

Solution Overview  
for  
Health Records SaaS  
using  
Blockchain Platform

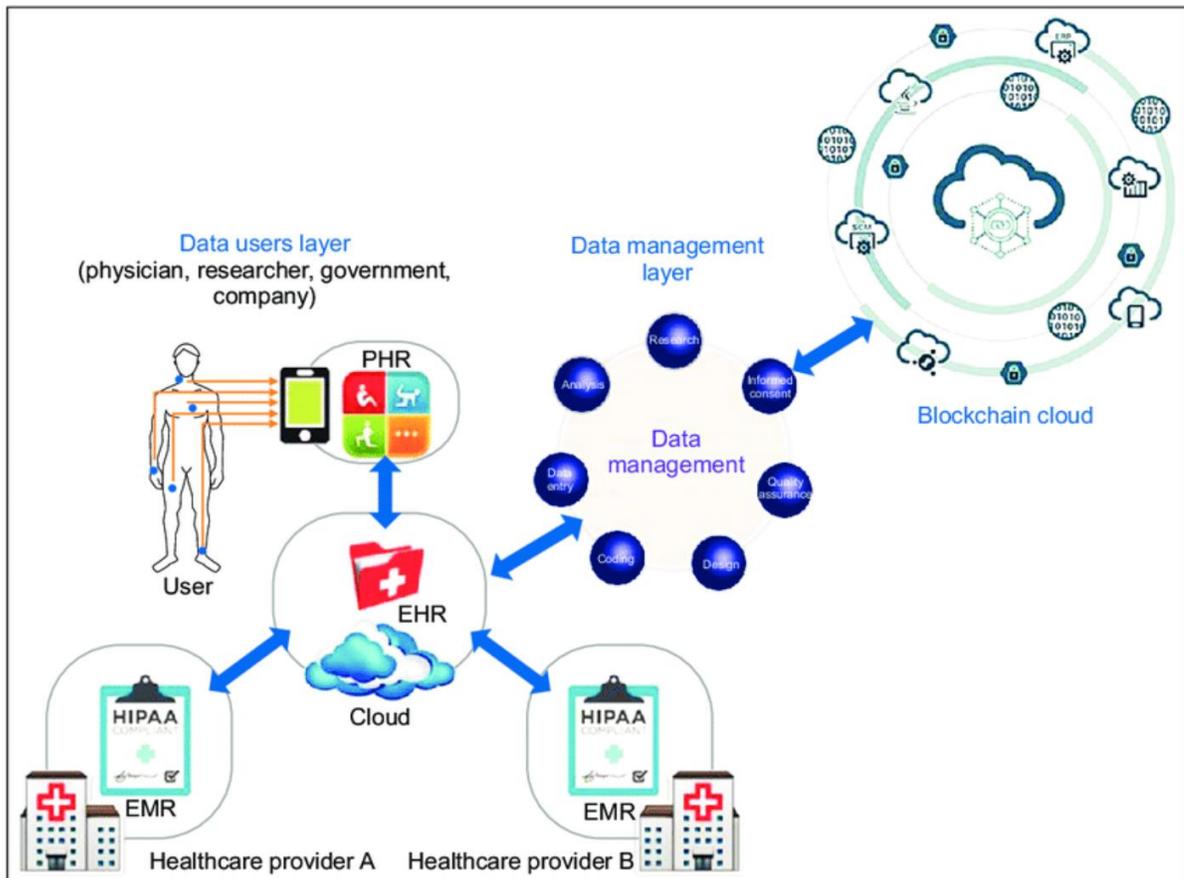
# Introduction

## Objective

The objective of this document is to assess and address in detail the implementation of next gen health record solution using block chain based solution to not only secure the health records but also to enable the end user with consent management capability.

