

Blockchain in Healthcare Domain

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Problems in Healthcare Sector	
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 - ATTP (Advanced Track and Trace for Pharmaceuticals)

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Introduction

- What is Blockchain?
- Current problems in healthcare sector
- Blockchain based solutions for healthcare problems

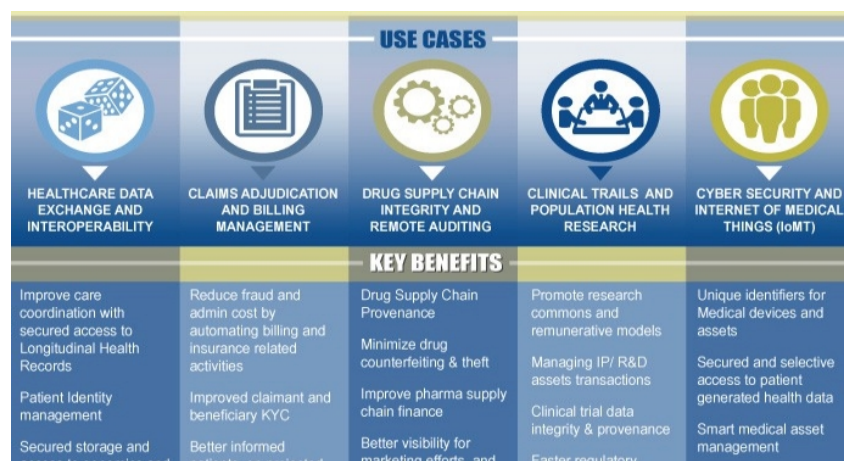
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Problems in Healthcare Sector

- Interoperability of healthcare data
- Fragmented health records
- Claim adjudication
- Data Privacy and security
- Ill-informed clinical decision making
- Data reliability
- Lack of transparency

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Blockchain Applications in Healthcare



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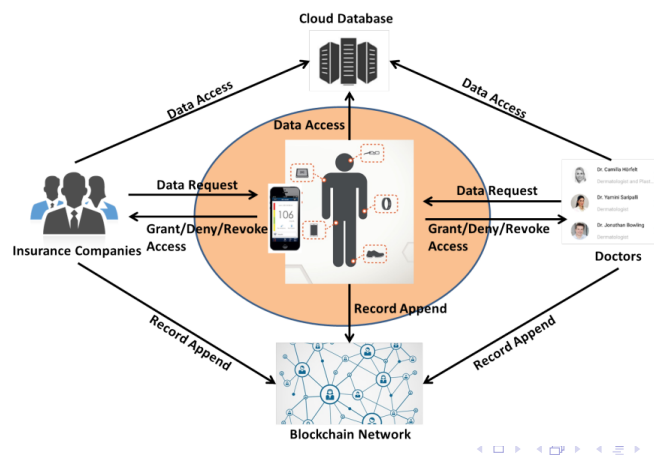
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Personal Health Records

- The architecture of blockchain is like a series of immutable records. This is highly helpful in implementing a patient-centric chain of health records.
- Data storage concept in Medrec.

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Health Information Exchange

- Currently, the healthcare industry experiences major inefficiencies due to diverse and unconnected data.
- Effective care collaboration is vital to improve healthcare outcomes.
- With digitized health data, the exchange of healthcare information across healthcare organizations is required.
- Data sharing should be done only by considering privacy of patients.

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Medrec

- Patient-Provider Relationship Contract(PPR) defines an assortment of data pointers.
- Each pointer consists of a query string that, when executed on the providers database, returns a subset of patient data.
- The query string is affixed with the hash of this data subset, to guarantee that data have not been altered at the source.
- To enable patients to share records with others, a dictionary implementation is used.
- This can make things complex as an intermediate mechanism is needed between internal system at hospital and the blockchain network.

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Medicalchain

- Patient A grants access to EHR to Practitioner A.
- Practitioner As ID is added to Patient As authorized asset on the ledger.
- Patient As ID is added to Practitioner As authorized asset on the ledger.
- The Symmetric key for the EHR is decrypted with Patient As private key.
- Symmetric key is then encrypted with Practitioner As public key.

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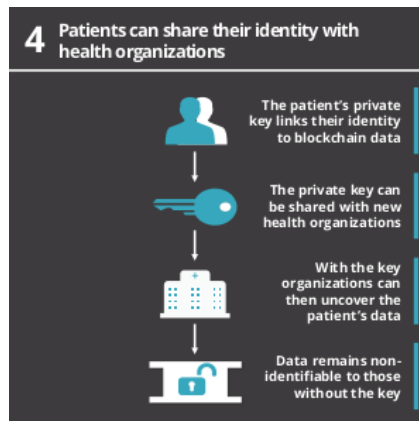
Deloitte

- Deloitte uses patients private key to share their health data.
- Patients private key links their identity to blockchain data.
- Only organizations with this key can access the information and others can not.

