Benefits of Hosting a DNS Root Server

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DNS Root System

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Root DNS System

- What is the Root DNS system?
  - Part of D(omain) N(ame) S(ystem)
  - Distributed database system to resolved (unique) domain names to other identifiers (usually: IP addresses)
  - Hierarchical architecture for the purpose of scaling
  - Root DNS system provides the root zone
  - “Which server to contact for which top level domain”
  - Explained in more details: http://www.internetsociety.org/internet-domain-name-system-explained-non-experts-daniel-karrenberg

Root DNS System

- What is the Root DNS system?

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Root DNS System

- What is the Root DNS system?
  - 634 T(op) L(evel) D(omain) (+IDN TLDs) http://www.iana.org/domains/root/db (June 2014)
  - Maintained by IANA http://www.iana.org/domains/root
  - Published by DNS root server operators
    - Operational authority is with the root server operator
    - Majority of the operation is anycast

Root DNS System

- Who are the root operators?
  - Organisations (not individuals) providing DNS root services
  - Selected by IANA
  - = 12 professional operators / 13 independent operations

Each letter identifies an unique IP address (IPv4/IPv6) at which the DNS root service is provided under the responsibility of the root server operator!

A	Verisign, Inc.
B	Information Sciences Institute
C	Cogent Communications
D	University of Maryland
E	NASA Ames Research Center
F	Internet Systems Consortium, Inc.
G	U.S. DOD Network Information Center
H	U.S. Army Research Lab
I	Netnod (formerly Autonomica)
J	Verisign, Inc.
K	RIPE NCC
L	ICANN
M	WIDE Project

Root DNS System

- Diversity in the root system is important
  - Different organisations
  - Different software (Bind9, NSD, etc.)
  - Different operating systems
  - Different hardware
  - To mitigate:
  - Bugs in software/hardware
  - DOS attacks

- About DDOS: Over-provisioning is not to scale!

Root DNS System

- More information about DNS
  - http://www.root-servers.org for information on root operators

Benefits?

Benefits

- Assumption:
  - Hosted DNS root server is anycast operated

Benefits

- Latency!
  - Which latency?

Benefits

- Latency!
  - Which latency?

