8 September 2023

Australia's Internet Resilience Extends Beyond Its Borders

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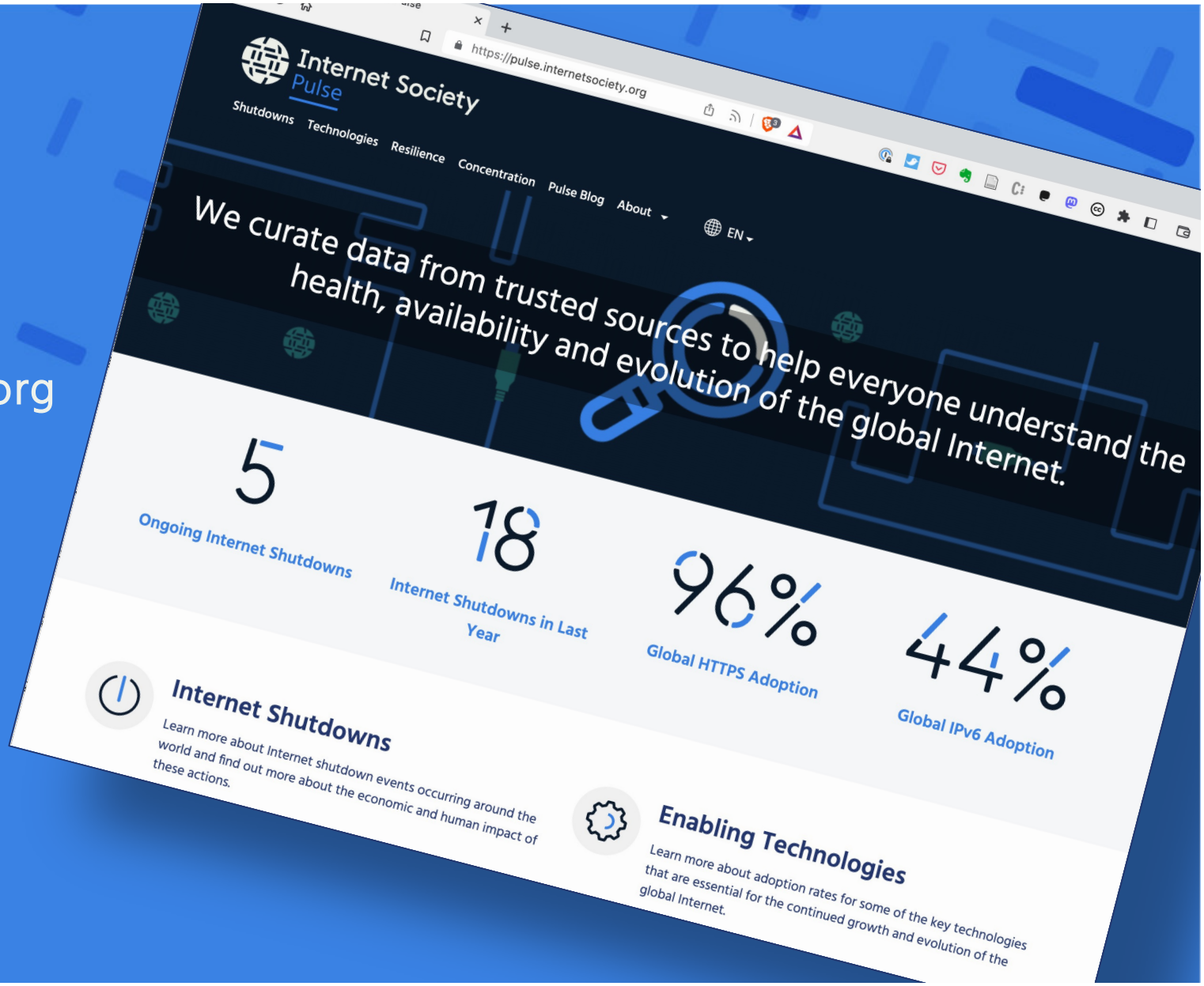
What we'll cover

- Three cases were Intrenet resilience has been compromised in Canada, Italy and Ukraine in the 18 months
- What can we learn from these mishaps to improve the resilience of the Internet in Australia
- How you can monitor and advocate for a more resilient Internet

pulse.internetsociety.org

Your Data Dashboard



Pulse tracks

Shutdowns: Where do Internet Shutdowns take place?

Technologies: What is the state of deployment of technologies critical for the evolution of the Internet.

Concentration: How much are services concentrated in the hands of a few?

Resilience: How robust is the Internet ecosystem?

Internet Resilience Index (IRI)

The Internet Resiliency Index (IRI)

The framework collates around 30 sets of public metric data that relate to **four pillars** of a resilient Internet:

.

Infrastructure

The existence and availability of physical infrastructure that provides Internet connectivity.

Performance

The ability of the network to provide end-users with seamless and reliable access to Internet services.

Security

The ability of the network to resist intentional or unintentional disruptions through the adoption of security technologies and best practices.

Market Readiness

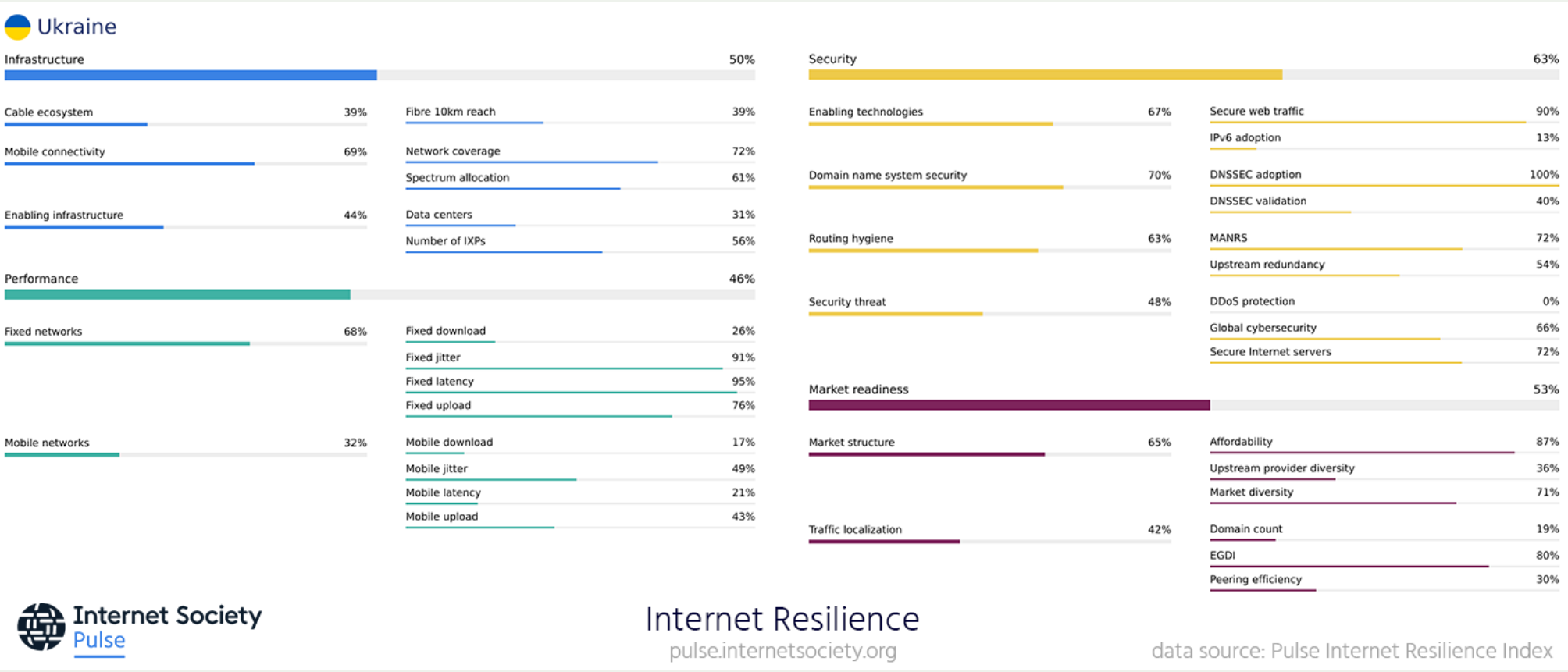
The ability of the market to self-regulate and provide affordable prices to end-users by maintaining a diverse and competitive market.

