Recursives in the Wild
Engineering Authoritative DNS Servers

Technical Report

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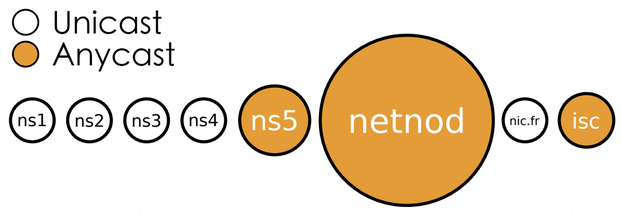
DNS operators are faced with different challenges:

- How many servers should they operate?
- How many should use anycast?
- How many sites should each anycast service employ?

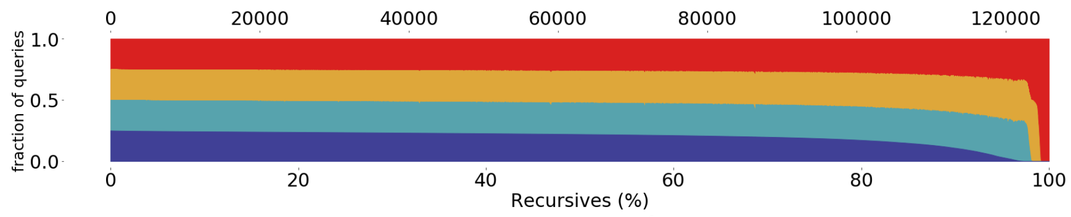


Authoritative name servers of .nl - area proportional to # of sites

To minimize latency and balancing load across NSes (name servers) and anycast, operators need to know how recursive resolvers select an NS, and how that interacts with their NS deployments.

Motivation for .nl

24% of the traffic to Dutch name servers is from the U.S. - why does it cross the Atlantic even though there are NSes in the U.S.?

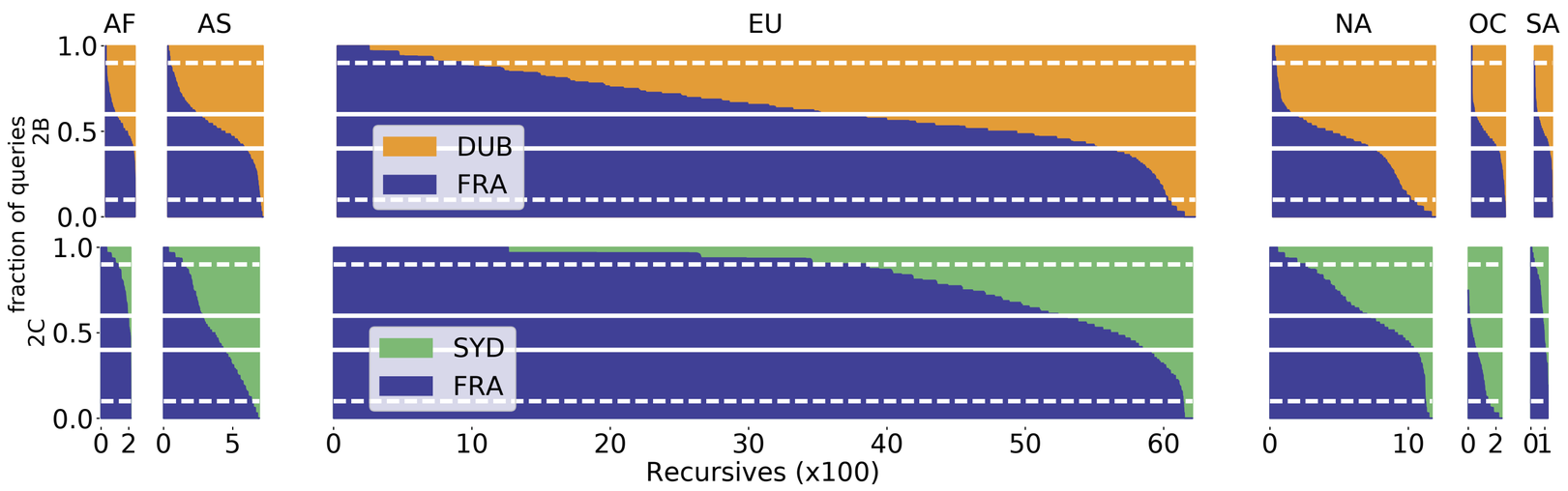


Recursive queries distribution across 4 .nl name servers (located in the Netherlands)

Q1: How do recursive resolvers select authoritative name servers?

Setup:

- One test domain with up to 4 different global NSes
- Measurement from 9000 RIPE Atlas probes
- Continuous DNS queries every 2 minutes for 1 hour using the probe's resolver



Recursive queries distribution across two NSes in Frankfurt (FRA), Dublin (DUB) and Sydney (SYD)

Main Results:

- Up to 69% of recursive resolvers favor NSes with shorter RTT
- Up to 41% of the recursive resolvers send the majority of queries to the slower responding NS
- Their preference is stronger when the RTT of the NSes is shorter

Q2: How can DNS operators optimize their service to reduce latency?

- Worst-case latency will be limited by the least anycast authoritative
- If some authoritatives are anycast all should be
- All anycast authoritatives need to be equally strong provisioned (sites, connectivity, peering)

Discussion and further research

- How many authoritative name servers are necessary?
- What is the impact for end-users?
- How can we decrease the RTT further?
- What are the critical recursive resolvers?
- How can we make them more resilient?

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