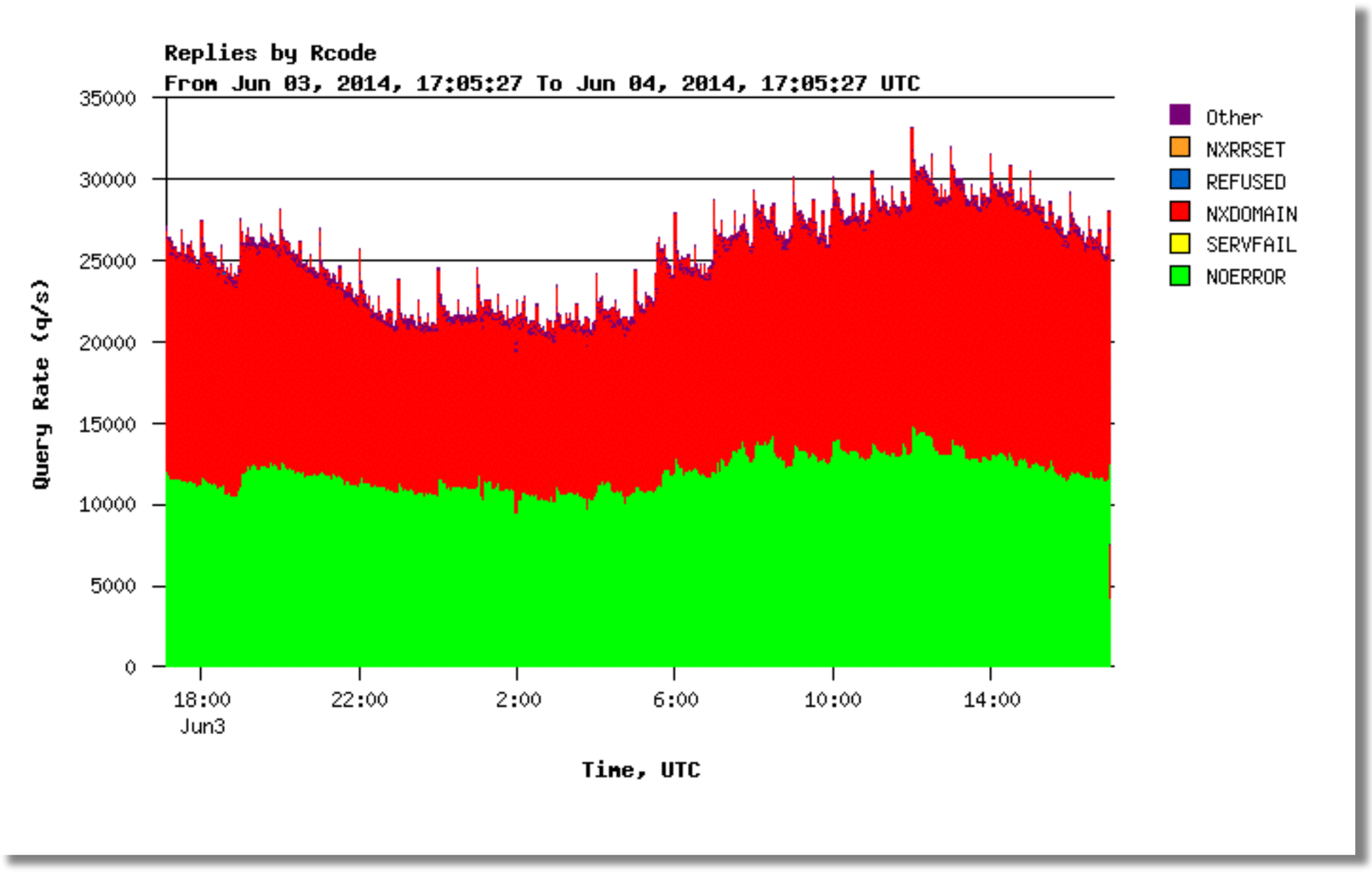
```
xxxAirxxx:server cteusche$ dig +trace nic.kz

; <<>> DiG 9.8.3-P1 <<>> +trace nic.kz
;; global options: +cmd
.                       56535   IN      NS      l.root-servers.net.
.                       56535   IN      NS      m.root-servers.net.
.                       56535   IN      NS      a.root-servers.net.
.                       56535   IN      NS      b.root-servers.net.
.                       56535   IN      NS      c.root-servers.net.
.                       56535   IN      NS      d.root-servers.net.
.                       56535   IN      NS      e.root-servers.net.
.                       56535   IN      NS      f.root-servers.net.
.                       56535   IN      NS      g.root-servers.net.
.                       56535   IN      NS      h.root-servers.net.
.                       56535   IN      NS      i.root-servers.net.
.                       56535   IN      NS      j.root-servers.net.
.                       56535   IN      NS      k.root-servers.net.
;; Received 496 bytes from 192.168.4.1#53(192.168.4.1) in 42 ms

kz.                     172800  IN      NS      kz.cctld.authdns.ripe.net.
kz.                     172800  IN      NS      ns.nic.kz.
;; Received 140 bytes from 192.58.128.30#53(192.58.128.30) in 75 ms

nic.kz.                 86400   IN      A       91.228.39.5
nic.kz.                 86400   IN      NS      ns2.nic.kz.
nic.kz.                 86400   IN      NS      ns.relcom.kz.
nic.kz.                 86400   IN      NS      ns.nic.kz.
;; Received 159 bytes from 194.0.21.5#53(194.0.21.5) in 28 ms
```

Benefits

- Latency!
  - Properly configured DNS servers cache results per TLD for 48 hours
  - Hence most of the DNS queries are answered by non-root servers
  - Misconfigured or broken DNS caching servers can cause a lot of traffic
- Latency benefit is lost if subsequent levels are far away
  - Good connectivity is necessary

Benefits

- NXDomain requests are caught early



Source: http://dsc.ripe.net/cgi-bin/dsc-grapher.pl?plot=rcode&server=K-ROOT

Benefits

- Keep DNS traffic within an area
  - Not only is performance an argument to keep traffic local
  - DNS queries for a ccTLD do not have to leave a country
  - Requirements:
    - Preferred root server instance within the country
    - Subsequent levels also within the country

