Hyperledger Fabric

An Introduction to Blockchain for Business

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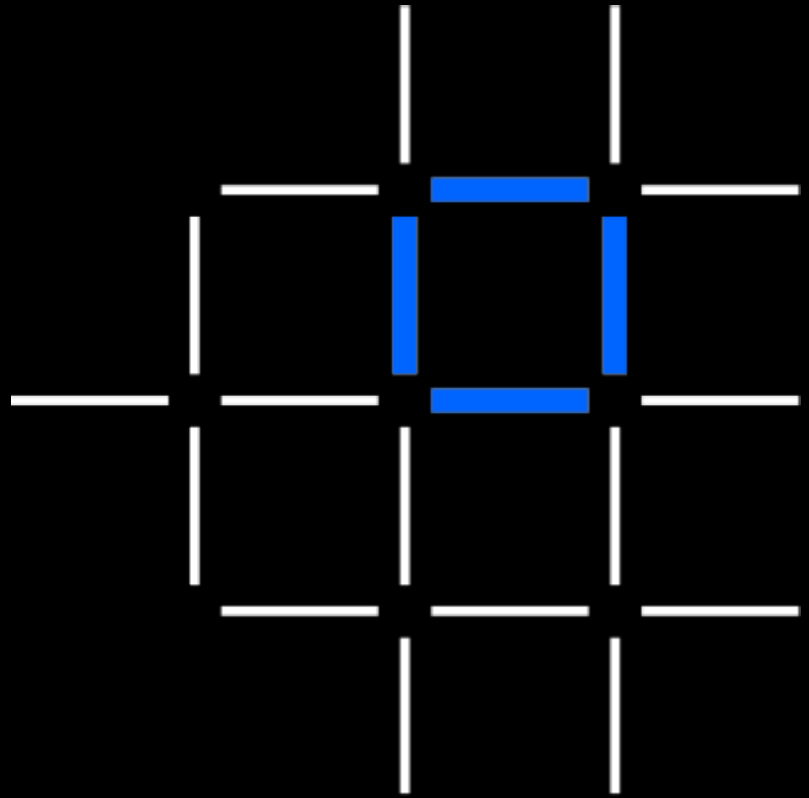
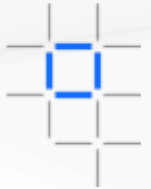


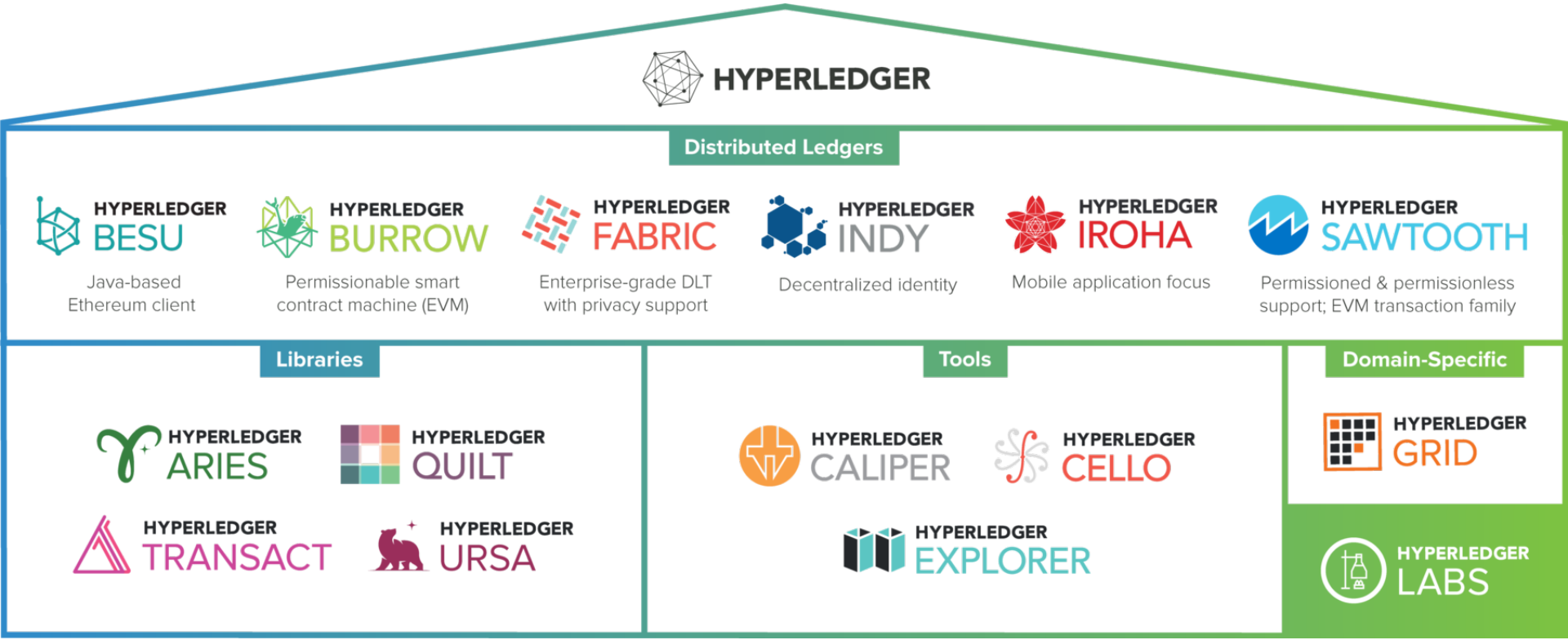
Agenda

1. Public vs Private Blockchain
2. Hyperledger Fabric
3. Example Networks
4. IBM Blockchain Platform
5. Demo

Public vs Private Blockchain

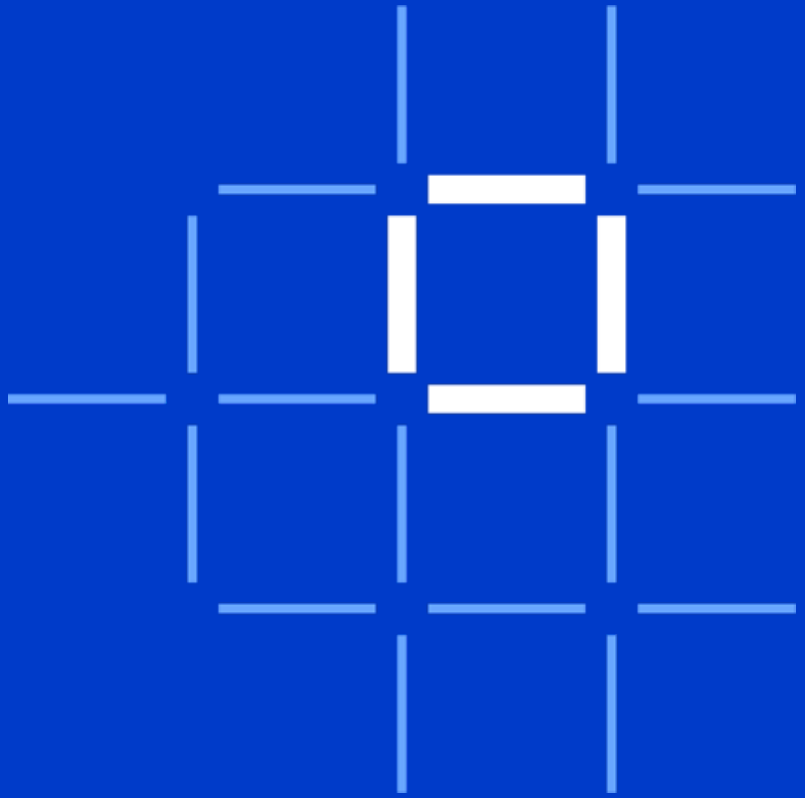


	Public Blockchain	Private Blockchain
Identity	Anonymous	Known Idendity
Access	Open Read/Write	Permissioned read and/or write
Speed	Slow	Fast
Security	Proof-of-Work / Proof-of-Stake	Pre-approved Participants
Asset	Native Asset	Any Asset


