COMP90007 Internet Technologies Network Analysis Project, Project 1

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Section 1 - Testing environments and choice of hosts

This test environments includes a consumer level network environment located in Brisbane, QLD, Australia. ISP is Telstra with 100 Mbps download speed (advertised figure) (nbn plans, n.d.) (speedtest, n.d.), WIFI connection through a 9000 Mbps WIFI 6 router (Mi Router AX9000, n.d.). At most two people using the network with mostly web browsing. Multiple network-based app running in the background (mostly smart home apps) but none of them is heavy network user. No large file downloading or video streaming through the testing process.

Regarding the hosts, some of the original hosts listed in worksheet are not compatible with the above testing environment (access refused or access timed out). Therefore, two new hosts are added to replace iperf.scottlinux.com and speedtest.wtnet.de, one additional host is added to make total number of hosts of 10. Host information are looked up by www.Site24x7.com (Find geographical location of your website, n.d.) for server location, and www.distancecalculator.net (Distance Calcaultor, n.d.) for physical distance, hosts details are listed below.

	Hosts	City	State	Country	Distance to local host (km)
1	iperf.he.net	Cazadero	California	USA	11378.39
2	bouygues.testdebit.info	Massy	Iledefrance	France	16569.98
3	ping-ams1.online.net	Amsterdam	Noordholland	Netherlands	16192.91
4	ikoula.testdebit.info	Boulogne-Billancourt	Iledefrance	France	16569.33
5	iperf.astra.in.ua	Lviv	L'vivs'ka Oblast'	Ukraine	15060.89
6	ping-90ms.online.net	Paris	Iledefrance	France	16557.57
7	speedtest.serverius.net	Almelo	Overijssel	Netherlands	16092.65
8	iperf.volia.net	Kyiv	Kyyiv	Ukraine	14592.03
9	iperf.biznetnetworks.com	Pela Mampang	Jakarta	Indonesia	5410.47
10	speedtest.uztelecom.uz	Tashkent	Toshkent	Uzbekistan	11497.55

Figure1.1 Hosts, geolocation and approximate physical distance from Brisbane

The screenshots of all data collected can be found:

- Appendix A – traceroute results
- Appendix B – ping test results
- Appendix C – iperf bandwidth test results
- Appendix D – Excel spreadsheet populating and calculations
- Appendix F – multiple website resource screenshots

Section 2 - Traceroute and hop counts

1) -n is used to print each hop address numerically instead of symbolically and numerically. In this case, it helps to demonstrate the tracing result clearly as we are more concerned with the hop counts than hop details. -w 1 is used to set the time, in seconds, to wait for response from a probe. By default it is set to 5. In this case, we set it to 1 to save times, especially when we deal with timed out connections.

2) Hop counts

	Hosts	Max Hop count	City	Distance to local host (km)
1	iperf.he.net	15	Cazadero	11377.29
2	bouygues.testdebit.info	21	Massy	16569.98
3	ping-ams1.online.net	21	Netherlands	16192.91
4	ikoula.testdebit.info	19	Lyon	16569.33
5	iperf.astra.in.ua	19	Lviv	15062.98
6	ping-90ms.online.net	20	Paris	16822.50
7	speedtest.serverius.net	26	Ijsselstein	16196.52
8	iperf.volia.net	34	Kyiv	14594.17
9	iperf.biznetnetworks.com	16	Jakarta	5413.47
10	speedtest.uztelecom.uz	23	Tashkent	11497.55

Figure 2.1 Traceroute hops count

Note*: 7th server in the list "speedtest.serverius.net" traceroute does not return any information after hop 26 (instead, from hop 27 to 64 it is just "* * *"). This may cause by router configuration during router tracing i.e. at router 26, it prevents the data transmitted back. That means, the packet that sent from my terminal may finally reached the host server speedtest.serverius.net, and it send acknowledgement information back to my terminal, however this piece of information might be dropped at certain point along this route.

3) Scatter chart of distance and hop counts

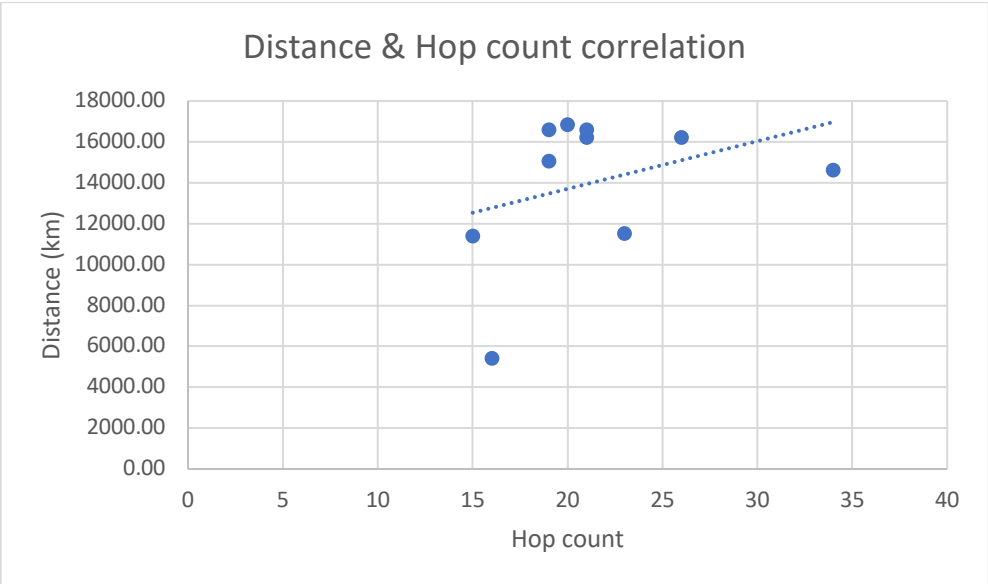


Figure2.2 Scatter chart of distance and hop counts

4) Observations:
   a) Host servers with similar geolocation have similar hop counts. It is likely that the route that connect from my IP address to the servers with similar geolocation share most same routes, apart from the last bit of each route. For example, host 4 and host 6 are both located in France, with hop counts 19 & 20 respectively. In appendix A, the screenshots demonstrate that from hop 1 to 14 both are following the same IP addresses. Therefore, host servers with similar geolocation have similar hop counts.

   b) Servers that close to my geo-location, usually indicates less hop count. Meaning it takes less routes to transmit data from my location to target server. Vice versa, server that is far from my location, usually indicates more hop count.

   c) However, server with similar physical distance might indicate quite different hop counts. This may cause by physical network cable construction different. For example, host 1 which is located in US is about 12,000kms from my location, with hop count of 15, while the server located in Uzbekistan is also about 12000 kms from my location, with hop count of 23. Route that cross continent under sea usually is directed linked (very difficult to have a server under the ocean), while the route travels over the land may separate by many short-distance routes (from nation to nation).

   d) In some case, host servers with similar hop count may have very different geo distance. Host 9 in Jakarta with 16 hop count, is about 5400 kms from my location. Server in US with 15 hop count, is about 12000 kms from my location. Again, this is caused by physical network cable arrangement. Network cable length to connect from Oceanic to South-East Asia is quite different to Oceanic to North America. Hence, we cannot depend on hop count to refer to distance.

Section 3 - measuring delay and jitter

1) Measurement of round-trip delay and jitter

	Hosts	test 1 – 1 (ms)	test 1 - 2 (ms)	test 1 - 3 (ms)	test 2 - 1 (ms)	test 2 - 2 (ms)	test 2 - 3 (ms)
1	iperf.he.net	182.129	167.268	170.783	175.947	170.419	174.884
2	bouygues.testdebit.info	315.590	342.058	413.754	379.637	426.035	482.842
3	ping-ams1.online.net	346.468	367.238	387.659	390.438	307.079	327.920
4	ikoula.testdebit.info	351.882	357.509	401.930	321.376	353.652	416.023
5	iperf.astra.in.ua	359.758	408.140	459.081	363.507	333.086	345.950
6	ping-90ms.online.net	413.521	436.155	486.251	499.494	546.128	400.198
7	speedtest.serverius.net	340.189	334.126	379.247	420.139	301.503	313.016
8	iperf.volia.net	397.548	365.092	366.488	400.755	449.075	364.242
9	iperf.biznetnetworks.com	196.269	191.729	235.595	215.547	190.252	192.842
10	speedtest.uztelecom.uz	394.596	438.979	482.518	380.505	381.291	426.959

Figure 3.1 (1) – Measurements of round-trip delay and jitters, test 1 & 2

	Hosts	test 3 - 1 (ms)	test 3 - 2 (ms)	test 3 - 3 (ms)	avg rt-delay (ms)	jitter (stdev)	Distance to local host (km)
1	iperf.he.net	180.233	165.464	173.059	173.354	5.249	11377.29
2	bouygues.testdebit.info	382.234	310.071	309.096	373.480	56.729	16569.98
3	ping-ams1.online.net	310.670	331.358	350.661	346.610	28.837	16192.91
4	ikoula.testdebit.info	327.228	326.618	325.065	353.476	32.535	16569.33
5	iperf.astra.in.ua	519.200	562.170	331.969	409.207	80.471	15062.98
6	ping-90ms.online.net	408.050	422.107	423.906	448.423	47.380	16822.50
7	speedtest.serverius.net	371.835	303.803	303.339	340.800	39.256	16196.52
8	iperf.volia.net	376.790	385.572	431.840	393.045	28.598	14594.17
9	iperf.biznetnetworks.com	305.711	348.295	199.917	230.684	54.191	5413.47
10	speedtest.uztelecom.uz	481.596	521.494	598.077	456.224	68.327	11497.55

Figure 3.1 (2) – Measurements of round-trip delay and jitters, test 3, avg delay and jitter standard deviation

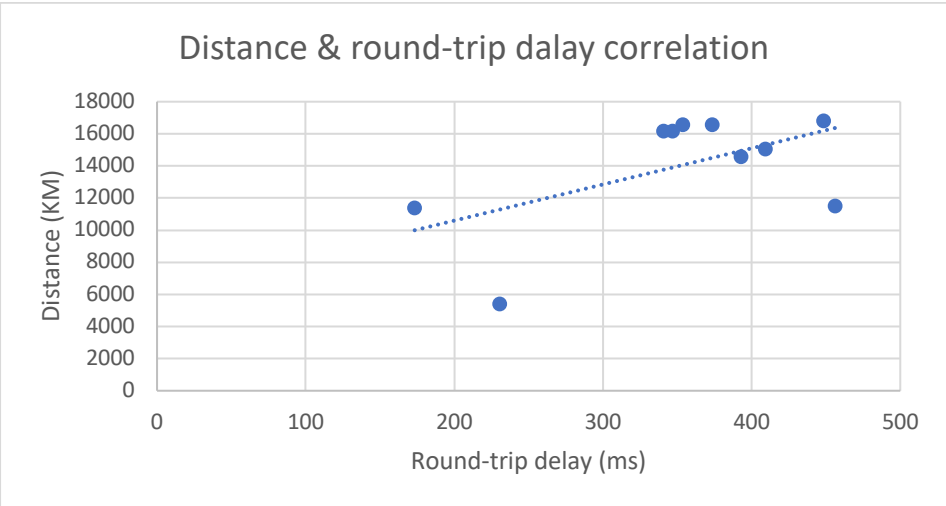


Figure 3.2 Scatter chart of average round-trip delay versus the approximate physical geographical distance to the server.

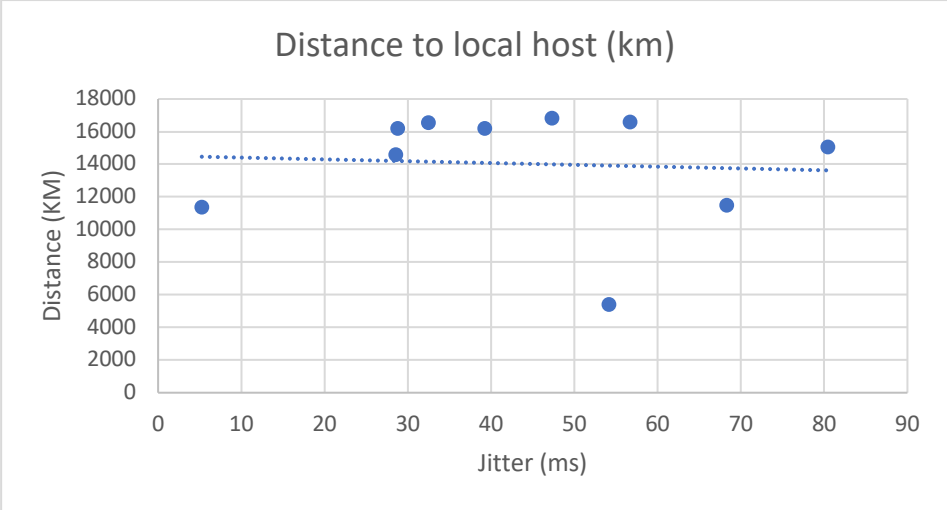


Figure 3.3 Scatter chart of average jitter versus the approximate physical geographical distance to the server.

2) Observations

a) It is an obvious fact that the time takes to transmit data from one location to another is close related to the speed of light. In other words, the physical distance between two server matters a lot when we are measuring the data transmitting latency. In figure 3.1, the longer the distance is, the bigger the delay gets. For instance, host 2 to 8 are all located in Europe, which is at the other side of earth from Australia, so they all have high latency. In figure 3.2, we can see the scatter points distribution, and the trendline is picking upwards. This accords with the network cable infrastructure design, that the longer the distance is, more length of network cable required to connect two locations. Hence, it takes longer for data to be transferred in between two locations.

b) From the observation of figure 3.1 and 3.3, the correlation of distance & jitter is not as clear as the previous one. A location with relatively close distance to local host might have quite different jitters (for example, host 2 – 56ms, host 5 – 80ms, host 6 – 60ms). A location with relatively long distance might have relatively small jitters (host 3 with 28ms jitter). Although the data transfers in (almost) the speed of light, the latency may vary in different tests. This is due to other factors that affect latency such as the data handling speed of routers and a congested network environment. Therefore, latency variances, or jitters are not close related to distance but the quality of data transmitting process.

c) It is a sadness that Australia is not known by its internet connections (we ranked 56th in the world in terms of internet connection speed (Internet Speeds by Country 2022, n.d.)). Compared to other counties, Australia in isolated geographically and has only a few submarine network cables going outwards (Submarine cable map, n.d.). For an internet video game enthusiast, I always experiencing high latency and unstable internet connection situation when competing with other games around the world. Although I invested a lot in internet connection (expensive NBN from Telstra and high-end router), the best I can achieve is a speedy and stable connection within or around Australia. This result is demonstrated in the above tests, where the latency to most Europe servers is higher than 350ms and jitters are higher than 40. For screenshots, please refer to appendix D.

This test(s) was carried during weekends from 4pm to 8pm, which is a typical high-load internet period. A better test result might be achieved if the tests are carried on early morning or weekdays.

Section 4 - Measuring the bandwidth-delay product

1) The bandwidth-delay product is a measurement of maximum unacknowledged data can be transferred at a given time. Under TCP protocol, to achieve the optimum data transmission, a sender needs to send as much data to fill propagation delay gap from the moment of sending fist bit of data to the moment the data is acknowledged back at sender. Therefore, having the bandwidth-delay product we are able to find an appropriate amount of data to be transmitted to achieve maximum efficiency and minimum blocking.