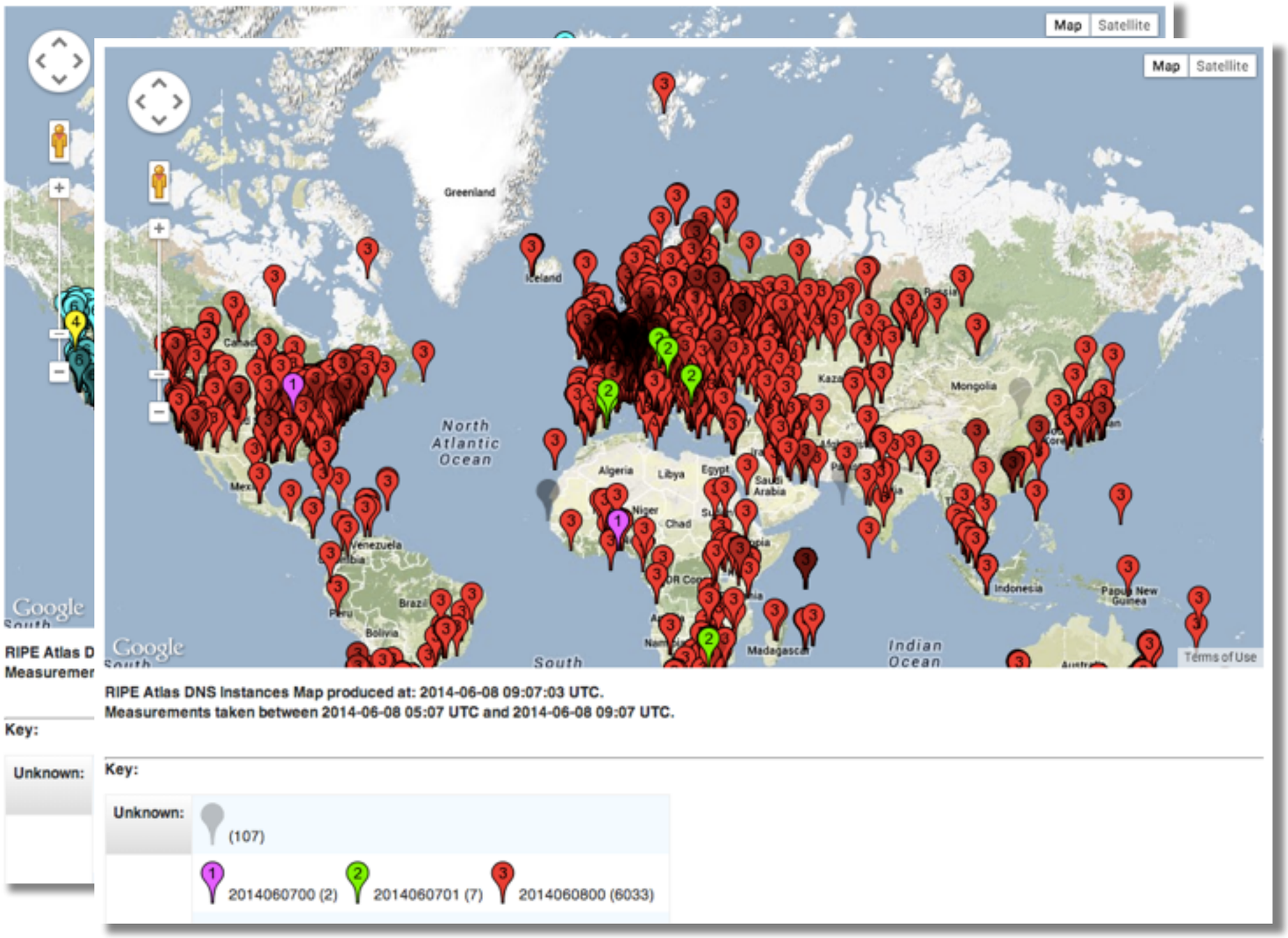
Considerations

Considerations On Hosting

- Hosting a DNS root server instance means responsibility
  - Keep the root zone up-to-date

Considerations On Hosting

- Serial number of the SOA record



Source: https://atlas.ripe.net/contrib/root_anycast.html?msm_id=1

Considerations On Hosting

- Hosting a DNS root server instance means responsibility
  - Keep the root zone up-to-date
  - Meet operational requirements

Operational Requirements

- RFC2870 “Root Name Server Operational Requirements”
  - Load requirements (three times normal load)
  - Security requirements
    - Physical security
      Access control, fire detection system etc.
    - Network security
      Meet standards for critical infrastructure
  - Communication and coordination between IANA and other root operators
  - etc. (see http://www.rfc-editor.org/rfc/rfc2870.txt)

