PROJECT 1 REPORT

1.INTRODUCTION

In this project, we set out to explore the world of internet infrastructure and its impact on data transfer delays. Our approach involved selecting ten destination points with varying geographical distances from the source, and we used the Traceroute program to measure the delays encountered during data transmission. Over four days and at three different times each day, we conducted multiple measurements (ranging from 10 to 100) to calculate maximum, minimum, and average delay times. This study sheds light on how internet latency varies across different destinations, different times in a day and different days providing valuable insights into the performance of internet connections in a real-world context.

2. MATERIALS AND METHODS

I have traced all connections with Eduroam either wireless or with cable. I have used *"tracert"* command at the beginning. However, *"tracert"* command was unscalable for required amount of data even with multiprocessing. Therefore, I compared the results of *"tracert"* and *"ping "* commands and noticed that they result identical in most cases. And, "ping" command was scalable therefore I continued with *"ping"* command. I have selected ten websites according to their distance to my host [Figure 1]. I got distance information from https://iplocation.io/.

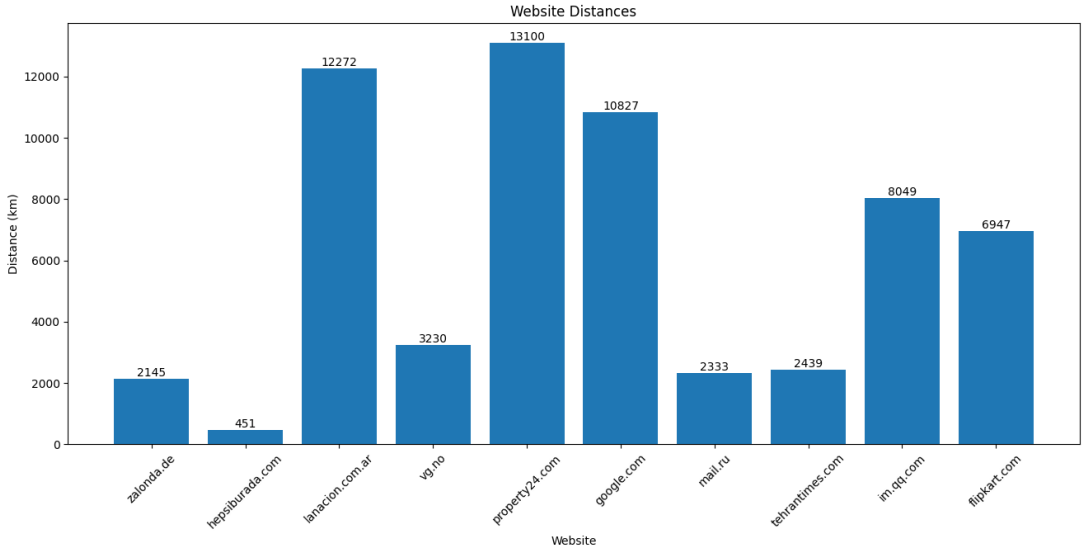

Figure 1

I have collected data 3 times for 4 days (24,25,26,27 October 2023). I divided day into 3 part as morning (9.30-11.30), evening (19.30-21.30) and night (23.00-00.30). Data can be seen under "data\location_diff" folder.

3.RESULTS

I examined the results according to three parameters, fixing two at a time. These are time, date and distance.

3.1 Time-Date Fixed

We can see the results for 25/10/23 evening in Figure 2, 24/10/23 night in Figure 3, 24/10/23 morning in Figure 4, 26/10/23 night in Figure 5. First thing I observe was that there is spikes in Figure 3. Since spikes are not wild as Figure 3 in Figure 2 and Figure 4. I thought it might be about night time. Then I compare with another night table which is Figure 5. It also has spikes than others but not as much as Figure 3. So, I concluded as spikes are common thing at night but at 24 October there was unusual jam at some point. I can say that it is only for a small amount of time since average didn't change so much; therefore, maximum value is an outlier. I can also mention that there's a speed hierarchy, where morning is faster than evening, and evening is faster than night. However, it's worth noting that the speeds of morning and evening are very similar. Also the most stable time was mornings. We can generally say that delay times increase directly with distance. But it does not match the correlation in google.com and mail.ru addresses. This may be because these sites have many servers around the world and we might be directed to other servers in different locations, even though we checked it from "iplocation.io".