	Hosts	iperf test 1 (Mbits/sec)	iperf test 2 (Mbits/sec)	iperf test 3 (Mbits/sec)	mean (Mbits/sec)
1	iperf.he.net	4.700	4.860	4.800	4.787
2	bouygues.testdebit.info	1.610	1.670	3.350	2.210
3	ping-ams1.online.net	13.500	14.100	13.900	13.833
4	ikoula.testdebit.info	1.700	1.680	1.700	1.693
5	iperf.astra.in.ua	13.900	12.400	8.630	11.643
6	ping-90ms.online.net	3.740	2.990	12.000	6.243
7	speedtest.serverius.net	14.000	15.000	13.400	14.133
8	iperf.volia.net	10.700	2.430	7.220	6.783
9	iperf.biznetnetworks.com	9.140	3.440	10.200	7.593
10	speedtest.uztelecom.uz	4.820	8.610	8.250	7.227

Figure 4.1 Bandwidth measurements by using iperf

2) Bandwidth-delay product calculation

	Hosts	mean (Mbits/sec)	avg rt-delay (ms)	bandwidth-delay product (kbits)
1	iperf.he.net	4.787	173.354	814.764
2	7ouygues.testdebit.info	2.210	373.480	601.302
3	ping-ams1.online.net	13.833	346.610	4679.237
4	ikoula.testdebit.info	1.693	353.476	600.909
5	iperf.astra.in.ua	11.643	409.207	5687.974
6	ping-90ms.online.net	6.243	448.423	1677.103
7	speedtest.serverius.net	14.133	340.800	4771.195
8	iperf.volia.net	6.783	393.045	4205.578
9	iperf.biznetnetworks.com	7.593	230.684	2108.453
10	speedtest.uztelecom.uz	7.227	456.224	2198.999

Figure 4.2 Bandwidth-delay product calculation

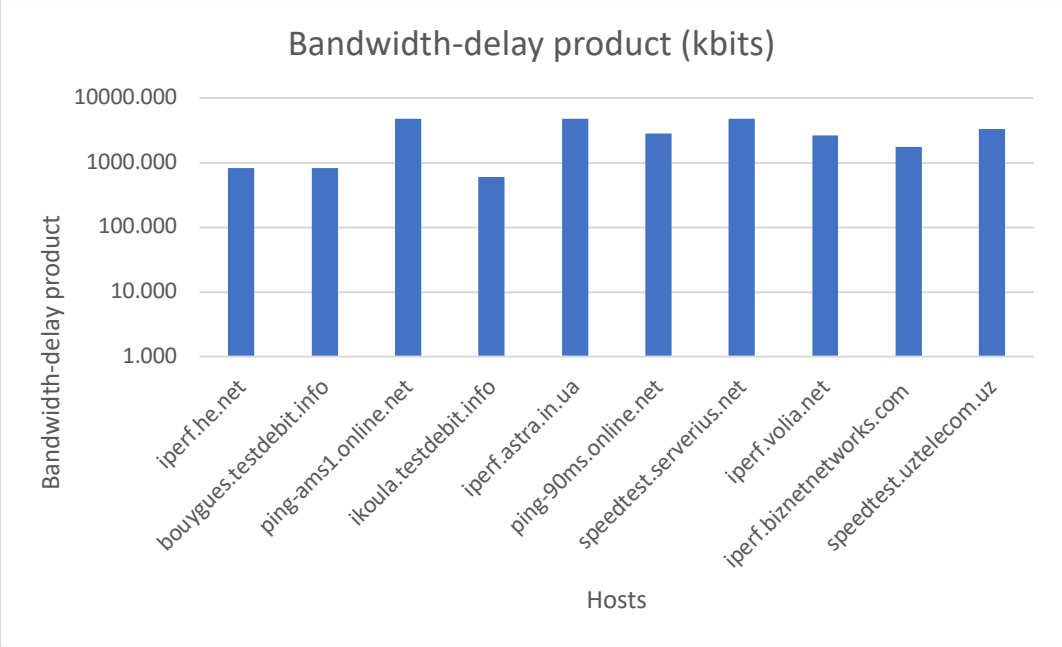


Figure 4.3 Bandwidth-delay product bar chart (logarithmic scale)

Figure 4.1 shows the iperf bandwidth tests for the hosts listed above. Combine figure 4.1 and figure 3.2, and use bandwidth-delay product formula B x D = bandwidth-delay product, we have figure 4.2.

From figure 4.2 & 4.3, it is clear that host 3, 5 & 7 which has the highest bandwidth measurements (13, 11 & 14 Mbits/sec) have the highest bandwidth-delay product (4679 kbits, 5687 kbits and 4771 kbits respectively). Hosts with lowest bandwidth have lowest bandwidth-delay product, such as host 2 & 4.

As mentioned above, this test was carried in a relatively stable and optimized test environment (consumer level) in Brisbane, Australia. It is not surprised to see that the delay measurement for host 2 to 8 are high as they are all located in Europe, which is far away from Australia. Therefore, the main driver of the bandwidth-delay product for these hosts is the bandwidth.

Vice versa, host 9 has a similar bandwidth measurement to host 8, but due to its relatively low latency (physical location closer), its bandwidth-delay product is only half of host 8 (2108 kbits vs 4205 kbits). Therefore, the deciding element of the bandwidth-delay product for host with similar bandwidth is the latency.

Host 1's result is quite different to the rest, as although it is located far away from Australia, its latency is the best among the ten. Along with its medium bandwidth test, its bandwidth-delay product is relatively low, 814 kbits. Compare to host 2 & 4, which the bandwidth-delay product are 600 kbits, host 1 has a much better bandwidth and latency. This may cause by a combined result of the physical network cable length, less router during the connection and better server configurations.

3) Bandwidth-delay product versus the hop count correlation

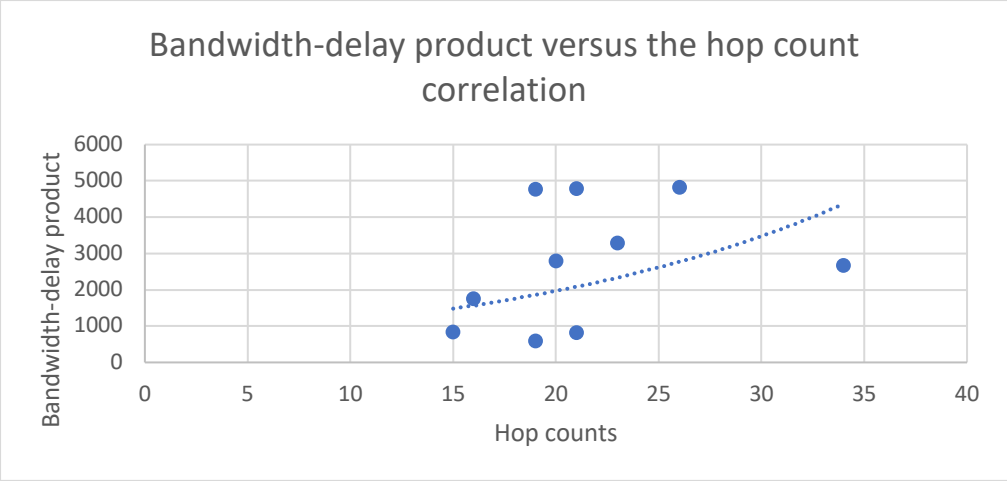


Figure 4.4 Bandwidth-delay product versus the hop count correlation

From figure 4.4, it is clear that with more hop counts, the bandwidth-delay product gets higher. Combine figure 2.2 and 3.1, more hop counts usually lead to high latency. And one of the deciding elements of bandwidth-delay product is latency. Hence, there is a positive correlation between hop counts and bandwidth-delay product.

4) Distance versus bandwidth-delay product correlation

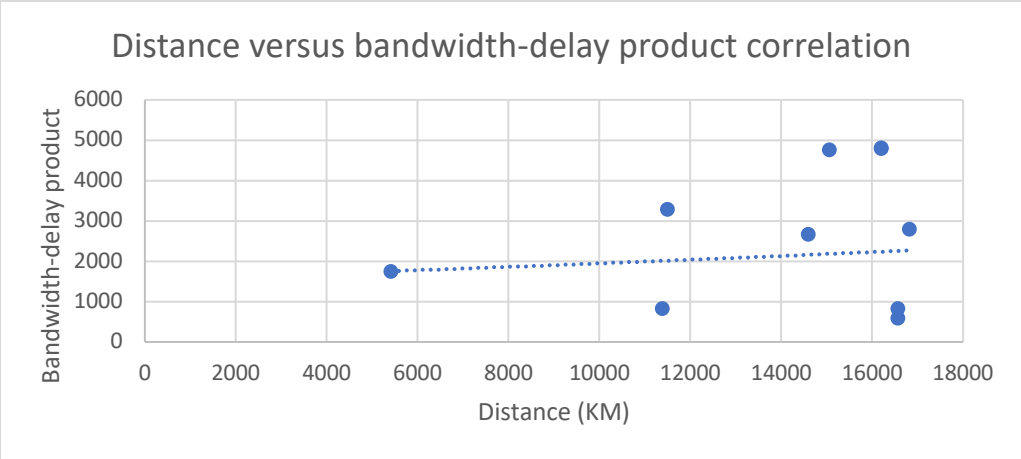


Figure 4.5 Distance versus bandwidth-delay product correlation

In figure 4.5, the correlation between distance and bandwidth-delay product is not as close as hop counts and bandwidth-delay product. This was also discussed in section 3.2.b, that the key elements is the quality of service (QoS) instead of distance.

5) As previously discussed in section 1 and section 3.2.c, this test result is subject to the current test environment, which include local user activities, ISP, physical location and distance etc. It is also related to ISP's capability during peak hour and server's configurations. To get the average result, instead of cherry picking each test has been run three times.

To improve the result (or to lower the impact of above variables), we can carry this test in different locations, with static IP address provided by ISP, and using different ISPs. We can also carry this test during off-peak hour and try multiple times (for example, 100 times instead of 3 times) to get more accurate results.

Appendix A – traceroute results

Host 1 iperf.he.net:

```
taylortang@3ca6f6514619 ~ % traceroute -nw 1 iperf.he.net
traceroute to 1500.mtu.he.net (216.218.207.42), 64 hops max, 52 byte packets
 1  192.168.31.1  29.055 ms  5.718 ms  4.018 ms
 2  192.168.0.1  19.739 ms  7.002 ms  5.217 ms
 3  58.162.26.5  46.306 ms  14.472 ms  13.444 ms
 4  203.50.61.1  30.226 ms  12.999 ms  21.306 ms
 5  203.50.61.16  22.207 ms
    203.50.61.0  24.416 ms  15.350 ms
 6  203.50.11.180  30.179 ms  26.478 ms  27.561 ms
 7  203.50.6.61  34.738 ms
    203.50.6.93  32.779 ms  26.088 ms
 8  203.50.13.90  37.540 ms
    203.50.13.98  39.097 ms
    203.50.13.90  30.545 ms
 9  203.50.13.98  27.910 ms
    203.50.13.90  177.492 ms
    203.50.13.98  29.561 ms
10  202.84.141.25  171.368 ms  165.095 ms
    202.84.222.130  43.326 ms
11  202.84.247.17  169.373 ms  165.108 ms
    202.84.222.130  169.951 ms
12  202.84.141.225  183.800 ms  172.921 ms  168.949 ms
13  202.84.141.225  170.017 ms
    184.105.65.113  187.092 ms
    202.84.141.225  171.064 ms
14  184.105.65.198  173.259 ms  167.116 ms  167.806 ms
15  216.218.207.42  170.177 ms  165.047 ms *
taylortang@3ca6f6514619 ~ %
```

Host 2 bouygues.testdebit.info

```
taylortang@3ca6f6514619 ~ % traceroute -nw 1 bouygues.testdebit.info
traceroute to bouygues.testdebit.info (89.84.1.186), 64 hops max, 52 byte packets
 1  192.168.31.1  26.572 ms  3.926 ms  3.774 ms
 2  192.168.0.1  12.261 ms  4.672 ms  5.443 ms
 3  58.162.26.5  27.035 ms  14.842 ms  13.295 ms
 4  203.50.61.17  19.175 ms
    203.50.61.1  25.463 ms  17.255 ms
 5  203.50.61.0  25.335 ms  17.230 ms
    203.50.61.16  30.282 ms
 6  203.50.11.180  31.766 ms  25.572 ms  27.287 ms
 7  203.50.6.61  36.217 ms
    203.50.6.93  31.997 ms  24.322 ms
 8  203.50.13.98  32.735 ms
    203.50.13.90  37.590 ms  31.847 ms
 9  203.50.13.98  31.088 ms
    203.50.13.90  26.972 ms
    203.50.13.98  48.891 ms
10  202.84.222.170  43.045 ms
    202.84.222.130  41.728 ms
    202.84.222.170  28.588 ms
11  202.84.222.130  169.755 ms  169.007 ms  170.741 ms
12  202.84.141.225  182.860 ms
    202.84.222.130  171.033 ms  170.867 ms
13  202.84.141.225  171.806 ms
    202.84.222.138  178.994 ms  171.496 ms
14  202.84.253.86  189.283 ms
    202.84.141.225  180.243 ms  170.296 ms
15  134.159.61.18  176.805 ms
    202.84.141.225  181.876 ms
    134.159.61.18  174.749 ms
16  202.84.253.86  170.437 ms
    4.68.62.9  174.833 ms *
17  * * *
18  62.34.2.113  366.659 ms  393.867 ms *
19  62.34.2.113  326.648 ms  409.509 ms *
20  * * 89.89.101.141  382.427 ms
21  89.84.1.186  399.621 ms *
    89.89.101.141  425.396 ms
taylortang@3ca6f6514619 ~ %
```

Host 3 ping-ams1.online.net

```
taylortang@3ca6f6514619 ~ % traceroute -nw 1 ping-ams1.online.net
traceroute to ping-ams1.online.net (163.172.208.7), 64 hops max, 52 byte packets
 1  192.168.31.1  5.386 ms  3.414 ms  3.529 ms
 2  192.168.0.1  5.310 ms  4.954 ms  4.281 ms
 3  58.162.26.5  18.161 ms  14.238 ms  14.936 ms
 4  203.50.61.17  23.001 ms
    203.50.61.1  14.313 ms  15.942 ms
 5  203.50.61.0  17.948 ms  15.541 ms  16.969 ms
 6  203.50.11.178  31.753 ms  30.607 ms  31.905 ms
 7  203.50.6.61  33.170 ms  34.483 ms
    203.50.6.93  28.534 ms
 8  203.50.13.98  28.007 ms
    203.50.13.90  32.611 ms  30.268 ms
 9  203.50.13.98  28.428 ms  29.466 ms  29.484 ms
10  202.84.222.130  28.838 ms  30.225 ms  30.601 ms
11  202.84.222.130  32.512 ms  31.619 ms  166.984 ms
12  202.84.222.138  30.987 ms
    202.84.222.130  170.344 ms
    202.84.141.225  171.337 ms
13  202.84.141.225  173.432 ms  169.056 ms  169.667 ms
14  202.84.141.225  171.400 ms  170.164 ms
    202.84.253.86  170.361 ms
15  134.159.61.18  166.063 ms
    202.84.253.86  168.738 ms  169.578 ms
16  202.84.253.86  170.554 ms
    134.159.61.18  170.930 ms *
17  * 212.72.47.186  371.339 ms
    4.69.203.102  409.788 ms
18  4.69.203.102  306.563 ms
    51.158.8.168  410.513 ms
    212.72.47.186  407.356 ms
19  51.158.143.3  411.779 ms
    51.158.143.1  409.516 ms  408.514 ms
20  51.158.143.3  308.301 ms
    51.158.8.168  407.656 ms
    51.158.143.1  411.528 ms
21  163.172.208.7  409.511 ms  409.463 ms  351.342 ms
taylortang@3ca6f6514619 ~ % ping ping-ams1.online.net
```

