

Project Design Phase-Part 2

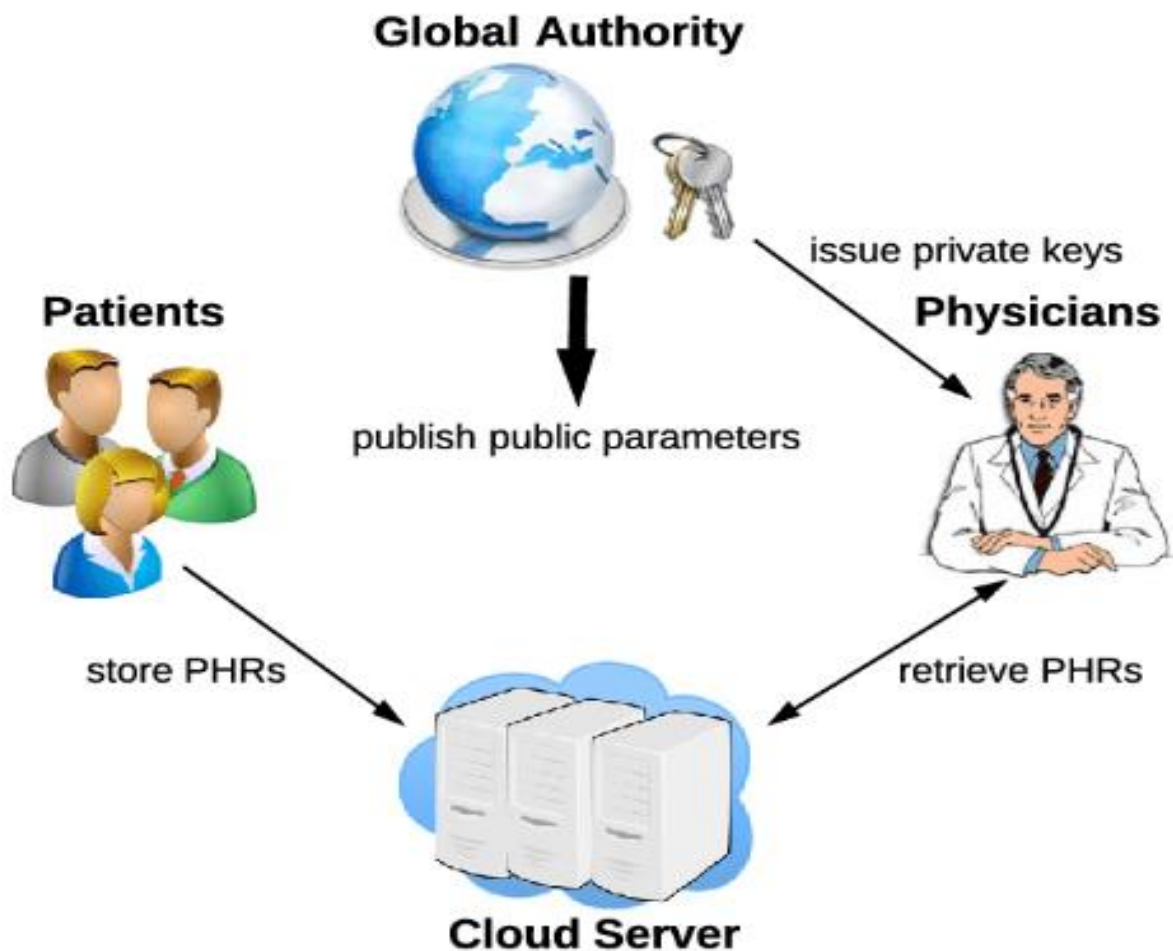
Technical Architecture

Team Id	NM2023TMID04415
Project Name	Block Chain Technology For Electronic Health Records

Introduction:

With the development of cloud computing, electronic health record (EHR) system has appeared in the form of patient-centric, in which patients store their personal health records (PHRs) at a remote cloud server and selectively share them with physicians for convenient medical care. Although the newly emerged form has many advantages over traditional client-server model, it inevitably introduces patients' concerns on the privacy of their PHRs due to the fact that cloud servers are very likely to be in a different trusted domain from that of the patients. In this paper, aiming at allowing for efficient storing and sharing PHRs and also eliminating patients' worries about PHR privacy, we design a secure cloud-based EHR system, which guarantees security and privacy of medical data stored in the cloud, relying on cryptographic primitive but not the full trust over cloud servers. Based on our proposed basic EHR system,

we provide several extensions including adding searchability, supporting revocation functionality and enabling efficient local decryption, which fills the gap between theoretical proposal and practical application.

