

World IPv6 Day - What did we learn?

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IETF 81

NMRG session

RIPE NCC Measurements - World IPv6 Day

- IPv6 Eyechart and 6to4 (not in this talk)
- Active measurements
 - Sources: 40 vantage points (RIPE TTM, CAIDA Ark, ...)
 - Destinations: 53 participant or already dual-stacked sites
 - From 2011-06-01 to 2011-06-11 we measured
 - DNS: A and/or AAAA records
 - ping(6)/traceroute(6)
 - HTTP over IPv4 and IPv6

Measurement vantage points

▼ CAIDA Ark ▼ RIPE NCC TTM ▼ Other

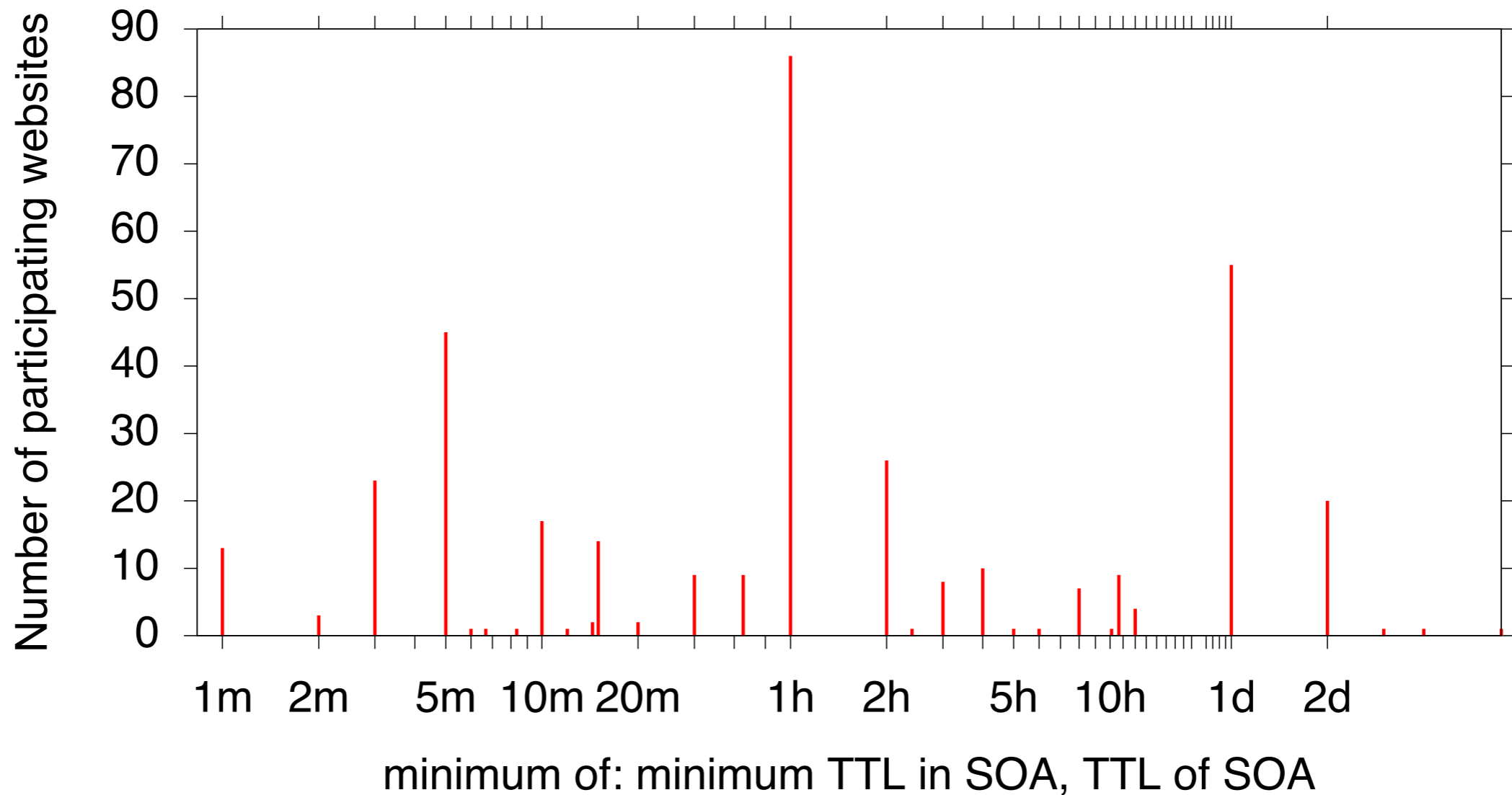


Lesson: Control

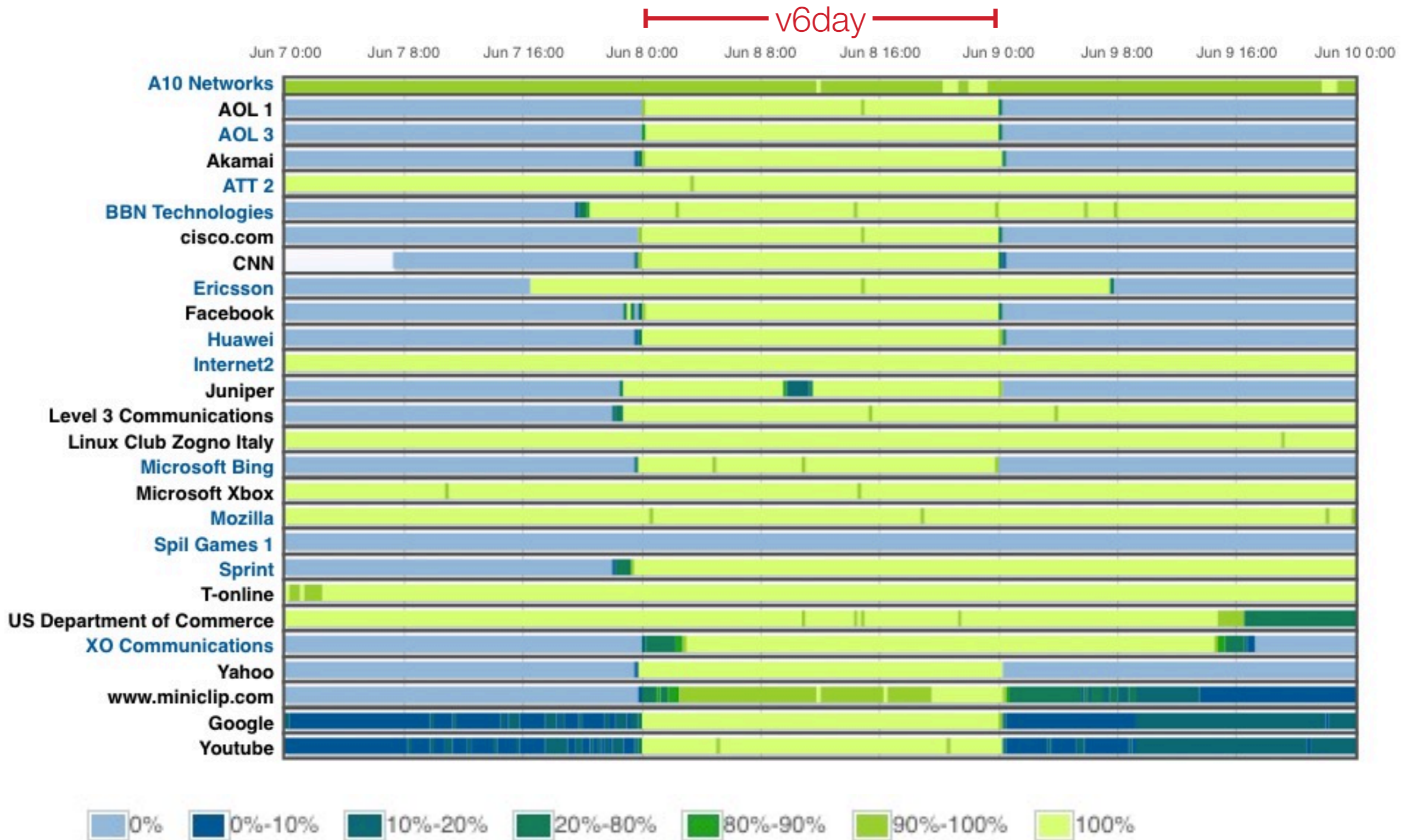
When did World IPv6 Day start?

