CS F303 - Computer Networks
Assignment 1

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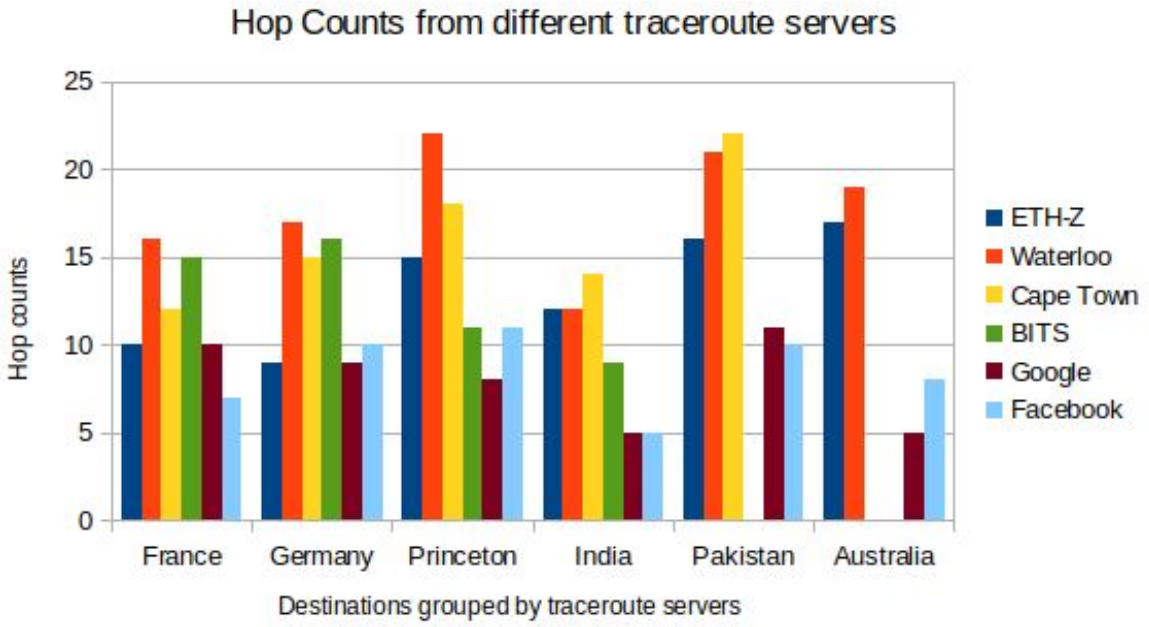
Question 3.

Study the following:

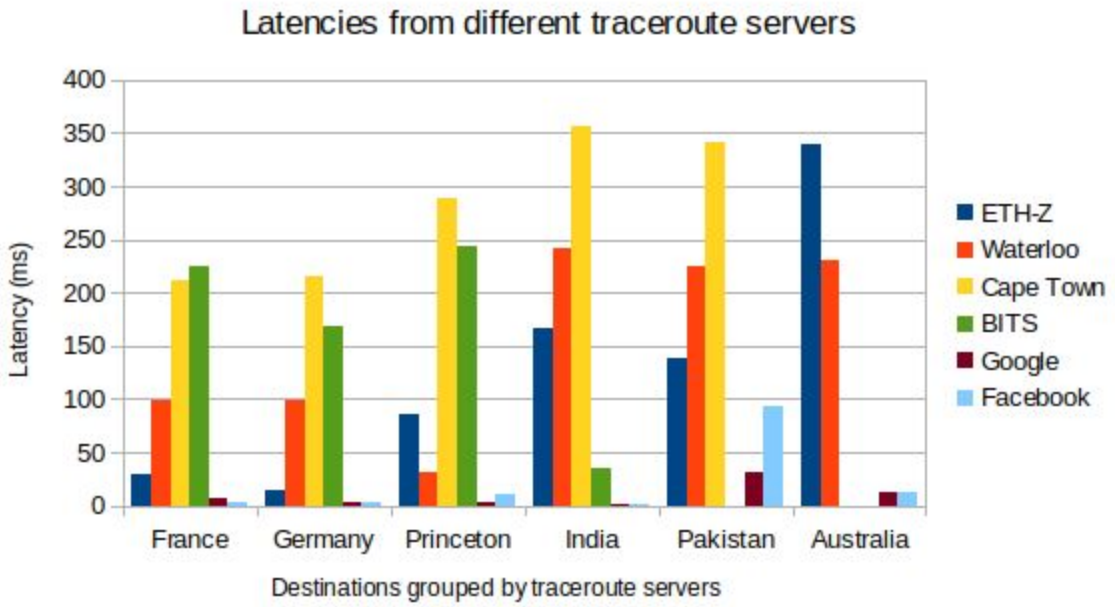
a) Frequency distribution of the number of hops from traceroute servers to the above destinations in different continents. Are the number of hops between nodes in the same continent lower than hops between nodes in different continents? Do Google and Facebook differ in the number of hops required to reach them?



