ETH
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Distributed Computing

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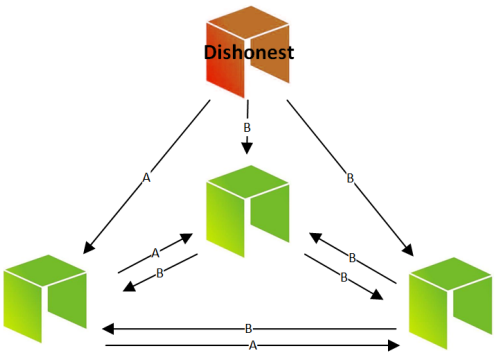
Evaluating Performance Limits of BFT Protocols

A distributed system consists of n nodes. The system is byzantine fault tolerant (BFT) if it can tolerate at most $f < \frac{n}{3}$ arbitrarily malicious (*byzantine*) nodes. BFT protocols have been studied in great detail since many decades, both in theory and practice. Nowadays, BFT protocols are the key to building "permissioned blockchains", an area traditionally known as "state machine replication" [9, 10].

In practice, BFT protocols have many applications ranging from online shopping to credit card transactions, cryptocurrencies and stock market trades; whenever a set of clients makes concurrent requests for (or with) limited resources, the service providers have an interest to both prevent fraudulent and tolerate faulty behaviour in the system.

From a research perspective, the interest in BFT systems has first been reignited by Castro and Liskov when they presented their "Practical" BFT (PBFT) system [2]. After PBFT, a large number of other BFT systems emerged [8, 11, 5, 12, 13, 1, 7, 3, 4, 6]. Many of these systems try to minimize the delay until transactions are committed. The aim of this research domain is to design systems that are *practical*, that is, systems that provide strong theoretic safety guarantees (e.g. may cope with arbitrary bad networking conditions), but do not incur an unproportional overhead during "normal operation" [2]. However, they do not specifically consider the impact of different network topologies and practical circumstances affecting the latency and throughput of the system. They simply show that, eventually, a non-byzantine leader will be in charge of driving progress for a sufficiently long time period such that the system does not stall completely.



In this project we aim to evaluate the peak performance limits of a multi-leader BFT system that was developed at our group. To that end, we will adapt an existing BFT protocol's implementation for fair comparison of the protocols' throughput and latency on the same set of machines. Practical optimizations to reach exceptional throughput may also be part of this project.

Requirements: The expected outcome of this project is of practical nature; hence, you should be comfortable with programming in `C++`. Progress, open problems and new ideas will be discussed in weekly meetings!

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