Blockchain Technology

Hyperledger Overview

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MEDIUM

Limitations of Public Blockchains

Businesses faced significant challenges adopting blockchain technology before Hyperledger. Most blockchain platforms, like Bitcoin and Ethereum, were public and had limitations for enterprise use.

1. Lack of Privacy

2. Scalability Issues

3. Lack of Control

Hyperledger's Development

To address these problems, the Linux Foundation launched Hyperledger in 2015 as an open-source, enterprise-focused blockchain project

1. Permissioned Blockchain for Privacy
2. Scalability & High Performance
3. Modular Architecture for Customization
4. Smart Contracts with Controlled Execution

Development Process of Hyperledger Projects

1. Proposal Stage
2. Incubation Stage
3. Graduation Stage
4. End-of-Life (EOL) Stage

Industries Using Hyperledger

1. Finance: BNP Paribas uses Hyperledger to streamline interbank transactions.
2. Healthcare: Change Healthcare uses Hyperledger to secure patient records.
3. Supply Chain: DHL uses Hyperledger for tracking shipments efficiently.
4. Government: Dubai is implementing Hyperledger-based smart contracts for government services.

History of Hyperledger

According to Brian Behlendorf, Executive Director of Hyperledger:

"Hyperledger is an open-source community of communities to benefit an ecosystem of Hyperledger-based solution providers and users focused on blockchain-related use cases across various industries."

1. The Beginning (2015)—Formation of Hyperledger

2. Early Growth (2016)—Expanding Collaboration

3. Major Frameworks Introduced (2017–2018)

4. 2017: Launch of Hyperledger Fabric & Sawtooth

5. 2018: More Frameworks & Expansion

6. Enterprise Adoption & Growth (2019–2021)

7. Maturity & Future Advancements (2022-Present)

Hyperledger Technology Layers

1. Consensus Layer

2. Smart Layer

3. Communication Layer

4. Identity Management Services

5. API (Application Programming Interface)

How Does Hyperledger Work?

1. Contract Initiation

2. Membership Validation

3. Transaction Processing by Peers

4. Consensus Mechanism for Validation

5. Transaction Execution & Ledger Update

How Does Hyperledger Work?
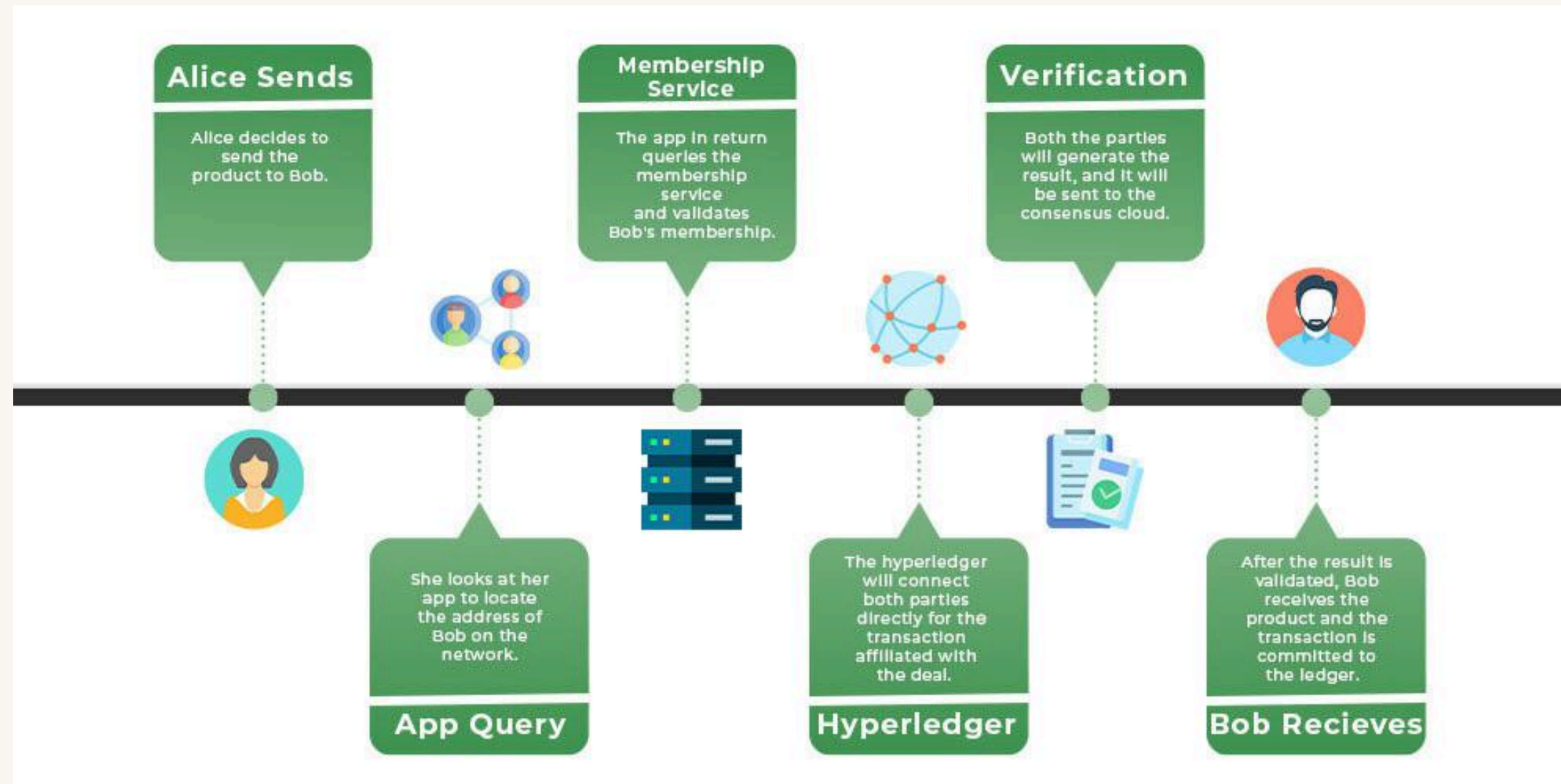
Hyperledger: Advantages

