Retevia

The state of IPv6-only

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RIPE75 Dubai

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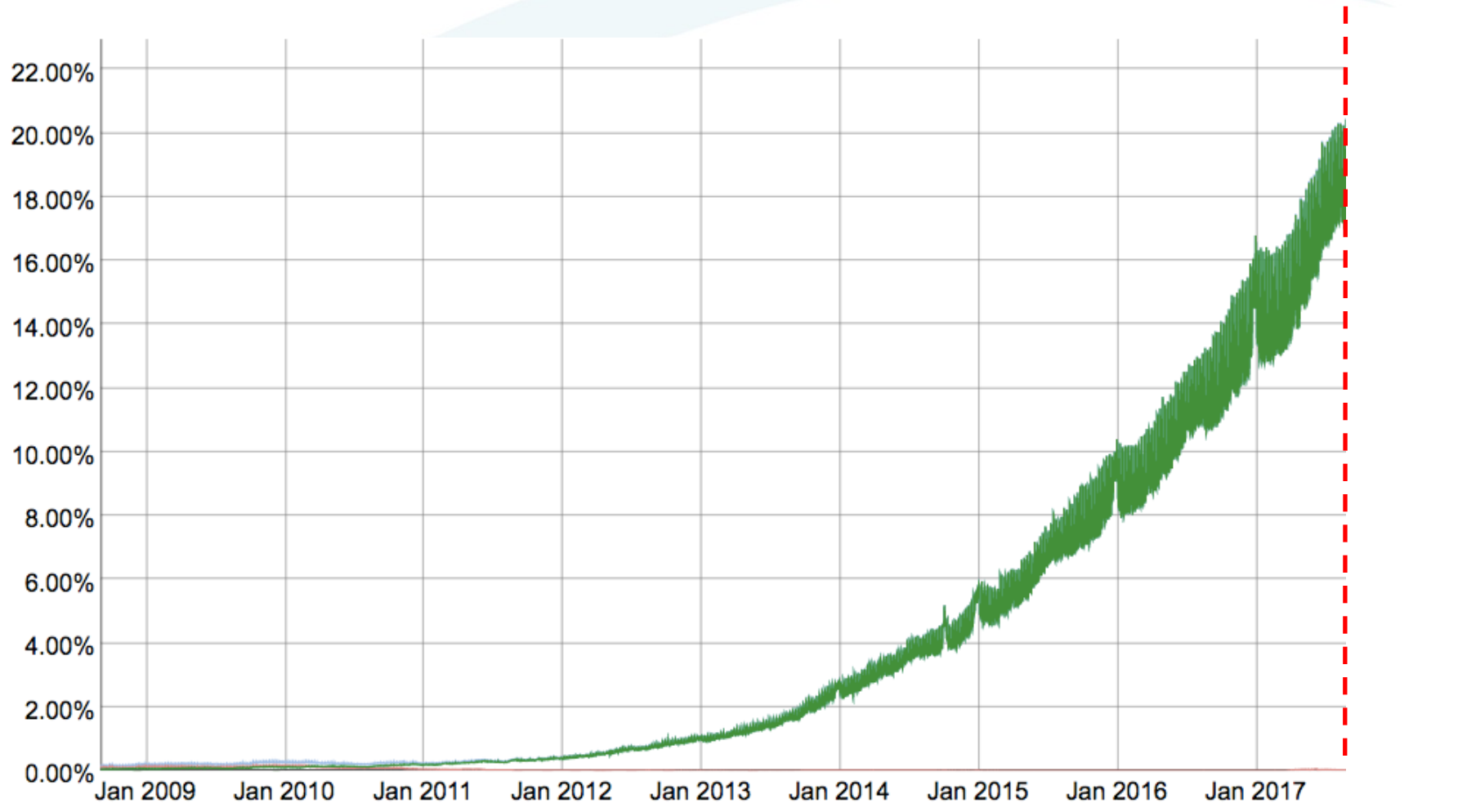
(subbed by Sander Steffann)

What's this all about?

