Workloads and Benchmarks for Permissioned Blockchains

1. Introduction

    (a) Motivation of analyzing workloads and benchmarks for permissioned Blockchains

        i. Blockchain technology is emerging: New approaches as well as use-cases are developed regularly

        ii. Enterprise usage of Blockchain technology is considered more frequently.

    (b) Problem statement and scope of this work

        i. Performance of Blockchain technology is important: In order for permissioned Blockchains to be applicable in enterprise contexts, they need to match the performance of currently used systems.

        ii. Benchmarks can be used as an evaluation tool: Determining the feasibility of using permissioned Blockchains needs methods to evaluate their performance, respecting relevant workload scenarios.

        iii. This work analyzes benchmarks and workloads that are currently used to measure performance of permissioned Blockchains and evaluates their potentials and limitations.

2. Related Work

    (a) Performance analysis of public Blockchains

        i. Gervais et al. used a quantitative framework to analyze the performance impacts of public blockchain system properties

        ii. In this work, we analyze permissioned Blockchains instead of public Blockchains and focus on practical benchmarking approaches

    (b) Real-time performance analysis of Blockchains

        i. Zheng et al. implemented a framework to monitor the real-time performance of different blockchain systems.

        ii. In this work, we analyze performance measurement approaches which simulate usage scenarios

3. Background on Blockchain technology

   (a) Evolution of Blockchain technology: After its initial appearance in the Bitcoin cryptocurrency system, it became more sophisticated over time by enabling turing-complete smart contract (c.f. Ethereum) and permissioned blockchain deployments (c.f. Hyperledger Fabric)

   (b) Permissioned Blockchains as an alternative for enterprise databases: Using them can have several security and process efficiency benefits, but also drawbacks in terms of operational costs and network performance

   (c) Performance benchmarks for permissioned Blockchains: Performance assessments are relevant for determining the feasibility of using permissioned enterprise Blockchain systems

4. Methods for benchmarking permissioned Blockchains

   (a) Metrics of Blockchain performance models: Benchmarks focus on measuring throughput, latency, scalability and fault-tolerance

   (b) Multi-Layer model of permissioned Blockchain systems: To get a complete view on the performance, macro- and microbenchmarks need to be conducted

   (c) Workloads for simulating test scenarios: A benchmark needs to cover multiple kinds of network configurations as well as data inputs

5. Current benchmarking approaches for permissioned Blockchains

   (a) Descriptions of benchmarking systems: There are several different frameworks (e.g. Blockbench) which can have their own distinctive properties and workloads and solve the benchmarking problem individually

   (b) Comparison of benchmarking systems: The introduced frameworks can be weighted against each other regarding their methodology, potentials, shortcomings and the impact of their results

6. Evaluation

   (a) Consolidation of all findings of this work: Based on the previous chapters, the general state of enterprise Blockchain technology as well as their benchmarking systems can be determined

   (b) Outlook: More sophisticated benchmarking systems can uncover more bottlenecks, which helps in making permissioned Blockchain systems more attractive compared to existing alternatives