We intend to create a Health care app on an existing Blockchain platform with SAAS model which may be ramped up to act on Pan India dimensions. Whereby we can connect with disparate databases for health care record keeping thus establishing data integrity, data security, Data integration, if possible, data interoperability (at a later stage), as well as contact tracing ( at drug supply chain level), along with an option for health care wallet creation for subscribers/patients and aggregation of medical and prescription records from multiple sites/providers to generate a single, up-to-date record at a patient's level. Need to know how much can we go ahead in terms of limits of possibility and feasibility. For POC we intend to take one hospital and one related diagnostic centre in our fold. As a first step before we pitch it, need a concept note/paper a process flow diagram. Also, whether this is being done anywhere and available online for quick reference. The steps the process, timelines involved. Also, can same app be made in a way that later it can be used as industry or sector neutral.

The end objective is to build a medical record system built on distributed ledger technology to build a master ledger with advanced security using private chains along with consensus management.



## **Problem Statement**

### **Challenges with current Healthcare system**

Data breaches cost the healthcare industry an average of \$6.5M, over 60% more than other industries. More than 11 billion records have been leaked in data breaches over the past 3 years, and one in four individuals have had their healthcare data breached.

In addition to poor security, interoperability is a significant challenge for Electronic Health Records (EHRs). Due to the sensitive nature of health records, sharing them between health professionals can often entail repeated bundles of paperwork, redundant testing, and poor communication and coordination which can in turn lead to detrimental errors. In fact, 50-70% of doctors experience burnout symptoms related to cumbersome EHR workflows.

In the time of COVID-19, interoperability is of unprecedented importance, as institutions must quickly transfer records and immediately gain access to patients' records.

To use EHR in alternate locations such as tent hospitals, one needs to build the department units in the software, extend Wi-Fi, deploy hardware, printers, and test everything. In its current state, scheduling a CT scan through EHR systems can take longer, which does not lend itself to emergency healthcare.

Not only are traditional healthcare records not nearly secure enough, the procedures for addressing breaches are inefficient and often extend the damage, pointing to gross miscommunication and lack of oversight in the space.

It takes longer for the healthcare industry to identify a breach and days to contain it, meaning that in the case of a breach, patients' records could be vulnerable for that duration. Half of individuals who had their data breached discovered it themselves, while only one-third were told about the breach by the institution in question.

This represents a breadth of costs and losses: emotional costs for patients, brand loyalty losses, falls in consumer trust, financial losses for the industry, time costs, and labor costs.

## **Solution Proposal**

Healthcare records contain critical and highly sensitive private information for diagnosis and treatment in healthcare. These data are a valuable source of healthcare intelligence. The sharing of healthcare data is an essential step toward making the healthcare system smarter and improving the quality of healthcare service

Blockchain could reinvent the way patient's electronic health records are shared and stored by providing safer mechanisms for health information exchange of medical data in the healthcare industry, by securing it over a decentralized peer-to-peer network. Intending to support and ease the understanding of this distributed ledger technology

