

# Bringing Blockchain to Global Enterprise

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Orange County ACM Chapter  
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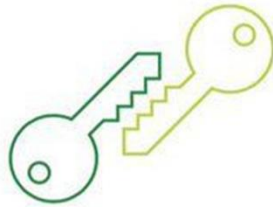
# Blockchain: Hyped and Ridiculed



# How Bitcoins Get Transferred



Bob owes Alice money for lunch. He installs an app on his smartphone to create a new Bitcoin wallet. A wallet app is like a mobile banking app and a wallet is like a bank account.



To pay her, he needs two pieces of information: his private key and her public key.



Bob gets Alice's public key by scanning a QR code from her phone, or by having her email him the payment address, a string of seemingly random numbers and letters.\*



The app alerts Bitcoin 'miners' around the world of the impending transaction. 'Miners' provide transaction verification services.



The miners verify that Bob has enough bitcoins to make the payment.



Many transactions occur in the network at any time. All the pending transactions in a given timeframe are grouped (in a block) for verification. Each block has a unique identifying number, creation time and reference to the previous block.

\*Anyone who has a public key can send money to a Bitcoin address, but only a signature generated by the private key can release money from it.

# So What Have We Learned from Bitcoin?

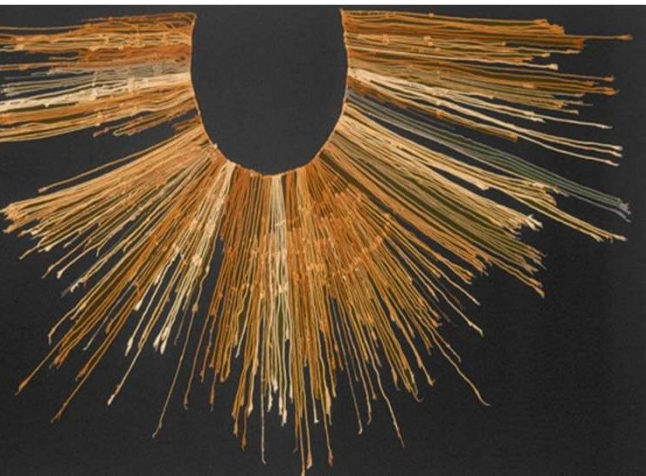
- Human progress is anchoring through STIPULATION of an ASSUMPTION
- Bitcoin's stipulation is that the tallest block is the right block
- 10 million members agree on a **single version of the truth every 10 minutes**



