Where are we now?
IPv6 deployment update

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APNIC

Agenda

- IPv6 End-User Readiness
- IPv6 Performance
- Industry Trends
- Observations

IPv6 stats from: https://stats.labs.apnic.net/ipv6
Retrieved: 30 Nov 2017

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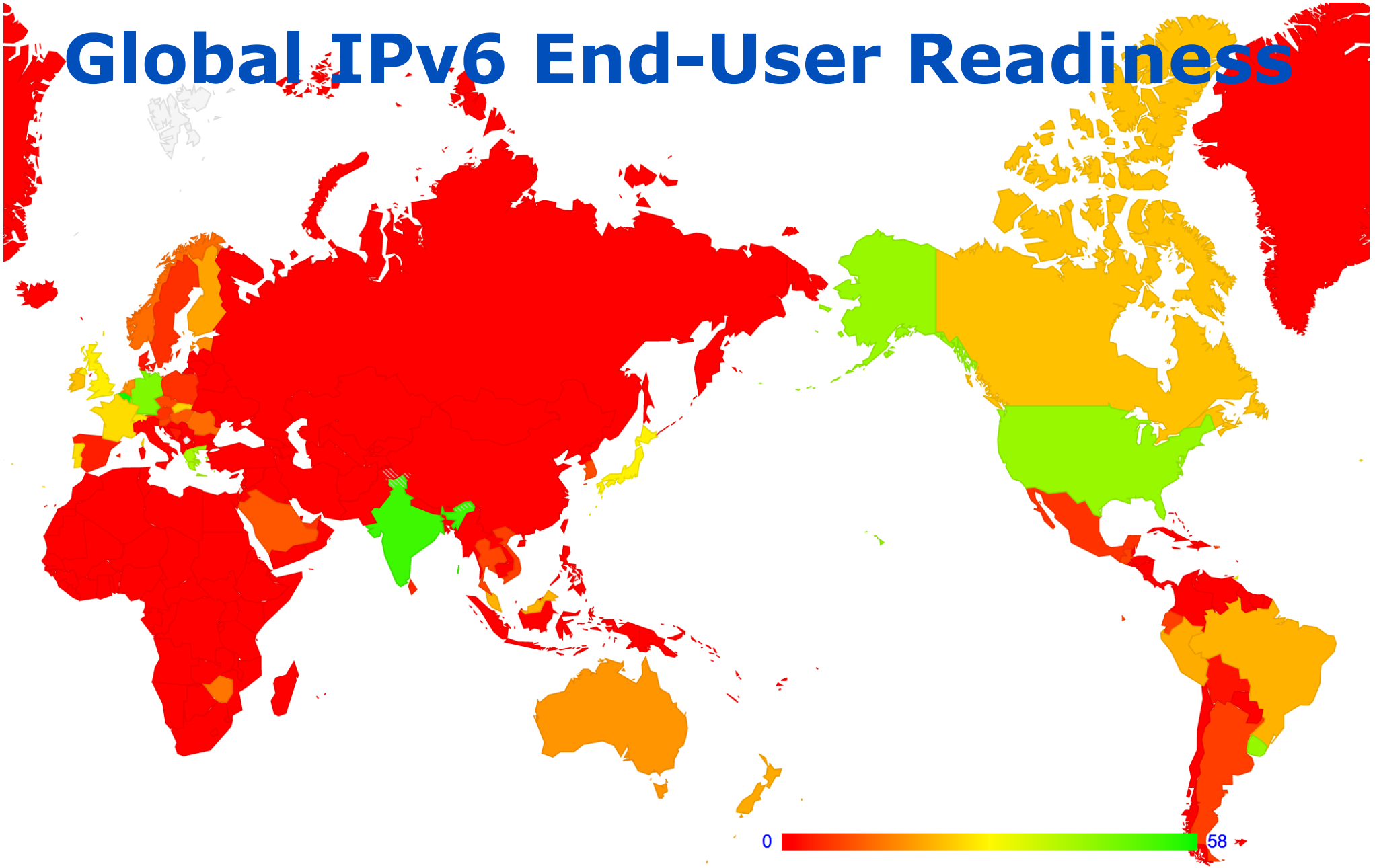
Global IPv6 End-User Readiness

IPv6 capable = 16.11% (30 Nov 2017)

