Technical University of Munich

Thesis M.Sc.

Designing a Lightweight Alternative to Distributed Ledgers

Motivation

Blockchains (BC) or *Distributed Ledger Technology (DLT)* are public (Bitcoin, Ethereum) or private (Hyperledger Fabric) data structures maintained by a peer-to-peer (P2P) network. This data structure's most important property is non-modifiability and non-mutability. In addition to tamper-resistant storage, many BC/DLT frameworks offer smart contracts (Ethereum) or chaincode (Fabric). Smart contracts/chain code are applications that implement logic that process inputs and data stored in the ledger, and writes the result of the computation back into the ledger.

Besides these positive properties, there exist a couple of drawbacks ranging from high complexity to inefficiency to non-applicability in certain scenarios.

Besides BC/DLT, there exists another technological paradigm with comparable properties called *Transparency Overlay (TO)*. TO was widely adopted in recent years with the rise of Certificate Transparency. TO is based on the idea of having n *public log servers*, which store information organized in a Merkle tree. However, an individual log server can delete or manipulate stored information. For this reason, entities which use the log's data cannot blindly trust the information in the log. As a remedy, further entities called *auditors* and *monitors* constantly perform various (semantic) tests over the public logs and warn entities in case a log is malicious.

In this thesis we want to explore if/how it is possible to build a system with similar properties as a DLT framework upon the paradigm of TO. Our particular focus is on mimicking the functionality of smart contracts/chain code.

Your Task

- Familiarize yourself with DLT frameworks (Hyperledger Fabric) and TO.
- Analyze properties of DLT frameworks $\rightarrow$ these are your requirements.
- Design a system that meets the requirements using TO as a design pattern.
- Implement your design in a prototype.
- Evaluate the prototypes performance in our test bed.

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