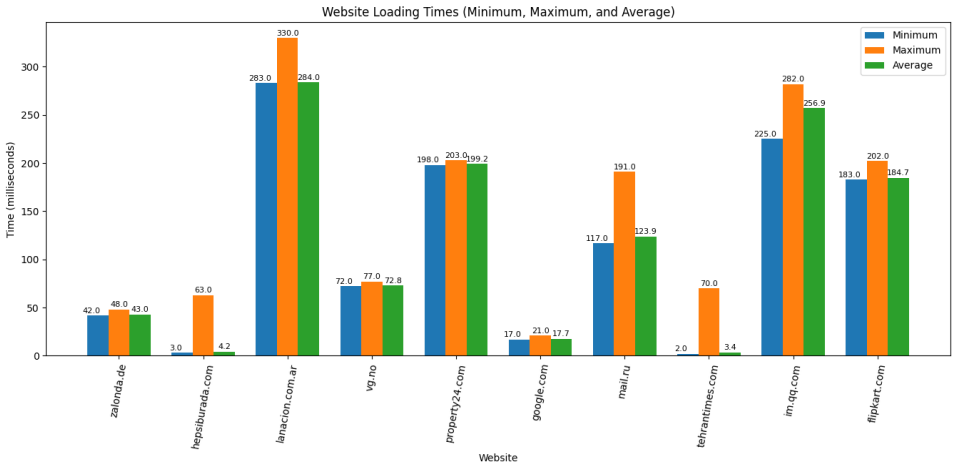

Figure 2

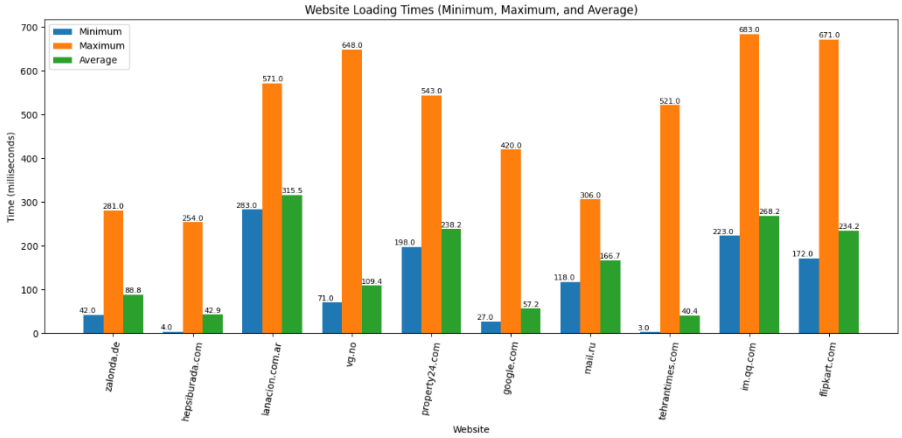

Figure 3

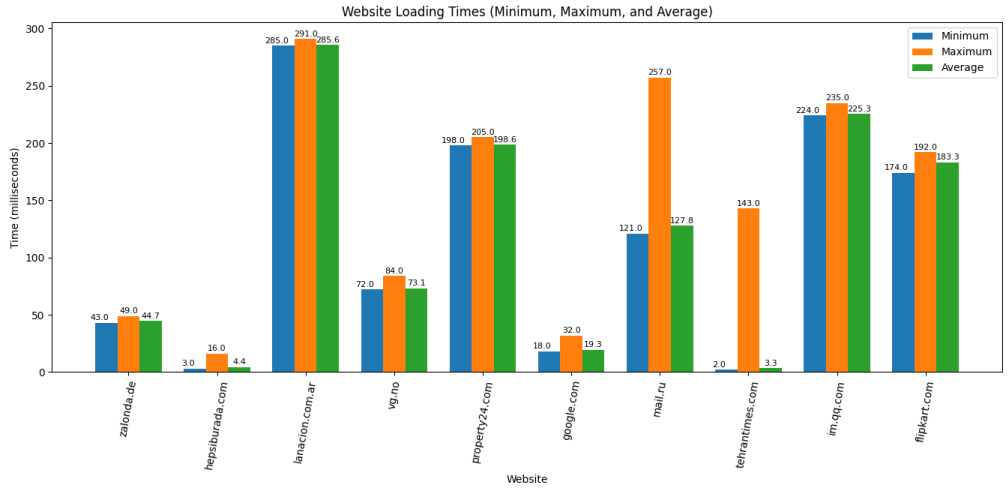

Figure 4

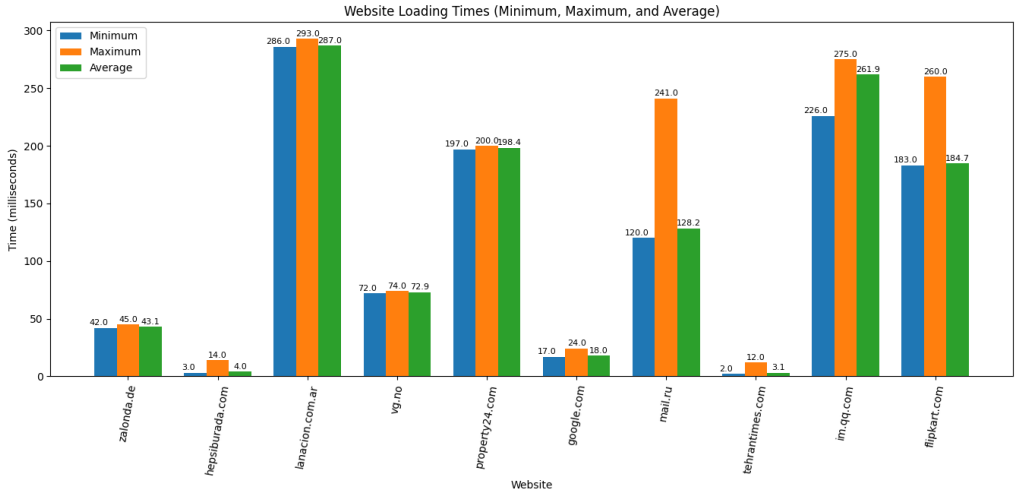

Figure 5

3.2 Distance-Date Fixed

We can see the results for 24/10/23 "*flipkart.com*" (India) in Figure 6, 25/10/23 *"im.qq.com"* (China) in Figure 7, 27/10/23 *"tehrantimes.com"* (Iran) in Figure 8. In Figure 7, we can observe that results didn't fluctuate much with time. However, in other two figures there were fluctuations in average up to nearly 50%. We can say that workload remained at the same levels throughout the day for 25/10/23. In Figure 8, we can observe exceptional fluctuations in delay times. Max value was 3200% more than average value. This might be due to a technical problem happened at that time in our route. We can't make any generalization about traffic at different times since they differ on each figure.

