

YAHOO!

IPv6 Transition at Yahoo

Stephen D. Strowes, sds@yahoo-inc.com

29th July, 2015

Who am I?

Outline

1. traffic stats on our edge
2. traffic stats from Android devices
3. open questions

Current Status

(a.k.a., things we all know)

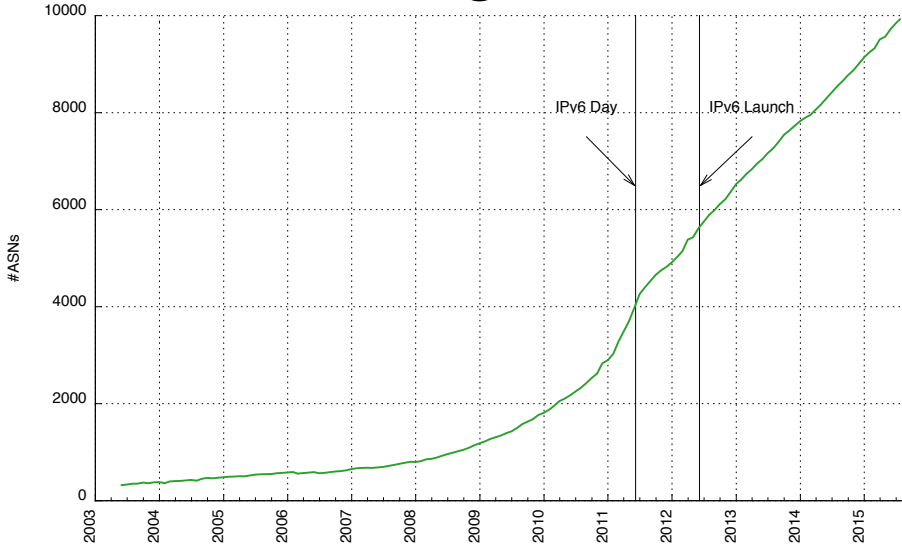
2011-02-03: Final /8s allocated by IANA

2011-06-08 UTC: World IPv6 Day

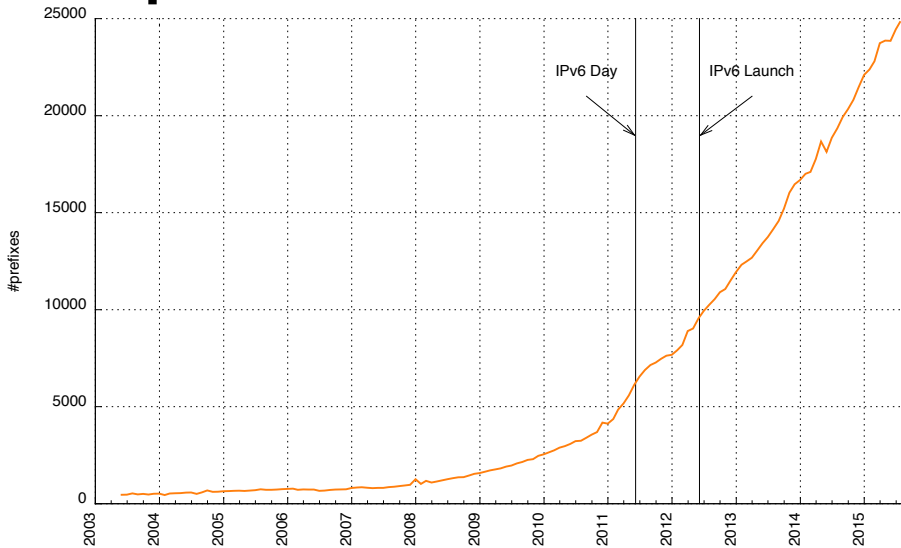
2012-06-06 UTC: World IPv6 Launch

Now: ARIN has 253 /24s remaining

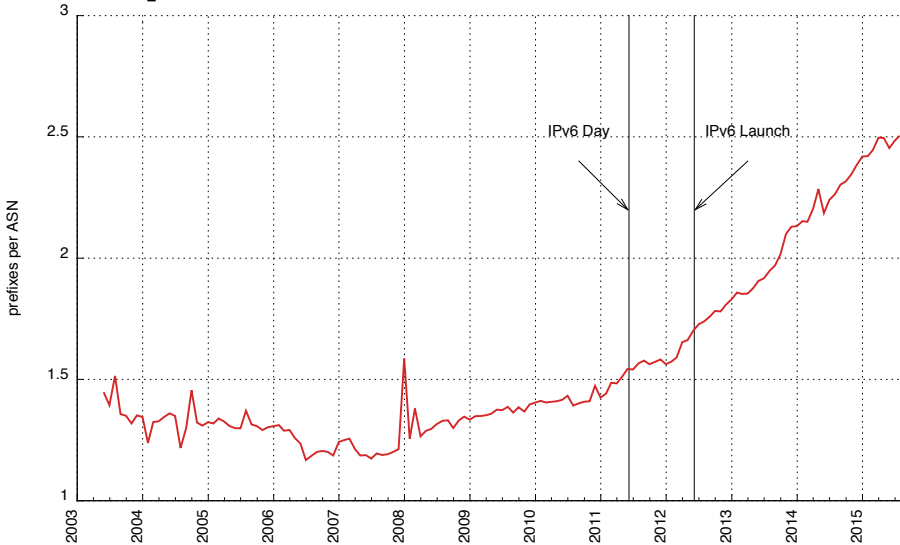
ASNs advertising IPv6



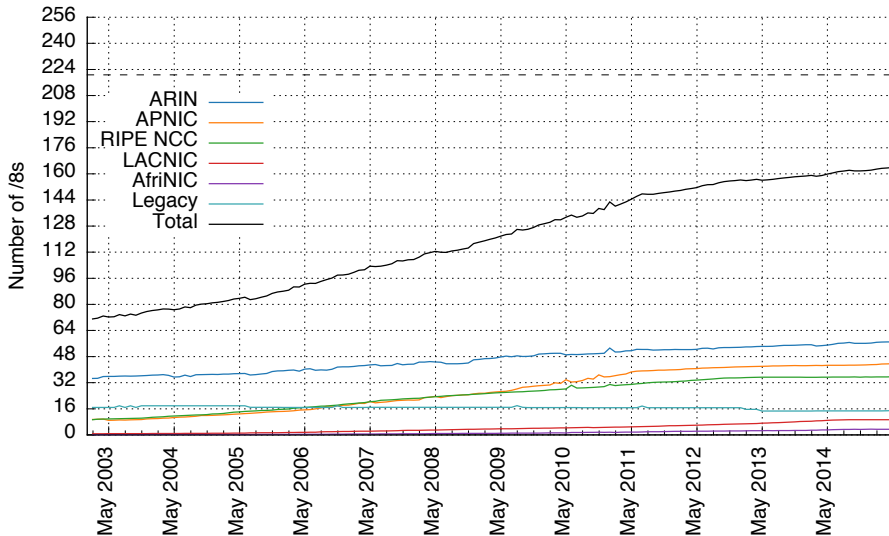