- Less than 2 days before World IPv6 Day:

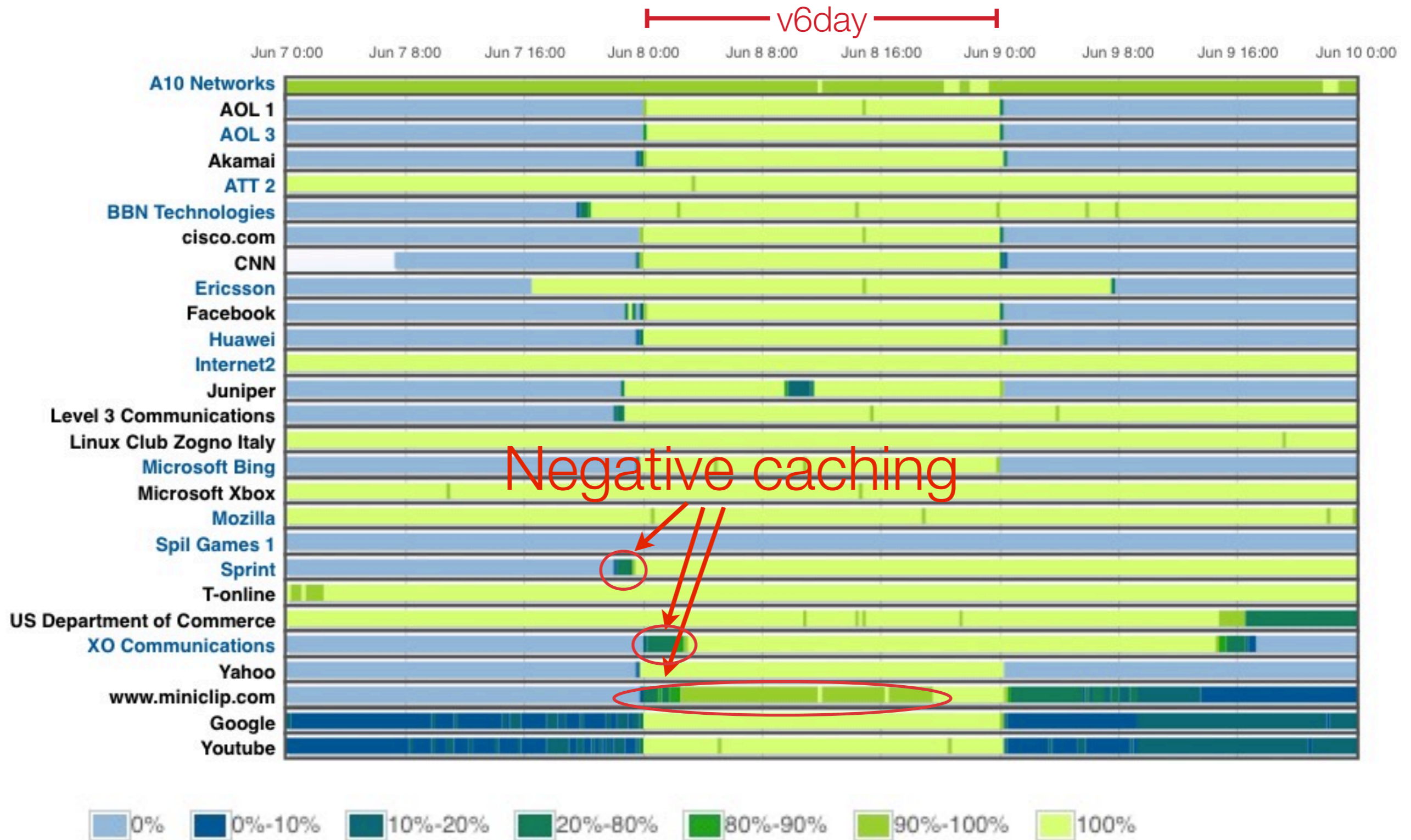
DNS negative caching for websites participating in World IPv6 Day



