

COMP90007 Internet Technologies
Project 1 – Network Analysis
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Section 2

Ans 2.1

Meaning of parameters:

- n: Prints hop addresses numerically rather than symbolically and numerically. This flag saves a name-server address-to-name look up for each gateway found on the path.
- w: Sets the time(in seconds) to wait for a response to a probe
- 1: the time to wait for a response to a probe is 1 seconds

Importance of parameters:

- n: Using IP can increase the speed of implementation, since it can reduce the time of host name resolution.
- w 1: Save test time

Ans 2.2

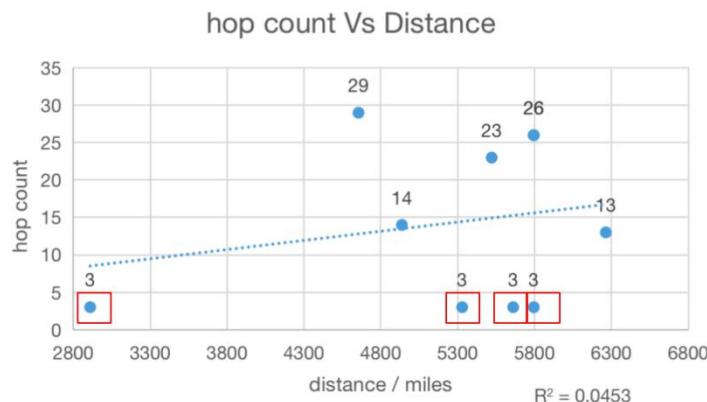


Fig. 2.2.1

I firstly found out the physical geographical distance using a combination of applications available online^{[1][2]}, and then detected the hop count of each host using command ‘traceroute’. According to Fig. 2.2.1, there is no an obvious correlation between hop count and distance, though from this figure, it seems that the number of hop decreases due to increasing distance. Since, the sample points I circled with red box might be outliers, in other words, it is time out or failure to detect these four hosts using ‘traceroute’ . Except these four hosts, these is also no exactly correlation between them. The main reason of such scenario I can think about is that there are several kinds of routing algorithm and each of them has different effects on network and router resources, and therefore sometimes the best route will change according to different situations like collisions.

Section 3

Ans 3.1

Looking at Fig <3.1.1>, <3.1.2>, <3.1.3>, and the experiment results and calculated results achieved in section 3 of the appendix.

Host	ip	Location	1st time		2nd time		3rd time		avg-delay/ms	std
			avg-delay	std	avg-delay	std	avg-delay	std		
bouygues.testdebit.info	89.84.1.186	France	438.17	21.37	327.23	18.65	391.14	41.97	385.51	27.33
speedtest.wt.net.de	213.209.106.95	Germany	311.03	22.24	310.50	40.67	310.19	38.61	310.57	33.84
iperf.astra.in.ua	193.93.216.52	Ukraine	307.48	33.26	295.55	21.28	393.99	67.38	332.34	40.64
ping-90ms.online.net	62.210.18.41	France	429.76	38.36	455.58	30.33	432.45	18.96	439.26	29.21
iperf.scotlinux.com	45.33.39.39	USA	150.80	2.85	258.86	20.34	226.58	31.06	212.08	18.08
speedtest.serverius.net	178.21.16.76	Netherlands	334.95	53.07	307.68	24.38	331.87	67.29	324.83	48.24
iperf.volia.net	77.120.3.236	Ukraine	310.02	24.75	311.68	36.15	294.70	24.16	305.47	28.36
lille.testdebit.info	89.84.1.234	France	444.47	149.02	404.32	58.17	437.89	116.67	428.89	107.95
ping.online.net	62.210.18.40	France	472.56	43.80	435.68	59.38	426.44	61.80	444.89	55.00
speedtest.uztelecom.uz	195.158.0.242	Uzbekistan	584.95	56.95	449.30	36.36	539.34	62.86	524.53	52.06
Formular			AV1	S1	AV2	S2	AV3	S3	avg-delay = (AV1+AV2+AV3)/3	avg-std = (S1+S2+S3)/3

Fig. 3.1.1

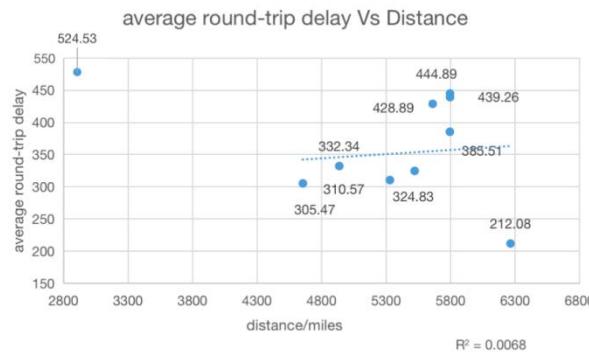


Fig. 3.1.2

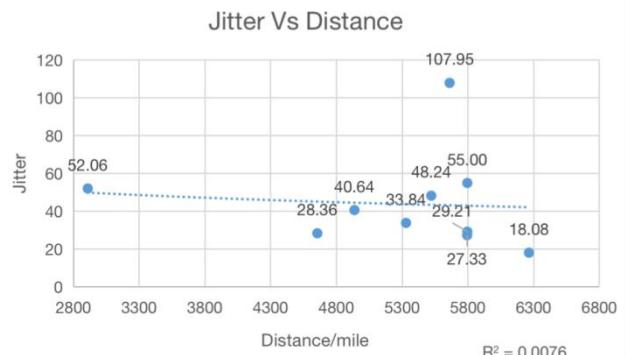


Fig. 3.1.3

Firstly, I recorded all of results including average delay and standard deviation of each round-trip using command ‘ping’ from my experiments and then computed the delay and jitter by averaging round-trip delays and standard deviations of three experiments. The experiment results and calculated results are shown in Fig. 3.1.1.

After drawing the relationships between average round-trip delay and physical geographical distance, and between round-trip jitter and physical geographical distance respectively, I found that the round-trip delay might increase with the growth of distance. As for the correlation of Jitter and distance, it is reluctant to say that there is a inverse proportion between them.

Although these experiment results indicate these two coarse correlations, the correlations are quite faint, since geography by itself cannot provide any information about many performance characteristics like bandwidth, congestion along a path^[3].

Ans 3.2 Looking at Fig <3.2.1> and the result achieved in section 3 of the appendix A.

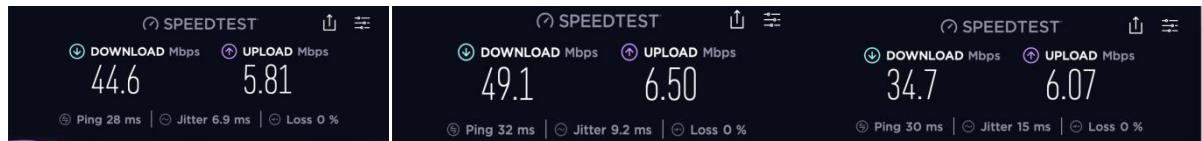


Fig. 3. 2.1

I test my network environment using application **Speedtest** three times, and then average these results I can get my network environment shown in following table.

The download speed	42.80 Mbps
The upload speed	6.127 Mbps

Also, in this experience the number of people sharing my network is 2.

The main networking environment that influence my results obtained might be my network occupancy and network bandwidth. To be concrete, when the available network occupancy is less (i.e., network usage is too high), it easily lead to delay. Also, when the network bandwidth is insufficient, it will still cause delay. In other words, there are multiple application need to transmit data at the same time, whereas the maximum of bandwidth is limited, so that it will cause a large amount of data loss and which will behave as a delay.

Section 4

Ans 4.1 Looking at Fig <4.1.1> and the result achieved in section 4 of the appendix A.

Host	bandwidth/mpbs			avg-bandwidth/mpbs
	1st time	2nd time	3rd time	
bouygues.testdebit.info	4.93	3.54	4.32	4.26
speedtest.wtnet.de	5.92	5.36	5.50	5.59
iperf.astra.in.ua	4.94	5.28	4.32	4.85
ping-90ms.online.net	4.17	6.63	2.08	4.29
iperf.scottlinux.com	5.99	6.83	6.63	6.48
speedtest.serverius.net	6.76	2.80	3.06	4.21
iperf.volia.net	0.31	0.33	0.45	0.36
lille.testdebit.info	5.88	5.42	1.70	4.33
ping.online.net	1.26	2.27	2.55	2.03
speedtest.uztelecom.uz	1.94	2.25	2.27	2.15
Formular	B1	B2	B3	(B1+B2+B3)/3

Fig. 4.1.1

Fig. 4.1.1. indicates the three set of measurements results of bandwidth for all these 10 hosts and also demonstrates the average bandwidth for each host by averaging these three experimental results respectively.

The bandwidth-delay product refers to the product of a data link's capacity (i.e., bandwidth) and its end-to-end delay. The bandwidth then refers to the link speed and the delay refers to what the network would like to account for. Consequently, the bandwidth-delay product is the maximum number of bits that can be transmitted by the sender during a given time in the link.

Ans 4.2 Looking at Fig <4.2.1> and the result achieved in section 4 of the appendix.

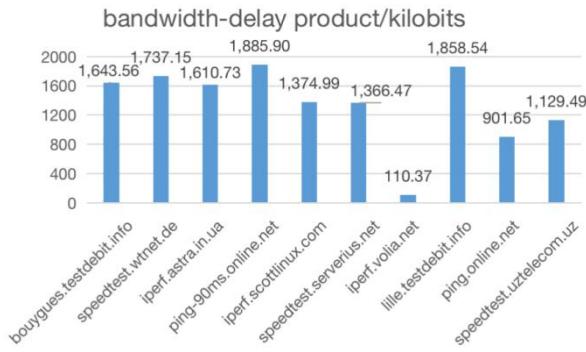


Fig. 4.2.1

Note: I will use abbreviation of bandwidth-delay product, BDP in this section.

Comparative Analysis: This figure indicates that the majority of hosts' bandwidth-delay product achieve over 1300 kbits. Whereas, the BDP of host 'iperf.volia.net' was only up to 110 kbits. The reason why I obtain the results without any regularities might be that I split several times to accomplished this experiment, so that during each time I implemented different types of applications, which will result different results. Because different types of applications occupy different amount of network bandwidth.

Reflection of actual internet link speed: As we can see from the figure 4.2.1, the bandwidth-delay product of each host is relatively high. Meanwhile, the delay of each host shown in is not long. Also, the bandwidth-delay product is the product of data link's capacity and delay time, where with the increasing of data link occupancy, the data link speed will be increase at the same time. Additionally, taking the relationship between data link speed and delay time into consideration (i.e., the increasing of data link speed indicates that the delay time will be shorten), we can easily obtain the regularity that the larger BDP refers to the higher data link speed.

The influence of results due to my network environment: Just as comparative analysis says, I make this experiment several round-trips and also during each round-trip I use different kinds of application simultaneously. Hence I gain different results of each turn. Although I computed their average values, the differences among these hosts cannot be avoided. For instance, I tested the bandwidth-delay of hosts 'iperf.volia.net' and 'ping.online.net' at the same time. Therefore, their BDP are lower than the others.

Outliers: I think the result of host 'iperf.volia.net' might be an outlier. The value of its bandwidth is very different from others'. Considering that when I tested the other one simultaneously might occupy a part of bandwidth, so that the rest available bandwidth is insufficient.

Ans 4.3 Looking at Fig <4.3.1> and the result achieved in section 4 of the appendix

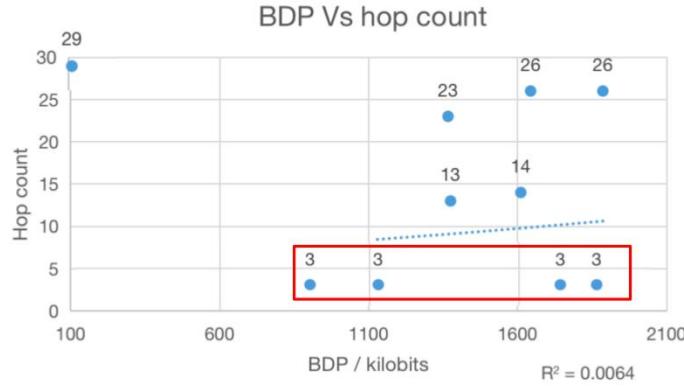


Fig. 4.3.1

From this figure, there is a vague relationship that with the higher BDP, the count of hop is increasing. However, this correlation is not apparent. Since, we can obviously so that when the BDP is up to 1500kbits, there are large number of hop can be detected in some hosts and still small number of hop be found in another hosts.