Methodology: https://pulse.internetsociety.org/wp-content/uploads/2023/07/Internet-Society-Pulse-IRI-Methodology-July-2023-v2.0-Final-EN.pdf

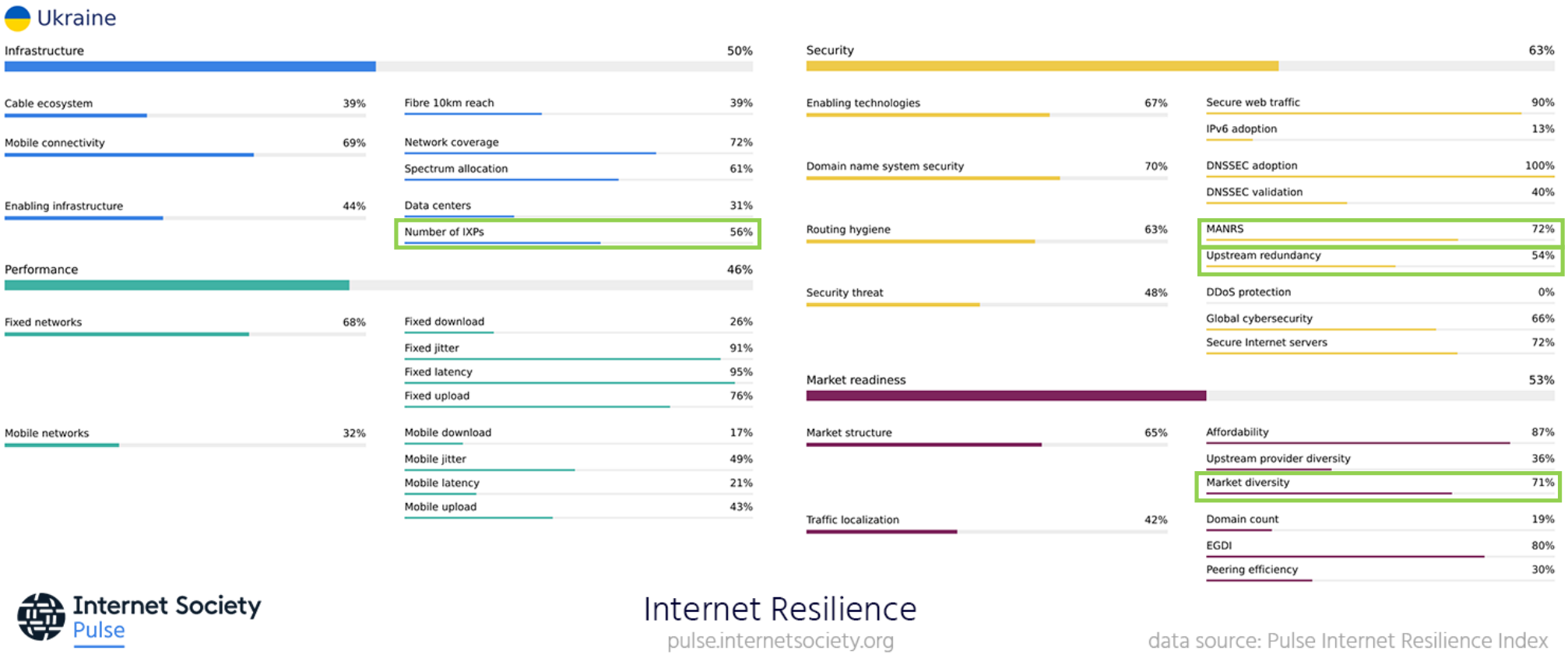
Ukraine: A Role Model for Internet Resilience

As reported by Amreesh Phokeer and Aftab Siddiqui on Pulse Blog:
https://pulse.internetsociety.org/blog/case-study-ukraine-a-role-model-for-internet-resilience
https://pulse.internetsociety.org/blog/ukraine-war-how-has-the-internet-changed-in-ukraine-12-months-on

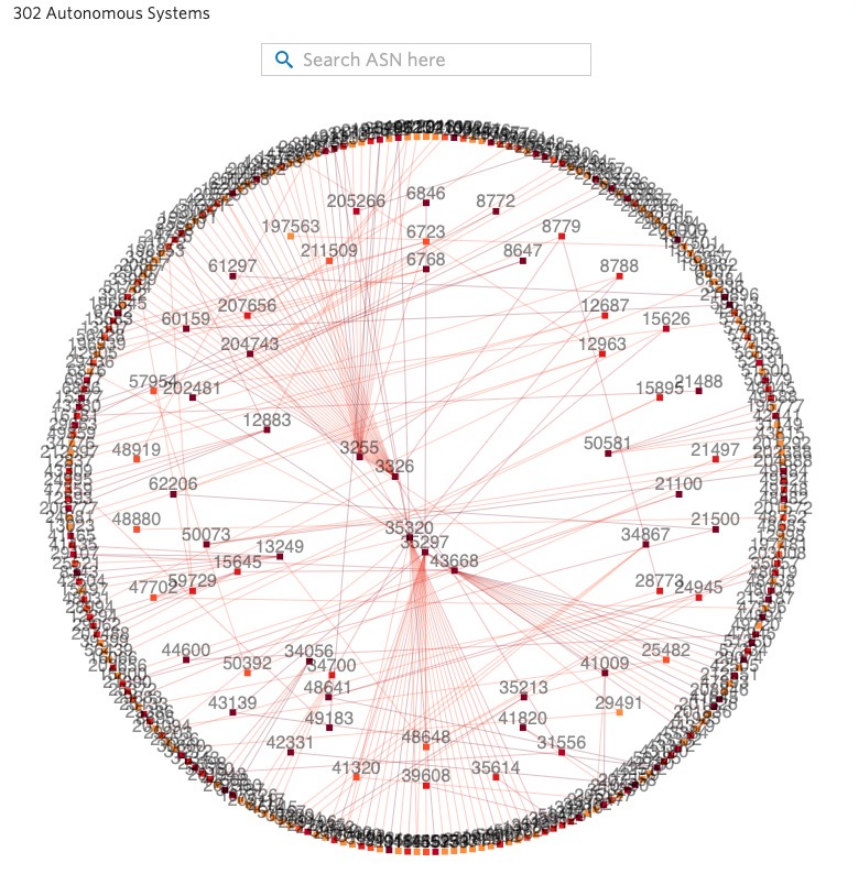
Ukraine– Internet Resilience Index

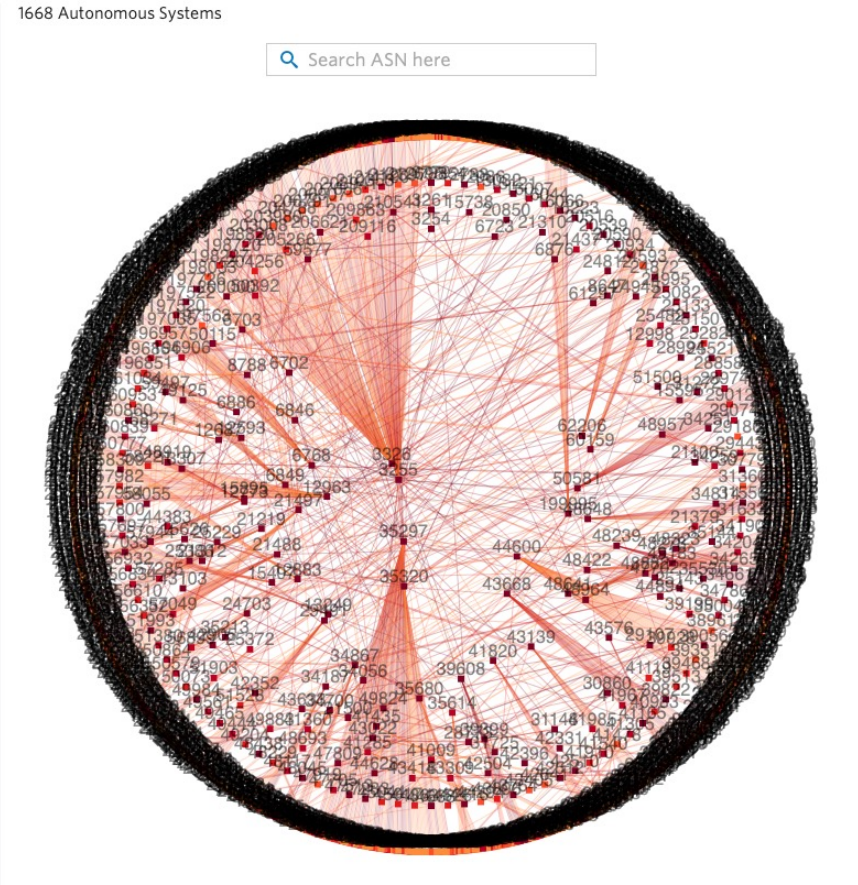


Ukraine– Internet Resilience Index



Ukraine – IPv4 and v6 Interconnection (APNIC REx)





