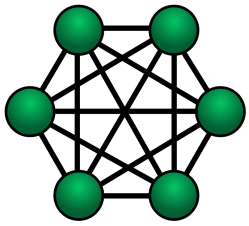
Chair of Network Architectures and Services
School of Computation, Information, and Technology
Technical University of Munich

Thesis M.Sc.

Congestion Control Optimization for Byzantine Fault Tolerant Consensus

Motivation



State-machine-replication (SMR) is used to build fault tolerant systems such as in airplanes, industrial control systems, and data centers. SMR uses multiple redundant machines (replicas), which agree on a common value even in case of faulty behavior of a minority. Byzantine Fault Tolerance (BFT) allows for a limited number of replicas to behave arbitrarily (drop/send wrong values/messages).

Due to the overhead of BFT-SMR system operation, a plethora of optimization approaches emerged. Only recently, research focus shifted towards analysis and improvement of the underlying network. Choice and configuration of the congestion control (CC) algorithm have a significant impact on system behavior during network instability.

In this thesis, we work on the BFT consensus protocol HotStuff [1]. The original authors provide a freely available C/C++ implementation. The main objective of this thesis is to analyze the impact of CC algorithm and configuration on HotStuff operation and measure the resulting performance impact.

Your Tasks

- Familiarize yourself with the HotStuff protocol and implementation
- Familiarize yourself with modern CC algorithms (e.g. CUBIC, BBR)
- Analyze and measure CC impact in HotStuff context
- Evaluate the results

References

[1] Yin, Maofan, et al. ”Hotstuff: Bft consensus with linearity and responsiveness.” Proceedings of the 2019 ACM Symposium on Principles of Distributed Computing. 2019.

Prerequisites

- Experience with Linux-based operating systems and networking
- Experience with C/C++/Python programming

Contact

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