HYPERLEDGER
Distributed Ledgers
HYPERLEDGER BESU
Java-based Ethereum client
HYPERLEDGER BURROW
Permissionable smart contract machine (EVM)
HYPERLEDGER FABRIC
Enterprise-grade DLT with privacy support
HYPERLEDGER INDY
Decentralized identity
HYPERLEDGER IROHA
Mobile application focus
HYPERLEDGER SAWTOOTH
Permissioned & permissionless support; EVM transaction family
Libraries
HYPERLEDGER ARIES
HYPERLEDGER QUILT
HYPERLEDGER TRANSACT
HYPERLEDGER URSA
Tools
HYPERLEDGER CALIPER
HYPERLEDGER CELLO
HYPERLEDGER EXPLORER
Domain-Specific
HYPERLEDGER GRID
HYPERLEDGER LABS

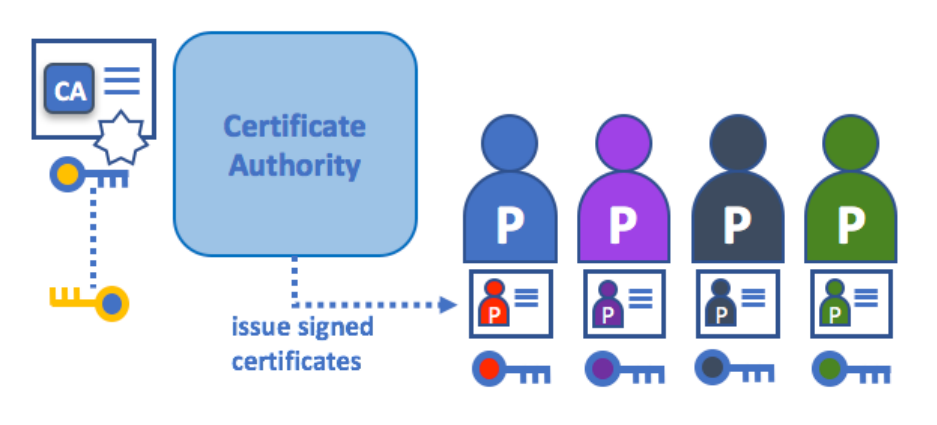
HYPERLEDGER

FABRIC

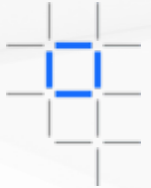


Certificate Authority

- Issues certificates to all the participating members (peers, ordering nodes, clients, and so on)
- These certificates represent a member's identity
- Every single operation needs to signed by the certificates

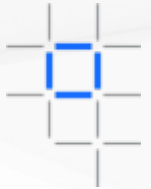


Peer



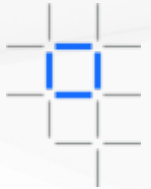
- Nodes
- Part of an Organization
- Single Peer means Single Point of Failure
- Peer
  - Stores Ledgers
  - Stores Chaincodes
  - Executes Chaincodes
  - Endorse Transactions
- Anchor Peer
  - Communication between Organizations
- Leading Peer
  - Receive Blocks

Ordering Service



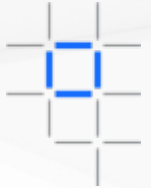
- Orders the transactions
- Bundles them into blocks
  - BatchTimeout
  - BatchSize
- Distributes these blocks to Leading Peers
- Single Orderer means Single Point of Failure

Consensus Algorithms



- Solo
  - Single ordering node
  - Not crash-fault tolerant
  - Test, Development, PoC
- Raft
  - Crash Fault Tolerant
  - Raft Protocol
  - "Leader and Follower" model
  - Hyperledger Fabric v1.4.1
- Kafka
  - Crash Fault Tolerant
  - Apache Kafka and ZooKeeper
  - "Leader and Follower" model
  - Hyperledger Fabric v1.0

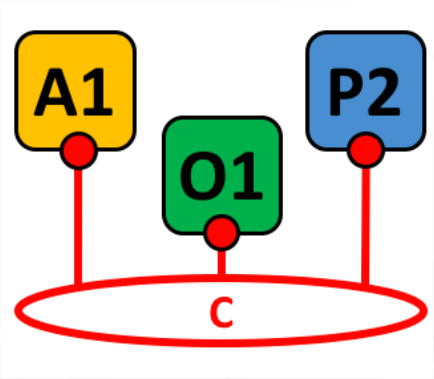
Consortium



- Collection of non-orderer organizations on the blockchain network
- At channel creation time, all organizations added to the channel must be part of a consortium

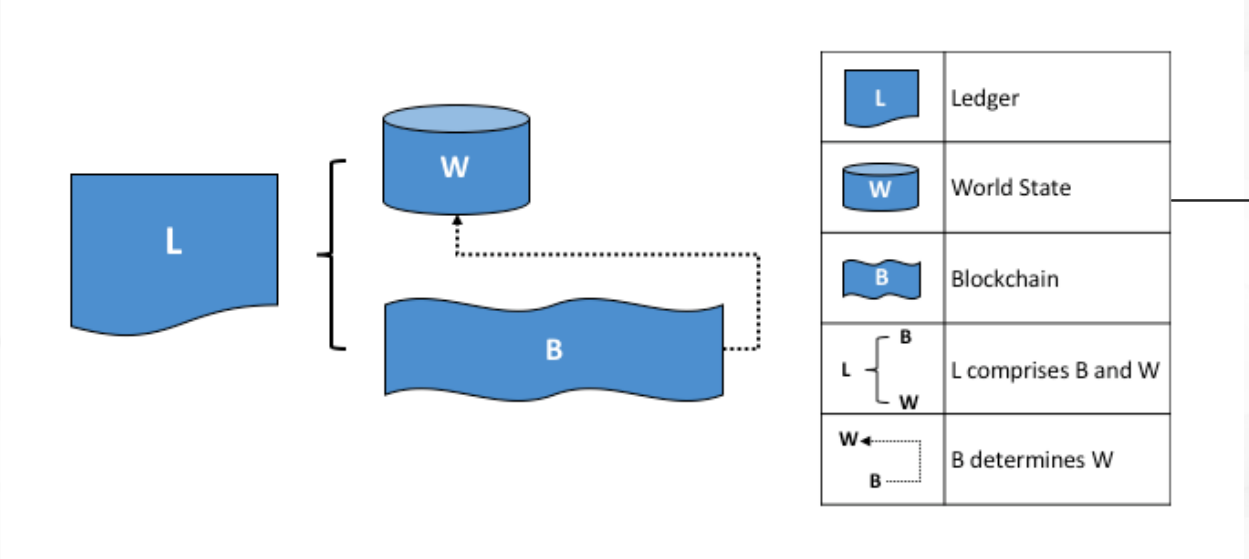
Channel

- Consisting of a subset of network members who want to transact privately
- Data isolation and confidentiality
- A channel-specific ledger is shared across the peers in the channel