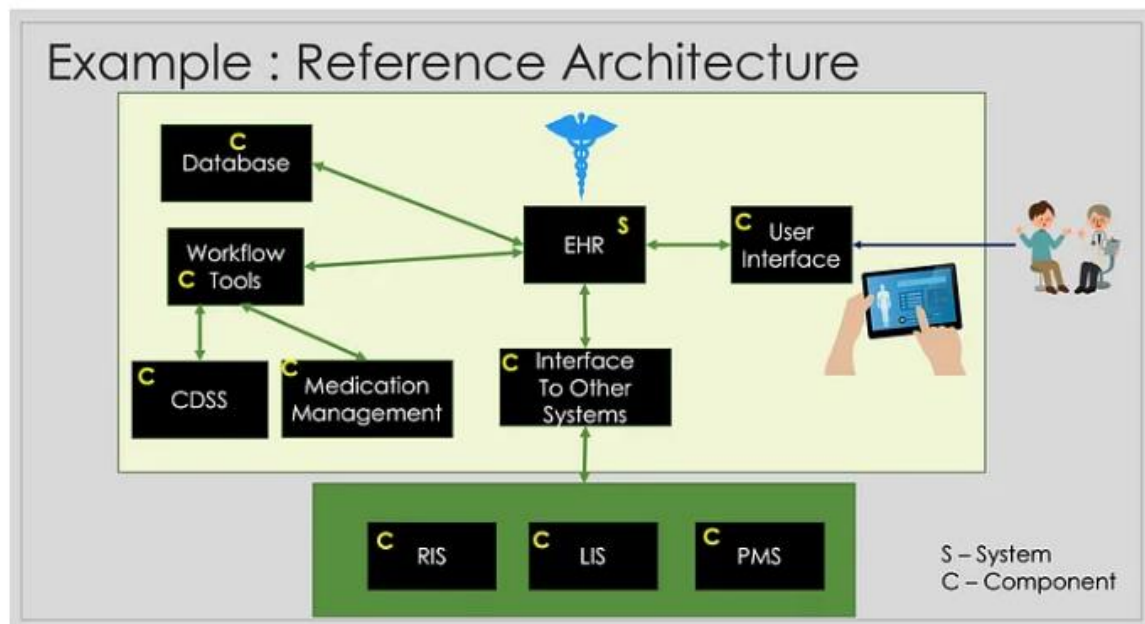


A Reference Architecture is a high-level, abstract representation of a system that defines the components, relationships, and rules necessary to achieve specific goals and objectives.

I am providing a healthcare example for a Reference Architecture of a Electronic Medical Record.

An EHR system is a collection of hardware, software, and data components that work together to support the management of patient health information.

In the below example I have tried to provide a RA (Reference Architecture) for a EHR (Electronic Health Record) system.



Reference Architecture of an Electronic Health Record System

In the above diagram, EHR is the System. Healthcare Personas like Physicians, Nurses, Patients, Laboratory Technicians, Radiologists, and Patients/Consumers interact with the EHR system via a User Interface or a UI. A UI can be a web-based portal or a simple Mobile Application.

The Components of the EHR system typically includes :

- A database to store patient information, including medical history, test results, and treatments
- User interfaces for healthcare providers to access and update patient information
- Workflow tools to manage the processes of capturing, sharing, and using patient information
- Interfaces with other healthcare systems, such as laboratory information and imaging systems.

Together, these components form a system that supports capturing, managing, and sharing patient health information to improve patient care.