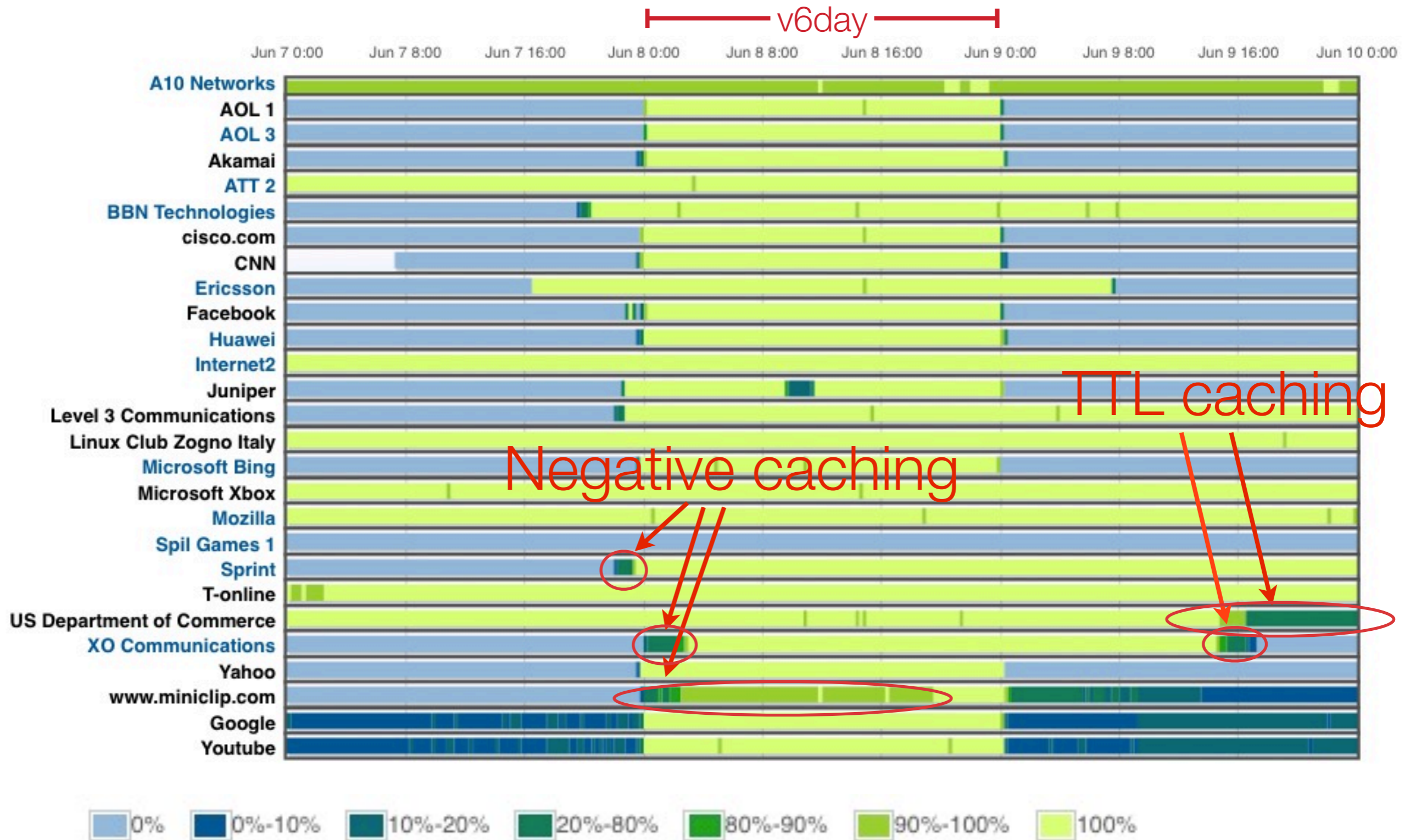
Percentage of vantage points seeing AAAA



Percentage of vantage points seeing AAAA



Percentage of vantage points seeing AAAA



Control - lessons learned

- Know your on/off switch
 - Control your DNS
- Set low TTL in case of roll-back
- Set low negative TTL
 - By means of minTTL in SOA / TTL of SOA

Lesson: Test and monitor

You don't want this to happen

On IPv4:

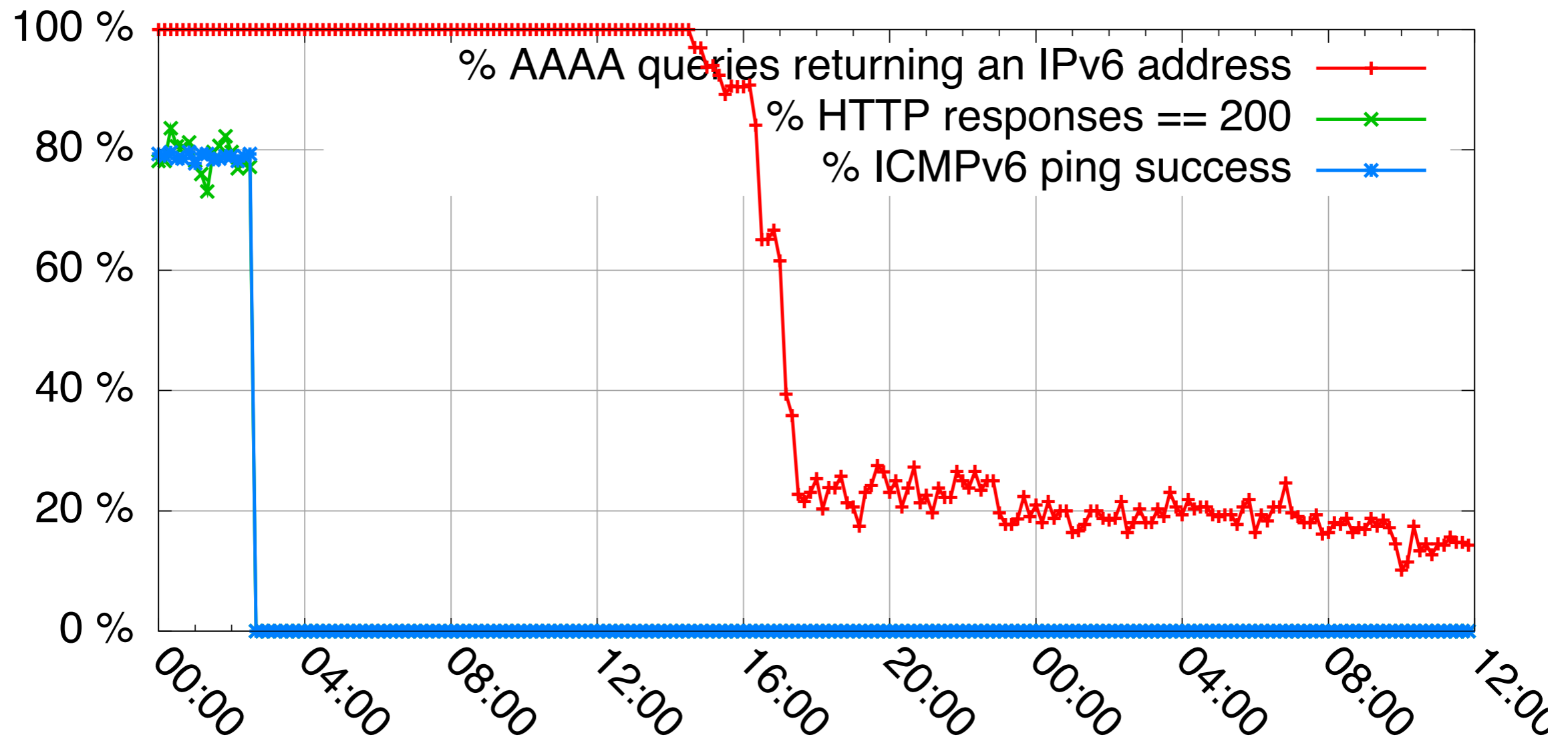


On IPv6:



