

Vantage Point Selection for IPv6 Measurements

Benefits and Limitations of RIPE Atlas Tags

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May 2017

Introduction

System Tags

Dual-Stacked Probes

By region

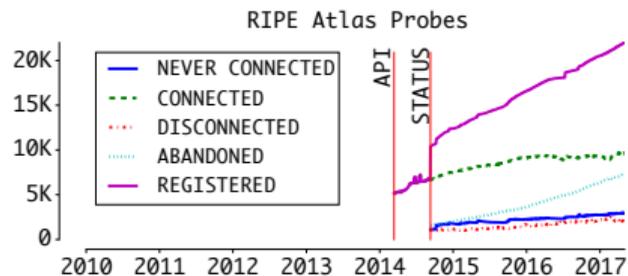
By network

Who connects faster?

User Tags

Takeway

- ▶ A platform of hardware-based probes that run active measurements on the Internet.
- ▶ Plays critical role in –
 - ▶ providing operational support to network operators.
 - ▶ facilitating measurement-based research.
- ▶ ~9.6K probes connected around the globe (May 2017).



NEVER CONNECTED	2965	13.48%
CONNECTED	9685	44.04%
DISCONNECTED	2009	09.14%
ABANDONED	7334	33.34%
REGISTERED	21993	100.0%

Feb '13 Public APIs [3, 4, 5] to provision measurements on probes.

MEASUREMENT	TARGET
ping,ping6	first hop, second hop (derived from traceroute measurements), *.root-servers.net, *.atlas.ripe.net
traceroute, traceroute6	*.root-servers.net, *.atlas.ripe.net, topology4.dyndns.atlas.ripe.net, topology6.dyndns.atlas.ripe.net, labs.ripe.net
dns,dns6	*.root-servers.net: TCP (SOA), UDP (SOA), version.bind, hostname.bind, id.server, version.server)
ssllcert,ssllcert6	www.ripe.net,atlas.ripe.net
http,http6	www.ripe.net/favicon.ico, ip-echo.ripe.net

- ▶ However, vantage point selection was based on simplistic filters that used –
 1. Latitudes and longitudes
 2. Network prefixes

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Jul '14 Feature to add tags to probes [6].

Oct '14 Feature to select probes using tags.

RIPE Atlas Probe Coverage (May 2017)

<https://atlas.ripe.net/results/maps/network-coverage>



- ▶ How do we select dual-stacked vantage points at *home*? Do tags help?
- ▶ What region— and network—based *bias* comes into play with this selection?

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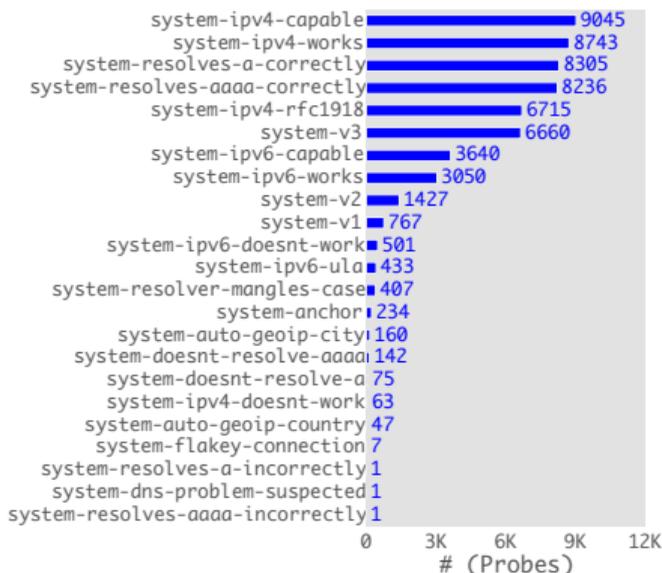
Who connects faster?

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Takeaway

System Tags

- ▶ Tags applied by RIPE Atlas based on results from built-in measurements.



- ▶ Frequently updated (every 4 hours)
- ▶ Fairly stable and accurate.
- ▶ Highlights state of DNS and IP connectivity.
- ▶ Helps identify hardware version of the probe.