IPv6 prefixes



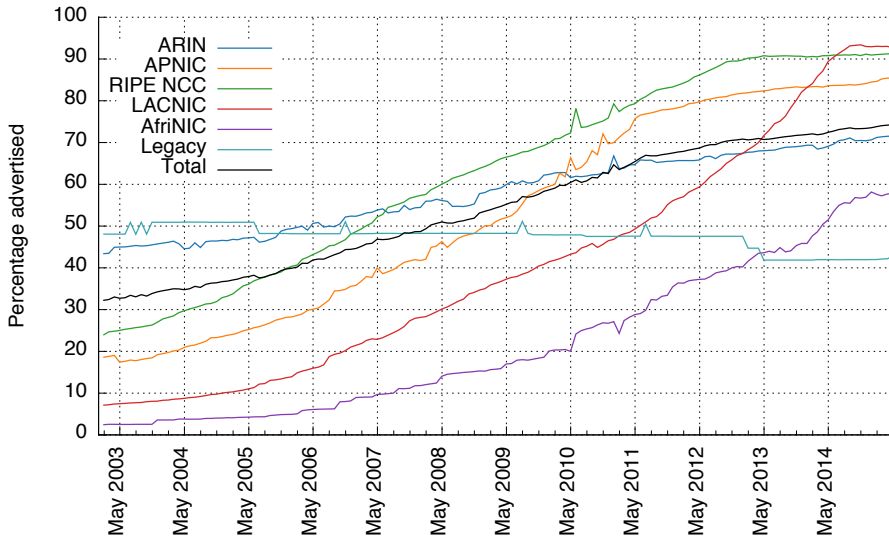
IPv6 prefix/ASN ratio



IPv4 space advertised



RIR space



Key Statuses

- ▶ Comcast
- ▶ Facebook
- ▶ Google
- ▶ Apple
- ▶ ... others

Key Statuses

- ▶ ... and also what we're doing

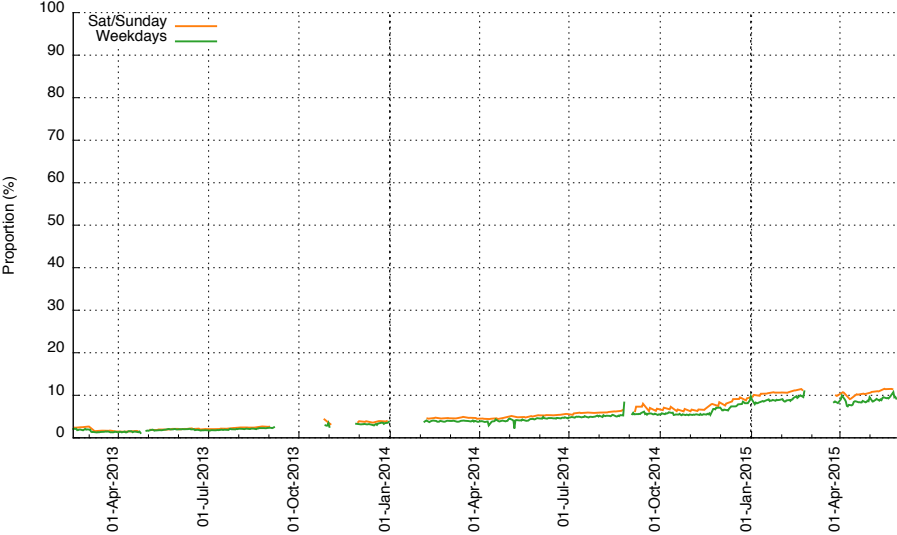
Data collection on Yahoo's CDN

(a.k.a., things Yahoo sees)

Data collection

- ▶ HTTP access logs at a range of our edges
- ▶ Geographically representative, but not everything
 - ▶ So, DNS load balancing could influence what we see