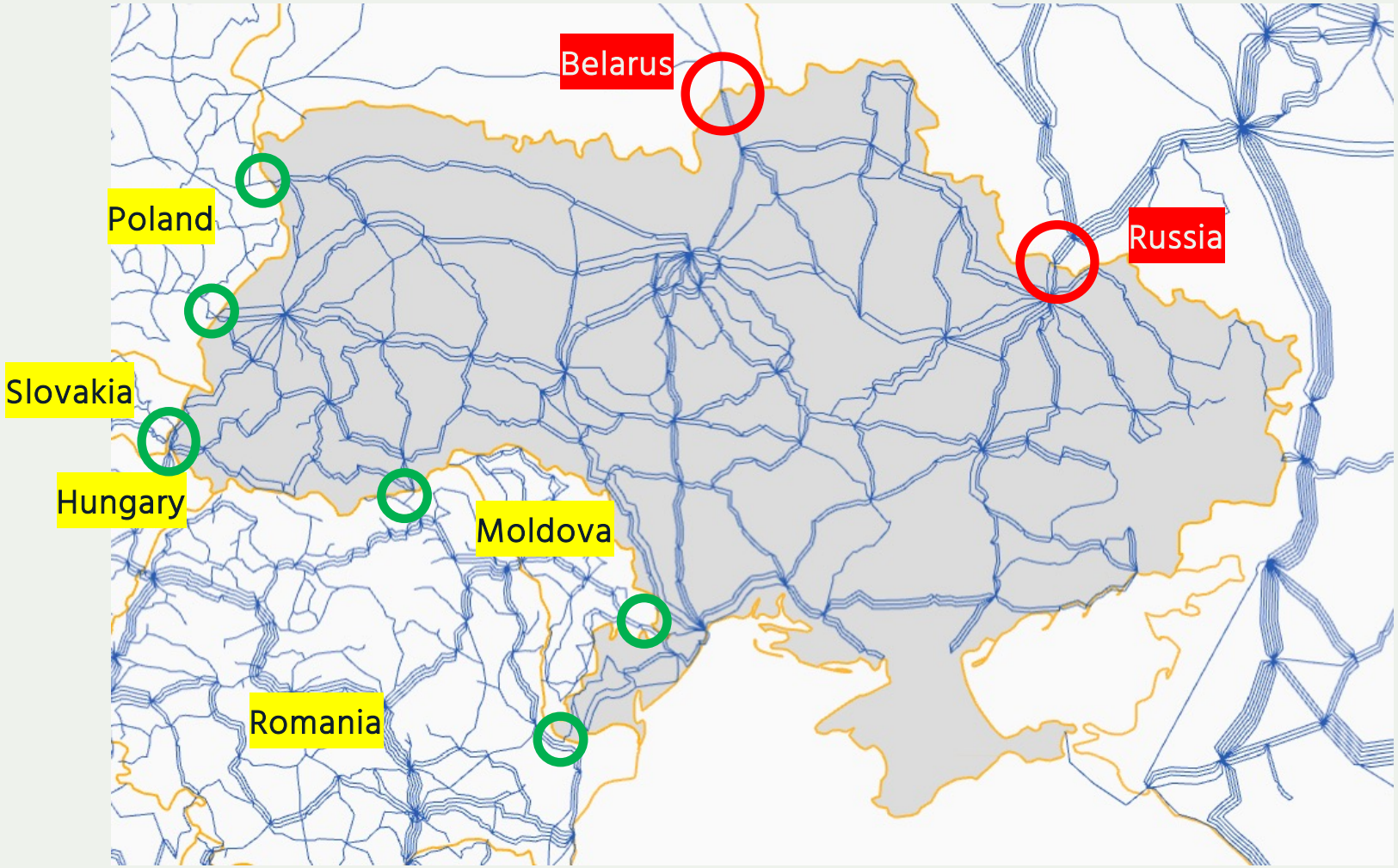
https://rex.apnic.net/as-interconnections?allocationType=ipv4,ipv6&economy=UA

Ukraine – ASN Dependency (IIJ Internet Health Report)

	Autonomous System	Population coverage			AS coverage
	Search	Total	Direct ↓	Indirect	Total
AS15895	KSNET-AS "Kyivstar" PJSC, UA	23.5%	22.5%	0.7%	1.5%
AS21497	UMC-AS PrJSC "VF UKRAINE", UA	10.0%	9.7%	0.2%	1.5%
AS34058	LIFECELL-AS Limited Liability Company "lifecell", UA	5.7%	5.6%	0.0%	0.1%
AS6849	UKRTELNET JSC "Ukrtelecom", UA	3.5%	3.3%	0.2%	1.5%
AS25229	VOLIA-AS Kyivski Telekomunikatsiyni Merezhi LLC, UA	3.2%	3.1%	0.1%	1.0%
AS13188	TRIOLAN CONTENT DELIVERY NETWORK LTD, UA	2.5%	2.5%	0.0%	0.1%
AS3255	UARNET-AS State Enterprise Scientific and Telecommunication Centre "Ukrainian Academic and Research Network" of the Institute for Condensed Matter Physics of the National Academy of Science of Ukraine (UARNet), UA	9.9%	2.1%	7.8%	11.6%
AS15377	FREGAT "Fregat TV" Ltd., UA	1.2%	1.2%	0.0%	0.1%
AS3326	Datagroup PRIVATE JOINT STOCK COMPANY "DATAGROUP", UA	6.9%	1.1%	5.8%	11.4%
AS31148	FREENET_LLC Freenet LTD, UA	1.2%	1.1%	0.1%	0.3%

https://ihr.iijlab.net/ihr/en-us/countries/UA?af=4&last=3&date=2023-08-24&rov_tb=routes

Ukraine – Exit Points



https://bbmaps.itu.int/bbmaps/

Rogers and a Nationwide Internet Outage

As reported by Jim Cowie on Pulse Blog:
https://pulse.internetsociety.org/blog/rogers-outage-what-do-we-know-after-two-months

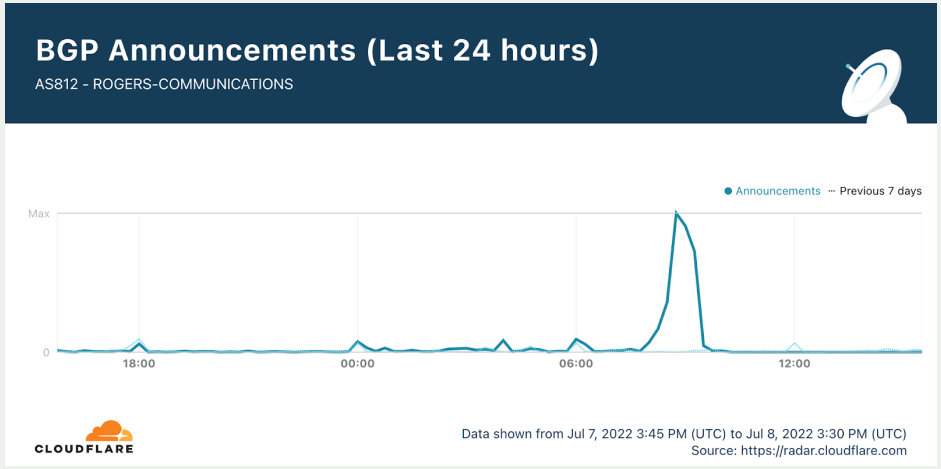
"We now believe we've narrowed the cause ***to a network system failure following a maintenance update in our core network****, which caused some of our routers to malfunction early Friday morning. We disconnected the specific equipment and redirected traffic, which allowed our network and services to come back online over time as we managed traffic volumes returning to normal levels."*

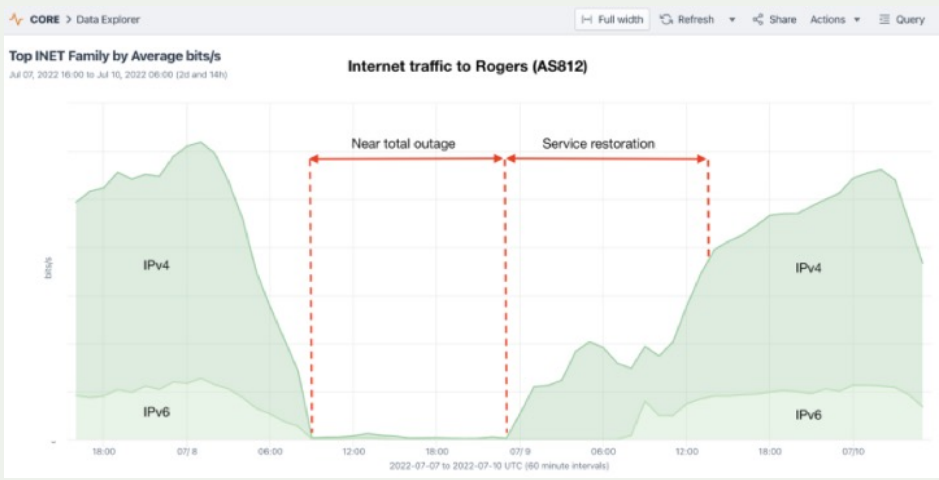
Initial communication from Rogers' CEO, 9 July 2022

What went wrong?