43.87% increase in the last 12 months

Global IPv6 End-User Readiness



The IPv6 economy league table

CC	Economy	IPv6 capable (%)
BE	Belgium	59.69
IN	India	51.37
DE	Germany	42.35
US	United States	40.98
CH	Switzerland	37.80
GR	Greece	37.21
LU	Luxembourg	31.07
UK	United Kingdom	27.33
UR	Uruguay	27.01
JP	Japan	25.40
PT	Portugal	23.80
FR	France	23.46
TT	Trinidad and Tobago	21.89
BR	Brazil	21.64

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Trinidad & Tobago

- 946,065 Internet users
- 69% Internet penetration
- 14 ASNs
- 21.89% IPv6 readiness

IPv4	
Addresses	541,696
Per Capita	0.40
ASNs in BGP	12
% Visible	99%

IPv6	
Addresses	2.11×10^{31}
Per Capita	1.54×10^{25}
ASNs in BGP	7
% Visible	3%

T&T IPv6 End-User Readiness

T&T IPv6 leaderboard

ASN	Organization	IPv6 capable (%)
33576	Digicel	87.21

T&T IPv6 leaderboard

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ASN	Organization	Delegated prefix	Routed
38740	**Digicel**	**2803:1500::/32**	**YES**
27665	**Columbus Communications**	**2800:e00::/24**	**YES**
5639	**Telecom Services of Trinidad**	**2800:420::/30**	**YES**
264811 61478	**Air Link Communications**	**2803:cd80::/32**	**YES**
27789	**Greendot**	**2800:70::/32**	**YES**
27924	**Massy Communications**	**2800:180::/32**	**YES**
264793	Network Technologies Limited	2803:1b80::/32	NO
263222	RVR International	2803:4680::/32	NO
28067	University of the West Indies	2801:0:40::/48	NO

How about Oceania?

CC	Economy	IPv6 capable (%)
AU	Australia	17.93
NZ	New Zealand	14.64
NR	Nauru	0.15
VU	Vanuatu	0.11
SB	Solomon Islands	0.05
WS	Samoa	0.03
PG	Papua New Guinea	0.03
FJ	Fiji	0.03
MH	Marshall Islands	0.03
FM	Federated States of Micronesia	0.01
PF	French Polynesia	0.01
NC	New Caledonia	0.01
GU	Guam	0.01

Australia

- 20,807,427 Internet users
- 85% Internet penetration
- 2,289 ASNs
- 17.93% IPv6 readiness