- Most corporations haven't had a single version of the truth since 1987

# 8,000 Years of Accounting History

**Blockchain** is the latest in a long line of financial computing innovations



Inca Khipu  
Decimalized computer  
Permanent storage  
1st distributed database

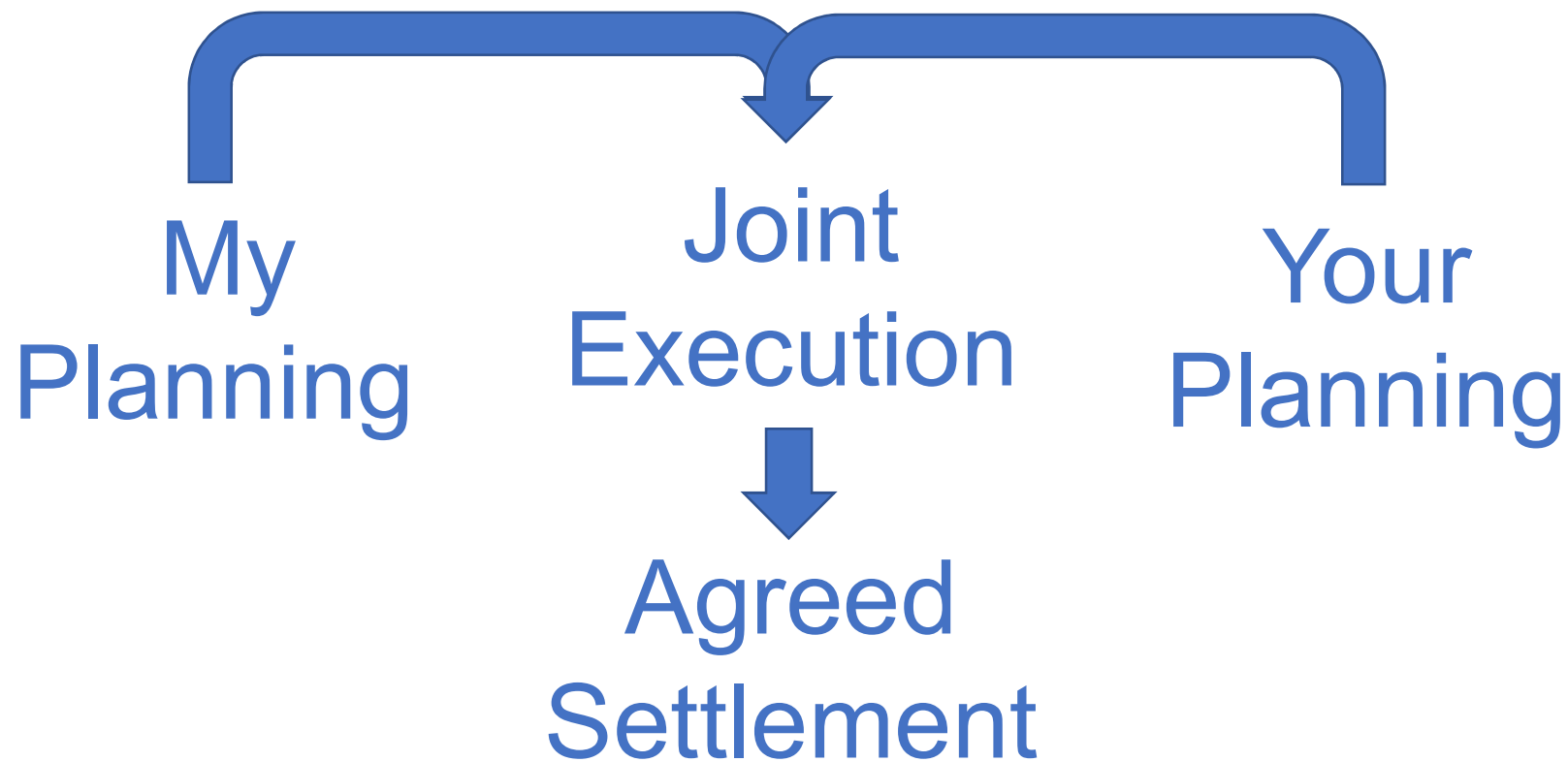
Pacioli's *Summa* (1494)  
• Double-entry bookkeeping



MIT Whirlwind (1951)  
• Parallelized logic  
• Magnetic core memory  
• Real-time graphical output

# 8,000 Years of Accounting History

**Blockchain** enables multiple parties to jointly transact & settle in near real-time



# What is Blockchain / Distributed Ledger?

*“We’ve always looked for a distributed database with a trust harness that allows multiple organizations to collaborate... Clearly, the blockchain and the distributed ledger that exists underneath it is a very novel implementation which can have massive implications.”*

– Microsoft CEO Satya Nadella

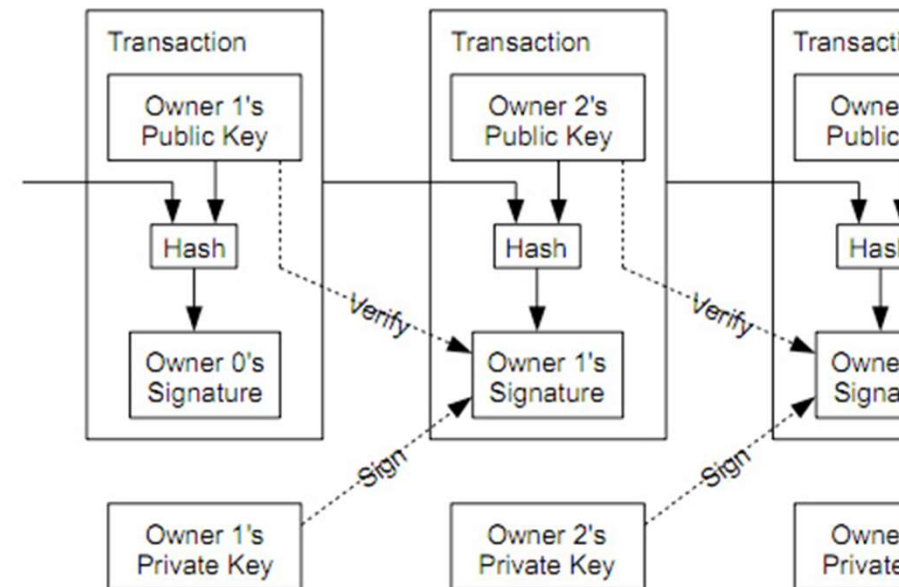


# What is Blockchain / Distributed Ledger

**Blockchain:** data structure capturing transactions are immutably time-stamped

**Smart contracts:** when parties agree to mutually execute a transaction in accordance with a "smart contract." Once notarized into a blockchain, the commitment is binding and irrevocable. Records in the blockchain are encrypted and linked, making alterations almost impossible.

