

Measuring Quality and Penetration of IPv6 Services

Matěj Grégr, Tomáš Podermański

Brno University of Technology, Czech Republic

igregr@fit.vutbr.cz, tpoder@cis.vutbr.cz

Measuring IPv6 – approaches

- Clients

- Measures clients and path between a client and a content provider
- Small invisible image: L. Colitti et.al PAM 2010
- Flash actionscript in ads: G. Huston, potaroo.net

- Global point of view

- How many connected devices on today's Internet are capable of making IPv6 connectins?

Measuring IPv6 – approaches

- Infrastructure

- Measures the IPv6 core network - #AS, #IPv6 prefixes
- Delay between vantage points
- A.Berger, Akamai, 2011
- A. Dhamdhere et.al. ACM 2012

- Core Infrastructure point of view:

- Are IPv6 BGP paths same as IPv4?
- How quickly does the DFZ table grow?

Measuring IPv6 – approaches

- Content
 - Measures the number of available IPv6 services
 - Penetration of AAAA RR DNS records

- Global and local point of views:
 - How much IPv6 content is available (to our users/per country)?
 - How much traffic will use IPv6 in our network?

Measuring content

- Different DNS RR records are checked

| | Record type | Test |
|---------------|-------------|--|
| Web services | A | <code>www.<domain></code> |
| | AAAA | <code>www.<domain></code> |
| | AAAA | <code>www6 ipv6 www.v6.<domain></code> |
| Mail services | A for MX | <code><domain></code> |
| | AAAA for MX | <code><domain></code> |
| DNS services | A for NS | <code><domain></code> |
| | AAAA for NS | <code><domain></code> |

Data set?

- Alexa top 1 mil.
 - Rank of 1 mil. popular websites
 - How is the list built?
 - Should the rank be taken into consideration?

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Alexa Service: Boost your Alexa Rank Below 100,000 - Website SEO Optimization

From Canada

I believe you already know how important the Alexa ranking is. Our Alexa Marketing Team will analyze your website for optimization .