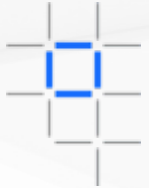


Distributed Ledger

- Can store ”Everything” – Works bit level



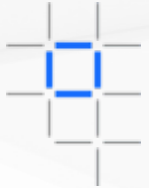
Private Data



- Confidential data that is stored in a private database on each authorized peer
- Logically separate from the channel ledger data
- Unauthorized organizations will have a hash of the private data

- Private Data Collection
  - Used to manage confidential data that two or more organizations on a channel want to keep private from other organizations on that channel

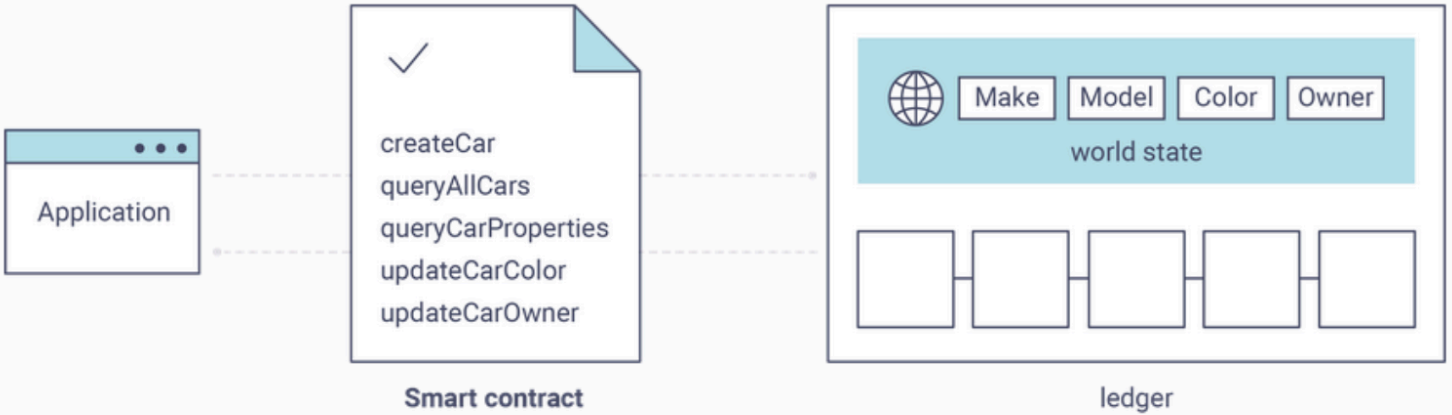
Gossip Protocol



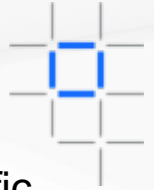
- Manages peer discovery and channel membership
- Disseminates ledger data across all peers on the channel
- Syncs ledger state across all peers on the channel.

Smart Contracts and Chaincode

- Business Logic
- Set of functions to query or update the ledger
- Go, Node.js, Java
- Invoke (write) & Query (read)



Endorsement Policy



- Defines the peer nodes on a channel that must execute transactions attached to a specific chaincode application, and the required combination of responses (endorsements)

- A transaction that is submitted must satisfy the endorsement policy before being marked as valid by committing peers

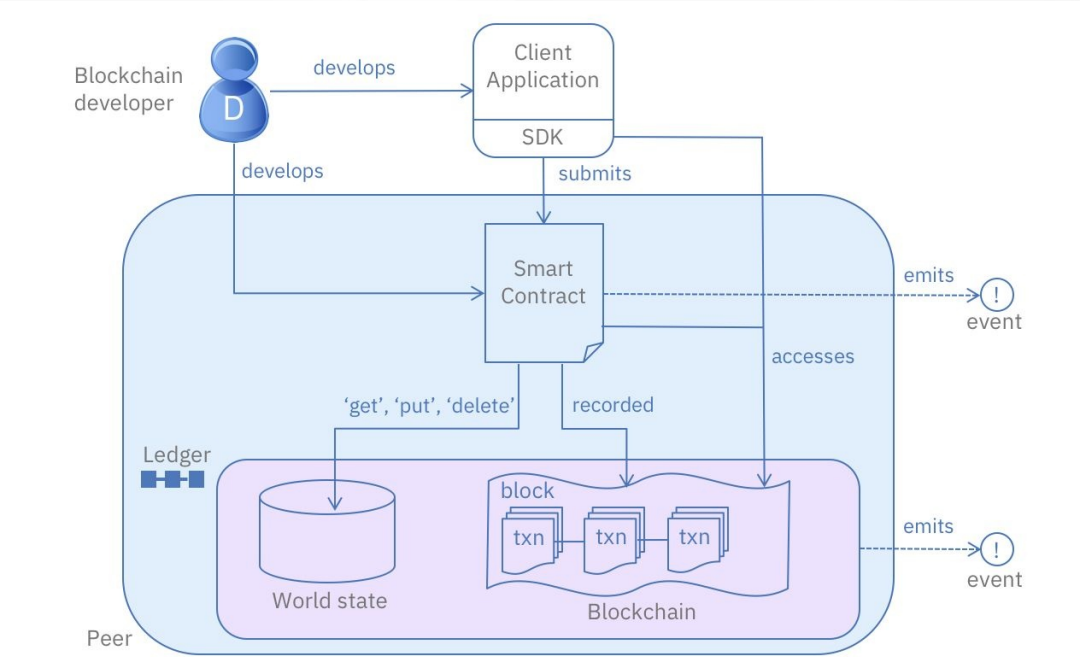
```
AND('Org1.member', 'Org2.member', 'Org3.member')

OR('Org1.member', 'Org2.member')

OR('Org1.member', AND('Org2.member', 'Org3.member')
```

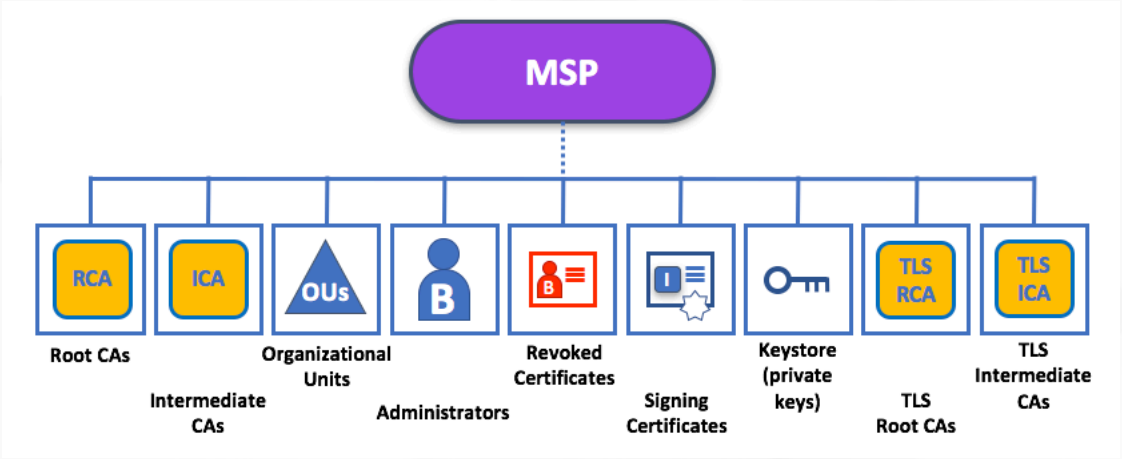
Software Development Kit (SDK)

- Structured environment of libraries for developers to write and test chaincode applications
- Officially supported SDKs are for Node.js and Java, not yet official supported SDKs are for Python, Go and REST

