparing this report, Dr Brooks has relied primarily on information from publicly available sources, best practices documents and our domain expertise. While reasonable measures were taken to confirm, verify and validate these sources, we offer no warranty, express or implied, regarding any information referenced within. The findings and recommendations of the study should not be reported as representing the views of the United Nations. The views expressed herein are those of the author. The study has been issued without formal editing, and the designations employed and material presented do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

To follow up aspects of this report, please contact:

Dr Paul Brooks
Internet Australia
Email: paul.brooks@internet.org.au

18 April 2023.

Acknowledgement

This report was prepared Paul Brooks under the guidance of Tiziana Bonapace, Director of ICT and Disaster Risk Reduction Division (IDD) of the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP). Tae Hyung Kim, Siope Vakataki ‘Ofa, Quynh Nguyen, Ma Xiangning, and Cynthia Lu provided substantive inputs.

Table of Contents

Declaration and Disclaimer 2
Acknowledgement 3
1 Introduction 5
2 Online survey design 7
4. Results 11
4.1 Cables and bandwidth current capacity and future requirements 11
4.2 Peering Exchange Presence 13
4.3 Potential demands for connection to the Pacific IXP 14
5. Conclusion and next steps 15

1 Introduction

According to ESCAP studies, [1] the Internet traffic routes in the Pacific can be divided into two groups, one in the North and the other in the South. Countries in the North Pacific group tend to be interconnected by subsea cables converging in Guam, which has traditionally (along with Hawaii) been used as a regeneration point and hub location, and increasingly as a point of interconnection for cables in this North Pacific region. Several existing IXPs operate in Guam, enabling Internet providers of North Pacific island countries around Guam to interconnect and exchange traffic.

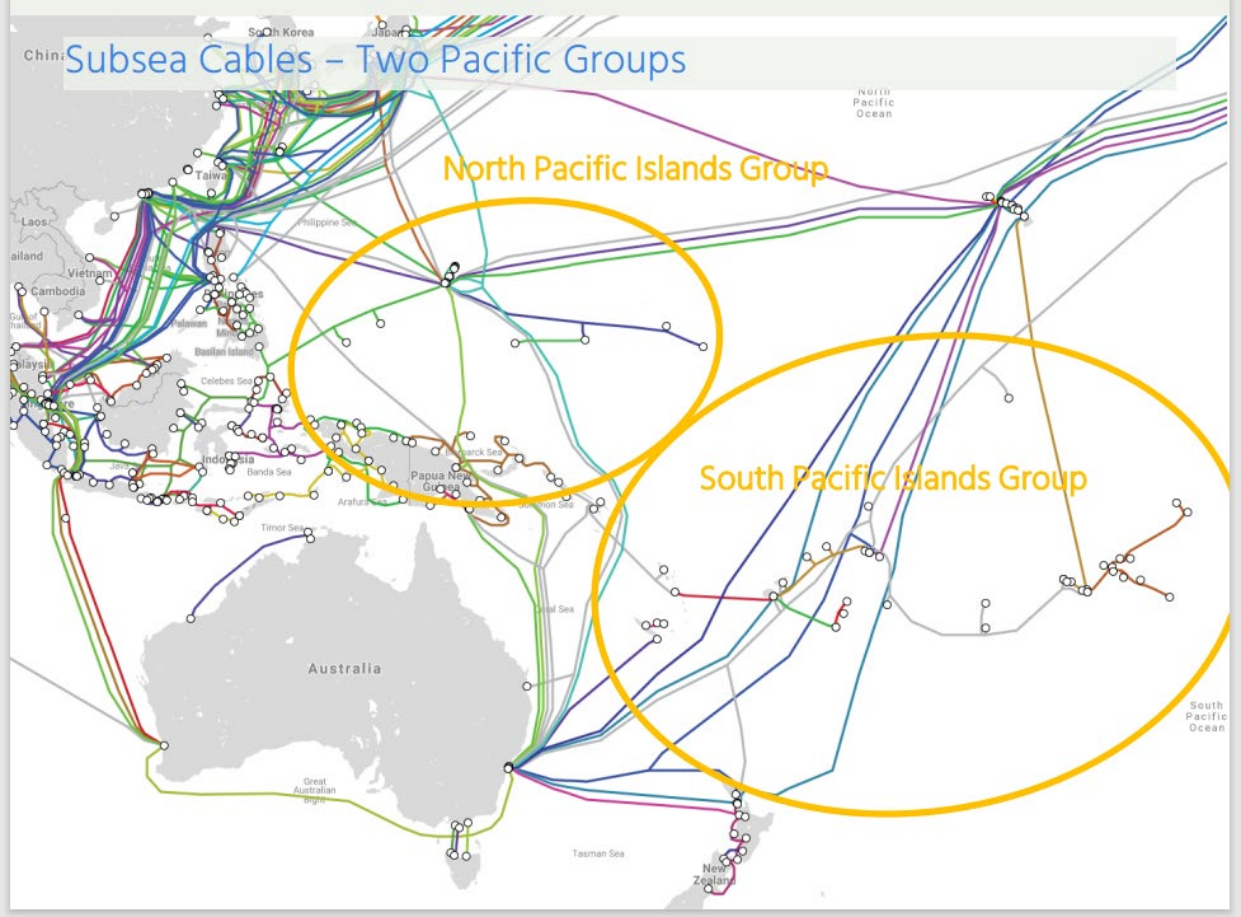
Countries in the South Pacific group, by contrast, have traditionally been poorly served by subsea telecommunications cables until recently. In many cases, trans-Pacific cables between Australia, New Zealand and Hawaii have been laid that bypass smaller Pacific island nations without landing, so they cannot be used. International Internet service in most of these South Pacific island countries has traditionally been achieved using satellite technology, which has struggled to keep pace with increased demand for reliable, low-cost and high-capacity connections.