The associated **ledger** is a consensus of replicated, shared, and synchronized digital data across multiple participants.



*A series of smart contracts from Satoshi Nakamoto's paper. Every bitcoin user has a public and private key – one for receiving, and one for sending. When a transaction is made, it is broadcasted to all the other nodes on the blockchain and verified. Once completed, the record of the transaction is virtually impossible to alter.*

# Distributed Ledger Variants

Important distinctions amongst different blockchain platforms

- **private vs. public blockchains** (commingled data)?
- **open or by invitation membership** (permissioned access)?
- **network costs borne by subscription or bounties** (mining)?

Bounties are typically paid in the form of cryptocurrency to successful “miners” who create blocks with newly minted coins, thereby adding inflation to system



- Permissioned blockchains may be warranted when access to information needs to be restricted based on necessity and privacy laws.
- On-chain vs. off-chain? Which data elements to store on the blockchain vs. store remotely? Cash register tape and stock ticker are blockchain precursors.

# Comparing Blockchain Platforms



<b>Positioning</b>	Visionary	Enterprise-grade	Classic
<b>Governance</b>	Ethereum Foundation?	Linux Foundation	Hmmmm
<b>Participation</b>	Open with Velvet Ropes	Permissioned, private	Open
<b>Consensus</b>	PoW → PoS?	Pluggable consensus	PoW Mining
<b>Smart contracts</b>	Yes, typically Solidity	Yes, typically Go or Java	More basic
<b>Currency</b>	ether, gas, altcoins	None in native form	bitcoin

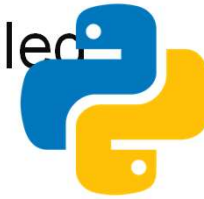
*Partially sourced from SBC Working Paper, 6/2017*

# Enterprise Computing Situation Report

Enterprises went hard into Relational Database in the '80s

- Client service and the web pushed the client points further and further
- Application servers managed & personalized client experiences

“Big data” is nice way of saying relational has failed



Wall Street: Algorithms (smart contracting) & High-frequency (real time)

Amazon and Google raised expectations....

*Enterprises: feet in relational concrete and heads in the big data clouds?*

# Challengers in Enterprise Blockchain Development

Linux Foundation and IBM driving Hyperledger Fabric

Amazon Web Services, IBM, HP, Microsoft, Oracle, and SAP styling themselves as blockchain-as-a-service (BaaS) providers

Financial services companies have formed consortia while pioneers like Northern Trust are in production with blockchain internally

Ethereum enterprise edition under way, while JPMorgan has launched Quorum initiative off Ethereum

Standalone proprietary blockchains such as Ripple have emerged

# How Can Enterprises Move Incrementally?

Blockchain Attributes	Strengths	Weaknesses	Opportunities	Threats
1. Shared data model	Key partnership	Hard to change	Future-proof	
Shared client and data model	Site efficiency	Maintainability		Viral Infection
3. Shared open system	TCO	Platform control	Lightning?	Security mod
Shared permissioned system	Industry control	Less flexible	Upgradability	
5. Shared permissioned and partitioned system	Gold standard	Expensive	Upgradability	