- Caused by a configuration change that deleted a route filter, flooding "*certain network routing equipment*"
- The outage affected Rogers' cable, mobile services (Rogers Wireless, Fido, and Chatr), and fixed-line telephone services, including access to 911 emergency services.
- Rogers' mobile customers overseas found themselves cut off

BGP Announcements by Rogers (AS812) between 7 and 8 July 2022, Cloudflare



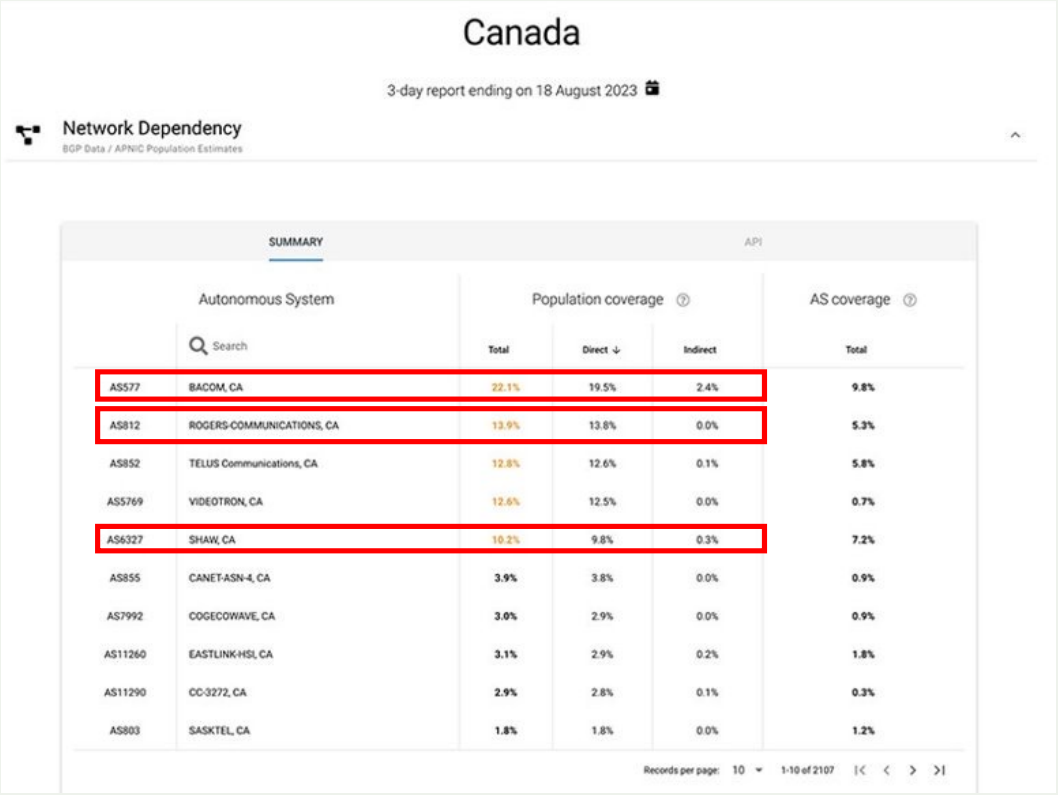


Internet traffic to Rogers (AS812) as seen by Kentik between 7 to 10 July

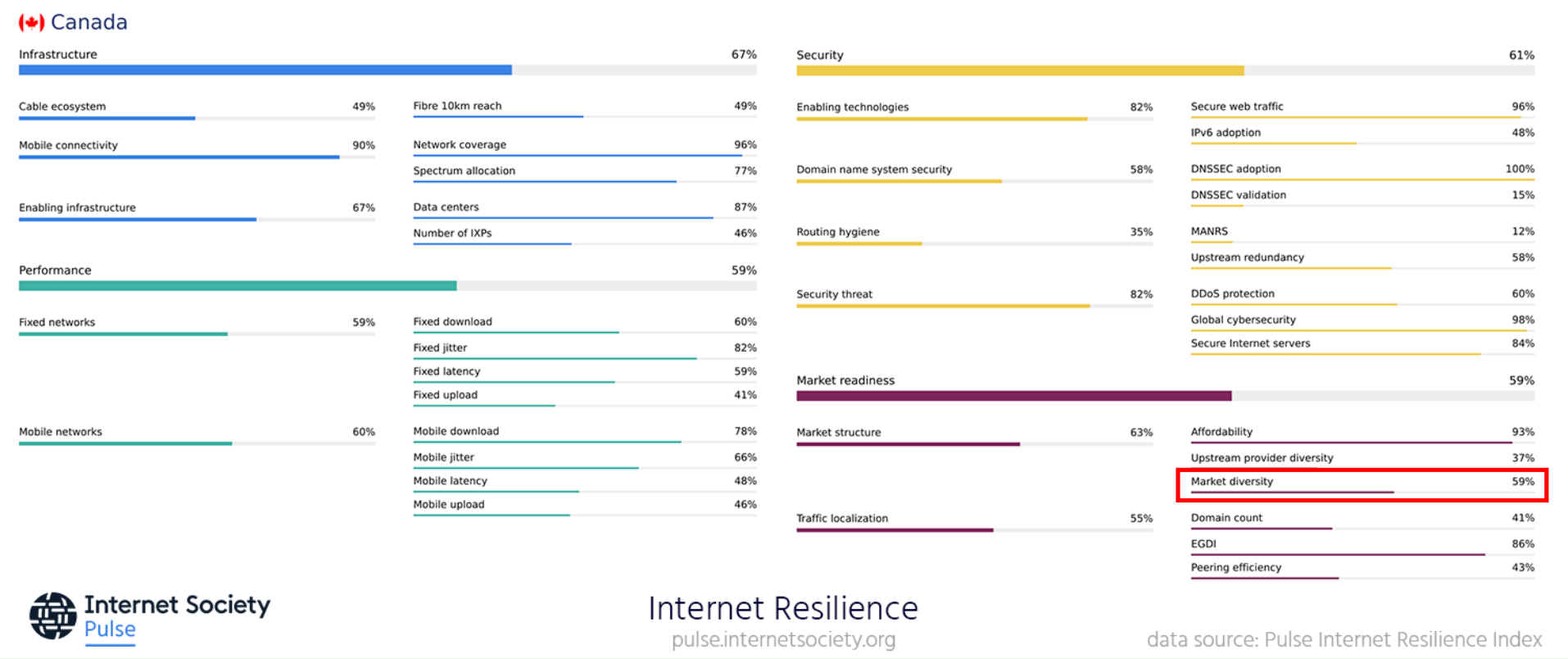
Canada — Centralization

Technological – separate networks > everything over IP

Market concentration – Rogers and Shaw merger will mean ~46% of market is controlled by two networks



Canada– Internet Resilience Index



Italy's Internet Outage a Perfect Storm

As reported by Max Stucchi on Pulse Blog:
https://pulse.internetsociety.org/blog/italys-internet-outage-a-perfect-storm

Italy – TIM dominate the market

AS6762 (Sparkle)— international carrier that serves as a transit provider for many networks in Italy, but does not directly serve any end users.

+

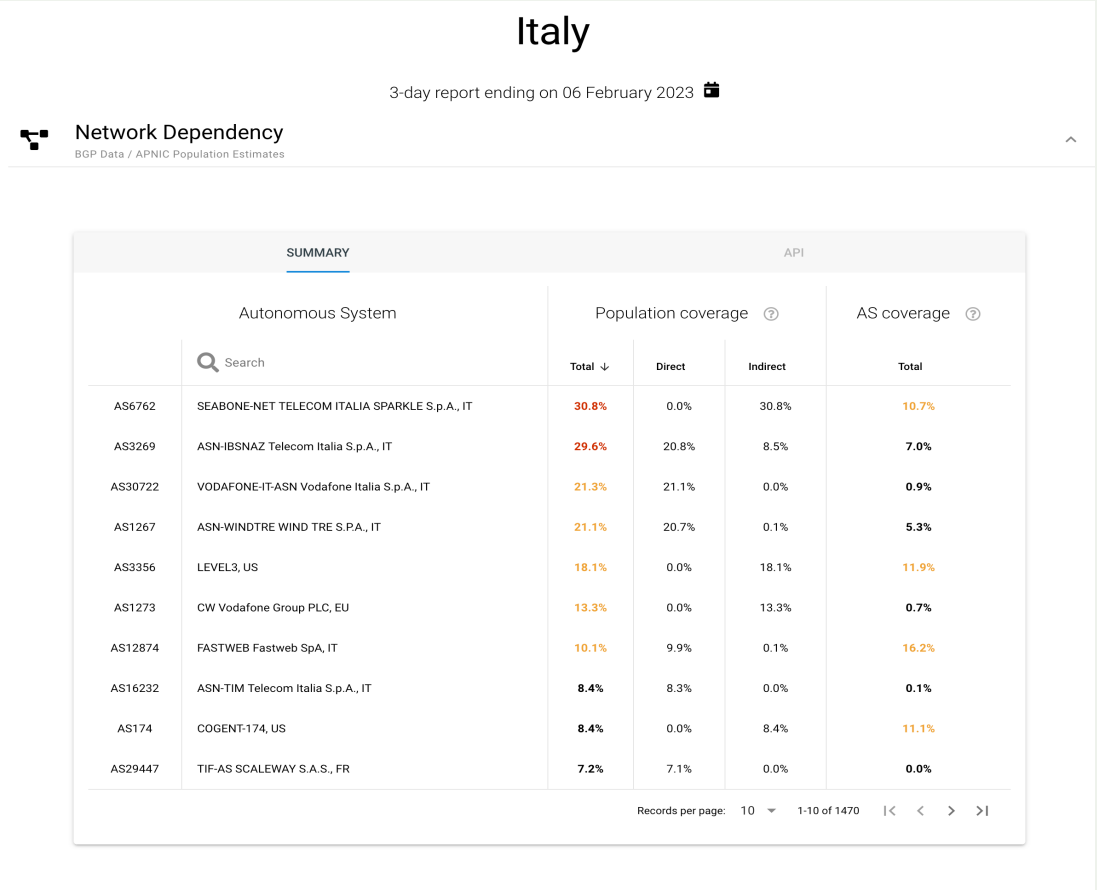
AS3269 — TIM's landline network directly serves 20.8% of the population and indirectly serves an 8.5% of the country's population.

