

Systematic Review on Emerging Blockchain Technology (BT) Applications

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Abstract - Blockchain Technology (BT) has become a reliable and trustable solution for many traditional issues in finance and computer science. Blockchain is a decentralized, peer to peer (P2P), immutable series of data which are stored and managed by clusters of computer. In recent years blockchain has shown an optimum reliability in multiple domains such as Healthcare, Education, Finance, Supply Chain Management, etc. This paper, helps to find where the recent researches are focused on and offers a wide perspective view in blockchain applications with smart contracts and distributed ledger design. The purpose of this review is to explore the further potential application of smart contract as a tool on multiple domains

Key Words: Blockchain Technology (BT), Smart Contract, Distributed Ledger, Finance, Healthcare, Education.

1. INTRODUCTION

Blockchain is a growing list of records, called blocks that are linked using cryptography. Blockchain can be described as data structure that holds transaction records by ensuring the security, transparency and decentralization. A blockchain is a distributed database, where the records of transaction in the ledger are held by all participants. In 1991, Stuart Haber described secured chain of blocks cryptographically. The concept of bitcoin was invented in 2008 by a person or group of people. Satoshi Nakamoto [1] has published a paper on crypto currency "Bitcoin- A Peer to Peer Electronic Cash System". In 2011, bitcoin increases its popularity due to the decentralization concept and encrypted currencies. In 2016 Ethereum's arrival was marked by the emergence of Initial Coin Offering (ICO's). Ethereum is a free ware, decentralized software platform based on blockchain. It enables smart contracts and Distributed Applications, which are used to build the code and run with minimum fallacy,

without any downtime.

A simple comparison of understanding the block chain is Google Doc. When a new document is created and shared with a group of people, the document is distributed rather than transferring or copied. The changes made to the document are transparent to all the group of members. Like wise the transaction on the block chain are also made transparent to overcome the risks and to protect the information from intruders.

Maintaining the transaction information publicly with a system of checks and balance, helps the blockchain to maintain integrity, trust among users and scalability of trust via network technology.

2. WORKING OF BLOCKCHAIN

A blockchain is a collection of informative blocks. Each blocks stores different transaction information such as date, time and the details of participants. For every transaction, a unique code called "hash" is generated. This hash code is a string of alphanumeric characters, which are created using a special cryptographic algorithm. Transactions are entered in the order in which they are occurring. Each block holds the hash of its transaction and also the hash of previous block known as parent block. If any changes made to the transaction, it will again recreate the hash code and this change will be replicated in the remaining blocks. Every node will have the copy of the whole blockchain. The blockchain automatically updates itself for very ten minutes to avoid the security risks. When every time a block arrives, it has to be approved by the remaining blocks. Once the whole chain of nodes has done its verification on the new node then only the node can be inserted or joined to blockchain. The

cryptography behind blockchains allows these transactions to be verified and ensures the permanency of the records.

3. LITERATURE REVIEW ON BLOCKCHAIN APPLICATIONS

3.1 BLOCKCHAIN IN FINANCE

Nizamuddin Ariffin[2] describes the trade finance application based on permissioned blockchain Hyper ledger Fabric. This paper proposes three-layer architecture for the fabric application as shown in Fig 1.

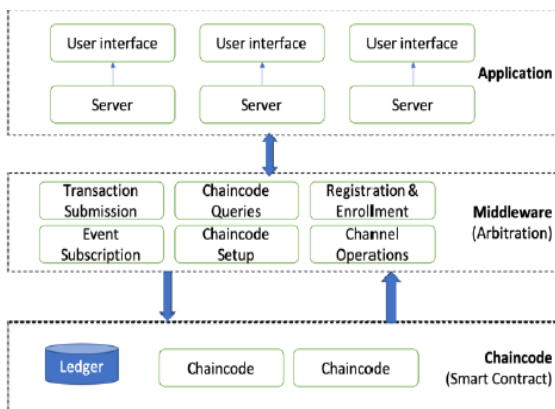


Fig 1: Three layer architecture for Hyperledger Fabric Application

The lowest layer is called as chaincode, in this layer the smart contract operates directly with shared ledger using the one or more chaincode units. These chaincodes run on the network platform to provide service API for notification of transactions, queries and the changes occurring over the channel. The middle layer works arbitrator, which resolves the problems or conflicts between chaincode layer and top layer. The topmost layer is called as the application layer, which consists of stacking of applications to different participants.

