Continuous Data-driven Analysis of Root Stability (CDAR)

Preliminary Results

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Context

- Together with NLNet Labs and TNO, we've won a RFP from ICANN
- CDAR project: `http://cdar.nl`

- **RQ: What's the impact of the new gTLD program on the Root DNS stability?**
- Approach
  - Data-driven, using wide variety of DNS data
- Interaction with the broader tech community
  - ICANN and advisory committees, RSOs, DNS-OARC, IEPG/IETF

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DNS Root and name resolution

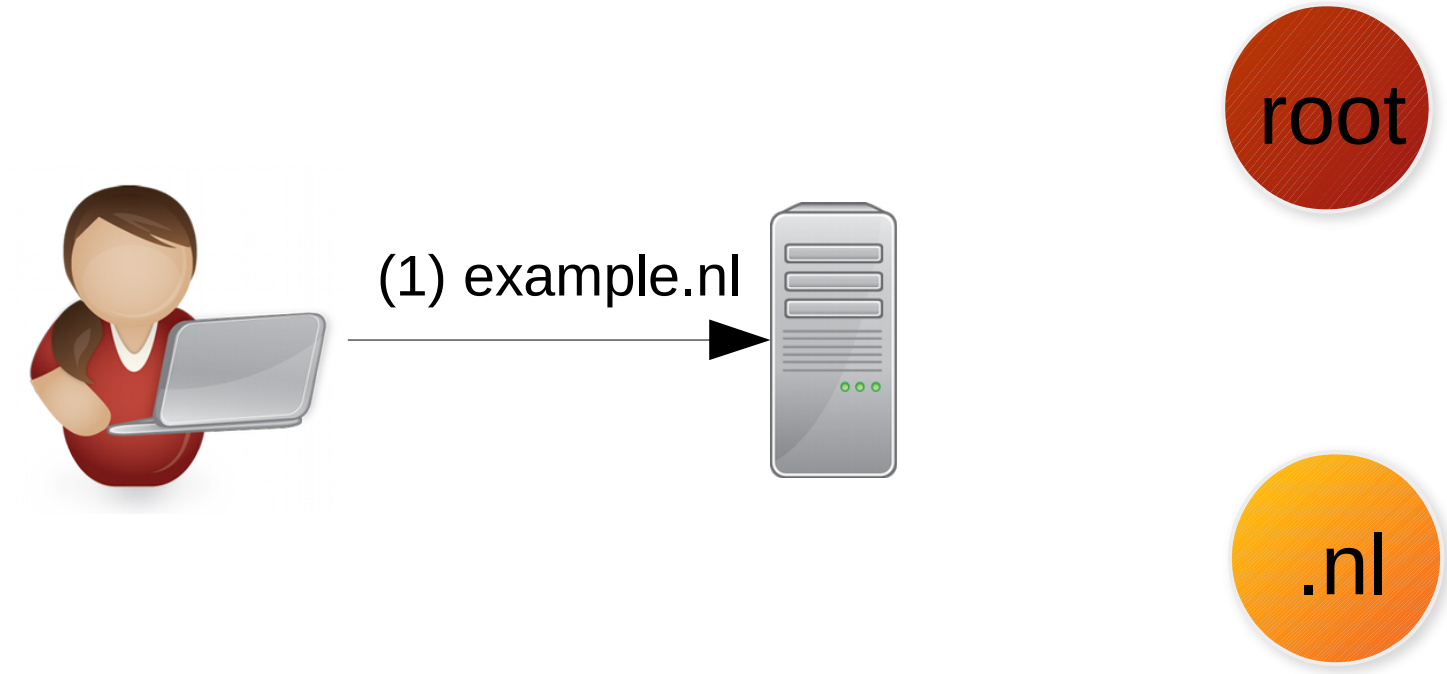
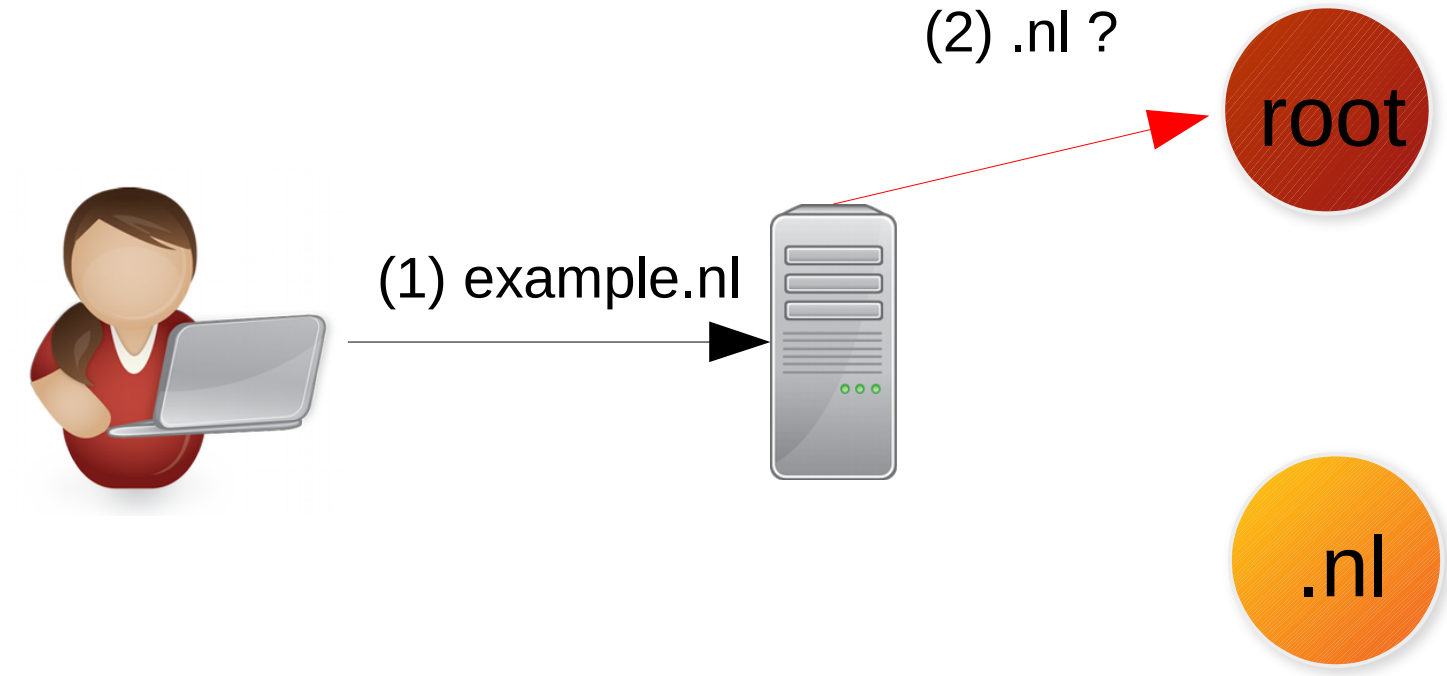


