Evaluating Performance and Dependability of Blockchain Protocols with Diablo

Andrei Lebedev
University of Sydney
Australia
andrei.lebedev@sydney.edu.au

Vincent Gramoli
University of Sydney and Redbelly Network
Australia
vincent.gramoli@sydney.edu.au

***Abstract*—Recent years have seen a surge in diverse blockchain protocols tailored for different purposes, settings, and transaction volumes. Developers now face the challenge of selecting the appropriate protocol, relying on benchmarking to compare and analyze these options effectively. Benchmarking involves assessing transaction speed and system reliability under normal conditions and stress scenarios. A tutorial explores this process using the Diablo benchmark suite to evaluate the performance and reliability of a state-of-the-art blockchain, aiding in understanding blockchain benchmarking for consistent and comparable results.**

I. Overview

In recent years, there has been a significant increase in the variety of available blockchain protocols, finding applications in various domains such as finance, supply chain management, and healthcare. These diverse use cases give rise to distinct system requirements, encompassing factors like participation types and transaction metrics, particularly when subjected to varying workloads. At the same time, these blockchain protocols are structured with multiple layers, including the membership selection layer, consensus layer, data layer, and execution layer, each precisely tailored to address specific utilization scenarios.

In the process of selecting appropriate blockchain protocols, system developers are tasked with making well-informed decisions by considering the array of available options, each tailored to specific layers in line with their particular requirements.

To facilitate this decision-making, benchmarking has emerged as a valuable tool to assess various systems. Both protocol developers and researchers contribute to this evaluation process by reporting metrics such as transaction throughput, latency, and resource utilization under various conditions.

In this *half-day* tutorial, we will evaluate the performance of one of the six blockchains, Algorand, Avalanche, Aptos, Ethereum, Redbelly and Solana with the recent Diablo [1] benchmark suite. Furthermore, we will evaluate the dependability of the protocols by emulating different network conditions [2].

The tutorial will have the following structure:

- **Introduction** (20 min). What is blockchain, transaction throughput and latency, and Diablo benchmarking framework.
- **Simple Demo** (30 min). Using the virual machine image, members of the audience will run a local experiment on their own machines.
- **Fault Tolerance and Dependability** (20 min). Explanation of crash faults and network partitioning.
- **Fault Tolerance Demo** (30 min). We will introduce crash faults in the scenario and observe performance under new conditions.
- **Benchmarking Details** (20 min). Explanation of metrics and workload types.
- **Advanced Demo** (30 min). We will explain the blockchain protocol integration in Diablo, workload specification and how to change the experimental environment in runtime.
- **Discussion** (30 min). Implications of design decisions, metrics and aspects to be evaluated.

II. Objectives

The goal of the tutorial is to spark the interest of the community in blockchain protocol performance and dependability evaluation. We aim at easing the entry to the subject by providing simple hands-on experience.

The main objectives of this tutorial are:

- Offer insight into benchmarking blockchain performance and reliability.
- Offer straightforward guidance on integrating protocols and designing workloads.
- Deliver a practical tutorial on using the Diablo benchmarking suite to generate reproducible and comparable results.

III. Supporting Material and Target Audience

Slides, virtual machine image containing the required software and scenarios to demonstrate both performance and fault tolerance evaluation, and the project website[1].

The tutorial is aimed for general audience interested in blockchains and benchmarking, as well as specialists in the field. We will cover both the basic aspects and potential pitfalls and future work directions in blockchain benchmarking.

[1]https://diablobench.github.io

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Andrei Lebedev is a PhD student at the University of Sydney. The focus of his research is evaluation and improvement of distributed systems. He received his MSc in Informatics from the Technical University of Munich and has been a technical lead for Hyperledger Iroha, a permissioned blockchain protocol. He served as Artifact Evaluation Committee member of international scientific conferences (OSDI'23, USEINX ATC'23).

Vincent Gramoli received a Future Fellowship from the Australian Research Council and leads the Concurrent Systems Research Group at the University of Sydney. He is also the founder and CTO of Redbelly Network. His expertise is in distributed computing and security. In the past, Gramoli has been affiliated with INRIA, Cornell, CSIRO and EPFL. He received his PhD from Université de Rennes and his Habilitation from UPMC Sorbonne University. He is the Chair of the Cybersecurity and Privacy committee for the CORE ranking.