As for the reasons, theoretically the number of hops increases, the end-to-end segment loss probability increases, resulting in a smaller congestion window size, and hence a large end-to-end delay^[4]. So that the BDP might increase due to increasing number of hops. The four points I cycled in red might be outliers, according to the testing results shown in appendix, the hop count testing using traceroute is fail, as all of these four hosts cannot be detected another hops after the certain two hops. So that it is hard to find a specific correlation between BDP and hop count through this experiment result.

Ans 4.4 Looking at Fig <4.4.1> and the result achieved in section 4 of the appendix.

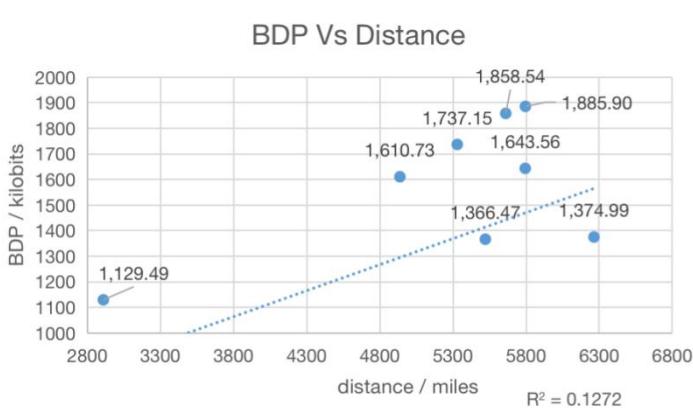


Fig. 4.4.1

From this figure, we can easily find that the value of BDP grows up with the increase of distance. Since, according to the correlation of delay and geography distance detected in Section 3 (i.e., the longer geography distance means the higher delay), plus BDP is the product of data link's capacity and delay. So, when the data link's capacities of all hosts are similar, the extending the geography distance between the sender to the sever will lead to improve the value of BDP.

Ans 4.5

During my experiment, I think the usage of my network including the number of people sharing my network and the number of application executed at the same time will be the major interference factors. Since, it will directly affect the available bandwidth of my network. Also, the geography location might be another variable that will influence my experiment results. As the geographic location of a source indirectly determines its network connectivity^[3].

In order to improve these problems, I think it is necessary to stay my network environment the same as soon as possible during the experiment. Because controlling variables is of great importance in experiments.

References

- [1] dpip. IP geolocation API and database. <https://db-ip.com/>
- [2] FreeMapTools. How Far is it Between. <https://www.freemaptools.com/how-far-is-it-between.htm>
- [3] Subramanian, L. , Arasu, A. , Badrinath, B. R. , Baker, M. , & Wood, D. . (2002). On inferring the geographic properties of the internet. Masters Thesis.
- [4] Lifeng Zhang & Celimuge Wu & Tsutomu Yoshinaga & Xianfu Chen & Tutomu Murase & Yusheng Ji, 2017 ‘Multihop Data Delivery Virtualization for Green Decentralized IoT’, Wireless Communications and Mobile Computing, vol. 2017, <https://doi.org/10.1155/2017/9805784>.

Appendix

Section 2

➤ traceroute -nw1 bouygues.testdebit.info

```
(base) yuhandan@MacBook-Pro:~ yuhandan$ traceroute -nw1 bouygues.testdebit.info
traceroute to bouygues.testdebit.info (89.84.1.186), 64 hops max, 52 byte packets
 1  192.168.124.1  2.832 ms  1.745 ms  1.729 ms
 2  192.168.1.1  2.956 ms  8.335 ms  31.412 ms
 3  115.224.144.1  16.823 ms  9.851 ms  8.122 ms
 4  61.175.183.14  4.898 ms  4.939 ms  7.762 ms
 5  * 61.175.183.133  18.999 ms
 220.187.251.37  15.479 ms
 6  202.97.102.33  16.645 ms
 202.97.101.185  12.843 ms
 202.97.101.201  11.749 ms
 7  202.97.57.157  19.248 ms
 202.97.24.166  32.354 ms
 202.97.24.254  12.394 ms
 8  202.97.12.210  14.812 ms
 202.97.12.186  11.541 ms *
 9  202.97.52.250  182.320 ms
 202.97.89.133  308.111 ms
 202.97.52.250  226.381 ms
10  38.104.138.105  303.478 ms  185.255 ms  307.624 ms
11  154.54.43.13  223.638 ms  153.491 ms
 154.54.43.9  247.360 ms
12  154.54.44.142  316.126 ms
 154.54.44.138  190.141 ms  202.086 ms
13  154.54.42.98  205.431 ms
 154.54.41.146  426.189 ms *
14  154.54.5.90  318.098 ms  297.944 ms
 154.54.31.90  205.276 ms
15  154.54.42.166  310.918 ms
 154.54.44.170  322.917 ms  424.163 ms
16  154.54.7.130  294.258 ms
 154.54.6.222  305.956 ms  224.516 ms
17  154.54.29.174  378.878 ms
 154.54.26.130  410.844 ms
 154.54.29.174  442.376 ms
18  154.54.41.62  397.002 ms
 154.54.40.62  379.269 ms
 154.54.0.222  407.717 ms
19  154.54.30.186  418.395 ms
 154.54.42.86  304.642 ms
 154.54.82.37  327.689 ms
20  154.54.56.130  505.977 ms
 154.54.57.70  310.109 ms
 154.54.56.130  302.230 ms
21  130.117.0.166  322.743 ms  335.920 ms
 130.117.1.46  349.863 ms
22  * * *
23  62.34.2.57  322.704 ms  378.513 ms  382.020 ms
24  * * *
25  89.89.101.141  396.581 ms  280.155 ms  441.527 ms
26  89.84.1.186  378.852 ms  410.145 ms  530.015 ms
```

➤ traceroute speedtest.wtnet.de

```
(base) yuhandan@MacBook-Pro:~ yuhandan$ traceroute -nw1 speedtest.wtnet.de
traceroute to speedtest.wtnet.de (213.209.106.95), 64 hops max, 52 byte packets
 1  172.20.10.1  6.617 ms  2.546 ms  1.898 ms
 2  * * *
 3  * 192.168.245.97  56.662 ms  48.280 ms
 4  * * *
 5  * * *
^C
```

➤ Traceroute iperf.astra.in.ua

```
(base) yuhandandeMacBook-Pro:~ yuhandande$ traceroute -nw1 iperf.astra.in.ua
traceroute to iperf.astra.in.ua (193.93.216.52), 64 hops max, 52 byte packets
 1  192.168.124.1  5.306 ms  1.613 ms  2.022 ms
 2  192.168.1.1  2.931 ms  2.302 ms  2.396 ms
 3  115.224.144.1  8.750 ms  36.789 ms  7.322 ms
 4  115.233.167.0  4.663 ms  4.316 ms  4.054 ms
 5  220.187.251.29  9.556 ms
 220.187.251.33  14.563 ms
 220.187.251.29  14.320 ms
 6  202.97.78.61  15.563 ms
 202.97.101.249  15.137 ms  15.813 ms
 7  202.97.57.149  12.368 ms *
 202.97.24.138  37.734 ms
 8  * * 202.97.12.190  13.099 ms
 9  202.97.74.98  299.695 ms
 202.97.61.18  310.104 ms
 202.97.95.190  292.083 ms
10  184.104.193.194  297.781 ms  232.841 ms  378.990 ms
11  184.104.196.233  306.560 ms  307.534 ms  409.693 ms
12  216.66.87.210  306.622 ms  331.326 ms  218.604 ms
13  193.93.218.154  273.776 ms  294.000 ms  419.693 ms
14  193.93.216.52  306.143 ms  224.762 ms  276.965 ms
```

➤ Traceroute ping-90ms.online.net

```
(base) yuhandandeMacBook-Pro:~ yuhandande$ traceroute -nw1 ping-90ms.online.net
traceroute to ping-90ms.online.net (62.210.18.41), 64 hops max, 52 byte packets
 1  192.168.124.1  4.374 ms  2.068 ms  1.822 ms
 2  192.168.1.1  25.173 ms  2.799 ms  5.007 ms
 3  115.224.144.1  6.110 ms  6.888 ms  34.737 ms
 4  115.233.167.2  5.075 ms  5.081 ms  5.875 ms
 5  61.175.183.125  6.981 ms
 220.187.251.41  11.450 ms
 61.175.183.109  10.471 ms
 6  202.97.101.241  12.629 ms
 202.97.23.221  11.692 ms
 202.97.100.233  15.222 ms
 7  * 202.97.83.89  18.870 ms *
 8  * 202.97.12.190  14.837 ms *
 9  202.97.51.206  452.402 ms
 202.97.58.186  217.271 ms
 202.97.58.194  136.804 ms
10  38.104.138.105  276.426 ms  300.760 ms  148.784 ms
11  154.54.43.13  269.726 ms  184.536 ms
 154.54.43.9  234.515 ms
12  154.54.44.142  379.584 ms
 154.54.44.138  224.283 ms  185.494 ms
13  * 154.54.41.146  245.808 ms
 154.54.42.98  188.625 ms
14  154.54.31.90  201.317 ms
 154.54.5.90  334.110 ms
 154.54.31.90  303.484 ms
15  154.54.42.166  298.835 ms  297.416 ms
 154.54.44.170  422.904 ms
16  154.54.7.130  309.478 ms
 154.54.6.222  289.304 ms
 154.54.7.130  203.653 ms
17  154.54.29.174  323.795 ms
 154.54.26.130  392.882 ms
 154.54.29.174  305.551 ms
18  154.54.40.62  296.179 ms
 66.28.4.238  336.322 ms
 154.54.41.62  297.882 ms
19  154.54.30.186  316.067 ms
 154.54.42.86  406.491 ms  432.407 ms
20  154.54.56.130  373.531 ms
 154.54.57.70  409.530 ms
 154.54.56.130  305.618 ms
21  154.54.38.66  410.533 ms  423.164 ms
 154.54.61.22  403.604 ms
22  154.54.61.26  421.602 ms  492.181 ms  314.717 ms
23  149.6.164.42  402.048 ms
 149.6.165.66  410.350 ms
 149.6.164.42  429.390 ms
24  51.158.1.37  409.226 ms
 51.158.1.43  389.494 ms  409.303 ms
25  195.154.1.105  408.413 ms
 195.154.1.107  362.431 ms
 195.154.1.105  356.165 ms
26  62.210.18.41  547.746 ms  475.497 ms  410.837 ms
```

➤ Traceroute iperf.scottlinux.com

```
(base) yuhandandeMacBook-Pro:~ yuhandan$ traceroute -nw1 iperf.scottlinux.com
traceroute to iperf.scottlinux.com (45.33.39.39), 64 hops max, 52 byte packets
 1  192.168.124.1  18.012 ms  2.010 ms  1.641 ms
 2  192.168.1.1  2.702 ms  5.683 ms  2.766 ms
 3  115.224.144.1  19.807 ms  7.074 ms  48.228 ms
 4  61.175.183.160  4.723 ms  4.341 ms  4.068 ms
 5  * 61.175.183.129  22.880 ms *
 6  202.97.102.17  21.829 ms
 202.97.97.209  135.138 ms
 202.97.100.245  15.524 ms
 7  202.97.24.198  44.625 ms
 202.97.85.49  17.754 ms
 202.97.24.230  16.198 ms
 8  202.97.85.22  19.052 ms
 202.97.83.22  13.555 ms
 202.97.12.186  12.147 ms
 9  202.97.89.133  167.096 ms
 202.97.52.250  134.397 ms
 202.97.89.133  146.231 ms
10  218.30.54.182  239.792 ms  195.972 ms  308.952 ms
11  62.115.172.133  215.183 ms  157.546 ms  252.470 ms
12  173.230.159.85  195.156 ms
 173.230.159.87  204.577 ms
 173.230.159.71  210.420 ms
13  45.33.39.39  197.827 ms !X  221.515 ms !X  188.028 ms !X
```