1. Flexibility & Modularity

2. Strong Security

3. High Scalability

4. Privacy & Permissioned Access

5. Interoperability with Other Systems

Hyperledger: Disadvantages

1. Complexity in Setup & Maintenance

2. Limited Decentralization

3. Smaller Community & Fewer Resources

4. Limited Smart Contract Functionality

Projects Under Hyperledger

Hyperledger projects are divided into two main categories:

1. Blockchain Frameworks—Full-fledged blockchain platforms.

2. Supporting Tools & Modules—Tools that enhance and extend

   blockchain functionality.

Currently, Hyperledger consists of five major blockchain frameworks

and several tools/modules that assist in blockchain development.

# Projects Under Hyperledger

1. Fabric

2. Sawtooth Lake

3. Iroha

4. Burrow

5. Indy

6. Explorer

7. Cello

8. Composer

9. Quilt

Have you ever wondered how companies like Walmart track the journey of food products from farm to store? Or how banks ensure secure transactions without exposing sensitive data?
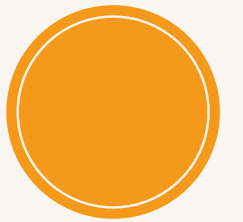
Hyperledger Fabric

Hyperledger Fabric is a permissioned

blockchain framework. It's designed
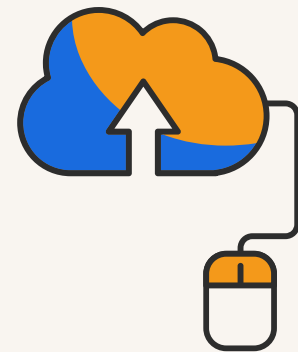
for enterprise use cases
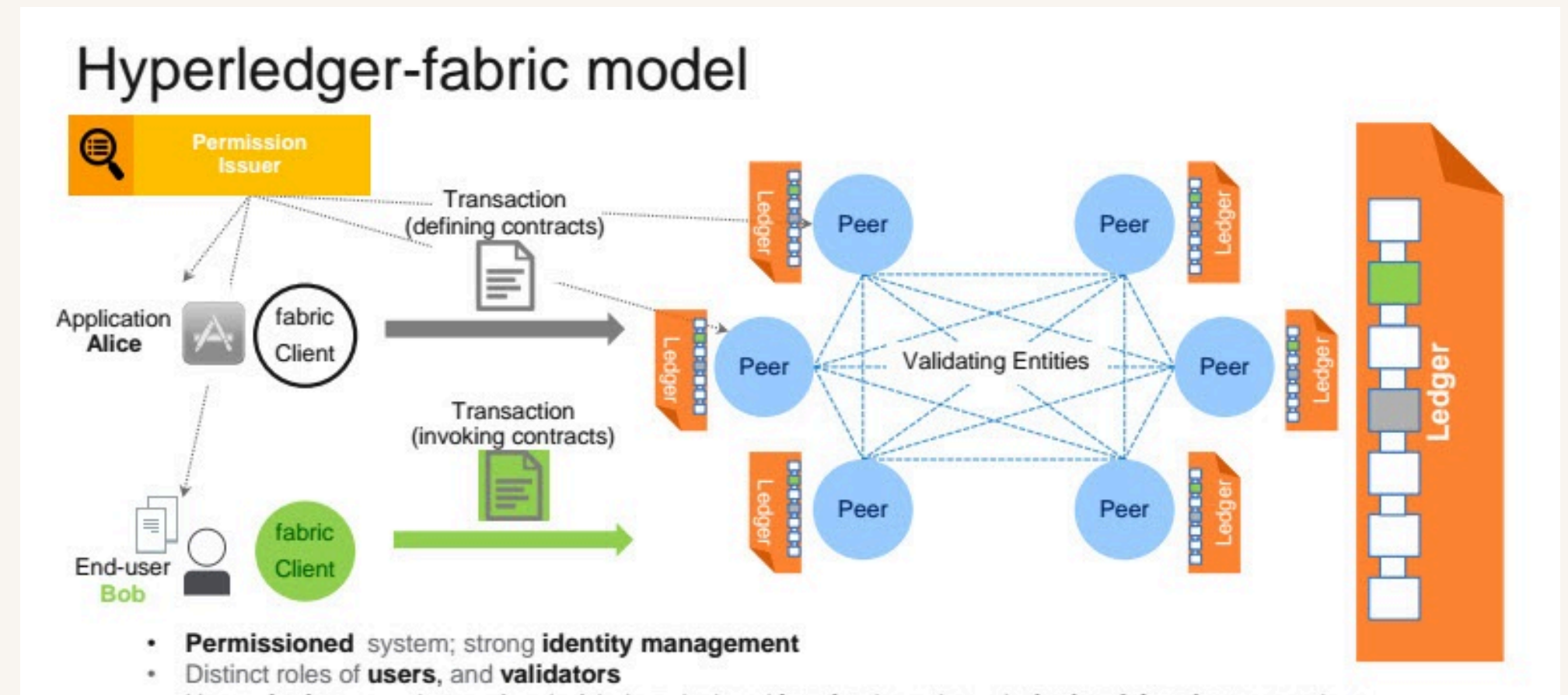
Key Features

Smart Contracts

Uses Chaincode, which can be written in Go, Java, or Node.js,allowing businesses to define their own logic.

Confidentiality with Channels

Supports private channels, ensuring transaction details remain hidden from unauthorized participants.

