

Do You Really Like Me?

Anycast Latency and Root DNS Popularity

(abstract)

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It is well known that, when given a choice, a DNS recursive resolvers will favor authoritative servers with lower latency. This performance optimization has been a part of their implementation since the 1990s, and the behavior has been documented in two studies: Yu et al. examined implementations and replayed traces [13], and Müller et al studied the Root DNS from thousands of RIPE Atlas nodes. In addition, many DNS services have deployed anycast, in part to reduce latency [3, 4, 10].

The contribution of this abstract to show *how lower DNS latency shifts traffic from one server to another* While prior studies examined DNS from the perspective of a client, we consider the server-side view.

If anycast deployments vary in latency, than implication of a recursive’s preference for lower latency is that more traffic will shift to the lower-latency anycast service. We confirm that lower latency results in increased traffic from recursive resolvers that have a choice between multiple anycast service addresses providing the same zone. (This question differs from studies that examine the optimality of a specific anycast service with multiple sites [5–7].)

To examine this question we use public RSSAC-002 statistics for the root server system [9, 12]. From this we use the “traffic-volume” statistic, which reports queries per day for each root anycast service. (Recall that the Root DNS is provided by 13 different anycast service addresses per IP version, each using a different anycast infrastructure.) We show 6 months of data here (2019-11-01 to 2020-05-31), but we noticed similar trends since 2016. This analysis omits G- and I-Root, which did not provide data during this period.

Figure 1 shows the fraction of traffic that goes to each anycast service in the root server system for one year. Two root letters deployed additional sites over this period: B-Root originally had 2 sites but added 3 sites in 2020-02-01 [1], then optimized routing around 2020-04-01 [2]. H-Root originally had 2 sites but deployed 4 additional sites on 2020-02-11 and 3 additional sites on 2020-04-06 [11]. While other letters also added sites, B and H’s changes were the largest improvements relative to their prior size. We see that, B and H’s share rises from about 4% in 2019-11 to about 6% in 2020-05.

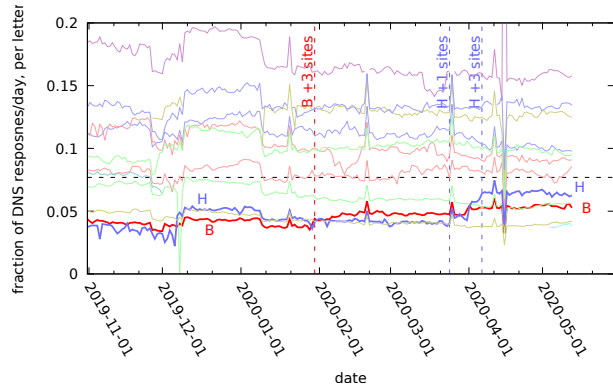


Figure 1: Fraction of traffic going to each root anycast service, per day, from RSSAC-002 data. B- and H-Root are bold lines.

This data confirms that when new sites deployed by one of the root letters, they offer some clients lower latency for that letter. Lower latency causes some clients to shift more of their traffic to this letter (automatically, as described in [8]), so its share of traffic relative to the others grows.

This data quantifies the long-term uneven balance of traffic across the 13 root letters.

Finally, it suggests that anycast DNS deployments that want to balance traffic across multiple IP anycast deployments (each on its own NS record and IP address) should either keep the size and connectivity of each anycast deployment similar, or expect that load will be uneven.

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