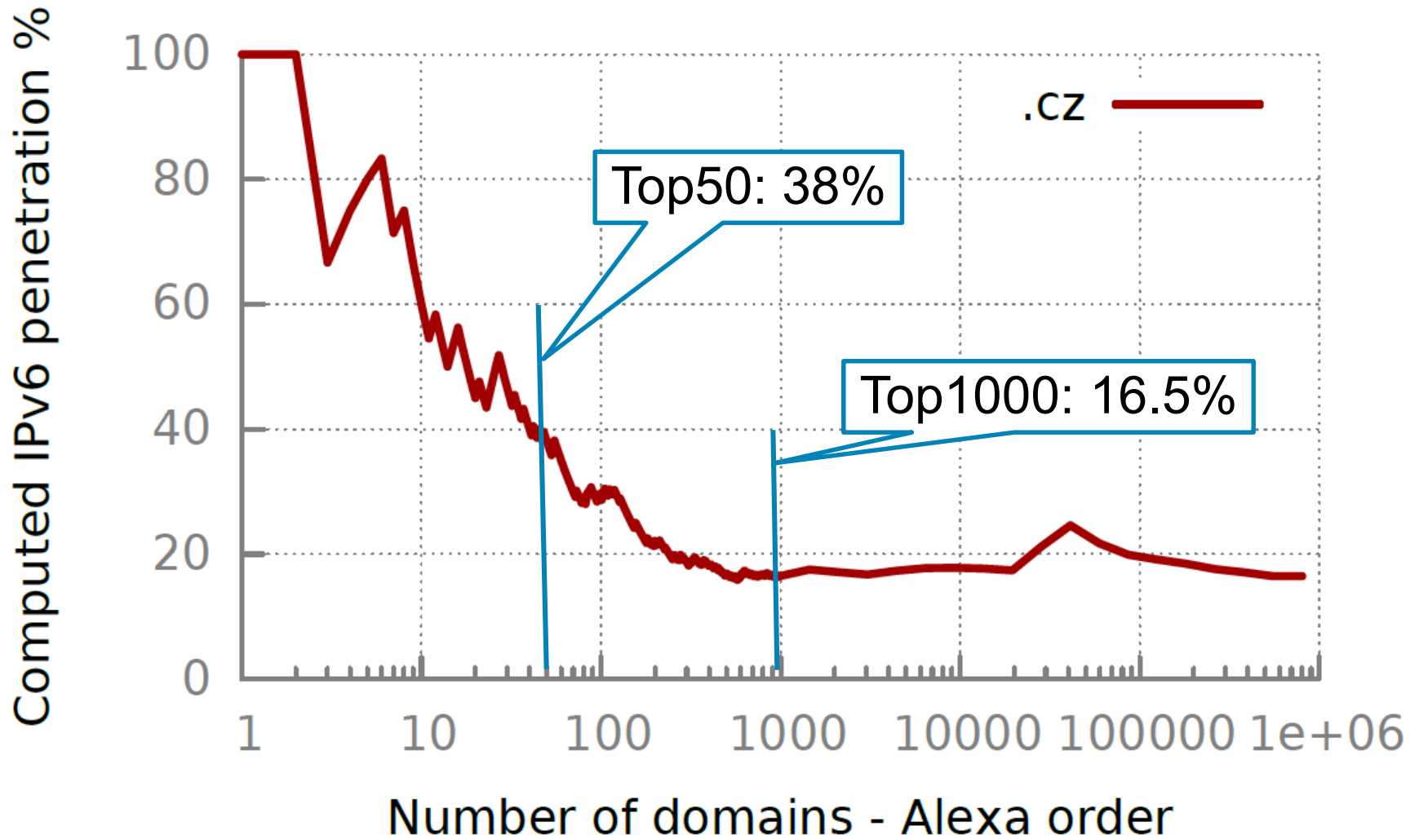
26d 10h 4m left

£107.09

Buy it now
or Best Offer

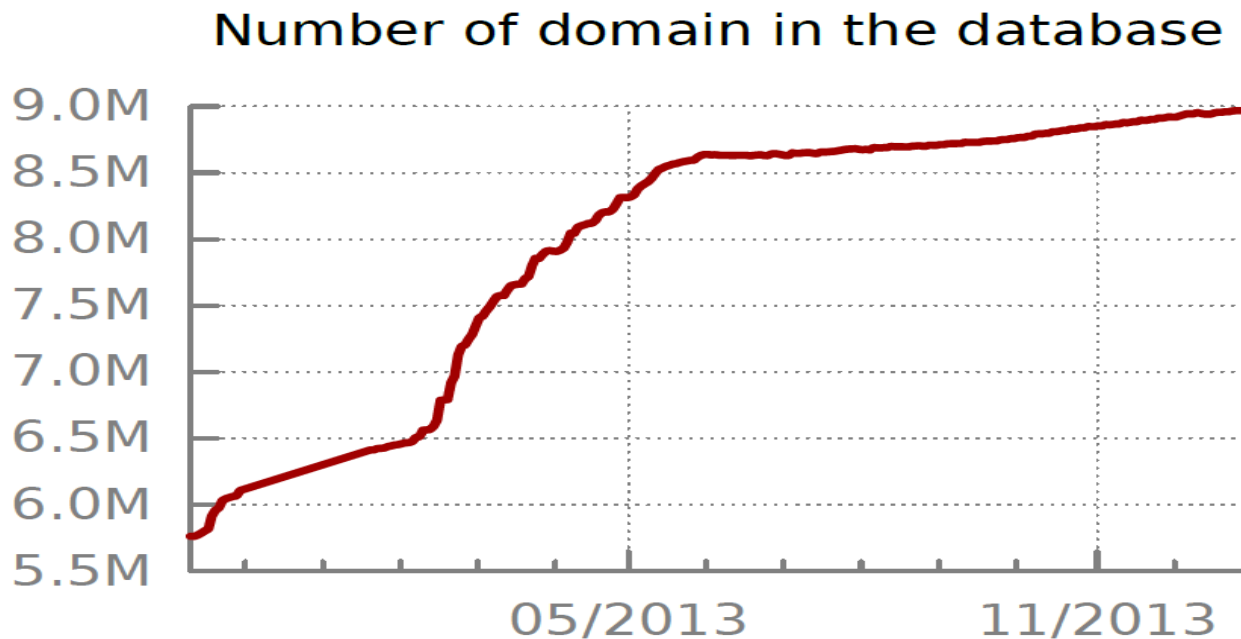
Free P&P

Alexa rank?



Build your own dataset

- DNS cache, mail cache...
- User's HTTP requests
- Alexa list
- Currently 9mil. domains, built by 20 000 users