Customizable Consensus

Unlike other blockchains with a fixed consensus (e.g., PoW, PoS), Fabric allows organizations to choose from Raft, Kafka, and Solo consensus mechanisms

Hyperledger Sawtooth Lake

Sawtooth is a blockchain platform designed for both permissioned and permissionless networks . It's known for its simplicity and ability to handle large-scale applications.

Key Features

Proof of Elapsed Time (PoET)

Sawtooth uses a unique consensus mechanism called PoET , which is energy-efficient and avoids mining

Parallel Transaction Executio

Sawtooth processes transactions in parallel , meaning multiple transactions can happen at the same time.

Modularity

you can customize the consensus mechanism, smart contracts, or even the type of data stored on the blockchain
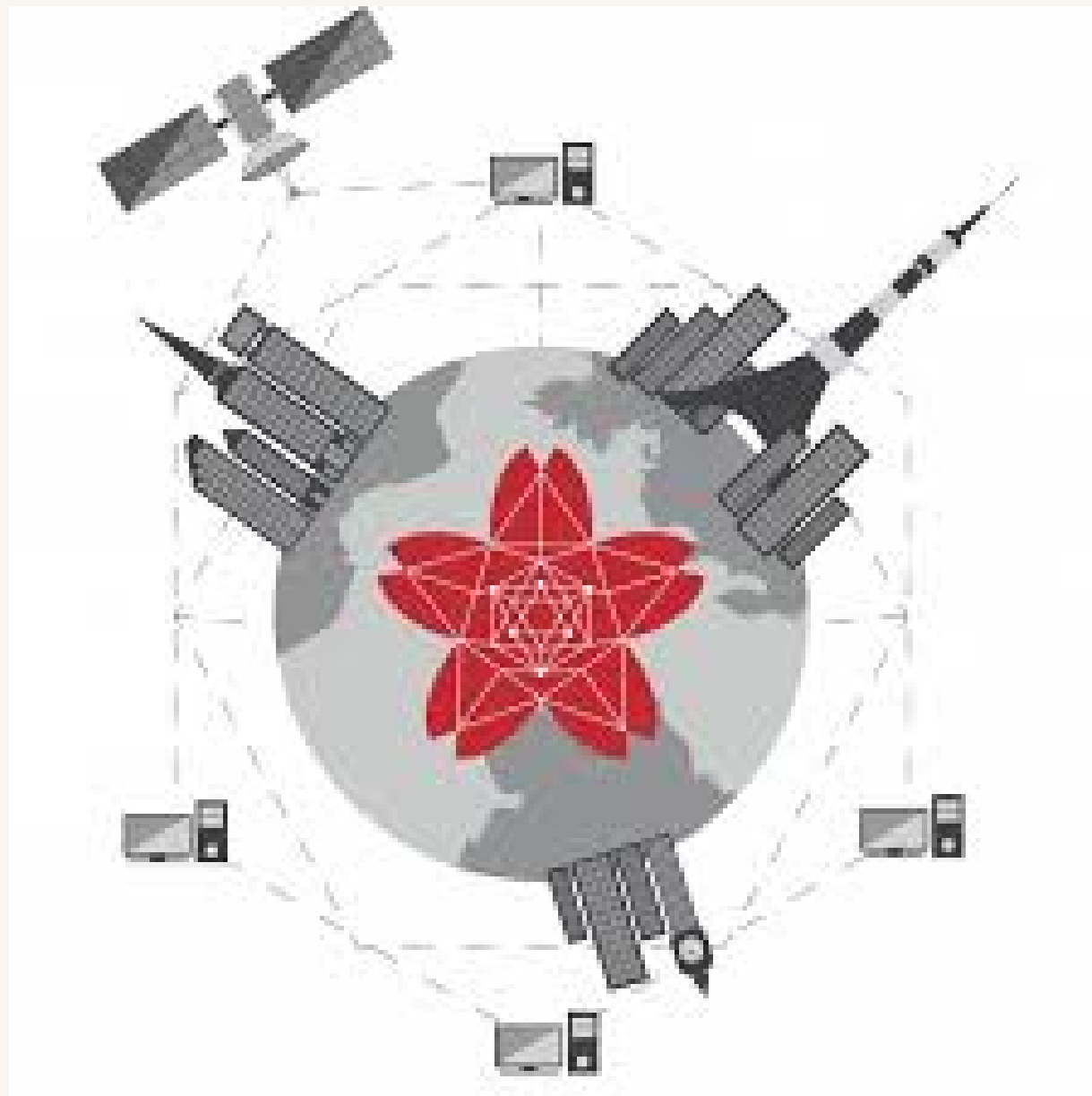
Hyperledger Iroha

Iroha is a lightweight blockchain framework designed for simplicity and ease of use.

Key Features

Simple API

Iroha provides easy-to-use libraries for building blockchain apps

Role-Based Access Control

Iroha ensures secure access to resources. For instance, only professors can approve grade changes, while students can only view their grades.

Asset Management

Iroha has built-in tools for managing digital assets. Think of it like a digital wallet

Hyperledger BURROW

- Hyperledger BURROW is a framework for executing smart contracts in permissioned blockchains.

- It enables businesses to use secure, efficient, and legally compliant smart contracts across various industries.