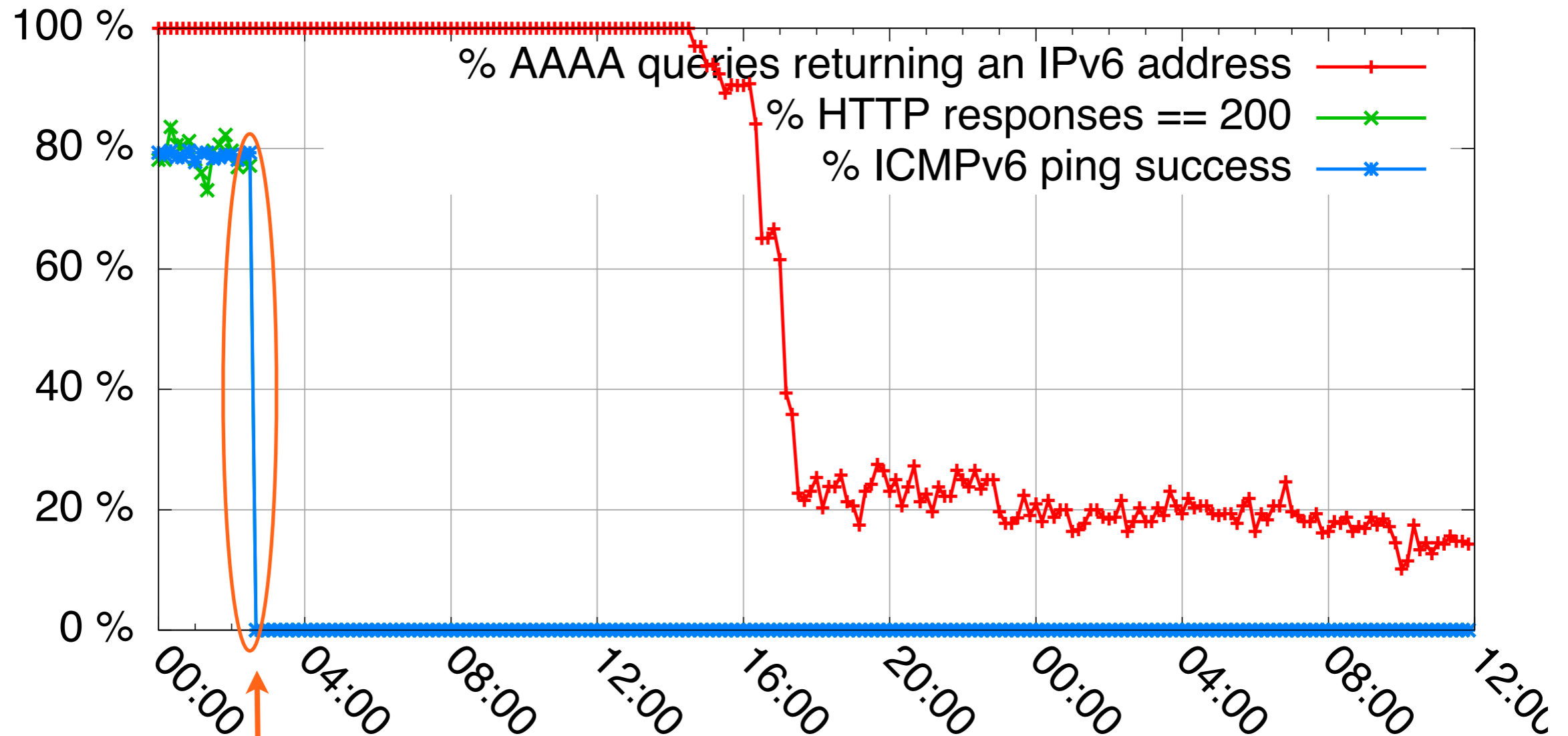
Or this ...

Comparing DNS, ping and HTTP IPv6 measurements to www.commerce.gov from 2011-06-09 0:00 UTC to 2011-06-10 12:00 UTC



Or this ...

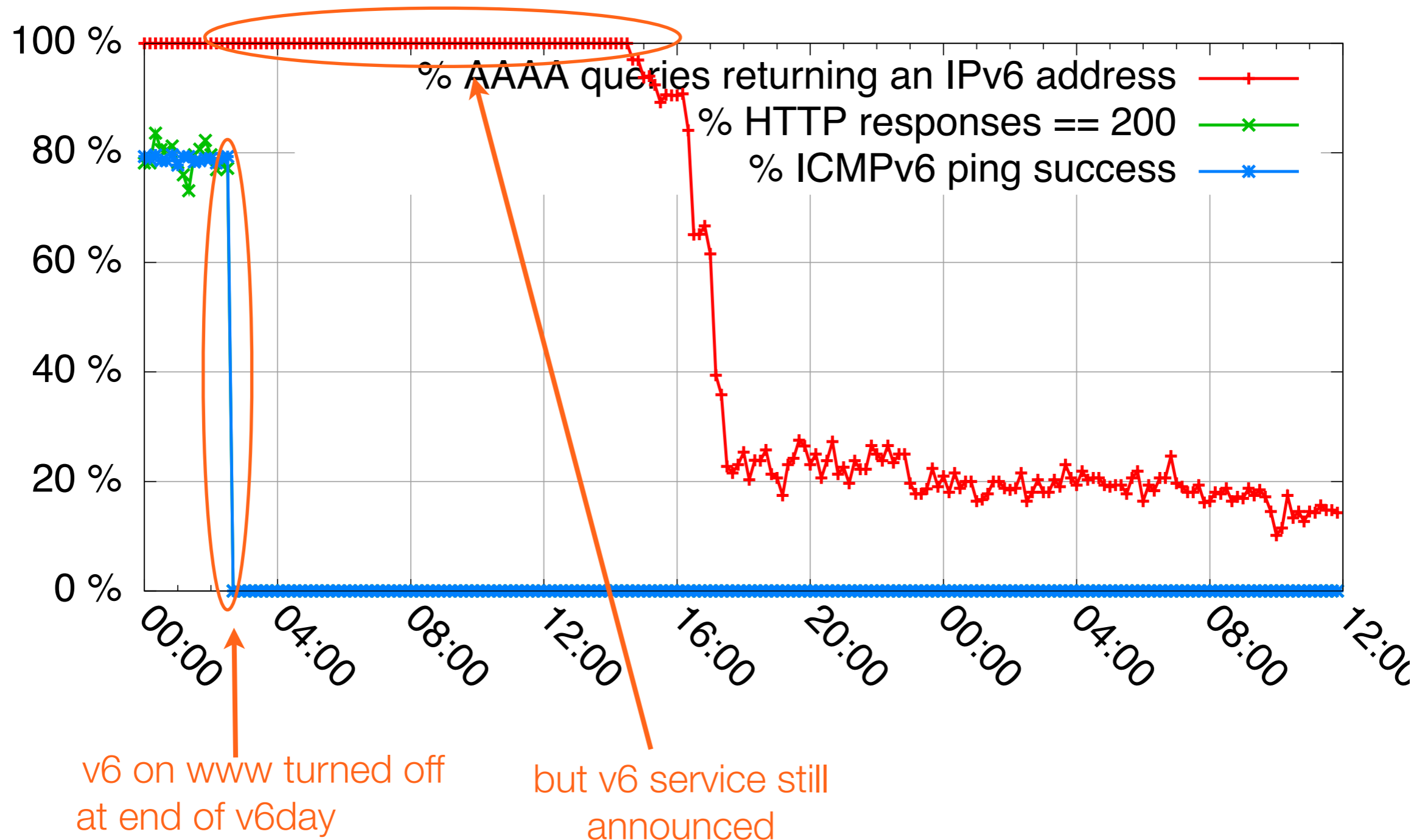
Comparing DNS, ping and HTTP IPv6 measurements to www.commerce.gov from 2011-06-09 0:00 UTC to 2011-06-10 12:00 UTC



v6 on www turned off at end of v6day

Or this ...