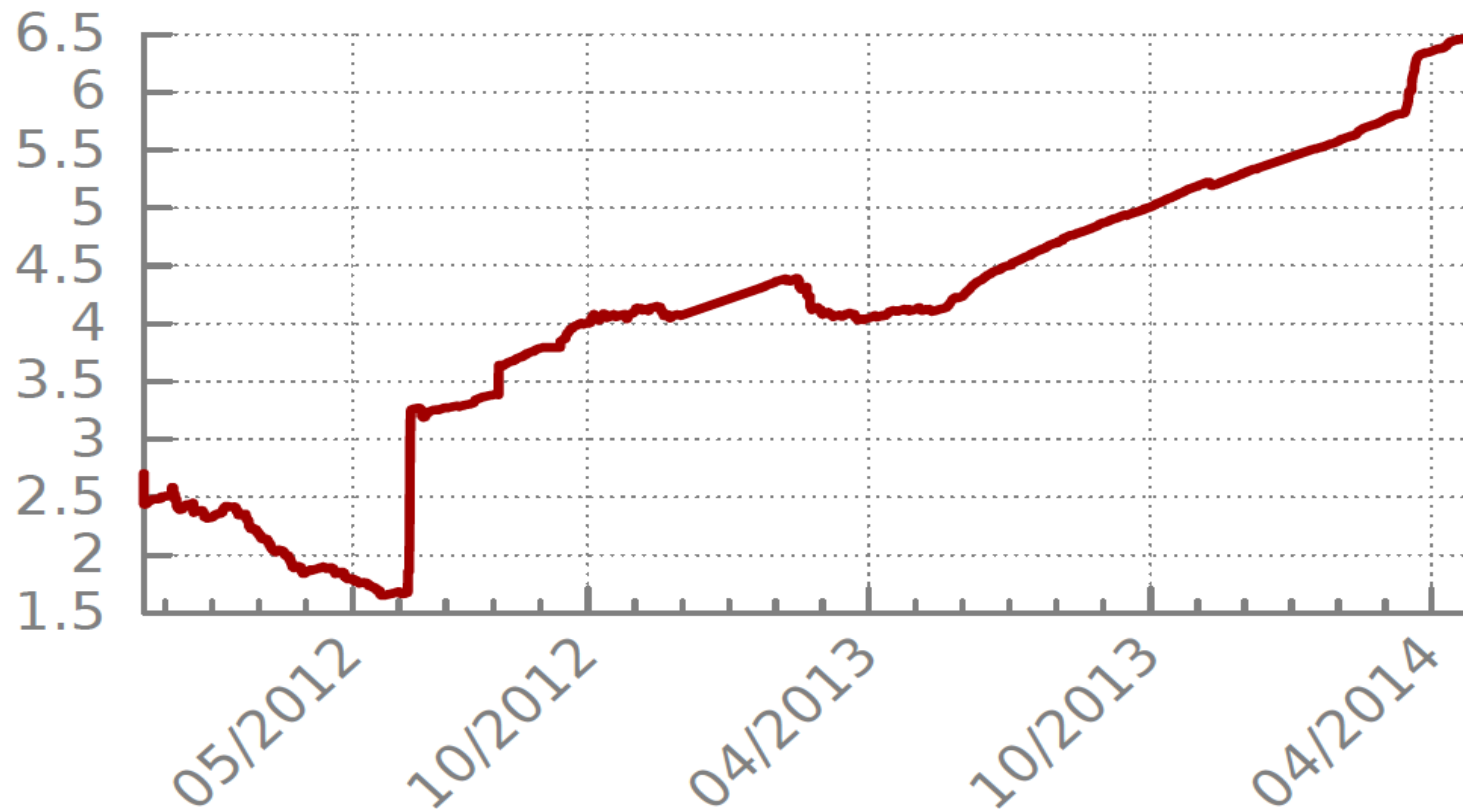
Updating the dataset

- 10 DNS requests are needed in average to obtain all information about a domain
- 1000 DNS queries per sec
- Whole update process takes approximately 2 days

- RTT is measured for all dual stacked web sites
 - The RTT update process takes approximately 6 hours