IPv4	
Addresses	48,547,328
Per Capita	1.99
ASNs in BGP	1388
% Visible	87%

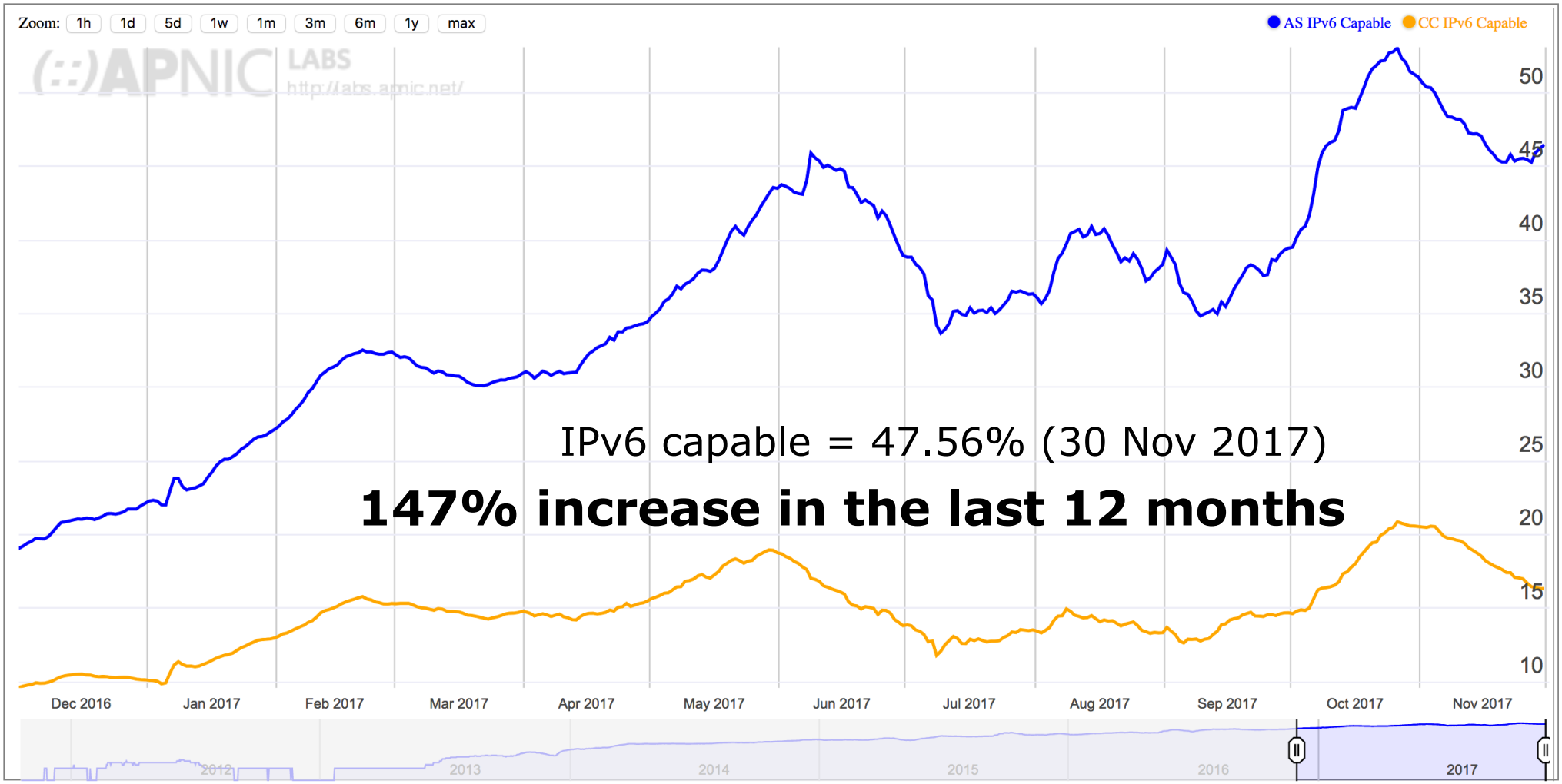
IPv6	
Addresses	7.09×10^{32}
Per Capita	2.90×10^{25}
ASNs in BGP	308
% Visible	47%

Australia IPv6 End-User Readiness

Australia IPv6 leaderboard

ASN	Organization	IPv6 capable (%)
133414	Foxtel	69.86
1221	Telstra	47.56
4793	Internode	9.30
36351	SoftLayer Technologies	2.43
20473	Choopa	2.36
7575	AARNet	0.40
133612	Vodafone	0.07

AS 1221: Telstra



IPv6 performance

- Enough data accumulated to analyze IPv6 performance
- APNIC R&D, Geoff Huston's recent study
  - Presented @ APRICOT 2016 (Feb, 2016)

- **Is IPv6 as robust as IPv4?**
  - Do all TCP connection attempt succeed?
    - Connection failure = No ACK for acknowledged SYN
  - IPv4 connection failure sits at 0.2%
  - IPv6 connection failure sits at 1.8%

[source : http://www.potaroo.net/presentations/2016-02-10-ad-measurement.pdf]

IPv6 performance

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- **Is IPv6 as fast as IPv4**? (IPv6 unicast)
  - Comparison of RTT (e2e)
    - Time since SYN till ACK (factors out any congestion issues)
  - IPv6 is faster about half of the time
    - 36-90ms faster
  - **IPv6 as fast as IPv4**

[source : http://www.potaroo.net/presentations/2016-02-10-ad-measurement.pdf]

