Measuring QUIC performance: An analysis of security and connection establishment in QUIC with comparison to TCP

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1 Status report

1.1 Proposal

1.1.1 Motivation

QUIC is a brand new transport layer protocol which aims to effectively replace TCP as the new default for establishing connections and transferring data over the Internet. It has been an intriguing new topic of study in the past few years, with many researchers performing measurement studies not unlike this one to establish whether QUIC is really as efficient as it promises. Given that QUIC was first proposed in 2016 by Google and formally adopted as a standard by the IETF only in 2021, the number of studies measuring QUIC performance are extremely limited. Recently, Internet traffic has been rapidly moving towards QUIC, and there is great demand for the rest of the Internet to do the same: it has therefore become increasingly important to perform as much research in this area as possible in order to accelerate this process. This measurement study aims to help the growth of available data regarding QUIC performance, in order to hopefully see a transition to QUIC as the default transport layer protocol in the near future.

1.1.2 Aims

This project aims to take various measurements of Internet connections by querying the top 1000 websites using both QUIC and TCP, and collecting the header information of all packets across these connections. A script was written for this purpose, using tcpdump to intercept any packets with their respective header information, and curl to query the websites and obtain their HTTP headers - for QUIC connections, qlog is used to obtain header information as most of it is normally encrypted. The script will be run from different locations in order to investigate how the speed of QUIC connections depends on the physical location from which a request is being made. Finally, the data collected will be examined to compare the security and speed of connections between TCP and QUIC.

1.2 Progress

- Appropriate research was made regarding background and motivation for the project.
- Background, Introduction, and Abstract sections of the dissertation were written.
- Appropriate research was made regarding tools and software to use for the project.

- Software and relevant tools necessary for the project were installed.
- A script for capturing packet information was written.
- A set-up script was written to facilitate the installation of the software and tools necessary to run the packet-capture script.
- Preliminary measurements were taken by querying the top 500 websites to test the script.

1.3 Problems and risks

1.3.1 Problems

- My laptop could not support Windows Subsystem Linux, so a VM had to be installed to work on the script for the packet captures.
- The virtual machine stopped working around week 10, so it was necessary to initiate a new VM and re-install all software and tools necessary to run the script.
- Due to QUIC being new and not very well documented, it was difficult to understand how to retrieve the unencrypted QUIC packet header information using qlog.
- The first preliminary measurement crashed the virtual machine, as not enough space had been allocated to the virtual disk. A new VM had to be initiated with more disk space, and the data from the first preliminary measurement was lost.
- Obtaining the qlog information takes a very long time, so it was necessary to allocate some time to monitor the preliminary measurements.

1.3.2 Risks

- Different aspects of the data could be explored, and right now it is unclear what parts of the data will be relevant and what will not be. **Mitigation:** will do some background research to figure out what aspects of the collected data are relevant to security and speed of connections.
- Only two vantage points have been used to take measurements so far, and it is unclear which cloud platforms could be used to conduct the measurements from other locations. **Mitigation:** will conduct research about Azure, DigitalOcean, and other possible cloud platforms.
- During the execution of the preliminary measurements, it was noted that the script takes a very long time to run. **Mitigation:** will either try to figure out a way to make it run faster, or allocate some time to monitor the script as it runs.

1.4 Plan

- Week 1: take measurements from campus and at home, and figure out where else to take measurements from.
  - **Deliverable:** a complete dataset for measurements taken from campus/home, and a concrete plan of when to take the remaining measurements, and which cloud platform to use for them.

- Week 2: conduct measurements from remaining cloud platforms.
  - **Deliverable:** data from the measurements, which completes the total amount of data collected for the project.
- Week 3: figure out what to analyse about the data collected.
  - **Deliverable:** a concrete plan of what parts of the data will be examined, and what data analysis methods will be used.
- Week 4-6: data analysis of collected measurements.
  - **Deliverable:** a detailed analysis of the data collected from the measurements.
- Week 7-9: write-up of dissertation draft.
  - **Deliverable:** a draft version of the dissertation will be completed and sent to supervisor for guidance throughout this period.
- Week 10: finalise dissertation.
  - **Deliverable:** a final, proofread version of the dissertation will be completed and sent to supervisor for insight before the submission deadline.