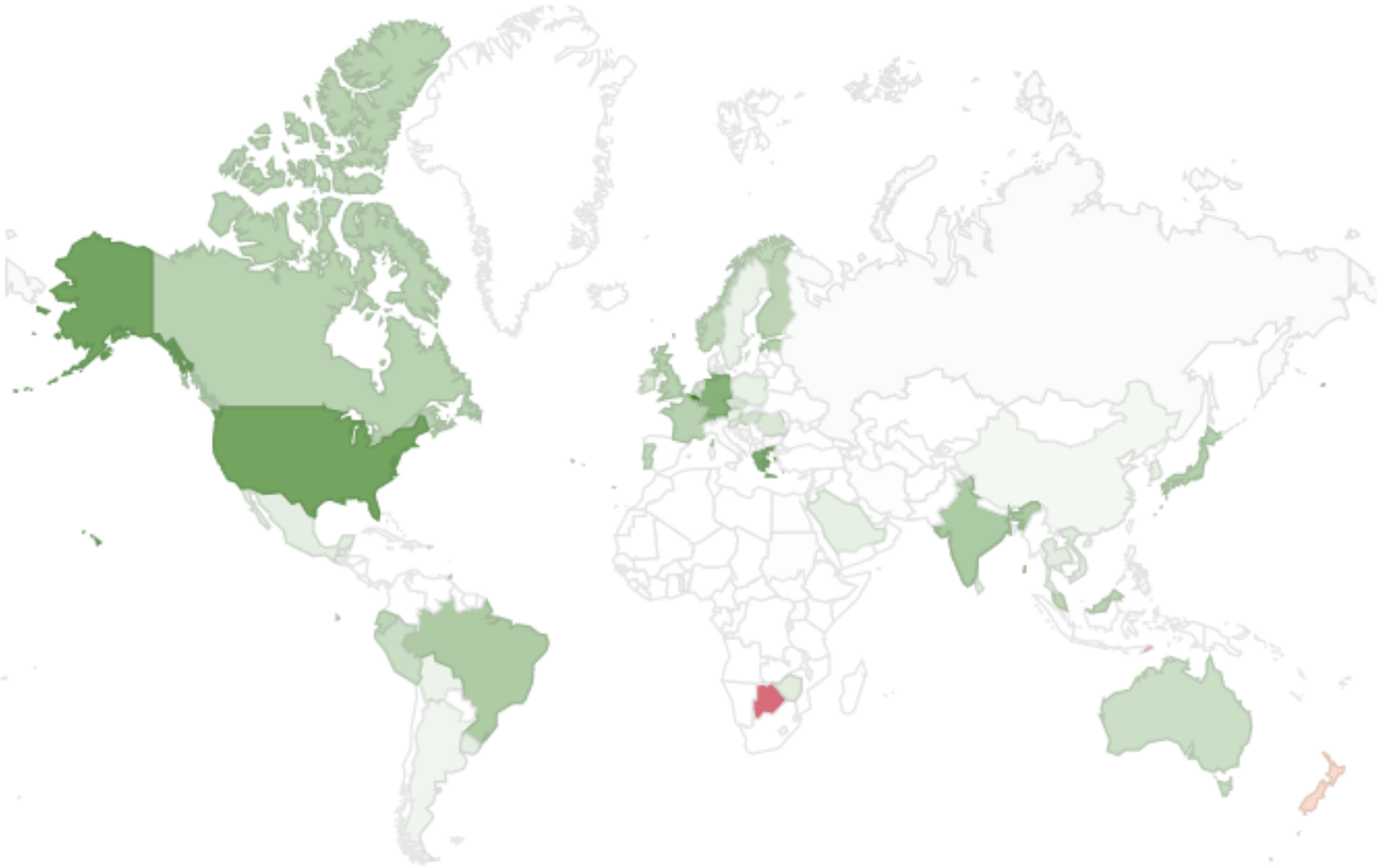
- The same charts you've (probably) seen 100 times
- …and charts you probably **haven't** seen 100 times

