

Blockchain Technology for Securing Healthcare Records

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Abstract - The modern day methods used to record as well as share patient related data are deeply flawed. These Shortcomings limit the amount of access patients have to their clinical records, reduce availability of essential data to healthcare providers, and thus stand as an obstacle in creating the ideal health care system. Storing crucial patient related data on a Blockchain can help overcome the shortcomings posed by the current model. This paper explores the application of Blockchain as a novel approach to secure storage of patient data, facilitate its secure sharing and revolutionize the health care industry.

Key Words: blockchain, healthcare, securing health records, blockchain challenges, blockchain healthcare

1. Introduction

Blockchain stores the Information across the Network or personal Computers making them not just Centralized, decentralized but distributed means no central company or a person owns the System

The Blockchain uses a form of math called Cryptography to ensure that Records can be Confidential and cannot change by anyone else.

The healthcare records are fragmented, distributed over different healthcare institution. In 2015, 140 million Patients records were breached according to Protenus Breach barometer report. A medical error is the third leading cause of death in U.S. with a block-based protocol, every modification regarding a patient's record would be verified, linked with other transactions and added as a block to chain of blocks. Personal healthcare records need to be protected with the highest standards with the increasing number of data breaches incident in the past several years, the awareness of the general public about the personal data privacy will continue to increasing the necessity for data privacy will grow stronger with an increasing number of services and device collecting our personal data associated with our personal identity.

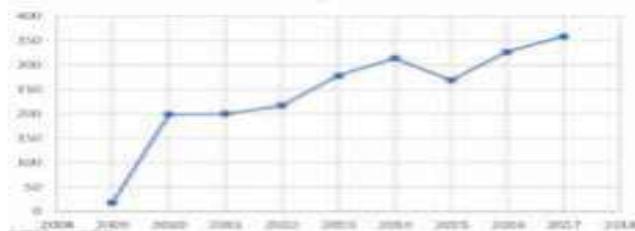


Figure 1: Annually Reported Breaches.

2. Why Blockchain Was Developed

To automatically provide Accuracy, Security, and Modify ability of Digital records using Computer and Mathematics. Blockchain uses Cryptology to achieve desired level of Privacy and Security for Digital records.

3. Blockchain Addresses Current Healthcare Challenges

Blockchain provides opportunity to overcome challenges that exist in the healthcare industry today.

Challenges are interoperability, security, Integrity, traceability and universal access.

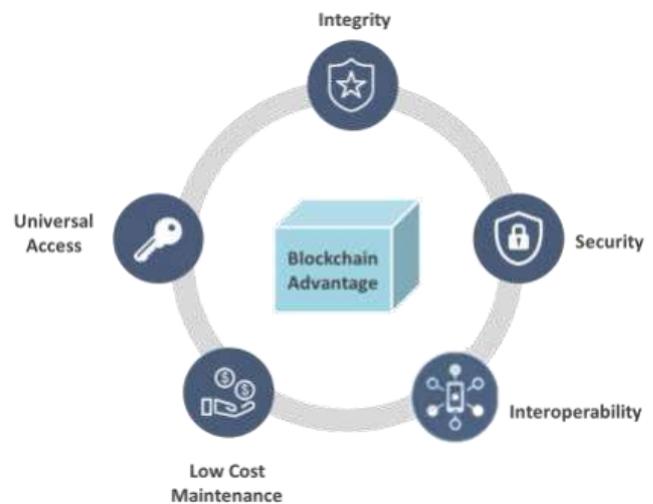


Figure 2 : Advantages of Blockchain

3.1 Interoperability

Today healthcare organizations are at different maturity levels as far as interoperability of healthcare data is concerned. There are some organizations who are exploring use of FHIR, while several organizations are using the CDA standard for data exchange and some share data using HL7 2.X standard varying data standards across organizations is another challenge which reduces which hamper Quality scores interoperability Blockchain helps overcome this challenge by accessing data through APIs. With transfer of data through APIs, blockchain achieves standardization of data format, which is used to transmit data irrespective of the capabilities of EHRs to communicate different HL7 versions.

3.2 Security

Security in healthcare industry encompasses various aspects based on integrity of data maintained in an organization. Tampering and security breach of healthcare data is a growing concern for many healthcare organizations. It is difficult to tamper with data present in blockchain as it requires validation from different nodes in the chain. Blockchain offers inbuilt security features as the data in blockchain is encrypted with private key of the sender and only intended recipient can decrypt data using key from the sender.

3.3 Integrity

Blockchain's distributed ledger and immutable transactions helps ensure data integrity while encryption of data enhances data security across the network. With the implementation of Blockchain technology, multiple instances of obsolete patient data with various stakeholders are replaced with single source of up-to-date information of patient information. Patient is the custodial owner of data controlling who has access to PHI information.

3.4 Universal Access

Managing access to patient data across healthcare entities is a challenge where Blockchain can help. Blockchain ensures that required data is present at every node and is available for use to the authorized entities based on the access rights provided through smart contracts or other mechanisms.