Host 4 ikoula.testdebit.info

```
taylortang@3ca6f6514619 ~ % traceroute -nw 1 ikoula.testdebit.info
traceroute to ikoula.testdebit.info (213.246.63.45), 64 hops max, 52 byte packets
 1  192.168.31.1  19.537 ms  3.682 ms  3.277 ms
 2  192.168.0.1  12.072 ms  4.251 ms  3.957 ms
 3  58.162.26.5  19.437 ms  13.462 ms  12.332 ms
 4  203.50.61.17  22.653 ms  17.143 ms
    203.50.61.1  26.000 ms
 5  203.50.61.16  30.886 ms  14.597 ms
    203.50.61.0  30.697 ms
 6  203.50.11.178  43.856 ms
    203.50.11.180  39.552 ms
    203.50.11.178  31.266 ms
 7  203.50.6.93  37.058 ms  24.944 ms
    203.50.6.61  38.210 ms
 8  203.50.13.98  34.921 ms  27.558 ms  25.456 ms
 9  203.50.13.98  30.922 ms
    203.50.13.90  178.749 ms
    203.50.13.98  28.154 ms
10  202.84.222.130  43.434 ms
    202.84.141.25  178.948 ms
    202.84.222.130  28.977 ms
11  202.84.222.130  168.250 ms  169.755 ms  170.020 ms
12  173.205.49.221  170.499 ms  168.089 ms  164.412 ms
13  202.84.141.225  184.277 ms  171.178 ms  168.318 ms
14  202.84.253.86  183.815 ms  168.580 ms
    154.14.26.154  374.573 ms
15  134.159.63.182  177.091 ms  166.910 ms  179.561 ms
16  213.246.32.134  389.781 ms  403.709 ms
    89.149.182.210  424.072 ms
17  213.246.32.163  402.973 ms
    154.14.26.154  307.325 ms  357.360 ms
18  213.246.32.156  365.559 ms  395.407 ms  300.508 ms
19  213.246.32.134  393.458 ms
    213.246.63.45  335.323 ms
    213.246.32.134  306.907 ms
taylortang@3ca6f6514619 ~ %
```

Host 5 iperf.astra.in.ua

```
taylortang@3ca6f6514619 ~ % traceroute -nw 1 iperf.astra.in.ua
traceroute to iperf.astra.in.ua (193.93.216.52), 64 hops max, 52 byte packets
 1  192.168.31.1  28.559 ms  3.793 ms  3.650 ms
 2  192.168.0.1  12.452 ms  3.311 ms  3.500 ms
 3  58.162.26.5  21.749 ms  12.293 ms  14.860 ms
 4  203.50.61.17  34.761 ms  15.797 ms
    203.50.61.1  27.684 ms
 5  203.50.61.16  29.506 ms  17.545 ms  15.887 ms
 6  203.50.11.180  39.262 ms  24.299 ms
    203.50.11.178  37.071 ms
 7  203.50.6.93  31.440 ms  30.170 ms  25.899 ms
 8  203.50.13.98  31.451 ms  25.280 ms
    203.50.13.90  36.520 ms
 9  203.50.13.98  29.173 ms  28.320 ms  28.638 ms
10  202.84.222.170  35.768 ms  29.565 ms
    202.84.222.133  41.129 ms
11  202.84.222.133  37.342 ms  30.060 ms
    202.84.222.130  176.224 ms
12  202.84.141.225  176.442 ms  170.991 ms
    202.84.222.130  172.616 ms
13  202.84.141.225  170.869 ms
    202.84.222.138  180.093 ms  172.754 ms
14  202.84.141.225  172.932 ms  171.002 ms  172.288 ms
15  202.84.141.225  169.524 ms
    202.84.253.86  176.518 ms
    134.159.61.46  175.229 ms
16  4.69.158.186  321.099 ms  315.217 ms
    4.68.62.9  185.294 ms
17  212.162.24.142  460.974 ms
    4.69.158.186  311.435 ms  391.726 ms
18  193.93.218.126  416.064 ms
    212.162.24.142  403.254 ms
    4.69.158.186  409.515 ms
19  212.162.24.142  409.074 ms
    193.93.218.126  412.135 ms
    193.93.216.52  412.608 ms
taylortang@3ca6f6514619 ~ %
```

Host 6 ping-90ms.online.net

```
taylortang@3ca6f6514619 ~ % traceroute -nw 1 ping-90ms.online.net
traceroute to ping-90ms.online.net (62.210.18.41), 64 hops max, 52 byte packets
 1  192.168.31.1  21.123 ms  3.787 ms  4.176 ms
 2  192.168.0.1  12.546 ms  4.846 ms  4.650 ms
 3  58.162.26.5  26.525 ms  14.106 ms  14.431 ms
 4  203.50.61.1  44.105 ms  34.601 ms
    203.50.61.17  23.422 ms
 5  203.50.61.16  28.495 ms  18.810 ms  14.159 ms
 6  203.50.11.178  37.116 ms
    203.50.11.180  32.463 ms
    203.50.11.178  30.522 ms
 7  203.50.6.93  31.709 ms
    203.50.6.61  35.739 ms
    203.50.6.93  24.530 ms
 8  203.50.13.98  32.875 ms
    203.50.13.90  34.357 ms
    203.50.13.98  24.074 ms
 9  203.50.13.90  26.439 ms
    202.84.222.170  36.093 ms  31.684 ms
10  202.84.222.133  37.865 ms
    202.84.222.130  42.341 ms  26.997 ms
11  202.84.222.130  28.840 ms  167.957 ms  169.591 ms
12  202.84.141.225  183.941 ms
    202.84.222.138  42.753 ms
    202.84.141.225  168.716 ms
13  202.84.141.225  169.607 ms  172.211 ms
    202.84.222.138  170.095 ms
14  202.84.253.86  174.022 ms
    202.84.141.225  171.177 ms
    202.84.253.86  168.323 ms
15  4.68.62.9  184.660 ms
    4.68.70.69  178.426 ms
    4.68.62.9  167.219 ms
16  * 4.68.62.9  180.312 ms *
17  * * *
18  * 51.158.1.37  400.324 ms  402.322 ms
19  212.3.235.198  421.496 ms
    195.154.1.105  404.522 ms  403.272 ms
20  195.154.1.107  319.128 ms  397.148 ms
    62.210.18.41  432.350 ms
taylortang@3ca6f6514619 ~ %
```

Host 7 speedtest.serverius.net

```
traceroute to speedtest.serverius.net (178.21.16.76), 64 hops max, 52 byte packets
 1  192.168.31.1  16.894 ms  4.126 ms  3.716 ms
 2  192.168.0.1  11.583 ms  4.147 ms  5.732 ms
 3  58.162.26.5  56.373 ms  50.241 ms  15.086 ms
 4  203.50.61.17  38.085 ms
    203.50.61.1  51.262 ms
    203.50.61.17  24.479 ms
 5  203.50.61.0  30.598 ms
    203.50.61.16  52.815 ms
    203.50.61.0  15.914 ms
 6  203.50.11.178  39.944 ms
    203.50.11.180  39.256 ms
    203.50.11.178  164.389 ms
 7  203.50.6.93  48.604 ms  24.574 ms  23.969 ms
 8  203.50.13.90  60.262 ms  31.668 ms  35.573 ms
 9  203.50.13.98  55.028 ms
    203.50.13.90  166.713 ms  164.977 ms
10  202.84.222.130  43.911 ms  30.051 ms
    202.84.141.25  180.453 ms
11  202.84.247.17  189.688 ms
    202.84.222.130  179.491 ms  168.092 ms
12  64.125.13.77  169.312 ms
    202.84.141.225  181.984 ms
    64.125.13.77  164.492 ms
13  202.84.141.225  167.581 ms
    64.125.31.12  179.713 ms  166.185 ms
14  64.125.30.230  310.733 ms
    202.84.143.30  185.550 ms
    64.125.30.230  317.384 ms
15  64.125.31.218  310.218 ms
    134.159.63.18  176.833 ms  170.770 ms
16  * * 64.125.29.18  308.901 ms
17  * * 64.125.26.19  199.005 ms
18  64.125.26.165  188.922 ms * *
19  64.125.26.42  355.931 ms
    64.125.29.119  305.168 ms  305.024 ms
20  64.125.29.16  311.686 ms * *
21  64.125.30.3  386.249 ms * *
22  * 79.141.46.98  313.057 ms
    79.141.46.99  309.310 ms
23  185.8.179.33  311.493 ms
    64.125.29.119  299.217 ms
    185.8.179.33  416.914 ms
24  * * *
25  * * *
26  79.141.46.100  352.133 ms
    79.141.46.98  394.066 ms *
27  * * *
28  * * *
29  * * *
30  * * *
31  * * *
32  * * *
33  * * *
34  * * *
35  * * *
36  * * *
37  * * *
38  * * *
39  * * *
40  * * *
41  * * *
42  * * *
43  * * *
44  * * *
45  * * *
46  * * *
47  * * *
48  * * *
49  * * *
50  * * *
51  * * *
52  * * *
53  * * *
54  * * *
55  * * *
56  * * *
57  * * *
58  * * *
59  * * *
60  * * *
61  * * *
62  * * *
63  * * *
64  * * *
taylortang@3ca6f6514619 ~ %
```

Host 8 iperf.volia.net

```
taylortang@3ca6f6514619 ~ % traceroute -nw 1 iperf.volia.net
traceroute to speedtest.volia.com (77.120.3.236), 64 hops max, 52 byte packets
 1  192.168.31.1  16.457 ms  4.340 ms  3.483 ms
 2  192.168.0.1  11.694 ms  5.022 ms  5.770 ms
 3  58.162.26.5  22.444 ms  18.089 ms  15.755 ms
 4  203.50.61.1  25.365 ms  20.209 ms  18.799 ms
 5  203.50.61.16  19.600 ms  17.132 ms
    203.50.61.0  27.250 ms
 6  203.50.11.178  38.125 ms  34.572 ms
    203.50.11.180  37.301 ms
 7  203.50.6.93  34.841 ms
    203.50.6.61  35.178 ms  34.498 ms
 8  203.50.13.98  35.464 ms
    203.50.13.90  38.937 ms  32.178 ms
 9  203.50.13.98  37.801 ms  31.403 ms
    203.50.13.90  167.465 ms
10  202.84.222.130  33.678 ms
    202.84.141.25  175.558 ms  168.365 ms
11  202.84.247.17  170.212 ms  165.701 ms  161.093 ms
12  213.248.75.146  171.777 ms
    202.84.141.225  175.158 ms  167.666 ms
13  62.115.115.216  176.809 ms  164.165 ms  165.823 ms
14  202.84.253.86  176.460 ms  169.994 ms
    62.115.174.65  169.526 ms
15  62.115.162.134  174.408 ms  171.158 ms  176.361 ms
16  * 154.54.44.142  198.890 ms
    154.54.44.138  192.651 ms
17  154.54.25.149  174.516 ms
    154.54.41.146  216.676 ms
    154.54.42.98  217.277 ms
18  154.54.31.90  218.114 ms  212.501 ms
    154.54.5.90  223.246 ms
19  154.54.42.78  198.632 ms
    154.54.42.166  229.995 ms
    154.54.42.78  189.853 ms
20  154.54.29.221  216.315 ms  208.695 ms
    154.54.30.161  210.561 ms
21  154.54.31.234  236.057 ms
    154.54.28.69  225.442 ms
    154.54.31.234  231.640 ms
22  154.54.24.221  327.988 ms
    154.54.42.90  306.566 ms
    154.54.30.186  321.575 ms
23  154.54.44.165  394.219 ms
    154.54.56.94  412.619 ms
    154.54.85.246  328.419 ms
24  154.54.58.233  378.817 ms
    154.54.61.118  418.375 ms
    154.54.58.237  327.367 ms
25  130.117.0.142  388.256 ms
    154.54.36.54  417.155 ms
    130.117.0.142  599.700 ms
26  154.54.36.54  409.751 ms
    154.54.61.114  415.560 ms
    154.54.59.181  418.339 ms
27  154.54.58.6  406.155 ms  332.083 ms
    154.54.59.181  372.992 ms
28  154.54.59.190  374.985 ms
    154.54.59.186  357.577 ms
    130.117.0.93  409.909 ms
29  154.54.59.178  399.344 ms
    154.54.38.246  419.044 ms
    130.117.3.138  409.513 ms
30  154.54.59.214  398.977 ms  359.970 ms
    154.54.38.246  348.860 ms
31  154.54.59.214  412.954 ms  410.506 ms
    130.117.2.237  415.970 ms
32  77.120.1.123  413.764 ms
    149.6.190.26  372.124 ms
    149.6.190.250  377.481 ms
33  77.120.1.123  359.036 ms
    77.120.1.49  423.239 ms  400.251 ms
34  77.120.3.236  367.594 ms
    77.120.1.49  452.088 ms  364.959 ms
taylortang@3ca6f6514619 ~ %
```

Host 9 iperf.biznetnetworks.com

```
taylortang@3ca6f6514619 ~ % traceroute -nw 1 iperf.biznetnetworks.com
traceroute to iperf.biznetnetworks.com (117.102.109.186), 64 hops max, 52 byte packets
 1  192.168.31.1  21.568 ms  3.839 ms  3.663 ms
 2  192.168.0.1  11.188 ms  4.892 ms  4.419 ms
 3  58.162.26.5  23.334 ms  20.947 ms  23.411 ms
 4  203.50.61.1  34.309 ms  12.661 ms  13.957 ms
 5  203.50.61.16  29.523 ms  24.992 ms
    203.50.61.0  24.631 ms
 6  203.50.11.180  42.005 ms  29.576 ms  27.049 ms
 7  203.50.11.173  40.078 ms
    203.50.11.177  38.089 ms  30.867 ms
 8  203.54.232.142  34.148 ms
    203.54.217.110  38.499 ms
    203.54.232.142  30.763 ms
 9  4.69.208.62  153.506 ms  165.901 ms  145.376 ms
10  113.29.40.86  314.476 ms  346.781 ms  348.991 ms
11  87.245.232.191  416.524 ms  403.663 ms  409.441 ms
12  87.245.231.241  164.660 ms  152.391 ms  153.400 ms
13  * * *
14  114.5.178.70  208.631 ms  192.967 ms  190.565 ms
15  182.253.100.193  210.373 ms  200.138 ms  188.509 ms
16  117.102.109.186  204.673 ms !Z  185.329 ms !Z  194.798 ms !Z
taylortang@3ca6f6514619 ~ %
```

Host 10 speedtet.uztelecom.uz

```
taylortang@3ca6f6514619 ~ % traceroute -nw 1 speedtest.uztelecom.uz
traceroute to speedtest.uztelecom.uz (195.158.0.242), 64 hops max, 52 byte packets
 1  192.168.31.1  30.058 ms  4.472 ms  6.120 ms
 2  192.168.0.1  19.034 ms  4.828 ms  4.202 ms
 3  58.162.26.5  31.107 ms  19.466 ms  15.614 ms
 4  203.50.61.2  41.711 ms  14.636 ms
    203.50.61.17  25.734 ms
 5  203.50.61.16  29.821 ms
    203.50.61.3  26.711 ms
    203.50.61.16  16.841 ms
 6  203.50.11.180  31.376 ms  29.265 ms
    203.50.61.16  14.621 ms
 7  203.50.11.180  27.009 ms  22.900 ms
    203.50.11.125  49.235 ms
 8  203.50.11.125  40.965 ms  36.521 ms
    203.50.6.230  70.746 ms
 9  203.50.6.230  55.291 ms  64.330 ms  51.446 ms
10  203.50.6.235  92.849 ms
    203.50.9.2  85.565 ms  80.031 ms
11  * 202.84.249.254  129.523 ms *
12  202.84.249.249  171.581 ms
    202.84.249.254  124.021 ms
    202.84.140.50  171.058 ms
13  202.84.157.37  166.596 ms
    202.84.249.161  161.098 ms
    202.84.157.37  146.623 ms
14  202.84.153.26  168.321 ms  147.728 ms
    87.245.240.224  320.084 ms
15  87.245.232.238  323.011 ms  317.228 ms
    87.245.240.224  336.534 ms
16  87.245.232.238  409.354 ms
    87.245.238.37  416.713 ms
    87.245.232.238  326.232 ms
17  195.69.191.38  345.412 ms
    195.69.189.52  455.567 ms  375.584 ms
18  195.69.191.46  364.464 ms
    195.69.189.52  386.222 ms
    195.69.189.38  424.553 ms
19  195.69.191.48  392.397 ms
    195.69.189.38  355.072 ms  459.677 ms
20  195.69.189.38  351.431 ms
    195.69.189.251  355.835 ms
    195.69.189.253  426.298 ms
21  195.69.189.251  351.105 ms
    195.69.189.253  356.310 ms
    84.54.64.202  354.969 ms
22  84.54.64.202  464.918 ms
    84.54.64.130  423.140 ms
    84.54.64.213  401.878 ms
23  84.54.64.213  403.982 ms
    195.158.0.242  353.125 ms  365.337 ms
taylortang@3ca6f6514619 ~ %
```

