CSCI 5010 – Fundamentals of Data Communications

Lab 1
Internet Speed Test & Computer Command Prompt

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Summary

This lab is intended to be an overview of Internet speed testing technologies and scenarios, as well as basic Operating Systems (OS) (Windows and Mac) command prompt utilization. This lab will be a baseline for future exploration into these topics used throughout this course.

The questions in the lab are intentionally vague. The purpose of this is for you not only to research, investigate, and learn the technologies, but also become proficient at interpreting both non-technical and technical questions. Being able to research and discover answers on your own will be critical as you progress in your career.

Objective 1: Internet Speed Testers

There are various ways to test Internet connectivity speeds from your device. In this objective, you will utilize different applications and technologies to evaluate differences in speed tests.
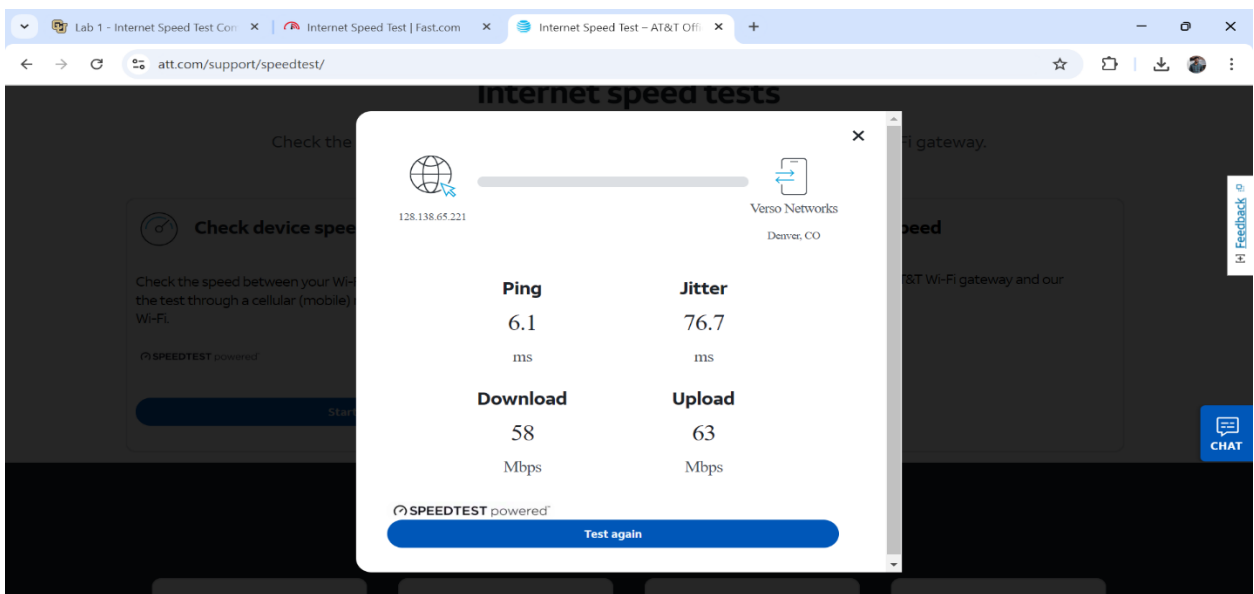
1. Select three (at least one of the three should be from an ISP (i.e. Comcast)) free, online Internet speed test sites (*Note: be careful where you click on some sites, as there are often malicious adds on free testing sites*).