## Interested entities in the Blockchain network

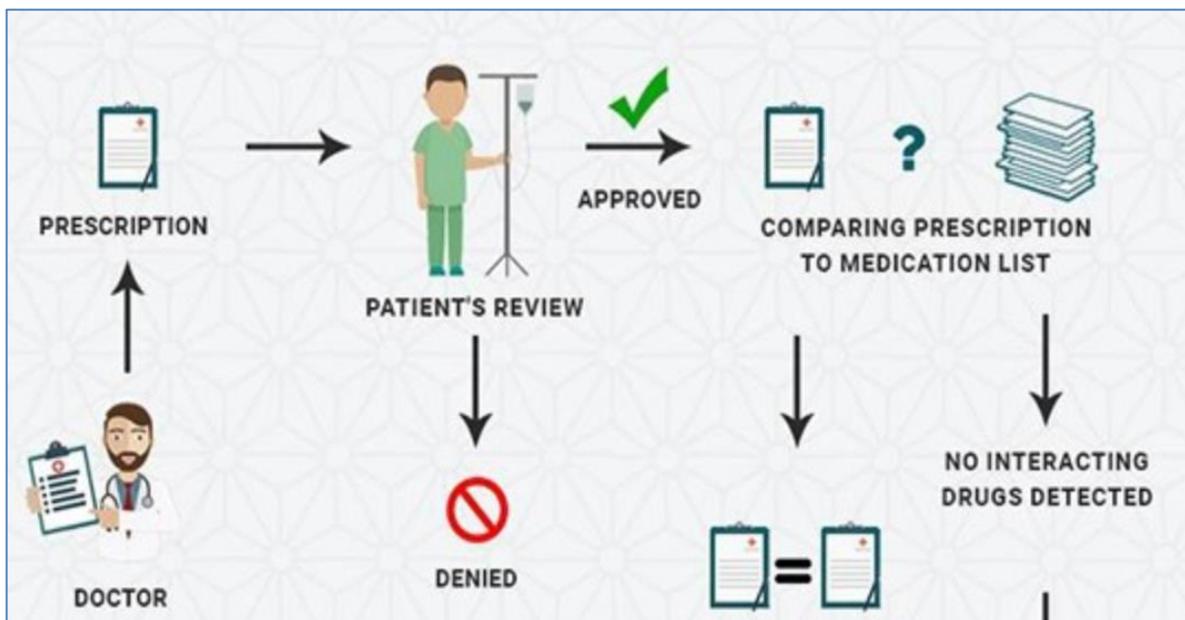
- Patients
- Healthcare Providers
- Healthcare Insurance
- The Government
- Testing Labs

## Technologies

- Cloud
  - Data Management
    - Data lake
    - Object Storage
- Blockchain
- IIoT/Sensors

Blockchain will enable users to give conditional access to different healthcare agents such as doctors, hospitals, laboratories, pharmacists and insurers to interact as they see fit.

With this solution, Patient's get a capability to provide consent to access the medical records to various third parties like drugs providers, insurance providers etc.



Each

interaction with their medical data is auditable, transparent and secure, and will be recorded as a transaction on Blockchain's distributed ledger.

Blockchain could be a platform for other digital health applications/records to develop on; users will be able to sign for these applications and services which are powered by their health data and secured by smart contracts.

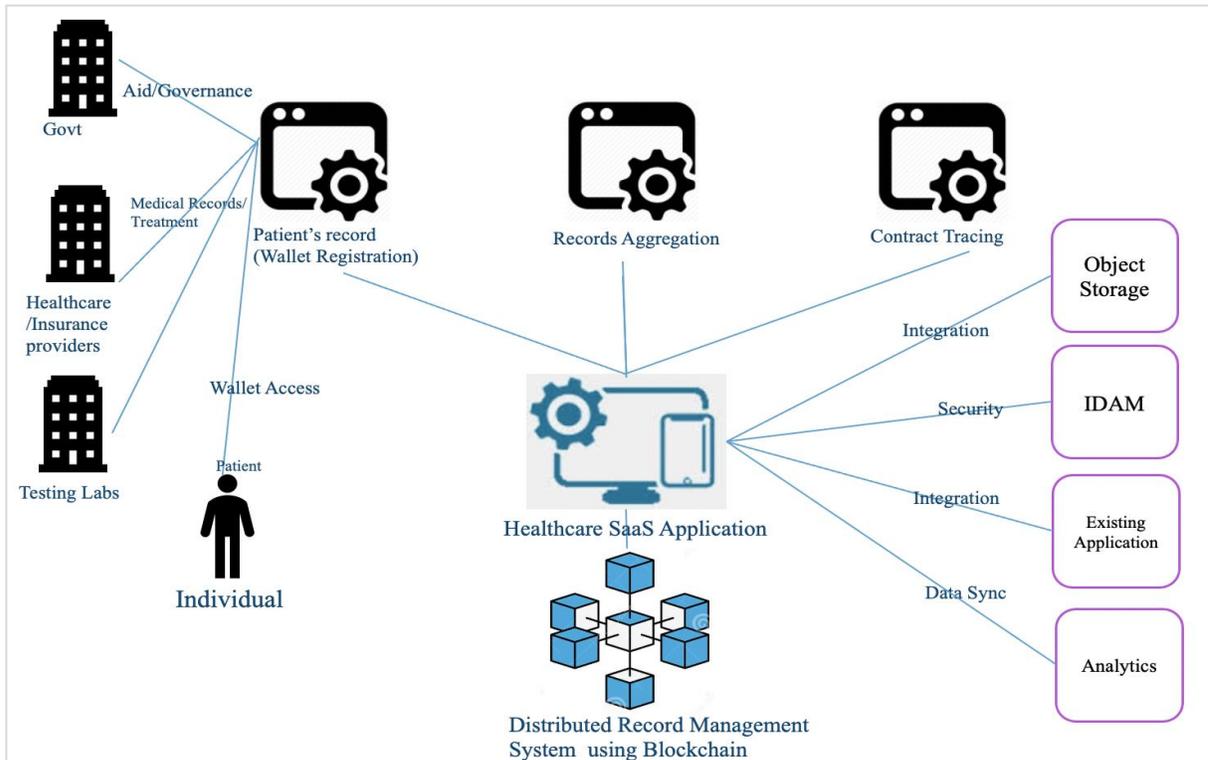
This solution would prove originality and integrity. signature blockchain-enabled feature tracks & timestamps all edits to the document and stores it in the unchangeable network of Blockchain giving the ultimate peace of mind for medical record originality.