Appendix B – ping results

Host 1 iperf.he.net

```
taylortang@3ca6f6514619 ~ % ping iperf.he.net
PING 1500.mtu.he.net (216.218.207.42): 56 data bytes
64 bytes from 216.218.207.42: icmp_seq=0 ttl=51 time=182.129 ms
64 bytes from 216.218.207.42: icmp_seq=1 ttl=51 time=167.268 ms
64 bytes from 216.218.207.42: icmp_seq=2 ttl=51 time=170.783 ms
^C
--- 1500.mtu.he.net ping statistics ---
4 packets transmitted, 3 packets received, 25.0% packet loss
round-trip min/avg/max/stddev = 167.268/173.393/182.129/6.342 ms
taylortang@3ca6f6514619 ~ %
taylortang@3ca6f6514619 ~ % ping iperf.he.net
PING 1500.mtu.he.net (216.218.207.42): 56 data bytes
64 bytes from 216.218.207.42: icmp_seq=0 ttl=51 time=175.947 ms
64 bytes from 216.218.207.42: icmp_seq=1 ttl=51 time=170.419 ms
64 bytes from 216.218.207.42: icmp_seq=2 ttl=51 time=174.884 ms
^C
--- 1500.mtu.he.net ping statistics ---
3 packets transmitted, 3 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 170.419/173.750/175.947/2.395 ms
taylortang@3ca6f6514619 ~ %
taylortang@3ca6f6514619 ~ %
taylortang@3ca6f6514619 ~ % ping iperf.he.net
PING 1500.mtu.he.net (216.218.207.42): 56 data bytes
64 bytes from 216.218.207.42: icmp_seq=0 ttl=51 time=180.233 ms
64 bytes from 216.218.207.42: icmp_seq=1 ttl=51 time=165.465 ms
64 bytes from 216.218.207.42: icmp_seq=2 ttl=51 time=173.059 ms
^C
--- 1500.mtu.he.net ping statistics ---
3 packets transmitted, 3 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 165.465/172.919/180.233/6.030 ms
taylortang@3ca6f6514619 ~ %
```

Host 2 bouygues.testdebit.info

```
taylortang@3ca6f6514619 ~ % ping bouygues.testdebit.info
PING bouygues.testdebit.info (89.84.1.186): 56 data bytes
64 bytes from 89.84.1.186: icmp_seq=0 ttl=48 time=315.590 ms
64 bytes from 89.84.1.186: icmp_seq=1 ttl=48 time=342.058 ms
64 bytes from 89.84.1.186: icmp_seq=2 ttl=48 time=413.754 ms
^C
--- bouygues.testdebit.info ping statistics ---
3 packets transmitted, 3 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 315.590/357.134/413.754/41.469 ms
taylortang@3ca6f6514619 ~ %
taylortang@3ca6f6514619 ~ % ping bouygues.testdebit.info
PING bouygues.testdebit.info (89.84.1.186): 56 data bytes
64 bytes from 89.84.1.186: icmp_seq=0 ttl=48 time=379.637 ms
64 bytes from 89.84.1.186: icmp_seq=1 ttl=48 time=426.035 ms
64 bytes from 89.84.1.186: icmp_seq=2 ttl=48 time=482.842 ms
^C
--- bouygues.testdebit.info ping statistics ---
3 packets transmitted, 3 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 379.637/429.505/482.842/42.205 ms
taylortang@3ca6f6514619 ~ %
taylortang@3ca6f6514619 ~ % ping bouygues.testdebit.info
PING bouygues.testdebit.info (89.84.1.186): 56 data bytes
64 bytes from 89.84.1.186: icmp_seq=0 ttl=48 time=382.234 ms
64 bytes from 89.84.1.186: icmp_seq=1 ttl=48 time=310.071 ms
64 bytes from 89.84.1.186: icmp_seq=2 ttl=48 time=309.096 ms
^C
--- bouygues.testdebit.info ping statistics ---
3 packets transmitted, 3 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 309.096/333.800/382.234/34.250 ms
taylortang@3ca6f6514619 ~ %
```

Host 3 ping-ams1.online.net

```
taylortang@3ca6f6514619 ~ % ping ping-ams1.online.net
PING ping-ams1.online.net (163.172.208.7): 56 data bytes
64 bytes from 163.172.208.7: icmp_seq=0 ttl=49 time=346.468 ms
64 bytes from 163.172.208.7: icmp_seq=1 ttl=49 time=367.238 ms
64 bytes from 163.172.208.7: icmp_seq=2 ttl=49 time=387.659 ms
^C
--- ping-ams1.online.net ping statistics ---
3 packets transmitted, 3 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 346.468/367.122/387.659/16.816 ms
taylortang@3ca6f6514619 ~ % ping ping-ams1.online.net
PING ping-ams1.online.net (163.172.208.7): 56 data bytes
64 bytes from 163.172.208.7: icmp_seq=0 ttl=49 time=390.438 ms
64 bytes from 163.172.208.7: icmp_seq=1 ttl=49 time=307.079 ms
64 bytes from 163.172.208.7: icmp_seq=2 ttl=49 time=327.920 ms
^C
--- ping-ams1.online.net ping statistics ---
3 packets transmitted, 3 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 307.079/341.812/390.438/35.421 ms
taylortang@3ca6f6514619 ~ % ping ping-ams1.online.net
PING ping-ams1.online.net (163.172.208.7): 56 data bytes
64 bytes from 163.172.208.7: icmp_seq=0 ttl=49 time=310.670 ms
64 bytes from 163.172.208.7: icmp_seq=1 ttl=49 time=331.358 ms
64 bytes from 163.172.208.7: icmp_seq=2 ttl=49 time=350.661 ms
^C
--- ping-ams1.online.net ping statistics ---
3 packets transmitted, 3 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 310.670/330.896/350.661/16.330 ms
```

Host 4 ikoula.testdebit.info

```
taylortang@3ca6f6514619 ~ % ping ikoula.testdebit.info
PING ikoula.testdebit.info (213.246.63.45): 56 data bytes
64 bytes from 213.246.63.45: icmp_seq=0 ttl=44 time=351.882 ms
64 bytes from 213.246.63.45: icmp_seq=1 ttl=44 time=357.509 ms
64 bytes from 213.246.63.45: icmp_seq=2 ttl=44 time=401.930 ms
^C
--- ikoula.testdebit.info ping statistics ---
3 packets transmitted, 3 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 351.882/370.440/401.930/22.385 ms
taylortang@3ca6f6514619 ~ %
taylortang@3ca6f6514619 ~ % ping ikoula.testdebit.info
PING ikoula.testdebit.info (213.246.63.45): 56 data bytes
64 bytes from 213.246.63.45: icmp_seq=0 ttl=44 time=321.376 ms
64 bytes from 213.246.63.45: icmp_seq=1 ttl=44 time=353.652 ms
64 bytes from 213.246.63.45: icmp_seq=2 ttl=44 time=416.023 ms
^C
--- ikoula.testdebit.info ping statistics ---
3 packets transmitted, 3 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 321.376/363.684/416.023/39.285 ms
taylortang@3ca6f6514619 ~ %
taylortang@3ca6f6514619 ~ % ping ikoula.testdebit.info
PING ikoula.testdebit.info (213.246.63.45): 56 data bytes
64 bytes from 213.246.63.45: icmp_seq=0 ttl=44 time=327.228 ms
64 bytes from 213.246.63.45: icmp_seq=1 ttl=44 time=326.618 ms
64 bytes from 213.246.63.45: icmp_seq=2 ttl=44 time=325.065 ms
^C
--- ikoula.testdebit.info ping statistics ---
3 packets transmitted, 3 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 325.065/326.304/327.228/0.911 ms
taylortang@3ca6f6514619 ~ %
```

Host 5 iperf.astra.in.ua

```
taylortang@3ca6f6514619 ~ % ping iperf.astra.in.ua
PING iperf.astra.in.ua (193.93.216.52): 56 data bytes
64 bytes from 193.93.216.52: icmp_seq=0 ttl=46 time=359.758 ms
64 bytes from 193.93.216.52: icmp_seq=1 ttl=46 time=408.140 ms
64 bytes from 193.93.216.52: icmp_seq=2 ttl=46 time=459.081 ms
^C
--- iperf.astra.in.ua ping statistics ---
4 packets transmitted, 3 packets received, 25.0% packet loss
round-trip min/avg/max/stddev = 359.758/408.993/459.081/40.553 ms
taylortang@3ca6f6514619 ~ %
taylortang@3ca6f6514619 ~ % ping iperf.astra.in.ua
PING iperf.astra.in.ua (193.93.216.52): 56 data bytes
64 bytes from 193.93.216.52: icmp_seq=0 ttl=46 time=363.507 ms
64 bytes from 193.93.216.52: icmp_seq=1 ttl=46 time=333.086 ms
64 bytes from 193.93.216.52: icmp_seq=2 ttl=46 time=345.950 ms
^C
--- iperf.astra.in.ua ping statistics ---
3 packets transmitted, 3 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 333.086/347.514/363.507/12.468 ms
taylortang@3ca6f6514619 ~ %
taylortang@3ca6f6514619 ~ % ping iperf.astra.in.ua
PING iperf.astra.in.ua (193.93.216.52): 56 data bytes
64 bytes from 193.93.216.52: icmp_seq=0 ttl=46 time=519.200 ms
64 bytes from 193.93.216.52: icmp_seq=1 ttl=46 time=562.170 ms
64 bytes from 193.93.216.52: icmp_seq=2 ttl=46 time=331.969 ms
^C
--- iperf.astra.in.ua ping statistics ---
3 packets transmitted, 3 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 331.969/471.113/562.170/99.941 ms
taylortang@3ca6f6514619 ~ %
```

Host 6 ping-90ms.online.net

```
taylortang@3ca6f6514619 ~ % ping ping-90ms.online.net
PING ping-90ms.online.net (62.210.18.41): 56 data bytes
64 bytes from 62.210.18.41: icmp_seq=0 ttl=49 time=413.521 ms
64 bytes from 62.210.18.41: icmp_seq=1 ttl=49 time=436.155 ms
64 bytes from 62.210.18.41: icmp_seq=2 ttl=49 time=486.251 ms
^C
--- ping-90ms.online.net ping statistics ---
4 packets transmitted, 3 packets received, 25.0% packet loss
round-trip min/avg/max/stddev = 413.521/445.309/486.251/30.389 ms
taylortang@3ca6f6514619 ~ %
taylortang@3ca6f6514619 ~ % ping ping-90ms.online.net
PING ping-90ms.online.net (62.210.18.41): 56 data bytes
64 bytes from 62.210.18.41: icmp_seq=0 ttl=49 time=499.494 ms
64 bytes from 62.210.18.41: icmp_seq=1 ttl=49 time=546.128 ms
64 bytes from 62.210.18.41: icmp_seq=2 ttl=49 time=400.198 ms
^C
--- ping-90ms.online.net ping statistics ---
4 packets transmitted, 3 packets received, 25.0% packet loss
round-trip min/avg/max/stddev = 400.198/481.940/546.128/60.855 ms
taylortang@3ca6f6514619 ~ %
taylortang@3ca6f6514619 ~ % ping ping-90ms.online.net
PING ping-90ms.online.net (62.210.18.41): 56 data bytes
64 bytes from 62.210.18.41: icmp_seq=0 ttl=49 time=408.050 ms
64 bytes from 62.210.18.41: icmp_seq=1 ttl=49 time=422.107 ms
64 bytes from 62.210.18.41: icmp_seq=2 ttl=49 time=423.906 ms
^C
--- ping-90ms.online.net ping statistics ---
3 packets transmitted, 3 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 408.050/418.021/423.906/7.089 ms
taylortang@3ca6f6514619 ~ %
```

Host 7 speedtest.serverius.net

```
[taylortang@3ca6f6514619 ~ % ping speedtest.serverius.net
PING speedtest.serverius.net (178.21.16.76): 56 data bytes
64 bytes from 178.21.16.76: icmp_seq=0 ttl=51 time=340.189 ms
64 bytes from 178.21.16.76: icmp_seq=1 ttl=51 time=334.126 ms
64 bytes from 178.21.16.76: icmp_seq=2 ttl=51 time=379.247 ms
^C
--- speedtest.serverius.net ping statistics ---
3 packets transmitted, 3 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 334.126/351.187/379.247/19.995 ms
[taylortang@3ca6f6514619 ~ %
[taylortang@3ca6f6514619 ~ % ping speedtest.serverius.net
PING speedtest.serverius.net (178.21.16.76): 56 data bytes
64 bytes from 178.21.16.76: icmp_seq=0 ttl=51 time=420.139 ms
64 bytes from 178.21.16.76: icmp_seq=1 ttl=51 time=301.503 ms
64 bytes from 178.21.16.76: icmp_seq=2 ttl=51 time=313.016 ms
^C
--- speedtest.serverius.net ping statistics ---
3 packets transmitted, 3 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 301.503/344.886/420.139/53.419 ms
[taylortang@3ca6f6514619 ~ %
[taylortang@3ca6f6514619 ~ % ping speedtest.serverius.net
PING speedtest.serverius.net (178.21.16.76): 56 data bytes
64 bytes from 178.21.16.76: icmp_seq=0 ttl=51 time=371.835 ms
64 bytes from 178.21.16.76: icmp_seq=1 ttl=51 time=303.803 ms
64 bytes from 178.21.16.76: icmp_seq=2 ttl=51 time=303.339 ms
^C
--- speedtest.serverius.net ping statistics ---
3 packets transmitted, 3 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 303.339/326.326/371.835/32.181 ms
taylortang@3ca6f6514619 ~ %
```

Host 8 iperf.volia.net

```
[taylortang@3ca6f6514619 ~ % ping iperf.volia.net
PING speedtest.volia.com (77.120.3.236): 56 data bytes
64 bytes from 77.120.3.236: icmp_seq=0 ttl=32 time=397.548 ms
64 bytes from 77.120.3.236: icmp_seq=1 ttl=32 time=365.092 ms
64 bytes from 77.120.3.236: icmp_seq=2 ttl=32 time=366.488 ms
^C
--- speedtest.volia.com ping statistics ---
3 packets transmitted, 3 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 365.092/376.376/397.548/14.982 ms
[taylortang@3ca6f6514619 ~ %
[taylortang@3ca6f6514619 ~ % ping iperf.volia.net
PING speedtest.volia.com (77.120.3.236): 56 data bytes
64 bytes from 77.120.3.236: icmp_seq=0 ttl=32 time=400.755 ms
64 bytes from 77.120.3.236: icmp_seq=1 ttl=32 time=449.075 ms
64 bytes from 77.120.3.236: icmp_seq=2 ttl=32 time=364.242 ms
^C
--- speedtest.volia.com ping statistics ---
3 packets transmitted, 3 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 364.242/404.691/449.075/34.745 ms
[taylortang@3ca6f6514619 ~ %
[taylortang@3ca6f6514619 ~ % ping iperf.volia.net
PING speedtest.volia.com (77.120.3.236): 56 data bytes
64 bytes from 77.120.3.236: icmp_seq=0 ttl=32 time=376.790 ms
64 bytes from 77.120.3.236: icmp_seq=1 ttl=32 time=385.572 ms
64 bytes from 77.120.3.236: icmp_seq=2 ttl=32 time=431.840 ms
^C
--- speedtest.volia.com ping statistics ---
3 packets transmitted, 3 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 376.790/398.067/431.840/24.149 ms
taylortang@3ca6f6514619 ~ %
```