   a. Provide a screenshot of the results/summary page from each site. [**6 points**]
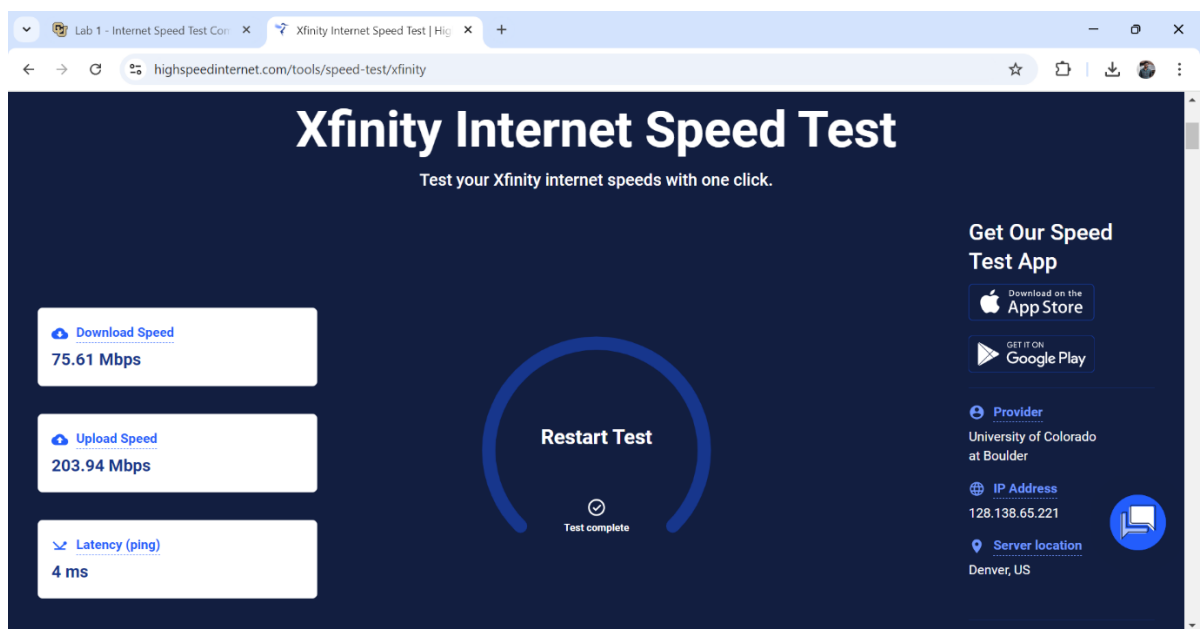
Xfinity Internet Speed Test
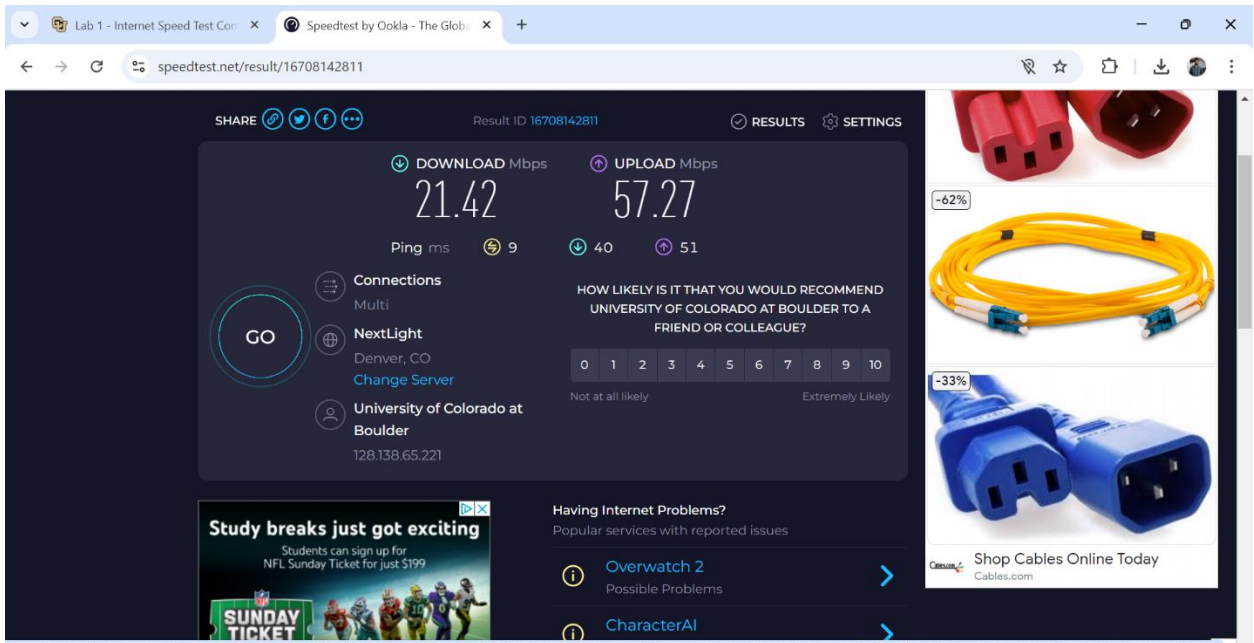
Speed test by Ookla

Speed test by AT&T

b. Were the results from the various sites the same or different? Why? [**2 points**]

All three-speed test showed different download and upload speed. The internet speed test was taken on campus. Since Each speed test have different servers

located at a distance so depending on the server distance the internet speed might vary. Then due to traffic in the network while performing the speed test might vary. ISPs might route traffic differently based on the destination to be routed so for different sites the performance will change.