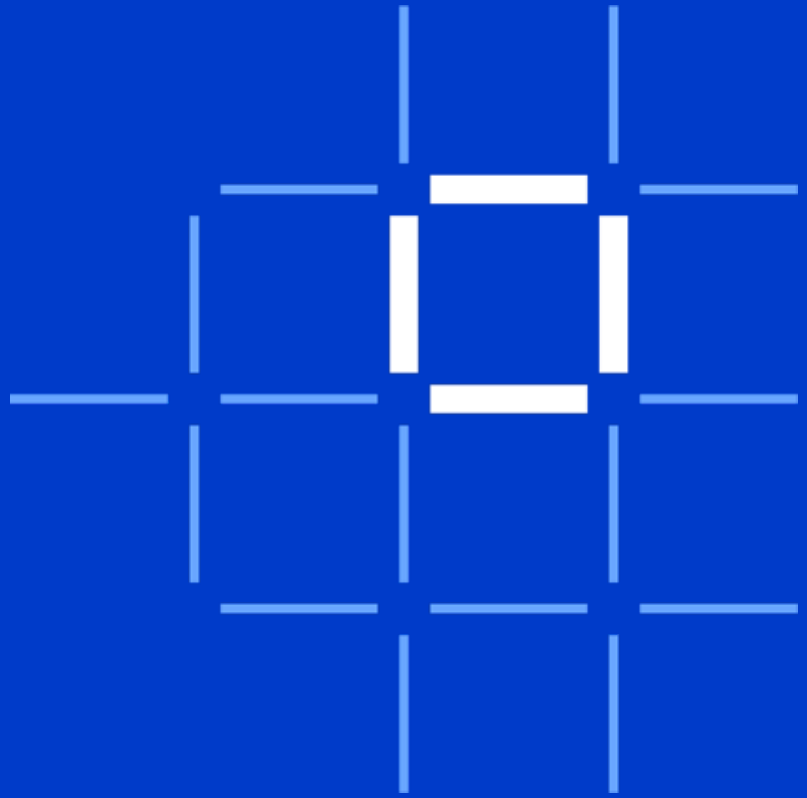


Membership Service Provider (MSP)

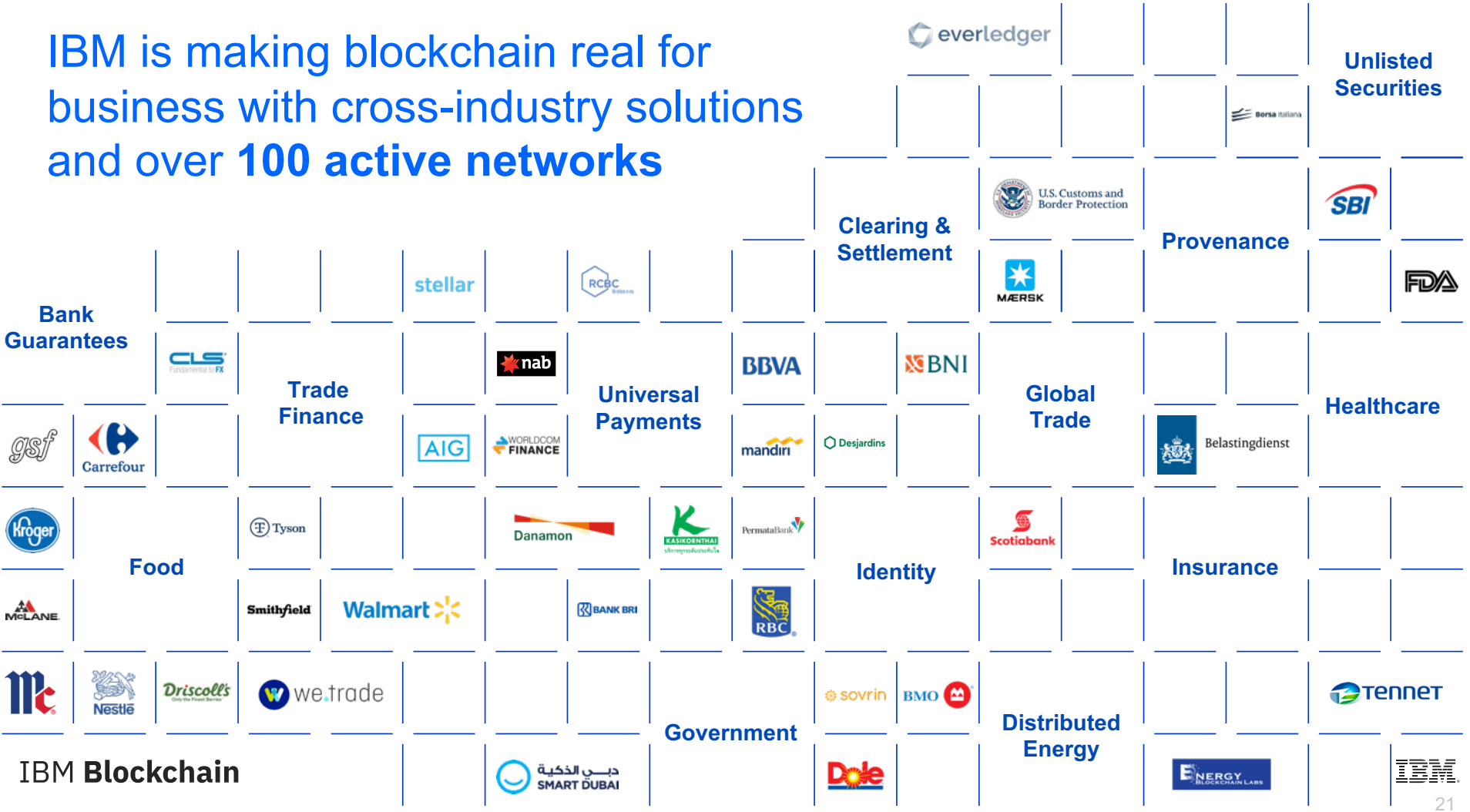
- Provides credentials to clients, and peers for them to participate in a Hyperledger Fabric network.
- Clients use these credentials to authenticate their transactions, and peers use these credentials to authenticate transaction processing results (endorsements)



Example Networks



IBM is making blockchain real for business with cross-industry solutions and over **100 active networks**



Food Trust

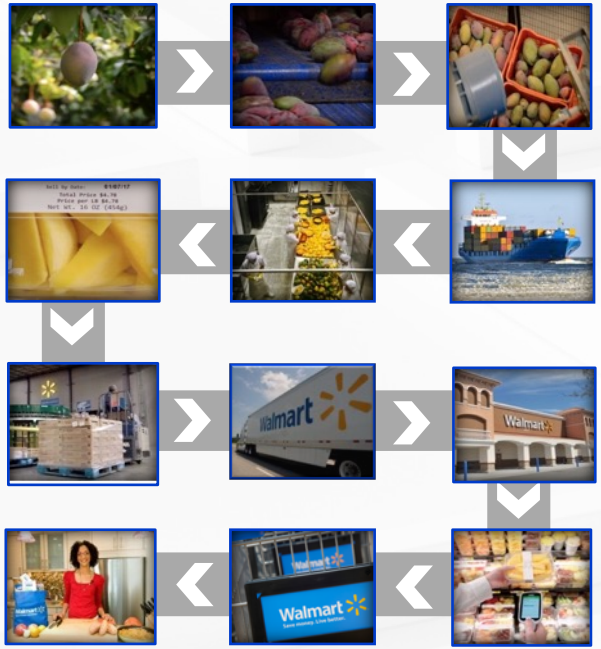
IBM **Blockchain**

The effectiveness of the IBM Food Trust solution was demonstrated with a Walmart mango pilot

Pilot Test Case

How long does it take to trace a package of sliced mangoes back to the farm?

