# A Primer in Registration Data Access Protocol (RDAP) Performance

Analyzing the RDAP response time of RIRs, TLD registries and ICANN-accredited registrars

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# Agenda

- $\odot$  Introduction
- $\odot$  Objectives
- $\odot$  Methodology
- ⊙ Results
- $\odot$  Conclusions



# From WHOIS to RDAP

- Why did we need another registration data access protocol?
  - WHOIS suffers from several issues
    - No standardized output format
    - No internationalization
    - No clear method for finding authoritative services
    - No authentication
    - No security
- Around 2011, RIPE NCC & ARIN developed *incompatible* RESTful services for WHOIS
- ◎ In 2015, the IETF standardized RDAP (RFCs 7480, 7481, 7482, 7483, 7484, 7485)
- ◎ In 2017, RySG and RrSG advised to speed up implementation
- From August 2019, ICANN requires that generic top-level domain (gTLD) registries and ICANN-accredited registrars must implement an RDAP service



• Overarching question:

To what extent is RDAP deployment at a stage where we can stop using WHOIS services and move to RDAP?

Goal:

- Investigating currently deployed RDAP services including those from RIR, TLD registries and ICANN-accredited registrars:
  - Measure RDAP performance
    - Performance defined as response time
    - Only using remote measurements



#### **Measurement methodology**

- Actively sending RDAP queries every 5 minutes to the RDAP service of RIRs, TLD registries and ICANN-accredited registrars
  - Only **domain** queries
  - **10** vantage points
  - 1 month of measurements (Dec 10, 2020 -- Jan 10, 202)



- For each query, the response time and response data were stored
  - Response time: the time from the start of the request until the last byte is received minus the time to resolve the RDAP server domain name



### **Aggregated results: response time**

- ~8 million RDAP queries:
  - Average query response time was 1.02 seconds
  - RIR's RDAP services were faster than TLD registries which in turn were faster than registrars
  - Presence of extreme outliers:
    - A few queries took several minutes to get responded

RIR

TLD

|           | Response time (sec) |      |      |      |      |       |        |  |
|-----------|---------------------|------|------|------|------|-------|--------|--|
|           | mean                | std  | min  | 50%  | 95%  | 99%   | max    |  |
| RIR       | 0.88                | 1.03 | 0.02 | 0.66 | 1.94 | 3.15  | 132.20 |  |
| TLD       | 1.26                | 1.38 | 0.04 | 1.06 | 2.82 | 14.44 | 259.37 |  |
| Registrar | 1.46                | 2.47 | 0.03 | 1.01 | 3.76 | 11.93 | 940.41 |  |
|           | :                   |      |      |      |      |       |        |  |



Registrar

### **Response time per vantage point (I)**

- Significant latency differences across vantage points
  - For the majority of RDAP services, response time is highly dependent on the location from where the query is performed

Queries executed from the same region have lower latencies



## **Response time per vantage point (II)**



• ~250 RIPE Atlas probes selected based on:

ICANN

- Stability: only probes online 90 days prior to the measurement
- Location: maximum of 25 probes per MESSAGE\*\* 11-region

Traceroutes to RDAP's service domain:

- ⊙ Average: 14.27 hops
- Max: 37 hops.



### **Response time vs response size**

- Average response size around 6KB
- RDAP response size highly varies per operator:
  - Maximum response size:
    **122 KB** (registrar)
  - 95% of all responses under 10 KB



 No significant correlation between response size and response time



- No statistically significant differences were observed in terms of response time depending on the IP address type
- Average query latency:
  - IPv4: 1.07 sec
  - IPv6: 0.87 sec





# **Breakdown of HTTPS Transaction Timings**

 RDAP latency can be broken down into several parts

- SSL handshake takes between
  20% to 40% of the response time
  - 40-80% of the time is spent in starting and actually transferring the RDAP response



|           | Time (sec) |            |             |               |          |  |  |  |  |  |  |
|-----------|------------|------------|-------------|---------------|----------|--|--|--|--|--|--|
|           | Connect    | Appconnect | Pretransfer | Starttransfer | Transfer |  |  |  |  |  |  |
| RIR       | 0.13       | 0.32       | 0.00        | 0.20          | 0.06     |  |  |  |  |  |  |
| TLD       | 0.19       | 0.43       | 0.00        | 0.40          | 0.04     |  |  |  |  |  |  |
| Registrar | 0.19       | 0.42       | 0.00        | 0.49          | 0.01     |  |  |  |  |  |  |



# Conclusions

- ➤ ~8 million RDAP queries were executed successfully
  - Average query response time: 1.02 sec
- Significant differences depending on the RDAP operator:
  - RIR's RDAP service had the fastest response time
- Source IP address type and response size did not significantly affect the response time
  - Query response size highly varies depending on the RDAP operator
  - Queries over IPv6 were responded slightly faster
- The geolocation from where the query is executed impacted the response time significantly
- ➤ The TLS handshake adds up to 20%-40% of the total response time





#### **Thank You and Questions**

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