3.5 Cost of Maintenance

Maintenance of a typical healthcare information system involves various operations including but not limited to performing backup storage services, having recovery mechanisms in place and ensuring up to date fields. In case of blockchain, data is distributed across the network and there is no single point of failure leading to inherent backup mechanism. Also, a single version of data is copied on every node of the blockchain. This reduces transaction volume that occurs between each information system reducing the burden on the healthcare ecosystem

4. Key Benefits of Blockchain for Healthcare

4.1 Blockchain is Decentralized management

Blockchain is peer to peer network that is each node runs independently while following the protocols so blockchain is suitable for applications where Stakeholders wish to collaborate with one another without sending control to a central management intermediary.

4.2 Blockchain is Immutable Audit Trail

Blockchain supports create and read functions that it is very difficult to change the data or records. Thus, Blockchain is

suitable as an unchargeable ledger to record critical information (example: insurance claim records).

4.3 Data Provenance

In Blockchain, The ownership can only be changed by the owner, following the Cryptographic protocols. Also the origin of the assets are traceable that is the sources or the data and records can be confirmed, increasing the reusability of verified data (example: patient consent records).

4.4 Robustness and Availability

Blockchain are based on distributed technology and thus do not suffer from single point of failure, each node has a whole copy of whole historical data records. Thus Blockchain is when the preservation and continuous availability of records (example: the electronic health records of patients are important).

5. Applications of Blockchain in Healthcare

5.1 Securing Patient Identification Information

Currently, all the health information about patients are being recorded in Databases controlled by individual organizations or group of organizations. It is not being shared with other organizations due to security issues and chance of the data being modified or tampered with. But having a single trusted source of information for health details will be a great boon to patients and healthcare organizations alike. Blockchain can be used to save this data, which can be accessed by all the organizations, allowing doctors to see the prescriptions for a patient by other practitioners. Blockchain prevents data corruption using hashes and the block chain can be design to be viewed only with a pass key

5.2 Maintaining longitudinal patient history

Block chain can be used as a generic tool to keep data securely in a distributed, encrypted ledger along with controlling the resources who can access this ledger. Rather than having one central administrator that acts as a guard the health data, there's one shared ledger which is spread across a network of synchronized, similar databases visible to anybody with access. This helps in preserving the patient health records securely and the same will be accessible even if a few of the systems in the data-network are unavailable.

5.3 Determining the Integrity of Drug Supply Chains

The healthcare industry is suffering massive losses from the proliferation of counterfeit drugs. A recent global investigation uncovered roughly \$74 Million worth of counterfeit drugs. However, it is envisioned that with the proper implementation of Blockchain-based supply chain systems, the integrity of drugs and services can be assured. This will be made possible by maintaining a Blockchain based custody log that tracks and records every step and custodian in the drug supply chain. This would let

pharmaceutical companies monitor their drugs down to the product level. Additional modules such as Smart Contracts can be added to the system to help build trust between the suppliers and Pharmaceutical companies. Provenance has thus come to become a major area for the application of Blockchain technology. Within a single supply chain of drugs and pharmaceuticals many use cases exist wherein Blockchain technology can be appropriately leveraged. A lot of this has to do with the fact that there are certain loopholes in the transportation processes, primarily due to the lack of transparency that can be exploited to introduce counterfeit drugs into the chain. In an effort to curb the problem, Drug Supply Chain Security Act (DSCSA) has formally been implemented in the US to help combat the proliferation of counterfeit drugs.

5.4 Securing Billing and Claims Sector

The Financial Sector of the Healthcare industry has much to gain from blockchain technology. Secure transaction of bills and process of claims can be established using blockchains, while tracking this information in case there is a need to backtrack. It has proved its potency in this sector through Bitcoins, Ethereum etc.

6. Conclusion and Future Work

Blockchain is a Technology promising that is is open and secure access to healthcare data. Blockchain is not enough for large scale business deployment. Many barriers needs to be overcome before blockchain can be fully adopted as a main stream technology for real world business solutions. To development of open system interfaces, and having intermediaries who currently profit from controlling the data to interface with blockchain system. To power blockchain applications, we need to continuously improve low-level blockchain protocols that are equivalent to the backbone of current internet services such as TCP/IP and HTTP. We need to improve trust and decision making process in blockchain so that system is more scalable with higher transaction without sacrificing security. One way is that Blockchain network could assign more weight into trusted nodes to expedite the computation of the block. Healthcare has its data value within a data pool. Blockchain tokens can be used to incentivize the data donors. It is important to have incentive mechanism as a built-in feature of the system to power the functioning of the chain. Build application that allow patients to donate their data in an anonymous way. The pricing model for various categories of data needs to be figured out. Another interesting topic is the communications across the multiple blockchain systems. Multiple blockchain system even for healthcare system that might interact with each other.

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