➤ Traceroute speedtest.serverius.net

```
(base) yuhandandeMacBook-Pro:~ yuhandan$ traceroute -n -m 30 -w 1 speedtest.serverius.net
traceroute to speedtest.serverius.net (178.21.16.76), 30 hops max, 52 byte packets
 1  192.168.124.1  26.589 ms  1.971 ms  2.057 ms
 2  192.168.1.1  3.155 ms  2.880 ms  4.215 ms
 3  115.224.144.1  8.333 ms  12.924 ms  5.582 ms
 4  * * *
 5  61.175.183.137  10.204 ms
 61.175.183.133  9.974 ms
 220.187.251.37  10.328 ms
 6  202.97.101.245  20.028 ms
 202.97.101.225  22.252 ms
 202.97.101.221  13.128 ms
 7  202.97.24.226  8.368 ms
 202.97.57.17  18.257 ms *
 8  * 202.97.12.190  17.008 ms
 202.97.83.22  12.425 ms
 9  202.97.52.250  212.917 ms
 202.97.58.202  468.007 ms
 202.97.58.206  308.225 ms
10  * * *
11  154.54.43.13  283.275 ms
 154.54.43.9  301.724 ms  294.601 ms
12  154.54.44.138  168.896 ms  245.386 ms  200.186 ms
13  154.54.42.98  408.967 ms
 154.54.41.146  224.993 ms
 154.54.42.98  185.056 ms
14  154.54.31.90  307.207 ms  228.970 ms  301.496 ms
15  154.54.44.170  325.905 ms
 154.54.42.166  273.933 ms  430.598 ms
16  154.54.6.222  209.377 ms
 154.54.7.130  499.673 ms
 154.54.6.222  298.614 ms
17  154.54.26.130  419.386 ms *  436.738 ms
18  154.54.0.222  384.827 ms  410.177 ms
 66.28.4.238  658.607 ms
19  154.54.42.86  364.945 ms
 154.54.82.37  526.059 ms
 154.54.42.86  399.507 ms
20  130.117.51.42  317.196 ms  418.376 ms
 154.54.56.94  494.423 ms
21  130.117.1.10  301.611 ms
 130.117.49.30  307.311 ms  329.217 ms
22  149.11.39.187  307.310 ms
 149.14.140.187  316.969 ms  479.728 ms
23  185.8.179.33  307.362 ms  409.681 ms  613.807 ms
24  * * *
25  * * *
26  * * *
27  * * *
28  * * *
29  * * *
30  * * *
```

➤ Traceroute iperf.volia.net

```
(base) yuhandandeMacBook-Pro:~ yuhandan$ traceroute -nw1 iperf.volia.net
traceroute to speedtest.volia.net (77.120.3.236), 64 hops max, 52 byte packets
 1  192.168.124.1  3.495 ms  1.895 ms  1.705 ms
 2  192.168.1.1  5.563 ms  30.488 ms  3.620 ms
 3  115.224.144.1  189.950 ms  307.852 ms  62.986 ms
 4  115.233.167.0  4.160 ms  3.984 ms  5.292 ms
 5  61.175.183.121  6.564 ms *  48.889 ms
 6  202.97.101.225  11.307 ms
 202.97.101.5  11.482 ms
 202.97.33.249  12.549 ms
 7  * 202.97.94.237  34.875 ms *
 8  202.97.12.194  41.907 ms
 202.97.12.201  13.797 ms *
 9  202.97.89.133  229.729 ms
 202.97.52.250  213.764 ms
 202.97.89.133  194.868 ms
10  * * *
11  154.54.43.13  162.585 ms
 154.54.43.9  230.561 ms  296.731 ms
12  154.54.44.138  194.120 ms
 154.54.44.142  226.369 ms  192.347 ms
13  154.54.42.98  181.696 ms  231.561 ms  295.355 ms
14  154.54.5.90  303.617 ms  303.227 ms  309.306 ms
15  154.54.42.166  307.127 ms  334.903 ms
 154.54.44.170  300.534 ms
16  154.54.7.130  302.333 ms
 154.54.6.222  300.940 ms  296.609 ms
17  154.54.26.130  428.656 ms
 154.54.29.174  416.577 ms
 154.54.26.130  388.852 ms
18  154.54.0.222  330.944 ms
 154.54.41.62  385.739 ms
 154.54.40.62  334.431 ms
19  154.54.82.33  294.356 ms
 154.54.42.86  497.568 ms  296.645 ms
20  130.117.51.42  259.534 ms  468.167 ms
 154.54.56.94  305.628 ms
21  130.117.0.142  243.771 ms  273.963 ms
 130.117.0.122  425.230 ms
22  154.54.36.254  296.760 ms  298.561 ms  306.379 ms
23  154.54.58.6  305.951 ms  308.110 ms
 154.54.59.181  307.671 ms
24  154.54.59.85  408.719 ms
 154.54.59.186  307.521 ms  242.930 ms
25  154.54.60.206  336.350 ms  361.401 ms  294.334 ms
26  149.6.190.26  338.485 ms  388.958 ms  291.466 ms
27  77.120.1.123  419.937 ms  419.798 ms  294.810 ms
28  77.120.1.49  425.317 ms  384.964 ms  514.647 ms
29  77.120.3.236  425.467 ms  415.905 ms  385.515 ms
```

➤ Traceroute lille.testdebit.info

```
(base) yuhandandeMacBook-Pro:~ yuhandan$ traceroute -nw1 lille.testdebit.info
traceroute to lille.testdebit.info (89.84.1.234), 64 hops max, 52 byte packets
 1  172.20.10.1  56.606 ms  131.300 ms  25.371 ms
 2  * * *
 3  * * 192.168.245.97  72.252 ms
 4  * * *
 5  * * *
 6  * * *
 7  * * *
 8  * * *
 9  * * *
^C
```

➤ Traceroute ping.online.net

```
(base) yuhandandeMacBook-Pro:~ yuhandan$ traceroute -nw1 ping.online.net
traceroute to ping.online.net (62.210.18.40), 64 hops max, 52 byte packets
 1  172.20.10.1  27.154 ms  1.972 ms  1.790 ms
 2  * * *
 3  192.168.245.97  61.075 ms  42.778 ms  24.987 ms
 4  * * *
 5  * * *
 6  * * *
 7  * * *
 8  * * ^C
```

➤ Traceroute iperf.scottlinux.com

```
(base) yuhandandeMacBook-Pro:~ yuhandan$ traceroute -nw1 iperf.scottlinux.com
traceroute to iperf.scottlinux.com (45.33.39.39), 64 hops max, 52 byte packets
 1  172.20.10.1  12.032 ms  1.815 ms  1.838 ms
 2  * * *
 3  * 192.168.245.97  57.493 ms  22.677 ms
 4  192.168.230.145  33.002 ms  43.288 ms  34.608 ms
 5  * * *
 6  * * *
 7  * * *
^C
```

Calculation and recording

Host	ip	Location	distance/miles	hop count
bouygues.testdebit.info	89.84.1.186	France	5794.10	26
speedtest.wtnet.de	213.209.106.95	Germany	5329.35	3
iperf.astra.in.ua	193.93.216.52	Ukraine	4937.05	14
ping-90ms.online.net	62.210.18.41	France	5795.30	26
iperf.scottlinux.com	45.33.39.39	USA	6263.99	13
speedtest.serverius.net	178.21.16.76	Netherlands	5521.15	23
iperf.volia.net	77.120.3.236	Ukraine	4654.88	29
lille.testdebit.info	89.84.1.234	France	5660.80	3
ping.online.net	62.210.18.40	France	5795.30	3
speedtest.uztelecom.uz	195.158.0.242	Uzbekistan	2909.34	3

Section 3

➤ ping bouygues.testdebit.info

```
(base) yuhandandeMacBook-Pro:~ yuhandan$ 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=47 time=438.813 ms
64 bytes from 89.84.1.186: icmp_seq=1 ttl=47 time=445.704 ms
64 bytes from 89.84.1.186: icmp_seq=2 ttl=47 time=463.529 ms
64 bytes from 89.84.1.186: icmp_seq=3 ttl=47 time=404.620 ms
^C
--- bouygues.testdebit.info ping statistics ---
4 packets transmitted, 4 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 404.620/438.167/463.529/21.365 ms
(base) yuhandandeMacBook-Pro:~ yuhandan$ 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=47 time=303.356 ms
64 bytes from 89.84.1.186: icmp_seq=1 ttl=47 time=317.227 ms
64 bytes from 89.84.1.186: icmp_seq=2 ttl=47 time=335.567 ms
64 bytes from 89.84.1.186: icmp_seq=3 ttl=47 time=352.768 ms
^C
--- bouygues.testdebit.info ping statistics ---
4 packets transmitted, 4 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 303.356/327.229/352.768/18.653 ms
(base) yuhandandeMacBook-Pro:~ yuhandan$ 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=47 time=326.473 ms
64 bytes from 89.84.1.186: icmp_seq=1 ttl=47 time=442.978 ms
64 bytes from 89.84.1.186: icmp_seq=2 ttl=47 time=390.730 ms
64 bytes from 89.84.1.186: icmp_seq=3 ttl=47 time=404.376 ms
^C
--- bouygues.testdebit.info ping statistics ---
4 packets transmitted, 4 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 326.473/391.139/442.978/41.965 ms
```

➤ ping speedtest.wtnet.de

```
(base) yuhandandeMacBook-Pro:~ yuhandan$ ping speedtest.wtnet.de
PING speedtest.wtnet.de (213.209.106.95): 56 data bytes
64 bytes from 213.209.106.95: icmp_seq=0 ttl=52 time=296.413 ms
64 bytes from 213.209.106.95: icmp_seq=1 ttl=52 time=319.325 ms
64 bytes from 213.209.106.95: icmp_seq=2 ttl=52 time=343.139 ms
64 bytes from 213.209.106.95: icmp_seq=3 ttl=52 time=285.257 ms
^C
--- speedtest.wtnet.de ping statistics ---
4 packets transmitted, 4 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 285.257/311.034/343.139/22.236 ms
(base) yuhandandeMacBook-Pro:~ yuhandan$ ping speedtest.wtnet.de
PING speedtest.wtnet.de (213.209.106.95): 56 data bytes
64 bytes from 213.209.106.95: icmp_seq=0 ttl=52 time=268.223 ms
64 bytes from 213.209.106.95: icmp_seq=1 ttl=52 time=342.957 ms
64 bytes from 213.209.106.95: icmp_seq=2 ttl=52 time=358.582 ms
64 bytes from 213.209.106.95: icmp_seq=3 ttl=52 time=272.225 ms
^C
--- speedtest.wtnet.de ping statistics ---
4 packets transmitted, 4 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 268.223/310.497/358.582/40.674 ms
(base) yuhandandeMacBook-Pro:~ yuhandan$ ping speedtest.wtnet.de
PING speedtest.wtnet.de (213.209.106.95): 56 data bytes
64 bytes from 213.209.106.95: icmp_seq=0 ttl=52 time=295.634 ms
64 bytes from 213.209.106.95: icmp_seq=1 ttl=52 time=257.658 ms
64 bytes from 213.209.106.95: icmp_seq=2 ttl=52 time=324.490 ms
64 bytes from 213.209.106.95: icmp_seq=3 ttl=52 time=362.987 ms
^C
--- speedtest.wtnet.de ping statistics ---
4 packets transmitted, 4 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 257.658/310.192/362.987/38.612 ms
```