+

AS16232 — TIM's mobile network serves 8.3% of the population

=

38% of Italy's inhabitants.



Italy

3-day report ending on 06 February 2023

Network Dependency

BGP Data / APNIC Population Estimates

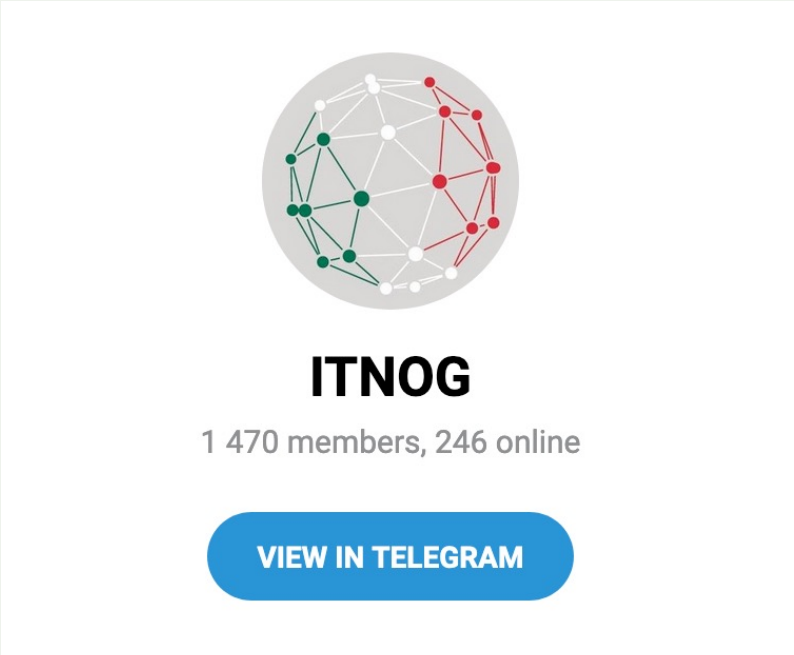
SUMMARY API

Autonomous System		Population coverage			AS coverage
	Search	Total	Direct	Indirect	Total
AS6762	SEABONE-NET TELECOM ITALIA SPARKLE S.p.A., IT	30.8%	0.0%	30.8%	10.7%
AS3269	ASN-IBSNAZ Telecom Italia S.p.A., IT	29.6%	20.8%	8.5%	7.0%
AS30722	VODAFONE-IT-ASN Vodafone Italia S.p.A., IT	21.3%	21.1%	0.0%	0.9%
AS1267	ASN-WINDTRE WIND TRE S.P.A., IT	21.1%	20.7%	0.1%	5.3%
AS3356	LEVEL3, US	18.1%	0.0%	18.1%	11.9%
AS1273	CW Vodafone Group PLC, EU	13.3%	0.0%	13.3%	0.7%
AS12874	FASTWEB Fastweb SpA, IT	10.1%	9.9%	0.1%	16.2%
AS16232	ASN-TIM Telecom Italia S.p.A., IT	8.4%	8.3%	0.0%	0.1%
AS174	COGENT-174, US	8.4%	0.0%	8.4%	11.1%
AS29447	TIF-AS SCALEWAY S.A.S., FR	7.2%	7.1%	0.0%	0.0%

Records per page: 10 1-10 of 1470

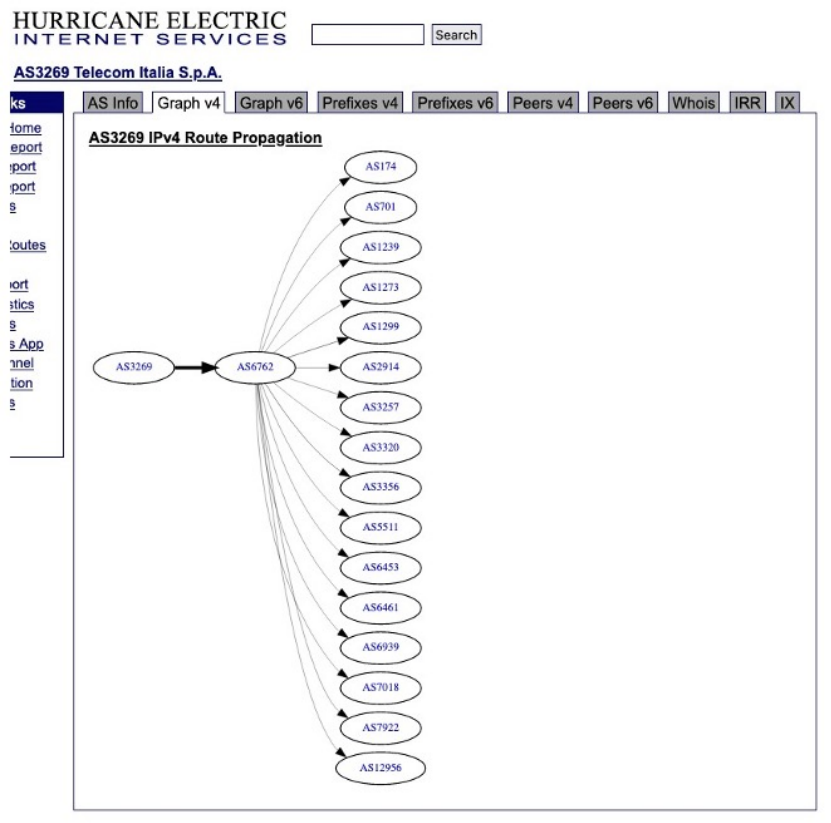
Italy – NOG diagnosis

- Was located around international connectivity, which TIM buys from Sparkle.
- Also affected DNS resolvers on TIM's network, and apparently some of its PPPoE servers.
- Disrupted connectivity between some locations in the country around the same time.