EHR interfaces with external components like Radiology Information Systems, Laboratory Information Systems, Patient Monitoring Systems, etc., to get and feed information to these systems for various clinical business process fulfilment in patient care.

Blockchain:

Blockchain or Distributed Ledger Technology (DLT) [9], is a technology that was initially proposed in a cryptocurrency system known as Bitcoin, which

allows a P2P (Peer to Peer) transfer of digital assets without intermediaries or third parties [10]. It is a decentralized ledger of immutable transactions where each node maintains a copy of the ledger by applying transactions that a consensus protocol has validated, and these transactions are grouped into blocks that include a hash that links each block to the previous one, as shown in **Figure 1**.

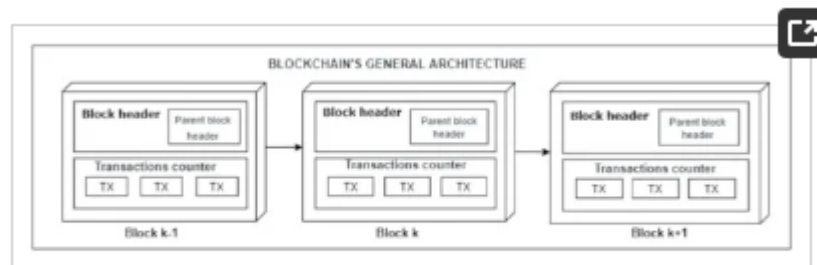


Figure 1. General blockchain architecture.

Blockchain Structure:

- A transaction is the fundamental element of Blockchain, a set of transactions is validated and issued. Many transactions form a block. Many blocks form a chain through a digital data link. Each of the blocks goes through a consensus process to select the following block added to the chain. The chosen block is verified and added to the current chain.
- The consensus and validation processes are carried out by particular peer nodes called miners. The general functioning of the Blockchain architecture is shown in **Figure 2**.

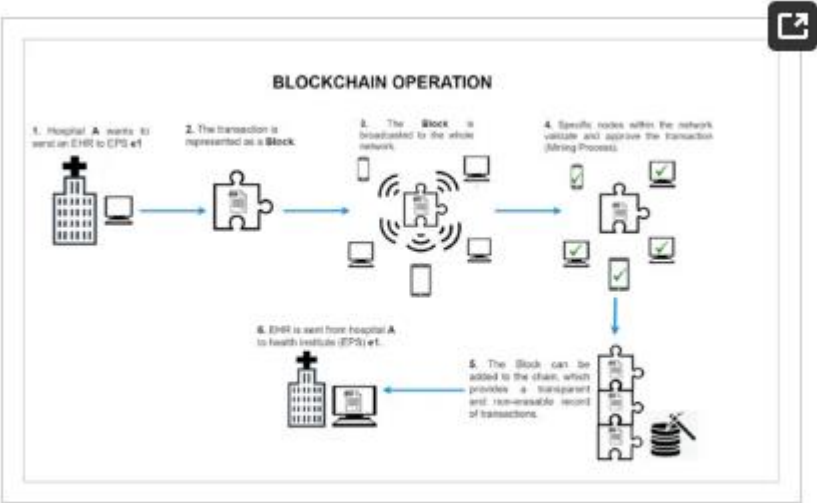


Figure 2. Blockchain operation.

Public vs. Private Blockchain:

In **Table 1** we find a general overview of the comparison between Private and Public Blockchain types, according to the use cases implemented in healthcare.

Table 1. Private vs. Public Blockchain Features.

In **Table 2** we find a comparison associated with the QAs that according to the literature review, may be needed in the Healthcare area.

Table 2. Private vs. Public Blockchain Quality Attributes.




Table 3. Guide for selecting a healthcare-focused Blockchain platform.




Table 4. Blockchain in healthcare systems using Hyperledger Fabric.




Table 5. Healthcare-oriented Blockchain systems using Ethereum.




Table 6. Comparison with related works.




Table 7. EHR Quality Attribute Scenarios.




Table 8. Architectural design inputs.




Table 9. QA Scenarios according to the utility tree.




Table 10. Latency and Throughput Statistical information in milliseconds.