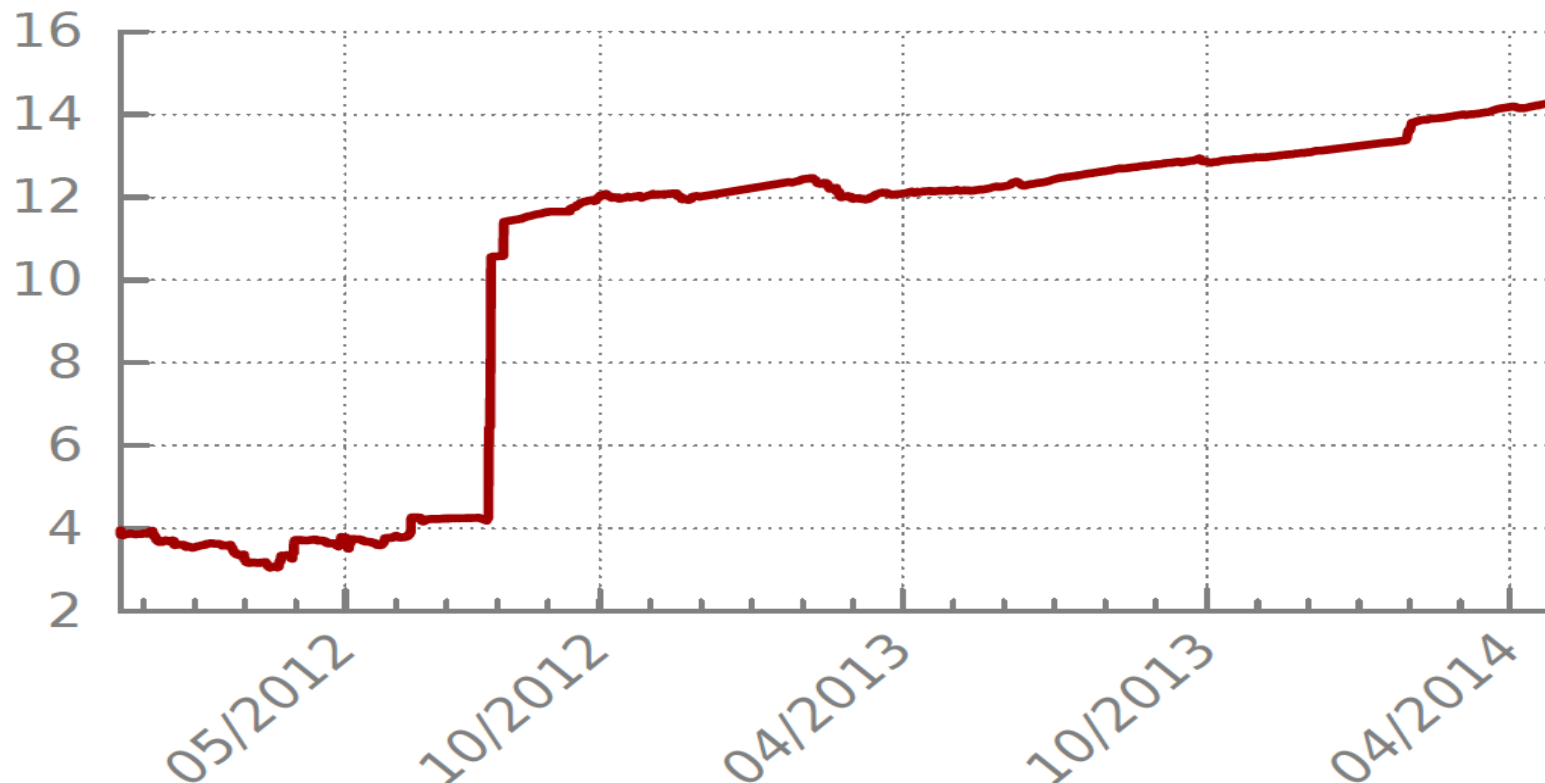
Web service available over IPv6

- AAAA record announced for www.<domain>
- Penetration: From **4.1%** to **6.46%** during last year



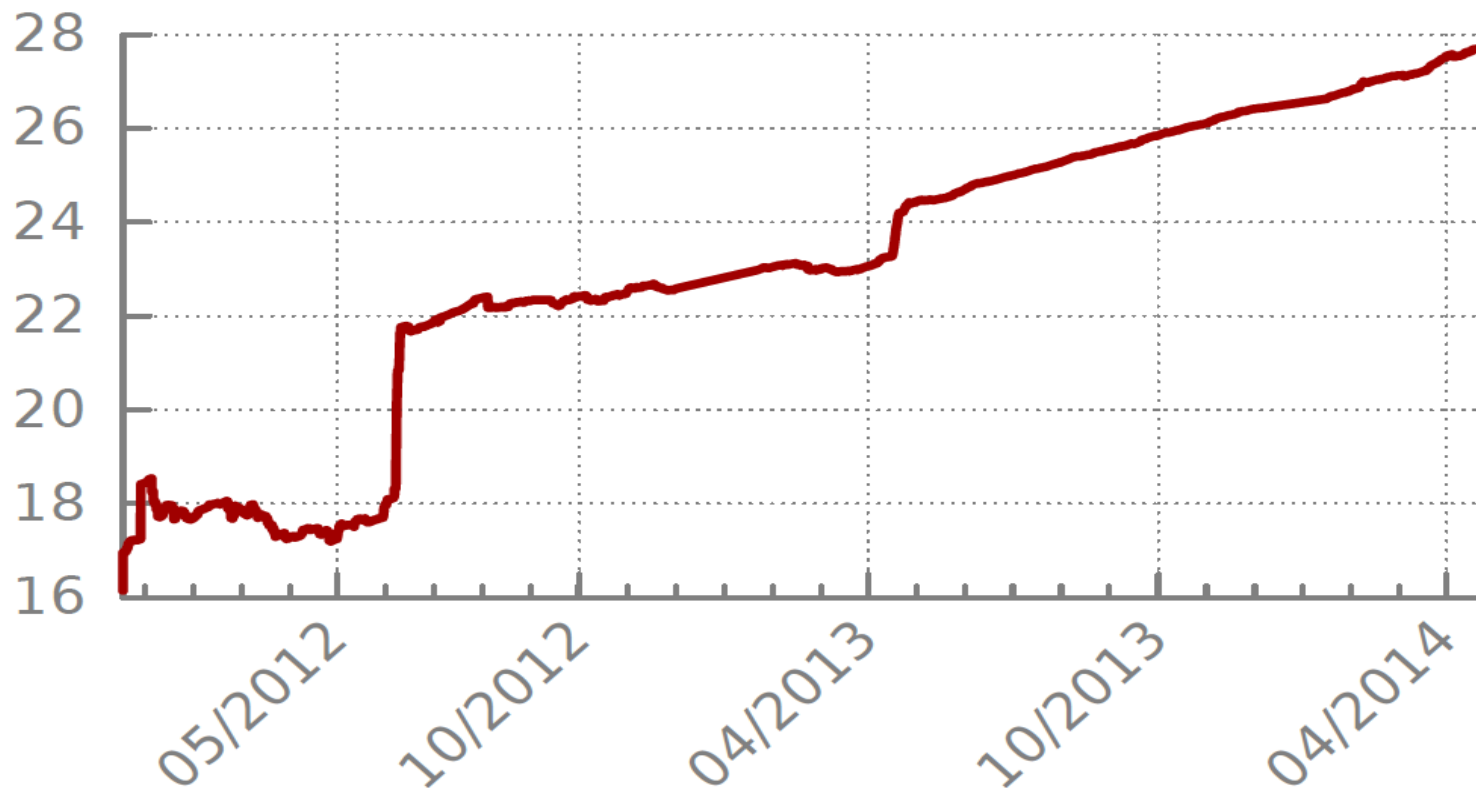
Mail service available over IPv6

- AAAA record announced for www.<domain>
- Penetration: From **12.15%** to **14.26%** during last year