Example: Smart Contracts in Trade Finance
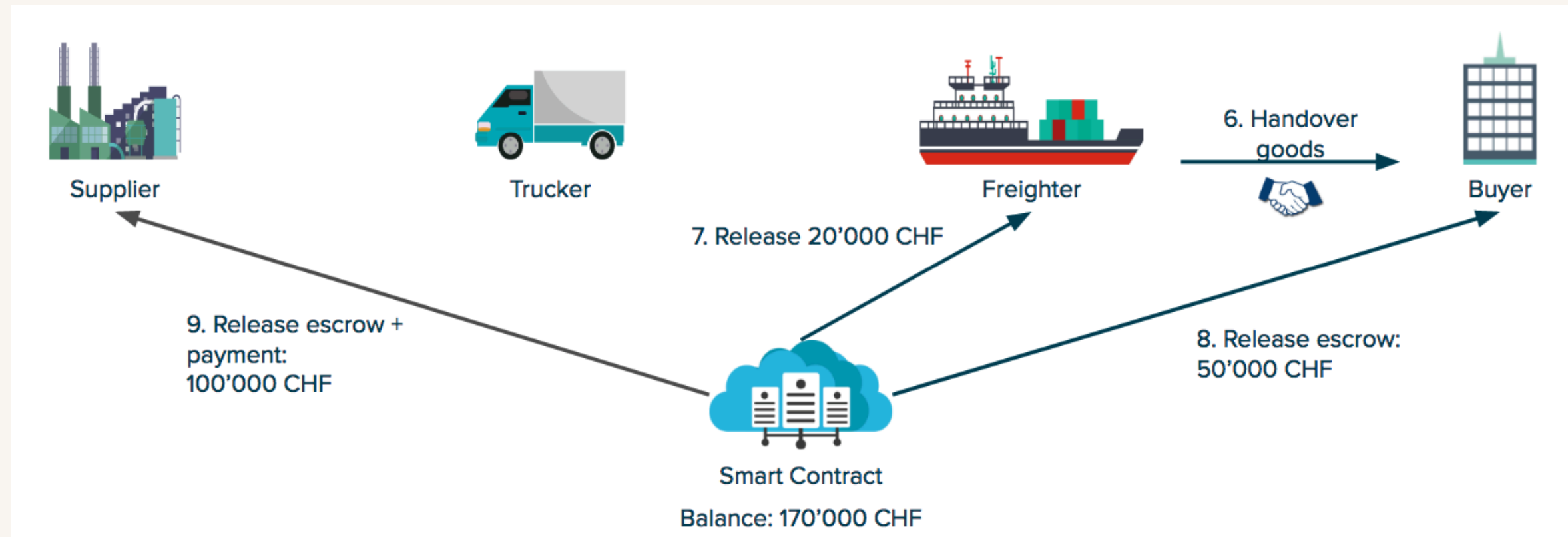
- The buyer and seller agree on terms (price, delivery date, payment conditions).

- The buyer deposits funds into a smart escrow account (held on the blockchain).

- Once goods are delivered and verified by the system, the smart contract releases the payment to the seller automatically.

- If conditions aren't met, funds are refunded to the buyer.

Hyperledger INDY
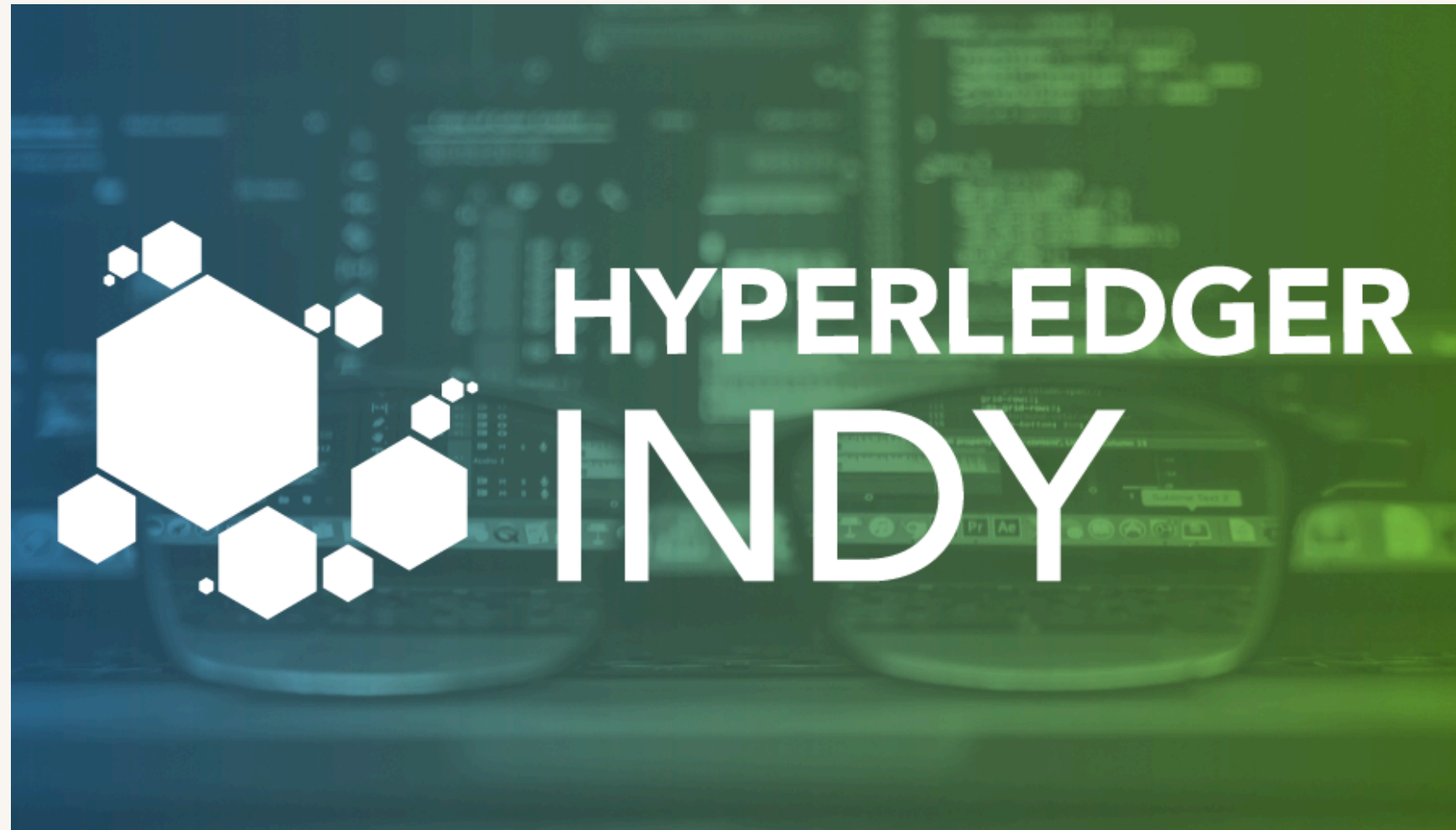
- Hyperledger Indy is a blockchain-based framework designed for decentralized identity (DID)

