**Project 1 COMP9007 Report, Semester 1, 2021**

**Section 1:**

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**Section 2:**

*Answer to Question 2.1*:

**-n** means to print hop addresses numerically rather than symbolically and numerically (saves a nameserver address-to-name lookup for each gateway found on the path). Sometimes we may encounter a delay at a certain gateway, which may be due to the blocking of gateway or physical device itself. If there is a problem with a DNS, there will be a delay when the host name and domain name cannot be resolved. We can simply add -n parameter to avoid DNS resolution and output data in IP format.

**-w** means to set the time (in seconds) to wait for a response to a probe (default 5 sec depends on OS). The following “**1**” apparently set the default timeout from 5 sec to 1 sec. If not received within the timeout, an asterisk (\*) is displayed. The importance of setting it to ‘1’ might be easier for detector to not wait a long time to trace a large amount of data.

\*All the description of command line arguments -n -w comes from the man page of ‘traceroute’ in zsh

*Answer to Question 2.2*:

|  |  |  |  |
| --- | --- | --- | --- |
| Host | Location | HOP Count | Approx. Distance (km) |
| iperf.he.net | Fremont, USA | 18 | 10482 |
| bouygues.testdebit.info | Meudon, France | 28 | 9614 |
| speedtest.uztelecom.uz | Tashkent, Uzbekistan | 21 | 4851 |
| ikoula.testdebit.info | Reims, France | 21 | 9479 |
| st2.nn.ertelecom.ru | Nizhniy N., Russia | 21 | 6729 |
| iperf.biznetnetworks.com | Jakarta, Indonesia | 21 | 3830 |
| iperf.scottlinux.com | Fremont, USA | 19 | 10482 |
| ping.online.net | Paris, France | 19 | 9605 |
| iperf.volia.net | Kiev, Ukraine | 33 | 7720 |
| ping.netnik.de | Muenster, Germany | 21 | 9100 |

From the investigation above, the most distant host is located at Fremont, USA and its hop count are only 17 (or 18). Compare to the nearest host in Jakarta, Indonesia whose hop count is 20. I didn’t find a correlation between the hop count and geographical distance between two hosts, so I assume geographical distance only has a weak correlation with hop count. The rationale behind might be that I can easily buy 10 routers and add a network of 10 hops from the same path to destination server.

\*Appendix Section B: file host\_list, shell script hop\_count.sh and raw data from hop\_count.sh

\*no.3 and no.8 hosts are alternative hosts, and no.10 was choosing by editor

\*https://www.site24x7.com/findwebsite-location.html

\*https://www.distancecalculator.net/

\*https://iperf.cc

**Section 3:**

*Answer to Question 3.1*:

|  |  |  |  |
| --- | --- | --- | --- |
| Host | Avg (ms) | Stddev (ms) | Geo. Distance (km) |
| iperf.he.net | 255.25 | 45.87 | 10482 |
| bouygues.testdebit.info | 325.37 | 30.91 | 9614 |
| speedtest.uztelecom.uz | 359.69 | 32.23 | 4851 |
| ikoula.testdebit.info | 251.76 | 35.51 | 9479 |
| st2.nn.ertelecom.ru | 299.01 | 30.83 | 6729 |
| iperf.biznetnetworks.com | 421.52 | 29.38 | 3830 |
| iperf.scottlinux.com | 263.94 | 32.64 | 10482 |
| ping.online.net | 382.38 | 35.63 | 9605 |
| iperf.volia.net | 366.02 | 31.19 | 7720 |
| ping.netnik.de | 287.80 | 26.62 | 9100 |

\*Appendix Section C: shell script avg\_stddev.sh and raw data output from avg\_stddev.sh.

*Answer to Question 3.2*:

I still don’t see a strong correlation between delay and jitter as a function of distance. From definition, jitter is the standard deviation of the round-trip delay time and its correlation with geographical distance might be subjective. From my investigation to the network environment in common, the packets I sent pass through different routers may wait in the queue or even be dropped. If there are people sharing the same network with you, then interface may get filled up which causes a variation in arrival time of the packet.