2. Choose your favorite testing site, used previously, to use again.

   a. Find a location where you can use either a wired or wireless connection.

      i. Run the speed test on wireless. Provide a screenshot of the results. [**2 points**]
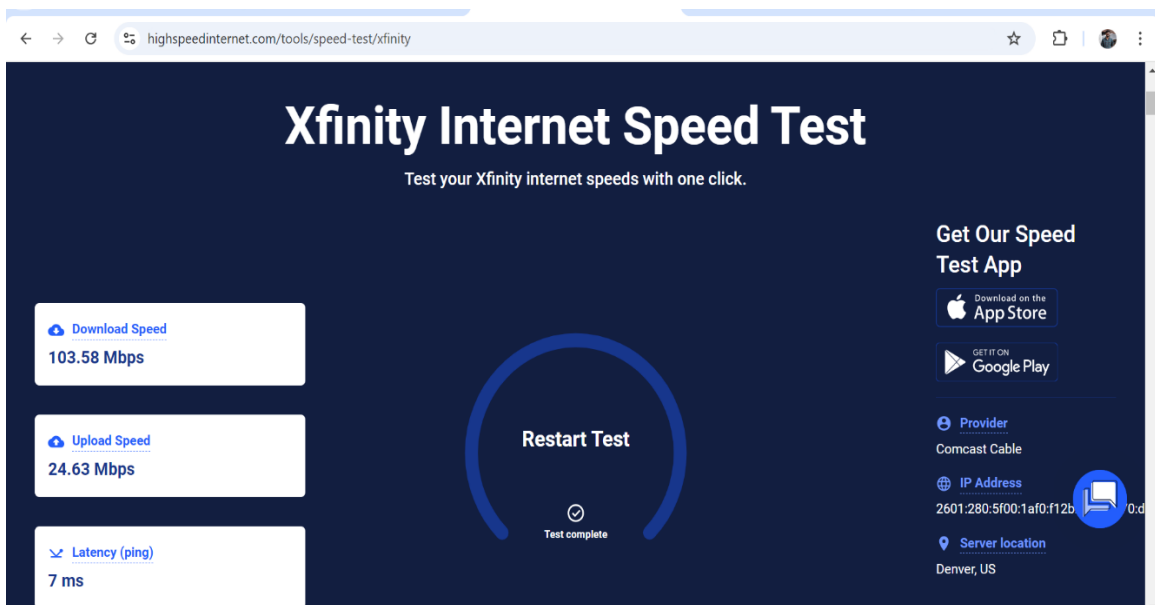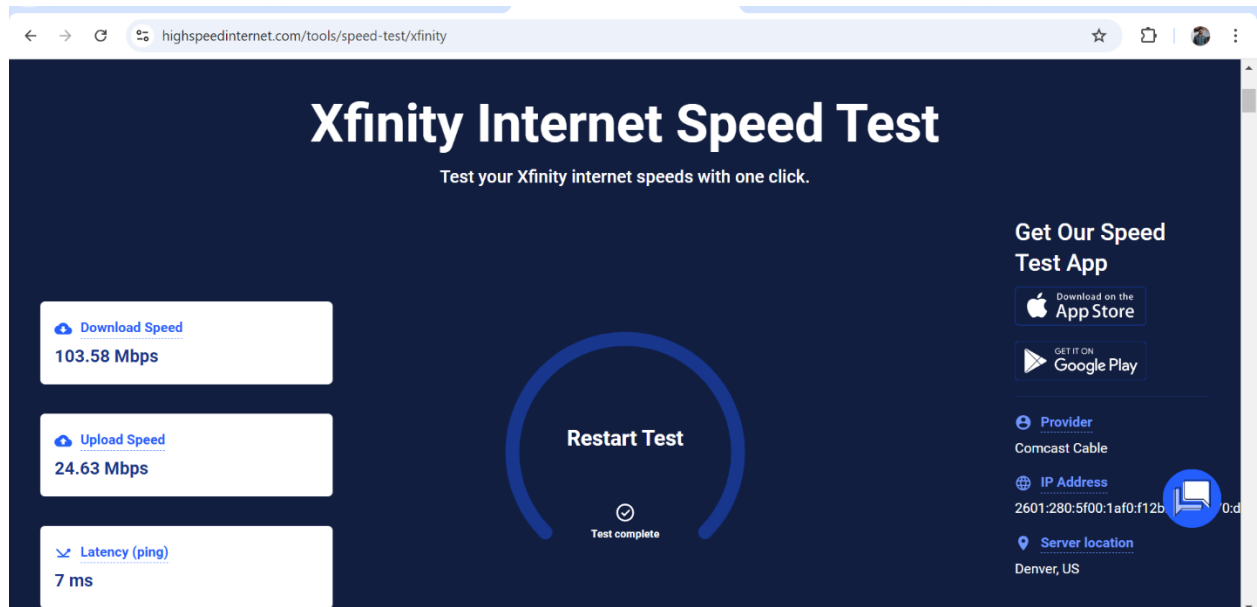