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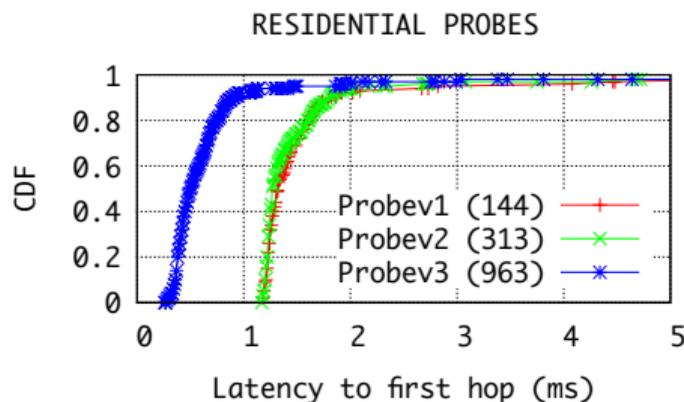
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- ▶ v3 home probes show < 1 ms *hop1* latencies.
- ▶ v1 and v2 probes show **higher** *hop1* latencies (experience load issues).

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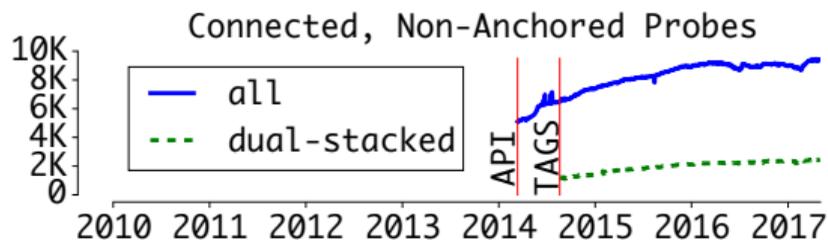
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Takeaway

- ▶ ~2.4K (~25%) probes are dual-stacked (May 2017).
- ▶ Richest source of vantage points for IPv6 measurement studies.



- ▶ Criteria:
 1. Probes with same¹ IPv4 and IPv6 ASN.
 2. Probes with system-ipv4-works and system-ipv6-works tags.

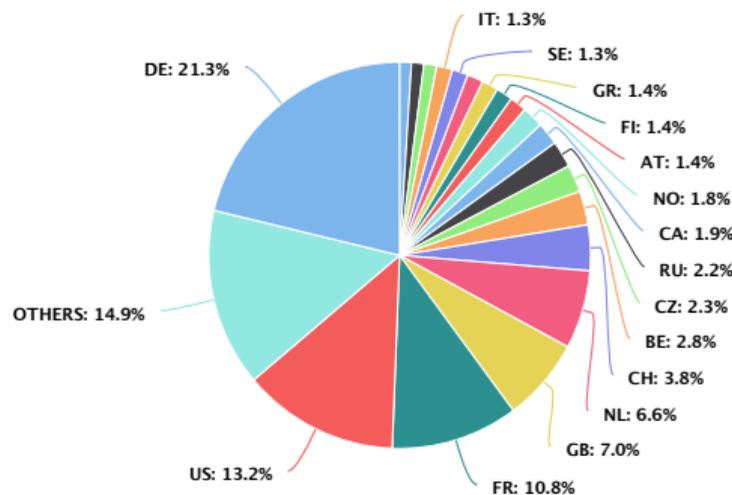
¹restrictive, but filters out hosts that use 6in4 tunnels

Dual-Stacked Probes | Country-based Distribution

- ▶ RIPE & ARIN regions with 91% probes.
- ▶ 88 countries / 822 ASNs covered.

DE	489	DTAG	181
US	304	COMCAST	169
FR	248	PROXAD	96
GB	161	XS4ALL	71
NL	151	ORANGE	71

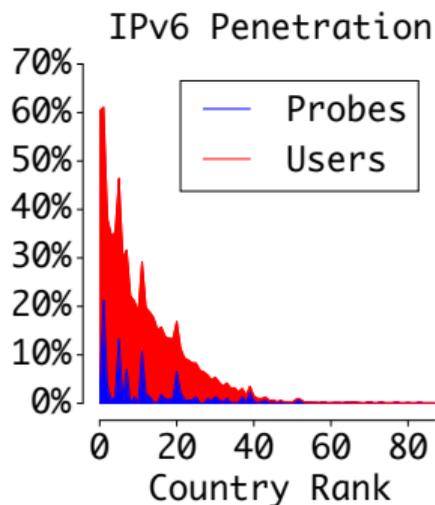
- ▶ Belgium² missing in the top 5 list!
- ▶ Probe deployment likely does not reflect IPv6 user population across the globe.