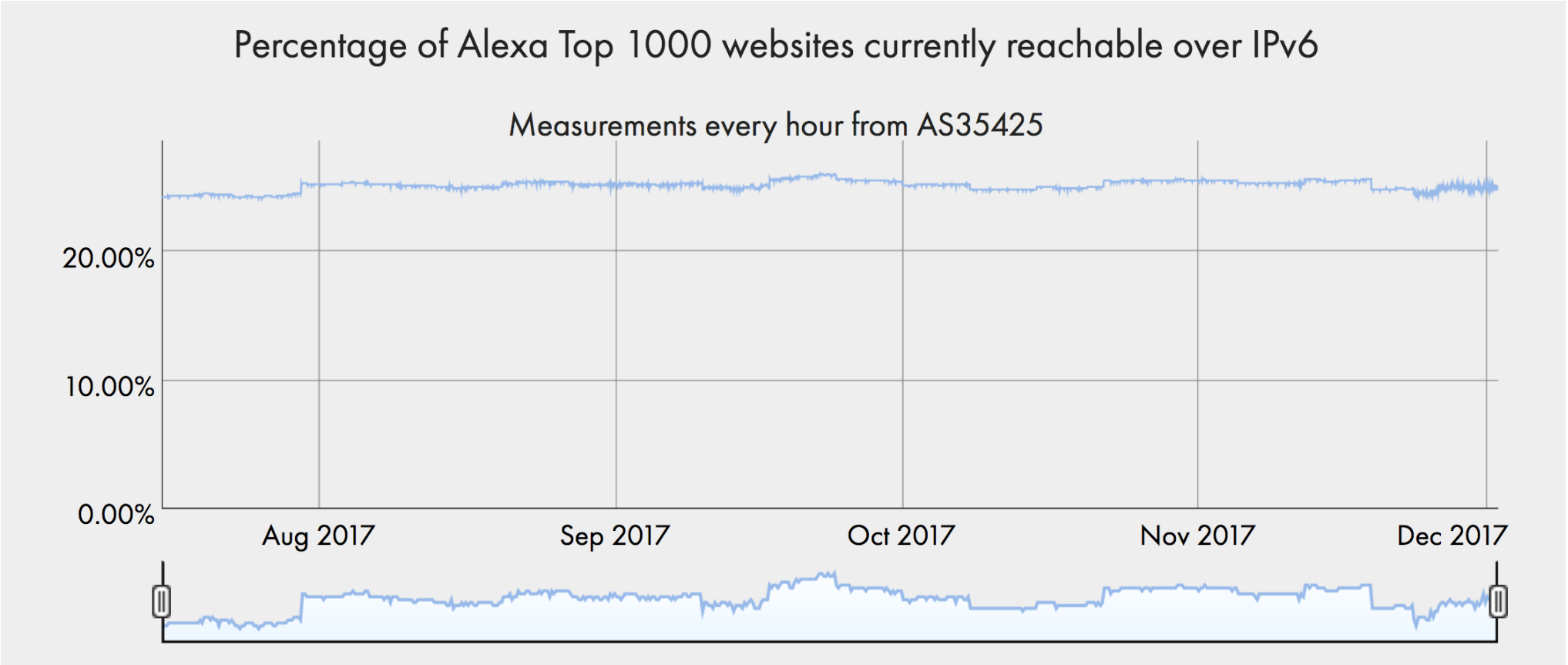
IPv6 performance

- There are good use cases and implementation
- LinkedIn Senior Director of Infrastructure Engineering, Zaid Ali Kahn
  - Presented @ APNIC42 (September, 2016)

- **IPv6 at LinkedIn**
  - For some select networks in Europe, LinkedIn is seeing up to **40% performance improvements over IPv6**, and in the **US, up to 10%.**
  - **TCP timeout on IPv4 over mobile** carrier networks is as high as **4.6%** and **IPv6 timeouts** are on a much lower side at **1.6%.**