➤ ping iperf.astra.in.ua

```
(base) yuhandandeMacBook-Pro:~ yuhandan$ 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=51 time=343.564 ms
64 bytes from 193.93.216.52: icmp_seq=1 ttl=51 time=264.901 ms
64 bytes from 193.93.216.52: icmp_seq=2 ttl=51 time=285.323 ms
64 bytes from 193.93.216.52: icmp_seq=3 ttl=51 time=336.110 ms
^C
--- iperf.astra.in.ua ping statistics ---
4 packets transmitted, 4 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 264.901/307.475/343.564/33.263 ms
(base) yuhandandeMacBook-Pro:~ yuhandan$ 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=51 time=267.760 ms
64 bytes from 193.93.216.52: icmp_seq=1 ttl=51 time=284.284 ms
64 bytes from 193.93.216.52: icmp_seq=2 ttl=51 time=306.434 ms
64 bytes from 193.93.216.52: icmp_seq=3 ttl=51 time=323.724 ms
^C
--- iperf.astra.in.ua ping statistics ---
4 packets transmitted, 4 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 267.760/295.550/323.724/21.281 ms
(base) yuhandandeMacBook-Pro:~ yuhandan$ 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=51 time=340.162 ms
64 bytes from 193.93.216.52: icmp_seq=1 ttl=51 time=355.554 ms
64 bytes from 193.93.216.52: icmp_seq=2 ttl=51 time=371.100 ms
64 bytes from 193.93.216.52: icmp_seq=3 ttl=51 time=509.138 ms
^C
--- iperf.astra.in.ua ping statistics ---
4 packets transmitted, 4 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 340.162/393.988/509.138/67.375 ms
```

➤ ping ping-90ms.online.net

```
(base) yuhandandeMacBook-Pro:~ yuhandan$ 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=47 time=477.896 ms
64 bytes from 62.210.18.41: icmp_seq=1 ttl=47 time=400.013 ms
64 bytes from 62.210.18.41: icmp_seq=2 ttl=47 time=456.010 ms
64 bytes from 62.210.18.41: icmp_seq=3 ttl=47 time=385.108 ms
^C
--- ping-90ms.online.net ping statistics ---
5 packets transmitted, 4 packets received, 20.0% packet loss
round-trip min/avg/max/stddev = 385.108/429.757/477.896/38.356 ms
(base) yuhandandeMacBook-Pro:~ yuhandan$ 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=47 time=427.692 ms
64 bytes from 62.210.18.41: icmp_seq=1 ttl=47 time=464.758 ms
64 bytes from 62.210.18.41: icmp_seq=2 ttl=47 time=428.590 ms
64 bytes from 62.210.18.41: icmp_seq=3 ttl=47 time=501.288 ms
^C
--- ping-90ms.online.net ping statistics ---
5 packets transmitted, 4 packets received, 20.0% packet loss
round-trip min/avg/max/stddev = 427.692/455.582/501.288/30.330 ms
(base) yuhandandeMacBook-Pro:~ yuhandan$ 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=47 time=449.934 ms
64 bytes from 62.210.18.41: icmp_seq=1 ttl=47 time=402.433 ms
64 bytes from 62.210.18.41: icmp_seq=2 ttl=47 time=429.970 ms
64 bytes from 62.210.18.41: icmp_seq=3 ttl=47 time=447.441 ms
^C
--- ping-90ms.online.net ping statistics ---
4 packets transmitted, 4 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 402.433/432.445/449.934/18.958 ms
```

➤ ping iperf.scottlinux.com

```
(base) yuhandandeMacBook-Pro:~ yuhandan$ ping iperf.scottlinux.com
PING iperf.scottlinux.com (45.33.39.39): 56 data bytes
64 bytes from 45.33.39.39: icmp_seq=0 ttl=49 time=151.640 ms
64 bytes from 45.33.39.39: icmp_seq=1 ttl=49 time=154.954 ms
64 bytes from 45.33.39.39: icmp_seq=2 ttl=49 time=147.292 ms
64 bytes from 45.33.39.39: icmp_seq=3 ttl=49 time=149.329 ms
^C
--- iperf.scottlinux.com ping statistics ---
4 packets transmitted, 4 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 147.292/150.804/154.954/2.847 ms
(base) yuhandandeMacBook-Pro:~ yuhandan$ ping iperf.scottlinux.com
PING iperf.scottlinux.com (45.33.39.39): 56 data bytes
64 bytes from 45.33.39.39: icmp_seq=0 ttl=49 time=227.616 ms
64 bytes from 45.33.39.39: icmp_seq=1 ttl=49 time=258.418 ms
64 bytes from 45.33.39.39: icmp_seq=2 ttl=49 time=265.317 ms
64 bytes from 45.33.39.39: icmp_seq=3 ttl=49 time=284.093 ms
^C
--- iperf.scottlinux.com ping statistics ---
4 packets transmitted, 4 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 227.616/258.861/284.093/20.339 ms
(base) yuhandandeMacBook-Pro:~ yuhandan$ ping iperf.scottlinux.com
PING iperf.scottlinux.com (45.33.39.39): 56 data bytes
64 bytes from 45.33.39.39: icmp_seq=0 ttl=49 time=257.824 ms
64 bytes from 45.33.39.39: icmp_seq=1 ttl=49 time=175.621 ms
64 bytes from 45.33.39.39: icmp_seq=2 ttl=49 time=229.706 ms
64 bytes from 45.33.39.39: icmp_seq=3 ttl=49 time=243.160 ms
^C
--- iperf.scottlinux.com ping statistics ---
4 packets transmitted, 4 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 175.621/226.578/257.824/31.055 ms
```

➤ ping speedtest.serverius.net

```
(base) yuhandandeMacBook-Pro:~ yuhandan$ 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=310.463 ms
64 bytes from 178.21.16.76: icmp_seq=1 ttl=51 time=260.197 ms
64 bytes from 178.21.16.76: icmp_seq=2 ttl=51 time=375.745 ms
64 bytes from 178.21.16.76: icmp_seq=3 ttl=51 time=393.389 ms
^C
--- speedtest.serverius.net ping statistics ---
4 packets transmitted, 4 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 260.197/334.949/393.389/53.073 ms
(base) yuhandandeMacBook-Pro:~ yuhandan$ 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=319.697 ms
64 bytes from 178.21.16.76: icmp_seq=1 ttl=51 time=334.622 ms
64 bytes from 178.21.16.76: icmp_seq=2 ttl=51 time=307.543 ms
64 bytes from 178.21.16.76: icmp_seq=3 ttl=51 time=268.869 ms
^C
--- speedtest.serverius.net ping statistics ---
4 packets transmitted, 4 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 268.869/307.683/334.622/24.375 ms
(base) yuhandandeMacBook-Pro:~ yuhandan$ 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=436.032 ms
64 bytes from 178.21.16.76: icmp_seq=1 ttl=51 time=340.938 ms
64 bytes from 178.21.16.76: icmp_seq=2 ttl=51 time=255.674 ms
64 bytes from 178.21.16.76: icmp_seq=3 ttl=51 time=294.838 ms
^C
--- speedtest.serverius.net ping statistics ---
4 packets transmitted, 4 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 255.674/331.870/436.032/67.285 ms
```

➤ ping iperf.volia.net

```
(base) yuhandandeMacBook-Pro:~ yuhandan$ ping iperf.volia.net
PING speedtest.volia.net (77.120.3.236): 56 data bytes
64 bytes from 77.120.3.236: icmp_seq=0 ttl=50 time=326.553 ms
64 bytes from 77.120.3.236: icmp_seq=1 ttl=50 time=332.113 ms
64 bytes from 77.120.3.236: icmp_seq=2 ttl=50 time=279.814 ms
64 bytes from 77.120.3.236: icmp_seq=3 ttl=50 time=331.829 ms
64 bytes from 77.120.3.236: icmp_seq=4 ttl=50 time=279.786 ms
^C
--- speedtest.volia.net ping statistics ---
6 packets transmitted, 5 packets received, 16.7% packet loss
round-trip min/avg/max/stddev = 279.786/310.019/332.113/24.753 ms
(base) yuhandandeMacBook-Pro:~ yuhandan$ ping iperf.volia.net
PING speedtest.volia.net (77.120.3.236): 56 data bytes
64 bytes from 77.120.3.236: icmp_seq=0 ttl=50 time=343.530 ms
64 bytes from 77.120.3.236: icmp_seq=1 ttl=50 time=366.451 ms
64 bytes from 77.120.3.236: icmp_seq=2 ttl=50 time=284.325 ms
64 bytes from 77.120.3.236: icmp_seq=3 ttl=50 time=279.402 ms
64 bytes from 77.120.3.236: icmp_seq=4 ttl=50 time=284.671 ms
^C
--- speedtest.volia.net ping statistics ---
6 packets transmitted, 5 packets received, 16.7% packet loss
round-trip min/avg/max/stddev = 279.402/311.676/366.451/36.150 ms
(base) yuhandandeMacBook-Pro:~ yuhandan$ ping iperf.volia.net
PING speedtest.volia.net (77.120.3.236): 56 data bytes
64 bytes from 77.120.3.236: icmp_seq=0 ttl=50 time=342.937 ms
64 bytes from 77.120.3.236: icmp_seq=1 ttl=50 time=284.053 ms
64 bytes from 77.120.3.236: icmp_seq=2 ttl=50 time=283.747 ms
64 bytes from 77.120.3.236: icmp_seq=3 ttl=50 time=279.843 ms
64 bytes from 77.120.3.236: icmp_seq=4 ttl=50 time=282.921 ms
^C
--- speedtest.volia.net ping statistics ---
5 packets transmitted, 5 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 279.843/294.700/342.937/24.164 ms
```

➤ ping lille.testdebit.info

```

[(base) yuhandandeMacBook-Pro:~ yuhandan$ ping lille.testdebit.info
PING lille.testdebit.info (89.84.1.234): 56 data bytes
64 bytes from 89.84.1.234: icmp_seq=0 ttl=41 time=371.458 ms
64 bytes from 89.84.1.234: icmp_seq=1 ttl=41 time=309.771 ms
64 bytes from 89.84.1.234: icmp_seq=2 ttl=41 time=652.190 ms
^C
--- lille.testdebit.info ping statistics ---
4 packets transmitted, 3 packets received, 25.0% packet loss
round-trip min/avg/max/stddev = 309.771/444.473/652.190/149.021 ms
[(base) yuhandandeMacBook-Pro:~ yuhandan$ ping lille.testdebit.info
PING lille.testdebit.info (89.84.1.234): 56 data bytes
64 bytes from 89.84.1.234: icmp_seq=0 ttl=41 time=419.714 ms
64 bytes from 89.84.1.234: icmp_seq=1 ttl=41 time=326.639 ms
64 bytes from 89.84.1.234: icmp_seq=2 ttl=41 time=466.612 ms
^C
--- lille.testdebit.info ping statistics ---
4 packets transmitted, 3 packets received, 25.0% packet loss
round-trip min/avg/max/stddev = 326.639/404.322/466.612/58.171 ms
[(base) yuhandandeMacBook-Pro:~ yuhandan$ ping lille.testdebit.info
PING lille.testdebit.info (89.84.1.234): 56 data bytes
64 bytes from 89.84.1.234: icmp_seq=0 ttl=41 time=616.793 ms
64 bytes from 89.84.1.234: icmp_seq=1 ttl=41 time=456.168 ms
64 bytes from 89.84.1.234: icmp_seq=2 ttl=41 time=375.776 ms
64 bytes from 89.84.1.234: icmp_seq=3 ttl=41 time=302.802 ms
^C
--- lille.testdebit.info ping statistics ---
4 packets transmitted, 4 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 302.802/437.885/616.793/116.670 ms