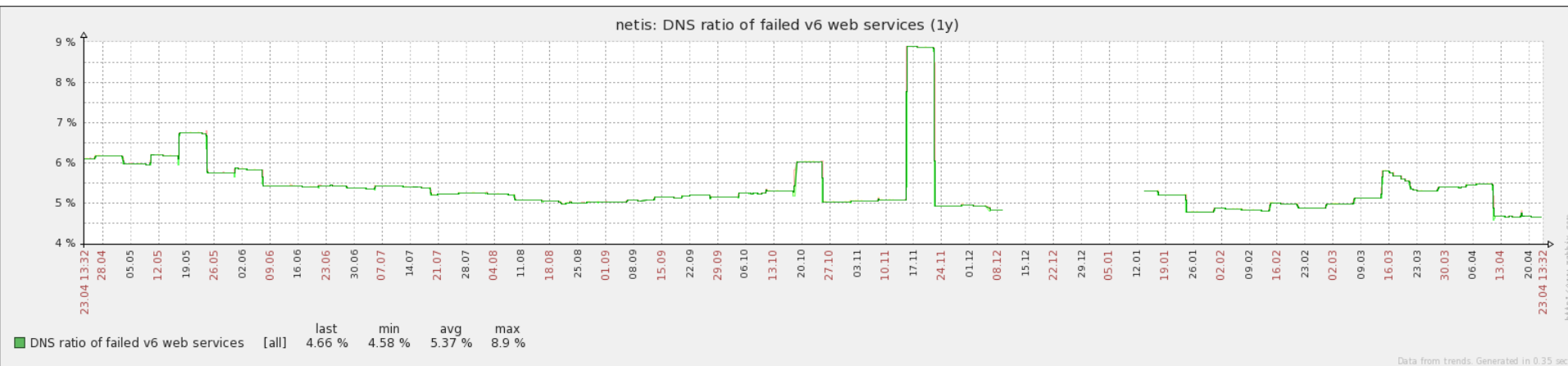
NS service available over IPv6

- NS record announced for <domain>
- Penetration: From **24.23%** to **27.72%** during last year



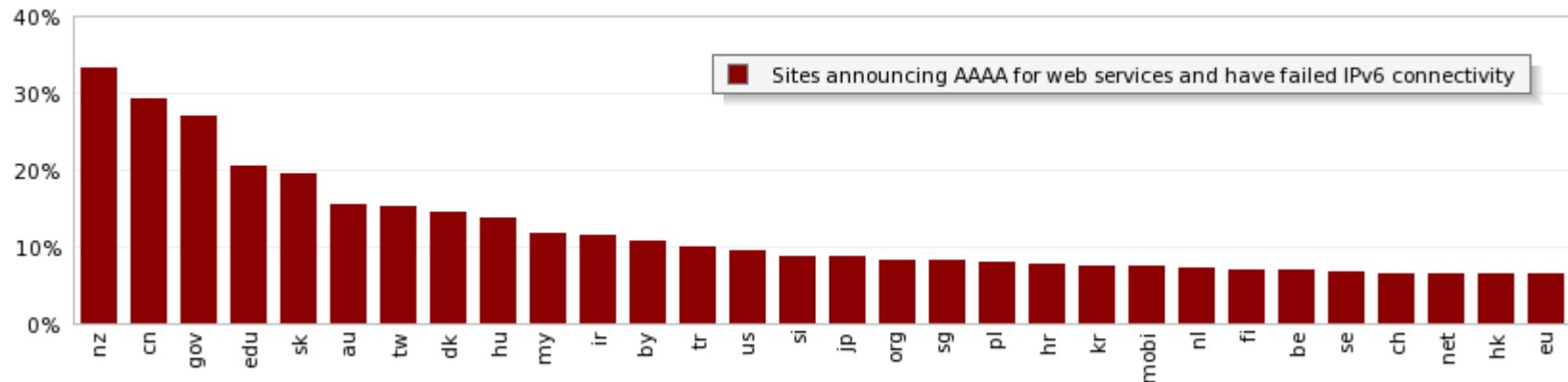
Failing web service

- 4,66% of websites with broken connectivity



Failing web service – per TLD

- 4,66% of websites with broken connectivity



<http://6lab.cz>, 2014-04-23

Other projects

| Project | Data set | Records | Test | Frequency |
|--------------------|---------------------|-------------|--|--------------|
| ipv6matrix | Alexa | 1 mil. | web, alt, MX, NS avail | monthly |
| ipv6observatory | Alexa | 500, EU TLD | web, alt, MX, NS | per 3 months |
| Eric Vyncke | Alexa | 50 per TLD | web, alt, MX, NS, avail | daily |
| Hurricane Electric | Zone files, Alexa | 158 mil. ? | domain | daily |
| 6lab.cisco.com | Alexa | 500 per TLD | web,alt, | daily ? |
| nic.cz | .cz zone file | 1,1 mil. | web, NS | monthly |
| 6lab.cz | http, alexa, users, | 9 mil. | web, alt mx, ns, SPF, DNSSEC, avail, rtt | daily |