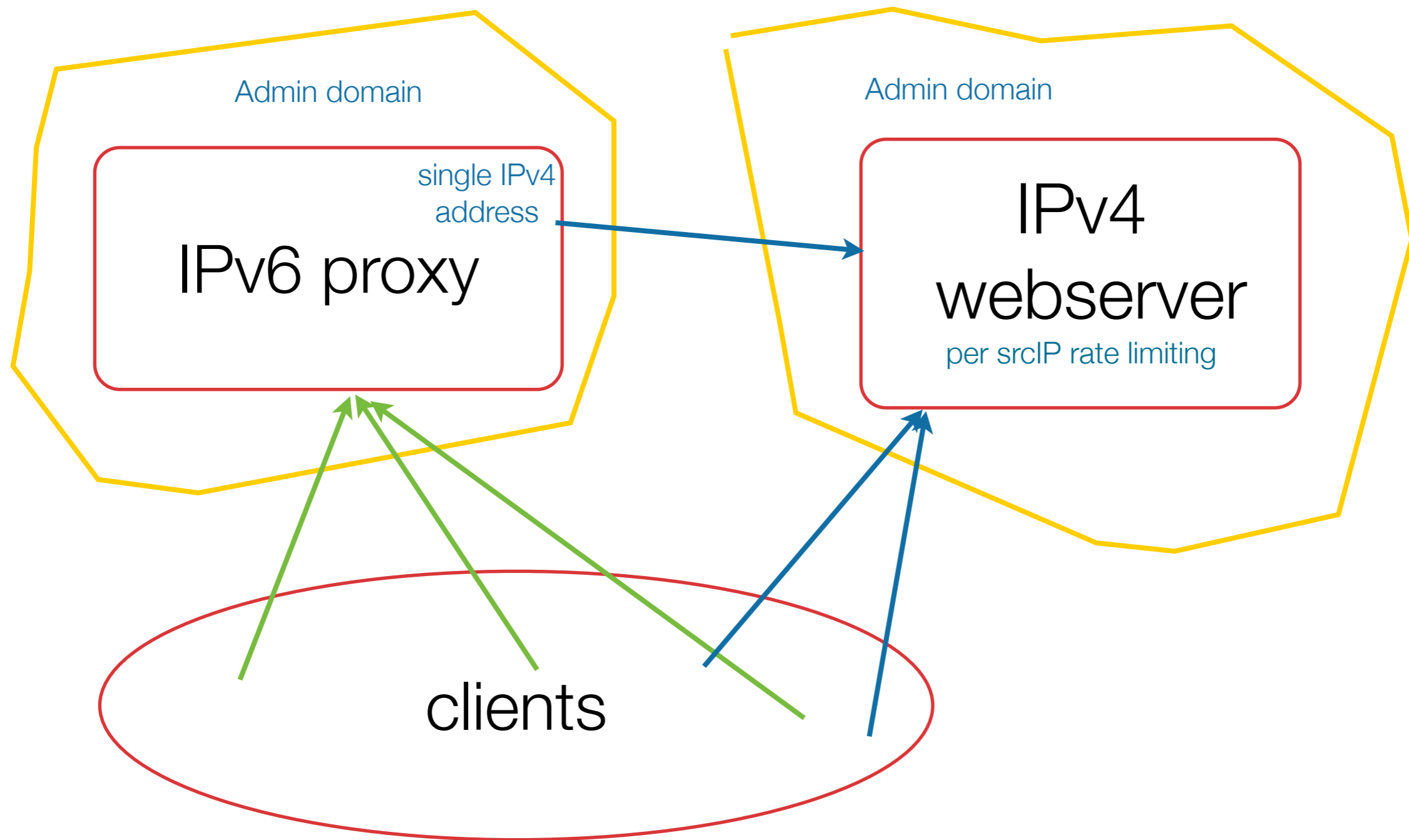
Comparing DNS, ping and HTTP IPv6 measurements to www.commerce.gov from 2011-06-09 0:00 UTC to 2011-06-10 12:00 UTC



Partial Reachability

- Internet is a collection of interconnecting networks, and can be different on IPv4/IPv6
- For some of our vantage points, not all destinations were reachable
 - Are our vantage points representative?
 - Network partitioning, examples we encountered:
 - Level3 - Hurricane Electric
 - Cogent - Hurricane Electric
 - See http://en.wikipedia.org/wiki/Comparison_of_IPv6_support_by_major_transit_providers

Case: Content-NAT Issue (1)



Case: Content-NAT Issue (2)

- Combine
 - v6-to-v4 proxy, srcNAT to single IPv4 address
 - Webserver with per-source IP rate-limiting
- Hard to catch if not tested under real-life load
- Violating e2e principle can make solutions brittle

- Solution: Keep it simple (no NAT!)

