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Measuring Global DNS Propagation Times Using RIPE Atlas

Bachelor Thesis by Tim Wattenberg

RIPE 77 – Amsterdam

Measuring Global DNS Propagation Times Using RIPE Atlas: Overview

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– Focus: detailed view on the Domain Name System (DNS)
– Goal: measuring consistency and the time it takes for changes to be globally visible

Chapters of the thesis:

1. Introduction: DNS, Measurement Structure, RIPE Atlas Project
2. Implementation
3. Results and Analysis
4. Project: ismydnslive.com
5. Conclusion

What’s the problem?

Inconsistent Responses

Introduction: Inconsistent Reponses

- Structure of DNS is likely to produce inconsistent responses
  - Resolver caches response
  - If resolver sticks to TTL, RR changes within TTL are not visible

- Does end-users ”see” the current configuration?
- Are there meaningful actions that can be taken before anticipated changes are made?

- Let’s measure it!

Introduction: Ideas for a Measurement Structure

- Verification of consistency only possible by measurements
  - One local measurement is not sufficient => measurements form different end-points of the internet are essential
  - wide measurement structure (both geographical and network-topology-wise) is needed => RIPE Atlas
- query one specific zone at nearly the same point in time from several different clients (Atlas probes)
- gather and compare the results of queries
- SOA RR with its serial-number were used to identify the version of a zone

Implementation: Components and Procedure

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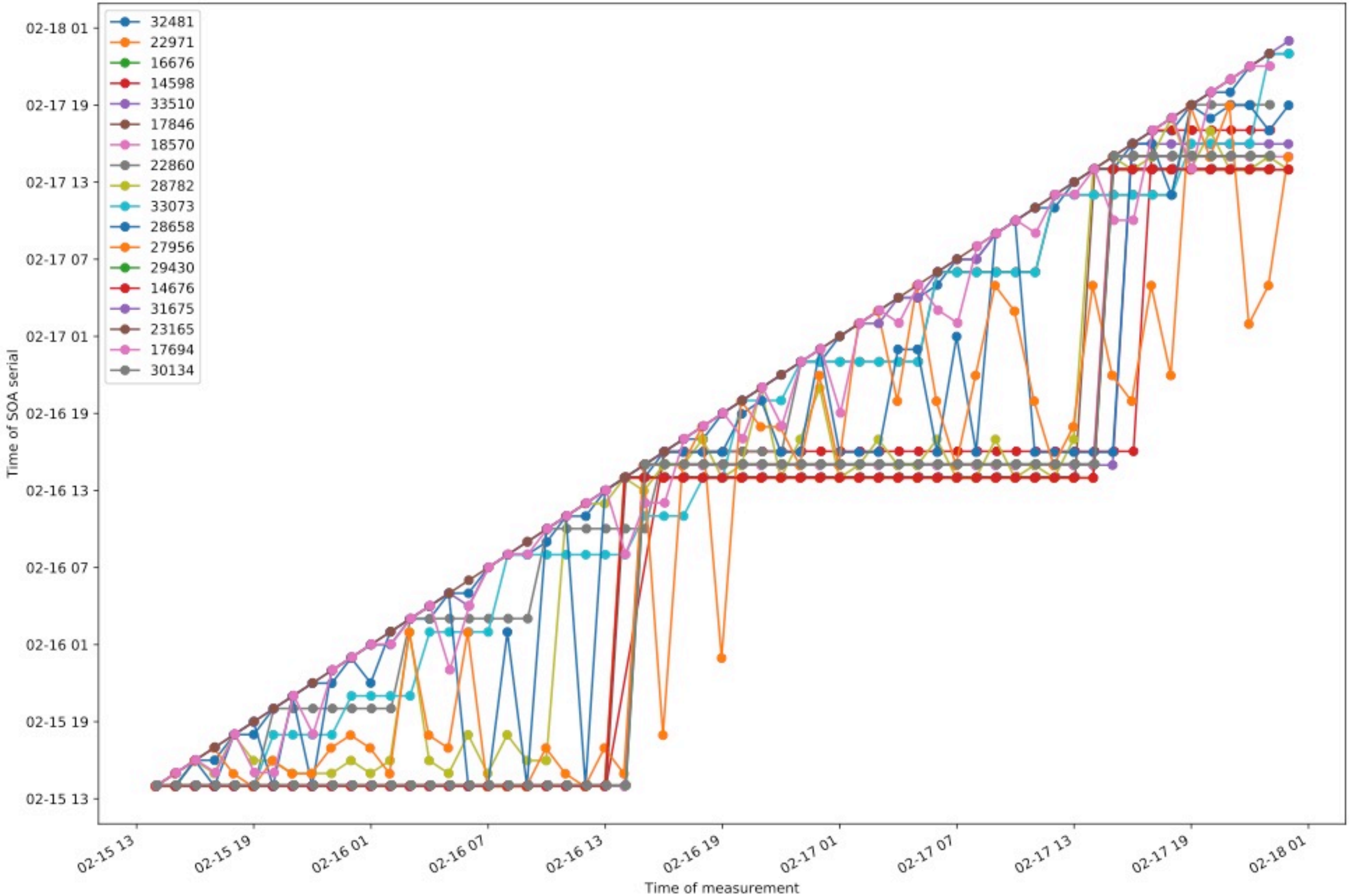
- RIPE Atlas:
  - Client side of DNS queries
  - Data-hub for measurement results
- Custom-implemented authoritative name server
  - Authoritative for the zone *dns-test.timwattenberg.de*
  - Allows various different schemes of SOA serial numbers
- Scripts for retrieving, parsing and plotting measurement results