Xfinity Speed Test at my Apartment

      ii. Run the speed test on wired. Provide a screenshot of the results. [**2 points**]

Do Not have wired connection

      iii. Were the results different? Why or why not? [**2 points**]

Since I do not have a wired connection, I couldn't do the difference.

   b. Run the speed test at a different location (on campus, home, coffee shop). Were the results better or worse than your other tests? Why? [**2 points**]

Xfinity Speed Test taken at my apartment

Results at my apartment were better compared to the speed test done on campus. The results will differ due to network congestion since only a few people are using the Wi-Fi at the apartment but whereas on campus there is heavy traffic. When a Device is kept near the Router will result in stronger Wi-Fi thereby better speed. The ISPs service infrastructure and plan might be different at different locations, at my apartment the service plan I am using might provide higher speed.

3. List three benefits of obtaining accurate Internet speed test results. [**5 points**]

- While testing the speed test, if the results show less speed than expected we can examine the problem we are facing. For example, if the speed is slow in Wi-Fi but faster using ethernet then there is a problem in the setup rather than the ISP.

- By knowing the accurate speed, we can optimize our online activities such as we can adjust the quality of video streaming. Make sure there is limited number of devices connected, the more devices the less the network capacity ensuring everyone has smooth experiences without any interruptions or lagging

- If on planning to switch ISP, we can compare the speed provided by the potential alternative ISP using the speed test with present and with this data we can make decision based on value of money.

4. What are three best practices to obtain accurate Internet speed test results? [**5 points**]

- By using wired ethernet cable from the modem or router can provide constant speed reducing the chances of speed fluctuation during the test and can test the speed accurately.
- While taking the speed test, make sure there is no background application running because it consumes bandwidth resulting lower speed.
- Internet speed fluctuates during the day depending upon the network congestion so its better to test the speed multiple times a day.

5. Explain the following concepts, and how they are used with speed tests? [**2 points each**]

   a. Ping (Latency) Test

   Ping test is used to find the latency in the communication between the device and the server. When we try to ping, it creates a packet of data and sends it to the server and checks how long(time) will it take for the server to respond back. The results are in milliseconds.

   b. Download Test

   It measures the speed that it takes to receive the data from the internet to our devices. Example: -Downloading files, streaming videos.

   c. Upload Test

   It measures the speed that it takes us to send the data to the internet from our devices. Example: - Sending Emails.

   d. Is TCP or UDP used? Why?

   Based on different speed tests they use different protocols. Yes, TCP and UDP are used in speed tests, it is used and evaluated based on the aspects of Network performance. TCP ensures data accuracy and reliability. During the download and upload test it establishes a TCP connection with the server and measures how fast it can download data from the internet and how fast it can upload data. UDP is

usually used in ping tests to check the performance of real time applications, and it used in low latency and transfer of error free data.

6. If the results of your speed test is lower than what you expect/pay for from your ISP, list two things you could do to troubleshoot the connection/speed before you contact the ISP? [**2 points**]

- By restarting the modem or router for 30sec it can temporarily resolve connectivity issues.
- Test the speed using wired and wireless connection. It can solve problems based on the strength of Wi-Fi signal. Perform speed test multiple times a day if there any fluctuation.
- Ensuring whether the cables are connected properly. If there is any loosely connected cables it can affect the quality of the connection

a. After troubleshooting, if you determine your Internet speed is lower than what you expect from your ISP, list three ways you could potentially boost your Internet speed, and explain each. [**6 points**]

- Older routers may not support new Wi-Fi standards so upgrading to a new Router may improve the internet speed.
- Many modern routers have features such as quality of service (QoS) which will prioritize certain traffic and ensure that major applications will receive the required bandwidth.
- Ensuring the Wi-Fi network is secure by providing a strong password so that unauthorized users cannot access the bandwidth. Always keep the router in an open area rather than in a corner.