Hyperledger Fabric is a better Blockchain solution for managing access to health records, as it accommodates for multiple layers of permission, meaning the owner of a set of data can control which parts of their data is accessed

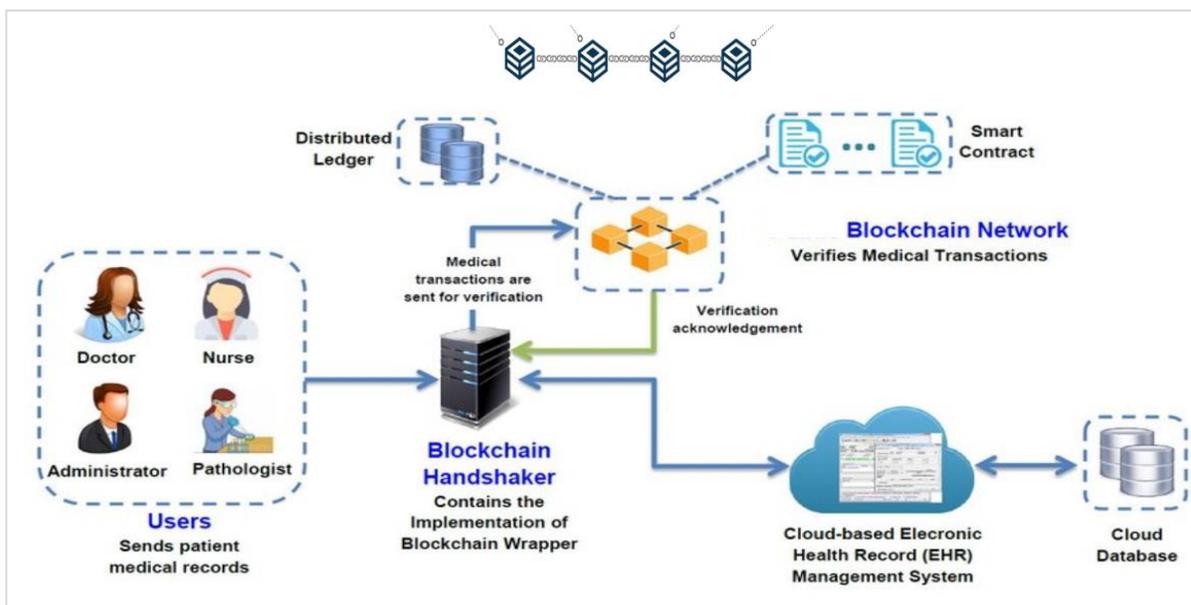
## **Use cases in consideration**

- Healthcare Wallet for subscribers/patients and aggregation of medical and prescription records from multiple sites/providers to generate a single, up-to-date record at a patient's level