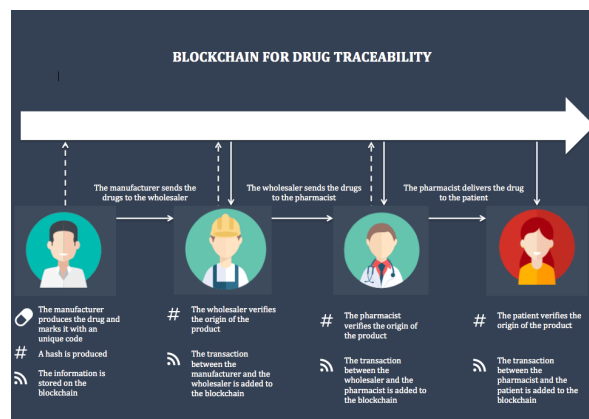
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Verifying the Authenticity of Drugs



Verifying the Authenticity of Drugs

- Instead of destroying returned drugs, pharmaceutical companies instead opt to resell them.
- However before they can resell these returned drugs, the pharmaceutical companies have a legal obligation to verify the authenticity of the returned drugs.
- A far better and recommended approach is to have pharmaceutical manufacturers record the serial numbers of their packages on a blockchain, which serves as a decentralized and distributed ledger.

Verifying the Authenticity of Drugs by SAP

- When a manufacturer ships a package they register the item on the SAP Pharma POC blockchain, with the four pieces of information generated; the item number (based on GS1 standard), a serial number, a batch number, and an expiration date.
- The distributor can extract the four pieces information from the packaging barcode, using a simple scanner mobile app, allowing them to verify returns .

Supply Chain Management

- Blockchains ability to track back to the origin of data makes it especially suited for this supply chain use case.
- The World Health Organization (WHO) estimates that 8 percent of the medical devices in circulation today are counterfeit copies.

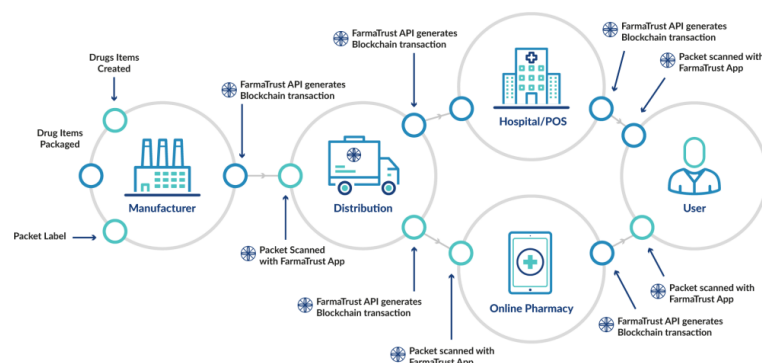


Figure: Farmatrust

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Supply Chain Management

- Health Insurance Claim Adjudication
- Patient Digital Identity
- Provider Directory

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Advantages of using blockchain

- Ensures trust between participating entities.
- Privacy and security for patients health data.
- Data reliability.
- Improved tracability of records.
- Faster transaction rates.

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Challenges in Implementation

- Uncertainty
- Storage Capability
- Scalability Challenge
- Adoption and Standardization
- Cost of Implementation
- Rules and Regulations
- Limited Performance
- Unwillingness to share data.

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Reference I

[RK16] [AE16] [PZW17] [wik] [med] [far]



John D. Halamka MD Andrew Lippman Ariel Ekblaw,
Asaph Azaria.

A case study for blockchain in healthcare: medrec prototype
for electronic health records and medical research data.
2016.



<https://www.farmatrust.com/>.



[https://medium.com/@Cryptostory/
blockchain-in-healthcare-use-cases-dd683df5065b](https://medium.com/@Cryptostory/blockchain-in-healthcare-use-cases-dd683df5065b).

Reference II



Douglas C. Schmidt Peng Zhang and Jules White.
Blockchain technology use cases in healthcare systems.
2017.



Mark White Mariya Filipova Florian Quarre Dan Barr Allen
Nesbitt Kate Fedosova Jason Killmeyer Adam Israel
Lindsay Tsai RJ Krawiec, Dan Housman.
Blockchain: Opportunities for health care.
2016.



[https:
//medicalchain.com/Medicalchain-Whitepaper-EN.pdf](https://medicalchain.com/Medicalchain-Whitepaper-EN.pdf).