Different projects, different numbers

| Project | Global | .cz | .fr | .com |
|----------------------|--------|--------|--------|-------|
| ipv6matrix | 4,86% | 11,8% | 2,79% | 5,2% |
| ipv6observatory (EU) | 5,1% | 11,2% | 3,1% | - |
| Eric Vyncke | 8% | 36% | 6% | - |
| Hurricane Electric | 3,5% | - | - | 2,37% |
| 6lab.cisco.com | | 61,16% | 49,69% | - |
| nic.cz | - | 20,5% | | |
| 6lab.cz | 6,46% | 16,4% | 6,9% | 5,59% |

Weight of the website?

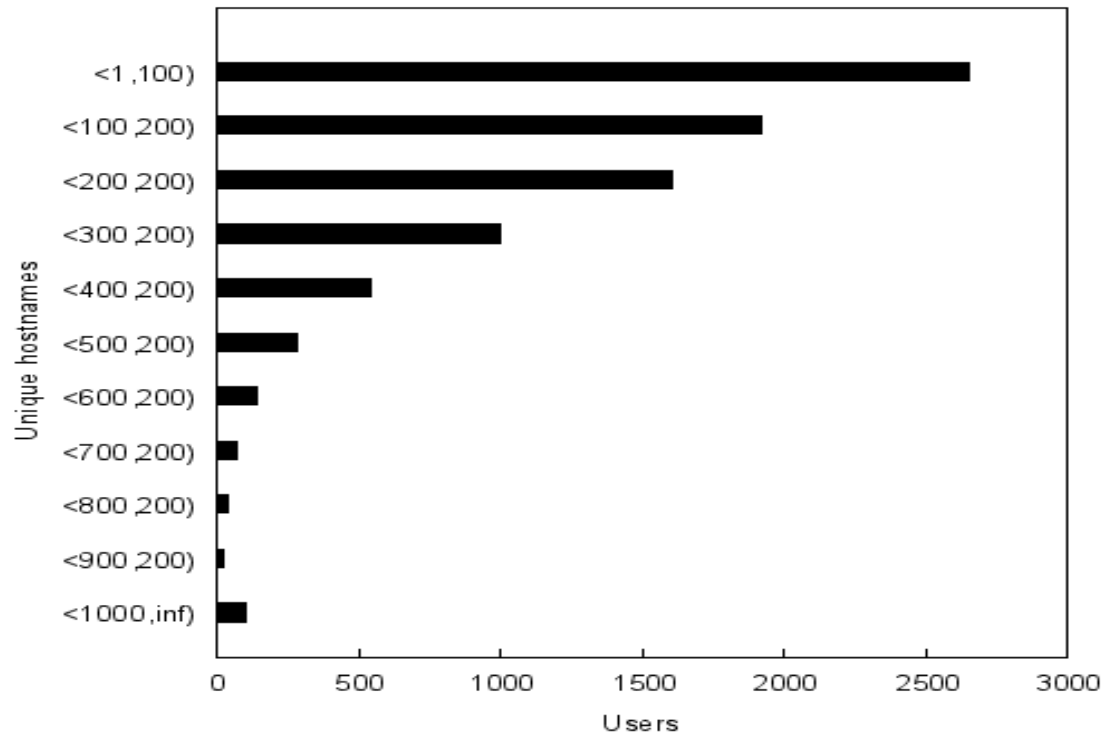
- Several projects using weight of a website to compute IPv6 penetration
 - More popular website (according Alexa) – higher weight
 - Assumption, that a user visits only popular websites

Weight of the website?