Steps:

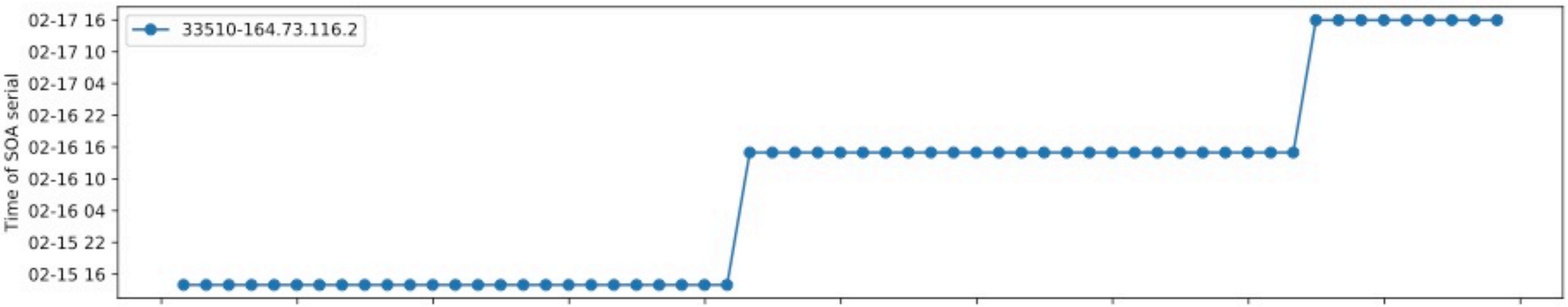
1. Adjust name server implementation
2. Create measurement on Atlas platform
3. Measurement is being executed within defined time range, results are collected on the Atlas platform
4. Results are being processed and visualized

Measurement: SOA serial is current timestamp, TTL set to 86400 (1 day)