- Patients Initial Record Establishment
- Connect with disparate databases for health care record keeping thus establishing data integrity , data security , Data integration
- contact tracing for supply chain
- Centralized governance using common distributed Ledger technology for Govt/Hospitals

***Medical Record System using Blockchain: Integrated Workflow***



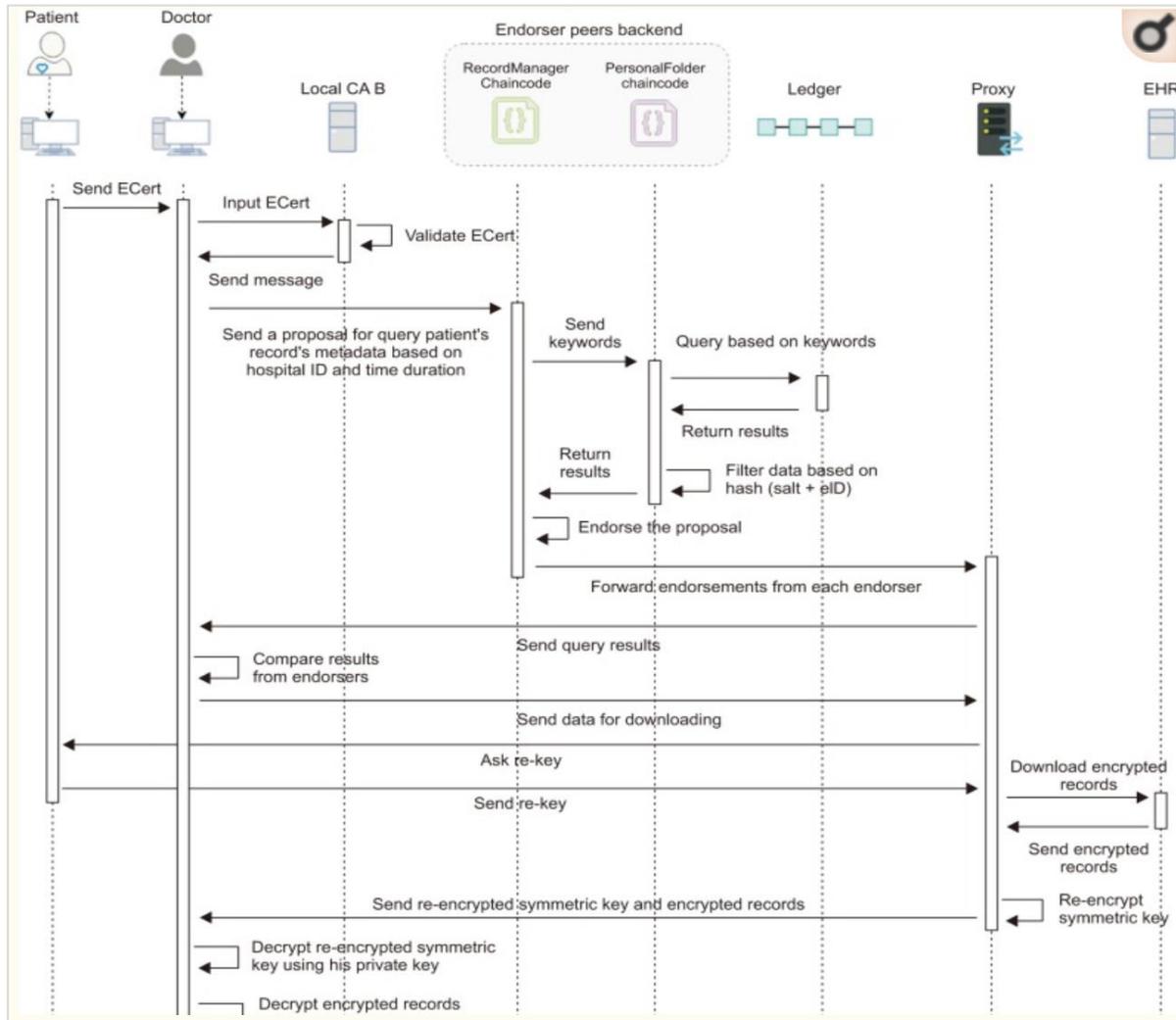
**Medical Record System using Blockchain: Dataflow**