South Pacific Island communications traditionally uses satellite links, which is a high-latency solution that doesn't provide local interconnection. In recent years, several subsea optical fibre cables have been built amongst the southern Pacific islands, and trans-Pacific cables increasingly link the islands to global Internet hubs in Australia, New Zealand and the United States. The Pacific-IXP proposal is to utilize these cables to enable every Internet provider in every Pacific island nation a low- latency connection point to interconnect with all other member networks, while minimizing the number of subsea 'cable hops' required to connect.

[1] For further details, see Pacific IXP Feasibility Study and Operating Guideline.

Figure1. ***North-Pacific and South-Pacific Island Countries and subsea cables.***

Pacific Island countries form naturally into two distinct groupings for telecommunications cable purposes.



Pacific-IXP

An Internet Exchange Point (IXP) to benefit all South Pacific countries. A single integrated Internet fabric spanning multiple anchor 'node sites', providing every Internet provider in every Pacific island country a low-latency connection point to interconnect with all other member networks, while minimizing the number of 'cable hops' required to connect.

Source: Brooks, P, "Pacific-IX Desktop Feasibility Study", Internet Society, December 2019. Available at https://www.unescap.org/resources/pacific-internet-exchange-point-feasibility-study

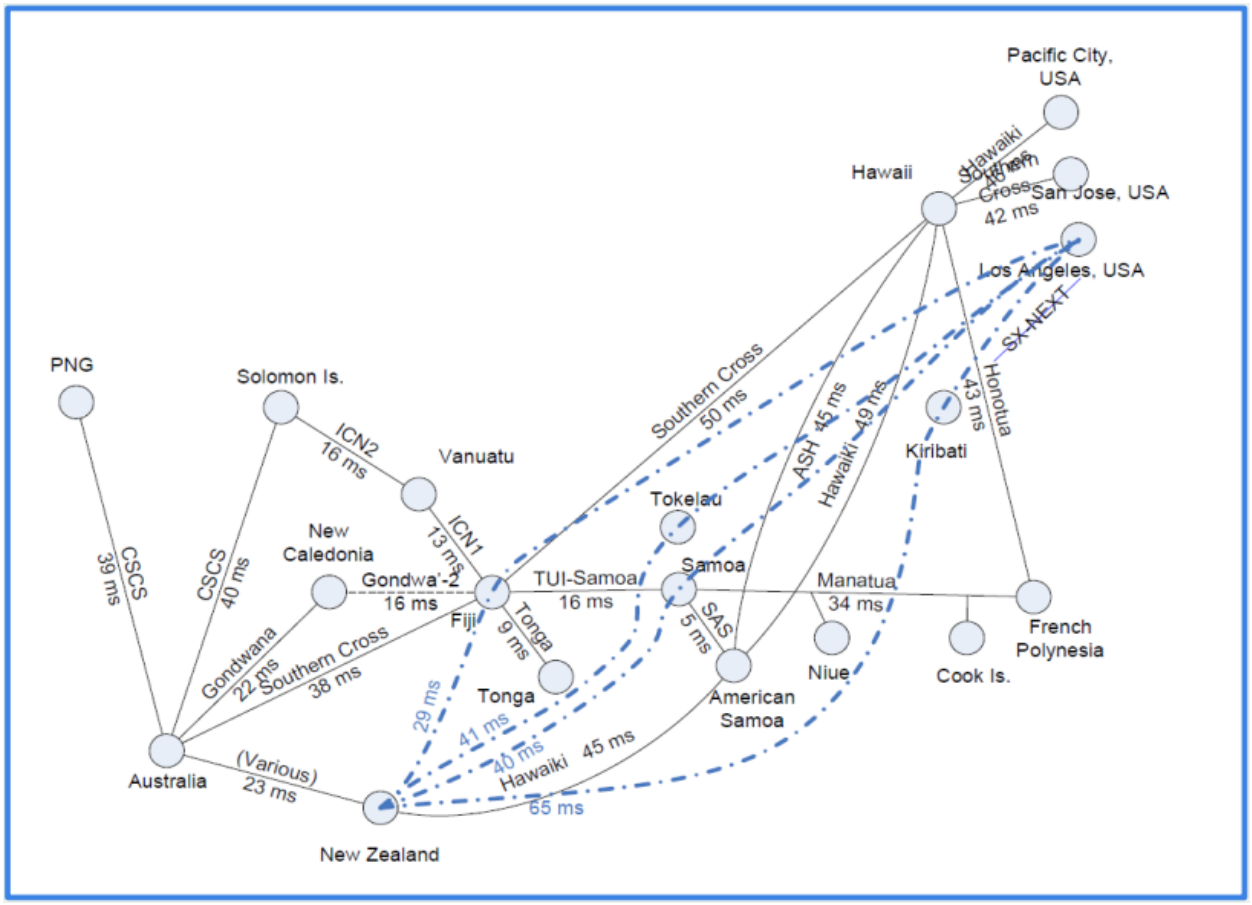
2 Online survey design

The objective of the online survey is to mapping the status, programmes and plans on Internet services in Pacific island countries, in particular among Pacific Internet service providers (ISP), and assessing emerging demands for Internet traffic bandwidth with the focus on Pacific IXPs.

The online survey of Pacific Island ISPs is to collect potential customers (ISPs) demand for the Pacific -IXP project if established. The online survey was distributed to the major ISPs in South Pacific island countries identified in earlier studies as candidates for connecting to Pacific-IXP (see Figure 2).

Figure 2. South Pacific Islands cable latency graph and Pacific-IXP nodes.

Map of South Pacific Island subsea telecommunications cables by latency (one-way speed-of-light transit time in milliseconds)



Source: Brooks, P, "Pacific-IX Desktop Feasibility Study", Internet Society, December 2019. Available at https://www.unescap.org/resources/pacific-internet-exchange-point-feasibility-study

The online survey included 40 different ISPs, including government agency service providers, as list by Table 1.