- ▶ IPs are mapped to ASNs and bundled together before I see them
 - ▶ The ASNs are those used by ISOC to further aggregate results
- ▶ These are HTTP *request* counts, not byte or packet counts
 - ▶ So content *type* might influence those metrics

Global Traffic



Global Traffic

May 2015:

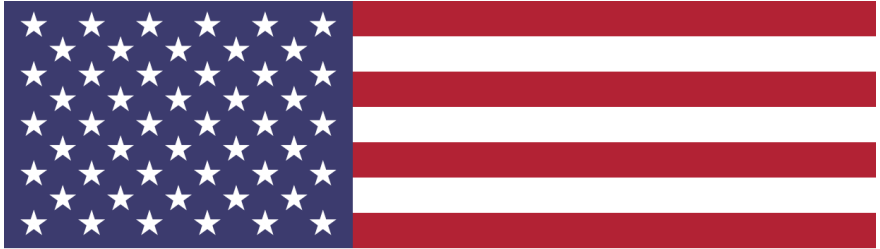
Mon-Fri: min: 8.53%
 median: 9.29%
 max: 10.74%

Weekends: min: 10.64%
 median: 11.15%
 max: 11.53%

Countries have different levels of deployment.

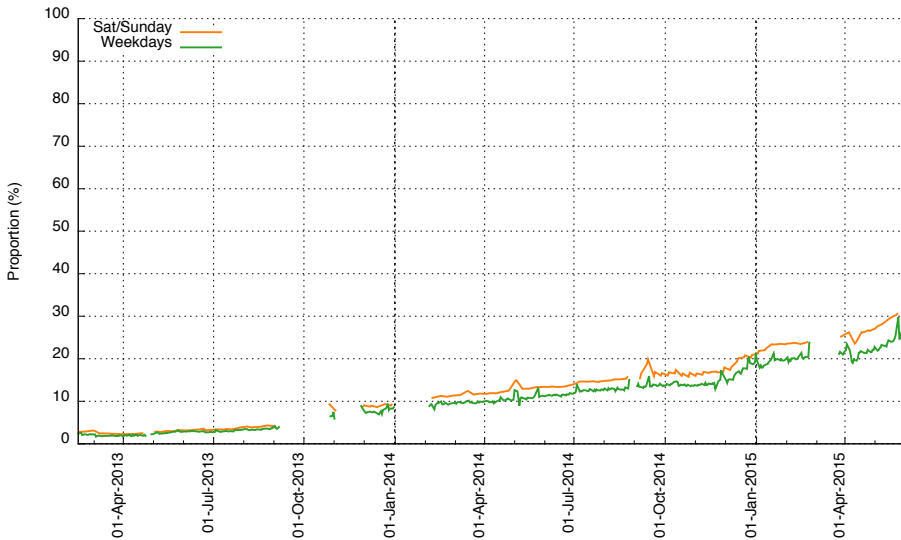
We see strong ($\geq 10\%$) deployment in:

- ▶ USA
- ▶ Germany
- ▶ Belgium
- ▶ Romania
- ▶ Malaysia
- ▶ Luxembourg
- ▶ Portugal



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USA



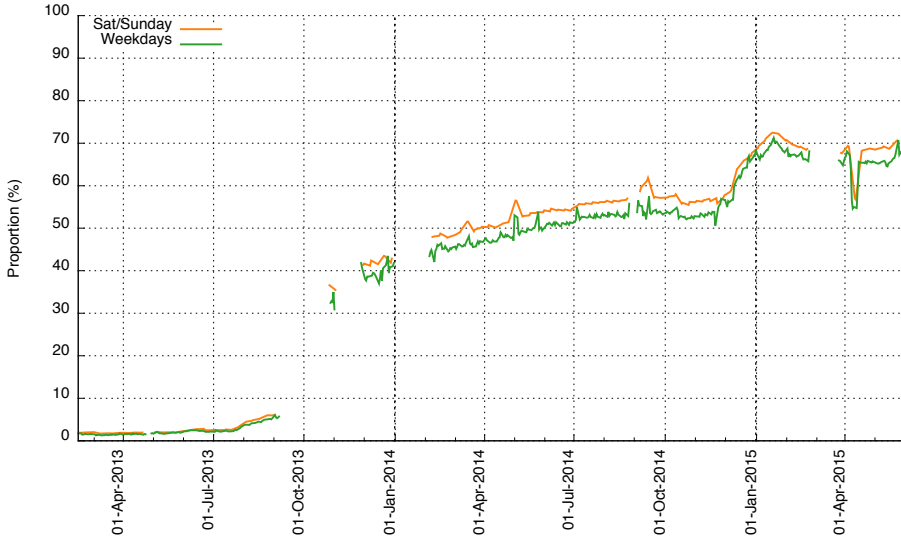
USA

May 2015:

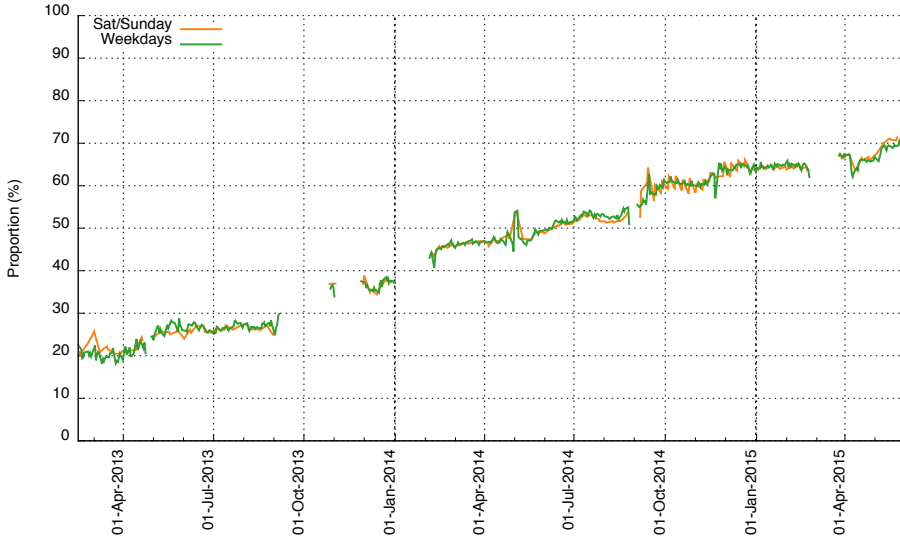
Mon-Fri: min: 21.89%
 median: 23.91%
 max: 29.77%