NOTE: The traceroute wasn't completed in the case of PAK → BITS and AUS → Cape Town and AUS → BITS

As we can see from the distribution the number of hops required to reach destinations within the same continent is generally lower than when the traceroute server and destination are in different continents. Google and Facebook differ in the amount of hops required to reach them but not by much. This could be because both Google and Facebook use CDNs which decrease the the number of hops required to complete requests to their servers greatly. This is not the case with university networks.

b) Frequency distribution of the latencies between the traceroute servers and web servers. Is the latency related to the number of hops?



NOTE: The traceroute wasn't completed in the case of PAK -> BITS and AUS -> Cape Town and AUS -> BITS

As we can see from the 2 graphs shown above higher the number of hops, more is the latency. The factor that comes into play here is dependent on the distance to the destination, that is, the propagation delay.

c) How many countries of traceroute servers did you find that have local ISPs directly peered with Google and Facebook?

None.

d) Now do the same exercise of tracerouting to the six destinations from a cellular data network in India (mobile hotspot). Contrast the number of hops and latency incurred inside the network of your cellular ISP, to the total number of hops and latency to the destinations. What do you find is the greatest source of latency?

Destination	Hops in ISP	Total hops
ETH-Z	13	23
Waterloo	10	30
Cape Town	10	30
BITS	10	18
Google	10	15
Facebook	10	14

The greatest source of latency between hops is the physical distance since the signal has to travel a large distance on the medium which results in propagation delay.

e) Do you find routes to some destinations to be closer than others? What does this tell you about the connectivity of your ISP to the rest of the world?

Yes. It tells us that the degree of connection of our ISP is higher to some destinations and lower to some others.

Screenshots of traceroutes which weren't completed

Nexlinx (Internet Services) LG

Target: 14.139.243.30, IP: 14.139.243.30, FQDN:

```
traceroute to 14.139.243.30 (14.139.243.30), 30 hops max, 40 byte packets
 1  FE-3-0-100M-CORE.nexlinx.net.pk (202.59.80.2)  0.236 ms   0.244 ms   0.269 ms
 2  10.10.80.11 (10.10.80.11)  0.732 ms   0.634 ms   0.597 ms
 3  tw202-static169.tw1.com (110.93.202.169)  0.865 ms   0.884 ms   0.994 ms
 4  110.93.253.226 (110.93.253.226)  16.689 ms   17.962 ms   16.534 ms
 5  110.93.252.164 (110.93.252.164)  32.529 ms tw255-static168.tw1.com (110.93.255.168)  18.572 ms 110.93.252.164 (110.93.252.164)  30.424 ms
 6  ae12.marsiglia98.mar.seabone.net (213.144.176.232)  126.140 ms   127.295 ms   124.817 ms
 7  ae20.marsiglia3.mar.seabone.net (213.144.176.212)  124.837 ms   122.957 ms   124.372 ms
 8  tata.marsiglia3.mar.seabone.net (213.144.170.61)  122.742 ms   123.310 ms   124.473 ms
 9  80.231.200.26 (80.231.200.26)  418.714 ms *   418.971 ms
10  * * *
11  * * *
12  * * *
13  * * *
14  * * *
15  * * *
16  * * *
17  * * *
18  * * *
19  * * *
20  * * *
21  * * *
22  * * *
23  * * *
24  * * *
25  * * *
26  * * *
27  * * *
28  * * *
29  * * *
30  * * *
```

