

# Validation of QUIC protocol usefulness in interactive communication

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# 1 Abstract

The goal of this thesis is to examine usefulness of QUIC transport protocol in an interactive communication. QUIC is a new transport protocol based on UDP protocol. With it there comes new HTTP version - HTTP/3. Both QUIC and HTTP/3 are not standardized yet but there exist some implementations of IETF draft versions which are successfully used in production. Therefore it is a good moment to examine if QUIC suits well and gains new advantages in an interactive communication in which neither TCP nor UDP protocols perform well enough. In this purpose Rust implementation of QUIC has been chosen. Results include comparison between TCP and QUIC protocols in terms of performance e.g. connection setup time and reliability.

# 2 Introduction

Transport layer of ISO/OSI model contains two most significant protocols in terms of Internet communication – TCP and UDP .

TCP is a connection based protocol which handles congestion control, sends confirmations when message is received or cannot be received and guarantees proper order of sending packets. Because TCP is a point to point protocol we are not allowed to realize multicast transmission using it. The biggest drawback of this protocol is its heaviness. Connection setup requires so called three way handshake which takes some time. Lack of any built-in security mechanisms forces us to use dedicated to this purpose TLS protocol which introduces its own connection handshake. This causes that connection setup becomes even less efficient. On the other hand there is a very lightweight, connectionless protocol called UDP . It does not guarantee proper order of sending packets. There are not also any confirmations or warnings sent in case of communication errors. Everything is performance oriented. UDP provides also multicast mechanism. According to this UDP is a good choice when we need very fast and lightweight communication but we can lose some packets. A good example of UDP destination is a video streaming.

We can see that these two protocols and their destinations are strongly opposite. And here comes QUIC – new transport layer protocol based on UDP which is intended to replace TCP providing higher performance and

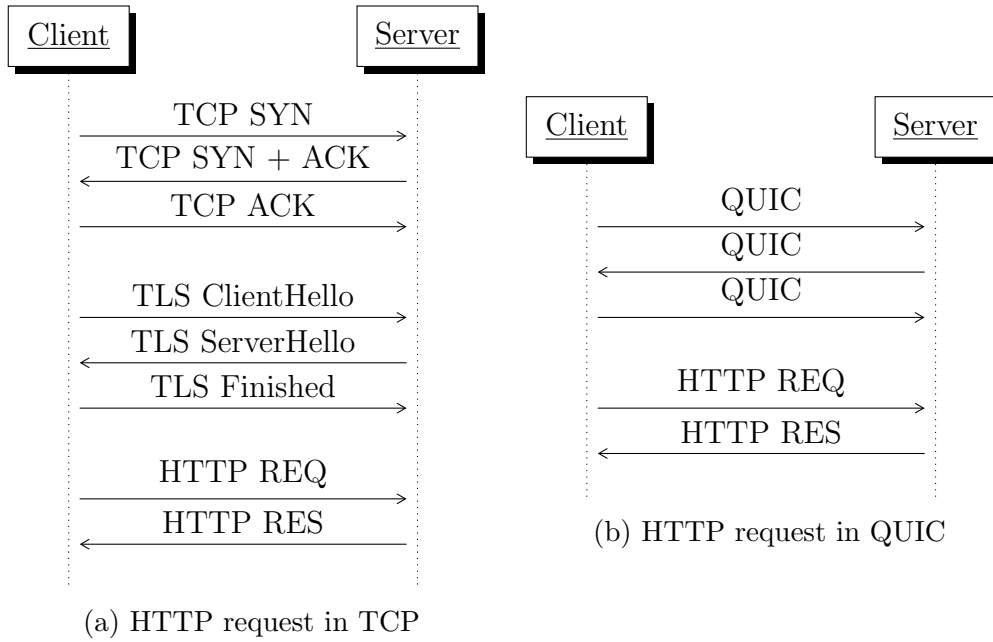


Figure 1: HTTP request comparison

even better reliability. First of all QUIC is user level protocol not system level one. It means that we can implement it without modifying operating systems kernels. Secondly QUIC is a secure protocol. It ensure data encryption and authentication which are handled by some other protocols like TLS . QUIC provides support for these protocols. Figure 1 presents comparison between HTTP request made in TCP and QUIC protocols. Typical QUIC handshake takes a single round-trip between hosts when TCP one requires two round-trips.

Another enhancement in QUIC is resistance for network changes. User can change its Wi-Fi network without performing a new client-server handshake. This is achieved by special ID's QUIC associates with each connection.

Results section describes performance differences between communication in TCP and QUIC protocols including connection time setup and reliability.

### 3 Related Work

Along with QUIC there come a new HTTP protocol version called HTTP/3. Both of them are not standardized yet but there are more and more IETF drafts describing these protocols. The last one was published on February and expires on August [1]. A lot of companies and scientists explores and tests QUIC and HTTP/3 features. For example in [2] QUIC was tested in terms of performance under network congestion. Therefor it is important to continuously examine new implementations and their.

## References

- [1] Hypertext transfer protocol version 3 ([http/3](http://3)).
- [2] Performance analysis of quic protocol under network congestion.