Philipp Peach [3] developed a conceptual framework for the governance of blockchain- based network in financial environment. It constructs a vision on financial regulation, private laws for the new technology to protect the market participants and societies.

Han Qiu.et.al [4] proposed a chainIDE, a cloud based solution for the construction of cross-blockchain

of smart contracts, without any time consuming. ChianIDE provides a geographical user interface (GUI), based on the user’s viewpoint. Along with GUI, help document also given to the user to interact directly with the block chain. The users can program their environment from any device with an internet connection that supports JavaScript. This cloud-based system also provides cache mechanism for developers, which saves the un compiled program even if the user loss their network connectivity. The programs are compiled on the cloud flare to speed up the process. An overview of system architeure is shown in Fig 2.

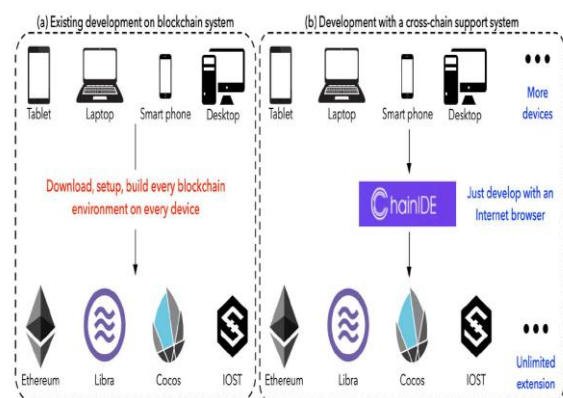


Fig 2: Improvement of chainIDE

3.2 BLOCKCHAIN IN HEALTHCARE

Asaph Azari [5] proposed a decentralized, immutable record management system called MedRec to handle Electronic Medical Records(EMRs). This MedRec provides accountability, confidentiality, authentication and Security over the sensitive information. In this system, stockholders will be participating as block “miners”, this in return provides security for networks via proof of work (POW). Hence, they utilize Ethereum’s smart contracts to create intelligent representations of existing medical records that are stored on individual nodes. This platform enables the emergence of data economics, matching demand and supply between the data producers and consumers. Fig 3 illustrates the contract strcture and relationships.

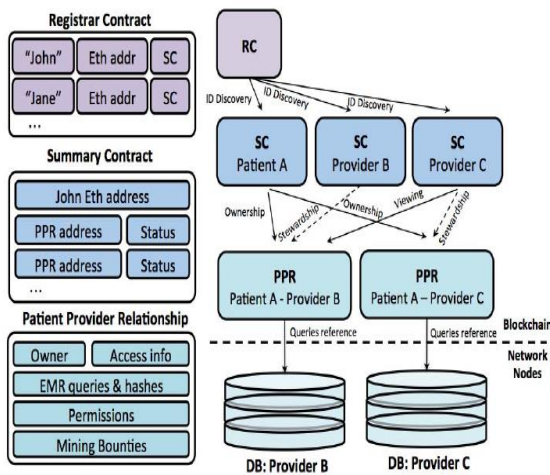


Fig 3: MedRec system Architecture

Koosha Mohammad Hossein[6] has proposed blockchain based architecture for e-health application which can provides access control mechanism. In the proposed system model, patients health information's are gathered using the sensors attached to the patients' body or smartphones, and these information's are stored on central server called IHM(IoT Health Manager). Here the minors are clustered and the patients health data are kept in another cluster. Each cluster operated independently but simultaneously. By this approach network throughput problem is reduced.