Considerations On Hosting

- Hosting a DNS root server instance means responsibility
  - Keep the root zone up-to-date
  - Meet operational requirements
  - Misconfigurations on the routing level for anycast can easily disrupt the service

Quick Case-Study

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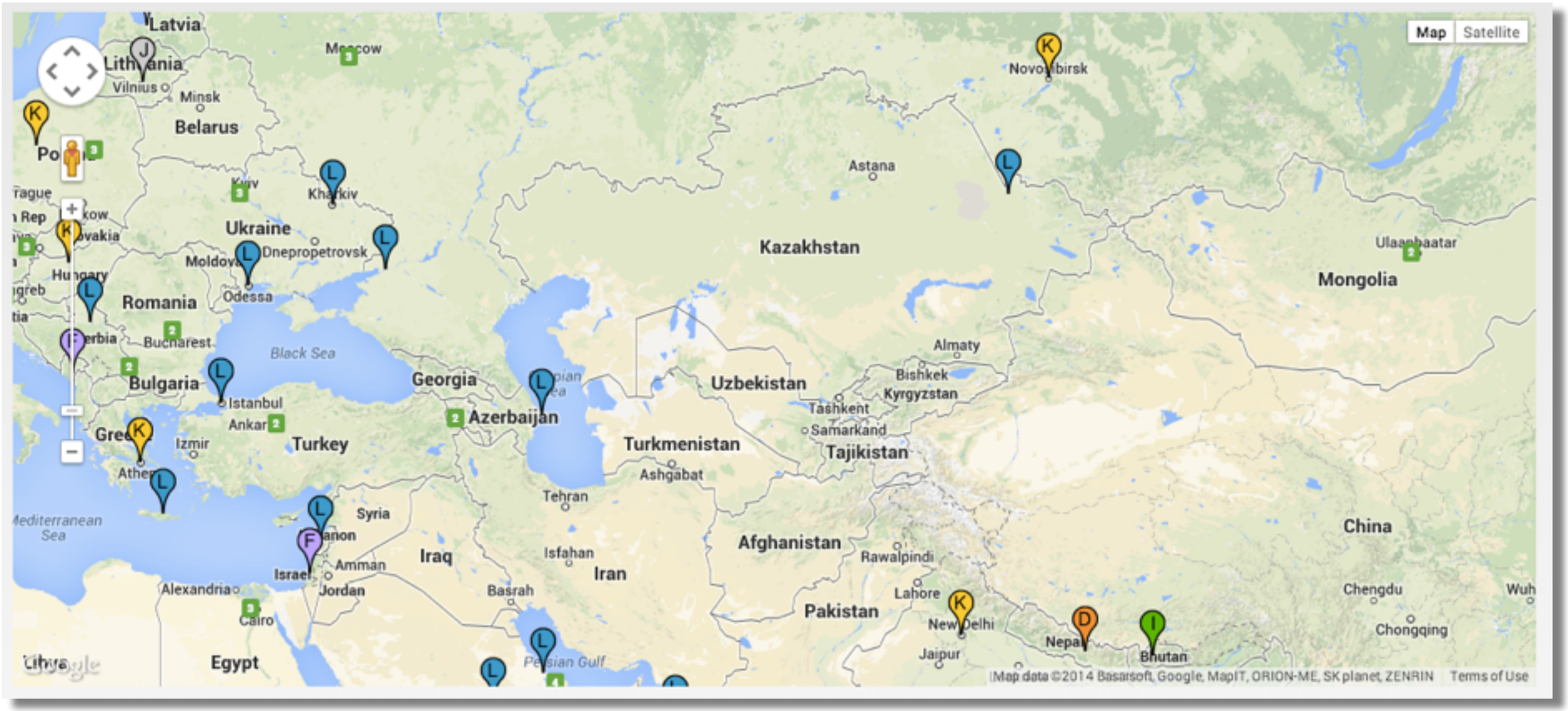
Quick Case Study

