Analyze the Performance of DNS

Procedure

Pick google.com, youtube.com, and aws.amazon.com as experiment targets. Run 3 different DNS resolvers (mydig, dig and dig @8.8.8.8) on each website 10 times. 30 seconds between each query. Platform: Ubuntu 22.04.1 LTS. Oracle Cloud instance.

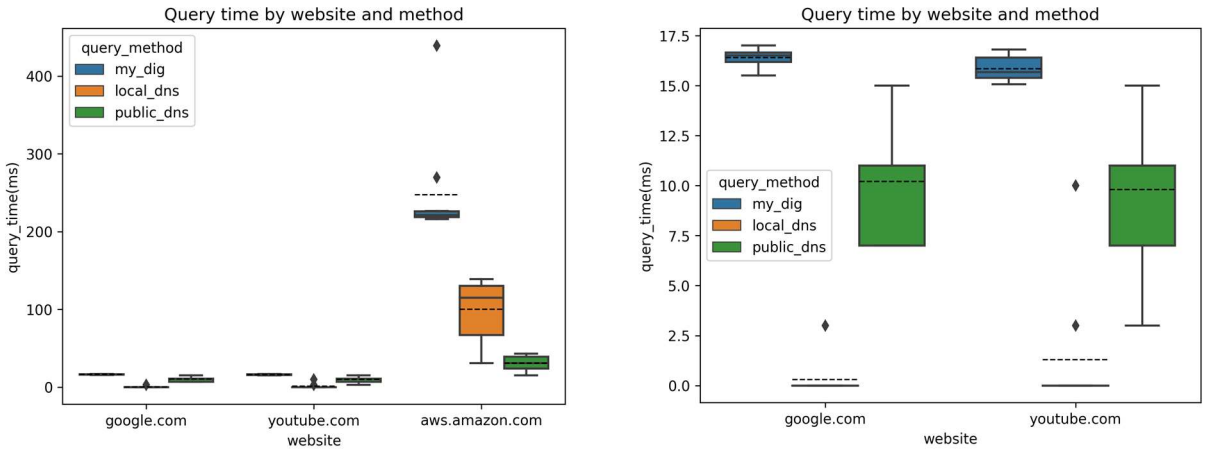
Data

website	mydig(ms)	local(ms)	public(ms)
google.com	16.68	3	7
google.com	16.59	0	15
google.com	17.01	0	7
google.com	16.48	0	11
google.com	16.84	0	7
google.com	16.53	0	15
google.com	15.90	0	11
google.com	15.51	0	11
google.com	16.17	0	11
google.com	16.24	0	7
average	16.39	0.3	10.2
25th percentile	16.18	0	7
75th percentile	16.66	0	11

website	mydig(ms)	local(ms)	public(ms)
youtube.com	16.21	10	11
youtube.com	15.09	0	11
youtube.com	15.43	0	3
youtube.com	16.47	0	7
youtube.com	15.75	0	7
youtube.com	16.80	3	11
youtube.com	15.60	0	7
youtube.com	15.38	0	15
youtube.com	16.56	0	11
youtube.com	15.07	0	15
average	15.84	1.3	9.8
25th percentile	15.40	0	7
75th percentile	16.40	0	11

website	mydig(ms)	local(ms)	public(ms)
aws.amazon.com	439.11	139	23
aws.amazon.com	224.25	135	15
aws.amazon.com	269.58	127	43
aws.amazon.com	219.14	107	39
aws.amazon.com	218.14	31	23
aws.amazon.com	220.79	51	39
aws.amazon.com	226.53	123	31
aws.amazon.com	221.24	55	39
aws.amazon.com	216.78	103	31
aws.amazon.com	216.11	131	27
average	247.17	100.2	31
25th percentile	218.39	67	24
75th percentile	225.96	130	39

Box Plots



The images are plotted using matplotlib and the code and csv files for input have been attached. Drawing two plots instead of one is because in image 1, the request time of the aws.amazon.com domain name is significantly different from that of the other two domain names, making the conclusion of google.com and youtube.com not obvious.

Conclusion

It can be found from the plots that the domain name resolution time of mydig tool is always longer than that of using local DNS and public DNS, which is expected.

Local DNS and public DNS implement the caching function to shorten the time spent on repeated requests for the same domain name in a short period of time. mydig starts from the root server for every request, which makes it take longer.

Since the steps of each request using mydig are roughly the same, the time required for the query is relatively concentrated and there will not be much fluctuation, which is consistent with the experimental results. Compared with mydig and local DNS, public DNS has larger query time fluctuations. This may be due to the extra step required to use public DNS - establishing communication with the public DNS. This process is influenced by many uncertain factors and thus often leads to scattered results. This extra step also makes public DNS often slower than local DNS even if it implements the caching function.

Also note that when using local DNS for resolution, the time it takes for some websites to request again within a period of time after a request is often 0. This should also be due to the cache function.

The result obtained by querying aws.amazon.com is more special. Requests tend to take longer and the local DNS resolves the domain name slower than the public DNS. The reason may be that the cache in local DNS may not be as large or well-maintained as a public resolver. Plus AWS uses DNS Security Extensions (DNSSEC) to secure its domain. DNSSEC can increase the time it takes to resolve a query due to the additional verification steps required.