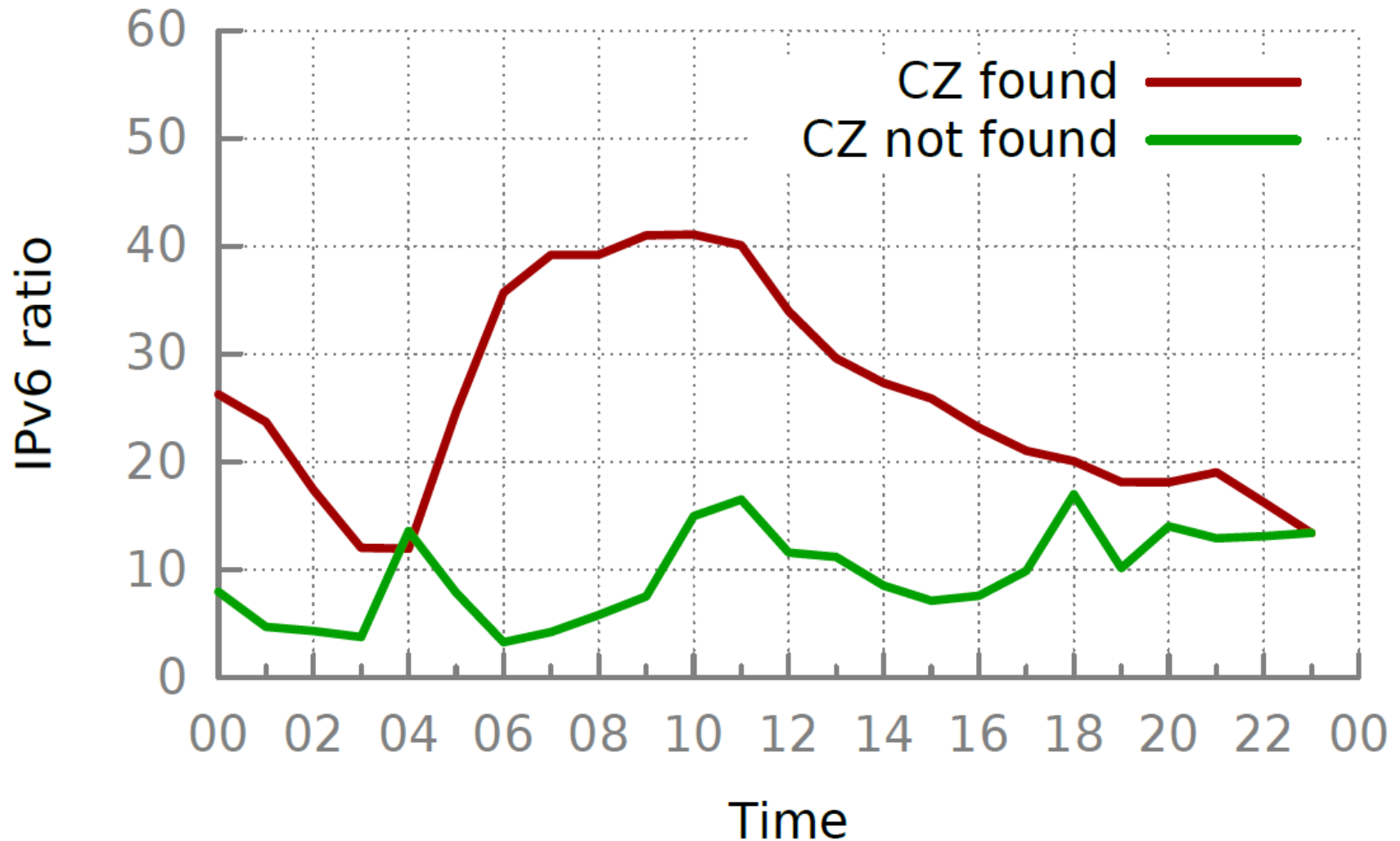
- Several projects using weight of a website to computing IPv6 penetration
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- Average: 232

- Median: 179



IPv6 ratio of requested website



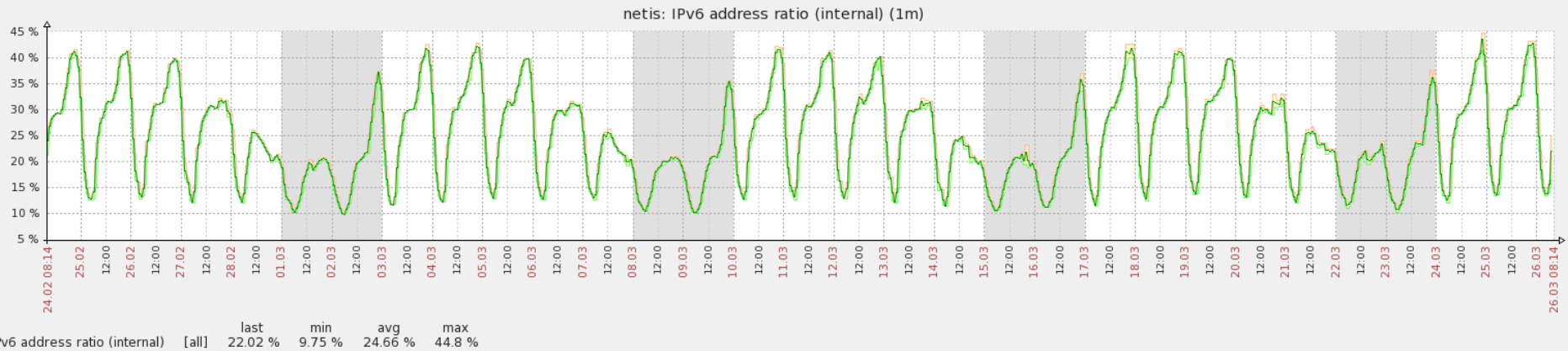
Requested websites available over IPv6

- IPv4ratio: 99.4%
- IPv6ratio: 28.4%

- 0.6% IPv6 only?
 - Test websites – websites for testing IPv6 connections
 - `labs.apnic.net`
 - IPv6 only domains - `ipv6.google.com`
 - IPv6 only content cache
 - `1v21k3k0.spray6.xx.fbcdn.net`