Host 9 iperf.biznetnetworks.com

```
[taylortang@3ca6f6514619 ~ % ping iperf.biznetnetworks.com
PING iperf.biznetnetworks.com (117.102.109.186): 56 data bytes
64 bytes from 117.102.109.186: icmp_seq=0 ttl=47 time=196.269 ms
64 bytes from 117.102.109.186: icmp_seq=1 ttl=47 time=191.729 ms
64 bytes from 117.102.109.186: icmp_seq=2 ttl=47 time=235.595 ms
^C
--- iperf.biznetnetworks.com ping statistics ---
3 packets transmitted, 3 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 191.729/207.864/235.595/19.696 ms
[taylortang@3ca6f6514619 ~ %
[taylortang@3ca6f6514619 ~ % ping iperf.biznetnetworks.com
PING iperf.biznetnetworks.com (117.102.109.186): 56 data bytes
64 bytes from 117.102.109.186: icmp_seq=0 ttl=47 time=215.547 ms
64 bytes from 117.102.109.186: icmp_seq=1 ttl=47 time=190.252 ms
64 bytes from 117.102.109.186: icmp_seq=2 ttl=47 time=192.842 ms
^C
--- iperf.biznetnetworks.com ping statistics ---
3 packets transmitted, 3 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 190.252/199.547/215.547/11.363 ms
[taylortang@3ca6f6514619 ~ %
[taylortang@3ca6f6514619 ~ % ping iperf.biznetnetworks.com
PING iperf.biznetnetworks.com (117.102.109.186): 56 data bytes
64 bytes from 117.102.109.186: icmp_seq=0 ttl=47 time=305.711 ms
64 bytes from 117.102.109.186: icmp_seq=1 ttl=47 time=348.295 ms
64 bytes from 117.102.109.186: icmp_seq=2 ttl=47 time=199.917 ms
^C
--- iperf.biznetnetworks.com ping statistics ---
3 packets transmitted, 3 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 199.917/284.641/348.295/62.380 ms
taylortang@3ca6f6514619 ~ %
```

Host 10 speedtest.uztelecom.uz

```
[taylortang@3ca6f6514619 ~ % ping speedtest.uztelecom.uz
PING speedtest.uztelecom.uz (195.158.0.242): 56 data bytes
64 bytes from 195.158.0.242: icmp_seq=0 ttl=45 time=394.596 ms
64 bytes from 195.158.0.242: icmp_seq=1 ttl=45 time=438.979 ms
64 bytes from 195.158.0.242: icmp_seq=2 ttl=45 time=482.518 ms
^C
--- speedtest.uztelecom.uz ping statistics ---
3 packets transmitted, 3 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 394.596/438.698/482.518/35.895 ms
[taylortang@3ca6f6514619 ~ %
[taylortang@3ca6f6514619 ~ % ping speedtest.uztelecom.uz
PING speedtest.uztelecom.uz (195.158.0.242): 56 data bytes
64 bytes from 195.158.0.242: icmp_seq=0 ttl=45 time=380.505 ms
64 bytes from 195.158.0.242: icmp_seq=1 ttl=45 time=381.291 ms
64 bytes from 195.158.0.242: icmp_seq=2 ttl=45 time=426.959 ms
^C
--- speedtest.uztelecom.uz ping statistics ---
3 packets transmitted, 3 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 380.505/396.252/426.959/21.716 ms
[taylortang@3ca6f6514619 ~ %
[taylortang@3ca6f6514619 ~ % ping speedtest.uztelecom.uz
PING speedtest.uztelecom.uz (195.158.0.242): 56 data bytes
64 bytes from 195.158.0.242: icmp_seq=0 ttl=45 time=481.596 ms
64 bytes from 195.158.0.242: icmp_seq=1 ttl=45 time=521.494 ms
64 bytes from 195.158.0.242: icmp_seq=2 ttl=45 time=598.077 ms
^C
--- speedtest.uztelecom.uz ping statistics ---
4 packets transmitted, 3 packets received, 25.0% packet loss
round-trip min/avg/max/stddev = 481.596/533.722/598.077/48.333 ms
taylortang@3ca6f6514619 ~ %
```

Appendix C – iperf results

Host 1 iperf.he.net

```
taylortang@3ca6f6514619 ~ % iperf -c iperf.he.net
------------------------------------------------------------
Client connecting to iperf.he.net, TCP port 5001
TCP window size:  129 KByte (default)
------------------------------------------------------------
[  1] local 192.168.31.80 port 53767 connected with 216.218.207.42 port 5001
[ ID] Interval       Transfer     Bandwidth
[  1] 0.00-10.48 sec  5.88 MBytes  4.70 Mbits/sec
taylortang@3ca6f6514619 ~ %
taylortang@3ca6f6514619 ~ % iperf -c iperf.he.net
------------------------------------------------------------
Client connecting to iperf.he.net, TCP port 5001
TCP window size:  129 KByte (default)
------------------------------------------------------------
[  1] local 192.168.31.80 port 53768 connected with 216.218.207.42 port 5001
[ ID] Interval       Transfer     Bandwidth
[  1] 0.00-10.36 sec  6.00 MBytes  4.86 Mbits/sec
taylortang@3ca6f6514619 ~ %
taylortang@3ca6f6514619 ~ % iperf -c iperf.he.net
------------------------------------------------------------
Client connecting to iperf.he.net, TCP port 5001
TCP window size:  129 KByte (default)
------------------------------------------------------------
[  1] local 192.168.31.80 port 53769 connected with 216.218.207.42 port 5001
[ ID] Interval       Transfer     Bandwidth
[  1] 0.00-10.48 sec  6.00 MBytes  4.80 Mbits/sec
taylortang@3ca6f6514619 ~ %
```

Host 2 bouygues.testdebit.info

```
taylortang@3ca6f6514619 ~ % iperf -c bouygues.testdebit.info
------------------------------------------------------------
Client connecting to bouygues.testdebit.info, TCP port 5001
TCP window size:  129 KByte (default)
------------------------------------------------------------
[  1] local 192.168.31.80 port 53770 connected with 89.84.1.186 port 5001
tcp write failed: Broken pipe
shutdown failed: Socket is not connected
[ ID] Interval       Transfer     Bandwidth
[  1] 0.00-0.65 sec   128 KBytes  1.61 Mbits/sec
taylortang@3ca6f6514619 ~ %
taylortang@3ca6f6514619 ~ % iperf -c bouygues.testdebit.info
------------------------------------------------------------
Client connecting to bouygues.testdebit.info, TCP port 5001
TCP window size:  129 KByte (default)
------------------------------------------------------------
[  1] local 192.168.31.80 port 53771 connected with 89.84.1.186 port 5001
tcp write failed: Broken pipe
shutdown failed: Socket is not connected
[ ID] Interval       Transfer     Bandwidth
[  1] 0.00-0.63 sec   128 KBytes  1.67 Mbits/sec
taylortang@3ca6f6514619 ~ %
taylortang@3ca6f6514619 ~ % iperf -c bouygues.testdebit.info
------------------------------------------------------------
Client connecting to bouygues.testdebit.info, TCP port 5001
TCP window size:  129 KByte (default)
------------------------------------------------------------
[  1] local 192.168.31.80 port 53772 connected with 89.84.1.186 port 5001
tcp write failed: Broken pipe
shutdown failed: Socket is not connected
[ ID] Interval       Transfer     Bandwidth
[  1] 0.00-0.31 sec   128 KBytes  3.35 Mbits/sec
taylortang@3ca6f6514619 ~ %
```

Host 3 ping-ams1.online.net

```
taylortang@3ca6f6514619 ~ % iperf3 -c ping-ams1.online.net -p 5201
Connecting to host ping-ams1.online.net, port 5201
[  7] local 192.168.31.80 port 54969 connected to 163.172.208.7 port 5201
[ ID] Interval           Transfer     Bitrate
[  7]   0.00-1.01   sec   143 KBytes  1.16 Mbits/sec
[  7]   1.01-2.01   sec   334 KBytes  2.74 Mbits/sec
[  7]   2.01-3.01   sec  1.55 MBytes  13.0 Mbits/sec
[  7]   3.01-4.00   sec  1.27 MBytes  10.7 Mbits/sec
[  7]   4.00-5.00   sec  2.01 MBytes  16.8 Mbits/sec
[  7]   5.00-6.00   sec  2.08 MBytes  17.4 Mbits/sec
[  7]   6.00-7.00   sec  2.14 MBytes  17.9 Mbits/sec
[  7]   7.00-8.00   sec  2.17 MBytes  18.2 Mbits/sec
[  7]   8.00-9.00   sec  2.18 MBytes  18.3 Mbits/sec
[  7]   9.00-10.00  sec  2.20 MBytes  18.4 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate
[  7]   0.00-10.00  sec  16.1 MBytes  13.5 Mbits/sec                  sender
[  7]   0.00-10.00  sec  15.3 MBytes  12.9 Mbits/sec                  receiver

iperf Done.
taylortang@3ca6f6514619 ~ % iperf3 -c ping-ams1.online.net -p 5201
Connecting to host ping-ams1.online.net, port 5201
[  7] local 192.168.31.80 port 54971 connected to 163.172.208.7 port 5201
[ ID] Interval           Transfer     Bitrate
[  7]   0.00-1.00   sec   143 KBytes  1.17 Mbits/sec
[  7]   1.00-2.01   sec   454 KBytes  3.71 Mbits/sec
[  7]   2.01-3.00   sec  1.44 MBytes  12.1 Mbits/sec
[  7]   3.00-4.00   sec  1.77 MBytes  14.9 Mbits/sec
[  7]   4.00-5.00   sec  2.04 MBytes  17.1 Mbits/sec
[  7]   5.00-6.00   sec  2.13 MBytes  17.9 Mbits/sec
[  7]   6.00-7.00   sec  2.16 MBytes  18.1 Mbits/sec
[  7]   7.00-8.00   sec  2.21 MBytes  18.5 Mbits/sec
[  7]   8.00-9.00   sec  2.21 MBytes  18.6 Mbits/sec
[  7]   9.00-10.00  sec  2.22 MBytes  18.6 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate
[  7]   0.00-10.00  sec  16.8 MBytes  14.1 Mbits/sec                  sender
[  7]   0.00-10.00  sec  16.1 MBytes  13.5 Mbits/sec                  receiver

iperf Done.
taylortang@3ca6f6514619 ~ % iperf3 -c ping-ams1.online.net -p 5201
Connecting to host ping-ams1.online.net, port 5201
[  7] local 192.168.31.80 port 54973 connected to 163.172.208.7 port 5201
[ ID] Interval           Transfer     Bitrate
[  7]   0.00-1.00   sec   143 KBytes  1.17 Mbits/sec
[  7]   1.00-2.01   sec   469 KBytes  3.83 Mbits/sec
[  7]   2.01-3.01   sec  2.67 MBytes  22.4 Mbits/sec
[  7]   3.01-4.01   sec  8.00 KBytes  65.5 Kbits/sec
[  7]   4.01-5.00   sec  0.00 Bytes  0.00 bits/sec
[  7]   5.00-6.00   sec  0.00 Bytes  0.00 bits/sec
[  7]   6.00-7.00   sec  15.7 KBytes   129 Kbits/sec
[  7]   7.00-8.00   sec  72.1 KBytes   592 Kbits/sec
[  7]   8.00-9.00   sec  74.9 KBytes   612 Kbits/sec
[  7]   9.00-10.00  sec   285 KBytes  2.34 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate
[  7]   0.00-10.00  sec  3.71 MBytes  3.11 Mbits/sec                  sender
[  7]   0.00-10.00  sec  3.61 MBytes  3.03 Mbits/sec                  receiver

iperf Done.
taylortang@3ca6f6514619 ~ % iperf3 -c ping-ams1.online.net -p 5201
Connecting to host ping-ams1.online.net, port 5201
[  7] local 192.168.31.80 port 54979 connected to 163.172.208.7 port 5201
[ ID] Interval           Transfer     Bitrate
[  7]   0.00-1.00   sec   141 KBytes  1.15 Mbits/sec
[  7]   1.00-2.00   sec   447 KBytes  3.68 Mbits/sec
[  7]   2.00-3.01   sec  1.53 MBytes  12.8 Mbits/sec
[  7]   3.01-4.00   sec  1.47 MBytes  12.4 Mbits/sec
[  7]   4.00-5.00   sec  2.01 MBytes  16.9 Mbits/sec
[  7]   5.00-6.00   sec  2.13 MBytes  17.9 Mbits/sec
[  7]   6.00-7.00   sec  2.19 MBytes  18.4 Mbits/sec
[  7]   7.00-8.00   sec  2.21 MBytes  18.6 Mbits/sec
[  7]   8.00-9.00   sec  2.23 MBytes  18.7 Mbits/sec
[  7]   9.00-10.00  sec  2.25 MBytes  18.9 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate
[  7]   0.00-10.00  sec  16.6 MBytes  13.9 Mbits/sec                  sender
[  7]   0.00-10.00  sec  15.9 MBytes  13.3 Mbits/sec                  receiver

iperf Done.
taylortang@3ca6f6514619 ~ %
```

Host 4 ikoula.testdebit.info

```
taylortang@3ca6f6514619 ~ % iperf -c ikoula.testdebit.info
------------------------------------------------------------
Client connecting to ikoula.testdebit.info, TCP port 5001
TCP window size:  129 KByte (default)
------------------------------------------------------------
[  1] local 192.168.31.80 port 54578 connected with 213.246.63.45 port 5001
tcp write failed: Broken pipe
shutdown failed: Socket is not connected
[ ID] Interval       Transfer     Bandwidth
[  1] 0.00-0.62 sec   128 KBytes  1.70 Mbits/sec
taylortang@3ca6f6514619 ~ %
taylortang@3ca6f6514619 ~ % iperf -c ikoula.testdebit.info
------------------------------------------------------------
Client connecting to ikoula.testdebit.info, TCP port 5001
TCP window size:  129 KByte (default)
------------------------------------------------------------
[  1] local 192.168.31.80 port 54579 connected with 213.246.63.45 port 5001
tcp write failed: Broken pipe
shutdown failed: Socket is not connected
[ ID] Interval       Transfer     Bandwidth
[  1] 0.00-0.63 sec   128 KBytes  1.68 Mbits/sec
taylortang@3ca6f6514619 ~ %
taylortang@3ca6f6514619 ~ % iperf -c ikoula.testdebit.info
------------------------------------------------------------
Client connecting to ikoula.testdebit.info, TCP port 5001
TCP window size:  129 KByte (default)
------------------------------------------------------------
[  1] local 192.168.31.80 port 54580 connected with 213.246.63.45 port 5001
tcp write failed: Broken pipe
shutdown failed: Socket is not connected
[ ID] Interval       Transfer     Bandwidth
[  1] 0.00-0.62 sec   128 KBytes  1.70 Mbits/sec
taylortang@3ca6f6514619 ~ %
```