*Answer to Question 3.3*:

The number of hops and the standard deviation reported by MTR are both quite different with the results obtained from traceroute and ping. I assume the reason behind this situation is related to the different diagnostic strategies. The technology used by MTR is based on route tracing, which is similar to traceroute but has slightly difference. MTR resolves every node that the destination address passes through. However, the computers in different geographical locations will connect to different servers with traceroute and ping. Whether each device along the path will respond to ICMP is determined by the configuration of the device. So, if you use route tracing to analyze the path to destination host, you might not be able to resolve delay or hosts along the path.

\*Appendix Section C: raw data from MTR

**Section 4:**

*Answer to Question 4.1*:

|  |  |  |  |
| --- | --- | --- | --- |
| Host | HOP Count | Mean Bandwidth | Bandwidth-delay Product |
| iperf.he.net | Not working | Not working | Not working |
| bouygues.testdebit.info | 28 | 103 kbps | 33.51 kb |
| speedtest.uztelecom.uz | Not working | Not working | Not working |
| ikoula.testdebit.info | 21 | 105 kbps | 26.43 kb |
| st2.nn.ertelecom.ru | Not working | Not working | Not working |
| iperf.biznetnetworks.com | 21 | 7.69 mbps | 3.24 mb |
| iperf.scottlinux.com | 19 | 6.40 mbps | 1.69 mb |
| ping.online.net | 19 | 5 mbps | 1.91 mb |
| iperf.volia.net | 33 | 69.9 kbps | 25.58 kb |
| ping.netnik.de | Not working | Not working | Not working |

Bandwidth-delay product represents the maximum amount of data that can be passed through specific bandwidth, and it is calculated by the product of a data link’s capacity and its round-trip delay time, which determines the data transmission capability of networks.

\*Appendix Section D:

iperf\_sup, iperf3\_sup (file contains the hosts that support whether iperf and iperf3)

shell script to measure the mean bandwidth and bandwidth-delay product

raw data output from the shell script

*Answer to Question 4.2*:

See chart above. The bandwidth-delay product which is the result comes from the product of a mean bandwidth (data link’s capacity in bits per second) and its round-trip delay time (calculated as mean round-trip delay time in above question in seconds). My current networking environment doesn’t really affect the investigation, because I am the only user of my Wi-Fi, the network congestion could not really happen in my working environment.

*Answer to Question 4.3*:

See chart above. I don’t really see the correlation here, but I am not sure whether it is my problem, because there are 4 hosts not working.

*Answer to Question 4.4*:

If another family member joins in and share the same WIFI with me (share the 100mbps bandwidth), it will affect the measurement of network bandwidth. There might be some physical factors like the wire gets cut-off or interrupted. To set a good network environment for measuring these data (bandwidth, delay, and jitter), I would kick out all my family member outside to share bandwidth and enjoy the exclusive high-speed WI-FI time.

**Appendix:**

Section A:

*Filename: host\_list*

Graphical user interface

Description automatically generated with low confidence

*Shell Script: hop\_count.sh*

Text

Description automatically generated with medium confidence

*Raw Data:*

Text

Description automatically generated

Section B:

*Shell Script: avg\_stddev.sh*

Text

Description automatically generated

*Raw Data:*

Table

Description automatically generated

Section C:

*Raw Data:*

A picture containing text, receipt

Description automatically generatedA picture containing text, receipt

Description automatically generated

A picture containing text, receipt

Description automatically generated

A picture containing text, receipt

Description automatically generated

A picture containing text, receipt

Description automatically generated

A picture containing text, receipt

Description automatically generated

A picture containing text, receipt

Description automatically generated

A close-up of a document

Description automatically generated with low confidence

A picture containing text, receipt

Description automatically generated

A picture containing text, receipt

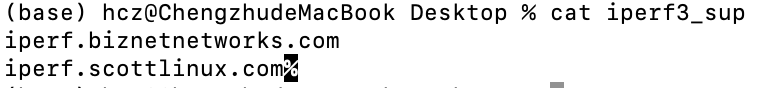
Description automatically generated

Section D:

*Filename: iperf\_sup, iperf3\_sup*

Text

Description automatically generated



*Shell Script:*

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Description automatically generated

A picture containing table

Description automatically generated

A picture containing text, receipt

Description automatically generated

Text

Description automatically generated