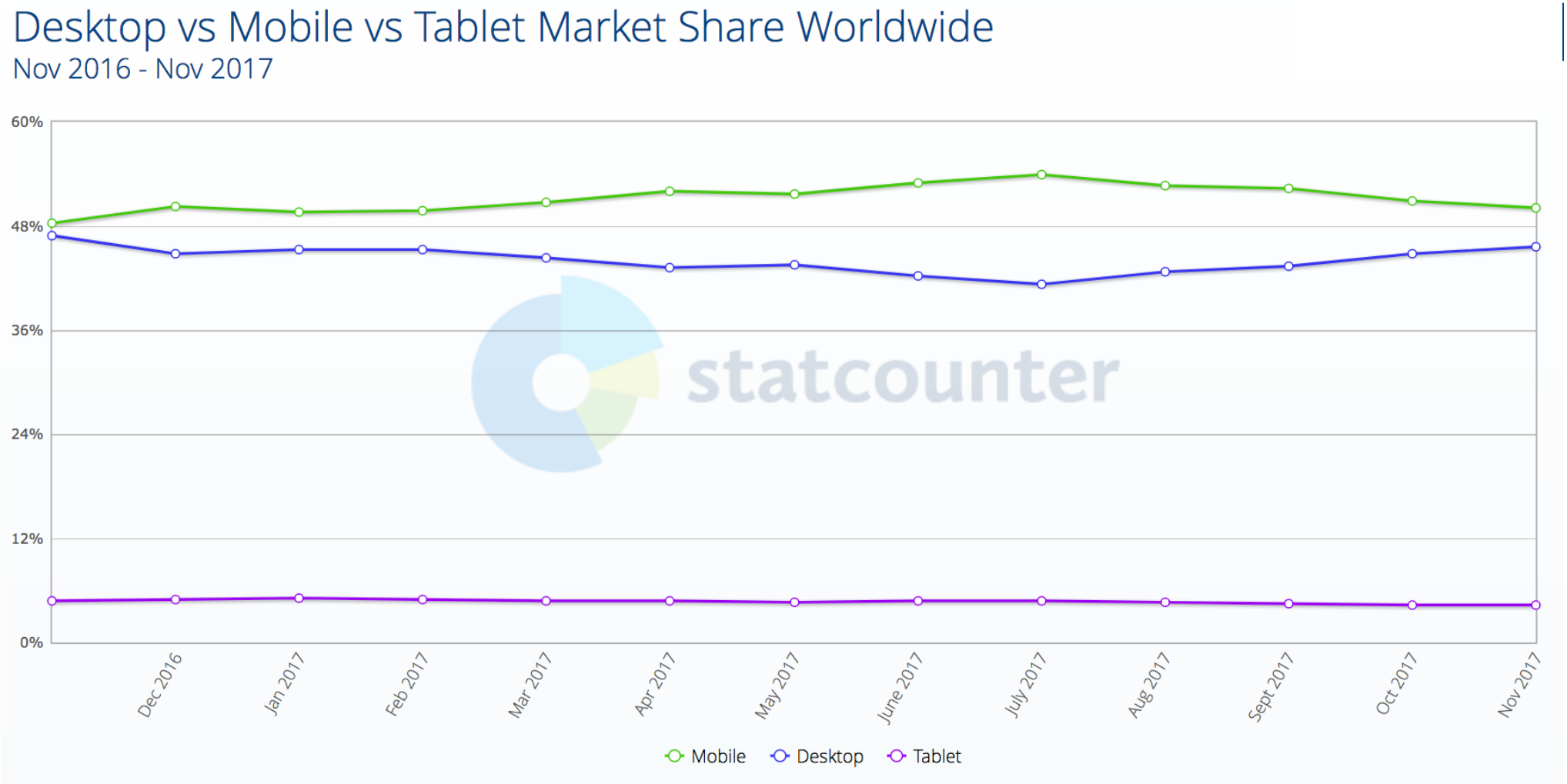
[source : https://blog.apnic.net/2016/05/13/linkedin-ipv6-measurements/]