Host 5 iperf.astra.in.ua

```
taylortang@3ca6f6514619 ~ % iperf3 -c iperf.astra.in.ua -p 5202
Connecting to host iperf.astra.in.ua, port 5202
[  7] local 192.168.31.80 port 54595 connected to 193.93.216.52 port 5202
[ ID] Interval           Transfer     Bitrate
[  7]   0.00-1.00   sec   143 KBytes  1.17 Mbits/sec
[  7]   1.00-2.00   sec   420 KBytes  3.45 Mbits/sec
[  7]   2.00-3.00   sec  1.71 MBytes  14.4 Mbits/sec
[  7]   3.00-4.00   sec  1.59 MBytes  13.3 Mbits/sec
[  7]   4.00-5.00   sec  1.53 MBytes  12.9 Mbits/sec
[  7]   5.00-6.00   sec  2.23 MBytes  18.7 Mbits/sec
[  7]   6.00-7.00   sec  2.19 MBytes  18.3 Mbits/sec
[  7]   7.00-8.00   sec  2.20 MBytes  18.5 Mbits/sec
[  7]   8.00-9.00   sec  2.27 MBytes  19.0 Mbits/sec
[  7]   9.00-10.00  sec  2.24 MBytes  18.8 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate
[  7]   0.00-10.00  sec  16.5 MBytes  13.9 Mbits/sec                  sender
[  7]   0.00-10.37  sec  15.7 MBytes  12.7 Mbits/sec                  receiver

iperf Done.
taylortang@3ca6f6514619 ~ %
taylortang@3ca6f6514619 ~ % iperf3 -c iperf.astra.in.ua -p 5202
Connecting to host iperf.astra.in.ua, port 5202
[  7] local 192.168.31.80 port 54597 connected to 193.93.216.52 port 5202
[ ID] Interval           Transfer     Bitrate
[  7]   0.00-1.00   sec   143 KBytes  1.17 Mbits/sec
[  7]   1.00-2.01   sec   420 KBytes  3.43 Mbits/sec
[  7]   2.01-3.00   sec  1.45 MBytes  12.2 Mbits/sec
[  7]   3.00-4.00   sec  1.31 MBytes  11.0 Mbits/sec
[  7]   4.00-5.00   sec  1.49 MBytes  12.5 Mbits/sec
[  7]   5.00-6.00   sec  2.13 MBytes  17.9 Mbits/sec
[  7]   6.00-7.00   sec  1.93 MBytes  16.2 Mbits/sec
[  7]   7.00-8.00   sec  1.97 MBytes  16.5 Mbits/sec
[  7]   8.00-9.00   sec  1.98 MBytes  16.6 Mbits/sec
[  7]   9.00-10.00  sec  1.97 MBytes  16.5 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate
[  7]   0.00-10.00  sec  14.8 MBytes  12.4 Mbits/sec                  sender
[  7]   0.00-10.39  sec  14.1 MBytes  11.4 Mbits/sec                  receiver

iperf Done.
taylortang@3ca6f6514619 ~ % iperf3 -c iperf.astra.in.ua -p 5202
Connecting to host iperf.astra.in.ua, port 5202
[  7] local 192.168.31.80 port 54604 connected to 193.93.216.52 port 5202
[ ID] Interval           Transfer     Bitrate
[  7]   0.00-1.00   sec   143 KBytes  1.17 Mbits/sec
[  7]   1.00-2.00   sec   431 KBytes  3.54 Mbits/sec
[  7]   2.00-3.00   sec  1.73 MBytes  14.5 Mbits/sec
[  7]   3.00-4.00   sec  2.02 MBytes  16.9 Mbits/sec
[  7]   4.00-5.00   sec   909 KBytes  7.47 Mbits/sec
[  7]   5.00-6.00   sec  0.00 Bytes  0.00 bits/sec
[  7]   6.00-7.00   sec   885 KBytes  7.27 Mbits/sec
[  7]   7.00-8.00   sec  1.34 MBytes  11.2 Mbits/sec
[  7]   8.00-9.00   sec  1.43 MBytes  12.0 Mbits/sec
[  7]   9.00-10.00  sec  1.47 MBytes  12.3 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate
[  7]   0.00-10.00  sec  10.3 MBytes  8.63 Mbits/sec                  sender
[  7]   0.00-10.37  sec  9.77 MBytes  7.90 Mbits/sec                  receiver

iperf Done.
taylortang@3ca6f6514619 ~ %
```

Host 6 ping-90ms.online.net

```
taylortang@3ca6f6514619 ~ % iperf -c ping-90ms.online.net
------------------------------------------------------------
Client connecting to ping-90ms.online.net, TCP port 5001
TCP window size:  129 KByte (default)
------------------------------------------------------------
[  1] local 192.168.31.80 port 54606 connected with 62.210.18.41 port 5001
[ ID] Interval       Transfer     Bandwidth
[  1] 0.00-10.93 sec  4.88 MBytes  3.74 Mbits/sec
taylortang@3ca6f6514619 ~ %
taylortang@3ca6f6514619 ~ % iperf -c ping-90ms.online.net
------------------------------------------------------------
Client connecting to ping-90ms.online.net, TCP port 5001
TCP window size:  129 KByte (default)
------------------------------------------------------------
[  1] local 192.168.31.80 port 54607 connected with 62.210.18.41 port 5001
[ ID] Interval       Transfer     Bandwidth
[  1] 0.00-11.59 sec  4.13 MBytes  2.99 Mbits/sec
taylortang@3ca6f6514619 ~ %
taylortang@3ca6f6514619 ~ % iperf -c ping-90ms.online.net
------------------------------------------------------------
Client connecting to ping-90ms.online.net, TCP port 5001
TCP window size:  129 KByte (default)
------------------------------------------------------------
[  1] local 192.168.31.80 port 54608 connected with 62.210.18.41 port 5001
[ ID] Interval       Transfer     Bandwidth
[  1] 0.00-10.87 sec  15.5 MBytes  12.0 Mbits/sec
taylortang@3ca6f6514619 ~ %
```

Host 7 speedtest.serverius.net

```
taylortang@3ca6f6514619 ~ % iperf3 -c speedtest.serverius.net -p 5002
Connecting to host speedtest.serverius.net, port 5002
[  7] local 192.168.31.80 port 54617 connected to 178.21.16.76 port 5002
[ ID] Interval           Transfer     Bitrate
[  7]   0.00-1.00   sec   143 KBytes  1.17 Mbits/sec
[  7]   1.00-2.00   sec   422 KBytes  3.45 Mbits/sec
[  7]   2.00-3.00   sec  1.54 MBytes  12.9 Mbits/sec
[  7]   3.00-4.00   sec  1.25 MBytes  10.6 Mbits/sec
[  7]   4.00-5.00   sec  2.10 MBytes  17.7 Mbits/sec
[  7]   5.00-6.00   sec  2.18 MBytes  18.3 Mbits/sec
[  7]   6.00-7.00   sec  2.27 MBytes  19.0 Mbits/sec
[  7]   7.00-8.00   sec  2.26 MBytes  18.9 Mbits/sec
[  7]   8.00-9.00   sec  2.25 MBytes  18.8 Mbits/sec
[  7]   9.00-10.00  sec  2.24 MBytes  18.8 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate
[  7]   0.00-10.00  sec  16.6 MBytes  14.0 Mbits/sec                  sender
[  7]   0.00-10.00  sec  15.9 MBytes  13.4 Mbits/sec                  receiver

iperf Done.
taylortang@3ca6f6514619 ~ % iperf3 -c speedtest.serverius.net -p 5002
Connecting to host speedtest.serverius.net, port 5002
[  7] local 192.168.31.80 port 54619 connected to 178.21.16.76 port 5002
[ ID] Interval           Transfer     Bitrate
[  7]   0.00-1.00   sec   143 KBytes  1.17 Mbits/sec
[  7]   1.00-2.00   sec   493 KBytes  4.02 Mbits/sec
[  7]   2.00-3.00   sec  2.02 MBytes  17.0 Mbits/sec
[  7]   3.00-4.00   sec  1.71 MBytes  14.4 Mbits/sec
[  7]   4.00-5.00   sec  2.59 MBytes  21.7 Mbits/sec
[  7]   5.00-6.00   sec  2.34 MBytes  19.6 Mbits/sec
[  7]   6.00-7.00   sec  2.31 MBytes  19.4 Mbits/sec
[  7]   7.00-8.00   sec  1.65 MBytes  13.8 Mbits/sec
[  7]   8.00-9.00   sec  2.35 MBytes  19.7 Mbits/sec
[  7]   9.00-10.00  sec  2.30 MBytes  19.3 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate
[  7]   0.00-10.00  sec  17.9 MBytes  15.0 Mbits/sec                  sender
[  7]   0.00-10.00  sec  17.0 MBytes  14.3 Mbits/sec                  receiver

iperf Done.
taylortang@3ca6f6514619 ~ % iperf3 -c speedtest.serverius.net -p 5002
Connecting to host speedtest.serverius.net, port 5002
[  7] local 192.168.31.80 port 54621 connected to 178.21.16.76 port 5002
[ ID] Interval           Transfer     Bitrate
[  7]   0.00-1.00   sec   143 KBytes  1.16 Mbits/sec
[  7]   1.00-2.01   sec   197 KBytes  1.61 Mbits/sec
[  7]   2.01-3.00   sec  1.77 MBytes  14.9 Mbits/sec
[  7]   3.00-4.00   sec  1000 KBytes  8.19 Mbits/sec
[  7]   4.00-5.00   sec  1.90 MBytes  15.9 Mbits/sec
[  7]   5.00-6.00   sec  2.12 MBytes  17.8 Mbits/sec
[  7]   6.00-7.00   sec  2.18 MBytes  18.3 Mbits/sec
[  7]   7.00-8.00   sec  2.23 MBytes  18.7 Mbits/sec
[  7]   8.00-9.00   sec  2.24 MBytes  18.8 Mbits/sec
[  7]   9.00-10.00  sec  2.24 MBytes  18.8 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate
[  7]   0.00-10.00  sec  16.0 MBytes  13.4 Mbits/sec                  sender
[  7]   0.00-10.00  sec  15.3 MBytes  12.8 Mbits/sec                  receiver

iperf Done.
taylortang@3ca6f6514619 ~ %
```

Host 8 iperf.volia.net

```
taylortang@3ca6f6514619 ~ % iperf -c iperf.volia.net
------------------------------------------------------------
Client connecting to iperf.volia.net, TCP port 5001
TCP window size:  129 KByte (default)
------------------------------------------------------------
[  1] local 192.168.31.80 port 54622 connected with 77.120.3.236 port 5001
[ ID] Interval       Transfer     Bandwidth
[  1] 0.00-10.79 sec  13.8 MBytes  10.7 Mbits/sec
taylortang@3ca6f6514619 ~ %
taylortang@3ca6f6514619 ~ % iperf -c iperf.volia.net
------------------------------------------------------------
Client connecting to iperf.volia.net, TCP port 5001
TCP window size:  129 KByte (default)
------------------------------------------------------------
[  1] local 192.168.31.80 port 54623 connected with 77.120.3.236 port 5001
[ ID] Interval       Transfer     Bandwidth
[  1] 0.00-12.49 sec  3.63 MBytes  2.43 Mbits/sec
taylortang@3ca6f6514619 ~ %
taylortang@3ca6f6514619 ~ % iperf -c iperf.volia.net
------------------------------------------------------------
Client connecting to iperf.volia.net, TCP port 5001
TCP window size:  129 KByte (default)
------------------------------------------------------------
[  1] local 192.168.31.80 port 54624 connected with 77.120.3.236 port 5001
[ ID] Interval       Transfer     Bandwidth
[  1] 0.00-10.89 sec  9.38 MBytes  7.22 Mbits/sec
taylortang@3ca6f6514619 ~ %
```

Host 9 iperf.biznetnetworks.com

```
taylortang@3ca6f6514619 ~ % iperf -c iperf.volia.net
------------------------------------------------------------
Client connecting to iperf.volia.net, TCP port 5001
TCP window size:  129 KByte (default)
------------------------------------------------------------
[  1] local 192.168.31.80 port 54626 connected with 77.120.3.236 port 5001
[ ID] Interval       Transfer     Bandwidth
[  1] 0.00-10.78 sec  11.8 MBytes  9.14 Mbits/sec
taylortang@3ca6f6514619 ~ %
taylortang@3ca6f6514619 ~ % iperf -c iperf.volia.net
------------------------------------------------------------
Client connecting to iperf.volia.net, TCP port 5001
TCP window size:  129 KByte (default)
------------------------------------------------------------
[  1] local 192.168.31.80 port 54627 connected with 77.120.3.236 port 5001
[ ID] Interval       Transfer     Bandwidth
[  1] 0.00-11.88 sec  4.88 MBytes  3.44 Mbits/sec
taylortang@3ca6f6514619 ~ %
taylortang@3ca6f6514619 ~ % iperf -c iperf.volia.net
------------------------------------------------------------
Client connecting to iperf.volia.net, TCP port 5001
TCP window size:  129 KByte (default)
------------------------------------------------------------
[  1] local 192.168.31.80 port 54628 connected with 77.120.3.236 port 5001
[ ID] Interval       Transfer     Bandwidth
[  1] 0.00-10.74 sec  13.0 MBytes  10.2 Mbits/sec
taylortang@3ca6f6514619 ~ %
```

Host 10 speedtest.uztelecom.uz

```
Last login: Sat Apr  9 16:54:11 on ttys001
taylortang@3ca6f6514619 ~ % iperf3 -c speedtest.uztelecom.uz -p 5204
Connecting to host speedtest.uztelecom.uz, port 5204
[  7] local 192.168.31.80 port 54639 connected to 195.69.189.215 port 5204
[ ID] Interval           Transfer     Bitrate
[  7]   0.00-1.00   sec   143 KBytes  1.17 Mbits/sec
[  7]   1.00-2.01   sec   187 KBytes  1.53 Mbits/sec
[  7]   2.01-3.00   sec  2.03 MBytes  17.1 Mbits/sec
[  7]   3.00-4.00   sec  2.39 MBytes  20.0 Mbits/sec
[  7]   4.00-5.00   sec  0.00 Bytes  0.00 bits/sec
[  7]   5.00-6.01   sec  15.2 KBytes   125 Kbits/sec
[  7]   6.01-7.01   sec   149 KBytes  1.22 Mbits/sec
[  7]   7.01-8.01   sec   189 KBytes  1.55 Mbits/sec
[  7]   8.01-9.00   sec   409 KBytes  3.36 Mbits/sec
[  7]   9.00-10.01  sec   270 KBytes  2.20 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate
[  7]   0.00-10.01  sec  5.75 MBytes  4.82 Mbits/sec                  sender
[  7]   0.00-10.01  sec  5.61 MBytes  4.70 Mbits/sec                  receiver

iperf Done.
taylortang@3ca6f6514619 ~ % iperf3 -c speedtest.uztelecom.uz -p 5204
Connecting to host speedtest.uztelecom.uz, port 5204
[  7] local 192.168.31.80 port 54643 connected to 195.69.189.215 port 5204
[ ID] Interval           Transfer     Bitrate
[  7]   0.00-1.00   sec   143 KBytes  1.17 Mbits/sec
[  7]   1.00-2.00   sec   197 KBytes  1.61 Mbits/sec
[  7]   2.00-3.00   sec  1.25 MBytes  10.5 Mbits/sec
[  7]   3.00-4.00   sec  3.02 MBytes  25.3 Mbits/sec
[  7]   4.00-5.01   sec  1.10 MBytes  9.20 Mbits/sec
[  7]   5.01-6.00   sec  0.00 Bytes  0.00 bits/sec
[  7]   6.00-7.00   sec   933 KBytes  7.66 Mbits/sec
[  7]   7.00-8.00   sec  1.13 MBytes  9.50 Mbits/sec
[  7]   8.00-9.00   sec  1.09 MBytes  9.08 Mbits/sec
[  7]   9.00-10.00  sec  1.43 MBytes  12.0 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate
[  7]   0.00-10.00  sec  10.3 MBytes  8.61 Mbits/sec                  sender
[  7]   0.00-10.00  sec  9.69 MBytes  8.13 Mbits/sec                  receiver

iperf Done.
taylortang@3ca6f6514619 ~ % iperf3 -c speedtest.uztelecom.uz -p 5204
Connecting to host speedtest.uztelecom.uz, port 5204
[  7] local 192.168.31.80 port 54645 connected to 195.69.189.215 port 5204
[ ID] Interval           Transfer     Bitrate
[  7]   0.00-1.01   sec   143 KBytes  1.16 Mbits/sec
[  7]   1.01-2.00   sec   197 KBytes  1.61 Mbits/sec
[  7]   2.00-3.00   sec  1.04 MBytes  8.76 Mbits/sec
[  7]   3.00-4.01   sec   585 KBytes  4.77 Mbits/sec
[  7]   4.01-5.01   sec   895 KBytes  7.33 Mbits/sec
[  7]   5.01-6.00   sec  1.49 MBytes  12.5 Mbits/sec
[  7]   6.00-7.00   sec  1.21 MBytes  10.2 Mbits/sec
[  7]   7.00-8.00   sec  1.50 MBytes  12.6 Mbits/sec
[  7]   8.00-9.01   sec  1.34 MBytes  11.2 Mbits/sec
[  7]   9.01-10.00  sec  1.47 MBytes  12.4 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate
[  7]   0.00-10.00  sec  9.84 MBytes  8.25 Mbits/sec                  sender
[  7]   0.00-10.00  sec  9.24 MBytes  7.75 Mbits/sec                  receiver

iperf Done.
taylortang@3ca6f6514619 ~ %
```