Supply Chain



Results

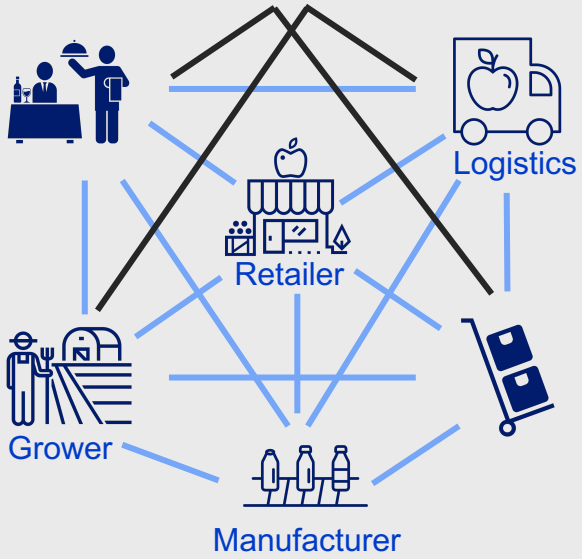
Typical manual, mixed digital and paper-based method

6 days
18 hours
26 minutes

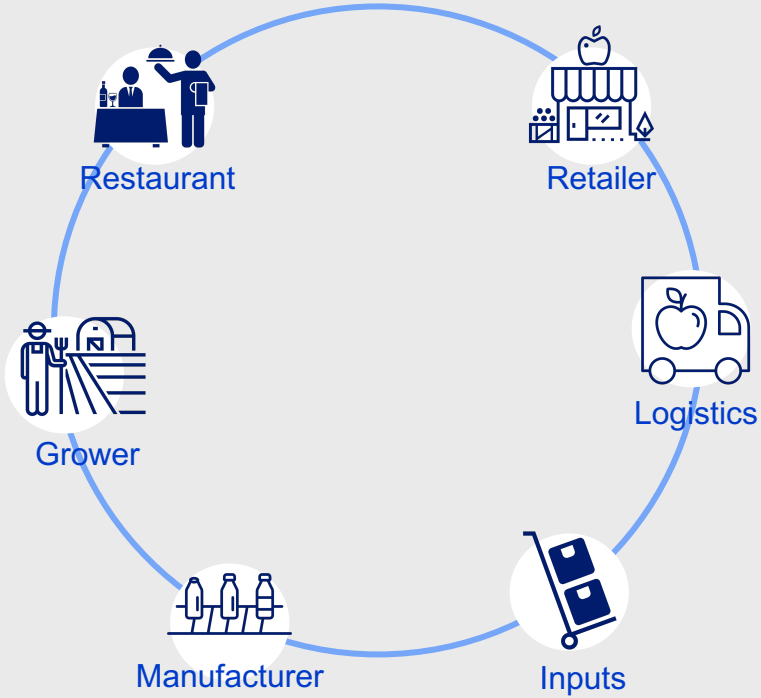
IBM Food Trust digital solution

2.2 seconds

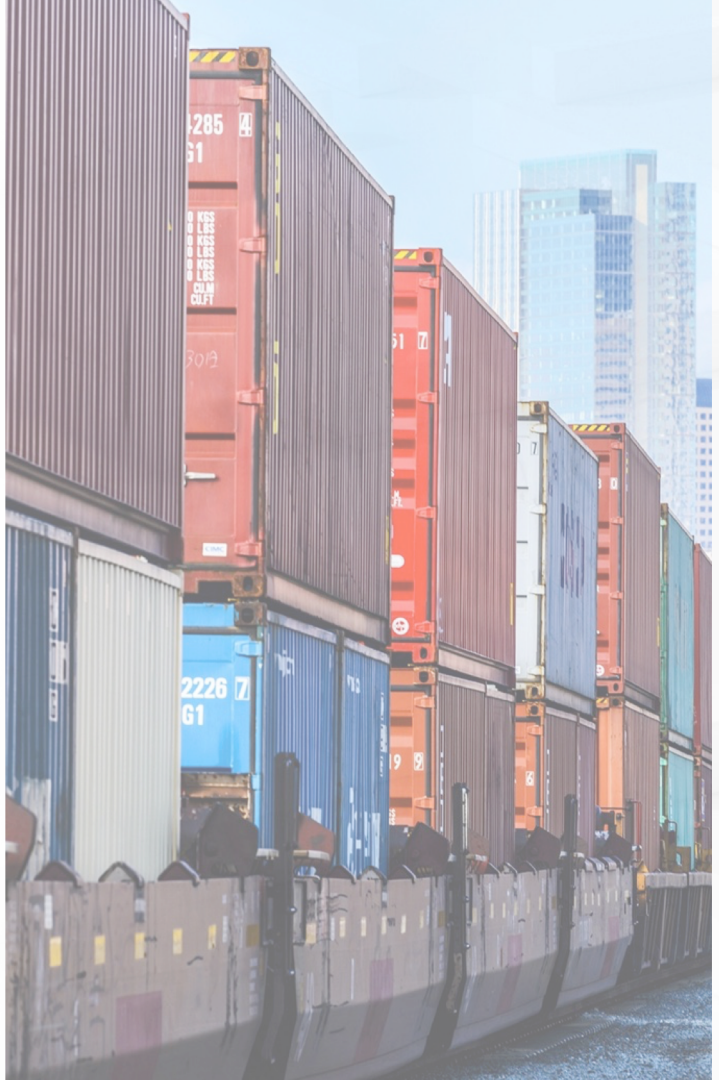
The food industry today



The food industry with blockchain



TradeLens



The cost of global trade is estimated at $1.8 trillion annually[1] with potential savings from more efficient processes of ~10%

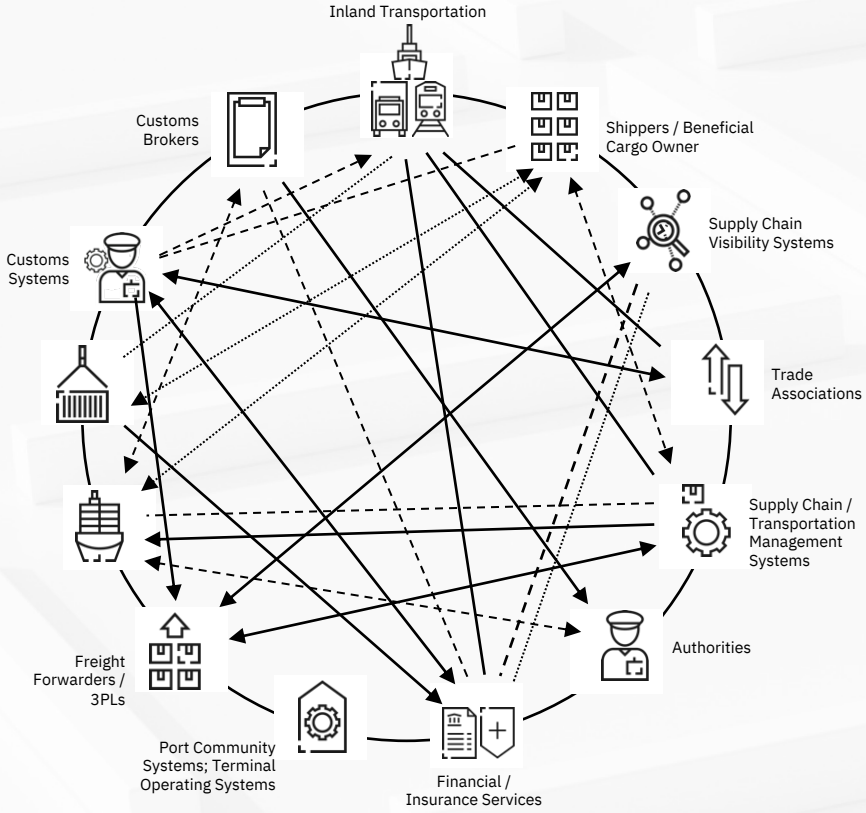
More than **$16 trillion** in goods are shipped across international borders each year