```

➤ ping ping.online.net

```

(base) yuhandandeMacBook-Pro:~ yuhandan$ ping ping.online.net
PING ping.online.net (62.210.18.40): 56 data bytes
64 bytes from 62.210.18.40: icmp_seq=0 ttl=37 time=495.469 ms
64 bytes from 62.210.18.40: icmp_seq=1 ttl=37 time=411.261 ms
64 bytes from 62.210.18.40: icmp_seq=2 ttl=37 time=510.951 ms
^C
--- ping.online.net ping statistics ---
4 packets transmitted, 3 packets received, 25.0% packet loss
round-trip min/avg/max/stddev = 411.261/472.560/510.951/43.804 ms
[(base) yuhandandeMacBook-Pro:~ yuhandan$ ping ping.online.net
PING ping.online.net (62.210.18.40): 56 data bytes
64 bytes from 62.210.18.40: icmp_seq=0 ttl=37 time=353.869 ms
Request timeout for icmp_seq 1
64 bytes from 62.210.18.40: icmp_seq=2 ttl=37 time=460.164 ms
64 bytes from 62.210.18.40: icmp_seq=3 ttl=37 time=492.999 ms
^C
--- ping.online.net ping statistics ---
5 packets transmitted, 3 packets received, 40.0% packet loss
round-trip min/avg/max/stddev = 353.869/435.677/492.999/59.380 ms
[(base) yuhandandeMacBook-Pro:~ yuhandan$ ping ping.online.net
PING ping.online.net (62.210.18.40): 56 data bytes
Request timeout for icmp_seq 0
64 bytes from 62.210.18.40: icmp_seq=1 ttl=37 time=452.495 ms
64 bytes from 62.210.18.40: icmp_seq=2 ttl=37 time=454.072 ms
64 bytes from 62.210.18.40: icmp_seq=3 ttl=37 time=478.319 ms
64 bytes from 62.210.18.40: icmp_seq=4 ttl=37 time=320.870 ms
^C
--- ping.online.net ping statistics ---
6 packets transmitted, 4 packets received, 33.3% packet loss
round-trip min/avg/max/stddev = 320.870/426.439/478.319/61.804 ms

```

➤ ping speedtest.uztelecom.uz

```

(base) yuhandandeMacBook-Pro:~ yuhandan$ 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=42 time=505.379 ms
64 bytes from 195.158.0.242: icmp_seq=1 ttl=42 time=613.930 ms
64 bytes from 195.158.0.242: icmp_seq=2 ttl=42 time=635.545 ms
^C
--- speedtest.uztelecom.uz ping statistics ---
4 packets transmitted, 3 packets received, 25.0% packet loss
round-trip min/avg/max/stddev = 505.379/584.951/635.545/56.954 ms
(base) yuhandandeMacBook-Pro:~ yuhandan$ 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=42 time=413.963 ms
64 bytes from 195.158.0.242: icmp_seq=1 ttl=42 time=499.316 ms
64 bytes from 195.158.0.242: icmp_seq=2 ttl=42 time=434.631 ms
^C
--- speedtest.uztelecom.uz ping statistics ---
4 packets transmitted, 3 packets received, 25.0% packet loss
round-trip min/avg/max/stddev = 413.963/449.303/499.316/36.357 ms
(base) yuhandandeMacBook-Pro:~ yuhandan$ 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=42 time=485.415 ms
64 bytes from 195.158.0.242: icmp_seq=1 ttl=42 time=505.086 ms
64 bytes from 195.158.0.242: icmp_seq=2 ttl=42 time=627.512 ms
^C
--- speedtest.uztelecom.uz ping statistics ---
4 packets transmitted, 3 packets received, 25.0% packet loss
round-trip min/avg/max/stddev = 485.415/539.338/627.512/62.864 ms

```

<Calculations>

Host	1st time		2nd time		3rd time		avg-delay/ms	std
	avg-delay	std	avg-delay	std	avg-delay	std		
bouygues.testdebit.info	438.17	21.37	327.23	18.65	391.14	41.97	385.51	27.33
speedtest.wt.net.de	311.03	22.24	310.50	40.67	310.19	38.61	310.57	33.84
iperf.astra.in.ua	307.48	33.26	295.55	21.28	393.99	67.38	332.34	40.64
ping-90ms.online.net	429.76	38.36	455.58	30.33	432.45	18.96	439.26	29.21
iperf.scotlinux.com	150.80	2.85	258.86	20.34	226.58	31.06	212.08	18.08
speedtest.serverius.net	334.95	53.07	307.68	24.38	331.87	67.29	324.83	48.24
iperf.volia.net	310.02	24.75	311.68	36.15	294.70	24.16	305.47	28.36
lille.testdebit.info	444.47	149.02	404.32	58.17	437.89	116.67	428.89	107.95
ping.online.net	472.56	43.80	435.68	59.38	426.44	61.80	444.89	55.00
speedtest.uztelecom.uz	584.95	56.95	449.30	36.36	539.34	62.86	524.53	52.06
Fomular	AV1	S1	AV2	S2	AV3	S3	avg-delay = (AV1+AV2+AV3)/3	avg-std = (S1+S2+S3)/3

Because I can get the standard deviation directly from terminal command, I need only to compute the average of these three round-trips' standard deviation of each host respectively to gain average standard deviation of each host.

Section 4

<Insert Images of results – screenshots of terminal/cmd>

➤ bouygues.testdebit.info

```

(base) yuhandandeMacBook-Pro:~ yuhandan$ /Users/yuhandan/Downloads/iperf3 -c bouygues.testdebit.info
Connecting to host bouygues.testdebit.info, port 5201
[ 6] local 172.20.10.2 port 49502 connected to 89.84.1.186 port 5201
[ ID] Interval Transfer Bandwidth
[ 6]  0.00-1.00  sec  128 KBytes  1.05 Mbits/sec
[ 6]  1.00-2.01  sec  27.9 KBytes  227 Kbytes/sec
[ 6]  2.01-3.01  sec  187 KBytes  1.53 Mbytes/sec
[ 6]  3.01-4.00  sec  1.03 MBytes  8.67 Mbytes/sec
[ 6]  4.00-5.00  sec  2.08 MBytes  17.4 Mbytes/sec
[ 6]  5.00-6.00  sec  107 KBytes  877 Kbytes/sec
[ 6]  6.00-7.00  sec  0.00 Bytes  0.00 bits/sec
[ 6]  7.00-8.00  sec  434 KBytes  3.55 Mbytes/sec
[ 6]  8.00-9.00  sec  522 KBytes  4.27 Mbytes/sec
[ 6]  9.00-10.00 sec  1.40 MBytes  11.8 Mbytes/sec
- - - - -
[ ID] Interval Transfer Bandwidth
[ 6]  0.00-10.00 sec  5.88 MBytes  4.93 Mbytes/sec
[ 6]  0.00-10.00 sec  3.88 MBytes  3.25 Mbytes/sec
                                         sender
                                         receiver
iperf Done.

```

```
(base) yuhandandeMacBook-Pro:~ yuhandan$ /Users/yuhandan/Downloads/iperf3 -c bouygues.testdebit.info
Connecting to host bouygues.testdebit.info, port 5201
[ 6] local 2409:8928:5eac:7cc:cc89:40de:d74d:9e4b port 50276 connected to 2001:860:de01:1100::2 port 5201
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-1.00  sec   132 KBytes  1.08 Mbits/sec
[ 6]  1.00-2.00  sec   20.9 KBytes  171 Kbits/sec
[ 6]  2.00-3.01  sec   159 KBytes  1.30 Mbits/sec
[ 6]  3.01-4.00  sec   904 KBytes  7.44 Mbits/sec
[ 6]  4.00-5.00  sec   1.60 MBytes  13.4 Mbits/sec
[ 6]  5.00-6.00  sec   949 KBytes  7.77 Mbits/sec
[ 6]  6.00-7.00  sec    0.00 Bytes  0.00 bits/sec
[ 6]  7.00-8.00  sec   92.5 KBytes  758 Kbits/sec
[ 6]  8.00-9.00  sec   383 KBytes  3.14 Mbits/sec
[ 6]  9.00-10.00 sec   48.7 KBytes  399 Kbits/sec
[ 6]  0.00-10.00 sec   4.23 MBytes  3.54 Mbits/sec
[ 6]  0.00-10.00 sec   3.02 MBytes  2.53 Mbits/sec
sender
receiver
iperf Done.

(base) yuhandandeMacBook-Pro:~ yuhandan$ /Users/yuhandan/Downloads/iperf3 -c bouygues.testdebit.info
Connecting to host bouygues.testdebit.info, port 5201
[ 6] local 2409:8928:5eac:7cc:cc89:40de:d74d:9e4b port 50287 connected to 2001:860:de01:1100::2 port 5201
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-1.00  sec   132 KBytes  1.08 Mbits/sec
[ 6]  1.00-2.00  sec   17.4 KBytes  143 Kbits/sec
[ 6]  2.00-3.00  sec   94.6 KBytes  775 Kbits/sec
[ 6]  3.00-4.00  sec   548 KBytes  4.49 Mbits/sec
[ 6]  4.00-5.00  sec   1.93 MBytes  16.2 Mbits/sec
[ 6]  5.00-6.00  sec   661 KBytes  5.40 Mbits/sec
[ 6]  6.00-7.00  sec    0.00 Bytes  0.00 bits/sec
[ 6]  7.00-8.00  sec   0.00 Bytes  0.00 bits/sec
[ 6]  8.00-9.00  sec   174 KBytes  1.42 Mbits/sec
[ 6]  9.00-10.00 sec   1.63 MBytes  13.7 Mbits/sec
[ 6]  0.00-10.00 sec   5.15 MBytes  4.32 Mbits/sec
[ 6]  0.00-10.00 sec   3.80 MBytes  3.19 Mbits/sec
sender
receiver
iperf Done.
```

➤ speedtest.wt.net.de

```
(base) yuhandandeMacBook-Pro:~ yuhandan$ /Users/yuhandan/Downloads/iperf3 -c speedtest.wt.net.de
Connecting to host speedtest.wt.net.de, port 5201
[ 6] local 2409:8928:5eac:7cc:cc89:40de:d74d:9e4b port 51883 connected to 2a02:2028:ff00:f9:2 port 5201
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-1.00  sec   132 KBytes  1.08 Mbits/sec
[ 6]  1.00-2.00  sec   18.6 KBytes  152 Kbits/sec
[ 6]  2.00-3.00  sec   122 KBytes  998 Kbits/sec
[ 6]  3.00-4.00  sec   766 KBytes  6.29 Mbits/sec
[ 6]  4.00-5.00  sec   2.20 MBytes  18.5 Mbits/sec
[ 6]  5.00-6.00  sec   456 KBytes  3.73 Mbits/sec
[ 6]  6.00-7.00  sec    0.00 Bytes  0.00 bits/sec
[ 6]  7.00-8.00  sec   454 KBytes  3.72 Mbits/sec
[ 6]  8.00-9.00  sec   1.50 MBytes  12.6 Mbits/sec
[ 6]  9.00-10.00 sec   967 KBytes  7.93 Mbits/sec
[ 6]  0.00-10.00 sec   6.55 MBytes  5.50 Mbits/sec
[ 6]  0.00-10.00 sec   4.70 MBytes  3.95 Mbits/sec
sender
receiver
iperf Done.
```

```
(base) yuhandandeMacBook-Pro:~ yuhandan$ /Users/yuhandan/Downloads/iperf3 -c speedtest.wt.net.de
Connecting to host speedtest.wt.net.de, port 5201
[ 6] local 172.20.10.2 port 51806 connected to 213.209.106.95 port 5201
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-1.00  sec   133 KBytes  1.09 Mbits/sec
[ 6]  1.00-2.00  sec   24.4 KBytes  199 Kbits/sec
[ 6]  2.00-3.01  sec   141 KBytes  1.15 Mbits/sec
[ 6]  3.01-4.00  sec   1.20 MBytes  10.1 Mbits/sec
[ 6]  4.00-5.00  sec   1.97 MBytes  16.5 Mbits/sec
[ 6]  5.00-6.00  sec   385 KBytes  3.14 Mbits/sec
[ 6]  6.00-7.00  sec   906 KBytes  7.42 Mbits/sec
[ 6]  7.00-8.00  sec   1.73 MBytes  14.5 Mbits/sec
[ 6]  8.00-9.00  sec   205 KBytes  1.68 Mbits/sec
[ 6]  9.00-10.00 sec   425 KBytes  3.48 Mbits/sec
[ 6]  0.00-10.00 sec   7.06 MBytes  5.92 Mbits/sec
[ 6]  0.00-10.00 sec   6.34 MBytes  5.32 Mbits/sec
sender
receiver
iperf Done.
```

```
(base) yuhandandeMacBook-Pro:~ yuhandan$ /Users/yuhandan/Downloads/iperf3 -c speedtest.wtnet.de
Connecting to host speedtest.wtnet.de, port 5201
[ 6] local 172.20.10.2 port 51851 connected to 213.209.106.95 port 5201
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-1.00  sec   133 KBytes  1.08 Mbits/sec
[ 6]  1.00-2.00  sec   24.4 KBytes  200 Kbits/sec
[ 6]  2.00-3.00  sec   213 KBytes  1.75 Mbytes/sec
[ 6]  3.00-4.00  sec   904 KBytes  7.39 Mbits/sec
[ 6]  4.00-5.00  sec   1.71 MBytes  14.3 Mbits/sec
[ 6]  5.00-6.00  sec   0.00 Bytes  0.00 bits/sec
[ 6]  6.00-7.00  sec   112 KBytes  918 Kbits/sec
[ 6]  7.00-8.00  sec   1.88 MBytes  15.8 Mbits/sec
[ 6]  8.00-9.00  sec   395 KBytes  3.24 Mbits/sec
[ 6]  9.00-10.00 sec   1.06 MBytes  8.88 Mbits/sec
[ 6]  0.00-10.00 sec   6.39 MBytes  5.36 Mbits/sec
[ 6]  0.00-10.00 sec   5.62 MBytes  4.71 Mbits/sec
sender
receiver

iperf Done.
```