Appendix D - Microsoft Excel spreadsheet calculating

Section 1

	A	B	C	D	E	F	G
1		Hosts	City	State	Country	Distance to local host (km)	
2	1	iperf.he.net	Cazadero	California	USA	11377.29	
3	2	bouygues.testdebit.info	Massy	Ile-de-France	France	16569.98	
4	3	ping-ams1.online.net	Amsterdam	Noordholland	Netherlands	16192.91	
5	4	ikoula.testdebit.info	Boulogne-Billa	Iledefrance	France	16569.33	
6	5	iperf.astra.in.ua	Lviv	L'vivs'ka Oblast	Ukraine	15062.98	
7	6	ping-90ms.online.net	Paris	Iledefrance	France	16822.50	
8	7	speedtest.serverius.net	Almelo	Overijssel;	Netherlands	16196.52	
9	8	iperf.volia.net	Kyiv	Kyyiv	Ukraine	14594.17	
10	9	iperf.biznetnetworks.co	Pela Mampang	Jakarta	Indonesia	5413.47	
11	10	speedtest.uztelecom.uz	Tashkent	Toshkent	Uzbekistan	11497.55	
12							

Section 2

	A	B	C	D	E	F	G
1		Hosts	Reached?	Max Ho	City	Distance to local host (km)	
2	1	iperf.he.net	Y	15	Cazadero	11377.29	
3	2	bouygues.testdebit.info	Y	21	Massy	16569.98	
4	3	ping-ams1.online.net	Y	21	Netherlan	16192.91	
5	4	ikoula.testdebit.info	Y	19	Lyon	16569.33	
6	5	iperf.astra.in.ua	Y	19	Lviv	15062.98	
7	6	ping-90ms.online.net	Y	20	Paris	16822.50	
8	7	speedtest.serverius.net	N	26	Ijsselstein	16196.52	
9	8	iperf.volia.net	Y	34	Kyiv	14594.17	
10	9	iperf.biznetnetworks.com	Y	16	Jakarta	5413.47	
11	10	speedtest.uztelecom.uz	Y	23	Tashkent	11497.55	
12							

Section 3

M2 =STDEV(C2:L2)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1		Hosts	test 1 - 1	test 1 - 2	test 1 - 3	test 2 - 1	test 2 - 2	test 2 - 3	test 3 - 1	test 3 - 2	test 3 - 3	avg rt-delay	jitter (stdev)	City	Distance to local host (km)	
2	1	iperf.he.net	182.129	167.268	170.783	175.947	170.419	174.884	180.233	165.464	173.059	173.354	5.249	Cazadero	11377.29	
3	2	bouygues.testdebit.info	315.590	342.058	413.754	379.637	426.035	482.842	382.234	310.071	309.096	373.480	56.729	Massy	16569.98	
4	3	ping-ams1.online.net	346.468	367.238	387.659	390.438	307.079	327.920	310.670	331.358	350.661	346.610	28.837	Netherlands	16192.91	
5	4	ikoula.testdebit.info	351.882	357.509	401.930	321.376	353.652	416.023	327.228	326.618	325.065	353.476	32.535	Lyon	16569.33	
6	5	iperf.astra.in.ua	359.758	408.140	459.081	363.507	333.086	345.950	519.200	562.170	331.969	409.207	80.471	Lviv	15062.98	
7	6	ping-90ms.online.net	413.521	436.155	486.251	499.494	546.128	400.198	408.050	422.107	423.906	448.423	47.380	Paris	16822.50	
8	7	speedtest.serverius.net	340.189	334.126	379.247	420.139	301.503	313.016	371.835	303.803	303.339	340.800	39.256	Ijsselstein	16196.52	
9	8	iperf.volia.net	397.548	365.092	366.488	400.755	449.075	364.242	376.790	385.572	431.840	393.045	28.598	Kyiv	14594.17	
10	9	iperf.biznetnetworks.com	196.269	191.729	235.595	215.547	190.252	192.842	305.711	348.295	199.917	230.684	54.191	Jakarta	5413.47	
11	10	speedtest.uztelecom.uz	394.596	438.979	482.518	380.505	381.291	426.959	481.596	521.494	598.077	456.224	68.327	Tashkent	11497.55	
12																

Section 4

	A	B	C	D	E	F	G	H	I	J	K	L
1		Hosts	iperf test 1 (Mbits/sec)	iperf test 2	iperf test 3	mean (Mbits/sec)	avg rt-delay (ms)	bandwidth-delay product (kbits)	Max Hop count	City	Distance to local host (km)	
2	1	iperf.he.net	4.700	4.860	4.800	4.787	173.354	829.788	15	Cazadero	11377.29	
3	2	bouygues.testdebit.info	1.610	1.670	3.350	2.210	373.480	825.390	21	Massy	16569.98	
4	3	ping-ams1.online.net	13.500	14.100	13.900	13.833	346.610	4794.773	21	Netherlands	16192.91	
5	4	ikoula.testdebit.info	1.700	1.680	1.700	1.693	353.476	598.553	19	Lyon	16569.325	
6	5	iperf.astra.in.ua	13.900	12.400	8.630	11.643	409.207	4764.531	19	Lviv	15062.979	
7	6	ping-90ms.online.net	3.740	2.990	12.000	6.243	448.423	2799.656	20	Paris	16822.5	
8	7	speedtest.serverius.net	14.000	15.000	13.400	14.133	340.800	4816.635	26	Ijsselstein	16196.521	
9	8	iperf.volia.net	10.700	2.430	7.220	6.783	393.045	2666.153	34	Kyiv	14594.17	
10	9	iperf.biznetnetworks.com	9.140	3.440	10.200	7.593	230.684	1751.661	16	Jakarta	5413.47	
11	10	speedtest.uztelecom.uz	4.820	8.610	8.250	7.227	456.224	3296.978	23	Tashkent	11497.55	
12												

Appendix F - data collected from variable websites

Locations of hosts by www.site24x7.com:

Location information : iperf.he.net	
Country Code	US
Country Name	UNITED STATES
Region	CALIFORNIA
City	CAZADERO

Location information : bouygues.testdebit.info	
Country Code	FR
Country Name	FRANCE
Region	ILEDEFRANCE
City	MASSY

Location information : ping-ams1.online.net	
Country Code	NL
Country Name	NETHERLANDS
Region	NOORDHOLLAND
City	AMSTERDAM

Location information : ikoula.testdebit.info	
Country Code	FR
Country Name	FRANCE
Region	ILEDEFRANCE
City	BOULOGNE-BILLANCOURT

Location information : iperf.astra.in.ua	
Country Code	UA
Country Name	UKRAINE
Region	LVIVSKA OBLAST
City	LVIV

Location information : ping-90ms.online.net	
Country Code	FR
Country Name	FRANCE
Region	ILEDEFRANCE
City	PARIS

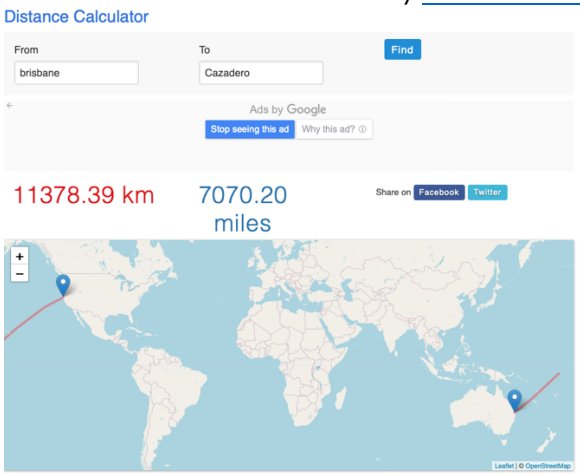
Location information : speedtest.serverius.net	
Country Code	NL
Country Name	NETHERLANDS
Region	OVERIJSSEL
City	ALMELO

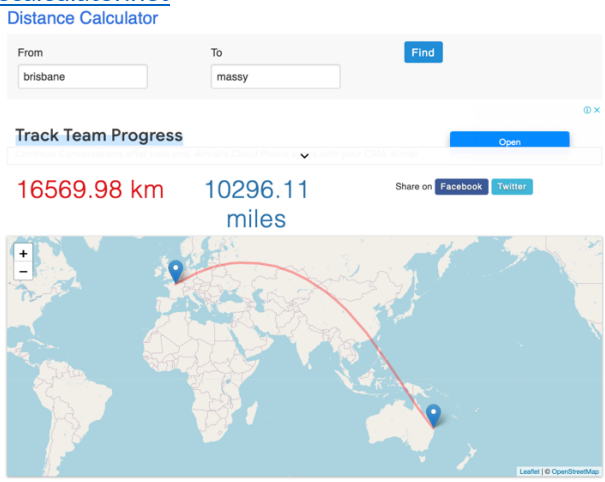
Location information : iperf.volia.net	
Country Code	UA
Country Name	UKRAINE
Region	KYIV
City	KIEV

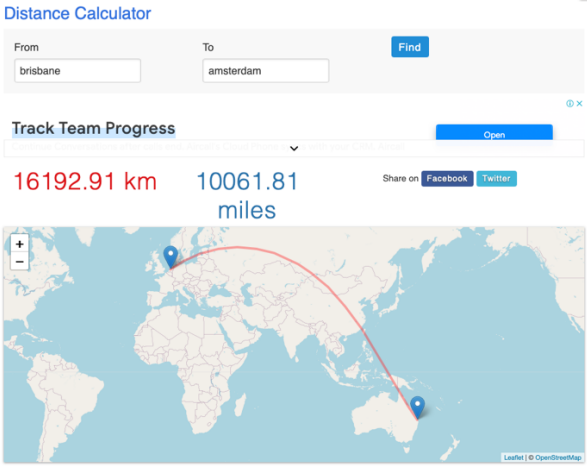
Location information : iperf.biznetnetworks.com	
Country Code	ID
Country Name	INDONESIA
Region	JAKARTA RAYA
City	PELA MAMPANG

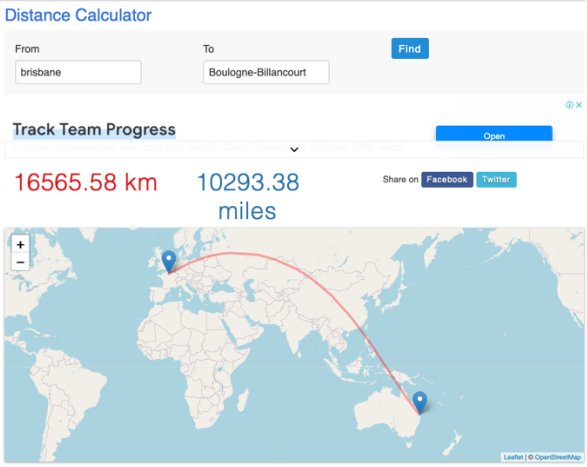
Location information : speedtest.uztelecom.uz	
Country Code	UZ
Country Name	UZBEKISTAN
Region	TASHKENT CITY
City	TASHKENT

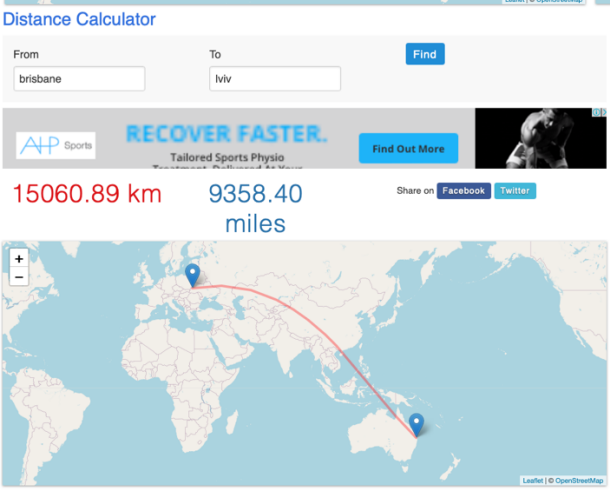
Distance of hosts from Brisbane by www.distancecalculator.net

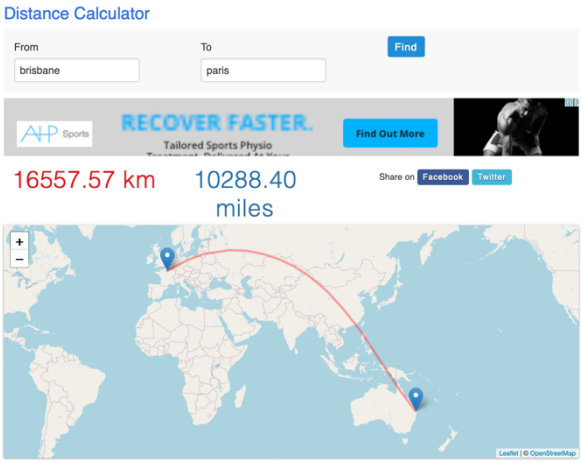


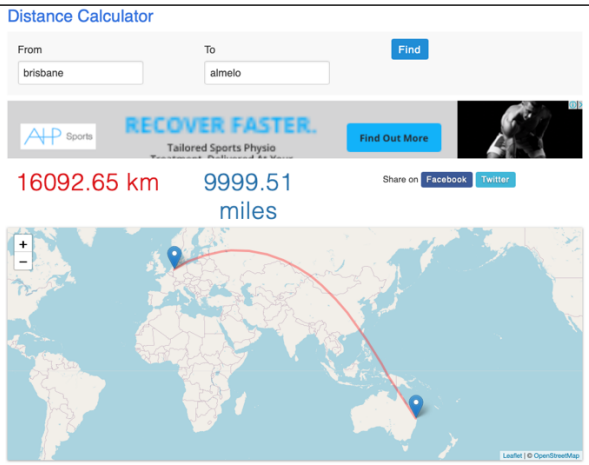


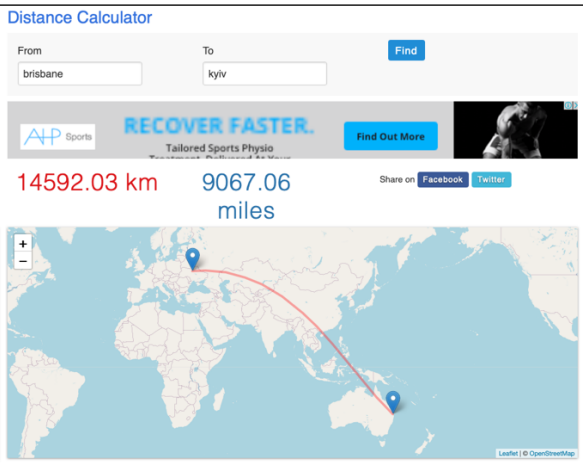









Distance Calculator
From
brisbane
To
almelo
Find
RECOVER FASTER.
Tailored Sports Physio
Find Out More
16092.65 km
9999.51 miles
Share on Facebook Twitter