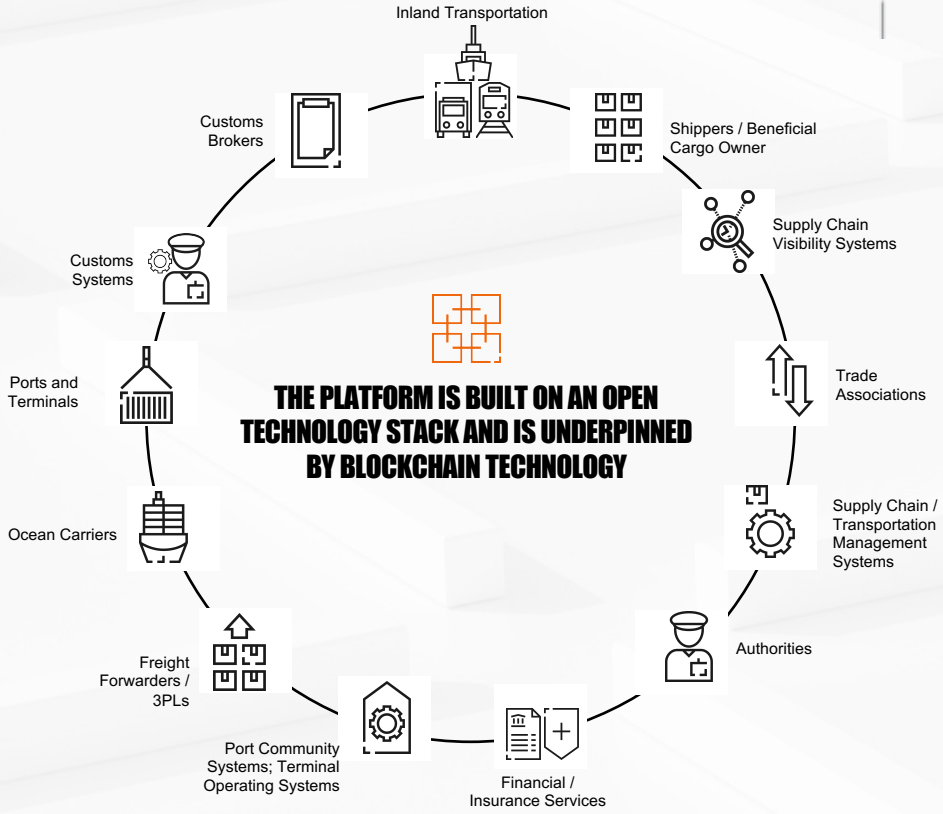
80% of the goods consumers use daily are carried by the ocean shipping industry

By reducing barriers within the international supply chain, global trade could increase by nearly **15%**, boosting economies and creating jobs[2]

In many cases the administrative cost of moving a container is **higher** than the cost of physically moving it

1) Maersk Strategy Group (May 19, 2016) based on World Bank data for World Trade Costs
2) The World Economic Forum: Enabling Trade Valuing Growth Opportunities 2013

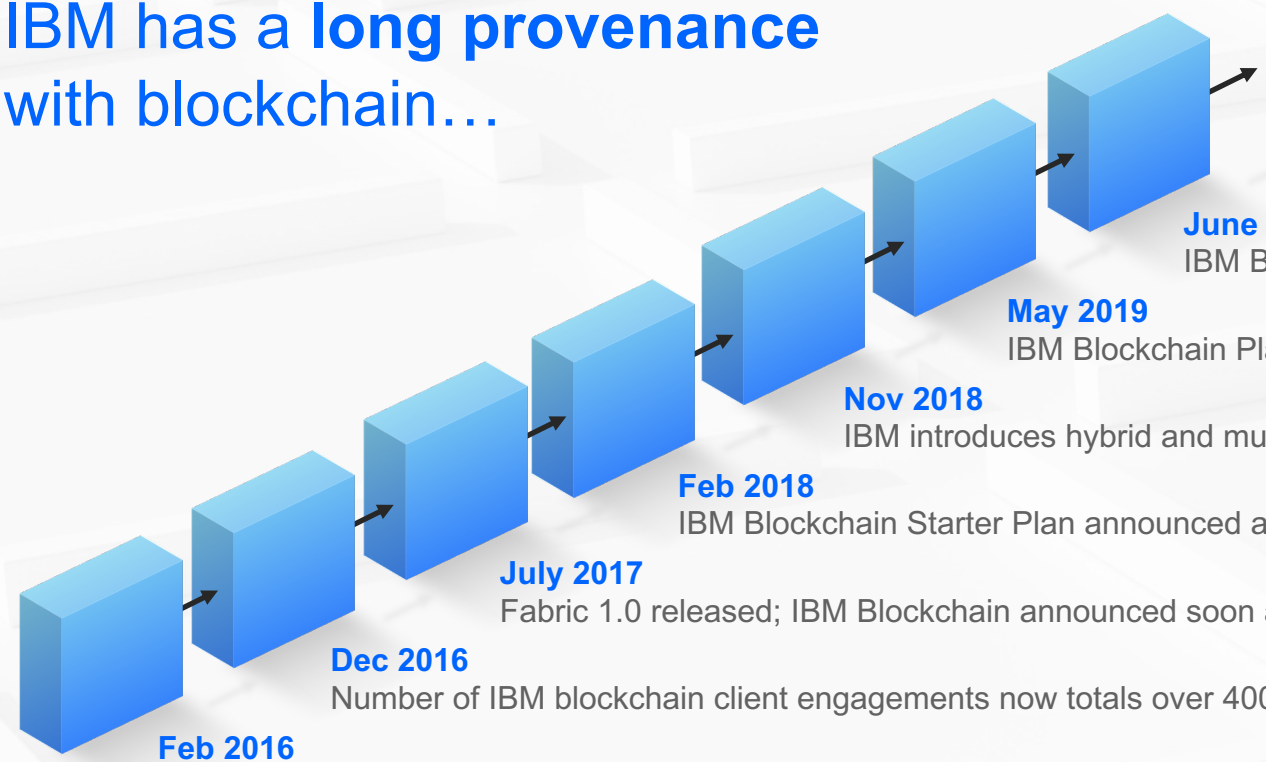




IBM **Blockchain**

IBM Blockchain Platform

IBM has a **long provenance** with blockchain…



June 2019
IBM Blockchain Platform for Multicloud released

May 2019
IBM Blockchain Platform for IBM Cloud released

Nov 2018
IBM introduces hybrid and multi-cloud networks

Feb 2018
IBM Blockchain Starter Plan announced at THINK

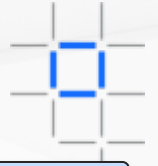
July 2017
Fabric 1.0 released; IBM Blockchain announced soon after

Dec 2016
Number of IBM blockchain client engagements now totals over 400

Feb 2016
IBM becomes a founding member of Linux Foundation Hyperledger; donates code and intellectual property

Aug 2015
IBM starts developing first prototype of blockchain technology (Open Blockchain); first client engagements