➤ iperf.astra.in.ua

```
(base) yuhandandeMacBook-Pro:~ yuhandan$ /Users/yuhandan/Downloads/iperf3 -c iperf.astra.in.ua
Connecting to host iperf.astra.in.ua, port 5201
[ 6] local 2409:8928:5eac:7cc:cc89:40de:d74d:9e4b port 50455 connected to 2a10:2f40:1::aa port 5201
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-1.00  sec   132 KBytes  1.08 Mbytes/sec
[ 6]  1.00-2.00  sec   40.6 KBytes  333 Kbits/sec
[ 6]  2.00-3.00  sec   472 KBytes  3.88 Mbytes/sec
[ 6]  3.00-4.00  sec   1.94 MBytes  16.3 Mbits/sec
[ 6]  4.00-5.00  sec   1.09 MBytes  9.10 Mbits/sec
[ 6]  5.00-6.00  sec   1.10 MBytes  9.28 Mbits/sec
[ 6]  6.00-7.00  sec   15.9 KBytes  131 Kbits/sec
[ 6]  7.00-8.00  sec   234 KBytes  1.92 Mbits/sec
[ 6]  8.00-9.00  sec   95.1 KBytes  778 Kbits/sec
[ 6]  9.00-10.00 sec   51.0 KBytes  418 Kbits/sec
[ 6]  0.00-10.00 sec   5.15 MBytes  4.32 Mbits/sec
[ 6]  0.00-10.00 sec   3.61 MBytes  3.02 Mbits/sec
sender
receiver

iperf Done.
```

```
(base) yuhandandeMacBook-Pro:~ yuhandan$ /Users/yuhandan/Downloads/iperf3 -c iperf.astra.in.ua
Connecting to host iperf.astra.in.ua, port 5201
[ 6] local 172.20.10.2 port 50438 connected to 193.93.216.52 port 5201
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-1.00  sec   128 KBytes  1.05 Mbits/sec
[ 6]  1.00-2.00  sec   13.0 KBytes  106 Kbits/sec
[ 6]  2.00-3.00  sec   47.4 KBytes  389 Kbits/sec
[ 6]  3.00-4.00  sec   434 KBytes  3.56 Mbits/sec
[ 6]  4.00-5.00  sec   1.16 MBytes  9.73 Mbits/sec
[ 6]  5.00-6.00  sec   1.77 MBytes  14.8 Mbits/sec
[ 6]  6.00-7.00  sec   142 KBytes  1.16 Mbits/sec
[ 6]  7.00-8.00  sec   866 KBytes  7.12 Mbits/sec
[ 6]  8.00-9.00  sec   1.61 MBytes  13.5 Mbits/sec
[ 6]  9.00-10.00 sec   174 KBytes  1.42 Mbits/sec
[ 6]  0.00-10.00 sec   6.30 MBytes  5.28 Mbits/sec
[ 6]  0.00-10.00 sec   4.58 MBytes  3.84 Mbits/sec
sender
receiver

iperf Done.
```

```
(base) yuhandandeMacBook-Pro:~ yuhandan$ /Users/yuhandan/Downloads/iperf3 -c iperf.astra.in.ua
Connecting to host iperf.astra.in.ua, port 5201
[ 6] local 172.20.10.2 port 50166 connected to 193.93.216.52 port 5201
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-1.00  sec   128 KBytes  1.05 Mbits/sec
[ 6]  1.00-2.00  sec   13.0 KBytes  106 Kbits/sec
[ 6]  2.00-3.00  sec   52.9 KBytes  432 Kbits/sec
[ 6]  3.00-4.00  sec   742 KBytes  6.10 Mbits/sec
[ 6]  4.00-5.00  sec   1.93 MBytes  16.2 Mbits/sec
[ 6]  5.00-6.00  sec   587 KBytes  4.80 Mbits/sec
[ 6]  6.00-7.00  sec   0.00 Bytes  0.00 bits/sec
[ 6]  7.00-8.00  sec   393 KBytes  3.22 Mbits/sec
[ 6]  8.00-9.00  sec   858 KBytes  7.03 Mbits/sec
[ 6]  9.00-10.00 sec   1.25 MBytes  10.4 Mbits/sec
[ 6]  0.00-10.00 sec   5.89 MBytes  4.94 Mbits/sec
[ 6]  0.00-10.00 sec   3.89 MBytes  3.26 Mbits/sec
sender
receiver

iperf Done.
```

```
(base) yuhandandeMacBook-Pro:~ yuhandan$ /Users/yuhandan/Downloads/iperf3 -c ping-90ms.online.net
Connecting to host ping-90ms.online.net, port 5201
[ 6] local 172.20.10.2 port 59209 connected to 62.210.18.41 port 5201
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-1.00  sec   133 KBytes  1.09 Mbits/sec
[ 6]  1.00-2.00  sec   21.7 KBytes  178 Kbits/sec
[ 6]  2.00-3.00  sec   28.5 KBytes  233 Kbytes/sec
[ 6]  3.00-4.00  sec   459 KBytes  3.76 Mbits/sec
[ 6]  4.00-5.00  sec   853 KBytes  7.01 Mbits/sec
[ 6]  5.00-6.00  sec   2.33 MBytes  19.6 Mbits/sec
[ 6]  6.00-7.00  sec   355 KBytes  2.90 Mbits/sec
[ 6]  7.00-8.00  sec   2.19 MBytes  18.5 Mbits/sec
[ 6]  8.00-9.00  sec   1.03 MBytes  8.61 Mbits/sec
[ 6]  9.00-10.00 sec   565 KBytes  4.64 Mbits/sec
- - - - -
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-10.00 sec   7.91 MBytes  6.63 Mbits/sec
[ 6]  0.00-10.00 sec   7.29 MBytes  6.12 Mbits/sec
                                         sender
                                         receiver
```

➤ ping-90ms.online.net iperf Done.

```
(base) yuhandandeMacBook-Pro:~ yuhandan$ /Users/yuhandan/Downloads/iperf3 -c ping-90ms.online.net
Connecting to host ping-90ms.online.net, port 5201
[ 6] local 172.20.10.2 port 60291 connected to 62.210.18.41 port 5201
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-1.00  sec   128 KBytes  1.05 Mbits/sec
[ 6]  1.00-2.00  sec   13.0 KBytes  107 Kbits/sec
[ 6]  2.00-3.00  sec   14.9 KBytes  122 Kbits/sec
[ 6]  3.00-4.00  sec   122 KBytes  1.01 Mbits/sec
[ 6]  4.00-5.00  sec   325 KBytes  2.66 Mbits/sec
[ 6]  5.00-6.00  sec   511 KBytes  4.19 Mbits/sec
[ 6]  6.00-7.00  sec   693 KBytes  5.68 Mbits/sec
[ 6]  7.00-8.00  sec   573 KBytes  4.70 Mbits/sec
[ 6]  8.00-9.00  sec   154 KBytes  1.26 Mbits/sec
[ 6]  9.00-10.00 sec   0.00 Bytes  0.00 bits/sec
- - - - -
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-10.00 sec   2.47 MBytes  2.08 Mbits/sec
[ 6]  0.00-10.00 sec   1.42 MBytes  1.19 Mbits/sec
                                         sender
                                         receiver
```

iperf Done.

```
(base) yuhandandeMacBook-Pro:~ yuhandan$ /Users/yuhandan/Downloads/iperf3 -c ping-90ms.online.net
Connecting to host ping-90ms.online.net, port 5201
[ 6] local 172.20.10.2 port 59760 connected to 62.210.18.41 port 5201
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-1.01  sec   128 KBytes  1.04 Mbits/sec
[ 6]  1.01-2.00  sec   1.89 MBytes  15.9 Mbits/sec
[ 6]  2.00-3.00  sec   46.1 KBytes  377 Kbits/sec
[ 6]  3.00-4.00  sec   56.9 KBytes  466 Kbits/sec
[ 6]  4.00-5.00  sec   286 KBytes  2.34 Mbits/sec
[ 6]  5.00-6.00  sec   561 KBytes  4.61 Mbits/sec
[ 6]  6.00-7.00  sec   565 KBytes  4.62 Mbits/sec
[ 6]  7.00-8.00  sec   0.00 Bytes  0.00 bits/sec
[ 6]  8.00-9.00  sec   388 KBytes  3.18 Mbits/sec
[ 6]  9.00-10.00 sec   1.11 MBytes  9.29 Mbits/sec
- - - - -
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-10.00 sec   4.98 MBytes  4.17 Mbits/sec
[ 6]  0.00-10.00 sec   3.74 MBytes  3.14 Mbits/sec
                                         sender
                                         receiver
```

iperf Done.

➤

➤

➤ iperf.scottlinux.com

<Insert Calculations>

```
(base) yuhandandeMacBook-Pro:Downloads yuhandan$ /Users/yuhandan/Downloads/iperf3 -c iperf.s
cottlinux.com
Connecting to host iperf.scottlinux.com, port 5201
[ 6] local 2409:8928:aac:a8e:432:da08:b5c4:6bab port 53338 connected to 2600:3c01::f03c:91f
f:fed5:ed33 port 5201
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-1.00  sec  2.01 MBytes  16.8 Mbits/sec
[ 6]  1.00-2.00  sec  94.0 KBytes  771 Kbytes/sec
[ 6]  2.00-3.00  sec   597 KBytes  4.89 Mbytes/sec
[ 6]  3.00-4.00  sec   1.17 MBytes  9.86 Mbytes/sec
[ 6]  4.00-5.00  sec   262 KBytes  2.15 Mbytes/sec
[ 6]  5.00-6.00  sec   495 KBytes  4.04 Mbytes/sec
[ 6]  6.00-7.00  sec   375 KBytes  3.08 Mbytes/sec
[ 6]  7.00-8.00  sec   691 KBytes  5.66 Mbytes/sec
[ 6]  8.00-9.00  sec   1.33 MBytes  11.2 Mbytes/sec
[ 6]  9.00-10.00 sec   171 KBytes  1.40 Mbytes/sec
- - - - -
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-10.00 sec   7.14 MBytes  5.99 Mbytes/sec
[ 6]  0.00-10.00 sec   6.30 MBytes  5.28 Mbytes/sec
               sender
               receiver
iperf Done.

(base) yuhandandeMacBook-Pro:Downloads yuhandan$ /Users/yuhandan/Downloads/iperf3 -c iperf.s
cottlinux.com
Connecting to host iperf.scottlinux.com, port 5201
[ 6] local 2409:8928:aac:a8e:432:da08:b5c4:6bab port 53348 connected to 2600:3c01::f03c:91f
f:fed5:ed33 port 5201
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-1.00  sec   132 KBytes  1.08 Mbytes/sec
[ 6]  1.00-2.00  sec   182 KBytes  1.49 Mbytes/sec
[ 6]  2.00-3.00  sec   1.53 MBytes  12.9 Mbytes/sec
[ 6]  3.00-4.00  sec   1.42 MBytes  11.9 Mbytes/sec
[ 6]  4.00-5.00  sec   542 KBytes  4.45 Mbytes/sec
[ 6]  5.00-6.00  sec   1.48 MBytes  12.4 Mbytes/sec
[ 6]  6.00-7.00  sec   0.00 Bytes  0.00 bits/sec
[ 6]  7.00-8.00  sec   1.43 MBytes  12.0 Mbytes/sec
[ 6]  8.00-9.00  sec   741 KBytes  6.06 Mbytes/sec
[ 6]  9.00-10.00 sec   735 KBytes  6.01 Mbytes/sec
- - - - -
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-10.00 sec   8.15 MBytes  6.83 Mbytes/sec
[ 6]  0.00-10.00 sec   7.62 MBytes  6.39 Mbytes/sec
               sender
               receiver
iperf Done.

(base) yuhandandeMacBook-Pro:Downloads yuhandan$ /Users/yuhandan/Downloads/iperf3 -c iperf.s
cottlinux.com
Connecting to host iperf.scottlinux.com, port 5201
[ 6] local 2409:8928:aac:a8e:432:da08:b5c4:6bab port 53356 connected to 2600:3c01::f03c:91f
f:fed5:ed33 port 5201
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-1.00  sec   138 KBytes  1.13 Mbytes/sec
[ 6]  1.00-2.00  sec   113 KBytes  926 Kbytes/sec
[ 6]  2.00-3.00  sec   1.78 MBytes  15.0 Mbytes/sec
[ 6]  3.00-4.01  sec   1.25 MBytes  10.4 Mbytes/sec
[ 6]  4.01-5.00  sec   272 KBytes  2.24 Mbytes/sec
[ 6]  5.00-6.00  sec   1.91 MBytes  16.1 Mbytes/sec
[ 6]  6.00-7.00  sec   159 KBytes  1.30 Mbytes/sec
[ 6]  7.00-8.00  sec   69.4 KBytes  569 Kbytes/sec
[ 6]  8.00-9.00  sec   1.84 MBytes  15.4 Mbytes/sec
[ 6]  9.00-10.00 sec   400 KBytes  3.28 Mbytes/sec
- - - - -
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-10.00 sec   7.91 MBytes  6.63 Mbytes/sec
[ 6]  0.00-10.00 sec   6.50 MBytes  5.46 Mbytes/sec
               sender
               receiver
iperf Done.
```