Distance Calculator
From
brisbane
To
kyiv
Find
RECOVER FASTER.
Tailored Sports Physio
Find Out More
14592.03 km
9067.06 miles
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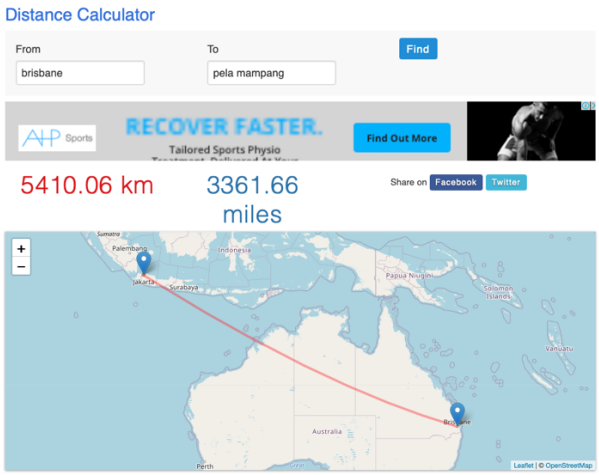
Distance Calculator
From
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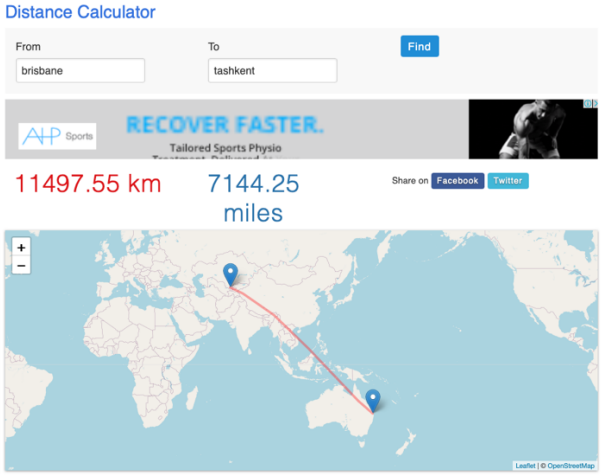
To
pela mampang
Find
RECOVER FASTER.
Tailored Sports Physio
Find Out More
5410.06 km
3361.66 miles
Share on Facebook Twitter


Distance Calculator
From
brisbane
To
tashkent
Find
RECOVER FASTER.
Tailored Sports Physio
11497.55 km
7144.25 miles
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https://www.telstra.com.au/internet/nbn

Telstra Upfront Internet Plan Premium

month-to-month

$1 for the first month

Then $110 per month

Best for multiple users, Ultra HD video streaming and serious gaming.

Plan speeds

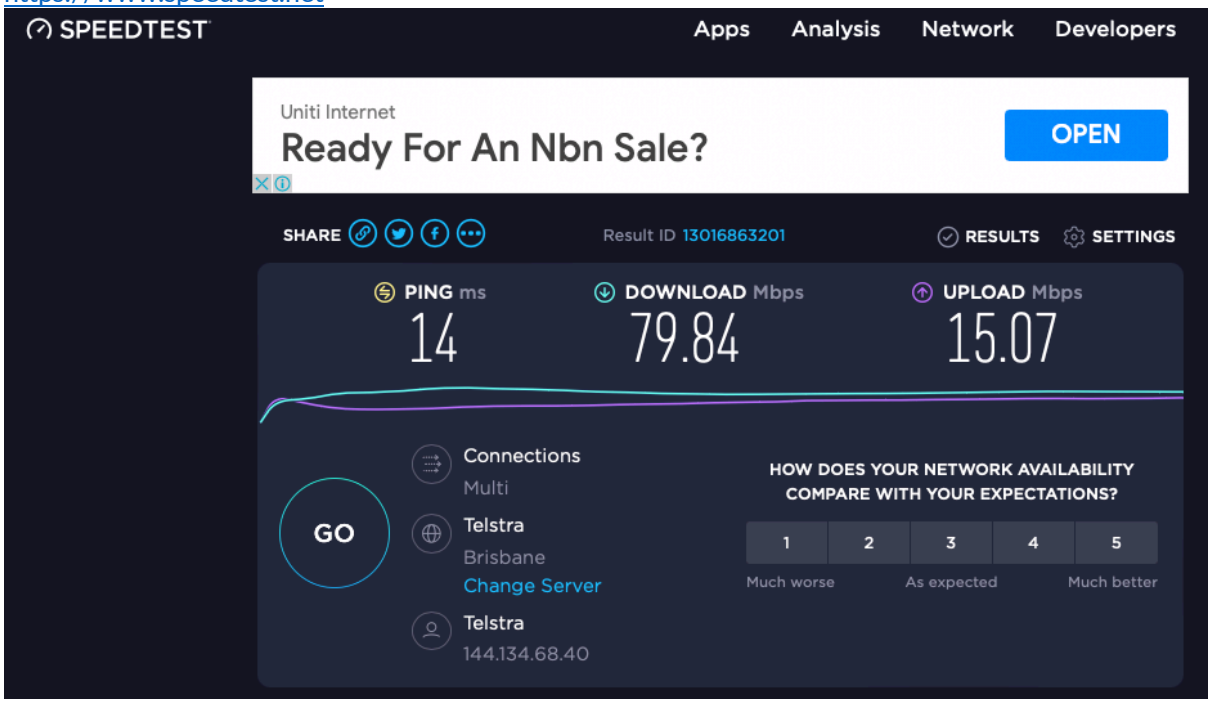
typical evening speed 7pm-11pm:

100 Mbps Download	17 Mbps Upload

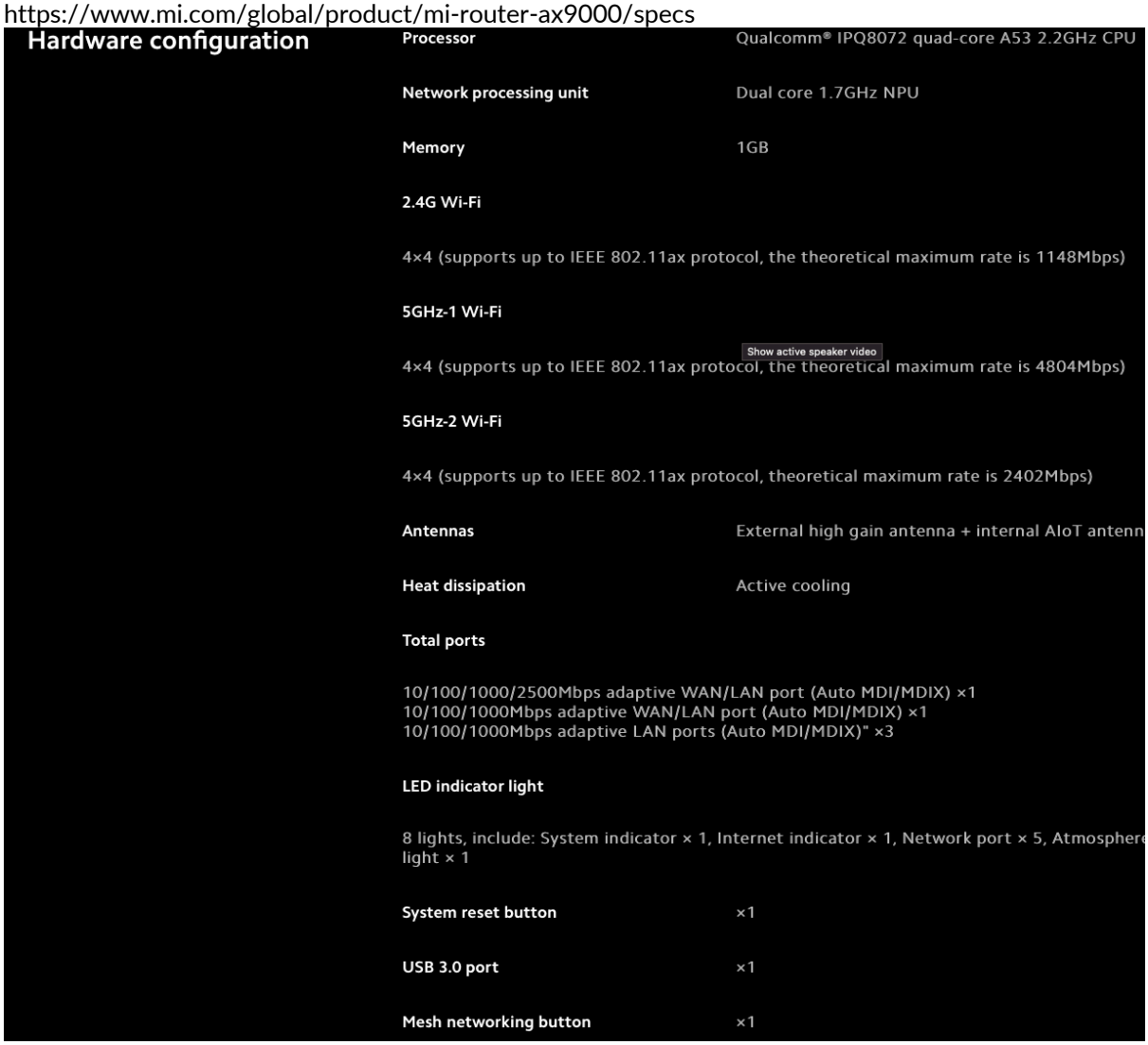
More on Premium Speed →

Speeds experienced may be lower due to factors incl. in-home set up/wiring.

https://www.speedtest.net

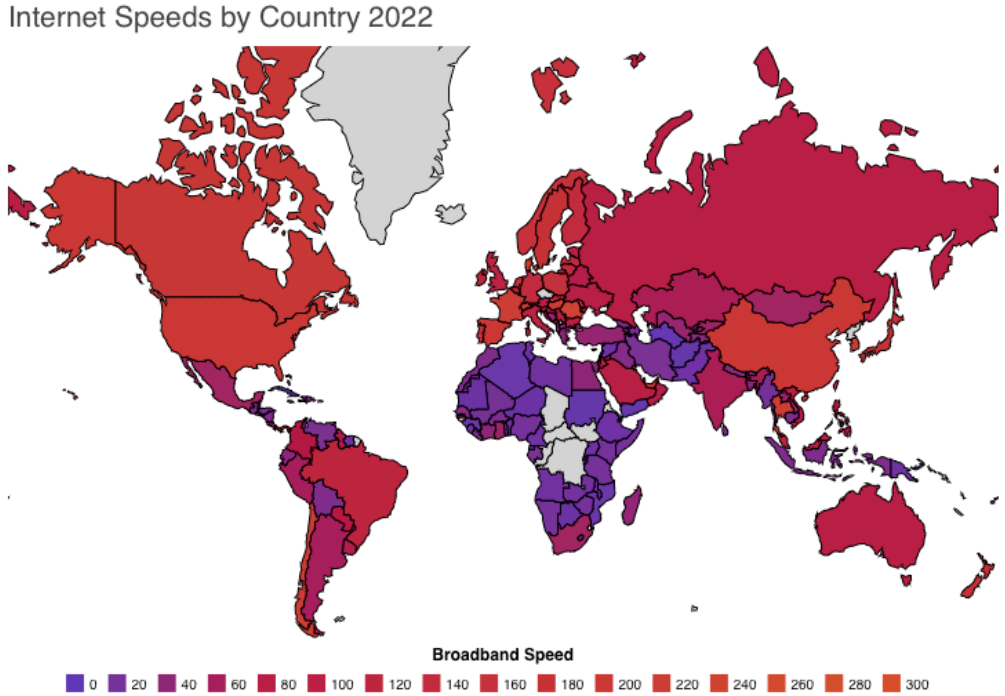


https://www.mi.com/global/product/mi-router-ax9000/specs

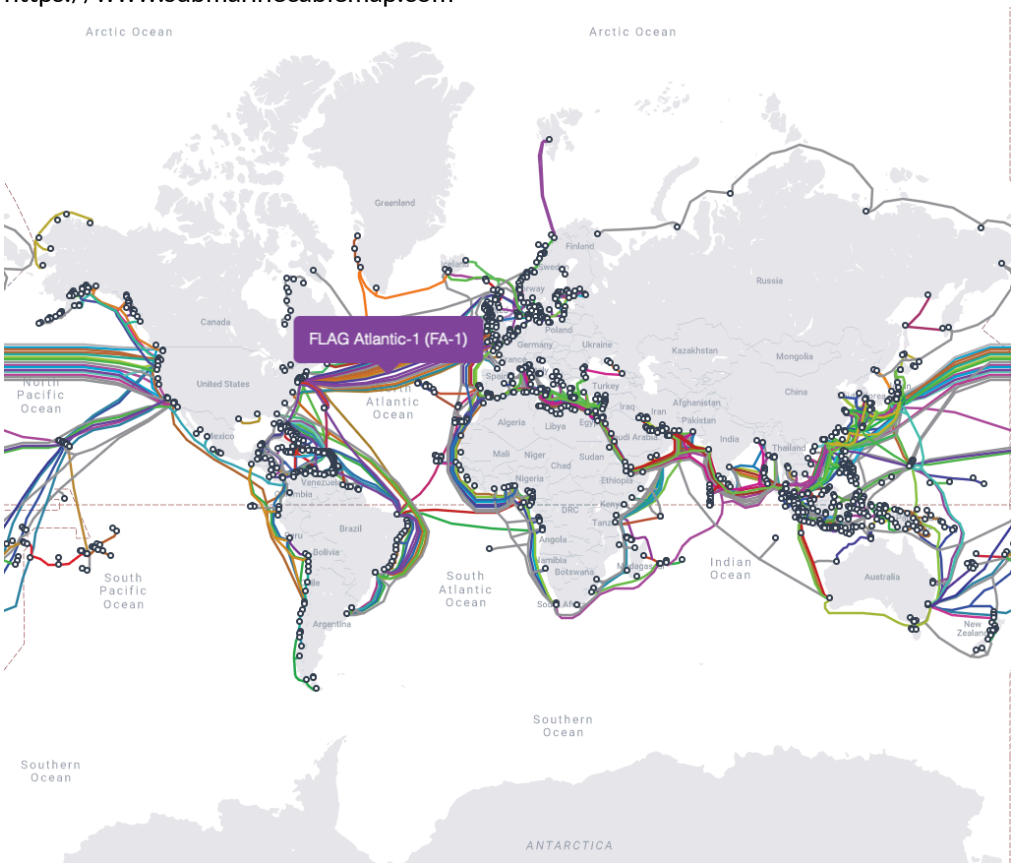


Hardware configuration	
Processor	Qualcomm® IPQ8072 quad-core A53 2.2GHz CPU
Network processing unit	Dual core 1.7GHz NPU
Memory	1GB
2.4G Wi-Fi	
4×4 (supports up to IEEE 802.11ax protocol, the theoretical maximum rate is 1148Mbps)	
5GHz-1 Wi-Fi	
4×4 (supports up to IEEE 802.11ax protocol, the theoretical maximum rate is 4804Mbps)	
5GHz-2 Wi-Fi	
4×4 (supports up to IEEE 802.11ax protocol, theoretical maximum rate is 2402Mbps)	
Antennas	External high gain antenna + internal AIoT antenn
Heat dissipation	Active cooling
Total ports	
10/100/1000/2500Mbps adaptive WAN/LAN port (Auto MDI/MDIX) ×1 10/100/1000Mbps adaptive WAN/LAN port (Auto MDI/MDIX) ×1 10/100/1000Mbps adaptive LAN ports (Auto MDI/MDIX)" ×3	
LED indicator light	
8 lights, include: System indicator × 1, Internet indicator × 1, Network port × 5, Atmosphere light × 1	
System reset button	×1
USB 3.0 port	×1
Mesh networking button	×1

https://worldpopulationreview.com/country-rankings/internet-speeds-by-country



https://www.submarinecablemap.com



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