Figure: Resolving a Name

DNS Root and name resolution



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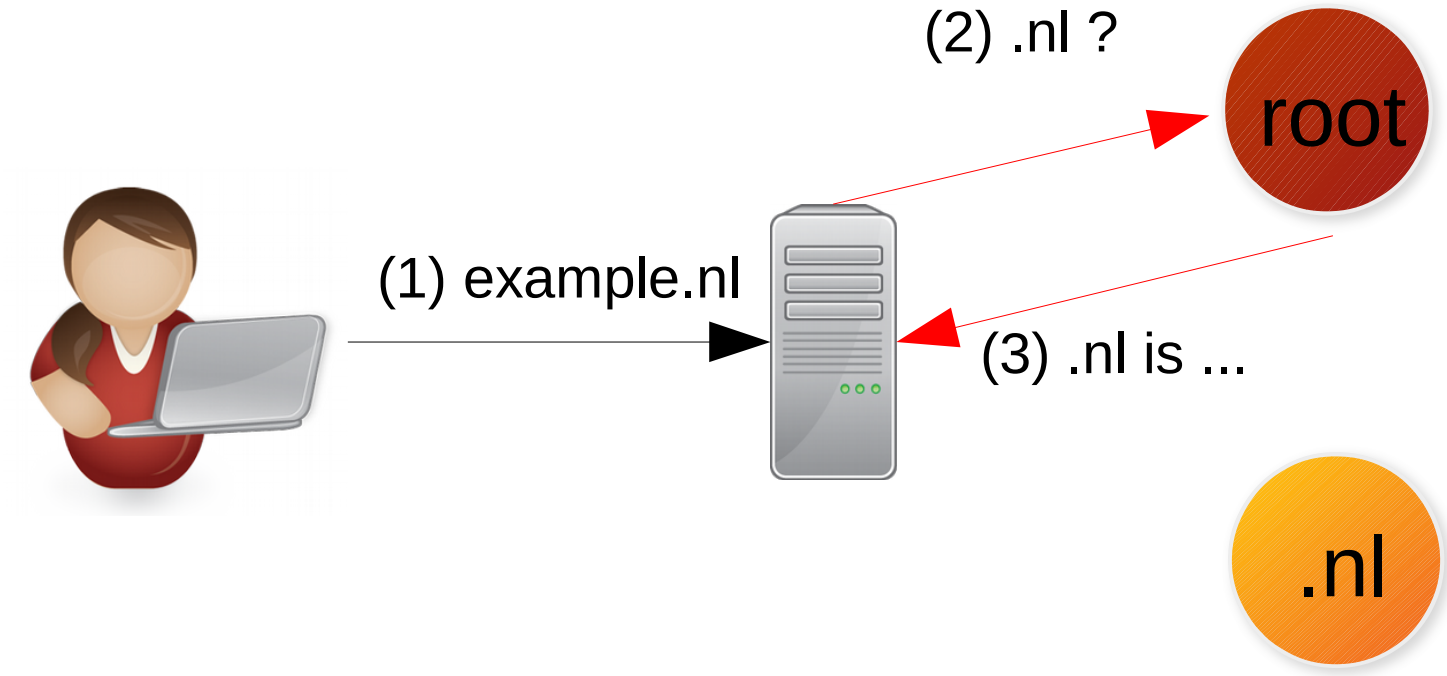