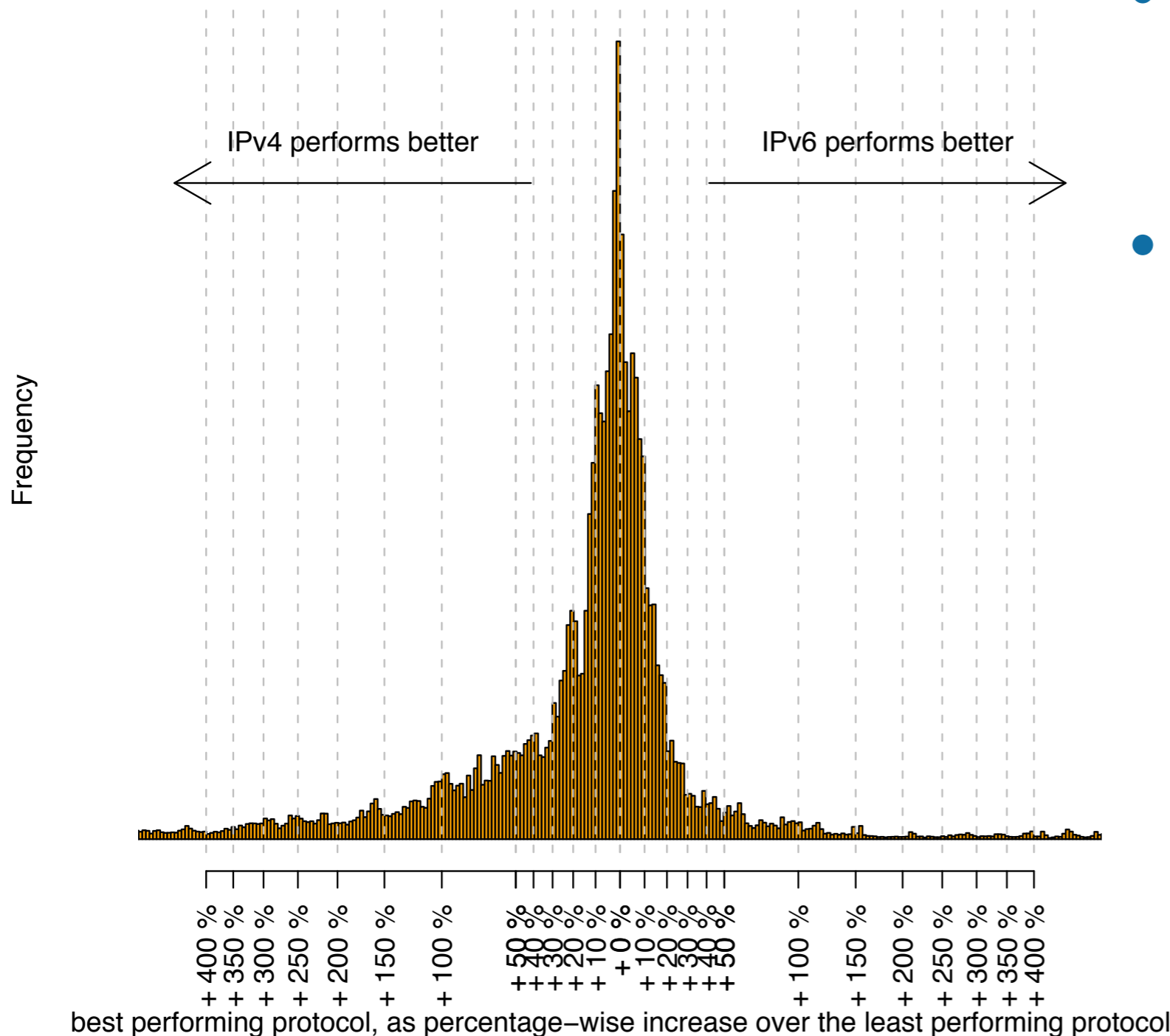
Test and monitor - lessons learned

- Test when deploying something
 - The more real-life, the less likely you !@#-\$-ed up
- Monitor your infrastructure
- People2people reachability
 - Avoidable situations like Level3 and Dept. Commerce
 - Contact info up to date in RIR databases (whois)
 - Monitor the web (NANOG, Twitter, ...)

Global view

Performance of src/dst pairs on 2011-06-08

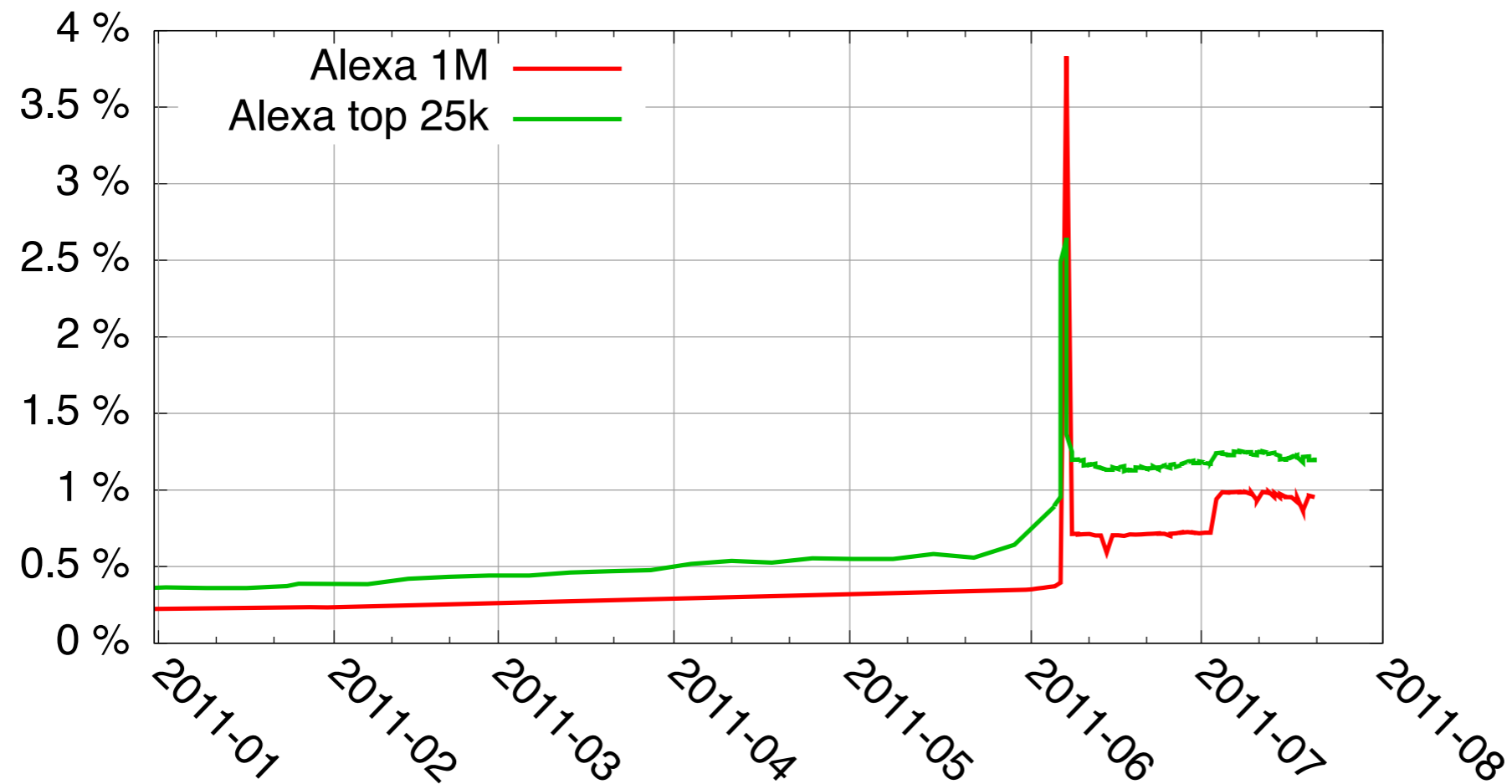
Distribution of IPv4/IPv6 relative performance



- Bell-shaped
 - with fatter IPv4-side
- Dual-stack = two chances for best performance!
 - Real-time apps can exploit this
 - voice
 - gaming