Entire list at: <http://goo.gl/UdEe1Q>

²Belgium with ~49% penetration leads (as of May 2017) Google IPv6 adoption statistics [8]

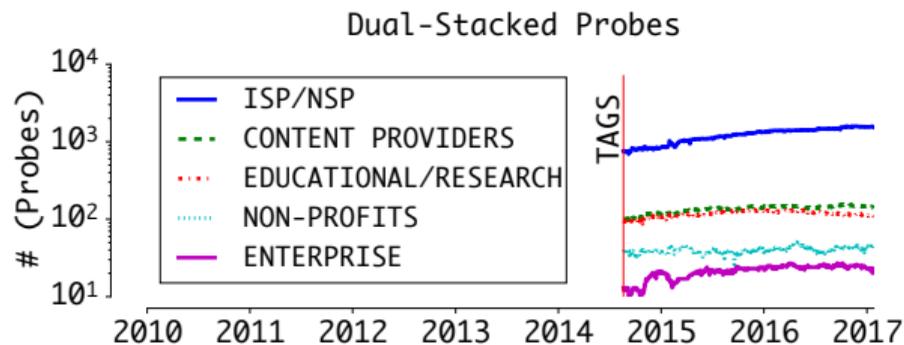
- ▶ Correlation of IPv6 users against dual-stacked probes using APNIC dataset [9]



	USERS	PROBES
BE	57.4%	2.8%
LU	34.2%	0.6%
GR	33.7%	1.4%
CH	34.3%	3.8%
PT	29.2%	0.7%
IN	22.0%	0.1%
US	33.2%	13.2%
EC	18.8%	0.1%
DE	39.9%	21.3%
JP	19.8%	1.4%

- ▶ JP with ~22M IPv6 users (~19% IPv6 usage ratio) hosts only ~1.4% (31) probes.
- ▶ These countries with large IPv6 userbase can benefit from more probes.

- ▶ We further used PeeringDB [10] to map ASNs by network type.



NSP	1540	83.0%
CP	139	7.5%
EDU	110	6.0%
NP	45	2.4%
EP	21	1.1%

- ▶ ~83% of dual-stacked probes are hosted by ISPs.
- ▶ ~60% (782 probes) deployed at home.

RESIDENTIAL	DSL	262
	CABLE	148
	FIBRE	179

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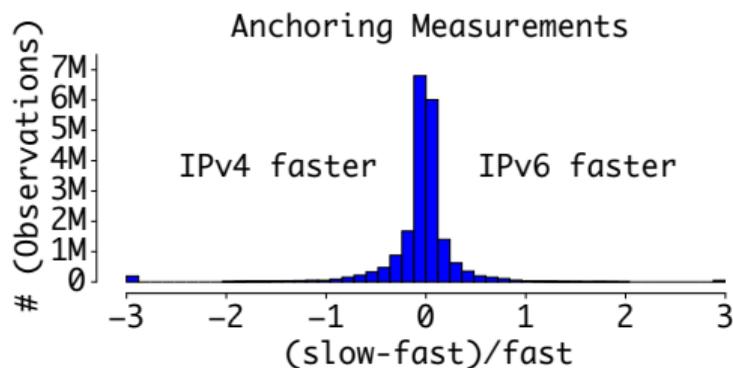
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Who connects faster?

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Takeaway

IPv4 versus IPv6 | Who connects faster?



- ▶ ping measurements from dual-stacked probes towards 149 RIPE Atlas anchors.
- ▶ 5th percentile latency comparison using month-long dataset (20M samples).
- ▶ Latency is comparable across AF, although IPv4 is marginally faster.
- ▶ Raw dataset is publicly released – <http://goo.gl/dOJL5Q>.