- Preferred root servers in Kazahkstan

Source: https://atlas.ripe.net/contrib/comparative_root_rtt.html

Quick Case-Study

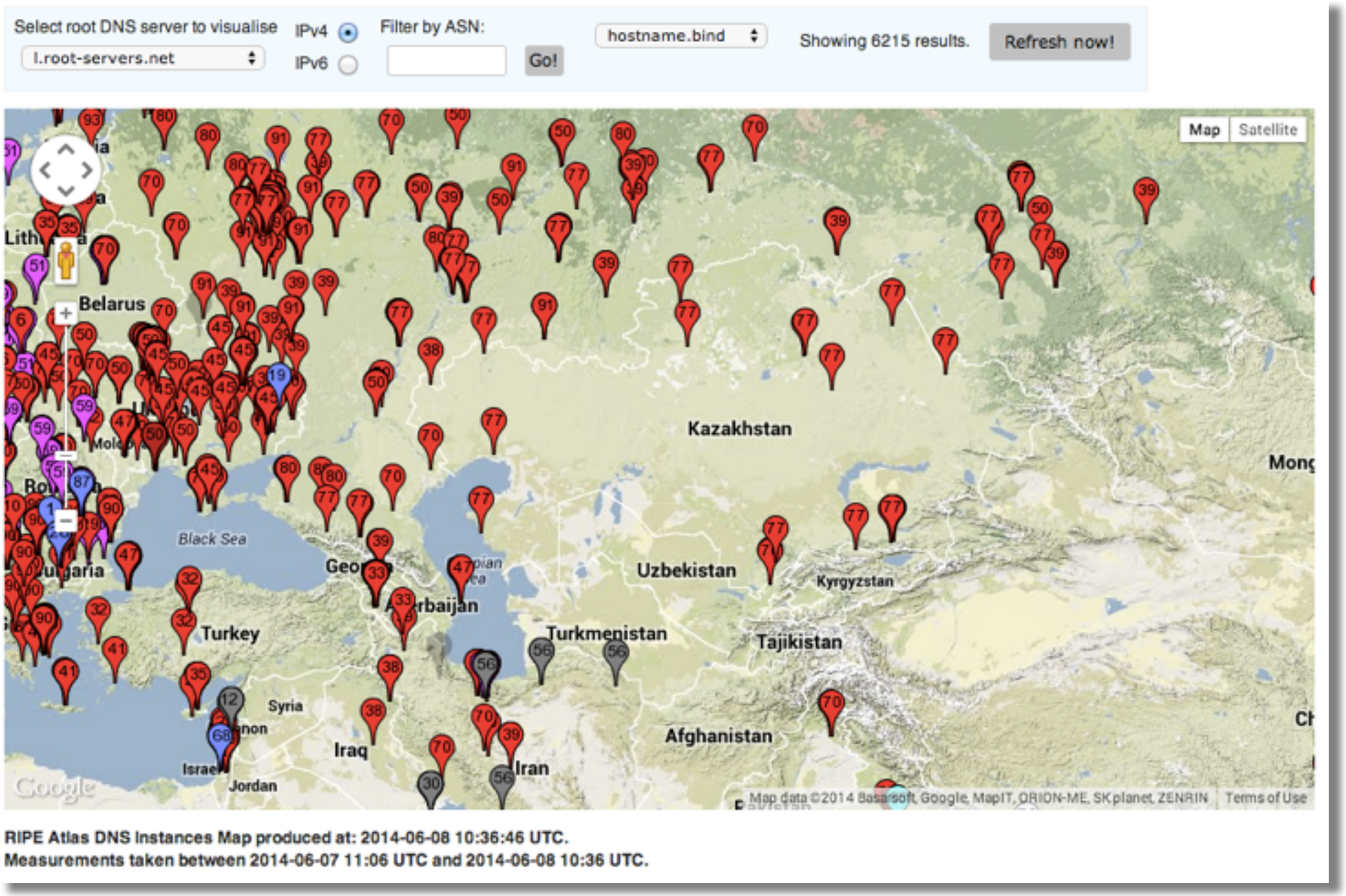
- DNS root server instances in Kazahkstan



Source: http://www.root-servers.org

Quick Case Study

- L-root instances



Source: https://atlas.ripe.net/contrib/root_anycast.html?msm_id=1

Quick Case Study

- L-root instances

Source: https://atlas.ripe.net/contrib/root_anycast.html?msm_id=1

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Conclusion

Conclusion

- Hosting a DNS root server can help to **improve latency for local users** and can provide means to keep DNS traffic local
- But it should be seen as one in many steps to improve network performance