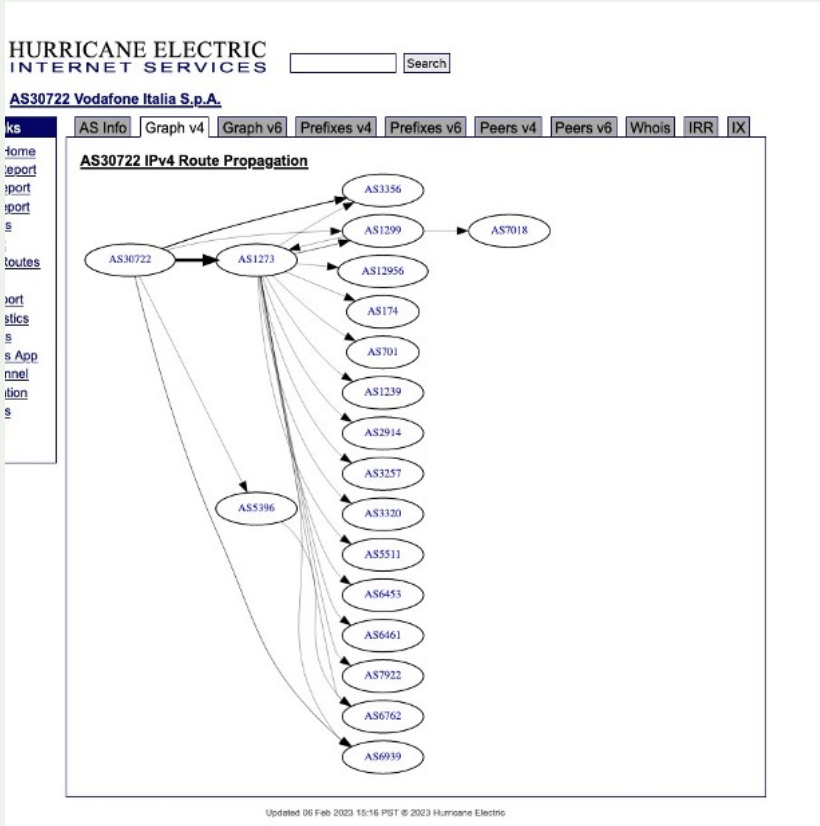


Italy – Compare the Pair

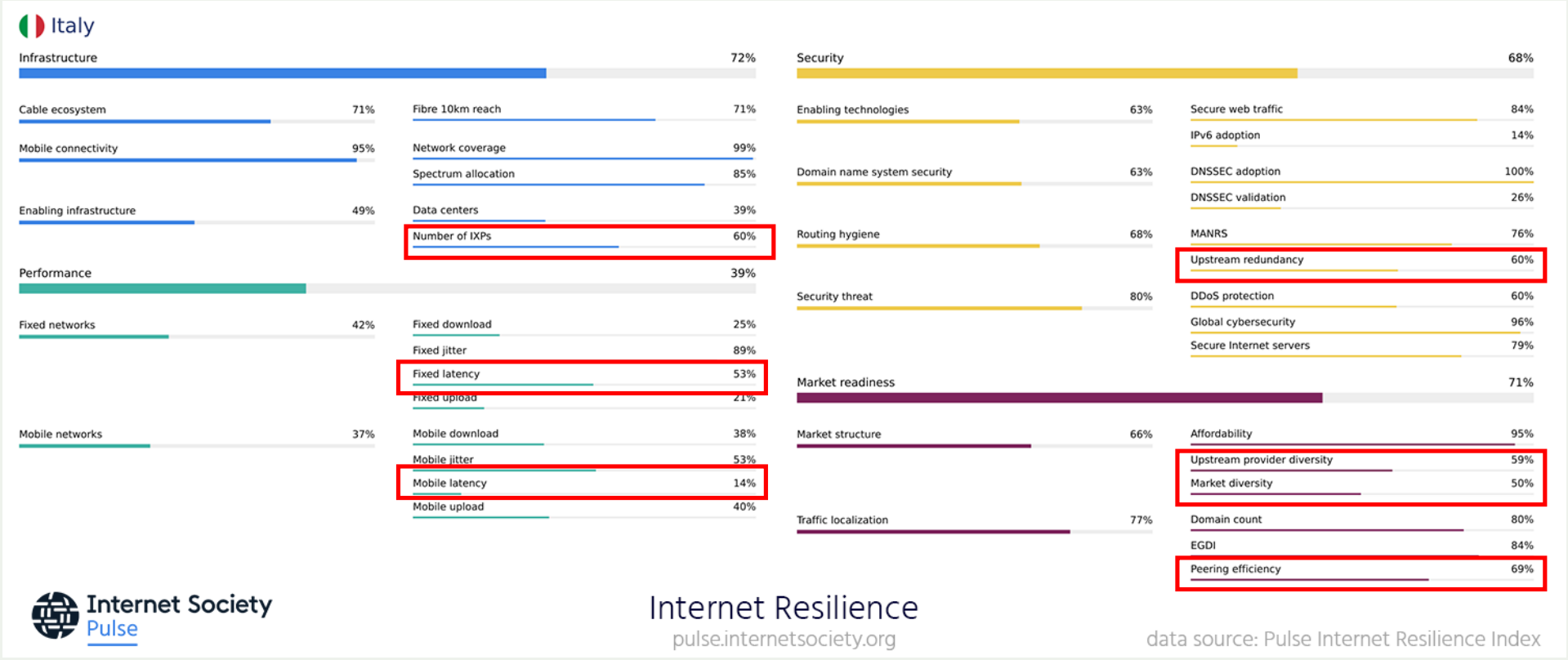
AS3269 TIM



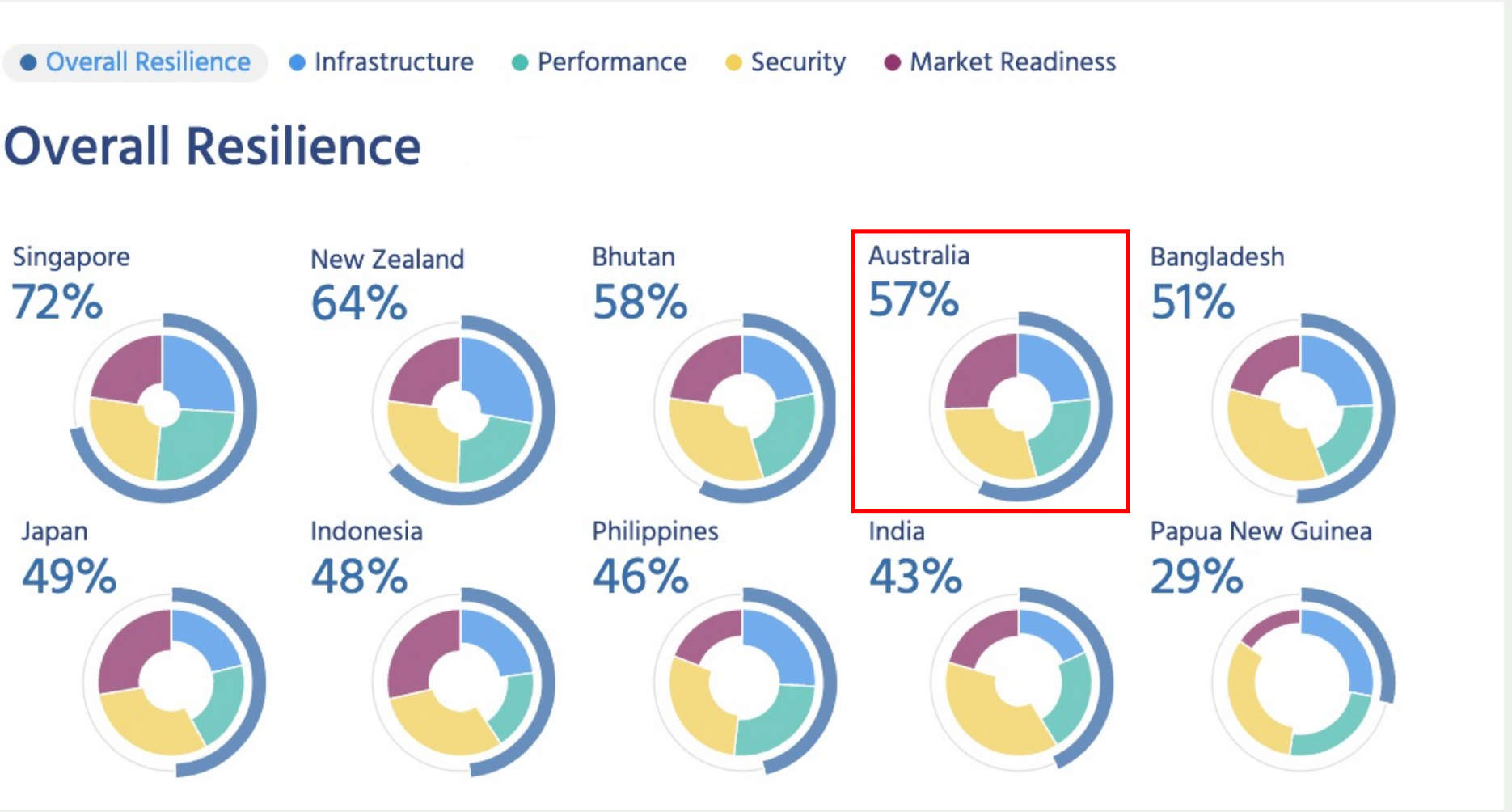
AS30722 Vodafone Italia

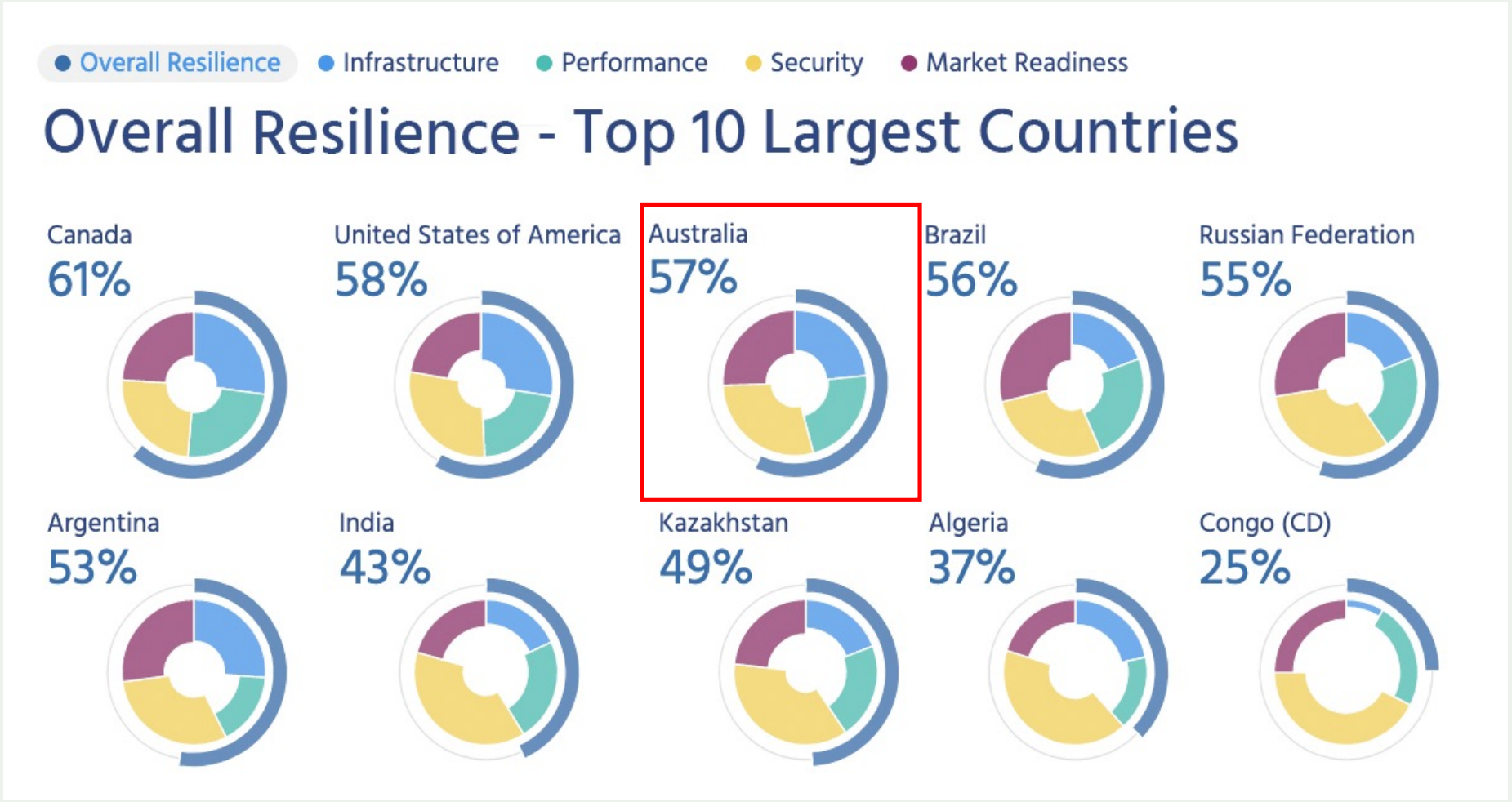


Italy – Internet Resilience Index

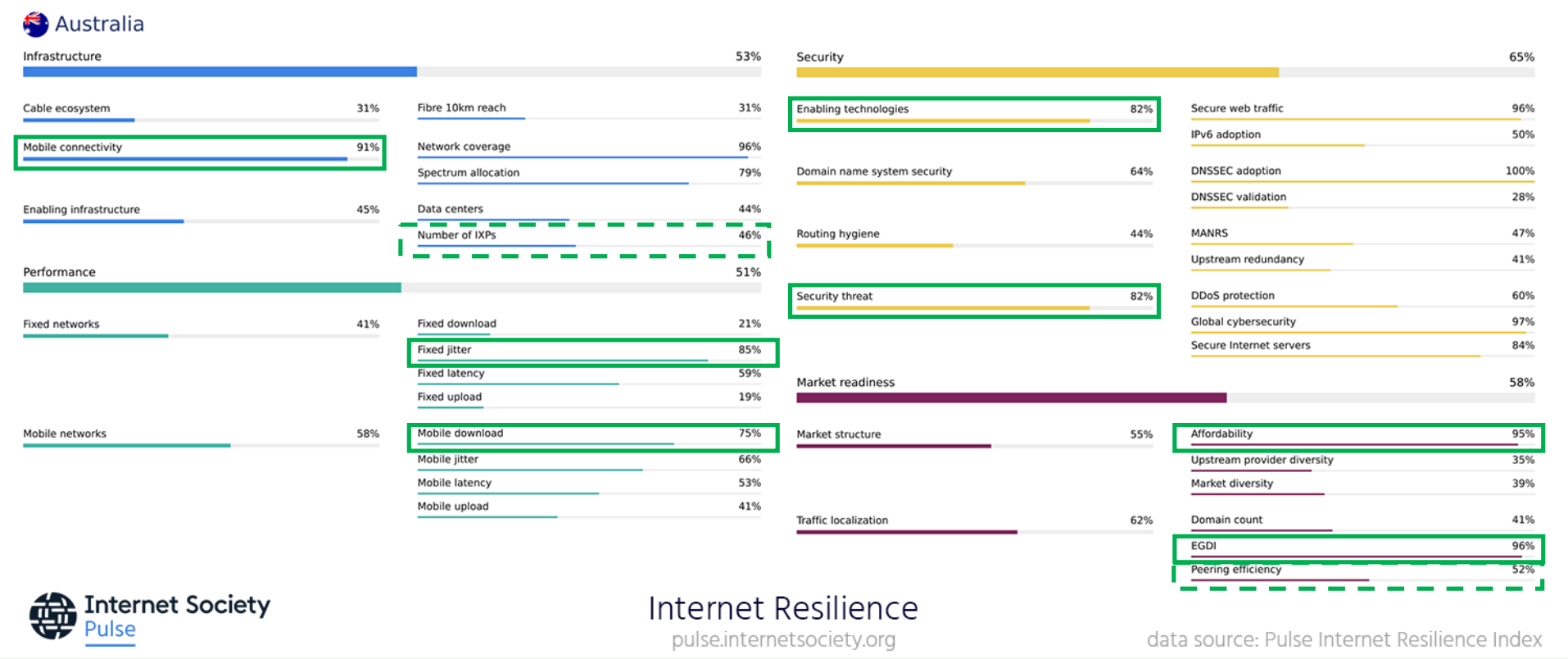


How Resilient is Australia's Internet?


Overall Resilience
Infrastructure
Performance
Security
Market Readiness
Overall Resilience
Singapore