Weekends: min: 22.90%
 median: 25.67%
 max: 30.72%

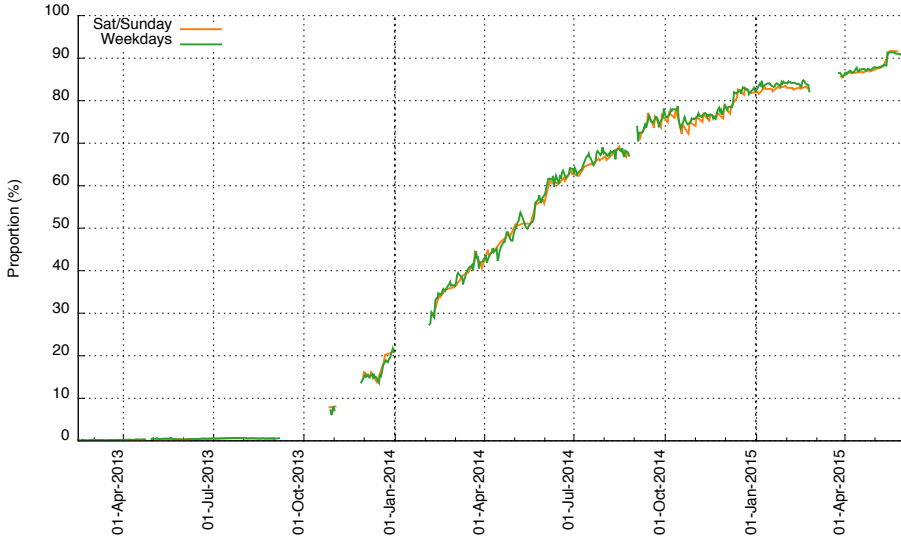
USA: \$ISP1



USA: \$ISP2



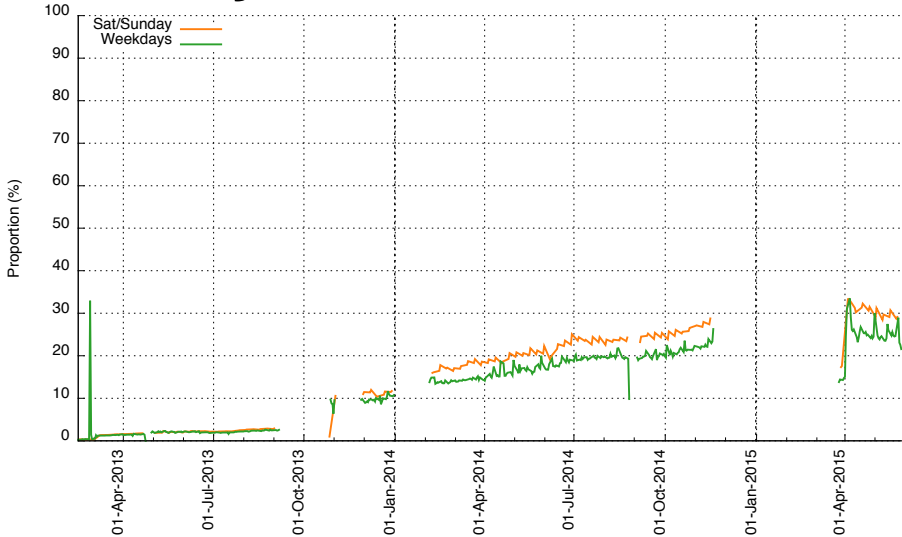
USA: \$ISP3



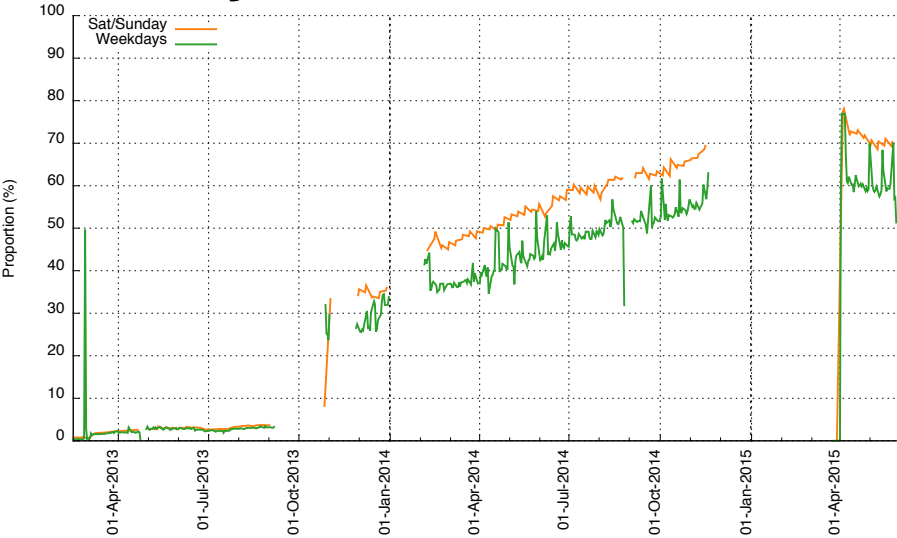