Monitoring

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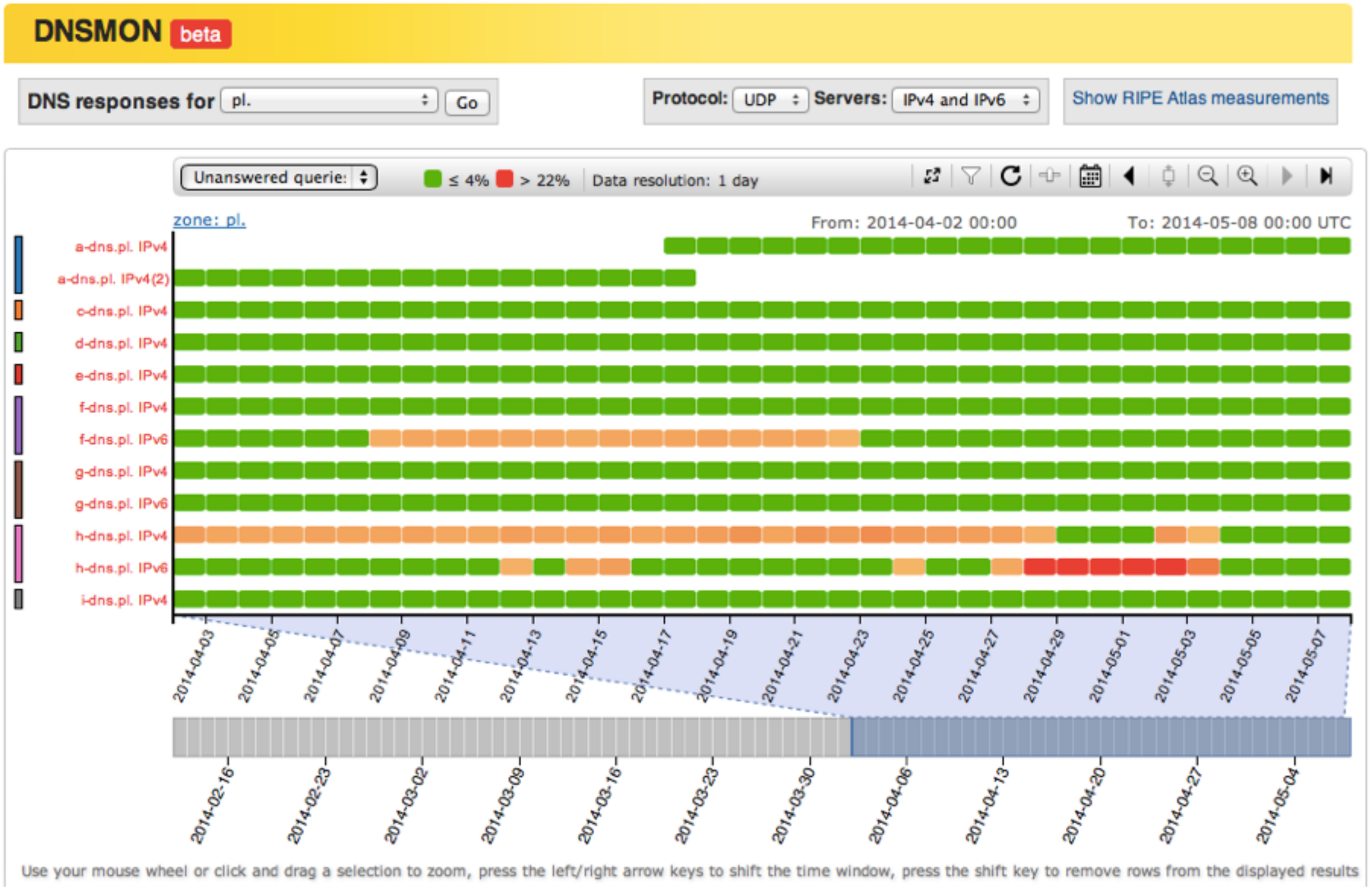
Monitoring for DNS TLD Ops



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Monitoring DNS

- RIPE Atlas anchors used as vantage points
- Currently monitoring small selection of zones
  - root name servers
  - 30 ccTLDs and few gTLDs
- New zones will be added next year
- https://atlas.ripe.net/dnsmon
- More details: https://labs.ripe.net/Members/fatemah_mafi/an-updated-dns-monitoring-service

Questions?