Table 1: List of Countries and government agency service providers of the survey

	Country	Top Level Dc	Org Name	ASN
2	Fiji	.fj	Telecom Fiji/Connect Internet Servic	4638 + 45349
3	Fiji	.fj	Vodafone Fiji Limited	38442
4	Fiji	.fj	Fiji International Telecomunications	9241
5	Fiji	.fj	Digicel Pacific	45355
6	Tonga	.to	Digicel Tonga	38198
7	Tonga	.to	Tonga Communications Corp	38201
8	Tonga	.to	Tonga Cable Limited	132579
9	Tonga	.to	(Tongan Government)	N/A
10	Samoa	.ws	Bluesky Samoa/Vodafone Samoa	17993
11	Samoa	.ws	Digicell Samoa	38800
12	Samoa	.ws	CSL	38227
13	American Samoa	.as	ASTCA Pago Pago	9751
14	American Samoa	.as	Samoa Telco	Part of ASTCA
15	American Samoa	.as	BlueSky Pago Pago	23657
16	American Samoa	.as	(American Samoan Government)	N/A
17	Kiribati	.ki	Vodafone Kiribati (was Amalgamatec	134783
18	Kiribati	.ki	(Kiribati Government)	N/A
19	Niue	.nu	IUSN Foundation	10025
20	Niue	.nu	Niue Telecom	55885
21	Cook Islands	.ck	Telecom Cook Islands	10131
22	Cook Islands	.ck	(Cook Islands Government)	N/A
23	French Polynesia	.pf	ONATi (was OPT)	55943 & 9471
24	French Polynesia	.pf	VINI SAS	9471 see above
25	French Polynesia	.pf	VITI	56017
26	French Polynesia	.pf	(French Polynesia Government)	N/A
27	Vanuatu	.vu	Vanuatu IX	
28	Vanuatu	.vu	Telecom Vanuatu/Vodafone Vanuatu	9249
29	Vanuatu	.vu	Interchange Ltd	45495
30	Vanuatu	.vu	Wantok	45935
31	Vanuatu	.vu	(Vanuatu Government)	N/A
32	Solomon Islands	.sb	Solomon Telekom	45891
33	Solomon Islands	.sb	Solomon Islands Submarine Cable Co	139609
34	Solomon Islands	.sb	SATSOL Ltd	132468
35	Solomon Islands	.sb	Bemobile Solomon Islands Ltd	132462
36	Solomon Islands	.sb	(Solomon Islands Government)	N/A
37	New Caledonia	.nc	OPT	18200
38	New Caledonia	.nc	Offratel	56089
39	New Caledonia	.nc	CANL	17480
40	New Caledonia	.nc	(New Caledonia Government)	N/A
41	Tokelau	.tk	(no '.tk' domains, sites or addresses physicaly located in Tokelau)	
42	Tokelau	.tk	(Tokelau Government)	

Source: Brooks, P, 'Online survey data', Internet Australia, December 2022.

The survey sample included 28 ISPs across 12 Pacific island countries listed in Table 2.

Table 2: the list of countries and percentage of responses across 12 Pacific countries

Country	Population	Internet Users	Number of ISPs	Responses To Date	Answer Percentage
Fiji	926,276	425,680	4	4	100%
New Caledonia	282,754	201,000	3	1	33%
French Polynesia	290,373	195,275	2	1	50%
Solomon Island	660,121	69,859	4		0%
Vanuatu	288,037	66,613	3		0%
Samoa	201,316	58,508	3	1	33%
Tonga	106,398	42,552	3	2	67%
American Samoa	50,826	1,700	2		0%
Kiribati	109,367	14,649	1	1	100%
Cook Island	11,700	5,160	1		100%
Niue	1,618	1,090	2		0%
Tokelau	1,285	805	0	0	
Total	**2,930,071**	**1,098,191**	**28**	**10**	**36%**
			Responses		

Source: Brooks, P, 'Online survey data', Internet Australia, December 2022.

The survey covered 5 main sections of data as follow:

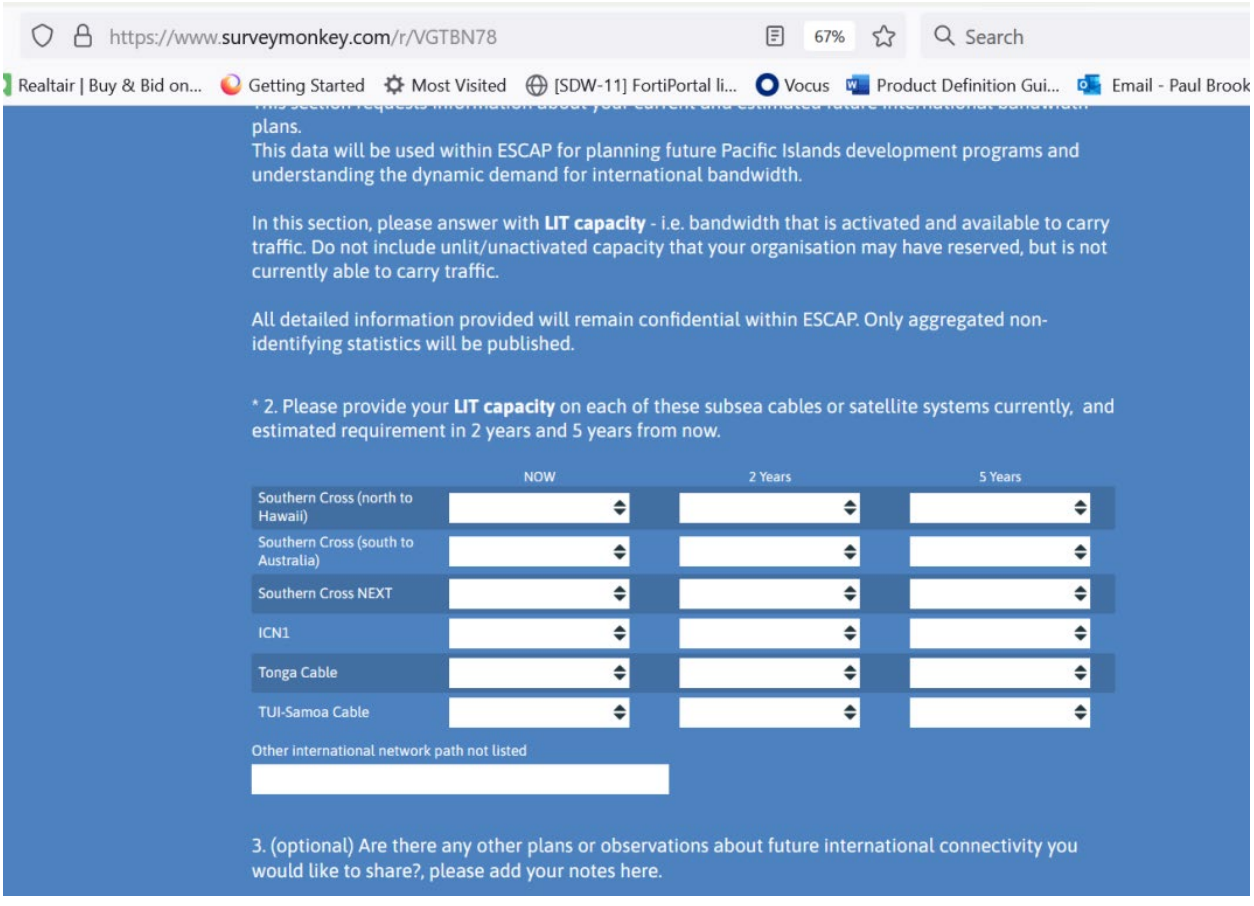
1. The International cable capacity, which activated from now, 2 years forecast, 5 years forecast.
2. The Upstream Internet transit providers, which activated from now and plans to increase or decrease up to 6 months, 2 years, 5 years forecast.
3. Peering Exchanges present at – now, increase/decrease over 6 months, 2 years, 5 years forecast.
4. Traceroutes to Fiji, Samoa, and New Zealand - to establish current baseline paths and latency to proposed Pacific-IXP nodes.
5. Likelihood of connecting to Pacific-IX, and interface port size likely required (for sizing of switches.

Each ISP received an individually customized survey incorporating details specific to that ISP:

- ASN
- Cable routes applicable for that country
- Upstream providers from public BGP-4 sources
- IXPs connected to
- Anticipated closest Pacific-IXP node and expected latency

Where possible, respondents were asked to confirm the details in public databases, instead of inputting data from scratch. The online survey was constructed using SurveyMonkey.com, and emailed a customized URL to each responded of which contacts was provided by the Pacific Islands Telecommunications Association (PITA).

Figure 3: Snapshot of online survey



Source: Brooks, P, 'Online survey data', Internet Australia, December 2022.