Industry Trend: Content



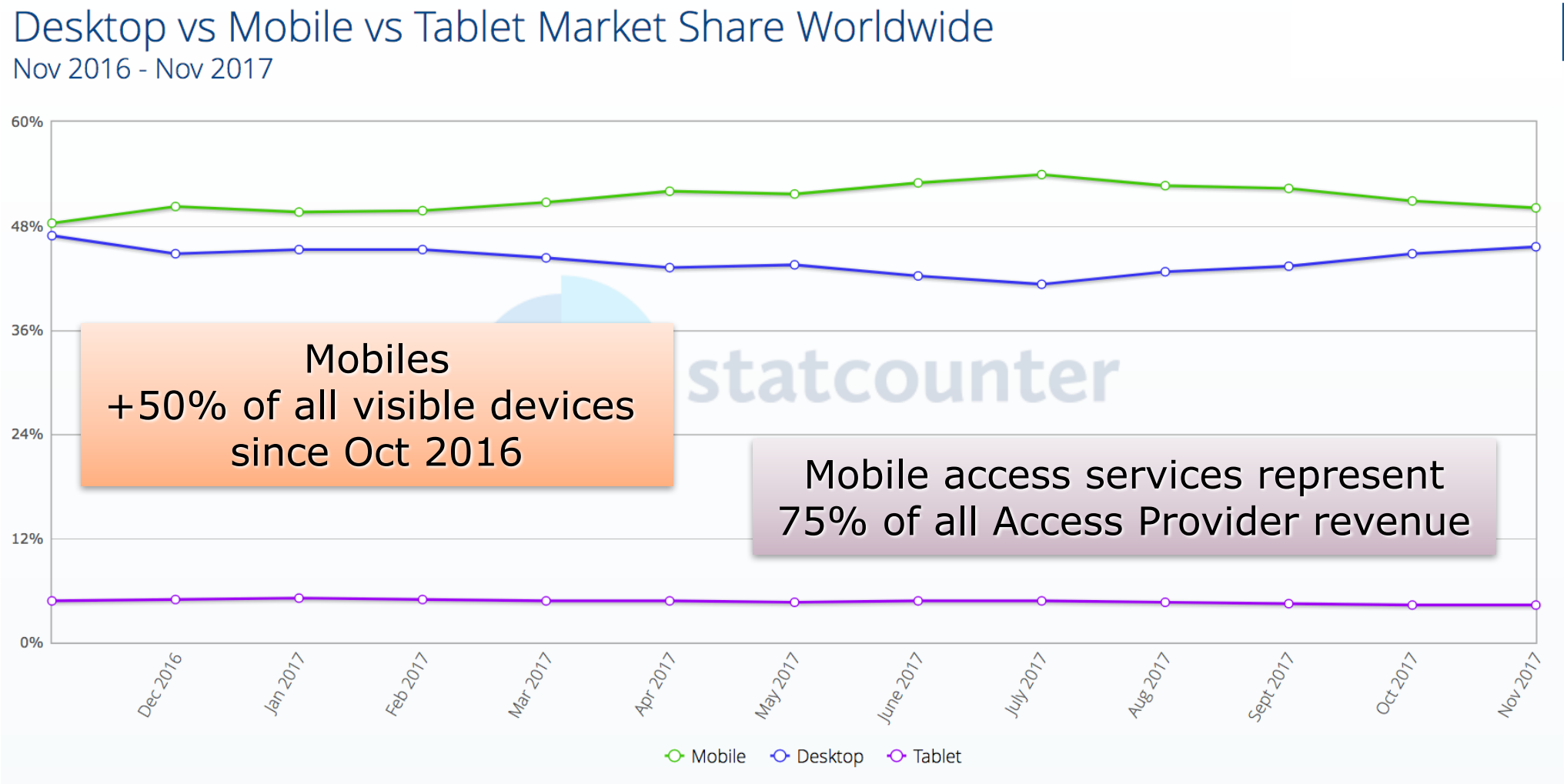
[source : http://www.worldipv6launch.org/measurements/]

Industry trend: Devices



[source : http://gs.statcounter.com/platform-market-share/desktop-mobile-tablet]

Industry trend: Devices



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IPv6 enabled devices

OS	Version	Installed by default	DHCPv6
Android	4.4	Yes	No
iOS	4.1	Yes	Yes
Windows Phone	8.1	Yes	Yes

