

Lightweight Blockchain Logging for Data-Intensive Applications

Yuzhe Tang [†] Zihao Xing [†] Cheng Xu [‡] Ju Chen [†] Jianliang Xu [‡]

[†]*Syracuse University, NY, USA, Email: {ytang100, zixing, jchen133}@syr.edu*

[‡]*Hong Kong Baptist University, Kowloon Tong, Hong Kong, Email: {chengxu, xujl}@comp.hkbu.edu.hk*

Abstract

With the recent success of cryptocurrency, Blockchain's design opens the door of building trustworthy distributed systems. A common paradigm is to repurpose the Blockchain as an append-only log that logs the application events in time order for subsequent auditing and query verification. While this paradigm reaps the security benefit, it faces technical challenges especially when being used for data-intensive applications.

Instead of treating Blockchain as a time-ordered log, we propose to lay the log-structured merge tree (LSM tree) over the Blockchain for efficient and lightweight logging. Comparing other data structures, the LSM tree is advantageous in supporting efficient writes while enabling random-access reads. In our system design, only a small digest of an LSM tree is persisted in the Blockchain and minimal store operations are carried out by smart contracts. With the implementation in Ethereum/Solidity, we evaluate the proposed logging scheme and demonstrate its performance efficiency and effectiveness in cost saving.