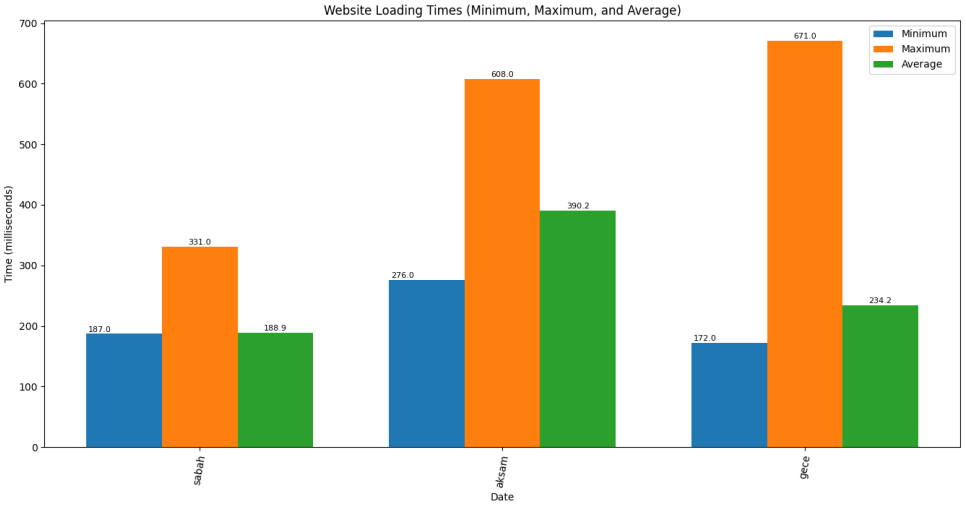

Figure 6

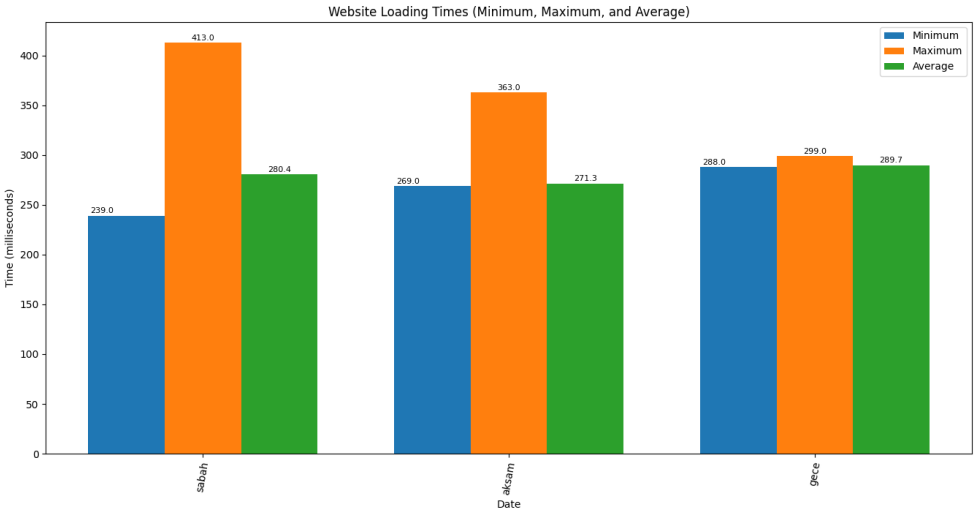

Figure 7

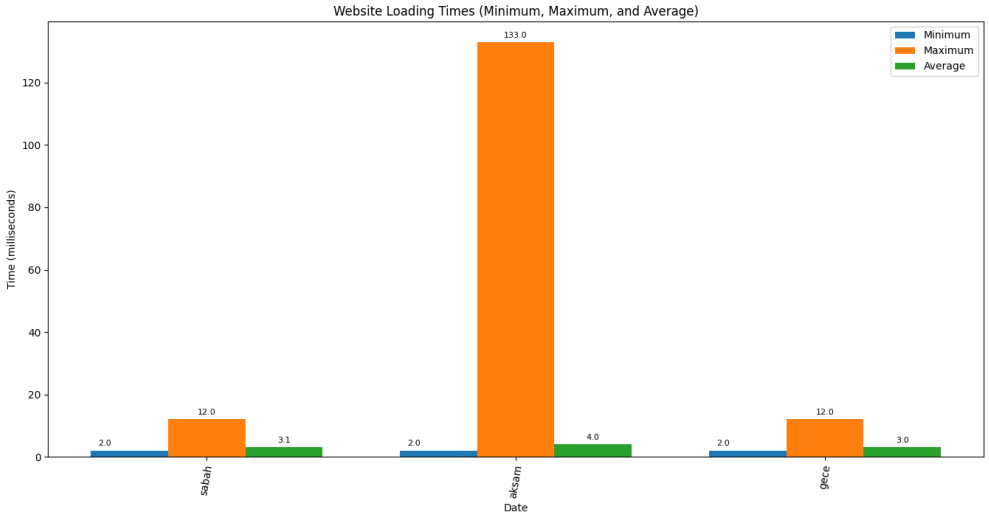

Figure 8

3.3 Time-Distance Fixed

We can see the results for morning time “zalonda.de” (Germany) in Figure 9, night time *“vg.no”* (Norway) in Figure 10, evening time *“hepsiburada.com”* (Turkey) in Figure 11. In Figure 9, we can observe the average delay time didn’t fluctuate with changing days. But in Figure 10 and Figure 11 we can observe there are an extra traffic for 24/10/23. When we compare all figures, we can see that spikes were common for 24/10/23 and 27/10/23. For each figure, minimum values are stable; therefore, we can say that any of the sites didn’t have a whole day technical difficulty. At final, we observe spikes at each day in Figure 11 which is the nearest site. It can indicate a technical difficulty at that site since it lasted for days.