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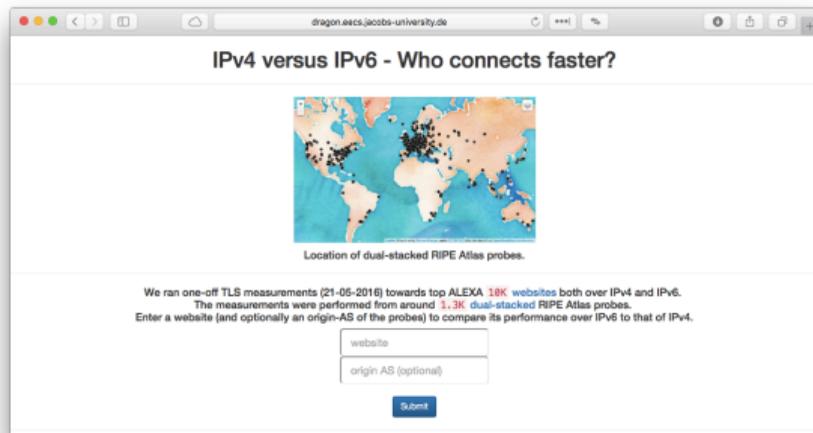
Who connects faster?

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Takeaway

IPv4 versus IPv6 | Who connects faster?

- ▶ We used the identified dual-stacked probes to create a web service.
- ▶ For a given website (and origin-AS), it shows which AF connects faster.



<http://goo.gl/hbzbwD>

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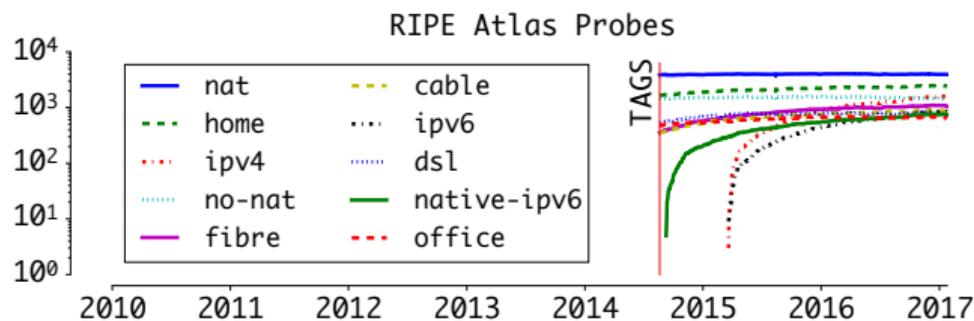
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- ▶ Tags manually applied by probe hosts.
- ▶ Requires proactive participation of probe hosts.



- ▶ Popular user tags are centered around home probes.



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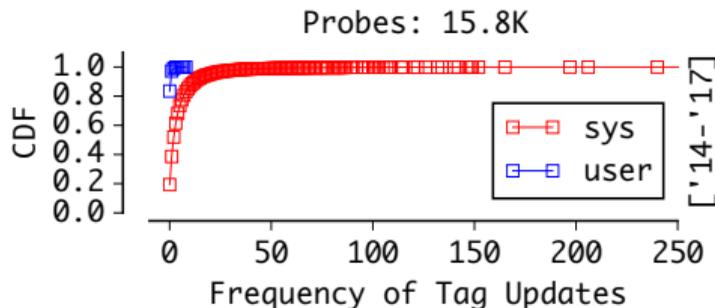
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User tags tend to become stale over time!



- ▶ ~2.8% of probe hosts ever update their user tags.
- ▶ ~61.4% of probes received at least 1 update on system tags.
- ▶ ~13.1% of probes received at least 10 updates on system tags.

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- ▶ User tags tend to become stale over time.
 - ▶ Associate a tag-creation timestamp (allow predictive weighting of tag accuracy)
 - ▶ Use built-in measurements to identify if user-tag is plausible.
- ▶ System tags (refresh every 4 hours) are stable and accurate.
- ▶ We used system tags to identify dual-stacked probes:
 - ▶ 2.4K (~25%) probes covering 88 countries and 822 ASNs.
 - ▶ 83% deployed by ISPs with 782 connected at homes.
 - ▶ Evenly split across DSL, cable and fibre deployments.
 - ▶ Some countries (such as BE and JP) are underrepresented in this sample.

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References

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