While developing the online survey, some challenges were encountered. The contacts from PITA consisted primarily of CEOs/Managing Directors, while survey focused on Chief Technology Officers/ network planners, and engineers. Hence, responses to the online survey relied heavily on recipient to forward within the organisation to someone with sufficient knowledge to answer the survey questions. Some of the contact details were out of date, left the company, or distinct provider networks have merged. As a result, significant time and effort spend on ongoing telephone follow-ups and investigation of each provider required to improve responses by identifying correct individuals and retargeting the survey emails to elicit response.

4. Results

4.1 Cables and bandwidth current capacity and future requirements

According to respondents, majority of subsea cable connections are currently running at less than 10 Gbps capacity, with some subsea cables utilizing whole 100Gbps channels, suggesting underutilization for many subsea cables.

Over the next 2 years, ISPs anticipate growing to 10Gbps per link technology, and over 5 years to move to multiple 100Gbps links. The aggregate capacity forecasted to grow only modestly over 2 years (~10%), but over 5 years to double (see Table 3 for details).

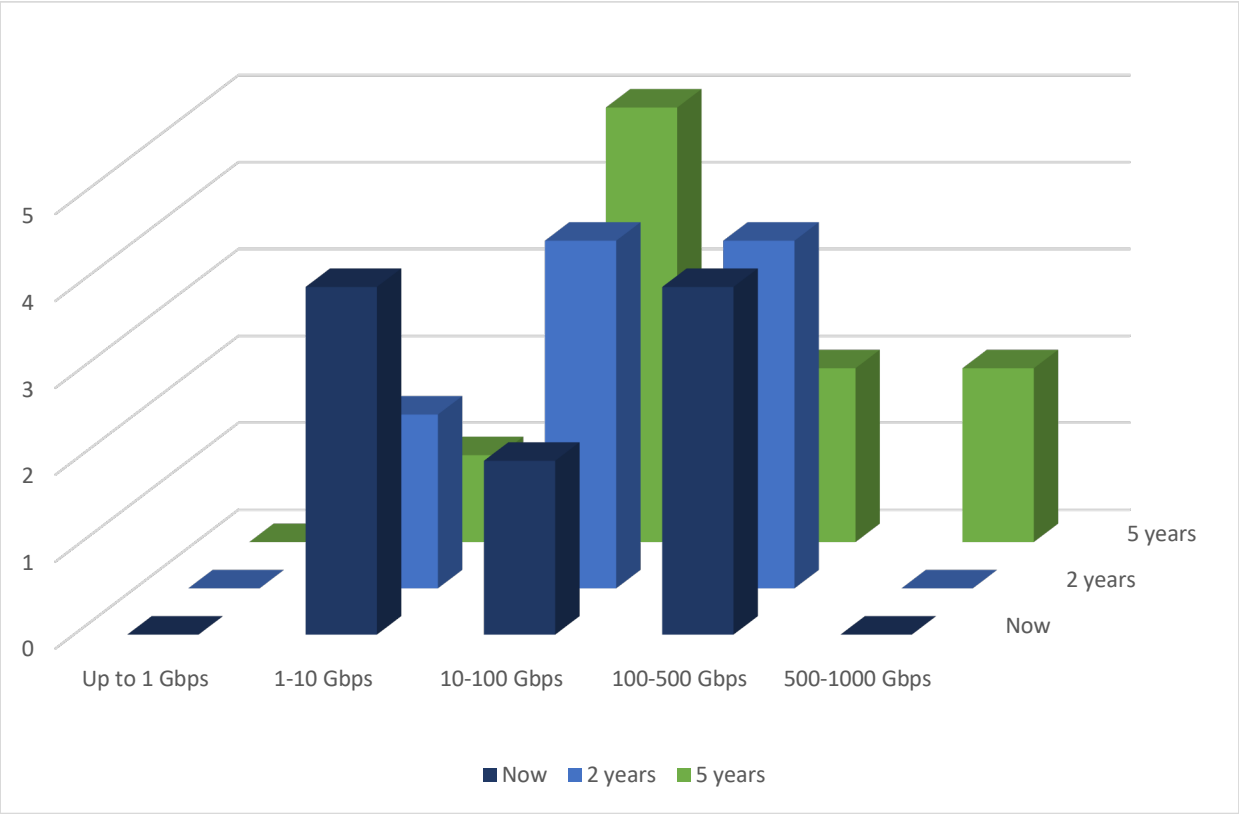
Table 3: LIT Capacity[2] of respondents

	Now	2 years	5 years
Up to 1 Gbps	0	0	0
1-10 Gbps	4	2	1
10-100 Gbps	2	4	5
100-500 Gbps	4	4	2
500-1000 Gbps	0	0	2
TOTAL (Gbps)	1,120	1,210	2,255

Source: Brooks, P, 'Online survey data', Internet Australia, December 2022.

