Hyperledger Fabric and Healthcare

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Abstract

Hyperledger Fabric is a blockchain framework implementation and one of the Hyperledger projects hosted by The Linux Foundation. Intended as a foundation for developing applications or solutions with a modular architecture, Hyperledger Fabric allows components, such as consensus and membership services, to be plug-and-play. . This project implements intelligent system of health records for maintaining up to date health records between patient and healthcare. A central part of the project plan is implementing traditional Healthcare Network with blockchain technology to provide a faster, better experience for all. The mission is to modernize the traditional healthcare system, which is plagued by inefficiency, fraud, and waste.

Introduction

Hyperledger Fabric is an open source enterprise-grade permissioned distributed ledger technology (DLT) platform, designed for use in enterprise contexts, that delivers some key differentiating capabilities over other popular distributed ledger or blockchain platforms.
Fabric has a highly modular and configurable architecture, enabling innovation, versatility and optimization for a broad range of industry.
Fabric is the first distributed ledger platform to support smart contracts authored in general-purpose programming languages such as Java, Go and Node.js, rather than constrained domain-specific languages (DSL).

KEY FEATURES :

- It is private and permission based
- Members of Hyperledger Fabric enrols through MSP - Membership Service Provider
- Ledger data can be stored in multiple formats.
- Consensus mechanisms can be switched in and out
- Ability to create channels - Allowing a group of participants to create a separate ledger of transactions

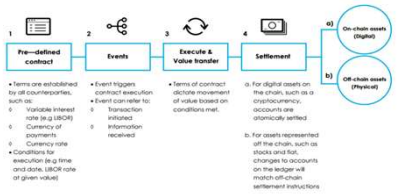

Figure 1. Transaction on a blockchain

Technology Used

- Fabric introduces a new architecture for transactions that we call execute-order-validate.
- It addresses the resiliency, flexibility, scalability, performance and confidentiality challenges faced by the order-execute model by separating the transaction flow into three steps:
  1. execute a transaction and check its correctness, thereby endorsing it,
  2. order transactions via a (pluggable) consensus protocol, and
  3. validate transactions against an application-specific endorsement policy before committing them to the ledger

At a high level, Fabric is comprised of the following modular components:

- A pluggable ordering service establishes consensus on the order of transactions and then broadcasts blocks to peers.
- A pluggable membership service provider is responsible for associating entities in the network with cryptographic identities.
- An optional peer-to-peer gossip service disseminates the blocks output by ordering service to other peers.
- Smart contracts ("chaincode") run within a container environment (e.g. Docker) for isolation. They can be written in standard programming languages but do not have direct access to the ledger state.
- The ledger can be configured to support a variety of DBMSs.
- A pluggable endorsement and validation policy enforcement that can be independently configured per application.

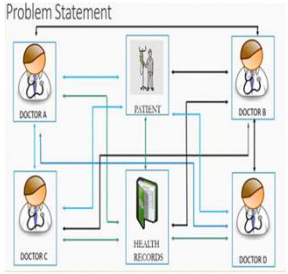

Figure 2. Software for health record system

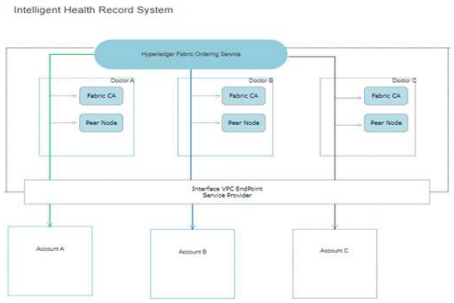

Figure 3. Structure of the proposed healthcare model

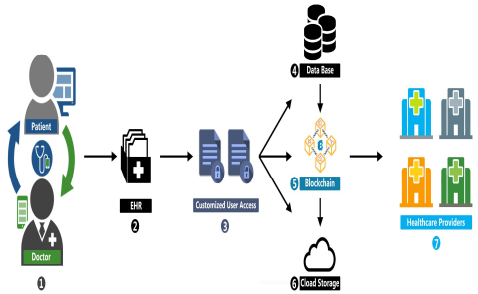

Figure 4. Healthcare data management in blockchain.

Intelligent Decentralized Health Record System

- The aim of the system is to provide the users ease of handling their health records and also providing them the authority to ensure controlled access of these records .
- The user has control over all aspects of the records and can henceforth provide access to parts of data to authorised health providers for a given period of time.
- The user can also revoke access to data as and when required.
- The verified health providers have the authority to update and upload various health records like lab test results or any new observations .
- The records can further be used to collect and maintain data over multiple nodes.
- The data collected can be used for predictive analysis and hence can be used to release alerts for serious patients.
- The system can be used in AI to train machines to constantly monitor various health aspects like blood sugar levels for patients under observation

Discussion

- When we are working across multiple hosts(servers), the containers can't communicate with each other.
- The overlay network driver creates a distributed network among multiple Docker daemon hosts.
- This network sits on top of (overlays) the host-specific networks allows containers connected to it to communicate securely.
- Access control language (ACL) provides declarative access control over the elements of the domain model.
- ACL rules determine which users/roles are permitted to create, read, update or delete elements in a business network's domain model.

Network Definition

Network Definitions are composed of:

- a set of model files:
  - defines the business domain for a business network
  - define the structure and relationships between model elements: assets, participants and transactions
  - created by business analysts
- a set of JavaScript files
  - The JavaScript files are typically created by developers who are implementing business requirements provided by business analyst
- an Access Control file
  - The Access Control file contains a set of access control rules that define the rights of the different participants in the business network.

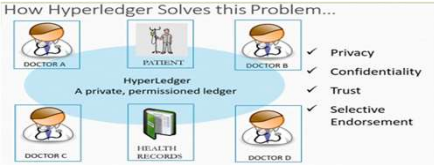

Figure 2. Advantages of the proposed system

Summary

- The proposed system can bring a revolution in terms of the healthcare ecosystem.
- The system proposed is transparent and secure.
- The health records are time-stamped and hence the integrity of data is maintained.
- The system has several challenges to be dealt with. Further research on regulation, standardization, and cross-border health data retrieving policies including retention and usage intention are duly urgent.

Contact Information

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