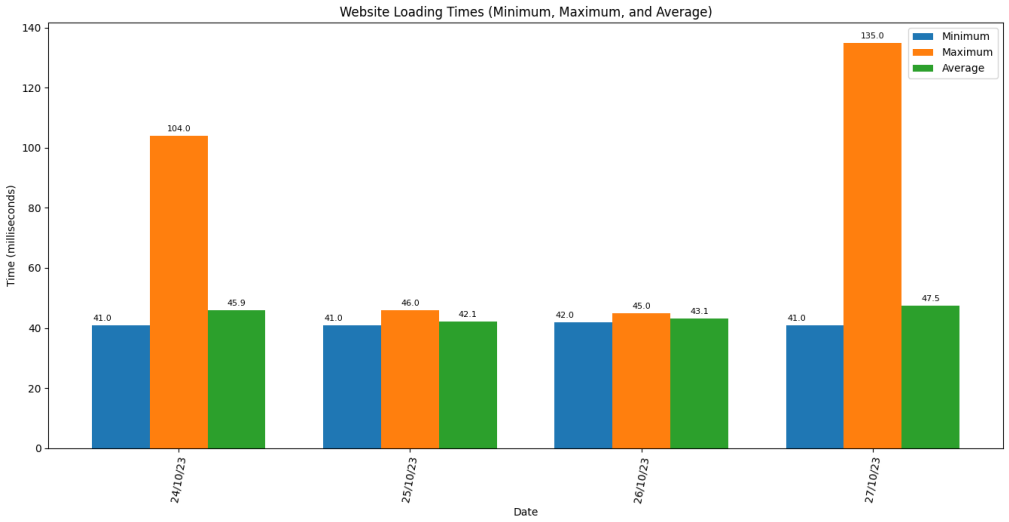

Figure 9

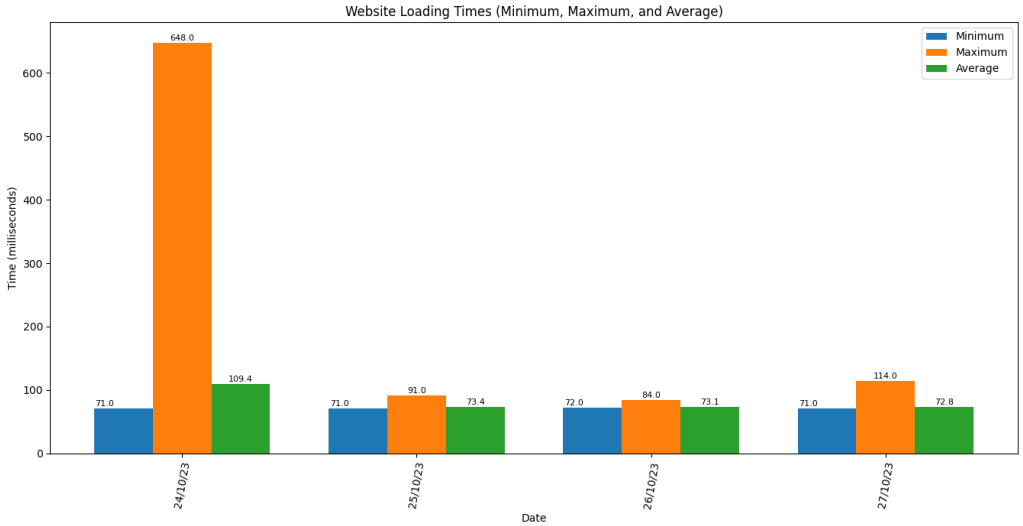

Figure 10

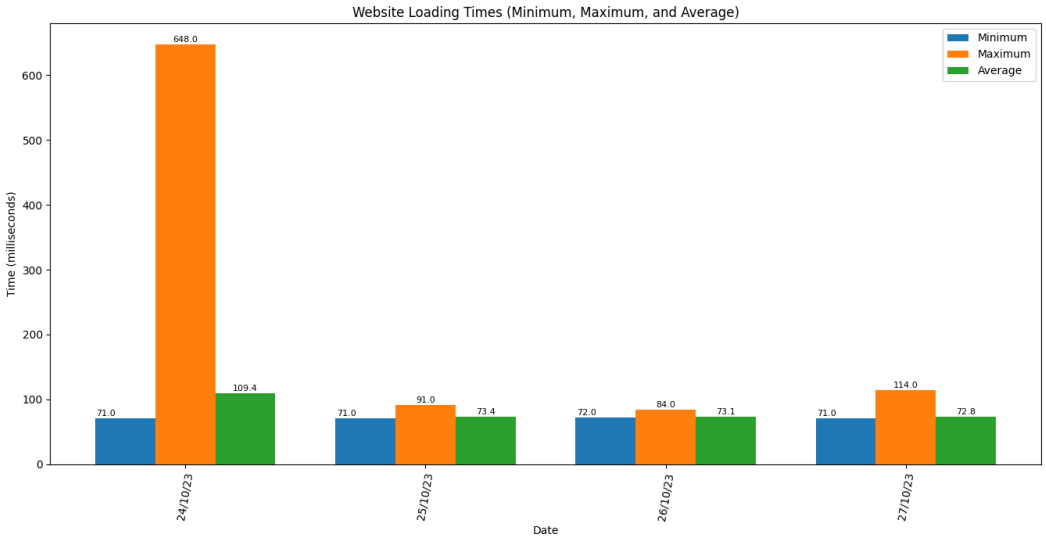

Figure 11

4.DISCUSSION AND SUMMARY

I want to again mention that I used *"ping"* command instead of *"tracert"* command since it wasn't scalable. With *"tracert*" execution of program took more than 3 hours (estimated). So, I provided both *"ping"* and *"tracert"* codes. They both work but took different times. I provided a sample output for *"tracert"* with few entries to prove that both codes work.

In summary, our observations reveal that the delay times of connections vary based on factors such as the server's distance, the level of network traffic during specific days and times. Typically, connections to remote servers tend to take longer due to the increased distance involved. However, when websites have multiple servers located across the world, the delay times may sometimes be misleading, as they can vary based on the server you connect to.

We have also noticed that certain servers experience higher levels of traffic during specific times of the day. This traffic pattern is not consistent and changes according to the day and time. This variation can be attributed to the fact that people in different geographical locations live in different time zones and access online services accordingly.Furthermore, many websites exhibit spikes in their delay times at particular times, but for some, this issue persists consistently. This persistent problem can result in a poor service experience for users.

Finally, it's worth noting that while many sites experience spikes and varying latencies at different days and times, the average delay time remains relatively stable, typically within a range of -10% to +10%.