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Germany



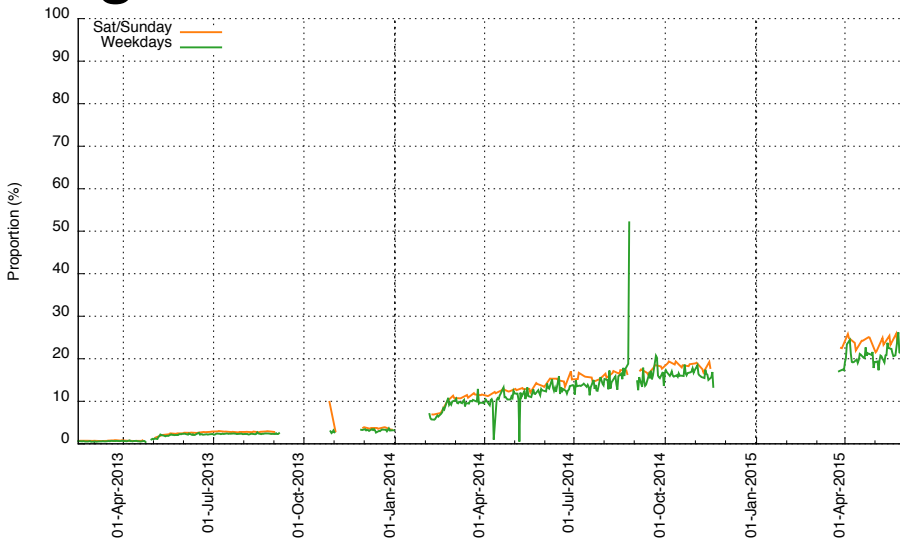
Germany: \$ISP4



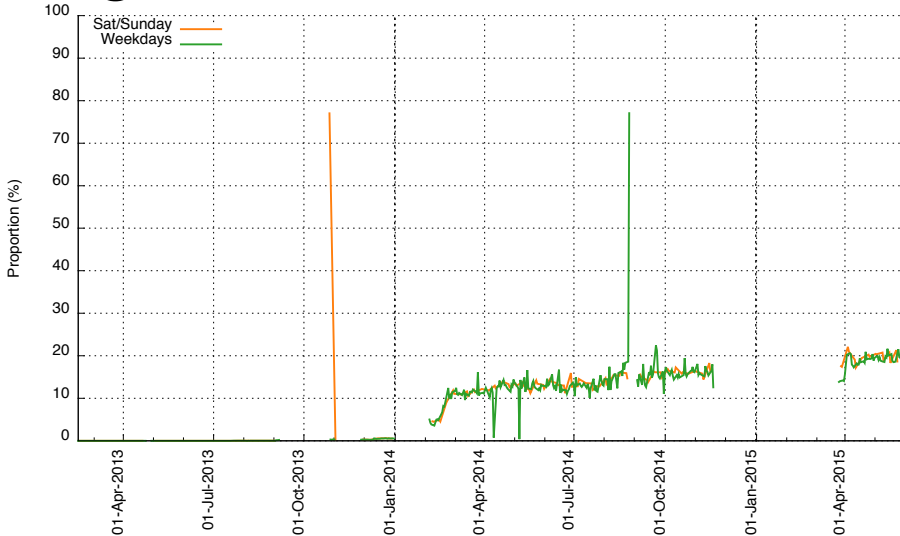


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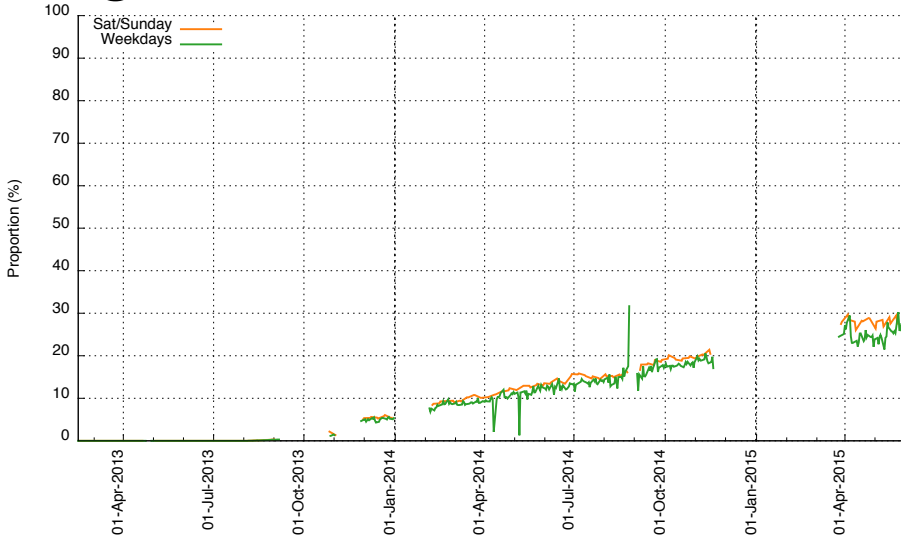
Belgium