72%
New Zealand
64%
Bhutan
58%
Australia
57%
Bangladesh
51%
Japan
49%
Indonesia
48%
Philippines
46%
India
43%
Papua New Guinea
29%

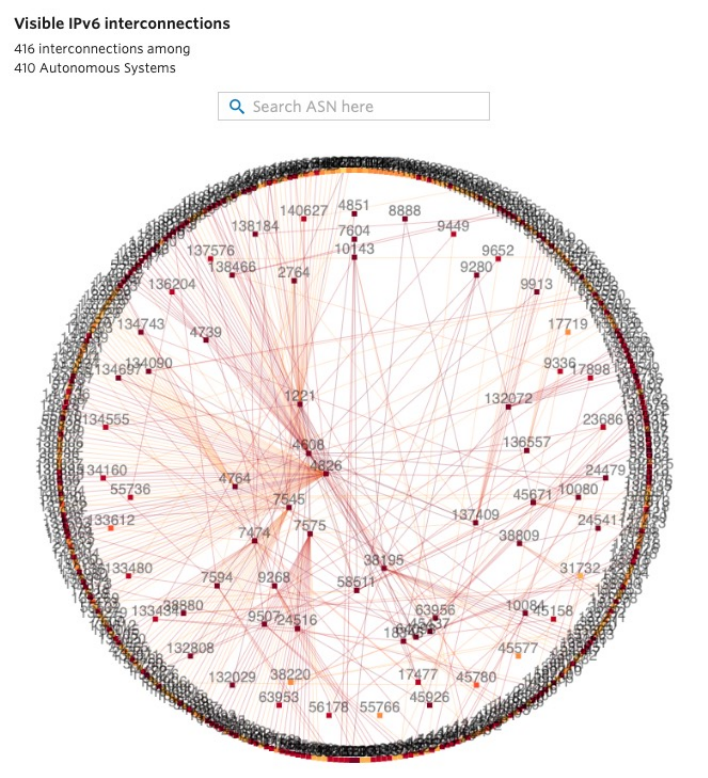

Overall Resilience
Infrastructure
Performance
Security
Market Readiness
Overall Resilience - Top 10 Largest Countries
Canada
61%
United States of America
58%
Australia
57%
Brazil
56%
Russian Federation
55%
Argentina
53%
India
43%
Kazakhstan
49%
Algeria
37%
Congo (CD)
25%