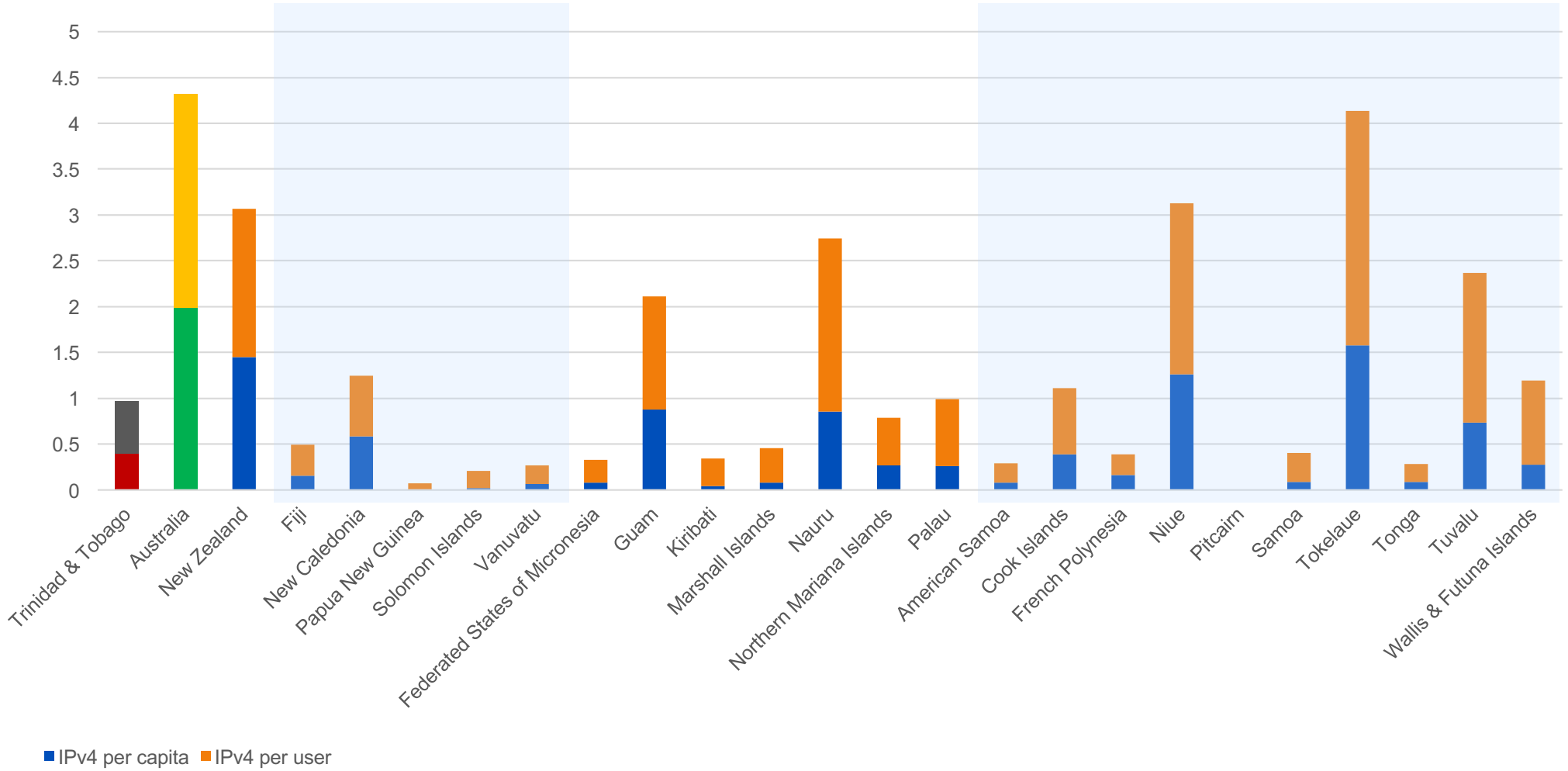
- Android and Windows Phone support 464XLAT transition technology
- Apple iOS IPv6-only network support since version 9
  - All Apple AppStore apps must include IPv6 support since early 2016
- Others incld: Huawei E398, E352u, Nokia N/E series

[source : https://getipv6.info/display/IPv6/3GPP+Mobile+Networks]