[2] Lit capacity is the amount of capacity (measured in Gbps) that is actually running over a cable.

Figure 4: Aggregate subsea cable capacities of respondents



Source: Brooks, P, 'Online survey data', Internet Australia, December 2022.

When respondents were asked about any other plans about future international subsea cable connectivity, the respondent from Tonga indicated that the country requires another fibre optic cable for redundancy purposes as the existing cable has been severed twice in a 3-year period. The respondent from Tonga also mentioned that there's been an ongoing feasibility study, of a secondary/backup international connectivity but still at the preliminary stage with no decision if such redundancy connectivity would be a satellite or cable connection, what available capacity it can carry, and to which Point of Presence (POP) to connect to. A respondent from Fiji stated that Fiji would like to establish connection to all Pacific Island Countries whose cables are transiting or terminating in Fiji. New Caledonia indicated plans of a future submarine fiber optic cable between New Caledonia and Vanuatu, planned for 2025. The respondent from Samoa indicated that Samoa have *Kacific* satellite and O3b terminals on island with no committed capacity yet.

In assessing of current and future demand on proportion of incoming data from each upstream transit provider and future plans, majority of respondents are planning to retain the same or increase the number of upstream providers, primarily to access better routes to international destinations. While anecdotal, this response lends support to current and future expectation on increasing incoming data. However, two providers reported planning to reduce the number of upstream transit providers (see Table 4).

Table 4: Proportion of incoming data from each upstream transit provider and future plans of respondents

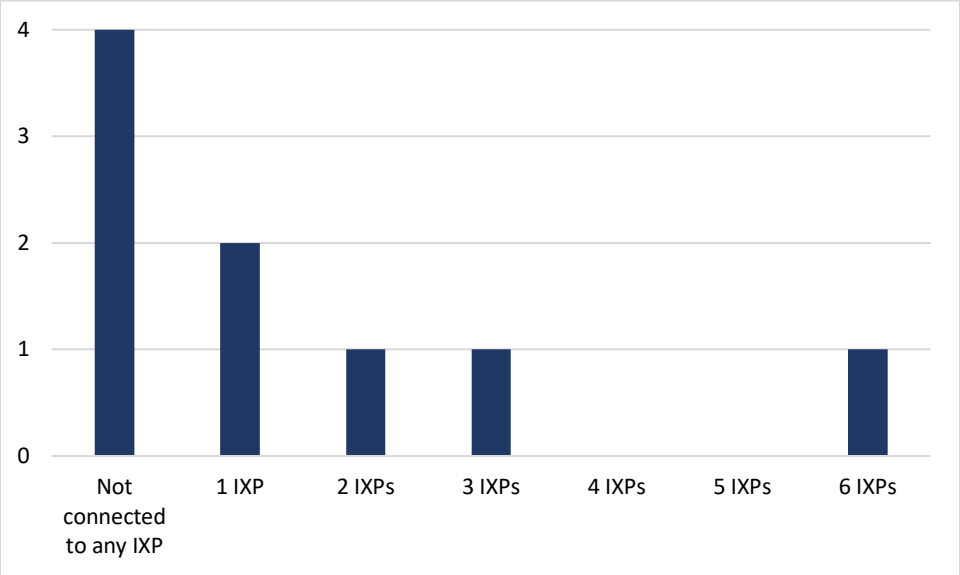
Number of Upstream providers			
	Increase/Decrease	Increase/Decrease	Increase/Decrease
	6 months	2 years	5 years
Increase	1	3	5
Remains the same	7	4	3
Decrease	1	2	1

Source: Brooks, P, 'Online survey data', Internet Australia, December 2022.