Long term effects - Content

Percentage of web sites in Alexa 1M that can be reached over IPv6

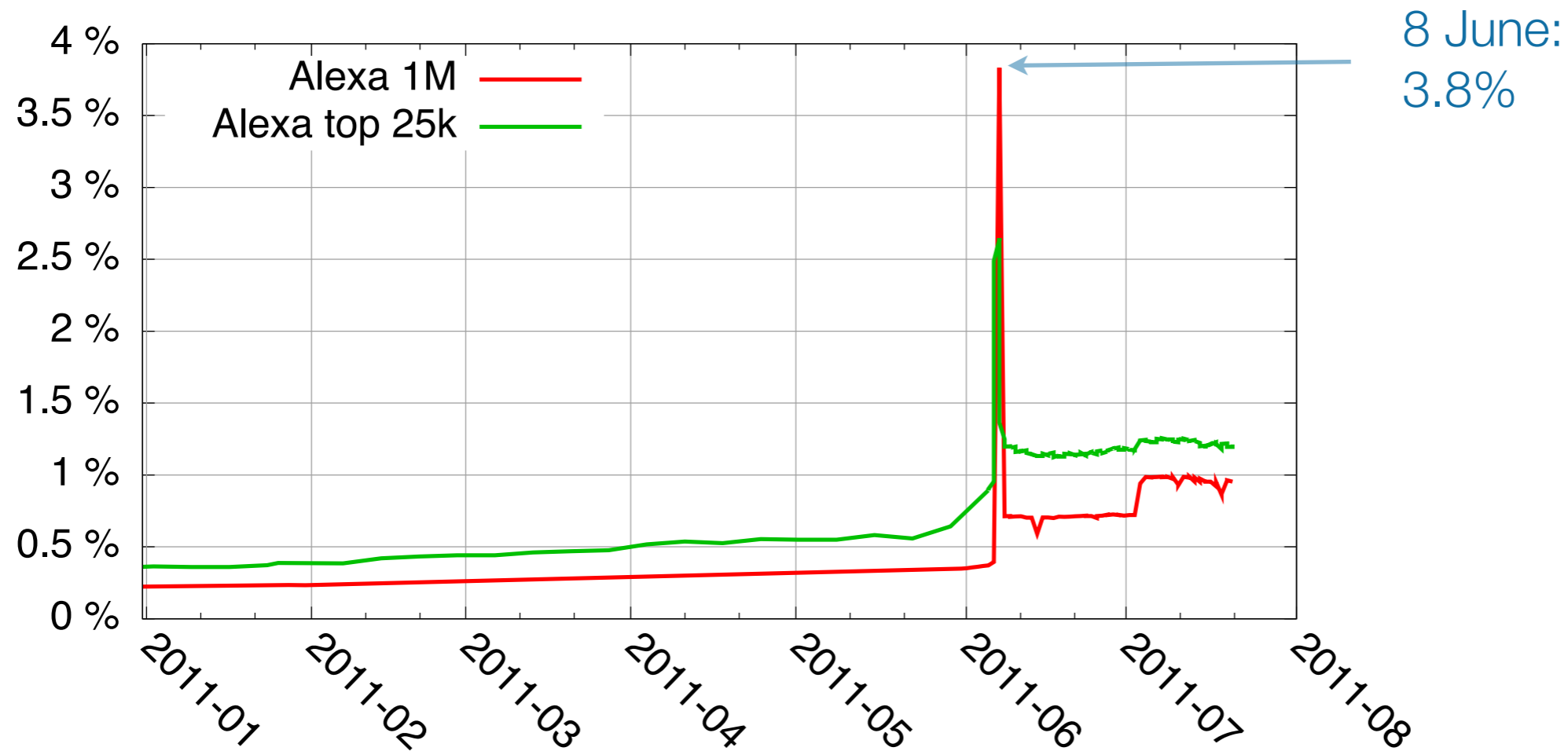


Raw data: Dan Wing

(<http://banjo.employees.org/~dwing/aaaa-stats.html>)

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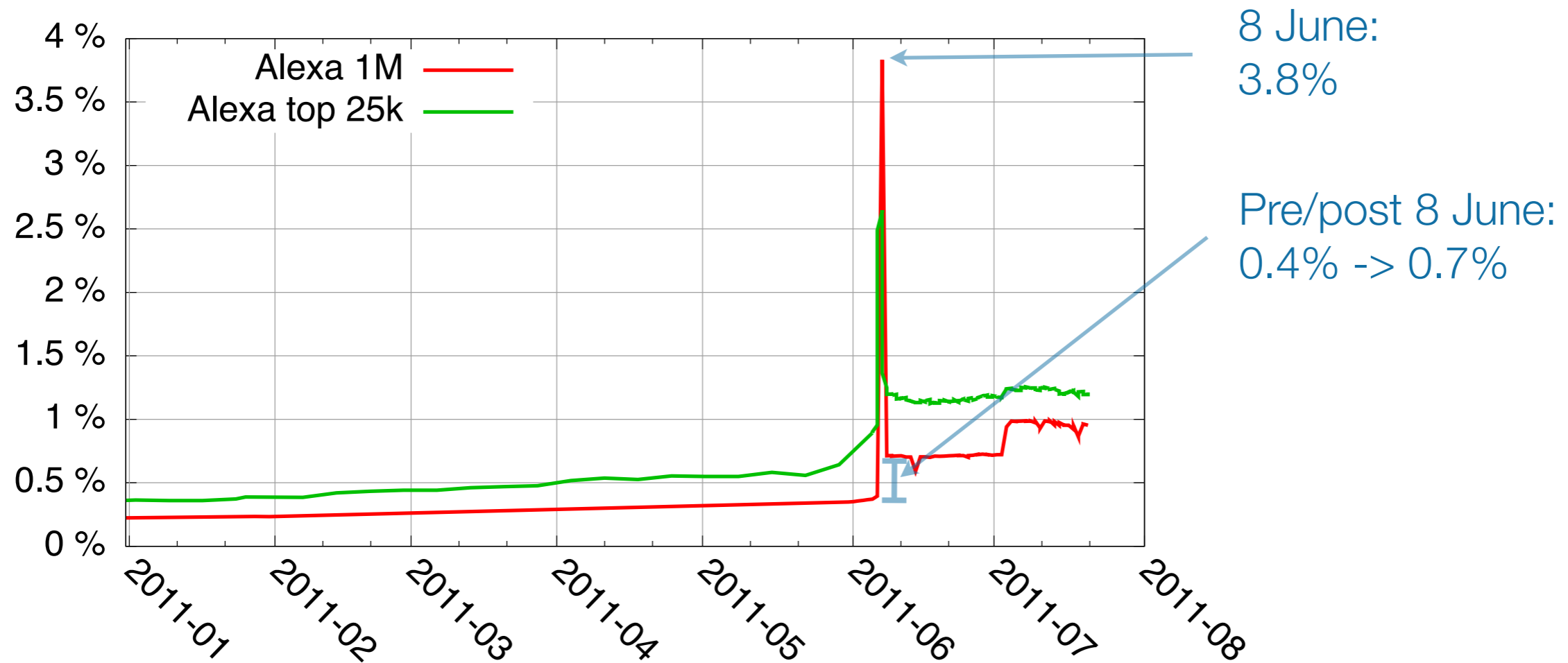