Objective 2 – Command Prompt (Windows/Mac)

The command line, also known as cmd or shell, is used by system administrators to quickly interact with a machine, without having to click through numerous graphic menus. This objective will provide the useful commands that are needed for networking and information gathering on a computer, such as IP address, MAC address, default-gateway, DNS, ARP table, and IP connectivity.

1. Basic Networking Information

    a. Open the command prompt

        i. **Windows users:** The easiest way to achieve this in Windows is to type "cmd" + <enter> in the Windows search bar.

        Mac users: Use the Finder to go to Applications > Utilities > Terminal.

        What is another way you can find the command prompt on your windows/mac machine? List the steps. [**2 points**]

        My pressing "win" + R to open the run dialog box. Type cmd and enter.

        ii. Issue a single command that will indicate all of the following information. Provide a screenshot of the command output [**3 points**], as well as answer the following questions based on the output [**1 point each**]:

        The command is ipconfig /all

1. What is your machine's IP address?

    From the above screenshot 10.0.0.25 is the IP address.

    a. Is it static or dynamic (DHCP)?

        From the above screenshot. Since DHCP is enabled, it is dynamic DHCP.

        i. What is the difference between static/dynamic?

Dynamic DHCP assigns Ip address automatically to devices. In Static DHCP, the device is always assigned with the same IP address by DHCP server.

    b. What layer of the OSI model is an IP address?

Network Layer

    c. Which NIC are you using (wired/wireless)? Indicate this.

Wireless

2. What is your machine's default-gateway address?

From the above screenshot the default-gateway is 10.0.0.1.

    a. What is the purpose of a default-gateway?

Default-gateway is a device typically a router that is used to access other network, pathway used to forward data to another network.

3. List the DNS server(s).

The IP address of the DNS server 75.75.75.75 and 75.75.76.76.

    a. What is the purpose of a DNS server?

The main purpose of the DNS server is to convert the domain name to IP address.

4. What is your MAC address of the NIC being used?

The MAC address is CC-D9-AC-D6-3D-41.

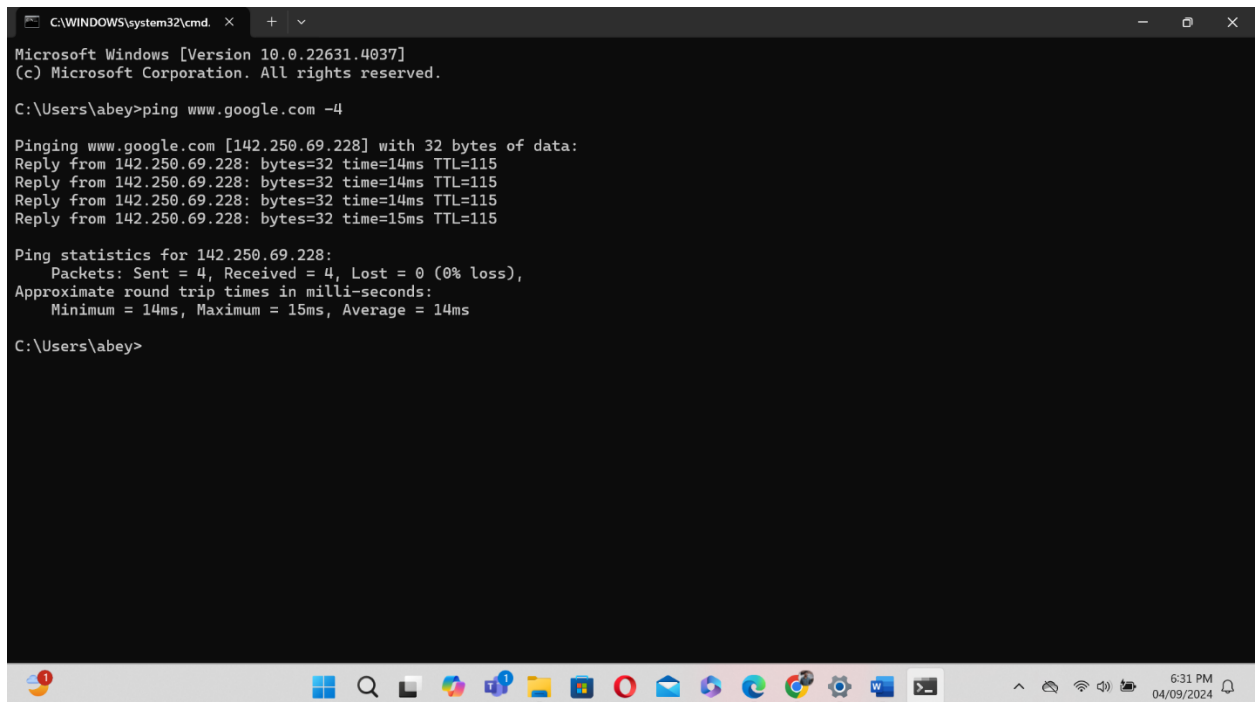   a. What layer of the OSI model is a MAC address?