IBM's end-to-end **Blockchain Strategy**



Services

Collaborate with services teams from ideation all the way to production

Ecosystem

Tap into our diverse ecosystem to develop strategic partnerships and create your competitive advantage

Solutions

Solve critical industry challenges by building and joining new business networks and applications

IBM **Blockchain Platform**

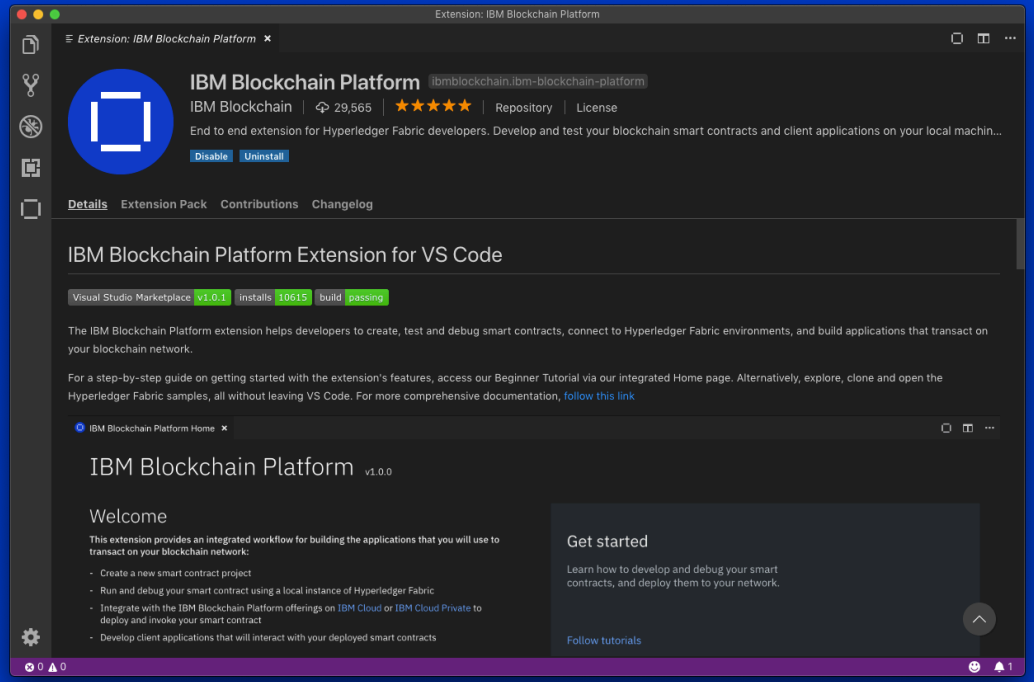
Build, operate and grow blockchain networks in heterogeneous environments

HYPERLEDGER

A founding, premier member of Hyperledger, IBM is committed to open source, standards & governance

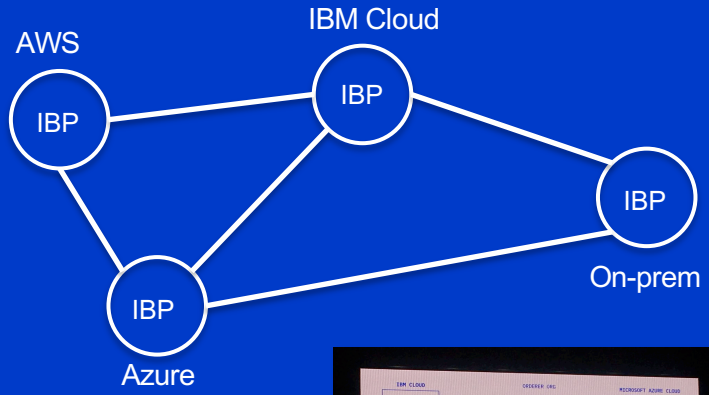
IBM Blockchain Platform's advanced tooling: **Build**

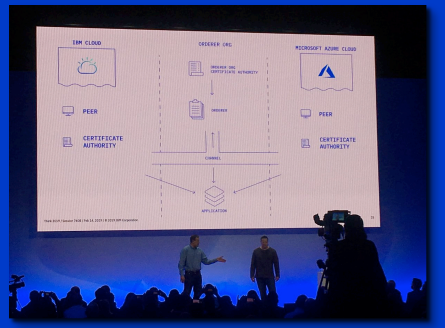
- Comprehensive developer tools for smart contracts and client applications, based on the popular **Visual Studio Code** environment
- Broad range of industry code samples and tutorials; smart contracts in JavaScript, TypeScript, Java and Go
- **Simplified DevOps** allows you easily move from development to test to production from a single console



IBM Blockchain Platform: **Deploy anywhere**

- IBM Blockchain Platform can be deployed wherever you want
  - **IBM Cloud** for a fully IBM-managed service
  - **On-premises** for greater deployment flexibility
  - In **other cloud providers** (e.g. AWS, Azure)
- **Fully heterogeneous**: different components can be deployed in different environments
- Caters for different vendor biases in the business network and **avoids lock-in**





IBM Cloud Turkey
Developer Group Slack

IBM Cloud Turkey
Meetup Group

Thank You

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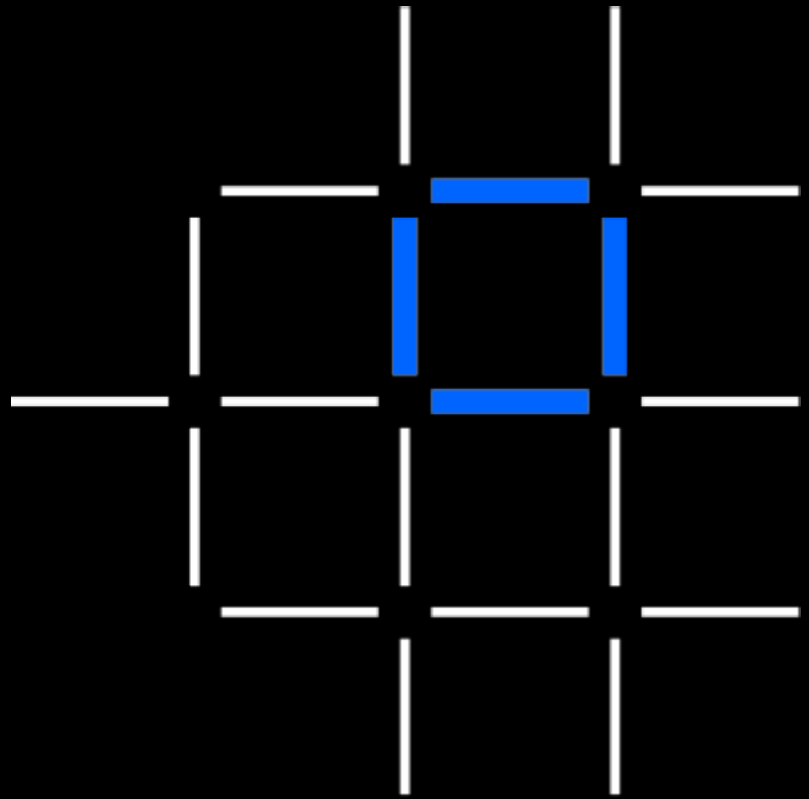