  - Decentralized identity means that you own and control your digital identity without relying on a central authority like a government or a company.

Example: Barcode Convertion

- Instead of your personal data being stored by big organizations, it is securely stored on a blockchain or similar technology, and only you decide who can access it.

- This makes identity verification safer, more private, and harder to hack or misuse.
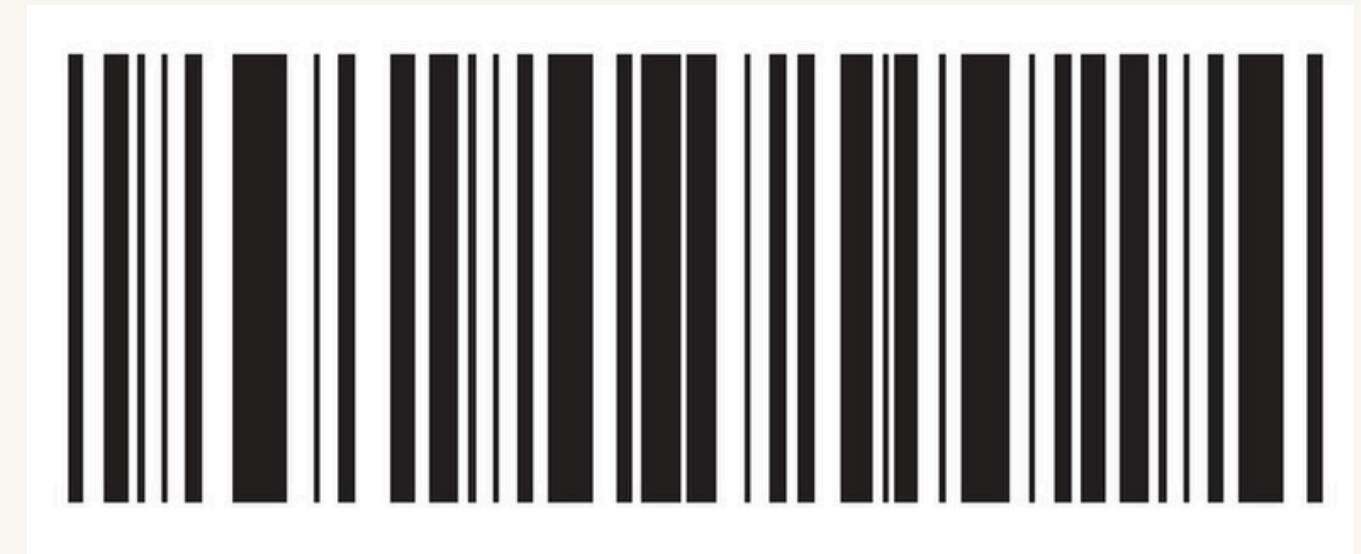
Hyperledger Explorer

- Hyperledger Explorer is a blockchain monitoring tool for Hyperledger Fabric networks. It provides a web-based dashboard where you can see details about your blockchain.
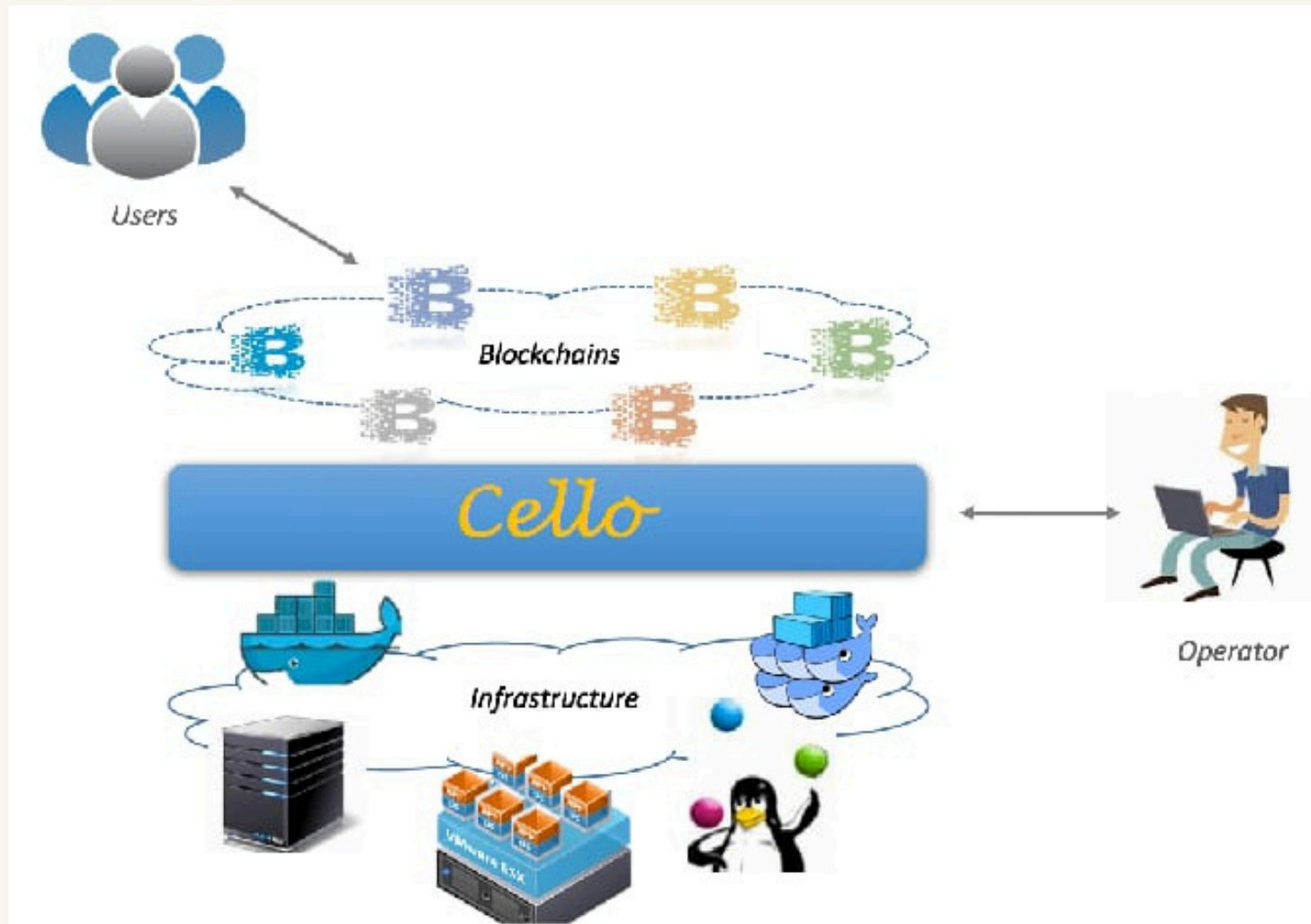
Explorer Operations:

- Blocks & Transactions – What's happening on the network.
- Network Status – Which nodes (peers, orderers) are active.
- Smart Contracts – Track deployed chaincodes.

- It helps developers and administrators easily view, search, and analyze blockchain activity without needing to dig into complex logs or command-line tools.

Example:
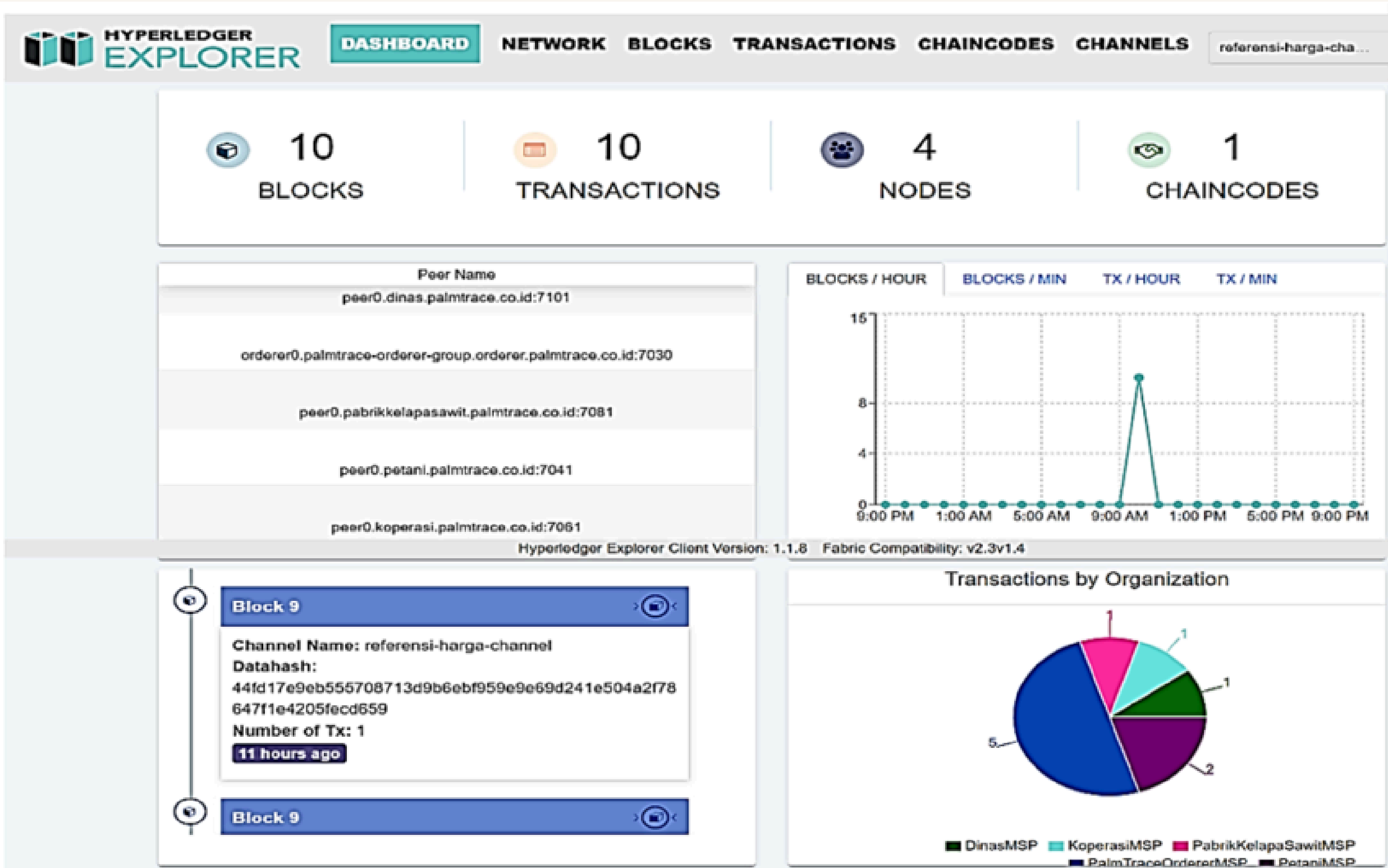
Hyperledger Cello

- Hyperledger Cello (HLC) is a blockchain provision and operation system, which helps people use and manage blockchains in a more efficient way.

