CS 2600 Lab 1

Learning Objectives of this Lab:

1. Use some basic internet benchmark tools.
2. See how distance is related to latency.

In this lab, there will be screenshots to take, data to record in a table, and questions that need answers. All the questions are numbered. In your lab report, include the associated number at the start of each answer.

It is preferred to connect to wired ethernet if possible. If you are using WiFi, It is critical that you have a good WiFi connection. To get the best WiFi connection, move close to the WiFi access point. If you don't know where the WiFi access point is, look at the signal strength indicator on your computer and move to a place where you have full bars. To get the most consistent results, it would be best to complete the lab all at once, using the same internet connection for the duration of the lab.

Internet Benchmark Tools (Speedtests)

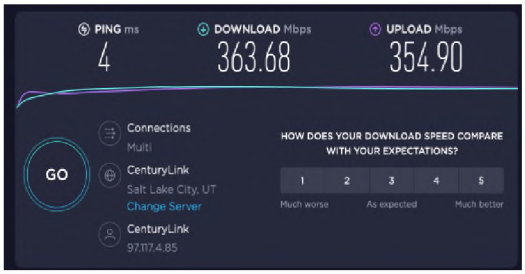
In this part of the lab you will be taking a look at data rate and latency benchmarking tools. Here is a list of some data rate and latency benchmark tools:

- speedtest.net
- fast.com
- dslreports.com/speedtest
- bandwidthplace.com

Go to each of these websites and run a speed test. You should record the results for upload speed, download speed, and ping/latency at each of these sites. You will answer questions using this data later in the lab. Run all the tests back to back, connected to the same network in the same way. Ensure you are not intentionally doing something data intensive on the internet like downloading OS updates, downloading something else, or watching videos while running these tests. Doing so will make your results less accurate. And on some sites it may be hard to find things like latency and upload speed. If you can't find it on the site you are testing with, that is fine, just move on to the next one.

Questions to answer in your lab report:

1. While on speedtest.net, not the other speed test sites, take a screenshot of your result and put that screenshot in your lab report. Here is an example of my screenshot. Your result will be different from mine, but yours should contain the same data, like upload speed, download speed, ping, and servers used.



2. What was the minimum and maximum download speed you recorded at each of these sites. Include the speed, and the site at which the speed was recorded.
3. What was the minimum and maximum upload speed you recorded at each of these sites. Include the speed, and the site at which the speed was recorded.
4. Was there a significant difference in download and upload speed?
    a. What was the difference?
    b. What factors do you think could be contributing to this difference?
5. What was the minimum and maximum latency you recorded?
6. Is the device you used to run these tests using a wired ethernet connection, or a WiFi connection?
    a. How could the type of network connection impact your results?

The Ping Utility

The ping utility is a commonly used internet and network troubleshooting tool. It comes preinstalled on almost all Windows, Mac, and Linux operating systems. Ping measures the round-trip time for a packet from the source computer to the destination server, and back to the source computer. Ping uses Internet Control Message Protocol (ICMP) functionality. ICMP is a protocol that adds supporting functions to the Internet.

To open the ping utility follow the instructions for your operating system:

- Windows
    - Click the start menu and search for command prompt
- Mac
    - Press command and spacebar at the same time and search for terminal
- Linux
    - Varies by OS, but you need to open the terminal application. Good luck :)

This is how to use the ping utility:

```
ping destination
```

On Windows the default behavior is to ping 4 times and the ping command exits on it's own. If you are on Mac or Linux, ping will keep pinging until you exit by pressing ctrl and c at the same time. On Mac and Linux, you only need to have ping do four pings, but if it does more before you exit, that's OK.

Here are some things you should try pinging. Run these commands:

```
ping google.com
ping apple.com
ping amazon.com
ping uvu.edu
ping 8.8.8.8
ping 1.0.0.1
```

Include in Lab report:

7. Take a screenshot of your window that shows the results of one of these pings.

Next, you will ping IP addresses from around the United States, and then ping some IP addresses from around the world. You should see how distance has an effect on latency. (It is not too unlikely that an IP address will change its geographical location over some amount of time, and while these IP addresses were their correct location when this lab was created, that does not mean they are still the correct location or they are still responding to ping requests.)

The Windows and Mac ping commands are slightly different in how they display results. Here are some screenshots of the results in Windows and Mac:

Windows:

```
Minimum = 5ms, Maximum = 6ms, Average = 5ms
```

Mac:

```
round-trip min/avg/max/stddev = 6.952/7.920/10.336/1.399 ms
```

Notice that both of them show the metrics for minimum, maximum, and average times for all the pings that occurred in your single ping command run. On all of these next ping runs for the United States and the world, record the minimum, maximum, and average ping times. (Remember on Mac and Linux to press ctrl c to exit the current ping command)

United States:

UVU Utah:	ping 161.28.25.131
Lehi, Utah:	ping 208.72.160.67
LA, California:	ping 72.51.45.108
Denver, Colorado:	ping 50.203.152.202
New York:	ping 68.216.230.2
Hawaii:	ping 166.122.9.116

World:

Russia:	ping 80.79.179.2
Japan:	ping 61.194.65.90
Australia:	ping 210.23.129.34

Canada:	ping 66.18.240.197
Brazil:	ping 45.225.123.34
Ireland:	ping 185.228.169.9
South Africa:	ping 196.21.247.1
India:	ping 169.38.73.5

Include in lab report:

8. What were the minimum, maximum, and average ping times for all 14 IP addresses in the United States and World boxes?
9. For the United States, what location had the lowest minimum ping time?
10. For the United States, what location had the highest minimum ping time?
11. For the World,what location had the lowest minimum ping time?
12. For the World,what location had the highest minimum ping time?
13. What location had the greatest difference in its minimum and maximum ping times?
    a. What do you think could have caused such a variance in ping times, especially given that both times were for the same location?
14. Distance is usually the greatest factor in latency. With that being said, what other factors would cause the increased ping times you saw in the United States ping times vs. the World ping times? (You can reverse this question if you saw higher ping times for the World compared to the United States.)

Summary of Deliverables:

- Answers to questions 1 - 14, and any information and screenshots required.