Sabysachi Chakraborty [7] has proposed a secured healthcare system framework with accordance to IoT and blockchain as a transaction and access management system. In this paper, a fusion of blockchain, Machine Learning and IoT is used to provide enhanced secure system. IoT is used to collect the patient's health information from the wearable devices of patients. Blockchain stores the collected information in the form of multiple transactions and also BT provides authentication and trusted data. At last Machine Learning mode is used for detection of abnormality and to forecast certain scenarios that may arise in due time by analysing the basic identification of patient condition.

3.3 BLOCKCHAIN IN SUPPLY CHAIN MANAGEMENT

Sidra Malik[8] has proposed a TrustChain, is a three layered management framework which uses consortium blockchain for tracking the interactions

among the participants of the supply chain and to provide trust and reputation based on this interaction.

This framework has been built to avoid the traceability and integrity challenges in the supply chain management system. As shown in Fig 4, the lowest layer is the data layer, which stores the information like supply chain data which are encompassed with the help of sensors, events between entities, and regulatory endorsements. While the message digest of data is sent to the middle layer (Blockchain layer) as a transaction. All the transaction information's are stored in ledger with set of access control rules. These transactions invoke smart contracts, which generate trust values and reputation among entities and quality scores for commodities using trust and reputation module. The topmost layer is the application layer which interacts with the block chain layer through queries. They query about the quality scores of entities and commodities.

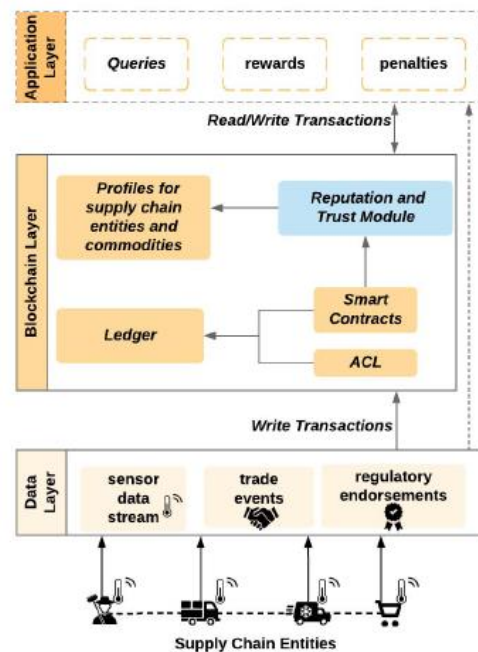


Fig 4: Three layered framework of Trust Chain framework

Dona Kaid[9] proposed a prototype using blockchain to handle the automate instalment payment between the supply chain parties with some specific condition, which can be achieved through smart contracts. In this prototype, the distributor and retailers are interacted through permissioned

blockchain using Hyperledger Fabric. Here the actions between the parties are based on Point of Sale (POS). Where each party has their roles and transactions. The admin has the access to all the data on a system to track the details of commodities in the network instantaneously.

3.4 BLOCKCHAIN IN EDUCATION

Khoulou Al Harthy [10] highlighted the importance of blockchain in higher education system. Since today's educational institutions are growing in higher rate, they need a secured data transaction such as students profile, certificates, etc. Between the campus at different locations. To keep tracking the data, blockchain functionalities uses the concept of Proof of Work(POW) to ensure the scalability, integrity and availability of data.

Qin Liu [11] proposed a Education -Industry cooperative system based on Hyperledger in blockchain. Here the transparency and non tampering features of blockchain are used in this framework system which stimulates the roles of enterprises and universities. By this stimulation it allows both universities and enterprises to share the information's like students skill profile, knowledge information, current market trends and demands of enterprise recruitment.

4. CONCLUSION AND FUTURE WORK

In recent years, the interest in Blockchain Technology (BT) has been increased in both industry and academic areas. We identified the current trends and applications of BT in various domains. Using this fastidious survey, we found out the main problems of traditional systems and the implementation of BT to overcome those problems. By the review, we conclude that there was a huge gap in blockchain application in the academic area.

As a future work, we can use a blockchain and concept of smart contract for the implementation of intellectual management system over the properties and in the field of education.

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