Major Features:

- Manage the lifecycle of blockchain networks.
- Support customized blockchain network config.
- Support multiple underly infrastructure including bare-metal, virtual machine, vSphere, swarm and Kubernetes.

- Extends with advanced features like monitoring, logging, health and analytics capability by integrating with existing tools like ElasticStack.

Using Cello, blockchain developers can:

- Build up a Blockchain as a Service (BaaS) platform quickly from scratch.
- Provision customizable Blockchains instantly, e.g., a Hyperledger fabric v1.x network.
- Check the system status and manage chains, upload smart contract and test... through dashboards.
- Maintain a pool of running blockchain networks on top of bare-metals, virtual clouds (e.g., virtual machines, vsphere Clouds), container clusters (e.g., Docker, Swarm, Kubernetes).

Hyperledger Composer
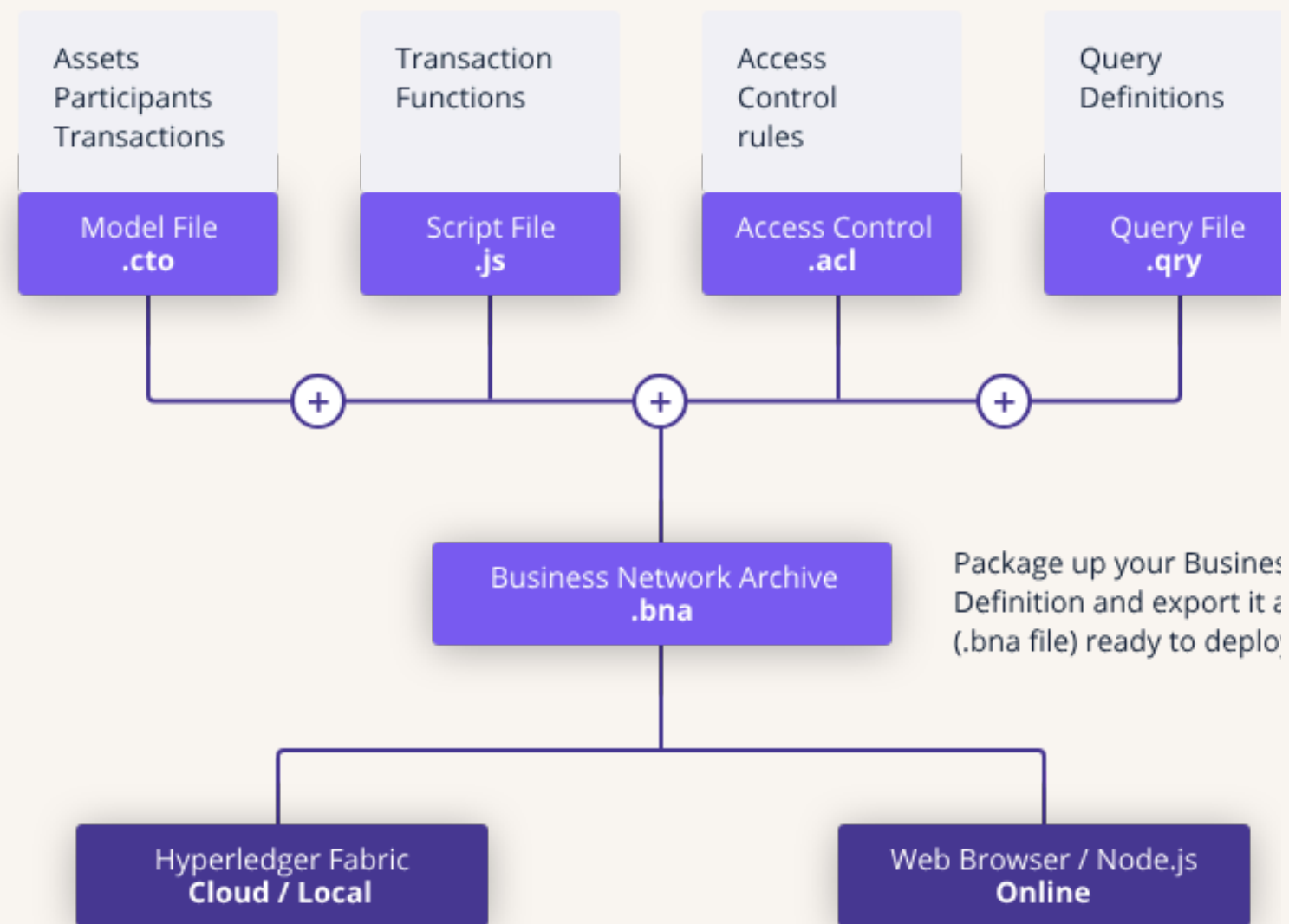
- Hyperledger Composer is an extensive, open development toolset and framework to make developing blockchain applications easier.
- Hyperledger Composer supports the existing Hyperledger fabric infrastructure and runtime.
- For an example of a business network in action; a realtor can quickly model their business network as such:
- Assets: houses and listings
- Participants: buyers and homeowners
- Transactions: buying or selling houses, and creating and closing listings