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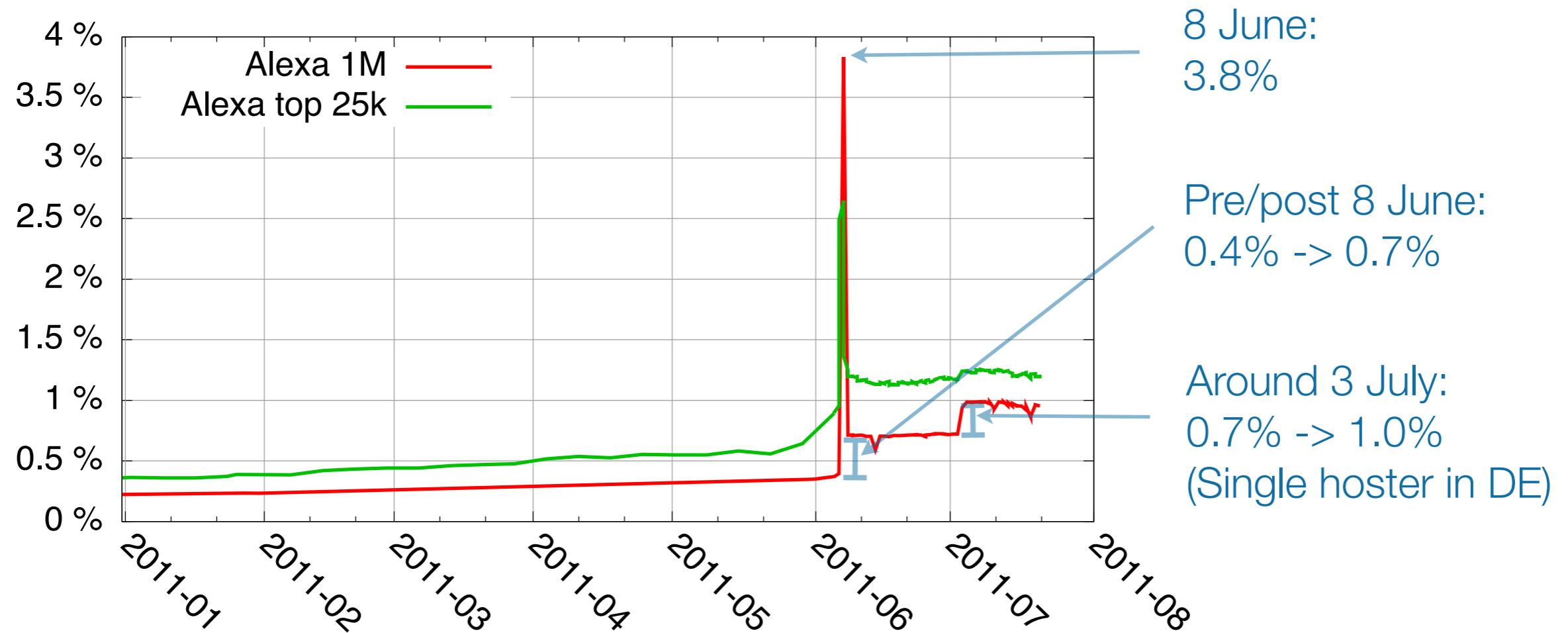


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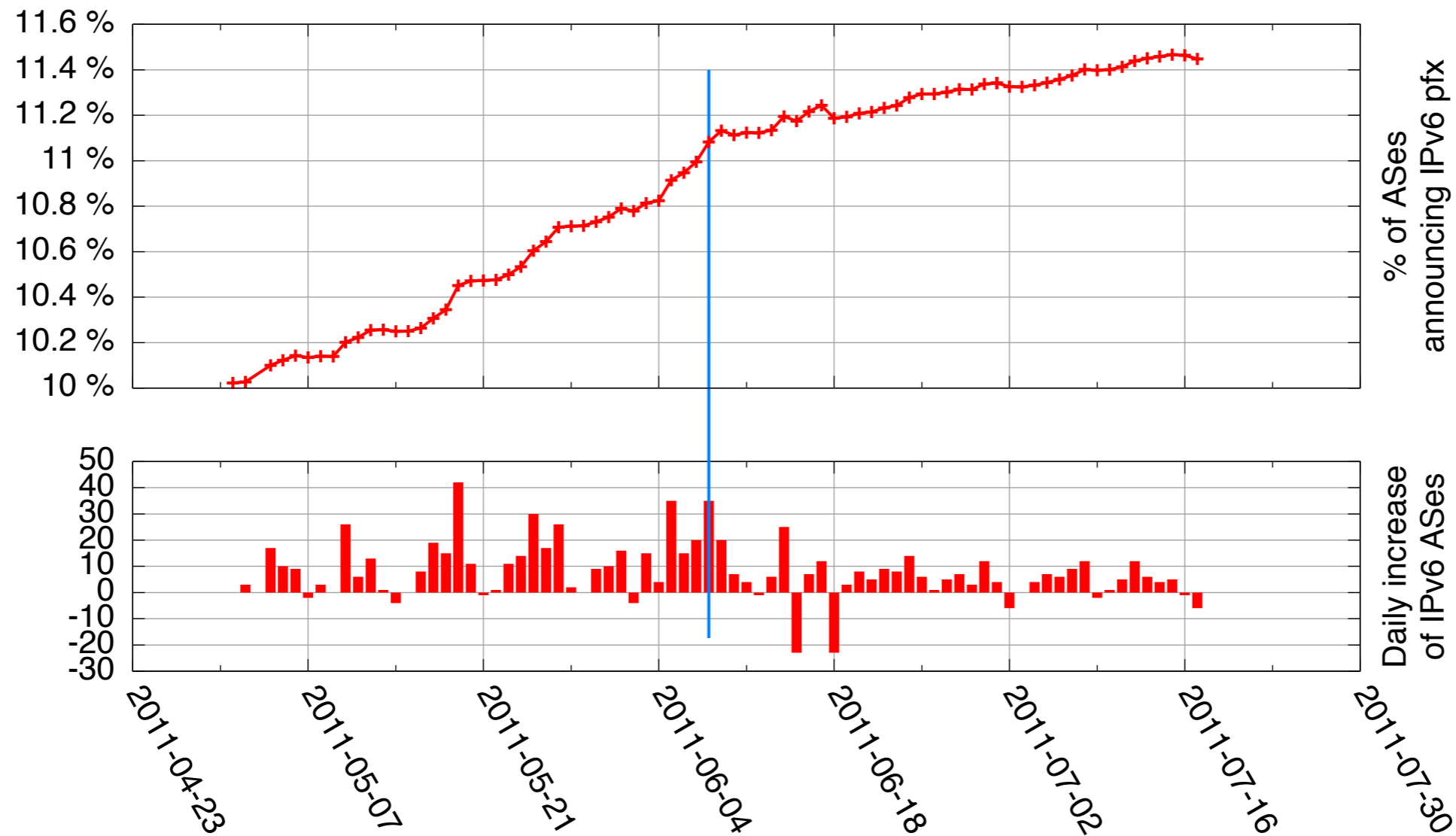
Long term effects - Content

- Linear extrapolation:
 - ~ an IPv6 year needed to get to 100%
- Exponential extrapolation:
 - ~ an IPv6 week needed to get to 100%

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- Linear extrapolation:
 - ~ an IPv6 year needed to get to 100%
- Exponential extrapolation:
 - ~ an IPv6 week needed to get to 100%
- Note: extrapolation based on two data points is dangerous and can get you lynched :)

Long term effects - IPv6 ASes



- Higher growth before v6d: Deployments pushed earlier?
- Lower growth after v6d: Summer-vacation?
- <http://v6asns.ripe.net>

More information

- Web interface to the measurements
 - <http://v6day.ripe.net/>
- Analysis on RIPE Labs
 - <http://labs.ripe.net/ipv6day>
- Raw data availability
 - <http://labs.ripe.net/datarepository/data-sets/ripe-ncc-active-measurements-of-world-ipv6-day-dataset>

Conclusions - what we learned

- IPv6/dual-stack works just fine, but make sure that
 - It is properly tested and monitored (like IPv4)
 - Your network can reach all others (like IPv4)
- Dual-stack = Two chances for best performance
- Days like this ‘work’
 - Raise awareness
 - Give people a target to work towards
 - We’re ready for a next IPv6(day|week|month|year|∞)

Questions?