**Blockchain based EHR - Sequence Data Flow For First visit to Hospital**



## Blockchain based EHR - Sequence Data Flow For Uploading Record and Consent Access



## Solution Benefits

- SaaS offering
- Store all healthcare data in one, consolidated, secure ledger

- Spin private chains to immediately and securely provide access to data to new permissioned parties
  - Automatically generate a traceable and immutable record of all access in real-time
  - Seamlessly scale to include an infinite number of parties and integrate with pre-existing systems, driving interoperability
  - Accessible through desktop or mobile app
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## Key Differentiator

- Immutable ledger with timestamps and Hash IDs
- Smart contracts for automated execution
- Consensus & Validation per specific parties
- Private chains and authentication
- APIs for 2-way communication
- Integration with existing ecosystem

## How does blockchain make an Healthcare system stronger?

### Immutability of data

We can add to a blockchain or change, but never delete. Blockchain provides a cryptographically secure transaction or record with a time/date stamp. Takes privacy and security concerns to the next level, and increases trust in the system and the records.

### Interoperability

There are too many different systems being operated by healthcare providers, and the systems are incapable of communicating with each other. In many cases, digitized or even printed copies of medical records must be obtained when multiple healthcare companies or doctors are involved. Blockchain removes this by using Smart Contracts that govern the way information is to be added into the chain in a common format to all parties.