IPv6 Adoption



Reference: http://www.google.com/intl/en/ipv6/statistics.html

Per country IPv6 adoption



Reference: http://www.google.com/intl/en/ipv6/statistics.html#tab=per-country-ipv6-adoption

Top IPv6 enabled network operators

Rank	Participating Network	ASN(s)	IPv6 deployment
1	Comcast	7015, 7016, 7725, 7922, 11025, 13367, 13385, 20214, 21508, 22258, 22909, 33287, 33489, 33490, 33491, 33650, 33651, 33652, 33653, 33654, 33655, 33656, 33657, 33659, 33660, 33661, 33662, 33664, 33665, 33666, 33667, 33668, 36732, 36733	60.31%
2	ATT	6389, 7018, 7132	70.00%
3	KDDI	2516	36.61%
4	RELIANCE JIO INFOCOMM LTD	55836, 64049	84.80%
5	Charter Communications	7843, 10796, 11351, 11426, 11427, 12271, 20001, 20115, 33363	28.53%
6	SoftBank	17676	26.26%
7	Verizon Wireless	6167, 22394	84.22%
8	T-Mobile USA	21928	88.56%
9	Deutsche Telekom AG	3320	48.77%
10	British Sky Broadcasting	5607	83.83%

Reference: http://www.worldipv6launch.org/measurements/

Top IPv6 enabled websites

Rank	Country	Sample size	Weighted	Green	Orange Test or broken
1	Armenia	50	64.78%	56.0% (28)	0.0% (0)
2	Palestinian Territory	50	67.19%	54.0% (27)	0.0% (0)
3	Tonga	50	41.80%	54.0% (27)	0.0% (0)
4	Seychelles	50	70.56%	52.0% (26)	0.0% (0)
5	Reunion	50	56.23%	50.0% (25)	0.0% (0)
6	Iceland	50	54.61%	50.0% (25)	0.0% (0)
7	Albania	50	63.12%	50.0% (25)	0.0% (0)
8	Montenegro	50	26.93%	50.0% (25)	0.0% (0)
9	Colombia	50	62.02%	50.0% (25)	0.0% (0)
10	Samoa	50	40.90%	48.0% (24)	0.0% (0)
11	Liechtenstein	50	29.72%	48.0% (24)	0.0% (0)
12	Gabon	50	54.62%	46.0% (23)	0.0% (0)
13	Antigua and Barbuda	50	65.89%	46.0% (23)	0.0% (0)
14	Central African Republic	50	20.96%	44.0% (22)	0.0% (0)
15	Guernsey	50	24.68%	44.0% (22)	0.0% (0)
16	Czech Republic	50	61.76%	44.0% (22)	0.0% (0)
17	Sweden	50	57.93%	44.0% (22)	0.0% (0)
18	Norway	50	60.28%	42.0% (21)	2.0% (1)

Reference: https://www.vyncke.org/ipv6status/

Top IPv6 enabled users

Rank	Country	%
1	Belgium	48.82%
2	Greece	33.13%
3	United States of America	32.98%
4	Germany	31.70%
5	Switzerland	28.24%
6	India	24.31%
7	Luxembourg	24.00%
8	Brazil	21.92%
9	Japan	19.91%
10	France	19.60%
11	United-Kingdom	18.85%
12	Trinidad and Tobago	18.38%
13	Estonia	18.20%
14	Malaysia	17.57%

