World IPv6 Day - What did we learn?

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RIPE 63
RIPE NCC Measurements - World IPv6 Day

- IPv6 Eyechart and 6to4 (not in this talk)

- Active measurements
  - Sources: 49 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
When Did World IPv6 Day Start?

• Less then 2 days before World IPv6 Day:

DNS negative caching for websites participating in World IPv6 Day

minimum of: minimum TTL in SOA, TTL of SOA
Percentage Of Vantage Points Seeing AAAA

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Percentage Of Vantage Points Seeing AAAA

v6day

Negative caching
Percentage Of Vantage Points Seeing AAAA

- A10 Networks
- AOL 1
- AOL 3
- Akamai
- ATT 2
- BBN Technologies
- cisco.com
- CNN
- Ericsson
- Facebook
- Huawei
- Internet2
- Juniper
- Level 3 Communications
- Linux Club Zogno Italy
- Microsoft Bing
- Microsoft Xbox
- Mozilla
- Spil Games 1
- Sprint
- T-online
- US Department of Commerce
- XO Communications
- Yahoo
- www.miniclip.com
- Google
- Youtube

- v6day
- TTL caching
- Negative caching
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:

Not Found

HTTP Error 404. The requested resource is not found.
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

- % AAAA queries returning an IPv6 address
- % HTTP responses == 200
- % ICMPv6 ping success
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v6 on www turned off at end of v6day
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- % AAAA queries returning an IPv6 address
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v6 on www turned off at end of v6day
but v6 service still announced
Test And Monitor - Lessons Learned

- Humanity
- Perfection
- Mythology
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, *NOG, Twitter, ...)

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IPv4/IPv6 Performance On World IPv6 Day

Distribution of IPv4/IPv6 relative performance

- Bell-shaped
  - centered around 0
  - with fatter IPv4-side (62%)
- Dual-stack = two chances for best performance!
  - Real-time apps can use this (voice/game)
Performance - Tunnels?

• 9.2% of paths had 1 (or more!) hops with ‘tunnel’ in the hostname

• TTM mesh tunnel-discovery: < 2% of paths
Performance - Same Path: No Difference

Traceroutes from Univ. in Greece to Univ. in Los Angeles

IPv6

IPv4
Partial Reachability

• Internet is a collection of interconnecting networks, and can be different on IPv4/IPv6

• Some vantage points couldn’t reach all dests.
  - Are our vantage points representative?
    - Working on this: RIPE Atlas
  - Network partitioning, examples we encountered:
    - Level3 - Hurricane Electric
    - Cogent - Hurricane Electric
Partial Reachability

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    - Level3 - Hurricane Electric  (fixed as of Aug 31)
    - Cogent - Hurricane Electric
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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8 June: 3.8%

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

8 June: 3.8%

Around 3 July: 0.7% -> 1.0% (DE?!)  
Pre/post 8 June: 0.4% -> 0.7%

Raw data: Dan Wing

(http://banjo.employees.org/~dwing/aaaa-stats.html)
Long Term Effects - IPv6 ASes

- Higher growth pre-event: Deployments pushed earlier?
- Lower growth post-event: Summer-vacation? Economy?
- http://v6asns.ripe.net
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|∞)
More Information

• Web interface to the measurements
  – http://v6day.ripe.net/

• Analysis on RIPE Labs
  – http://labs.ripe.net/ipv6day

• Raw data availability
Questions?