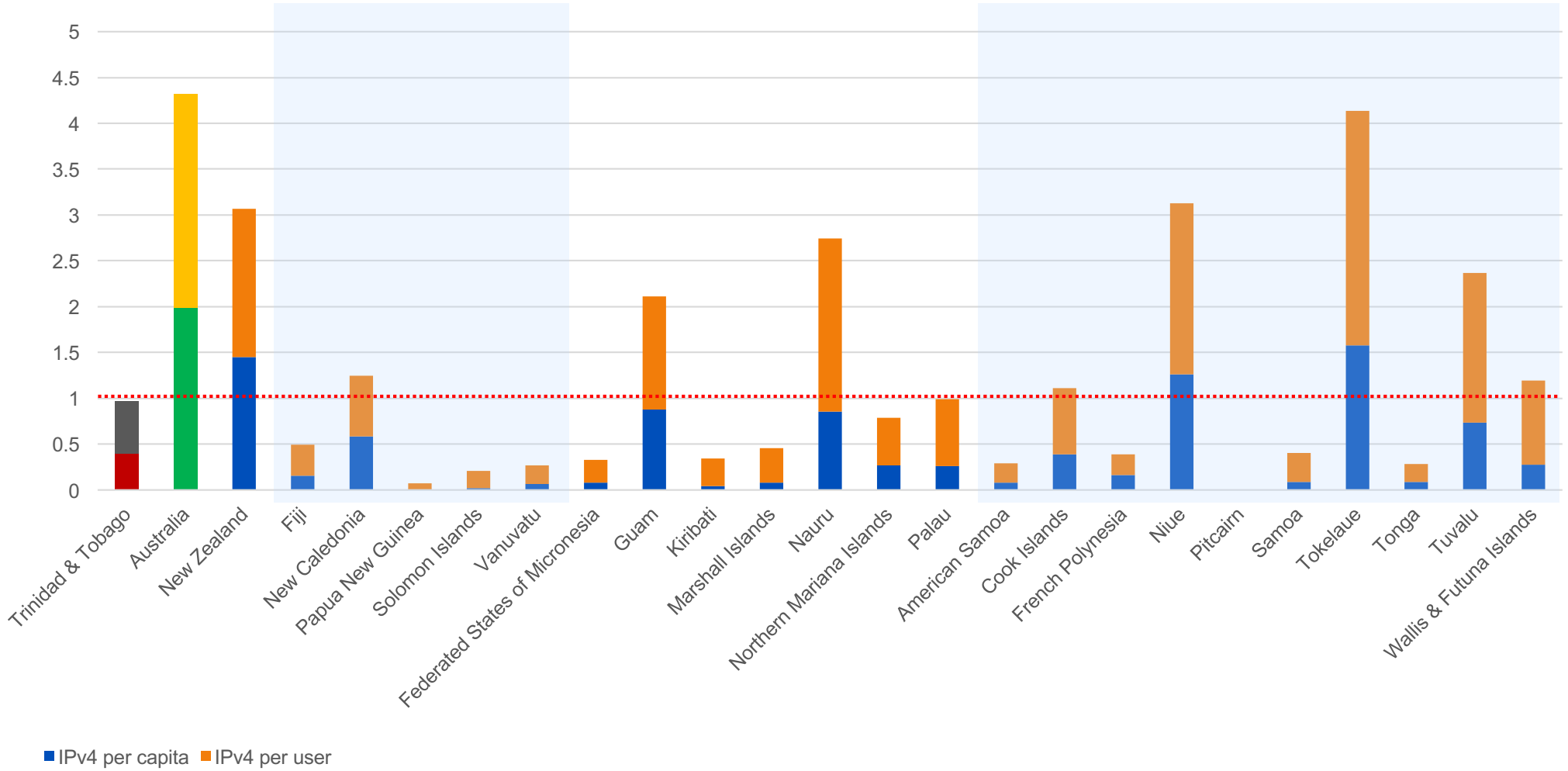
IPv6 Mobile Networks: Technology

Carrier	Economy	Note
Verizon Wireless	USA	Deployed dual stack transition technology in 2011
T-Mobile	USA	Deployed IPv6 transition technology (464XLAT) in 2012
SK Telecom	Korea	Deployed IPv6 transition technology (464XLAT) in 2014
Telstra	Australia	Deployed IPv6 transition technology (464XLAT) in 2016
Reliance Jio	India	Deployed dual stack transition technology in 2016
Digicel	Trinidad and Tobago	Deployed dual stack lite transition technology in 2016

IPv4 in Oceania



IPv4 in Oceania



Observations

- Connectivity is increasing across Pacific in both access and capacity
- Key market players taking lead on IPv6 continues have sizable impact on economy wide IPv6 readiness.
- Once IPv6 is enabled a network, end user readiness tends to grow rapidly.
- With pragmatic, forward looking plan, IPv6 can be deployed in effective way

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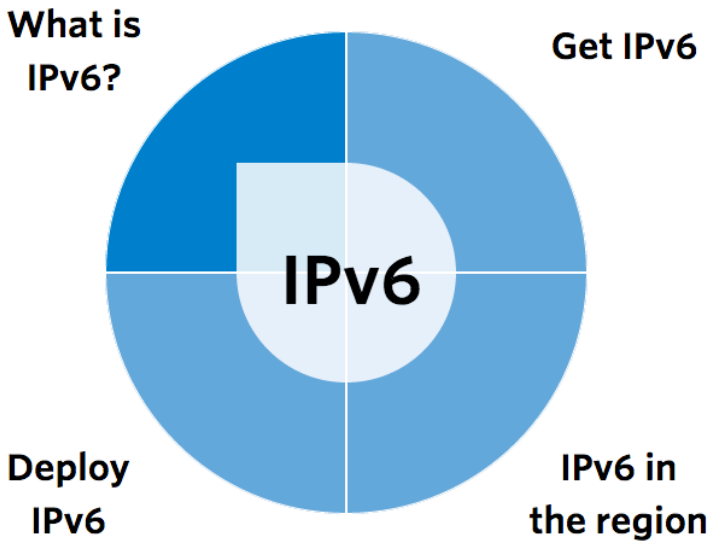

What is IPv6? | Why is it important? | What does IPv6 mean to me? | Benefits

apnic.net/ipv6

Mālō!

Thank You!

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