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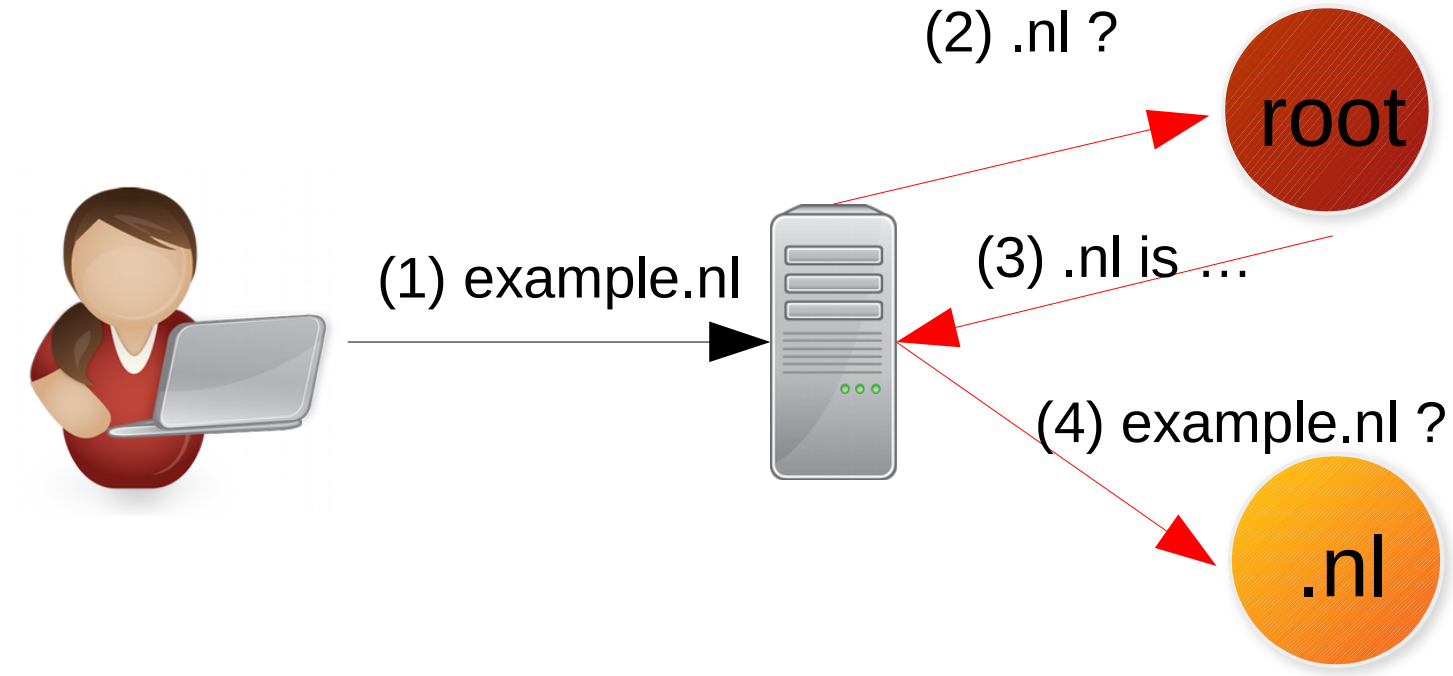

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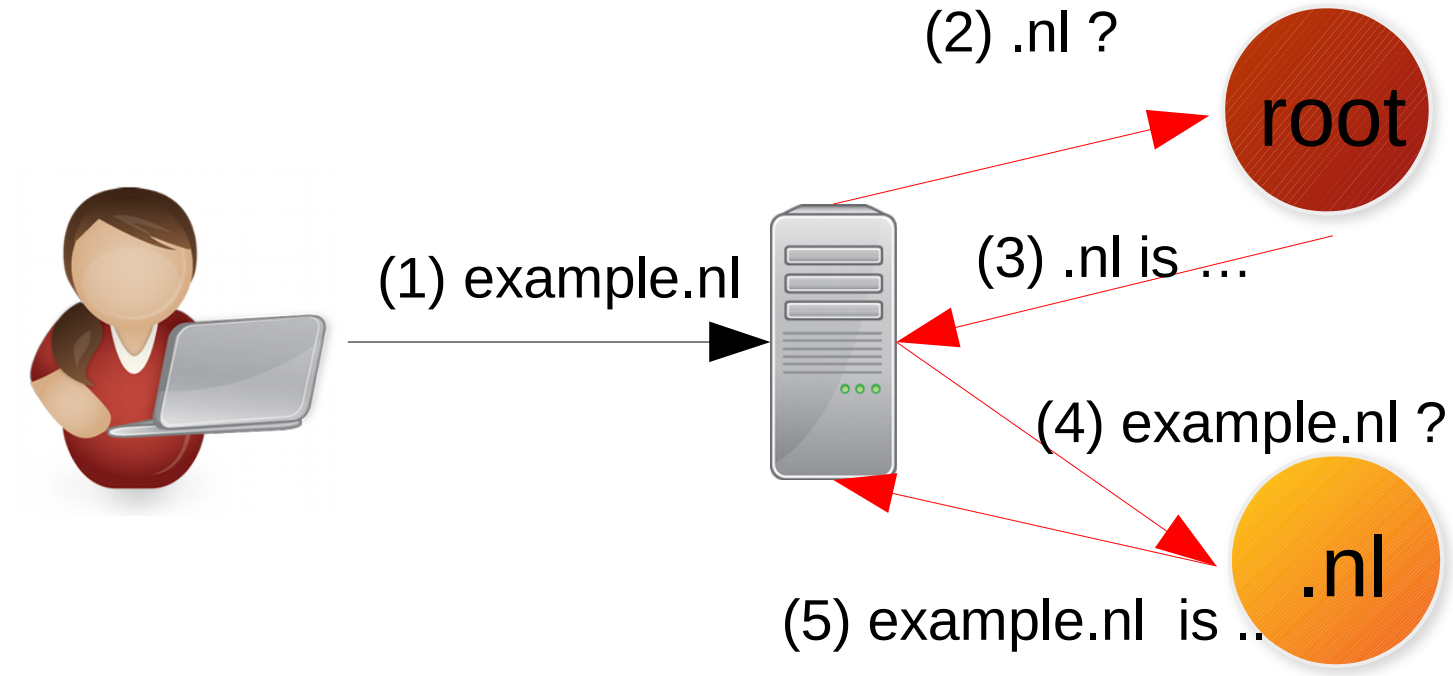