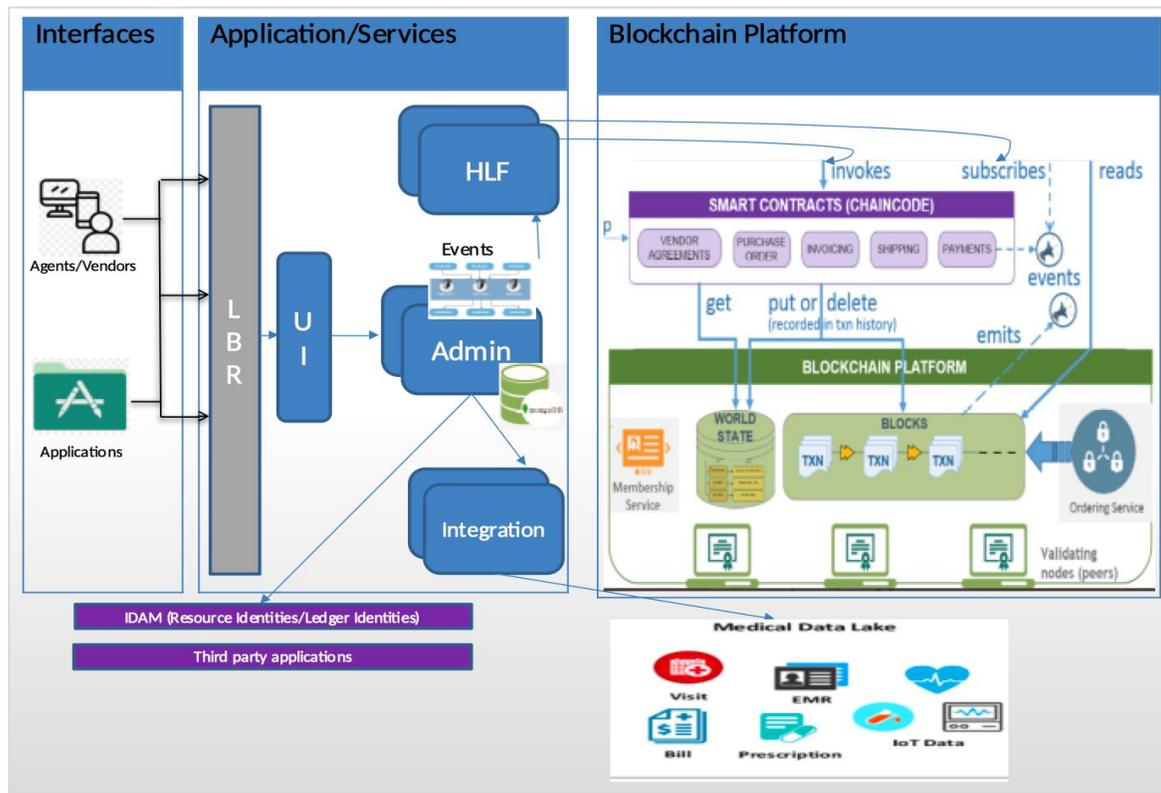
### Single Source of Truth

The decentralized nature of blockchain technology and use of consensus algorithms, means after a block of data has been validated by all members, it is sent out to all network members simultaneously. This eliminates the problem in centralized systems that not all members will have the latest information from the update, since they will update at different times

### Real Time Data

Since everyone is updated simultaneously, blockchain technology provides a view of data to all network members in real time. This is critical in emergency facilities and trauma centres, where a delay in getting the latest data or results available can mean the difference between life and death.

## Internal Component Design: Healthcare SaaS Solution



**Solution will be comprised of below technologies:**

- **WAF (Optional)**
  - WAF solution like Cloudflare or Akamai need to be considered for security
- **LBR**
  - Nginx Based load balancer layer to distribute/handle the requests in balanced manner
- **UI Service**

- UI will be responsible for client interfaces and will interact only with admin service.
- **Admin Service**
  - Admin will be responsible for primary business logic implementations and based on the need would interact with other microservices in the system.
- **HLF Service**

BCS i.e. Blockchain Service will be responsible to interact with blockchain network to have secured way of data access to and from blockchain system.

### **Cache Service**

Redis based caching service for metadata caching for better performance and meet the client's SLA

### **Database**

Metadata DB1  
Blockchain DB using CouchDB

## **Requirement from the concept paper/note (Responses below are for POC)**

1. Pointers for Choosing the right Blockchain Platform ( Preferably with using pre-built blockchain open-sources)
  - a. Factors to choose the right technology and deployment options
    - i. Features to be used from blockchain
    - ii. Volume or scale needed
    - iii. Supported by Big industry player for long term support
    - iv. Preference is Hyperledger fabric
2. Blockchain solution limits in terms of possibility and feasibility
  - a. This would be determined from scope or volume needed for POC
  - b. If volume is limited then we can build Hyperledger fabric cluster in-house and self-managed otherwise would prefer managed Blockchain offering from cloud providers like Amazon or Oracle
3. Proof of Concept options and feasibility
  - a. Finalize the scope of usecases
  - b. Pick one hospital, one lab/diagnostic centre
  - c. Make these entities part of blockchain network
  - d. Build business functionality and UI/Mobile app to serve the finalized usecases

4. Visual and Technical Designs options along (with user interfaces) having minimal code options
  - a. Above doc contains the technical/deployment and sequence diagrams
  
5. Reference Development time lines and costing
  - a. POC
    - i. 3 Months
    - ii. 5 Resources
  
6. Above requirements referenced and depicted in a process flow diagram something akin to this with timelines