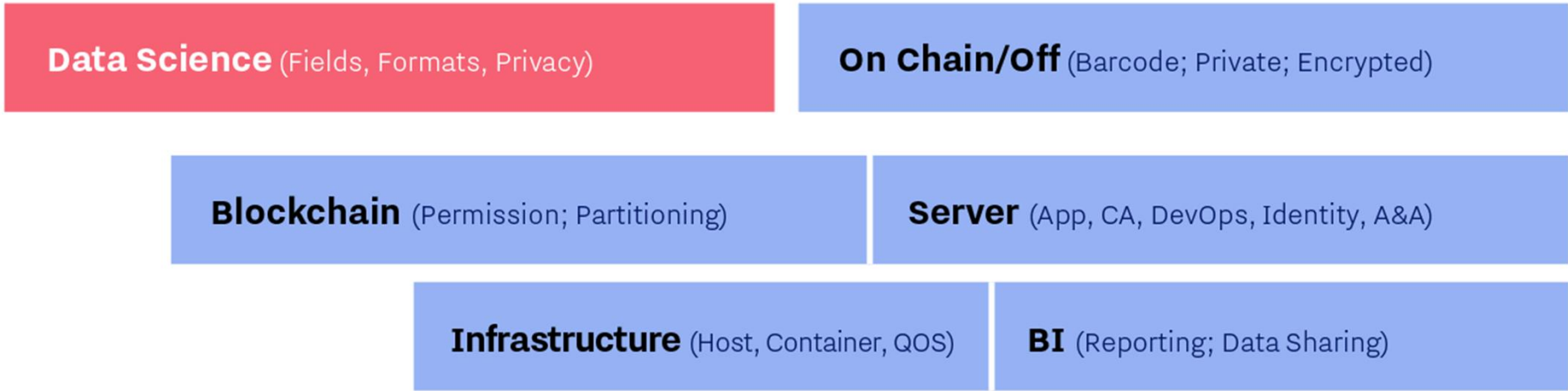
# Blockchain Solution Process Flow

TIME →

CLIENT SIDE



SERVER SIDE

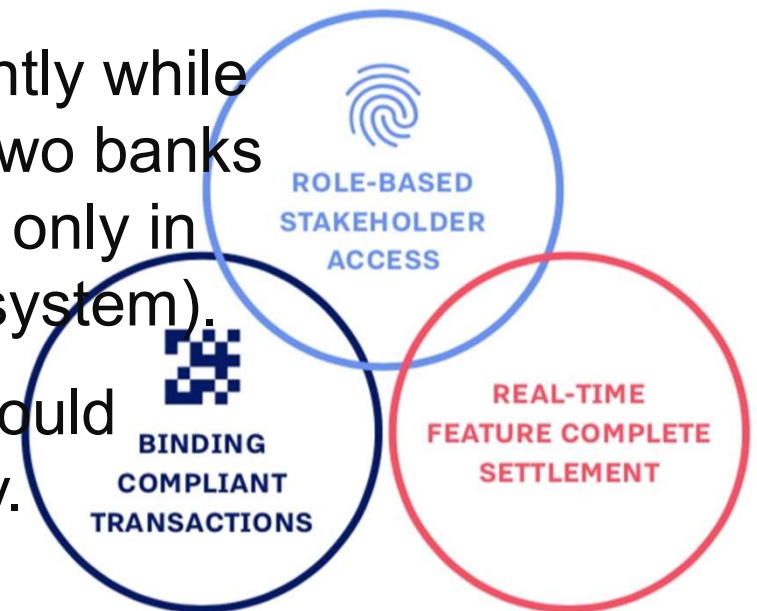


# Enterprise Use Cases for Blockchain

**Global supply chains:** pharmaceuticals, electronics, national security procurement, etc. The blockchain-based supply chain opportunity for discrete finished products will exceed \$424 million globally by 2023 (*ABI Research*).

**Private transactions between banks:** Currently while a million wires shoot back and forth between two banks in the course of a day, the money itself moves only in single massive net transfers (e.g. the SWIFT system).