PAK → BITS

```
 1  gigabitethernet3-3.exi1.melbourne.telstra.net (203.50.77.49)  0.364 ms  0.268 ms  0.241 ms
 2  bundle-ether3-100.exi-core10.melbourne.telstra.net (203.50.80.1)  1.489 ms  1.542 ms  2.118 ms
 3  bundle-ether2.way-core10.adelaide.telstra.net (203.50.6.230)  15.108 ms  14.036 ms  14.734 ms
 4  bundle-ether3.pie-core10.perth.telstra.net (203.50.6.235)  41.592 ms  41.894 ms  40.719 ms
 5  bundle-ether1.wel-core10.perth.telstra.net (203.50.11.228)  40.466 ms  39.645 ms  40.594 ms
 6  203.50.9.6 (203.50.9.6)  41.216 ms  39.400 ms  39.967 ms
 7  i-25154.sgcn-core01.telstraglobal.net (202.84.141.237)  86.194 ms  86.368 ms  86.442 ms
 8  i-91.istt04.telstraglobal.net (202.84.224.197)  85.444 ms  85.618 ms  85.442 ms
```

AUS → BITS

```
 1  gigabitethernet3-3.exi1.melbourne.telstra.net (203.50.77.49)  0.385 ms  0.266 ms  0.241 ms
 2  bundle-ether3-100.exi-core10.melbourne.telstra.net (203.50.80.1)  2.864 ms  1.541 ms  2.240 ms
 3  bundle-ether12.chw-core10.sydney.telstra.net (203.50.11.124)  12.234 ms  13.037 ms  12.611 ms
 4  bundle-ether1.oxf-gw11.sydney.telstra.net (203.50.6.93)  12.234 ms  13.161 ms  12.735 ms
 5  bundle-ether1.sydo-core03.sydney.reach.com (203.50.13.98)  14.359 ms  14.286 ms  12.611 ms
 6  i-10403.sydo-core04.telstraglobal.net (202.84.222.130)  12.860 ms  12.410 ms  12.986 ms
 7  i-10604.1wlt-core02.telstraglobal.net (202.84.141.225)  155.277 ms  154.453 ms  155.654 ms
 8  i-0-6-0-1.paix-core02.telstraglobal.net (202.84.143.198)  197.249 ms  196.553 ms  196.879 ms
 9  i-92.paix02.telstraglobal.net (202.84.247.41)  195.376 ms  195.555 ms  197.128 ms
10  pax-edge-03.inet.qwest.net (65.119.103.17)  153.773 ms  153.830 ms  219.741 ms
11  sjp-brdr-06.inet.qwest.net (67.14.34.218)  154.025 ms  153.954 ms  178.262 ms
12  be3112.ccr41.sjc03.atlas.cogentco.com (154.54.12.117)  154.151 ms  154.202 ms  154.280 ms
13  be3670.ccr22.sfo01.atlas.cogentco.com (154.54.43.13)  155.650 ms
14  be3109.ccr21.slc01.atlas.cogentco.com (154.54.44.138)  185.560 ms  185.435 ms  185.261 ms
15  be3037.ccr21.den01.atlas.cogentco.com (154.54.41.146)  194.379 ms
16  be3036.ccr22.mci01.atlas.cogentco.com (154.54.31.90)  201.874 ms  201.427 ms
17  be2831.ccr41.ord01.atlas.cogentco.com (154.54.42.166)  228.038 ms  228.411 ms  228.108 ms
18  be2717.ccr21.cle04.atlas.cogentco.com (154.54.6.222)  225.359 ms
19  be2879.ccr22.alb02.atlas.cogentco.com (154.54.29.174)  226.661 ms  227.660 ms  226.675 ms
20  be3600.ccr32.bos01.atlas.cogentco.com (154.54.0.222)  230.545 ms  229.654 ms
21  be2099.ccr41.lon13.atlas.cogentco.com (154.54.82.33)  294.996 ms  295.120 ms  294.448 ms
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AUS → Cape Town