1 Problem

This paper discusses about the **impact in performance** caused due to switch from traditional DNS protocol(Do53) to DNS-over-HTTPS(DoH). Author mentions that this maybe caused due to multiple **latent variables** such as Bandwidth, Income Group, Number of ASNs, Resolver type - (cloudfare, Google, NextDNS, Quad9), studied how this impact differ from region to region. Also, Author analyzed **geographic differences** between the resolution times of Do53 and DoH, causes.

2 Contributions

Author contributed a method to calculate DoH resolution time and Do53 resolution time. To come up with this method, author utilized BrightData Super proxy server - paid HTTPS proxy service to route the traffic globally through exit nodes(VPN installed) . Upon excluding the time spent on communication with the super proxy, DoH resolution time is the sum of Local DNS Value, TCP handshake, TLS Session and IP address resolving time. Author made **2 assumptions** before proceeding with the ground-truth experiment to validate/compare the overall method. RoundTripTime between client and exit node is stable, tBrightData is considered only once upon establishing TCP tunnel, post that tBrightData is negligible.

3 Conclusions & Support

Query time calculation method introduced in this paper is consistent and accurate in comparison to ground-truth experiment data. With highest number of unique Point-of-Presence(PoP), Cloudfare(146) stands as the top-performing DoH providers, followed by google, NextDNS, Quad9. While analyzing geographic differences, clients from many regions took longer to resolve DoH queries and clients from some other regions quickly resolved the queries. Switch from Do53 to DoH increases the time taken to resolve single DNS query in some regions, while it slowdown in some regions.

Author considered client level and country level factors as explanatory variables to determine the performance difference between DoHN and traditional DNS. Data along with regression explains the strength of each attribute, cause of DoH slowdown in some regions. It is evident from **Logistic regression** model that, clients with **fast bandwidth, high income group, high number of ASNs, Cloudfare resolver** setting has no impact in performance while switching from traditional DNS to DoHN. Linear model gives insight about the impact of latent variables on DoH and Do53 query time. Experimental evidences, real-time data collection are the biggest advantages.

4 Likes

Author while calculating tDoH, came up with tDoHR, here exit node reuses the existing TLS session to perform upcoming requests. tDoHN, exit node reuses the existing TLS session to perform N requests. RIPE Atlas network was used to get missing Do53 data of 11 countries, Later performed validation experiments with regions(use RIPE Atlas and BrightData) data.

5 Dislikes / Disagreements

On contrary, there are few limitations while conducting the experiment such as using one proxy service(BrightData). Due to this, Do53 query time was not available for 11 countries. Also, during the study, they filtered regions with minimum 10 unique clients and eliminated the rest, which skewed the results. In future, there is a space for potential improvements in deploying DoH-by-default, DoH resolution services, Cache miss and hit.