HYPERLEDGER QUILT

- The Hyperledger Quilt began in 2017 as a unique and innovative idea in the realm of blockchain technology that aimed to enable seamless transactions across different payment networks whether fiat or crypto.
- Hyperledger Quilt was a stepping stone towards the creation of a universal payment network.
- Hyperledger Quilt was built on Java, a widely-used programming language. This made it accessible to a large number of developers and provided them with easy-to-use libraries for sending and receiving Interledger payments.
- Despite these innovative features, Hyperledger Quilt did not gain the expected level of adoption.
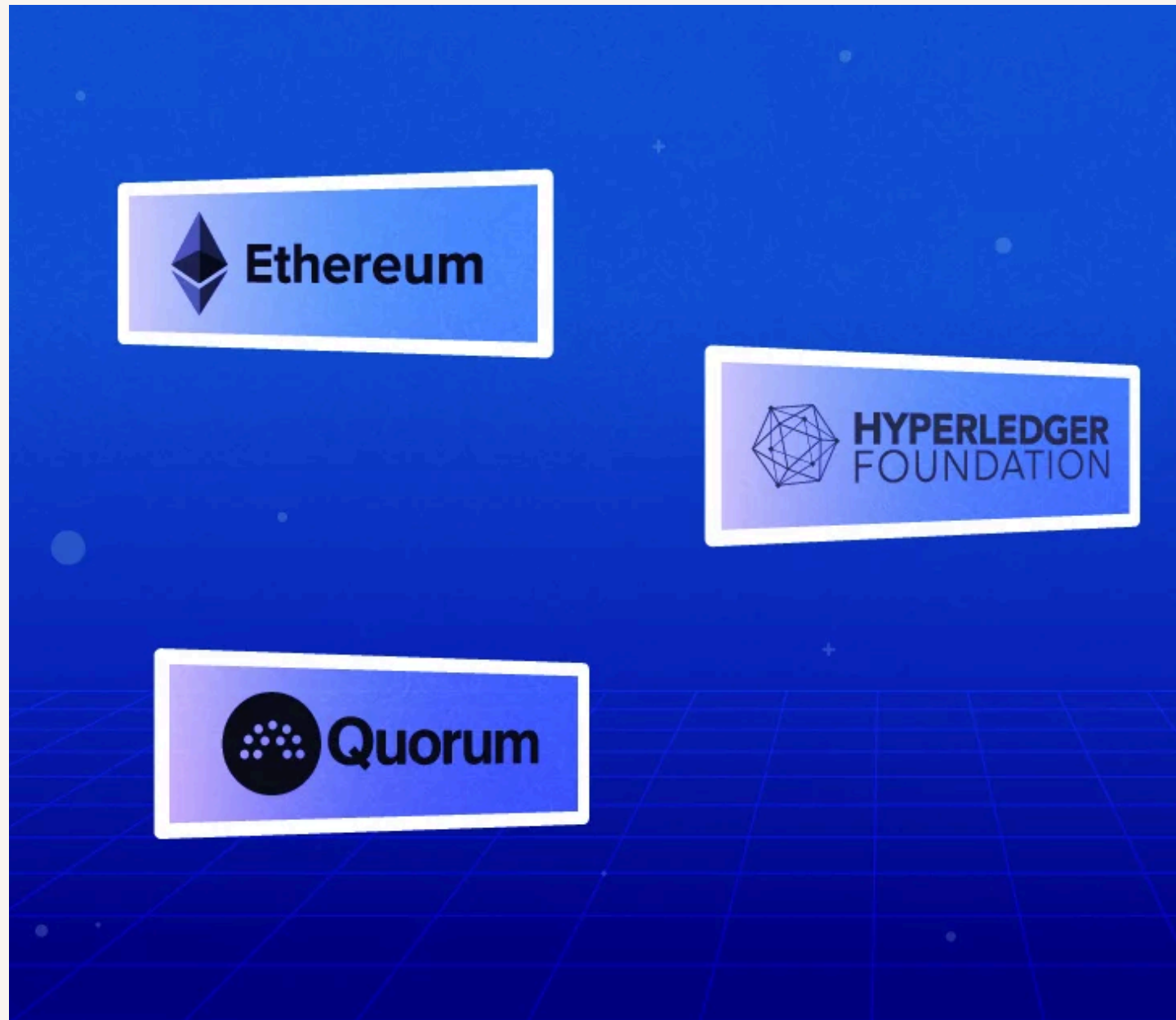
HYPERLEDGER QUILT

- One reason was the lack of active maintainers. Open source projects rely heavily on their community for development and maintenance and, if the project contributors are not active or large enough, the project can stagnate.
- Cross network interoperability has proven to be a critical component for advancing this market. Other projects have taken their own approach to interoperability.
- Over time, they have delivered performance, ease of use, or community support that drew more users than Hyperledger Quilt.
- Open-source approach encouraged collaboration and ensured that no single entity had control over the Java implementation of the Interledger Protocol.

KEY FEATURES OF QUILT

- Cross-Ledger Transactions – Enables payments across different blockchain and financial networks.
- Interledger Protocol (ILP) Implementation – Uses ILP to connect various payment networks.
- Enterprise Integration – Helps businesses integrate blockchain payments with existing financial systems.
- Atomic Transactions – Ensures that cross-network transactions are completed fully or not at all.
- Open Source & Modular – Part of Hyperledger, making it flexible and customizable.

HYPERLEDGER AS PROTOCOL

- A blockchain protocol is a set of rules that govern how transactions are executed and recorded on a blockchain network.
- These protocols ensure that the network is secure, transparent, and tamper-proof.
- Hyperledger is a collection of open source projects created to support the development of blockchain-based distributed ledgers.
- Unlike public blockchains (Bitcoin, Ethereum), Hyperledger networks are controlled by authorized participants.
- Supports confidential transactions, making it ideal for industries like finance and supply chain management.

THANKYOU