Belgium: \$ISP5



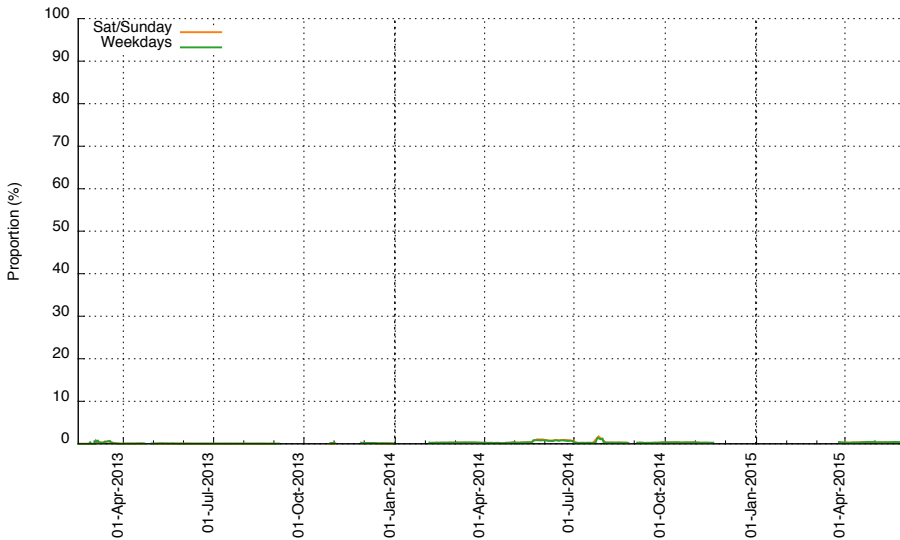
Belgium: \$ISP6





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UK



Summary

- ▶ Weekend/weekday split is evident
- ▶ Mobile networks are big contributors

Data collection on Android devices

(a.k.a., things Flickr sees)

Data collection

- ▶ Android app reports various metrics to Splunk
- ▶ To help monitor user experience differences between v4 and v6, the app reports the *server IP* it hits for a request.
- ▶ Sampled. Also, partial visibility across our dual-stacked names. (We're working on it.)
- ▶ By chance, these requests hit a completely different set of edges

July 28th Traffic Splits

LTE:

- Global:
 - ▶ 25.4% of requests over native v6
 - ▶ 74.6% over v4 or through NAT64
- US:
 - ▶ 60.4% of requests over native v6
 - ▶ 39.6% over v4 or through NAT64

July 28th Traffic Splits

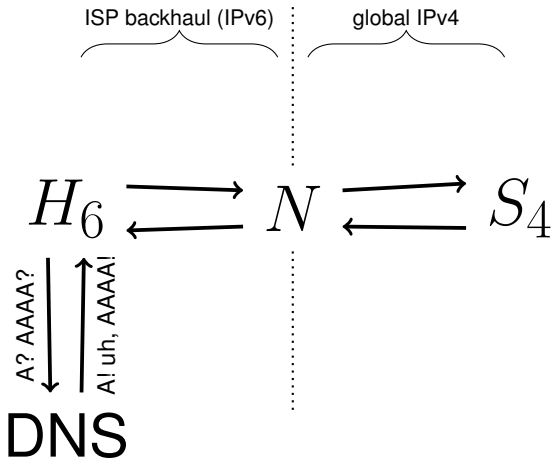
Wifi:

- Global:
 - ▶ 10.8% of requests over native v6
 - ▶ 89.2% over v4
- US:
 - ▶ 33.7% of requests over native v6
 - ▶ 66.3% over v4