Reference: https://www.vyncke.org/ipv6status/

Top IPv6 enabled websites in Middle East

Rank	Country	Sample size	Weighted	Green	Orange Test or broken
1	Armenia	50	64.78%	56.0% (28)	0.0% (0)
2	Palestine	50	67.19%	54.0% (27)	0.0% (0)
57	Azerbaijan	50	39.85%	24.0% (12)	0.0% (0)
60	Turkey	50	36.31%	22.0% (11)	0.0% (0)
89	Iraq	50	36.96%	18.0% (9)	0.0% (0)
96	Cyprus	50	13.40%	16.0% (8)	0.0% (0)
102	United Arab Emirates	50	32.82%	16.0% (8)	0.0% (0)
109	Qatar	50	33.51%	14.0% (7)	0.0% (0)
117	Israel	50	26.53%	12.0% (6)	0.0% (0)
131	Saudi Arabia	50	26.58%	10.0% (5)	0.0% (0)
136	Lebanon	50	32.92%	10.0% (5)	0.0% (0)
148	Georgia	50	32.18%	8.0% (4)	0.0% (0)
150	Bahrain	50	27.57%	8.0% (4)	0.0% (0)
165	Oman	50	38.02%	6.0% (3)	0.0% (0)
167	Kuwait	50	35.52%	6.0% (3)	0.0% (0)
169	Syria	50	25.56%	6.0% (3)	0.0% (0)
172	Jordan	50	24.88%	6.0% (3)	0.0% (0)
186	Iran	50	5.83%	4.0% (2)	0.0% (0)