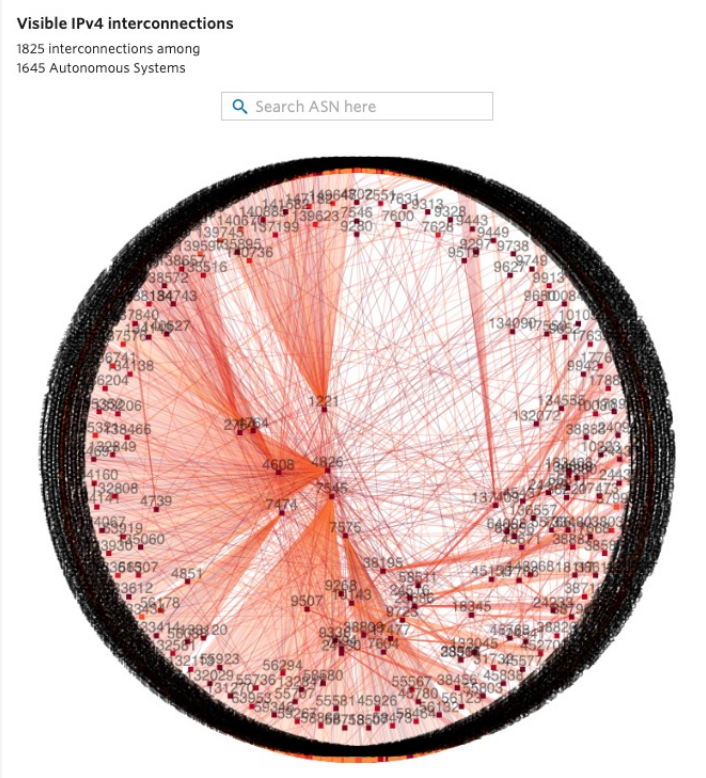
Australia – Internet Resilience Index



Australia – Local Connectivity

Thanks to major IXPs in metro cities, the local interconnection looks healthy





https://rex.apnic.net/as-interconnections?allocationType=ipv4,ipv6&economy=AU

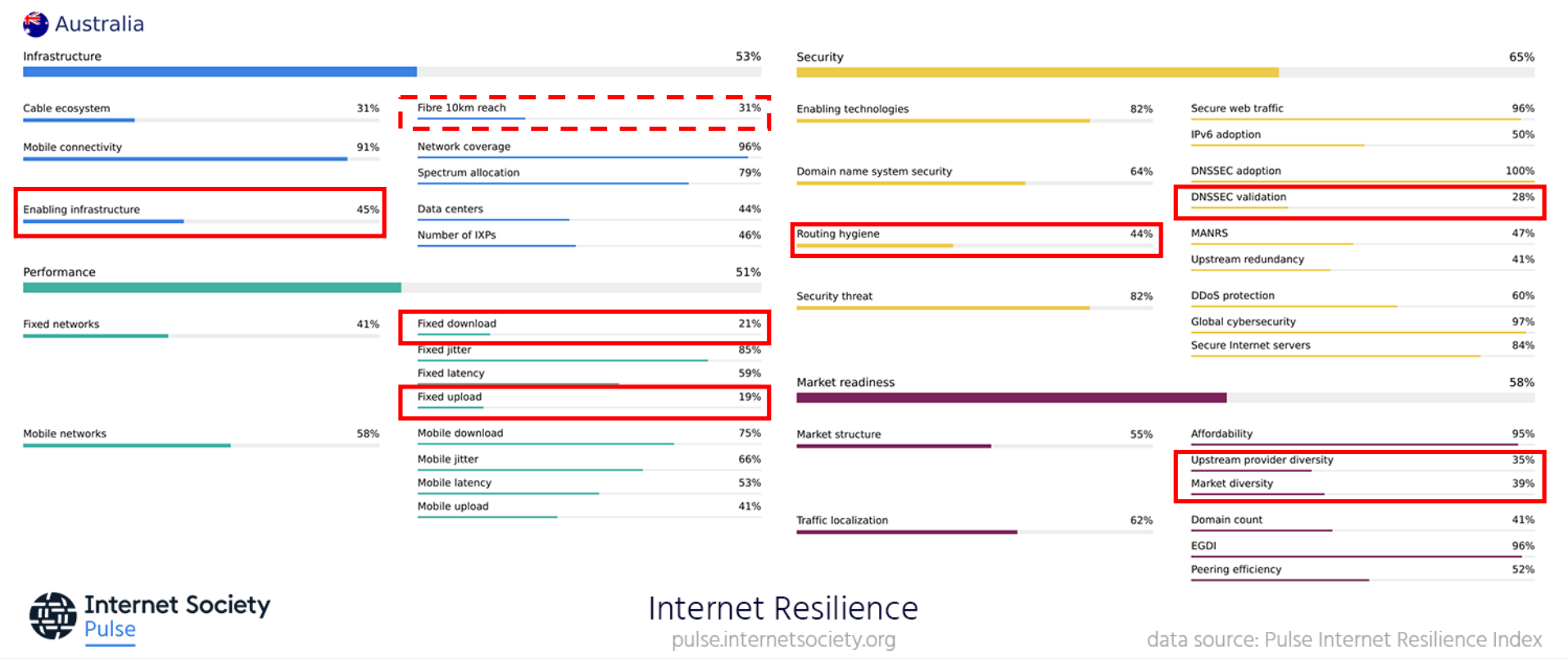
Australia – Local Connectivity

If we take connection data from PeeringDB for all the bigger IXPs in Australia such as IX Australia, Edge IX, Megaport IX and Equinix IX then in total there are 1,825 connections (*considering only IPv4 connections*)

Total Active AU Networks [1]	1,602
Total Connection [2]	1,810
Total Unique ASN	517
Networks Registered in AU	333
% of AU Networks on IX	20%

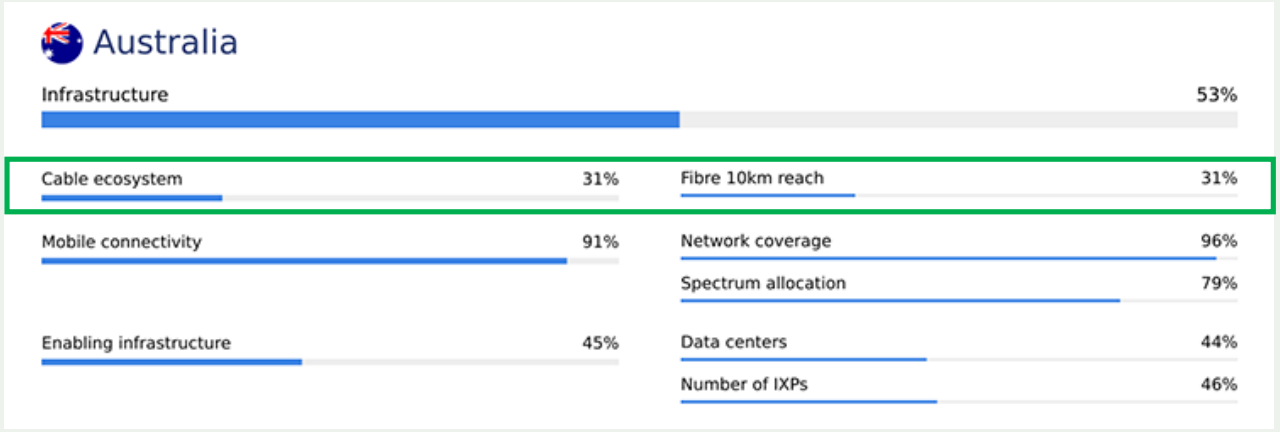
References:
[1] - https://stat.ripe.net/ui2013/AU#tabId=routing
[2] - Peeringdb - https://www.peeringdb.com/api/ixlan/<ixp_id>

Australia – Internet Resilience Index



Australia - Terrestrial Cable Systems

Big population of the country is still outside the current fibre coverage area.



Australia https://bbmaps.itu.int/bbmaps/

- Fiber routes Research -

Route Km
638,322 km

- Terrestrial Fibres mapped (Status) -

Fiber total
239,445 km

Fiber operational
233,766 km

Fiber planned
5,680 km

Microwave total
1,243 km

Microwave operational
1,243 km

Microwave planned
1,243 km

- Population reach -

Population reach 10 km range
32 %

Population reach 25 km range
72 %

Population reach 50 km range
96 %

Population reach 100 km range
99 %

Limitations

Limitations

- The data is pulled from external public sources, not always up-to-date.
  - An indicator is not included if there is missing data on more than 25% of countries in the Index.
- Without in-country measurements it's difficult to validate the data.
  - Something Dr Vijay Sivaraman has discussed in this forum before
    https://www.ausnog.net/sites/default/files/ausnog-2021/presentations/D2_S4_Vijay_Sivaraman_Forget_Speed_Lets_Talk_Experience.pdf
- Some of the data undergoes processing, normalization, and weighing, we use a methodology that is reproducible.
- Ultimately, the Index benchmarks countries with one another and helps decision makers recognize gaps and weaknesses to then conduct further study into validating these and then working towards addressing them.

Take aways

Take aways

- Understanding what’s happening upstream and beyond your shores is equally as important as knowing the health of your own network.
- Having an insightful national measurement system in place improves resolution of the health of the edge.
- Your network's health and the health of the whole of Australia’s Internet is interconnected. We all have a role to play to make sure it is robust and secure.

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