NAT64

Flickr is interesting because they
have enough data to see when
NAT64 is in use

High-level: NAT64 + DNS64

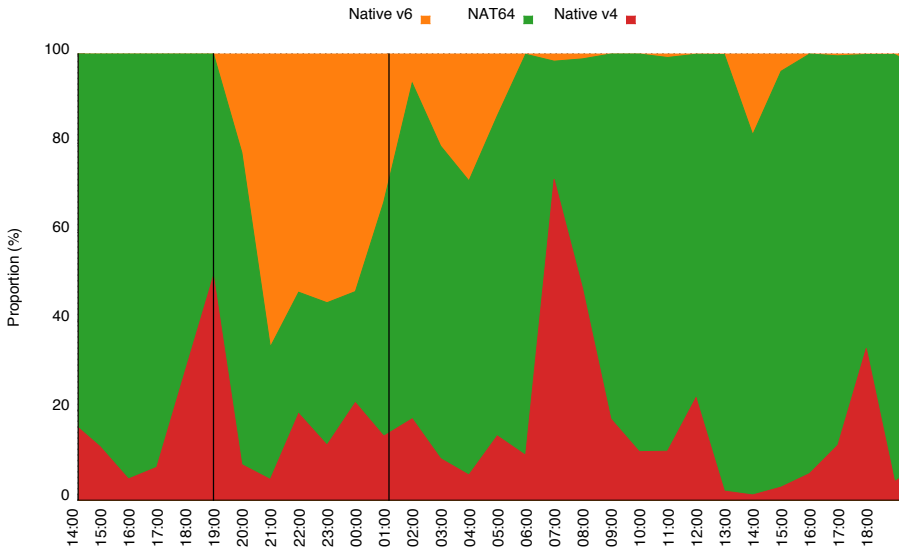


In this environment,

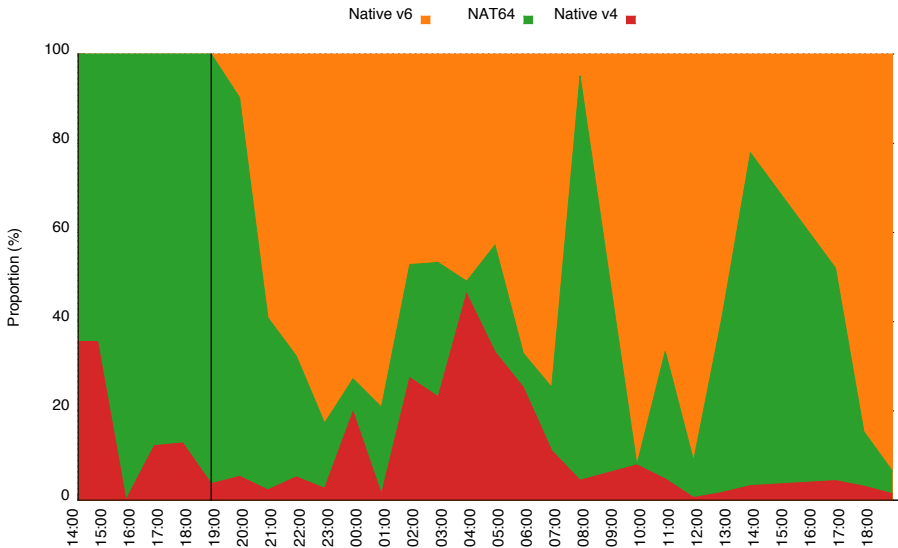
- ▶ H has an IPv6 connection open, with N
- ▶ S has an IPv4 connection open, with N
- ▶ ... and these are the same connection
- ▶ ... and neither side is directly aware of the other

And this really happens without *developers* being aware

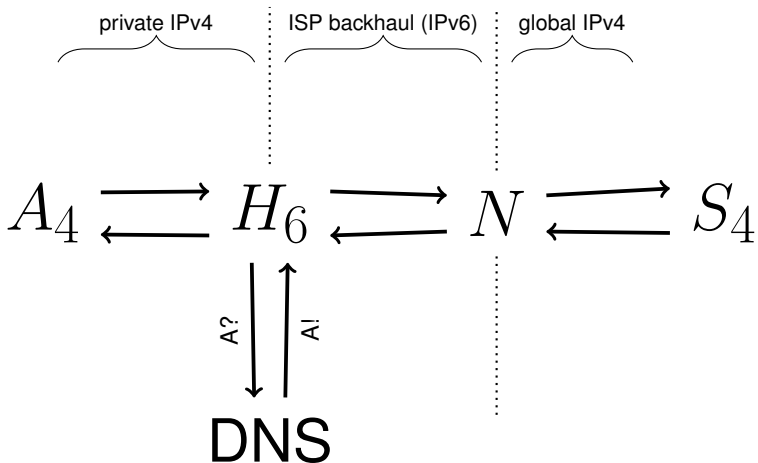
Roll-on/roll-off



On



464xlat



Wrap-up

- ▶ IPv4 still dominates but IPv6 is far beyond “lab” status
- ▶ Mobile networks are big contributors and can move faster than traditional networks
- ▶ DNS64 interactions deserve a little more attention to understand

Wrap-up: Open questions

- ▶ Prevalence of Carrier-Grade NAT is not well understood
- ▶ geo-ip on v6 is *even trickier* than it was previously
- ▶ Use of transition technologies sometimes (necessarily) transparent to apps
- ▶ PMTUD is still hard
- ▶ Performance comparisons are difficult to pin down
- ▶ More broadly: how much of that v6 space in BGP is *in use*
 - ▶ an aside: for (i in $0 .. 2^{32}$) $i \rightarrow \text{PTR} \rightarrow \text{AAAA}$
- ▶ Further into the future, disabling IPv4 on hosts
 - ▶ IETF WG sunset4

Wrap-up

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Questions?

`sds@yahoo-inc.com`