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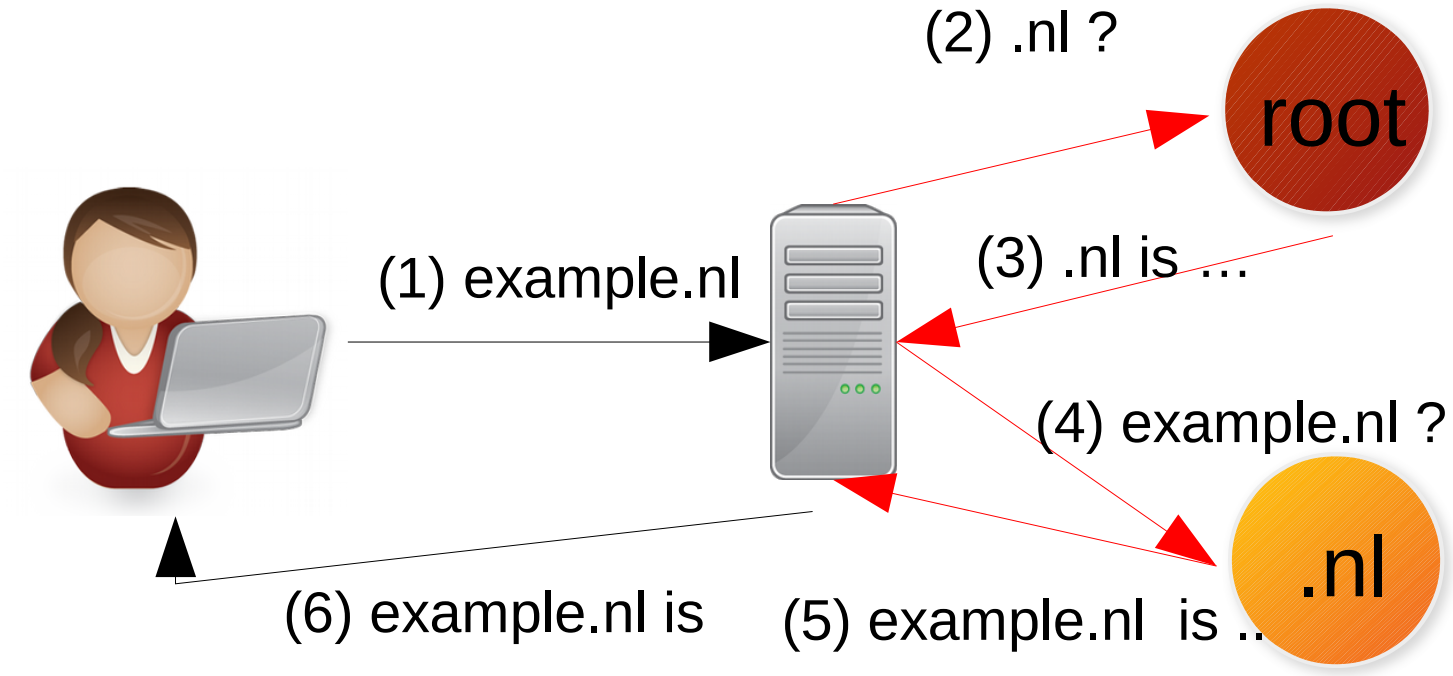

Figure: Resolving a Name

The Root DNS System

- Lists records for TLDs
- Extremely redundant to improve performance and availability:
  - 13 letters (A through M)
  - Each letter hosts several to more than 100 servers (Anycast)
  - Distributed all over the world
  - Has been up and running for many years
- Survived some major DDoS attacks
- Letters are ran by different organizations worldwide
- It's dynamic: more servers, lines added frequently

How many TLDs are out there?

