

Problem Sheet #5

Problem 5.1: *multipath tcp*

(1+2+3 = 6 points)

Multipath TCP (MPTCP) is an experimental extension of the TCP protocol that allows a TCP connection to use multiple paths to maximize resource usage and increase redundancy. MPTCP is defined in RFC 6824 [1]. A good introduction to MPTCP can be found in an overview article published in the Communications of the ACM [2]. Answer the following questions:

- a) How does the establishment of the MPTCP connection differ from the establishment of a regular TCP connection?
- b) How is a new TCP subflow added to a MPTCP connection? How does MPTCP ensure that only the original client and server can add a subflow to a MPTCP connection?
- c) What are the problems caused by middlebox described in the [2]?

Problem 5.2: *quic*

(2+2 = 4 points)

QUIC is a new protocol proposed by Google to reduce the latency of web transactions [3]. Answer the following questions:

- a) How does QUIC differ from the classic web protocol stack HTTP over TLS over TCP?
- b) What are the main insights gained from the experiment described in [3]?

References

- [1] A. Ford, C. Raicu, M. Handley, and O. Bonaventure. TCP Extensions for Multipath Operation with Multiple Addresses. RFC 6824, Cisco, U. Politecnica of Bucharest, U. College London, U. catholique de Louvain, January 2013.
- [2] C. Paasch and O. Bonaventure. Multipath TCP. *Communications of the ACM*, 57(4):51–57, April 2014.
- [3] G. Carlucci, L. De Cicco, and S. Mascolo. HTTP over UDP: An Experimental Investigation of QUIC. In *Proceedings of the 30th Annual ACM Symposium on Applied Computing, SAC '15*, pages 609–614. ACM, April 2015.