Data-Link layer

2. IP Connectivity

a. Open the command prompt

    i. Ping www.google.com. Provide a screenshot of the results [**2 points**], and answer the following questions based on the output [**1 point each**]:

    1. What is ping?

    It is used to check the connectivity of two devices, it creates a packet of data and sends it to another device and checks how long(time) will it take for the device to respond back.

    2. What is the IP address of Google?

    The IP address of google is 142.250.69.228.

    3. What was the average round trip time for packets to reach Google's server from your machine?

The average round trip time is 14ms.

4. If you wanted to ping an IP address (or domain name) continuously, what parameter would you add to the ping command?

We have to used -t as the parameter for instance in this case www.google.com -t.

   a. How would you stop this continuous ping?

   By Pressing clrl key and C key simultaneously we can stop the ping, and it provides the result.

ii. Using the IP address of Google (obtained above), type this in your Internet browser's URL. Does this resolve to www.google.com? Why or why not? [**2 points**]

Yes, it resolves to www.google.com .when we type the ip address the browser directly maps to google server since we have given a specific ip address. It skips the DNS step, and the browser connects with the server. The server sees the upcoming request and provides the google homepage

iii. If you want to see how many Internet routers (hops) and the path your packet traverses to reach Google's server, what command could you use? Provide a screenshot of the command and corresponding output. [**3 points**]

tracert google.com is the command.

```
    Default Gateway . . . . . . . . . : fe80::c650:9cff:fe6d:1d8f%4
                                        10.0.0.1
    DHCP Server . . . . . . . . . . . : 10.0.0.1
    DHCPv6 IAID . . . . . . . . . . . : 80533932
    DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-28-35-34-7D-CC-D9-AC-D6-3D-41
    DNS Servers . . . . . . . . . . . : 2001:558:feed::1
                                        2001:558:feed::2
                                        75.75.75.75
                                        75.75.76.76
    NetBIOS over Tcpip. . . . . . . . : Enabled

C:\Users\abey>tracert google.com

Tracing route to google.com [2607:f8b0:400f:803::200e]
over a maximum of 30 hops:

  1     3 ms     2 ms     2 ms  2601:280:5f00:1af0:c650:9cff:fe6d:1d8f
  2    13 ms    11 ms    13 ms  2001:558:1028:3ea1::3
  3    12 ms    24 ms    58 ms  po-319-340-rur302.arvada.co.denver.comcast.net [2001:558:1c2:c005::1]
  4    16 ms    13 ms    13 ms  po-2-rur301.arvada.co.denver.comcast.net [2001:558:1c0:11e::1]
  5    15 ms    14 ms    13 ms  po-300-xar01.arvada.co.denver.comcast.net [2001:558:1c0:819::1]
  6     *        *       21 ms  be-308-arsc1.denver.co.denver.comcast.net [2001:558:1c0:1ca::1]
  7    16 ms    22 ms    18 ms  be-36031-cs03.1601milehigh.co.ibone.comcast.net [2001:558:3:2fe::1]
  8    15 ms    14 ms    14 ms  be-3311-pe11.910fifteenth.co.ibone.comcast.net [2001:558:3:5e::2]
  9    20 ms    22 ms    14 ms  comcast-1-2.ipv6.r1.ch.hwng.net [2001:559::292]
 10    13 ms    14 ms    15 ms  2607:f8b0:82be::1
 11    16 ms    13 ms    21 ms  2001:4860:0:1::5834
 12    18 ms    17 ms    28 ms  2001:4860:0:1::7db8
 13    13 ms    18 ms    12 ms  2001:4860:0:1::85e3
 14    17 ms    14 ms    12 ms  2001:4860:0:1::5803
 15    14 ms    26 ms    14 ms  den08s06-in-x0e.1e100.net [2607:f8b0:400f:803::200e]

Trace complete.
```

Total Score = _____/68