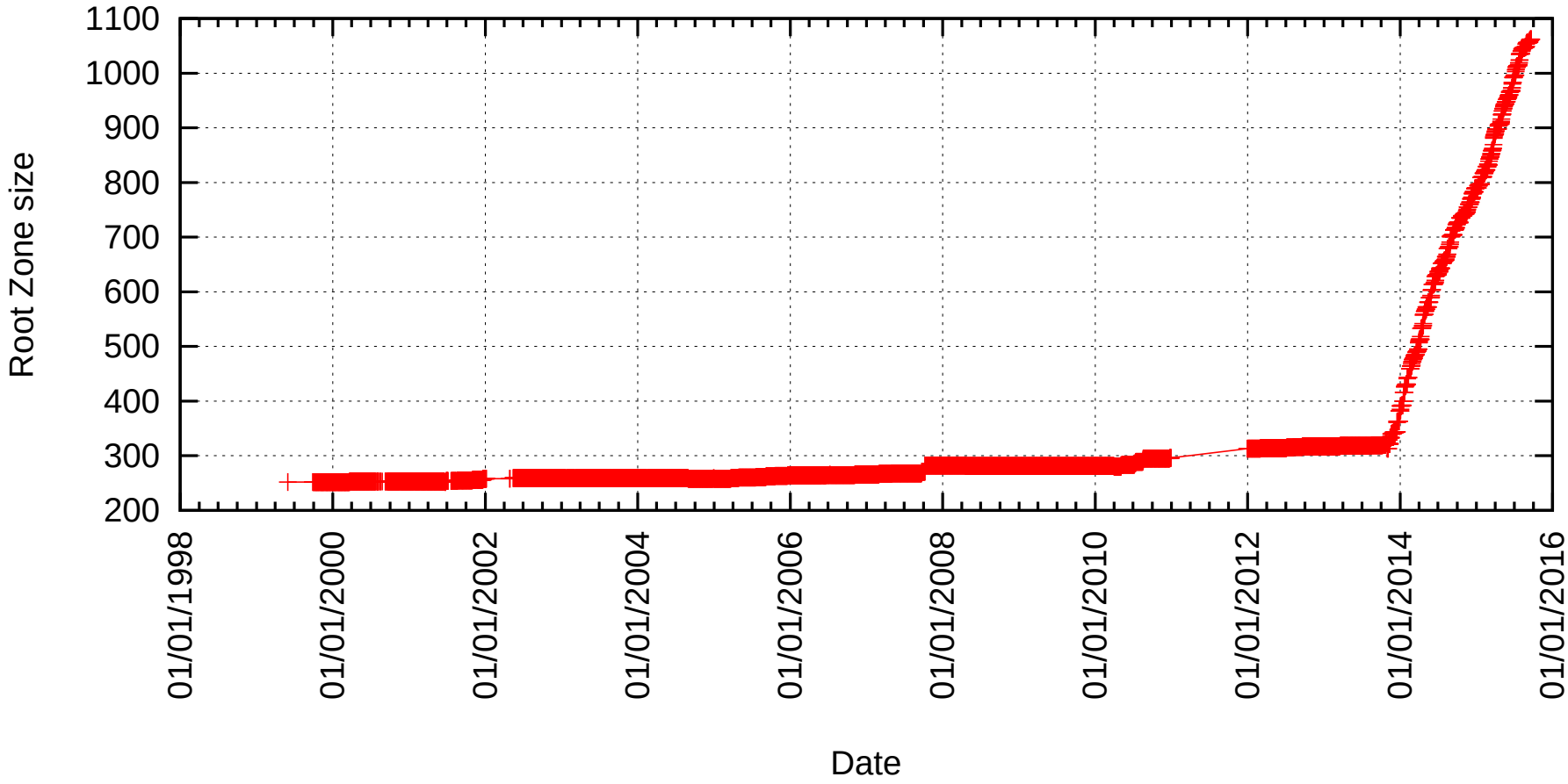

Figure: Timeseries of TLDs in the Root Servers

Is it too many? .com has 126+ million domains

What's the root traffic like (DITL = 1 day/year)