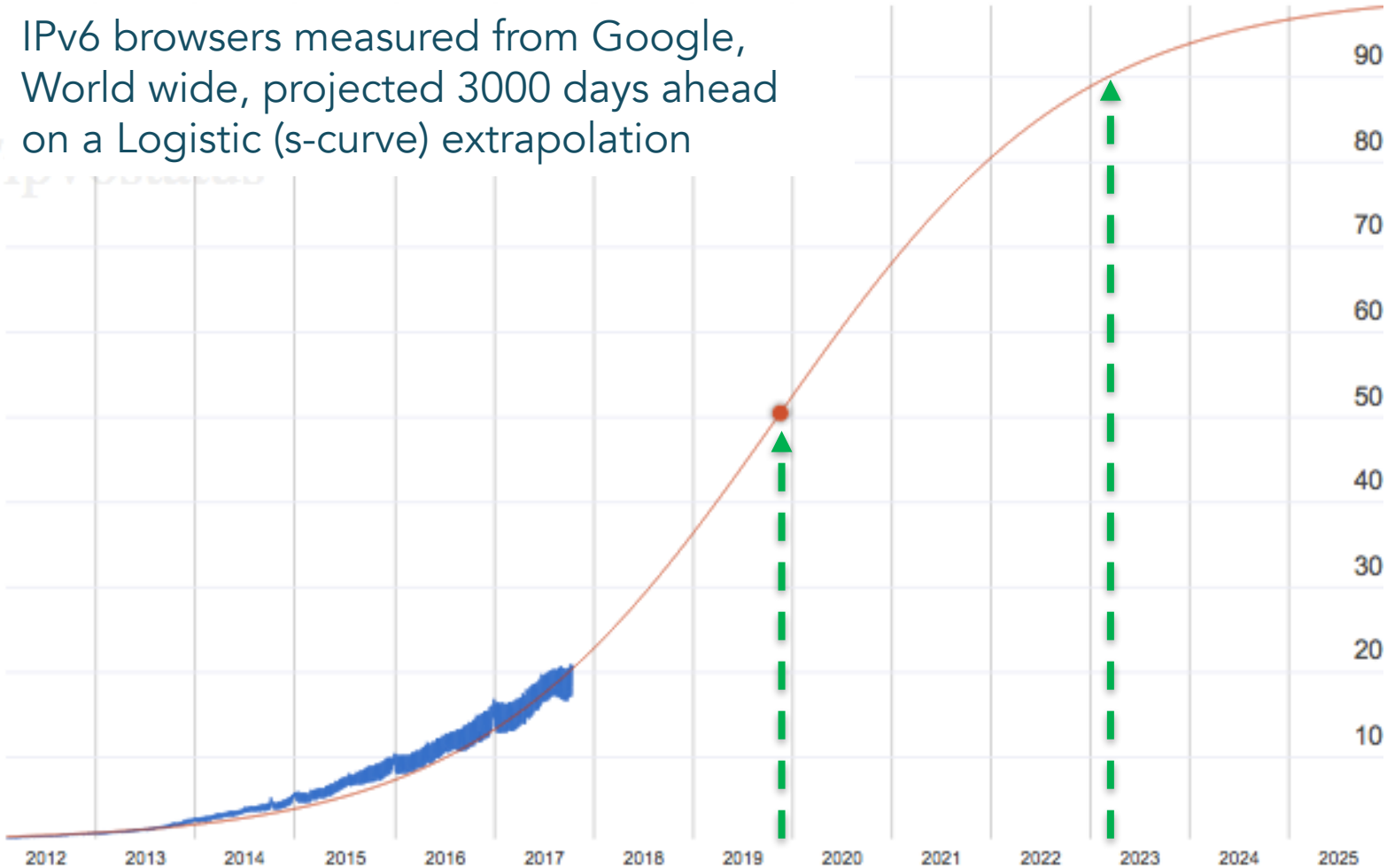
Top IPv6 enabled users in Middle East

Rank	Country	%
38	Saudi Arabia	6.01%
49	United Arab Emirates	2.63%
50	Israel	2.47%
58	Oman	0.92%
59	Iran	0.90%
75	Cyprus	0.20%

Reference: https://www.vyncke.org/ipv6status/

Projected use of IPv6 enabled users

IPv6 browsers measured from Google, World wide, projected 3000 days ahead on a Logistic (s-curve) extrapolation



Reference: https://www.vyncke.org/ipv6status/project.php?metric=p&country=ww

IPv6 capability per region

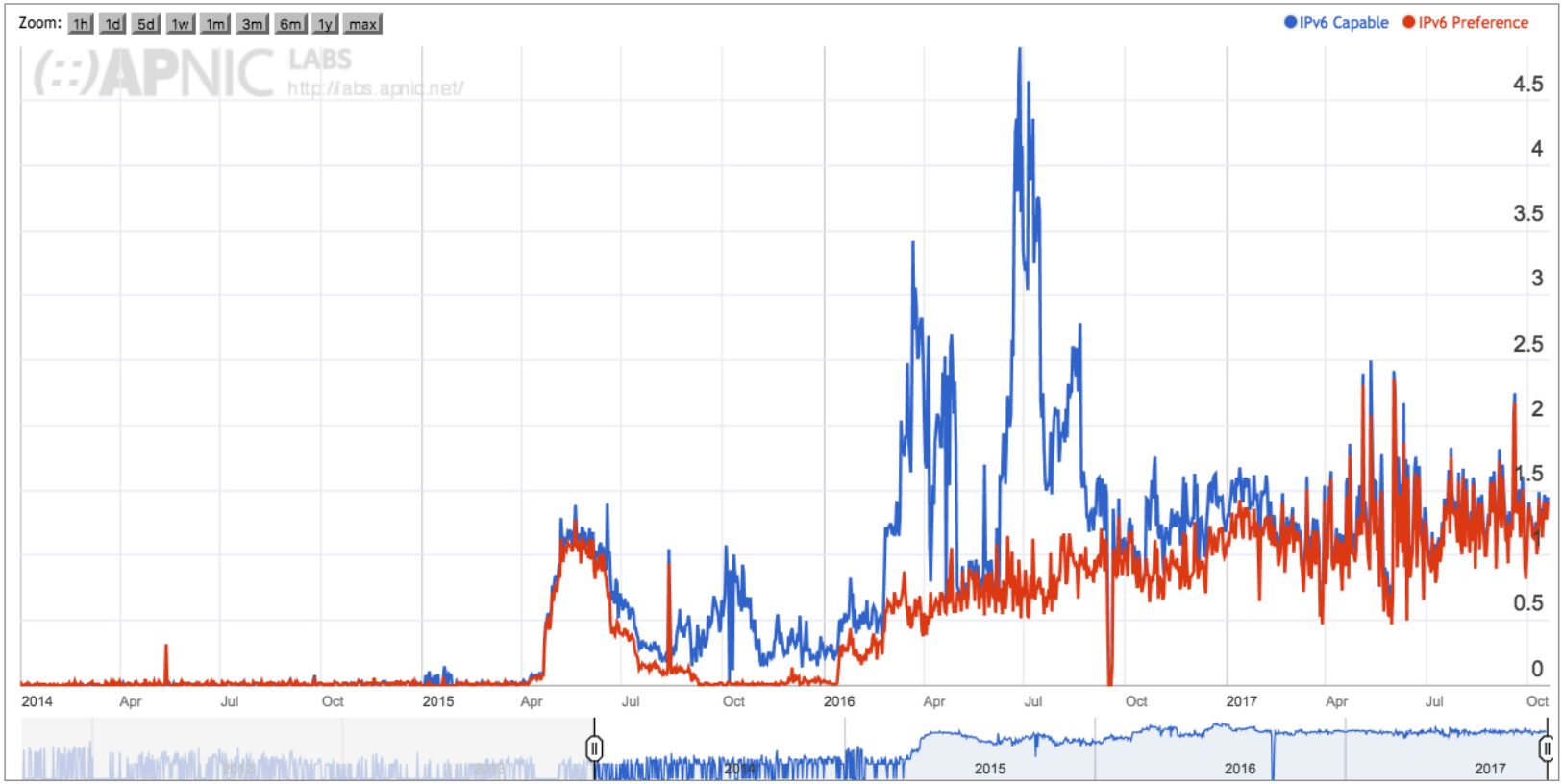
Code	Region	IPv6 Capable	IPv6 Preferred	Samples
XA	World	15.54%	14.96%	515,520,305
XG	Unclassified	85.25%	84.83%	7,020,125
XC	Americas	24.27%	23.26%	102,396,935
XE	Europe	15.24%	14.78%	85,779,203
XD	Asia	14.83%	14.27%	279,222,580
XF	Oceania	14.05%	13.37%	4,135,421
XB	Africa	0.48%	0.46%	43,985,989