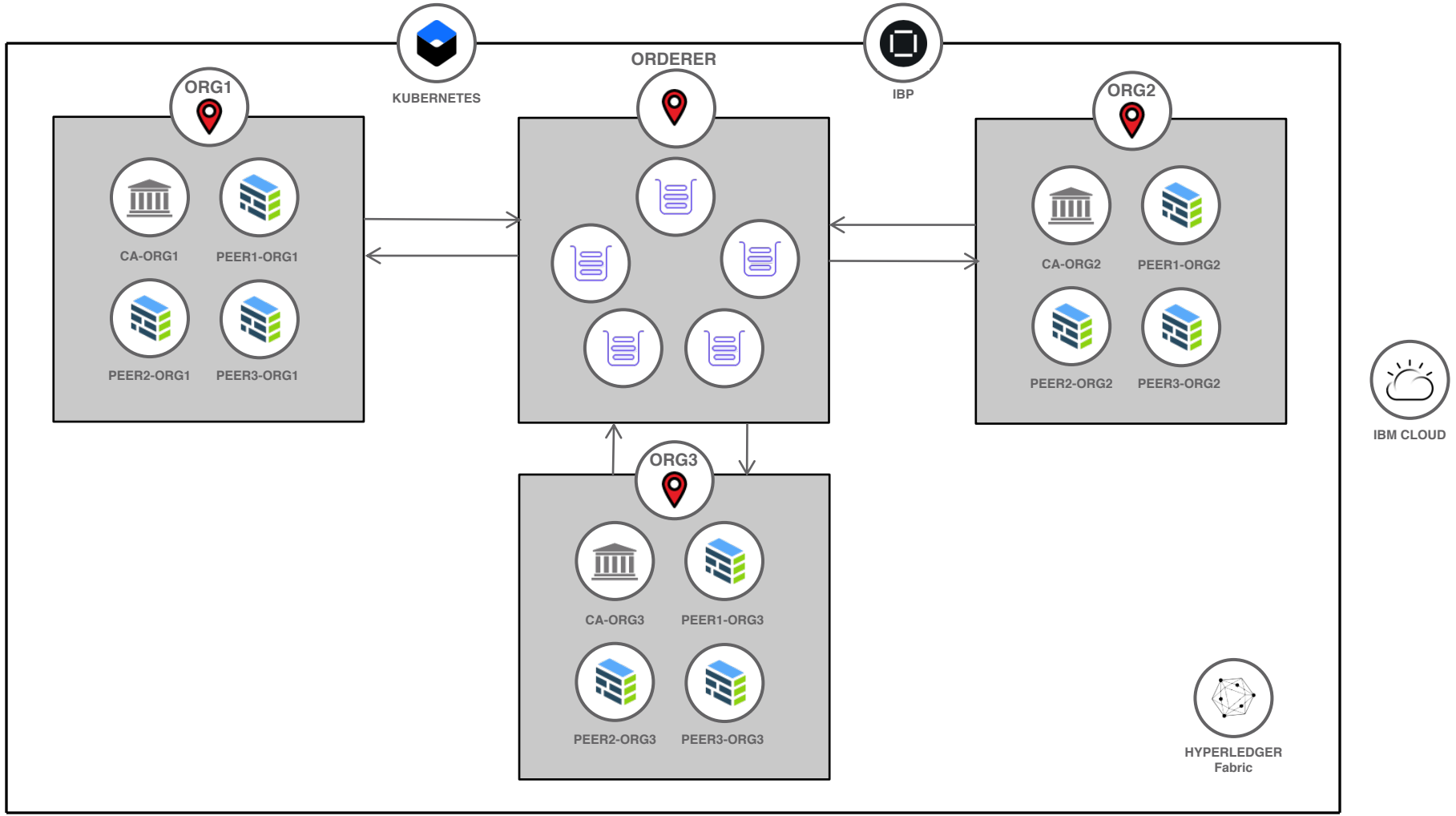
KUBERNETES
IBP
ORDERER
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PEER1-ORG1
PEER2-ORG1
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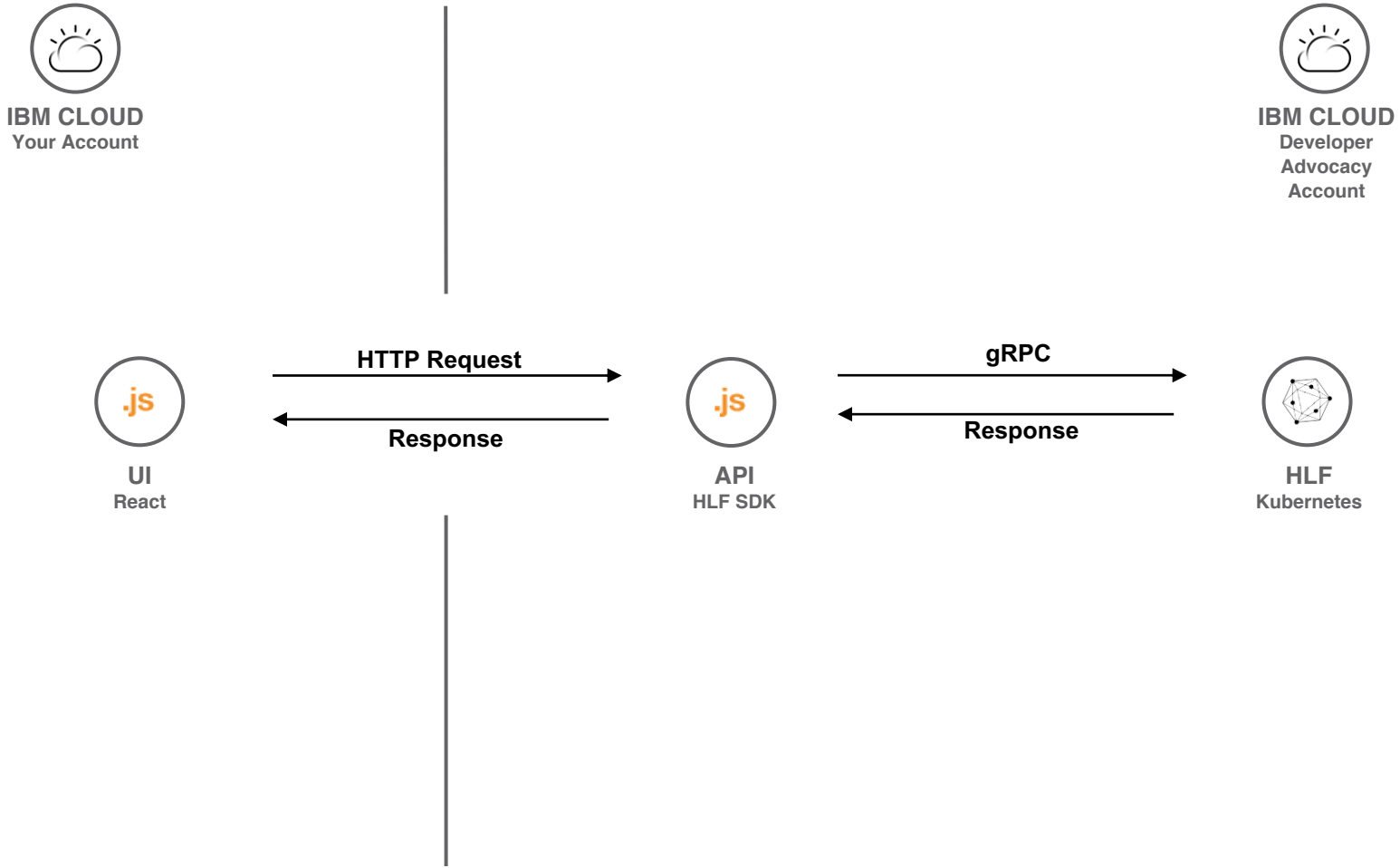
PEER3-ORG3
IBM CLOUD
HYPERLEDGER
Fabric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