➤ speedtest.serverius.net

```
(base) yuhandandeMacBook-Pro:~ yuhandan$ /Users/yuhandan/Downloads/iperf3 -c speedtest.serverius.net -p 5002
Connecting to host speedtest.serverius.net, port 5002
[ 6] local 172.20.10.2 port 59353 connected to 178.21.16.76 port 5002
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-1.00  sec   133 KBytes  1.09 Mbits/sec
[ 6]  1.00-2.00  sec   24.4 KBytes  200 Kbits/sec
[ 6]  2.00-3.00  sec   516 KBytes  4.23 Mbytes/sec
[ 6]  3.00-4.00  sec   2.01 MBytes  16.9 Mbits/sec
[ 6]  4.00-5.00  sec   995 KBytes  8.15 Mbits/sec
[ 6]  5.00-6.00  sec   435 KBytes  3.57 Mbits/sec
[ 6]  6.00-7.00  sec   1.85 MBytes  15.5 Mbits/sec
[ 6]  7.00-8.00  sec   176 KBytes  1.44 Mbits/sec
[ 6]  8.00-9.00  sec   1.41 MBytes  11.8 Mbits/sec
[ 6]  9.00-10.00 sec   572 KBytes  4.68 Mbits/sec
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-10.00 sec   8.06 MBytes  6.76 Mbits/sec
[ 6]  0.00-10.00 sec   6.06 MBytes  5.08 Mbits/sec
                                         sender
                                         receiver

(base) yuhandandeMacBook-Pro:~ yuhandan$ /Users/yuhandan/Downloads/iperf3 -c speedtest.serverius.net -p 5002
Connecting to host speedtest.serverius.net, port 5002
[ 6] local 172.20.10.2 port 59357 connected to 178.21.16.76 port 5002
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-1.00  sec   133 KBytes  1.09 Mbits/sec
[ 6]  1.00-2.01  sec   24.4 KBytes  199 Kbits/sec
[ 6]  2.01-3.00  sec   432 KBytes  3.56 Mbytes/sec
[ 6]  3.00-4.00  sec   1.98 MBytes  16.6 Mbits/sec
[ 6]  4.00-5.00  sec   796 KBytes  6.54 Mbits/sec
[ 6]  5.00-6.00  sec   0.00 Bytes  0.00 bits/sec
[ 6]  6.00-7.01  sec   0.00 Bytes  0.00 bits/sec
[ 6]  7.01-8.01  sec   0.00 Bytes  0.00 bits/sec
[ 6]  8.01-9.00  sec   0.00 Bytes  0.00 bits/sec
[ 6]  9.00-10.00 sec   0.00 Bytes  0.00 bits/sec
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-10.00 sec   3.33 MBytes  2.80 Mbits/sec
[ 6]  0.00-10.00 sec   1.41 MBytes  1.18 Mbits/sec
                                         sender
                                         receiver

iperf Done.

(base) yuhandandeMacBook-Pro:~ yuhandan$ /Users/yuhandan/Downloads/iperf3 -c speedtest.serverius.net -p 5002
Connecting to host speedtest.serverius.net, port 5002
[ 6] local 172.20.10.2 port 59361 connected to 178.21.16.76 port 5002
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-1.01  sec   133 KBytes  1.08 Mbits/sec
[ 6]  1.01-2.00  sec   24.4 KBytes  201 Kbits/sec
[ 6]  2.00-3.01  sec   242 KBytes  1.97 Mbytes/sec
[ 6]  3.01-4.00  sec   1.32 MBytes  11.1 Mbits/sec
[ 6]  4.00-5.00  sec   1.47 MBytes  12.3 Mbits/sec
[ 6]  5.00-6.00  sec   0.00 Bytes  0.00 bits/sec
[ 6]  6.00-7.00  sec   227 KBytes  1.86 Mbits/sec
[ 6]  7.00-8.00  sec   0.00 Bytes  0.00 bits/sec
[ 6]  8.00-9.01  sec   195 KBytes  1.59 Mbits/sec
[ 6]  9.01-10.00 sec   56.9 KBytes  467 Kbits/sec
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-10.00 sec   3.65 MBytes  3.06 Mbits/sec
[ 6]  0.00-10.00 sec   2.73 MBytes  2.29 Mbits/sec
                                         sender
                                         receiver

iperf Done.
```

➤ iperf.volia.net

```
(base) yuhandandeMacBook-Pro:~ yuhandan$ /Users/yuhandan/Downloads/iperf3 -c iperf.volia.net
Connecting to host iperf.volia.net, port 5201
[ 6] local 172.20.10.2 port 50125 connected to 77.120.3.236 port 5201
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-1.00  sec   137 KBytes  1.12 Mbits/sec
[ 6]  1.00-2.00  sec   67.5 KBytes  552 Kbits/sec
[ 6]  2.00-3.00  sec   598 KBytes  4.91 Mbits/sec
[ 6]  3.00-4.00  sec   2.47 MBytes  20.7 Mbits/sec
[ 6]  4.00-5.00  sec   409 KBytes  3.35 Mbits/sec
[ 6]  5.00-6.00  sec   579 KBytes  4.75 Mbits/sec
[ 6]  6.00-7.00  sec   1.84 MBytes  15.4 Mbits/sec
[ 6]  7.00-8.00  sec   344 KBytes  2.82 Mbits/sec
[ 6]  8.00-9.00  sec   0.00 Bytes   0.00 bits/sec
[ 6]  9.00-10.01 sec   0.00 Bytes   0.00 bits/sec
- - - - -
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-10.01 sec   6.40 MBytes  5.36 Mbits/sec
[ 6]  0.00-10.01 sec   4.52 MBytes  3.79 Mbits/sec
                                         sender
                                         receiver
iperf Done.

(base) yuhandandeMacBook-Pro:~ yuhandan$ /Users/yuhandan/Downloads/iperf3 -c iperf.volia.net
Connecting to host iperf.volia.net, port 5201
[ 6] local 172.20.10.2 port 61817 connected to 77.120.3.236 port 5201
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-1.01  sec   130 KBytes  1.06 Mbits/sec
[ 6]  1.01-2.00  sec   8.13 KBytes  66.7 Kbits/sec
[ 6]  2.00-3.00  sec   8.13 KBytes  66.9 Kbits/sec
[ 6]  3.00-4.00  sec   13.6 KBytes  111 Kbits/sec
[ 6]  4.00-5.01  sec   16.3 KBytes  133 Kbits/sec
[ 6]  5.01-6.00  sec   35.0 KBytes  287 Kbits/sec
[ 6]  6.00-7.00  sec   60.3 KBytes  496 Kbits/sec
[ 6]  7.00-8.01  sec   56.3 KBytes  459 Kbits/sec
[ 6]  8.01-9.00  sec   17.5 KBytes  143 Kbits/sec
[ 6]  9.00-10.00 sec   31.0 KBytes  255 Kbits/sec
- - - - -
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-10.00 sec   376 KBytes  308 Kbits/sec
[ 6]  0.00-10.00 sec   275 KBytes  225 Kbits/sec
                                         sender
                                         receiver
iperf Done.

(base) yuhandandeMacBook-Pro:~ yuhandan$ /Users/yuhandan/Downloads/iperf3 -c iperf.volia.net
Connecting to host iperf.volia.net, port 5201
[ 6] local 172.20.10.2 port 61822 connected to 77.120.3.236 port 5201
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-1.00  sec   130 KBytes  1.06 Mbits/sec
[ 6]  1.00-2.00  sec   10.8 KBytes  88.8 Kbits/sec
[ 6]  2.00-3.00  sec   10.8 KBytes  88.6 Kbits/sec
[ 6]  3.00-4.00  sec   13.6 KBytes  111 Kbits/sec
[ 6]  4.00-5.00  sec   16.3 KBytes  133 Kbits/sec
[ 6]  5.00-6.00  sec   26.8 KBytes  220 Kbits/sec
[ 6]  6.00-7.00  sec   37.6 KBytes  309 Kbits/sec
[ 6]  7.00-8.00  sec   87.0 KBytes  713 Kbits/sec
[ 6]  8.00-9.00  sec   21.7 KBytes  177 Kbits/sec
[ 6]  9.00-10.00 sec   44.5 KBytes  366 Kbits/sec
- - - - -
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-10.00 sec   399 KBytes  327 Kbits/sec
[ 6]  0.00-10.00 sec   305 KBytes  250 Kbits/sec
                                         sender
                                         receiver
iperf Done.
```

