Bachelor Thesis Project

Benchmarking of Distributed Ledger Technology

Supervisor:	Thomas Locher
Professor:	Roger Wattenhofer
Start Date:	April 15, 2019
Submission Date:	October 13, 2019
Required Work Time:	300 hours

Introduction and Motivation

There is tremendous interest in the blockchain, the distributed ledger that powers the Bitcoin network. A key advantage of distributed ledgers compared to centralized solutions is that a distributed ledger removes the need to trust any particular party. In other words, trust is shifted from a specific party to a distributed system and its embedded protocols. As a conse- quence, one needs to trust that the majority of the parties involved in maintaining the ledger follows the protocols, ensuring that the ledger operations are carried out as intended, and the remaining (malicious) entities cannot corrupt the system. Since trust is a valuable and crucial commodity in any distributed system, numerous use cases for blockchain technology have been proposed.

Several distributed ledger platforms exist, e.g., Hyperledger Fabric [1, 3], Corda [4], or Ten-dermint [2], with varying feature sets and capabilities. It is thus not straightforward how to determine which, if any, platform is suitable for a given use case scenario with specific require-ments. Although their individual features can be extracted from the provided documentation, there is no generic method or tool available that would facilitate the direct comparison in a chosen environment.

The objective of this Bachelor thesis project is to devise and implement a benchmarking tool that makes it possible to evaluate the properties of the most popular distributed ledger platforms and to compare them. The platforms should be evaluated in terms of throughput (e.g., transactions per second), latency (e.g., time to finality), degradation under attack and potentially other metrics that might be defined as part of this work.

Tasks

1. Familiarize yourself with the state of the art in distributed ledger technology.

2. Identify and define metrics that are used to evaluate and compare distributed ledger platforms.

3. Conceptualize a generic benchmarking tool that can measure the defined metrics.

4. Implement the proposed benchmarking tool and use it to evaluate popular distributed ledger platforms.

5. Write a report that documents the benchmarking tool and the experimental results.

Deliverables

1. Regular meetings will be held between the supervisor and the student in order to discuss progress and the work items for the upcoming weeks. The student may be requested to give short presentations of his current work and provide short written summaries.

2. Source code and experimental data must be made available to the supervisor.

3. The final report must be written in English and typeset in LaTeX. It should include an introduction, an overview of related work, and a detailed description of the obtained results. Three copies of the final report must be delivered to the supervisor.

4. At the end of the thesis, a presentation of 30 minutes must be given, which should include a description of the context, the contributions, and details of the work.

The grading will be based on the scientific contributions of the work, the initiative and commitment of the student, and the quality of the report and the presentation.

References

[1] E. Androulaki, A. Barger, V. Bortnikov, C. Cachin, K. Christidis, A. De Caro, D. Enyeart, C. Ferris, G. Laventman, Y. Manevich, et al. Hyperledger Fabric: A Distributed Operating System for Permissioned Blockchains. In *Proc. 13th EuroSys Conference*, page 30, 2018.

[2] E. Buchman. *Tendermint: Byzantine Fault Tolerance in the Age of Blockchains*. PhD thesis, 2016.

[3] C. Cachin. Architecture of the Hyperledger Blockchain Fabric. In *Workshop on Distributed Cryptocurrencies and Consensus Ledgers*, volume 310, 2016.

[4] M. Hearn. Corda: A Distributed Ledger. *Corda Technical White Paper*, 2016.