INTERNET ARCHITECTURE

OBSERVATIONS AND DETAILED ANALYSIS

Note :

We have provided you with 4 excel files **:**
1 Hops_table
2 Analysis_graph
3 Latency_table
4 Local_ISP

The proofs have been provided separately in proof_traceroute.pdf

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PART A
Tracerouting from six traceroute servers from different continents to the six web servers :

Web servers :

ETHZ (Switzerland): 129.132.19.216
University of Waterloo (Canada east): 129.97.208.23
University of Cape Town (South Africa): 137.158.158.44
BITS Pilani (India): 14.139.243.30
Google: 216.58.219.196
Facebook: 31.13.75.36

Traceroute servers are chosen: (source: traceroute.org)

Greece
Russia
Canada
Australia
Singapore
South Africa

We tested 6 different servers on different continents by using the traceroute servers from the traceroute.org. The packet files are first passing through the local ISP server and then proceeding to go onto the target destination. Also here we noticed that as the number of hops and distance from the source server increases, the latency is also increasing.

Google and Facebook differ in the number of hops required to reach them Countries like the USA, Canada appear to provide lesser latency on average. The latency depends on the distance of the server and also depends on the firewall and other protective measures installed in the server.

We observed that some traceroute servers were giving timeout in certain cases. These are basically due to 3 reasons :

1 The server under observation has some kind of protective layer or firewall around it.

2 The IP addresses have been made private due to which the packets are not able to return the information.

3 The server under observation is currently down.

Number of Hops

Traceroute Servers	ETHZ (Switzerland): 129.132.19.216	University of Waterloo (Canada east): 129.97.208.23	University of Cape Town (South) 137.158.158.44	BITS Pilani (India): 14.139.243.30	Google 216.58.219.196	Facebook 31.13.75.36
			Destination servers			
Greece	14	18	>30	>30	>30	10
Russia	7	12	>30	>30	>30	9
Canada	14	15	>30	>30	>30	14
Australia	16	19	>30	>30	>30	15
Singapore	22	17	>30	>30	>30	11
South Africa	14	18	>30	>30	>30	17

Latency Table (in ms)

Traceroute Servers	ETHZ (Switzerland): 129.132.19.216	University of Waterloo (Canada east): 129.97.208.23	University of Cape Town (South) 137.158.158.44	BITS Pilani (India): 14.139.243.30	Google 216.58.219.196	Facebook 31.13.75.36
			Destination servers			
Greece	37.669 ms	136.288 ms	max hops reached	max hops reached	max hops reached	57.596 ms
Russia	102 ms	183.32 ms	max hops reached	max hops reached	max hops reached	54 .802 ms
Canada	169.342 ms	41.31 ms	max hops reached	max hops reached	max hops reached	87.433 ms
Australia	311.311 ms	229.985 ms	max hops reached	max hops reached	max hops reached	160.34 ms
Singapore	334.229 ms	247.150 ms	max hops reached	max hops reached	max hops reached	181.96 ms
South Africa	200.12 ms	188.34 ms	max hops reached	max hops reached	max hops reached	190.541 ms

PART B

Tracerouting over Mobile Hotspot:

We ran traceroute command on the same 6 servers from our machine using the cellular data connection which in my case is JIO 4G LTE. The packet files are passing through the local ISP first and then are further routed to the target destination. This may be one of the reasons why the server in India(BITS Pilani) has all intermediate routers inside local ISP, whereas other countries have fewer hops inside the local ISP.
It could be noted that the latency values over cellular data connection are higher than those observed for the LAN. This may be owing to the fact that the packets have to first go to the respective ISP and then move onto the target destination which takes more time.

Latency Table for local ISP using cellular data connection (in ms)

Destination Probed	Number of hops	No.of hops inside local ISP	% Age of hops inside local ISP	Total latency (ms)	Latency inside local ISP (ms)	%Age of latency inside local ISP
ETHZ (Switzerland): 129.132.19.216	22	5	22.72	3819.766	459.46	12.02848551
University of Waterloo (Canada east 129.97.208.23	30	10	33.33333333	7240.1	407.8	5.632518888
University of Cape Town (South) 137.158.158.44	24	11	45.83333333	5541.31	363.12	6.552963108
BITS Pilani (India): 14.139.243.30	18	18	100	735	735	100
Google 216.58.219.196	12	10	83.33333333	553.12	458.13	82.82651143
Facebook 31.13.75.36	22	10	45.45454545	2322.43	512.34	22.0605142

PART C

Another Important Analysis :

As the number of hops increases, the latency time also increases. But this is not always true. The correlation also depends on the distance of the server and also depends on the firewall and other protective measures installed in the server.