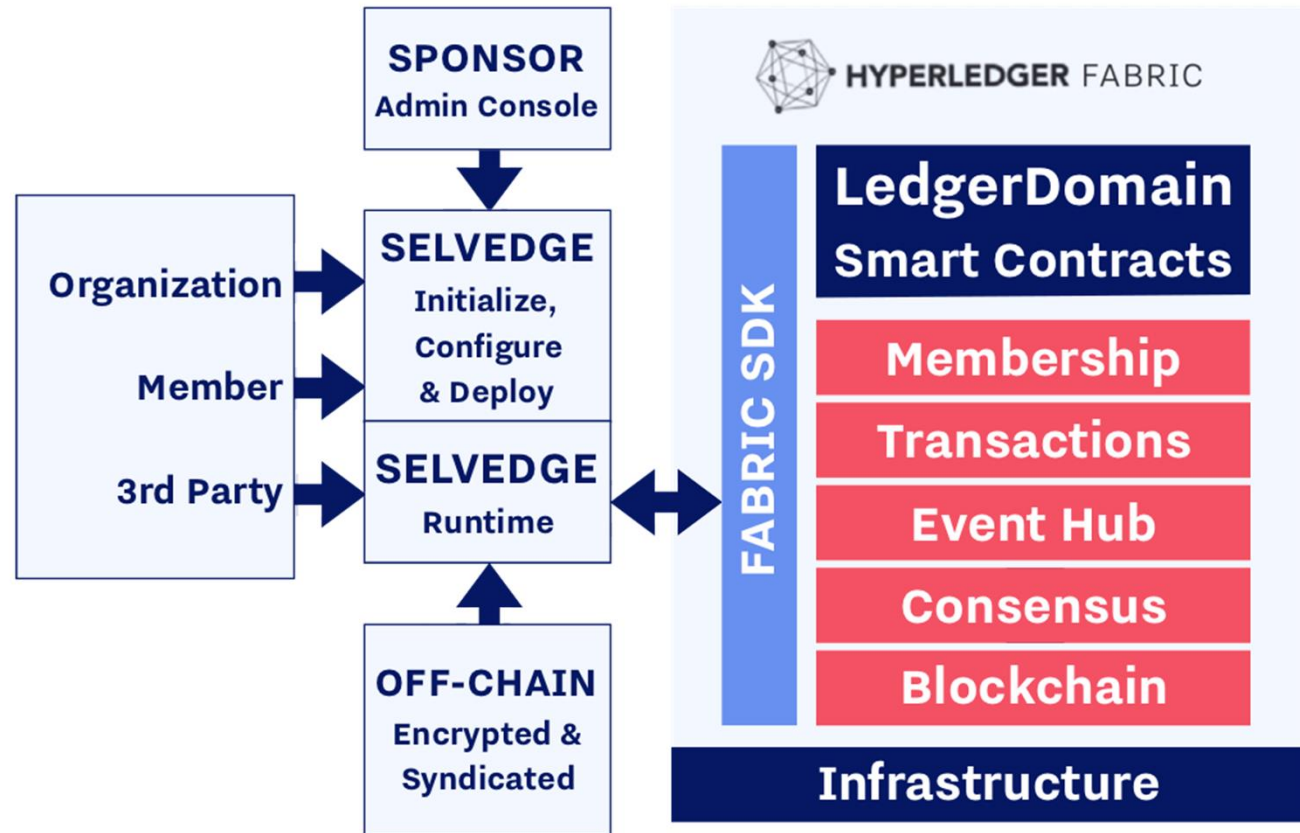
**Patient records:** Encrypted patient records would allow for real-time access with greater security.