Reference: http://stats.labs.apnic.net/ipv6

IPv6 capability

Reference: https://stats.labs.apnic.net/ipv6/XV

IPv6 capability



Reference: https://stats.labs.apnic.net/ipv6/XV

IPv6 capability in the region

CC	Country	IPv6 Capable	IPv6 Preferred	Samples	Weight	Weighted Samples
SA	Saudi Arabia	6.70%	6.40%	6301522	0.55	3492822
IL	Israel	2.99%	2.94%	1360919	0.73	994922
AE	UAE	1.59%	1.54%	1431554	0.99	1423937
OM	Oman	0.29%	0.28%	983716	0.57	555809
CY	Cyprus	0.19%	0.18%	429176	0.33	140586
TR	Turkey	0.01%	0.01%	16482199	0.47	7690171
AM	Armenia	0.01%	0.01%	552562	0.45	249425
LB	Lebanon	0.01%	0.01%	3952618	0.19	755760
GE	Georgia	0.00%	0.00%	695352	0.5	346482
QA	Qatar	0.00%	0.00%	1097568	0.32	354655
PS	Palestine	0.00%	0.00%	759734	0.67	509467
YE	Yemen	0.00%	0.00%	616678	1.86	1145151
KW	Kuwait	0.00%	0.00%	759625	0.71	540109
AZ	Azerbaijan	0.00%	0.00%	1564881	0.64	1004743
SY	Syria	0.00%	0.00%	3536807	0.26	922720
BH	Bahrain	0.00%	0.00%	462539	0.46	214057
JO	Jordan	0.00%	0.00%	3709922	0.16	593495
IQ	Iraq	0.00%	0.00%	15816289	0.05	828511