- 100% requested websites are available over IPv4
- 30% requested websites are available **also** over IPv6

BUT IPv6 address ratio



BUT #connections, volume of data

- IP4 flows IN/OUT ratio: 82.7%
- IP6 flows IN/OUT ratio: 17.3%



- IPv4 bytes IN/OUT ratio: 75.3%
- IPv6 bytes IN/OUT ratio: 24.7%



BUT / CESNET IPv6 traffic ratio

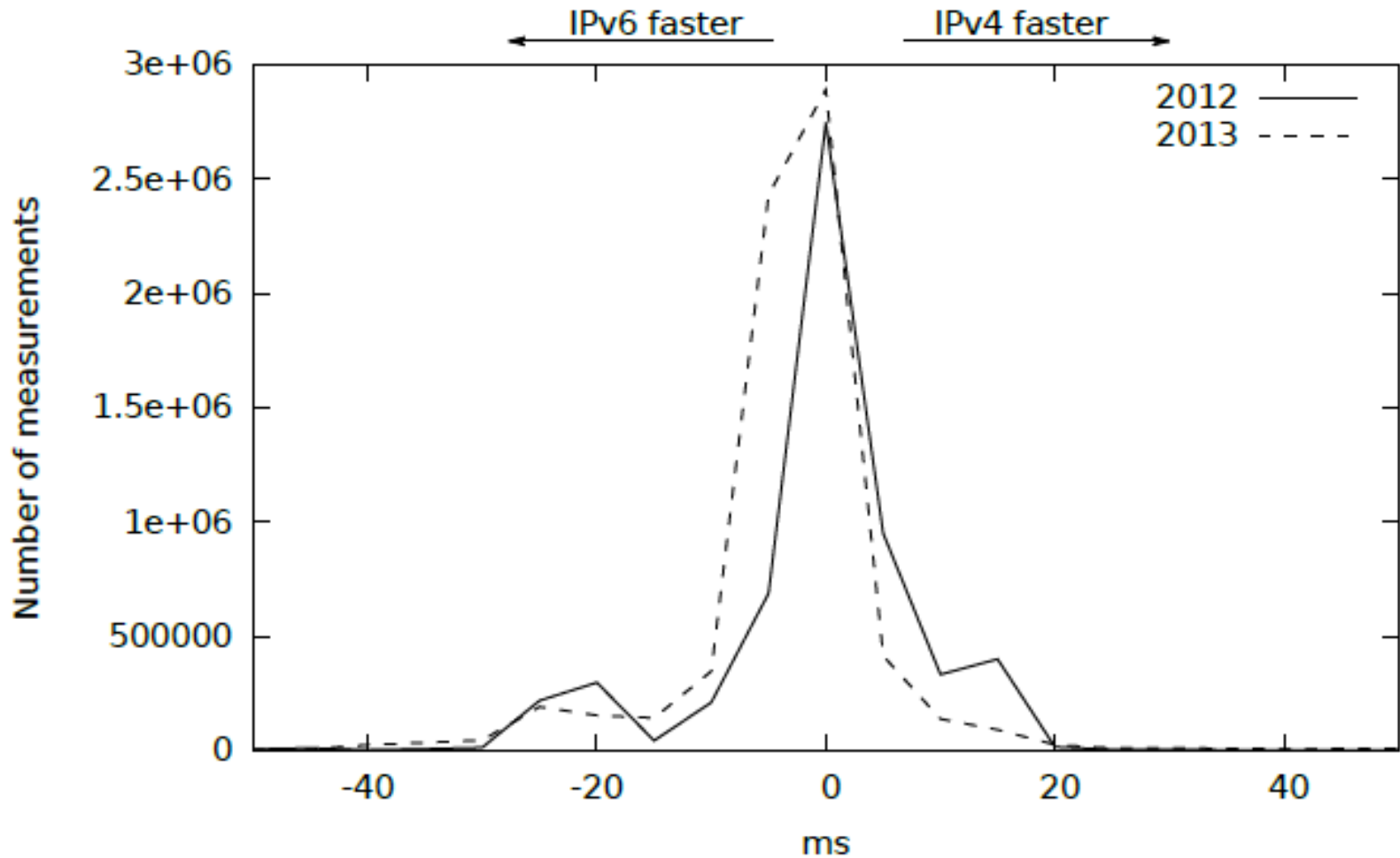


<http://6lab.cz>, 2014-04-25



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Quality of IPv6 connection



Summary

- Relying only on Alexa list overestimates the IPv6 penetration
- The availability of IPv6 content (websites) per TLD is lower than it is presented
- At least 1000 domains should be used to compute the IPv6 penetration
- The availability of IPv6 content for our users is 30%
- The IPv6 is usually slightly faster with current BGP paths

More information at 6lab.cz

- <http://6lab.cz/live-statistics/data-source/>
- <http://6lab.cz/live-statistics/>
- <http://6lab.cz/live-statistics/ipv6-brno-univeristy-of-technology/>
- <http://6lab.cz/live-statistics/ipv6-cesnet-network/>