Results: Measurement DNS-01

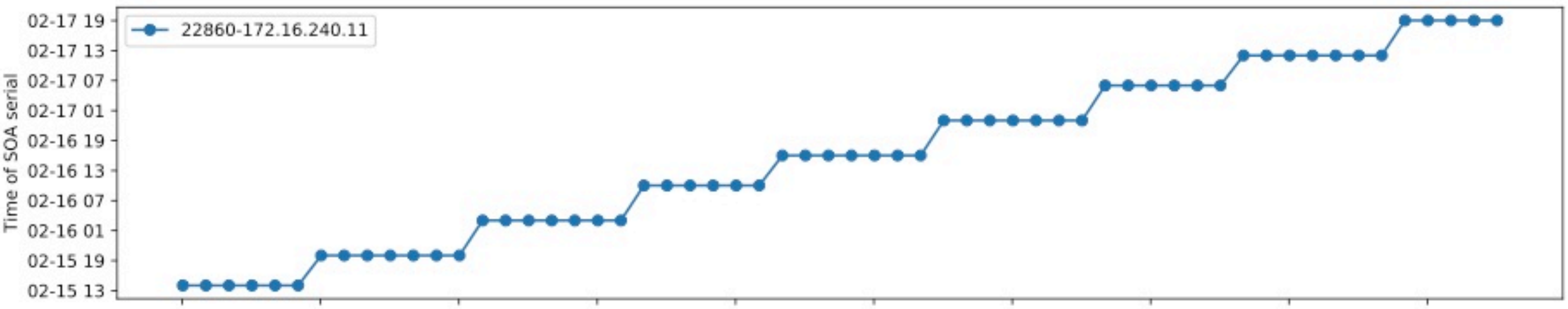


Results: Measurement DNS-01



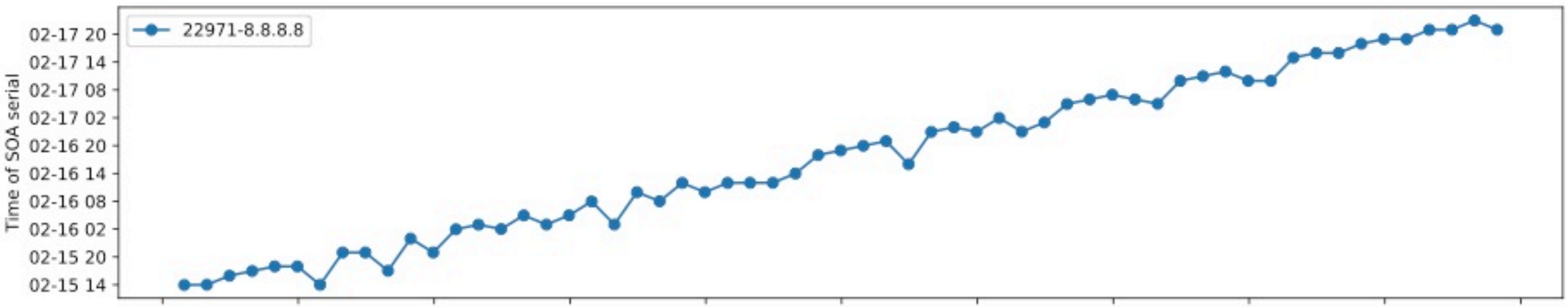
Sticks to TTL

Results: Measurement DNS-01



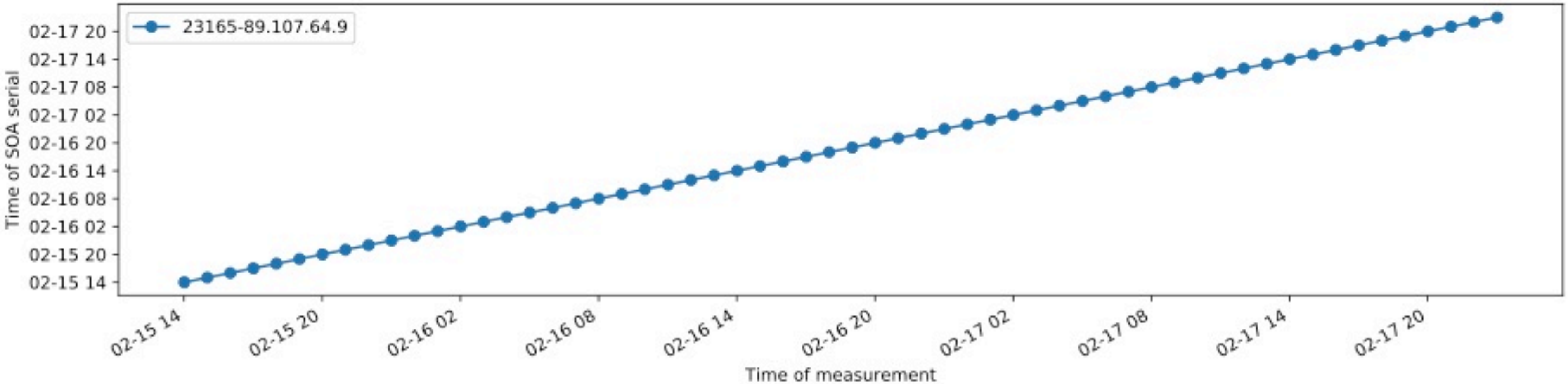
Reduces TTL consistently

Results: Measurement DNS-01



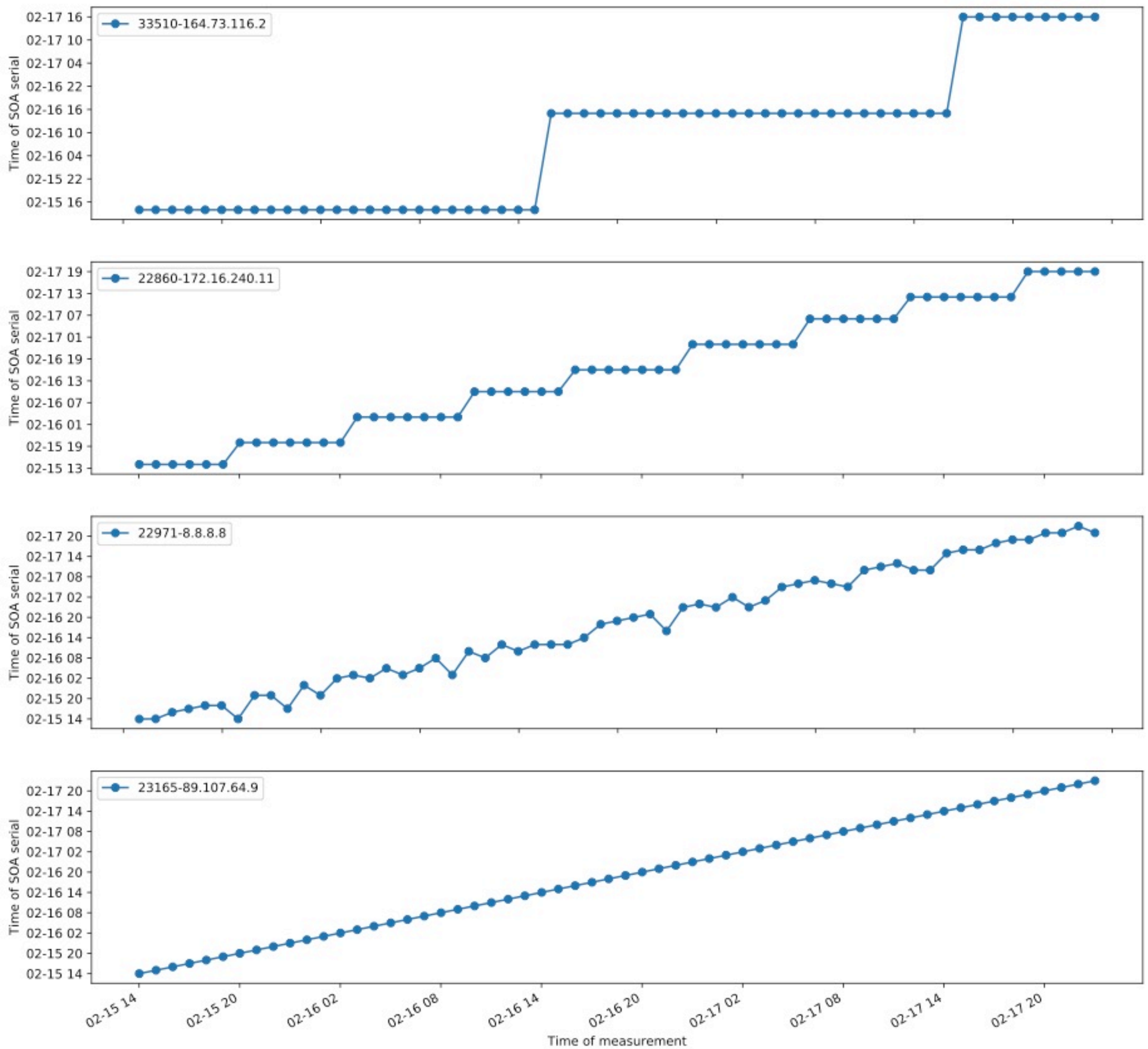
Reduces TTL inconsistently

Results: Measurement DNS-01



Ignores TTL

Results: Measurement DNS-01



Sticks to TTL

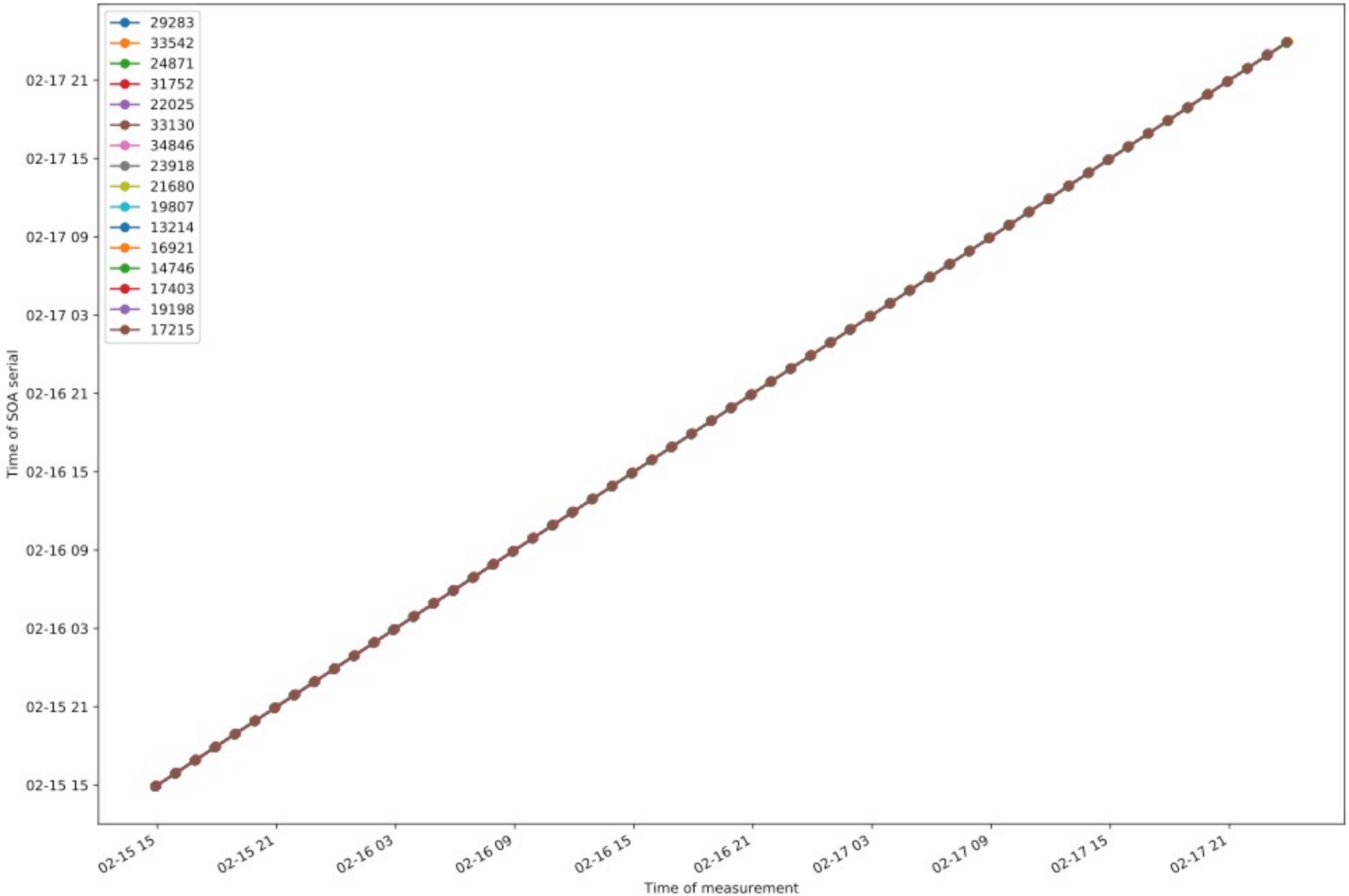
Reduces TTL consistently

Reduces TTL inconsistently

Ignores TTL

Setting TTL to 0?

Results: Measurement DNS-02



ismydnslive.com

A proof of concept.

ismydnslive.com: Idea

- Build a tool to compare the current status for a given zone as it is seen by clients in several different networks => especially useful after changes to a zone

- „Freshest“ SOA serial is determined by directly querying the primary name server
- a measurement querying the specific zone is created on the Atlas platform
- responses received from the probes are analyzed with regard to the SOA serial
  - If both serial numbers match, the resolver already responded with the current RR
  - otherwise there is still data in resolver-caches

ismydnslive.com: Improvements & Enhancements

- ”End-User-Features”:
  - Implement checks for several RR types (not only SOA)
  - Extend capabilities to include long running measurement: could be used as monitoring tool to quickly indicate reachability problems in certain regions or networks
- Aspects worth evaluating:
  - comparison of RR data could potentially reveal DNS-censoring-mechanisms
- Technical improvements:
  - extend IPv6 capabilities

Conclusion & Future Directions

- it is possible to build an infrastructure for measuring the consistency of DNS responses across different networks
- conducted measurements exposed methods that should be applied to ensure timely dissemination of zone changes

- Expanded measurements beyond only taking SOA records into account
- negative response caches
- DNS Name Server Identifier (NSID) Option

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Q&A