Reference: https://stats.labs.apnic.net/ipv6/XV

Definition of IPv6-only

- What does "IPv6-only" mean?
  - https://datatracker.ietf.org/doc/draft-palet-ietf-v6ops-ipv6-only/
- Proposed:
  - A host is IPv6-only if it has no IPv4 addresses on any interface
  - A network is IPv6-only if it transports no IPv4
  - Transition mechanisms (over IPv6) are allowed

IPv6 networks (USA)

ASN	AS Name	IPv6 Capable	IPv6 Preferred	Samples
AS62023	NYNEX	99.29%	98.14%	2098
AS36384	GOOGLE-IT - Google Incorporated	98.95%	98.40%	13600
AS4250	ALENT-ASN-1 - Alentus Corporation	98.56%	98.05%	24517
AS3598	MICROSOFT-CORP-AS - Microsoft Corporation	97.63%	96.73%	55415
AS54115	FACEBOOK-CORP - Facebook Inc	96.57%	90.87%	1019
AS13443	LINKEDIN - LinkedIn Corporation	96.30%	92.06%	189
AS132892	CLOUDFLARE Cloudflare, Inc.	95.28%	89.62%	106
AS21321	ARETI-AS	94.00%	93.35%	34088
AS26729	MW-NET-AS - Midwest Internet, Inc.	92.63%	0.66%	9727
AS21928	T-MOBILE-AS21928 - T-Mobile USA, Inc.	88.50%	87.18%	3280011
AS22394	CELLCO - Cellco Partnership DBA Verizon Wireless	86.95%	82.97%	3111578
AS16591	GOOGLE-FIBER - Google Fiber Inc.	82.54%	80.23%	150307
AS7018	ATT-INTERNET4 - ATT Services, Inc.	81.35%	77.13%	7503019
AS10507	SPCS - Sprint Personal Communications Systems	70.63%	69.49%	1338094
AS7922	COMCAST-7922 - Comcast Cable Communications, LLC	70.21%	67.31%	12820117
AS27357	RACKSPACE - Rackspace Hosting	70.13%	70.13%	154
AS109	CISCOSYSTEMS - Cisco Systems, Inc.	67.65%	64.52%	2263