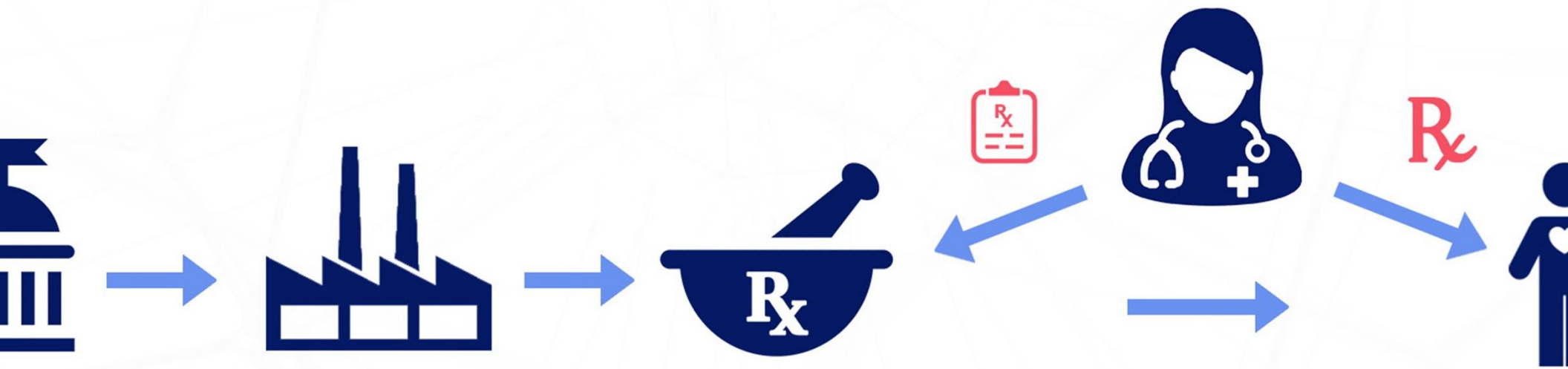
# LedgerDomain Simplified Architecture

CLIENT SIDE  
WITH TIERED CLIENTS

SERVER SIDE  
WITH SELVEDGE & HYPERLEDGER FABRIC



# Supply Chain Demo

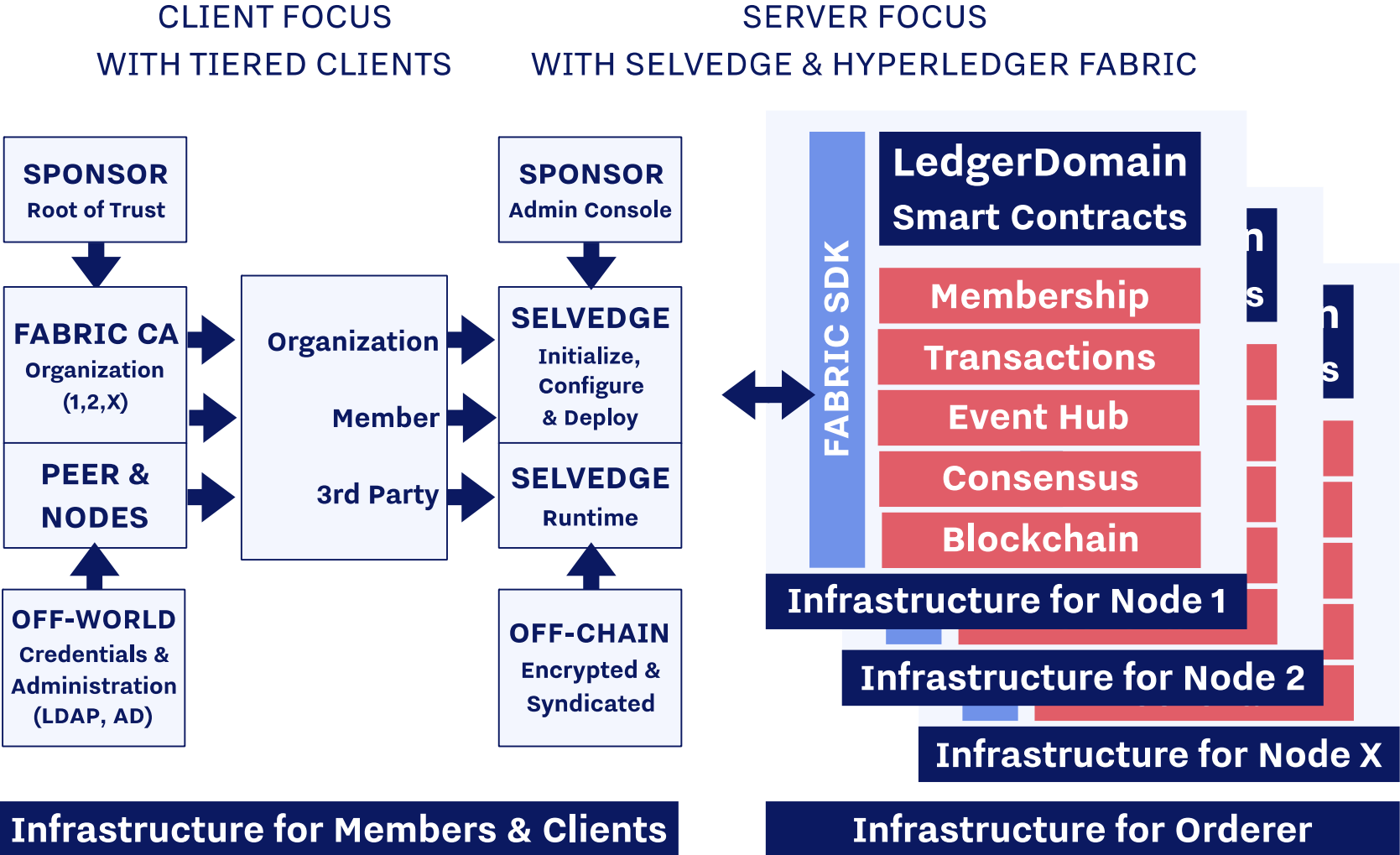




# LedgerDomain

## Supply Chain Demo

# LedgerDomain Architectural Cascade



# Where is Development Heading?

- Chaincode portability, blockchain federation and integrability
- More robust models for organizations and permissions
- Analytics on chaincode data
- Next-generation crypto and data models
- Integration with enterprise systems such as ERP & MES
- Designing for compliance with privacy laws (e.g. HIPAA, GDPR)

*Blockchain, artificial intelligence & IoT combine to make every transaction*

*...instantaneous, confidential, unforgeable & trackable*



Feedback and  
Questions?

# Where to Learn More

[How Blockchain Unlocks the Fourth Wave of Financial Computing](#)

[Hyperledger Fabric](#)