➤ lille.testdebit.info

```

(base) yuhandandeMacBook-Pro:~ yuhandan$ /Users/yuhandan/Downloads/iperf3 -c lille.testdebit.info -p 9240
Connecting to host lille.testdebit.info, port 9240
[ 6] local 172.20.10.2 port 60659 connected to 89.84.1.234 port 9240
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-1.00  sec   141 KBytes  1.15 Mbits/sec
[ 6]  1.00-2.00  sec   223 KBytes  1.82 Mbits/sec
[ 6]  2.00-3.00  sec   1.06 MBytes  8.96 Mbits/sec
[ 6]  3.00-4.00  sec   1.76 MBytes 14.8 Mbits/sec
[ 6]  4.00-5.00  sec   496 KBytes  4.05 Mbits/sec
[ 6]  5.00-6.00  sec   0.00 Bytes  0.00 bits/sec
[ 6]  6.00-7.00  sec   747 KBytes  6.11 Mbits/sec
[ 6]  7.00-8.00  sec   699 KBytes  5.74 Mbits/sec
[ 6]  8.00-9.00  sec   1.19 MBytes  9.96 Mbits/sec
[ 6]  9.00-10.00 sec   761 KBytes  6.22 Mbits/sec
- - - - - [ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-10.00 sec  7.01 MBytes  5.88 Mbits/sec
[ 6]  0.00-10.00 sec  5.05 MBytes  4.24 Mbits/sec
sender
receiver

iperf Done.

(base) yuhandandeMacBook-Pro:~ yuhandan$ /Users/yuhandan/Downloads/iperf3 -c lille.testdebit.info -p 9240
Connecting to host lille.testdebit.info, port 9240
[ 6] local 172.20.10.2 port 60670 connected to 89.84.1.234 port 9240
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-1.00  sec   133 KBytes  1.08 Mbits/sec
[ 6]  1.00-2.00  sec   54.2 KBytes 445 Kbytes/sec
[ 6]  2.00-3.00  sec   539 KBytes  4.41 Mbits/sec
[ 6]  3.00-4.00  sec   1.82 MBytes 15.4 Mbits/sec
[ 6]  4.00-5.00  sec   1.24 MBytes 10.3 Mbits/sec
[ 6]  5.00-6.00  sec   743 KBytes  6.08 Mbits/sec
[ 6]  6.00-7.00  sec   0.00 Bytes  0.00 bits/sec
[ 6]  7.00-8.00  sec   946 KBytes  7.72 Mbits/sec
[ 6]  8.00-9.00  sec   851 KBytes  6.98 Mbits/sec
[ 6]  9.00-10.00 sec   0.00 Bytes  0.00 bits/sec
- - - - - [ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-10.00 sec  6.25 MBytes  5.24 Mbits/sec
[ 6]  0.00-10.00 sec  5.75 MBytes  4.82 Mbits/sec
sender
receiver

iperf Done.

(base) yuhandandeMacBook-Pro:~ yuhandan$ /Users/yuhandan/Downloads/iperf3 -c lille.testdebit.info -p 9240
Connecting to host lille.testdebit.info, port 9240
[ 6] local 2409:8928:aac:cd2:7427:87bd:7bce:e7b9 port 60676 connected to 2001:8
60:de12:200::2 port 9240
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-1.00  sec   132 KBytes  1.08 Mbits/sec
[ 6]  1.00-2.00  sec   48.7 KBytes 399 Kbytes/sec
[ 6]  2.00-3.00  sec   371 KBytes  3.05 Mbits/sec
[ 6]  3.00-4.00  sec   893 KBytes  7.31 Mbits/sec
[ 6]  4.00-5.00  sec   0.00 Bytes  0.00 bits/sec
[ 6]  5.00-6.00  sec   0.00 Bytes  0.00 bits/sec
[ 6]  6.00-7.00  sec   607 KBytes  4.97 Mbits/sec
[ 6]  7.00-8.00  sec   0.00 Bytes  0.00 bits/sec
[ 6]  8.00-9.00  sec   0.00 Bytes  0.00 bits/sec
[ 6]  9.00-10.00 sec   27.3 KBytes  224 Kbytes/sec
- - - - - [ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-10.00 sec  2.03 MBytes  1.70 Mbits/sec
[ 6]  0.00-10.00 sec  1.86 MBytes  1.56 Mbits/sec
sender
receiver

iperf Done.

```

➤ ping.online.net

```
(base) yuhandandeMacBook-Pro:~ yuhandan$ /Users/yuhandan/Downloads/iperf3 -c ping.online.net -p 5200
Connecting to host ping.online.net, port 5200
[ 6] local 172.20.10.2 port 61624 connected to 62.210.18.40 port 5200
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-1.34    sec   128 KBytes   782 Kbits/sec
[ 6]  1.34-2.00    sec   2.71 KBytes   33.5 Kbits/sec
[ 6]  2.00-3.00    sec   13.6 KBytes   111 Kbits/sec
[ 6]  3.00-4.00    sec   19.0 KBytes   155 Kbits/sec
[ 6]  4.00-5.00    sec   31.2 KBytes   255 Kbits/sec
[ 6]  5.00-6.00    sec   52.9 KBytes   432 Kbits/sec
[ 6]  6.00-7.00    sec   190 KBytes   1.56 Mbits/sec
[ 6]  7.00-8.00    sec   276 KBytes   2.26 Mbits/sec
[ 6]  8.00-9.00    sec   394 KBytes   3.23 Mbits/sec
[ 6]  9.00-10.00   sec   426 KBytes   3.49 Mbits/sec
[ -----]
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-10.00   sec   1.50 MBytes   1.26 Mbits/sec
[ 6]  0.00-10.00   sec   1.21 MBytes   1.02 Mbits/sec
                                         sender
                                         receiver
iperf Done.

(base) yuhandandeMacBook-Pro:~ yuhandan$ /Users/yuhandan/Downloads/iperf3 -c ping.online.net -p 5200
Connecting to host ping.online.net, port 5200
[ 6] local 172.20.10.2 port 61635 connected to 62.210.18.40 port 5200
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-1.54    sec   128 KBytes   682 Kbits/sec
[ 6]  1.54-2.00    sec   0.00 Bytes   0.00 bits/sec
[ 6]  2.00-3.00    sec   10.3 KBytes   84.1 Kbits/sec
[ 6]  3.00-4.00    sec   13.6 KBytes   111 Kbits/sec
[ 6]  4.00-5.00    sec   129 KBytes   1.06 Mbits/sec
[ 6]  5.00-6.00    sec   297 KBytes   2.43 Mbits/sec
[ 6]  6.00-7.00    sec   847 KBytes   6.96 Mbits/sec
[ 6]  7.00-8.00    sec   767 KBytes   6.26 Mbits/sec
[ 6]  8.00-9.00    sec   574 KBytes   4.71 Mbits/sec
[ 6]  9.00-10.00   sec   5.42 KBytes   44.5 Kbits/sec
[ -----]
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-10.00   sec   2.71 MBytes   2.27 Mbits/sec
[ 6]  0.00-10.00   sec   1.54 MBytes   1.29 Mbits/sec
                                         sender
                                         receiver
iperf Done.

(base) yuhandandeMacBook-Pro:~ yuhandan$ /Users/yuhandan/Downloads/iperf3 -c ping.online.net -p 5209
Connecting to host ping.online.net, port 5209
[ 6] local 172.20.10.2 port 61668 connected to 62.210.18.40 port 5209
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-1.45    sec   128 KBytes   721 Kbits/sec
[ 6]  1.45-2.00    sec   0.00 Bytes   0.00 bits/sec
[ 6]  2.00-3.00    sec   1.89 MBytes   15.8 Mbits/sec
[ 6]  3.00-4.00    sec   47.4 KBytes   389 Kbits/sec
[ 6]  4.00-5.00    sec   62.4 KBytes   510 Kbits/sec
[ 6]  5.00-6.00    sec   203 KBytes   1.67 Mbits/sec
[ 6]  6.00-7.00    sec   279 KBytes   2.29 Mbits/sec
[ 6]  7.00-8.00    sec   320 KBytes   2.62 Mbits/sec
[ 6]  8.00-9.01    sec   137 KBytes   1.12 Mbits/sec
[ 6]  9.01-10.00   sec   0.00 Bytes   0.00 bits/sec
[ -----]
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-10.00   sec   3.04 MBytes   2.55 Mbits/sec
[ 6]  0.00-10.00   sec   1.73 MBytes   1.45 Mbits/sec
                                         sender
                                         receiver
iperf Done.
```

➤ D

```
(base) yuhandandeMacBook-Pro:~ yuhandan$ /Users/yuhandan/Downloads/iperf3 -c spe
edtest.uztelecom.uz -p 5209
Connecting to host speedtest.uztelecom.uz, port 5209
[ 6] local 172.20.10.2 port 61690 connected to 195.158.0.242 port 5209
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-1.00  sec   133 KBytes  1.08 Mbits/sec
[ 6]  1.00-2.00  sec   24.4 KBytes  200 Kbytes/sec
[ 6]  2.00-3.00  sec   207 KBytes  1.70 Mbits/sec
[ 6]  3.00-4.00  sec   585 KBytes  4.79 Mbits/sec
[ 6]  4.00-5.00  sec   442 KBytes  3.62 Mbits/sec
[ 6]  5.00-6.00  sec   741 KBytes  6.07 Mbits/sec
[ 6]  6.00-7.00  sec   230 KBytes  1.88 Mbits/sec
[ 6]  7.00-8.01  sec    0.00 Bytes  0.00 bits/sec
[ 6]  8.01-9.00  sec    0.00 Bytes  0.00 bits/sec
[ 6]  9.00-10.00 sec    0.00 Bytes  0.00 bits/sec
- - - - -
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-10.00 sec   2.31 MBytes  1.94 Mbits/sec
[ 6]  0.00-10.00 sec   1.48 MBytes  1.24 Mbits/sec
                                         sender
                                         receiver
iperf Done.
```

```
(base) yuhandandeMacBook-Pro:~ yuhandan$ /Users/yuhandan/Downloads/iperf3 -c spe
edtest.uztelecom.uz -p 5209
Connecting to host speedtest.uztelecom.uz, port 5209
[ 6] local 2409:8928:aac:cd2:448:bae2:7106:bc3e port 61698 connected to 2a05:45
c7:f000:100::215 port 5209
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-1.00  sec   131 KBytes  1.07 Mbits/sec
[ 6]  1.00-2.00  sec   22.0 KBytes  181 Kbytes/sec
[ 6]  2.00-3.00  sec   366 KBytes  3.00 Mbits/sec
[ 6]  3.00-4.00  sec   596 KBytes  4.87 Mbits/sec
[ 6]  4.00-5.00  sec   641 KBytes  5.26 Mbits/sec
[ 6]  5.00-6.00  sec   403 KBytes  3.30 Mbits/sec
[ 6]  6.00-7.00  sec    0.00 Bytes  0.00 bits/sec
[ 6]  7.00-8.00  sec    0.00 Bytes  0.00 bits/sec
[ 6]  8.00-9.00  sec    0.00 Bytes  0.00 bits/sec
[ 6]  9.00-10.00 sec   591 KBytes  4.84 Mbits/sec
- - - - -
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-10.00 sec   2.69 MBytes  2.25 Mbits/sec
[ 6]  0.00-10.00 sec   2.25 MBytes  1.89 Mbits/sec
                                         sender
                                         receiver
iperf Done.
```

```
(base) yuhandandeMacBook-Pro:~ yuhandan$ /Users/yuhandan/Downloads/iperf3 -c spe
edtest.uztelecom.uz -p 5209
Connecting to host speedtest.uztelecom.uz, port 5209
[ 6] local 172.20.10.2 port 61791 connected to 195.158.0.242 port 5209
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-1.00  sec   133 KBytes  1.09 Mbits/sec
[ 6]  1.00-2.00  sec   24.4 KBytes  200 Kbytes/sec
[ 6]  2.00-3.00  sec   261 KBytes  2.14 Mbits/sec
[ 6]  3.00-4.00  sec   707 KBytes  5.79 Mbits/sec
[ 6]  4.00-5.00  sec   422 KBytes  3.46 Mbits/sec
[ 6]  5.00-6.00  sec   733 KBytes  5.98 Mbits/sec
[ 6]  6.00-7.00  sec    0.00 Bytes  0.00 bits/sec
[ 6]  7.00-8.00  sec    0.00 Bytes  0.00 bits/sec
[ 6]  8.00-9.00  sec    0.00 Bytes  0.00 bits/sec
[ 6]  9.00-10.00 sec   496 KBytes  4.07 Mbits/sec
- - - - -
[ ID] Interval      Transfer     Bandwidth
[ 6]  0.00-10.00 sec   2.71 MBytes  2.27 Mbits/sec
[ 6]  0.00-10.00 sec   2.14 MBytes  1.80 Mbits/sec
                                         sender
                                         receiver
iperf Done.
```

Calculation

Host	avg-delay/ms	avg-bandwidth/mpbs	bandwidth-delay product/kilobits
bouygues.testdebit.info	385.51	4.26	1643.56
speedtest.wt.net.de	310.57	5.59	1737.15
iperf.astra.in.ua	332.34	4.85	1610.73
ping-90ms.online.net	439.26	4.29	1885.90
iperf.scottlinux.com	212.08	6.48	1374.99
speedtest.serverius.net	324.83	4.21	1366.47
iperf.volia.net	305.47	0.36	110.37
lille.testdebit.info	428.89	4.33	1858.54
ping.online.net	444.89	2.03	901.65
speedtest.uztelecom.uz	524.53	2.15	1129.49
Fomular	delay	bandwidth	$BDP = \text{delay} * \text{bandwidth}$