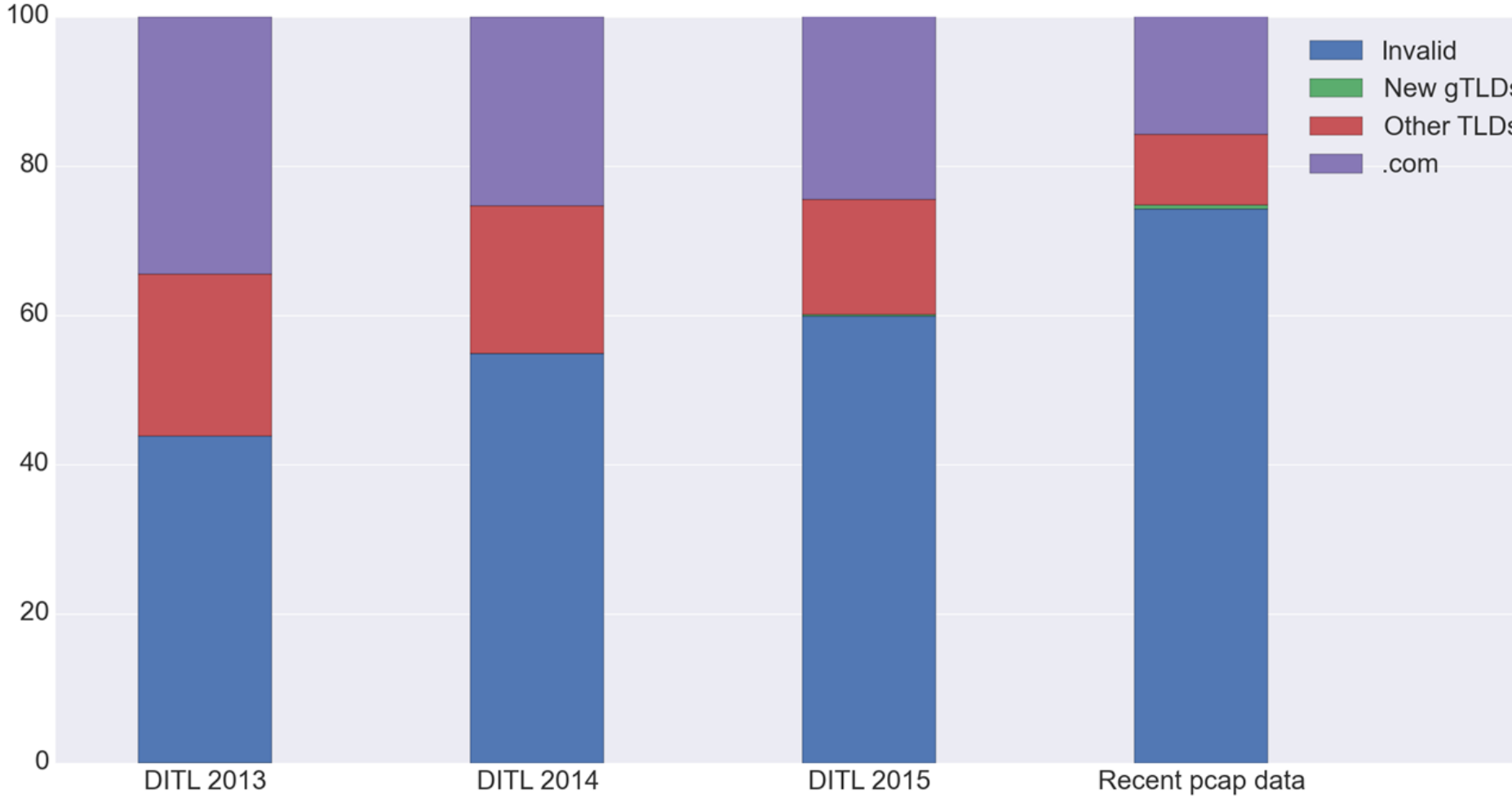

Figure: DITL data $\rightarrow$ new gTLD traffic is still too small

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Correlation between TLDs size and number of root queries

TLD	Queries	Zone Size	Ratio
.com	779.171.677	120.585.440	6.46
.org	91.095.714	10.569.583	8.62
.cn	51.949.760	11.678.026	4.45
.br	15.696.021	3.568.492	4.40
.club	651.082	202.519	3.21
.xyz	420.885	842.340	0.50

Table: DITL 2015 Data for K-root - Valid Queries only

- Ratio rarely exceeds 10 for DITL 13, 14, 15 , and recent H-root
- new gTLDs ratios are lower
- Limitation datasets: 1 day only per year
  - hard to generalize

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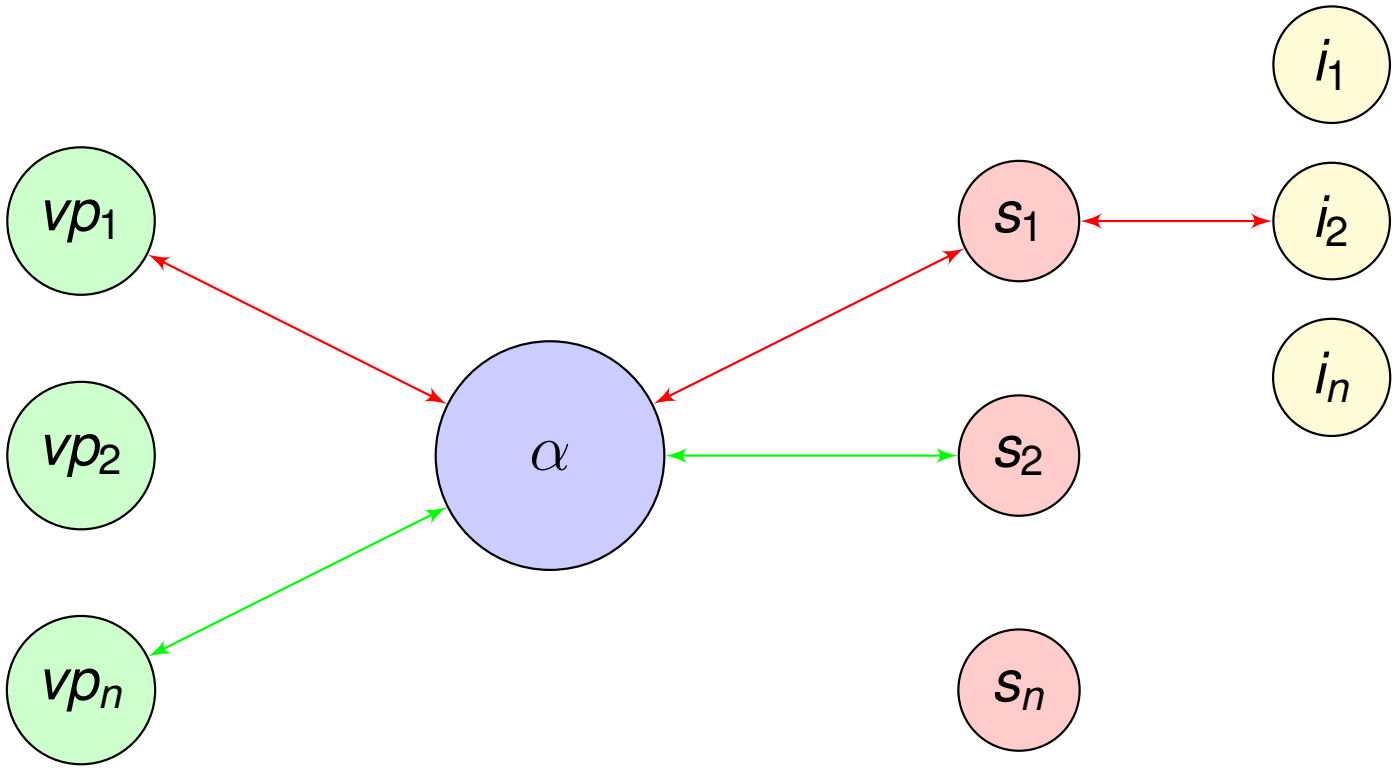
So far:

- DITL data set is great; but it is a snapshot
  - Hard to generalize conclusions
  - Have to combine with other analysis
- Is there any other longitudinal dataset out there?
  - YES! RIPE Atlas monitors every single root server letter :)
  - Every 4 min (except A)
  - They've been doing this for YEARS now
  - Limitation: influenced by other network errors
  - Pro: a good approximation of a resolver

Active Measurements with RIPE Atlas



- We can measure RTT, errors, on various levels:
  - letter (α = A-M)
  - site (s_n = city)
  - instance/server (i_n= actual machine)

Measurement plan with RIPE Atlas

1. Choose 30 dates in which new gTLDs were included in the root zone in the last years
2. For each day *d*, gets -2 and +2 days of data from RIPE Atlas , for each letter
3. Analyze RTT, responses per root server letter, site, and server

We have some **preliminary** results

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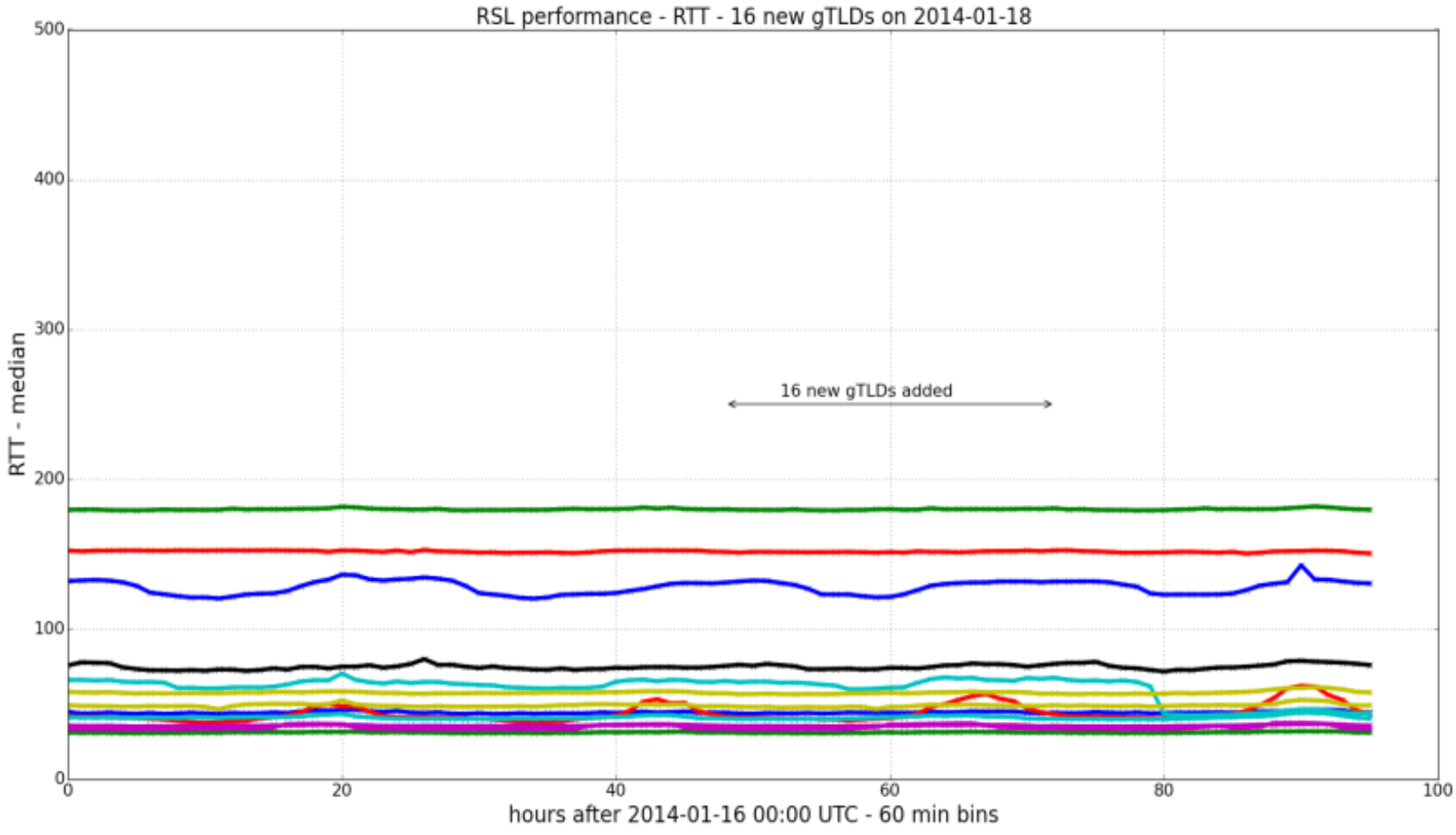
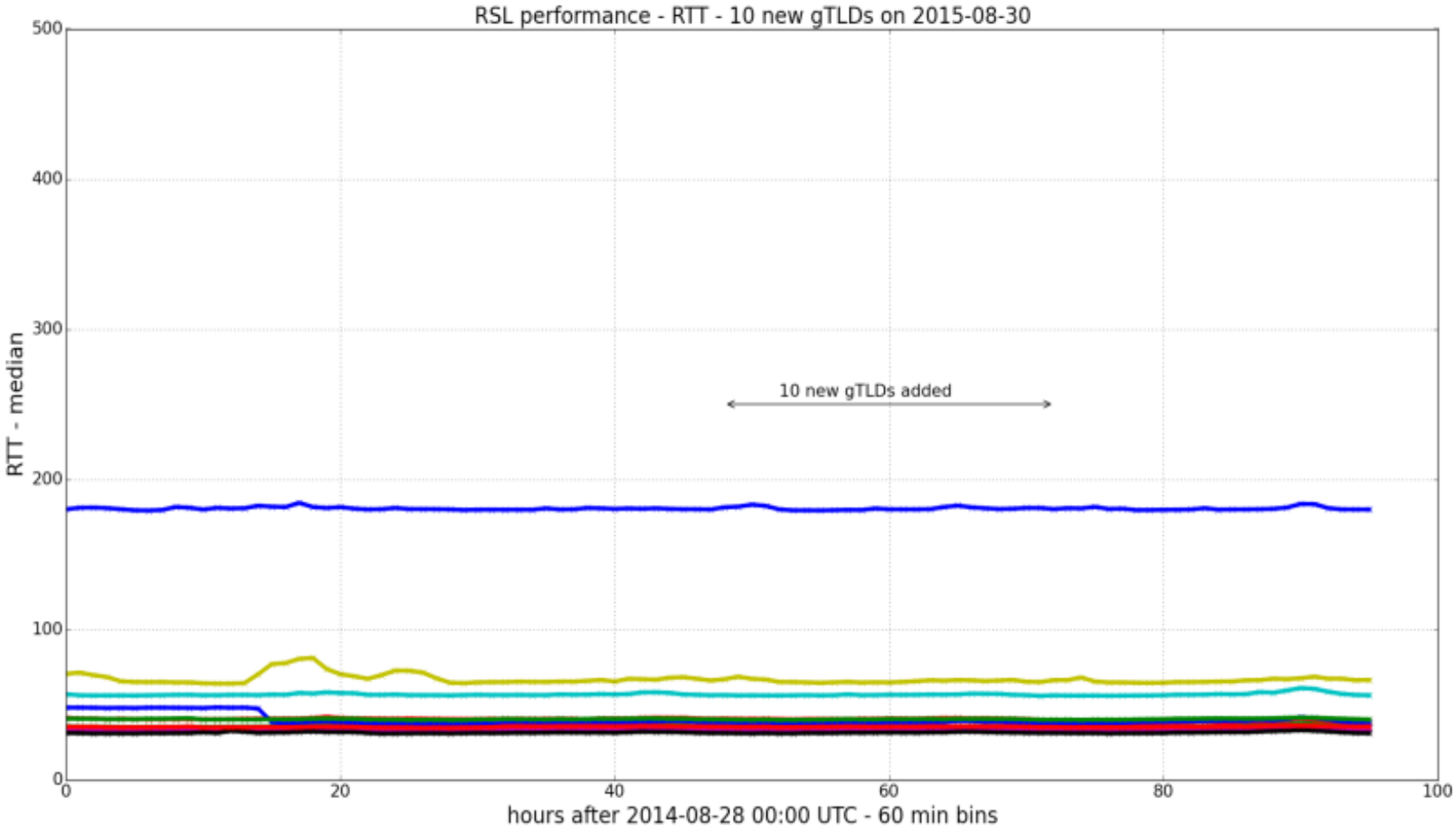
16 New TLDs: changes overall performance?



10 New TLDs: changes overall performance?



New gTLDs: changes overall performance?

- We are still working on the RIPE data
- Statistical tests to determine if there's variation
- So far, it seems to not impact that much
  - Root DNS is very robust
  - It's designed to "take the punch"
  - It would be weird to see major problems
- Other events can happen: DDoS Nov 30th/Dec 1st
  - See Matt Weinberg/Duane Wessels (A/J Root) DNS OARC Presentation

Summary

- Study aims at determining impact of new gTLD on Root DNS stability/security
- Various datasets; each one with its own limitation
- So far, new gTLD seem to have no significant impact the Root DNS system
- Next: continue our analysis to draw final conclusions
  - More metrics, more data, more analysis

Questions?

CDAR Project Team

- Bart Gijsen (TNO)
- Benno Overeinder (NLnet Labs)
- Cristian Hesselman (SIDN)
- Daniël Worm (TNO)
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- Jaap Akkerhuis (NLnet Labs)

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