**PART B**

**Input :** Website name (verisigninc.com)

**Output :** response if validated

Otherwise – verification failed / DNSSEC unsupported.

The input website name is sent to DNSSEC for resolving IP address, record type will be ‘A’ default.

List of root servers, root key is assigned/ initialized. The input website is first split, each name is passed to either get final IP address/ address of the next connecting server. Then make query message with website name and record type. After sending this query message using TCP, a response is obtained for further validation. To compare the response/ to validate, we make query using root key, obtain message after using TCP. We perform this operation to fetch DNSKEY [ZSK, KSK], RRSig or DNSKEY. As a next step, we perform validation

In DNSSEC, there are 4 parts namely, DNSKEY, RRSET, RRSIG, DS. At every step, We verify keys and RRSET. We use ZSK (Zone signing Key) and KSK(Key signing Key). We use chain of trust, to validate/ensure the security of our DNS server (i.e; DS Validation). This is because, if RRset and DNSKey are verified but ZSK and KSK are not verified, Security gets compromised which leads to man in the middle attack. So, we recursively verify the child hashed KSK with servers DS value.

If DNSSEC verification is successful, then proceed to the next level.

If there is a CNAME(canonical name) exists, perform additional the same operation again to resolve the IP address. If additional section is empty, get name from authority section and resend it for resolution.

**PART C**

Out of the top 25 alexa sites I chose 5 top websites namely **"baidu.com", "wikipedia.org", "yandex.ru", "facebook.com", "tiktok.com"** to analyze the average resolution time taken by 3 servers.

I compared mydigTool Vs. Google Vs. LocalDNS server’s resolution time and came to a conclusion that my local DNS server has very low resolution time.

Below is the resolution time for the 5 websites each resolver was run for 10 times.

mydig=[[0.65818190574646, 0.7141292095184326, 0.37682032585144043, 0.45375919342041016, 0.45160603523254395, 0.49492406845092773, 0.5419390201568604, 0.5509660243988037, 0.40897321701049805, 0.5173299312591553],

[0.2866220474243164, 0.3014819622039795, 0.29326510429382324, 0.31515002250671387, 0.2821478843688965, 0.2957320213317871, 0.30971717834472656, 0.3023509979248047, 0.306607723236084, 0.2775449752807617],

[0.4639101028442383, 0.37842607498168945, 0.414517879486084, 0.406268835067749, 0.3921658992767334, 0.5510740280151367, 0.3939940929412842, 0.6317539215087891, 0.41981005668640137, 0.39168524742126465],

[0.17413687705993652, 0.1781320571899414, 0.181427001953125, 0.20044302940368652, 0.20796680450439453, 0.21140670776367188, 0.17014026641845703, 0.38434886932373047, 0.20679783821105957, 0.19986510276794434],

[0.17836880683898926, 0.1819140911102295, 0.17802810668945312, 0.20049715042114258, 0.18095183372497559, 0.2182610034942627, 0.18204379081726074, 0.18082809448242188, 0.2070159912109375, 0.20695185661315918]]

local\_dns=[

[0.0718379020690918, 0.007485866546630859, 0.006608009338378906, 0.006090879440307617, 0.009235143661499023, 0.0071260929107666016, 0.008703947067260742, 0.00879526138305664, 0.006562948226928711, 0.006742954254150391],

[0.0556027889251709, 0.007260799407958984, 0.006533145904541016, 0.00640106201171875, 0.011229991912841797, 0.00646519660949707, 0.0066449642181396484, 0.008699893951416016, 0.007889032363891602, 0.0079193115234375],

[0.058741092681884766, 0.00914311408996582, 0.030395984649658203, 0.007229804992675781, 0.00894618034362793, 0.00824880599975586, 0.008951187133789062, 0.009810924530029297, 0.010081052780151367, 0.009483098983764648],

[0.05943918228149414, 0.01082611083984375, 0.00799107551574707, 0.0072231292724609375, 0.00951075553894043, 0.006932973861694336, 0.009316682815551758, 0.00677490234375, 0.008144140243530273, 0.006654977798461914],

[0.057166099548339844, 0.007361173629760742, 0.007118940353393555, 0.02435612678527832, 0.006994009017944336, 0.007862091064453125, 0.006513833999633789, 0.0064640045166015625, 0.006623029708862305, 0.006673097610473633]]

google\_server=[[0.05533599853515625, 0.06409382820129395, 0.04385805130004883, 0.03903698921203613, 0.03990888595581055, 0.04718518257141113, 0.06534194946289062, 0.04783487319946289, 0.055500030517578125, 0.056452035903930664],

[0.0665590763092041, 0.04844808578491211, 0.06041121482849121, 0.06188321113586426, 0.05770707130432129, 0.04900360107421875, 0.050776004791259766, 0.04889273643493652, 0.04888010025024414, 0.05875873565673828],

[0.056639909744262695, 0.041786909103393555, 0.0428011417388916, 0.05751323699951172, 0.04334115982055664, 0.05313420295715332, 0.06267404556274414, 0.04038095474243164, 0.047393083572387695, 0.043622732162475586],

[0.04769492149353027, 0.049108028411865234, 0.054077863693237305, 0.06120014190673828, 0.05788993835449219, 0.07228994369506836, 0.05186200141906738, 0.05451011657714844, 0.04480791091918945, 0.058316946029663086],

[0.07718920707702637, 0.07158684730529785, 0.053083181381225586, 0.06006288528442383, 0.05510878562927246, 0.049127817153930664, 0.07713794708251953, 0.062143802642822266, 0.05176901817321777, 0.06001162528991699]]

Chart, bar chart

Description automatically generated

**Insight :**

Local DNS server resolved the IP address quickly compared to other(my dig tool, google) servers. Whereas, mydig tool performed worse while resolving IP address for the above mentioned websites. It is because, every time, when an input is parsed, the server must go to root server and perform all the steps right from TLD to authoritative name server. However, In local and Google DNS servers has caching which aids in quick IP resolution.