Enabling Blockchain Architecture for Health Information Exchange (HIE)

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Abstract:

Electronic health records (EHRs) have become such an important aspect of the healthcare system, making security a crucial component in this framework. Health Information Exchanges (HIE) is a centralized system that enables health care providers to securely access and share these patient EHRs over the internet. However, privacy concerns, security threats, limited transparency of the system, and a lack of patient control are all major challenges faced by the present HIE systems. HIE systems are designed to lower healthcare costs, minimize medical errors, and increase inter-organizational coordination of patient data among health care institutions. Blockchain technology has the potential to revolutionize health care by putting the patient at the center of the system. Every transaction has an immutable audit trail owing to the shared ledger structure. Without the requirement for a central authority, healthcare institutions can create authorized entries. A blockchain-based HIE architecture can increase healthcare records' security, privacy, and interoperability while also maintaining data integrity through its smart-contract standard. At the same time, it permits only authorized individuals to access confidential information and patient identities. As a result, blockchain-based HIE architectures are viable solutions that can help healthcare companies achieve their goals.

Keywords: Health Information Exchange (HIE), Blockchain, Electronic Health Records (EHR), Security, Distributed Ledger, Healthcare

Introduction:

Blockchain has a few properties that make it desirable to any industry, but especially to healthcare. According to CBInsights' 2018 research report, blockchain can aid in addressing some of the healthcare industry's most pressing issues [1]. Supply chain integrity is a valuable application of blockchain in this field. Every transaction between medicine makers, distributors, pharmacists, and patients may be verified using blockchain, and the process can be secured.

Every day, terabytes of new data is generated in the healthcare sector – laboratory reports, medical records, clinical trials, device monitoring, and other sources – which are often buried in several separate, isolated databases. In addition, data breaches in healthcare are particularly costly in comparison to other businesses. One excellent application of blockchain in healthcare is to combine a patient's medical information from different Electronic Health Records (EHRs) into a single, up-to-date, and tamper-resistant record. Full interoperability, as per one study, could save the US healthcare system $77.8 billion each year. This chapter delves deeper into the use of blockchain-based HIE systems to enable national interoperability. While blockchain isn't a panacea for all problems, it does give a platform for research, investing, and proof-of-concept validation.

The rest of the chapter is organized as follows: The existing HIE systems, their limitations, and pitfalls are discussed in Section 2. The architectural foundation for scalability and data flow in blockchain-based HIE systems is described in Section 3. Section 4 throws some light on the benefits of utilizing blockchain-based architecture. The challenges and shortcomings in implementing these designs in practice are discussed in Section 5. Finally, Section 6 presents our conclusions.

Tentative Table of Contents:

Section 1: Introduction
- A. Overview of Blockchain Systems
  (*Introduces key blockchain concepts and categories - Public, Private, Consortium, Hybrid Blockchain)*
- B. Use Cases of blockchain in healthcare
  (Applications like supply chain transparency, insurance settlements, etc. Focusses more on HIE systems)

Section 2: Pitfalls in the Traditional HIE systems
  (Discusses the following pain points of the current HIE system and how blockchain architecture would help overcome them)
- A. Varying data standards
- B. High cost per transaction
- C. Inconsistent rules and permission
- D. non-secure network infrastructure
- E. Unsynchronized records and multiple patient identifiers

Section 3: HIE architecture using Blockchain
  (How medical data is created and accessed in a blockchain-based architecture takes place)
- A. Data Creating & Updating
- B. Transaction Processing & Storage
- C. Data Query
- D. Patient's Data Sharing

Section 4: Advantages of Blockchain-based, HIE systems over traditional systems
  (How blockchain implementation could help solve some of the industry's most pressing issues)
- A. Security enhancing
- B. Interoperability enabling
- C. Trust
- D. Opt-in Intention
- E. Traceability and transparency
- F. Business Value
  - i.) Patient Perspective

ii.) Provider and organization perspective

Section 5: Implementation challenges and considerations
(Explores the obstacles while building blockchain solutions for HIE)
      A. Time-consuming transaction verification
      B. Compliance with Federal and Local Laws
      C. Inadequate Technical infrastructure and social support

Section 6: Conclusion

References:

[1] How Blockchain in Healthcare disrupts the industry (Nov 14, 2018)
https://www.cbinsights.com/research/report/blockchain-technology-healthcare-disruption/