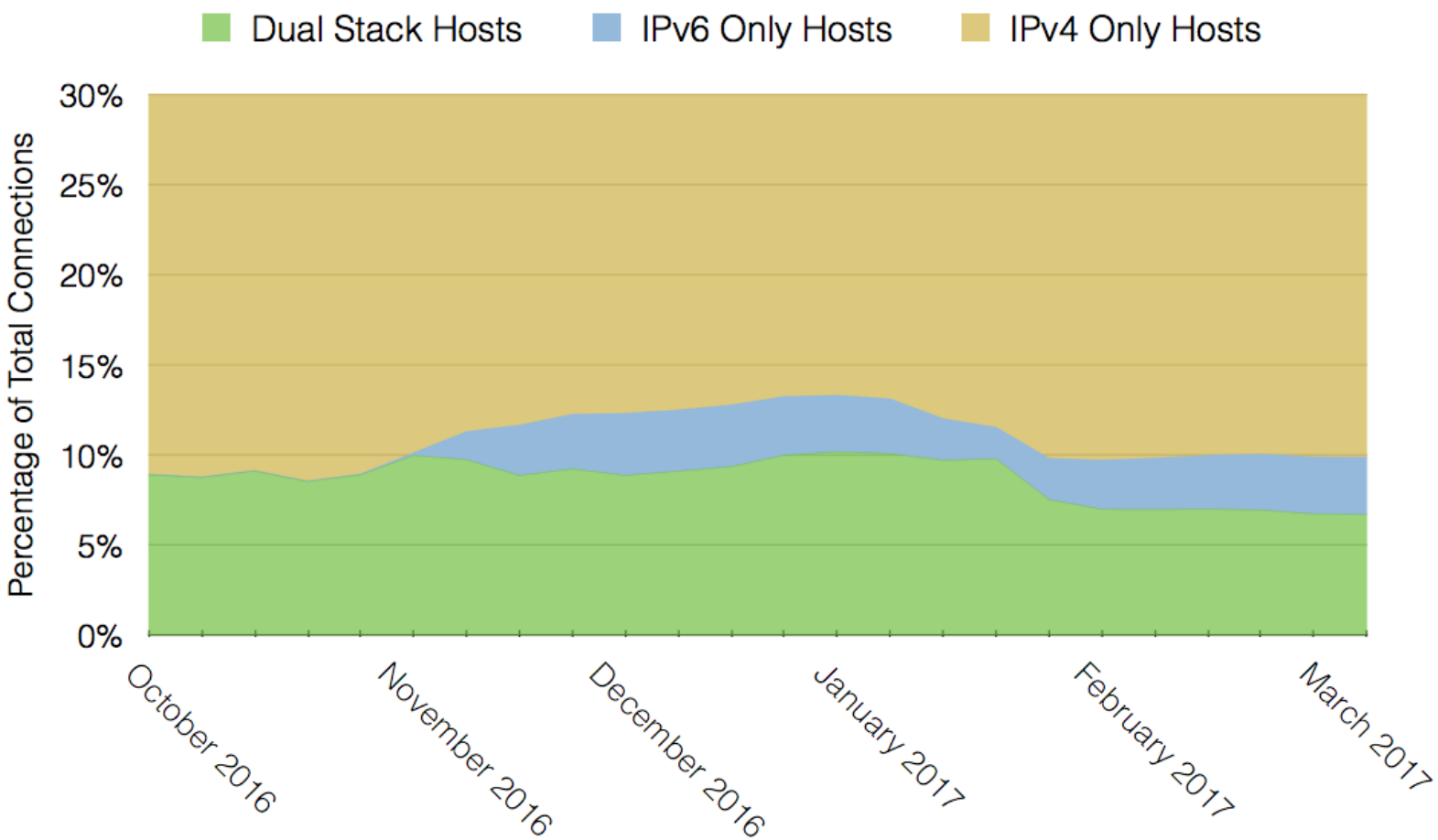
Reference: http://stats.labs.apnic.net/ipv6/US (excerpt, sorted by IPv6 capability)

374 ASNs announcing IPv6-only

	# ASNs	May 2017	July 2017	October 2017
IPv4 ASNs	58456	99.40%	99.40%	99.40%
IPv6 ASNs	14190	23.10%	23.70%	24.10%
IPv4-only ASNs	44640	76.90%	76.30%	75.90%
IPv6-only ASNs	374	0.55%	0.61%	0.64%
Dual stack ASNs	13816	22.60%	23.10%	23.50%

Reference: http://bgp.he.net/ipv6-progress-report.cgi

Rise of IPv6-only hosts



Reference: Apple presentation at https://www.ietf.org/proceedings/98/slides/slides-98-maprg-measuring-trends-in-ipv6-support-tommy-pauly-00.pdf

IPv6-Only Initiatives

- Cisco IPv6-only Building 23
  - https://blogs.cisco.com/enterprise/an-ipv6-campus-of-the-future
- Deutsche Telekom's Terastream
- Charter
- T-Mobile Going IPv6-only
- LinkedIn
- Facebook
- Microsoft IPv6-only internal dev network
- Retevia, IPv4-as-a-Service
  - http://www.retevia.net/

Reasons for IPv6-only

GOOD

Simplicity

- Subnetting
- Segment routing

Clever use of addresses

- Process IDs
- Terastream service bits

FAST

Lower latency

- The Register
- Infoblox blog
- NANOG panel (Facebook, Akamai, LinkedIn, TWC)

CHEAP

Avoid buying IPv4

Sell IPv4

Predictions for 2018

- Continued growth in existing DS-Lite ISPs
- Large trials of MAP continuing
- Mobile increasingly IPv6 + translation
  - NAT64 for iOS, 464xlat for Android
- Data centers increasingly IPv6 + translation

Summary

- Dual-stack is only the halfway point
- IPv6-only in 2017 is where dual-stack was in 2011
- Does “IPv6-only” include translation?