4.2 Peering Exchange Presence

Many ISPs do not have presence at any IXP (as there aren't any close by). Those that do are generally connecting to a national Internet exchange, while a small number have a link to peering centres in Australia. Most ISPs are planning to increase the number of IXPs they participate in, and expected to double in the next 5 years (see and Figure 5 and Table 5).

Figure 5: Number of IXPs used by ISPs



Source: Brooks, P, 'Online survey data', Internet Australia, December 2022.

Table 5: Plans of ISPs to increase the number of IXPs network connection

	Plan to increase/same/decrease connection to IXPs within 6 months	Plan to increase/same/decrease connection to IXPs in the next 2 years	Plan to increase/same/decrease connection to IXPs in the next 5 years
Increase	2	4	4
Remains the same	7	4	4
Decrease	0	1	1

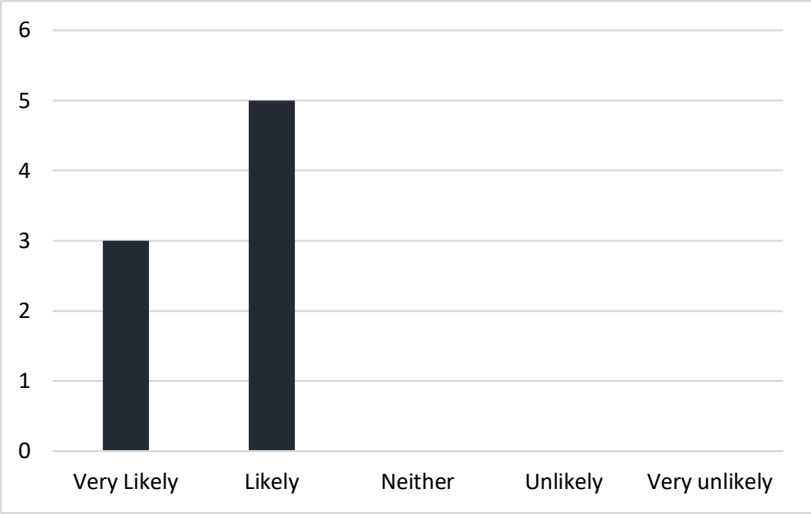
Source: Brooks, P, 'Online survey data', Internet Australia, December 2022.

4.3 Potential demands for connection to the Pacific IXP

Based on the subsea cable map, the Pacific IXP once established, is estimated achieve an average of 9 milliseconds connection speed within a network's shortest path. All respondents (100%) of the survey indicated that they were LIKELY or VERY LIKELY to connect to the Pacific IXP (see Figure

6). No responses selected any other option. This provides a strong indicator from ISPs of the potential demand for connecting to the Pacific IXP and highlighting the key role of a Pacific IXP on improving South Pacific island countries Internet connectivity. In addition, given the current 'distributive' nature of subsea cable connections in South Pacific island countries (with the exception of a few countries such as Fiji and Samoa, most have one subsea cable with one-on-one connection to another country), the Pacific IXP may be the most feasible modality that many of the providers can feasibly connect to.

Figure 6: Likeliness of ISPs to connect to a Pacific IXP



Source: Brooks, P, 'Online survey data', Internet Australia, December 2022.

5. Conclusion and next steps

In conclusion, the findings of this online survey highlight the following:

1. Majority of subsea cable connections are currently running at less than 10 Gbps capacity, suggesting underutilization. However, ISPs aggregate capacity forecasted to grow only modestly over 2 years (~10%), but over 5 years to double.
2. Majority of respondents are planning to retain the same or increase the number of upstream providers, primarily to access better routes to international destinations.
3. Many ISPs do not have presence at any IXP (as there aren't any close by). Most ISPs are planning to increase the number of IXPs they participate in, and expected to double in the

next 5 years.

4. All respondents indicated that they were LIKELY or VERY LIKELY to connect to the Pacific IXP.
5. ISPs provided various reasons for planning to increase connection to subsea cable including redundancy (Tonga), anticipating increasing demand (New Caledonia), better coordinating as a hub for subsea cables (Fiji), and exploring different types of technologies for improving digital connectivity (Samoa).

As a next step, the Taskforce on Pacific IXP may discuss the structure, governance, of a Pacific IXP entity. The key issues to discuss and agreed upon include:

- Membership (All participants should be stakeholders 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