Secure Data Search via Searchable Encryption Using HYPERLEDGER FABRIC Smart Contracts

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INTRODUCTION

I. Encryption
- protects data from attackers
- reduces search capabilities

II.Searchable Encryption (SE)
- allows keyword search over encrypted data [1]
- trapdoors are encrypted queries used for search delegation
- majority of SE schemes model server as honest-but-curious

III.Hyperledger Fabric (HLF)
- permissioned distributed ledger (DL) platform
- provides trust, immutability, transparency and provenance
- DLs are immutable databases shared across network of peers
- ledgers: data about current & historical state of a set of objects

IV. Smart Contracts (SC) [2]
- automated transaction protocols for asset manipulation
- based on predefined conditions
- known as chaincode (CC)

OBJECTIVE

How can SE be implemented using HLF Smart Contracts?

METHODOLOGY

I. Literature Review

II. Protocol Design
- Learn the requisite frameworks and concepts
- Develop a model using the open-source network [3]
- Implement the algorithm
- Evaluate the performance

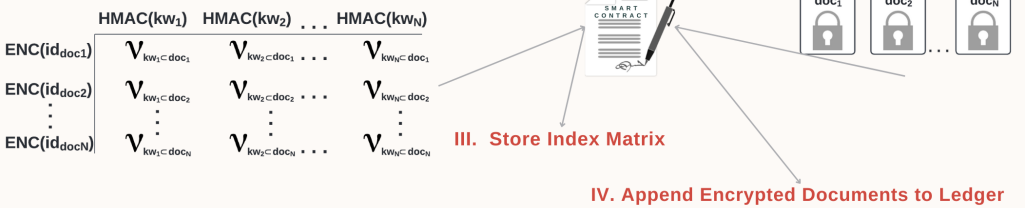
III. Log findings and draw appropiate conclusions

SYSTEM MODEL*

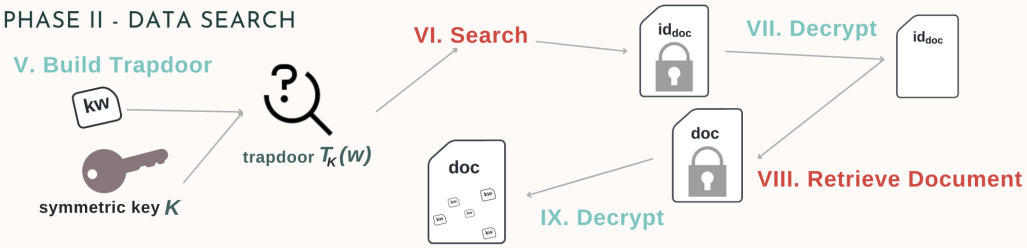
PHASE I - DATA APPENDMENT

I. System Initialisation

II. Build Index Matrix



PHASE II - DATA SEARCH



RESULTS

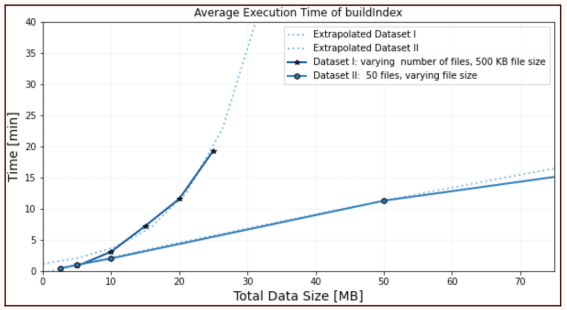


Figure 1. Time performance of two datasets. Dataset1 consists of 5 sets of 10, 20, 30, 40, and 50 files of size 500 KB. Dataset2 contains 5 sets of 10 files, each having size 250 KB, 500KB, 1MB, 5MB, and 25MB, respectively.

CONCLUSION

- **buildIndex** is faster for datasets with smaller number of files
- search takes ms to execute
- suitable for **larger files**
- single-writer/single-reader architecture

FUTURE WORK

- multi-writer/multi-reader architecture
- support multiple-keyword documents
- extend range of assets
- implement **dynamic** SE

* *methods written in **orange** are run by SC*
*methods written in **turquoise** are run locally*
the model was built upon the the PBSE scheme

References

[1] E. Androulaki et al., "Hyperledger Fabric: A Distributed Operating System for Permissioned Blockchains" Proceedings of the Thirteenth EuroSys Conference, 2018.
[2] N. Szabo, "Smart Contracts: Building Blocks for Digital Markets," 1996.
[3] Hyperledger Fabric: Using the Fabric Test Network.
[4] S. Tahir and M. Rajarajan, "Privacy-preserving searchable encryption framework for permissioned Blockchain Networks", pp. 1628–1633, 2018.