SUMMIT

London

Building enterprise solutions with blockchain and ledger technology

Dr. Andrew Kane
Principal Solutions Architect
Amazon Web Services

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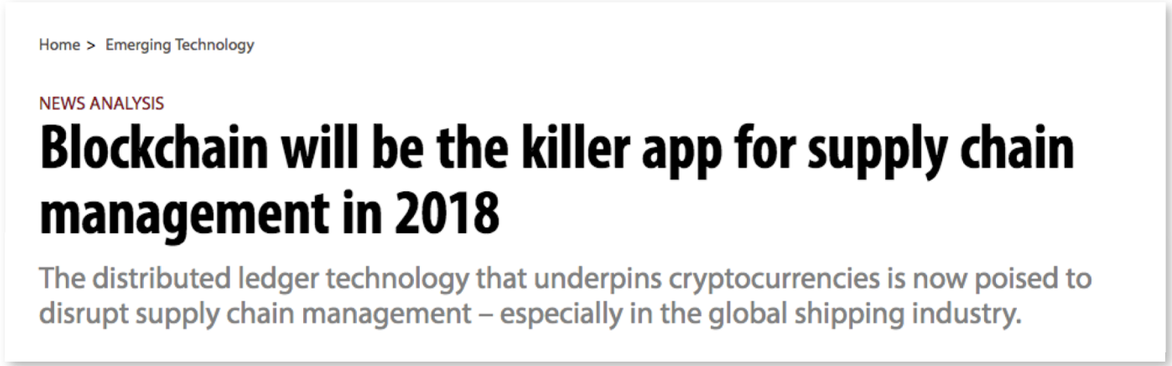
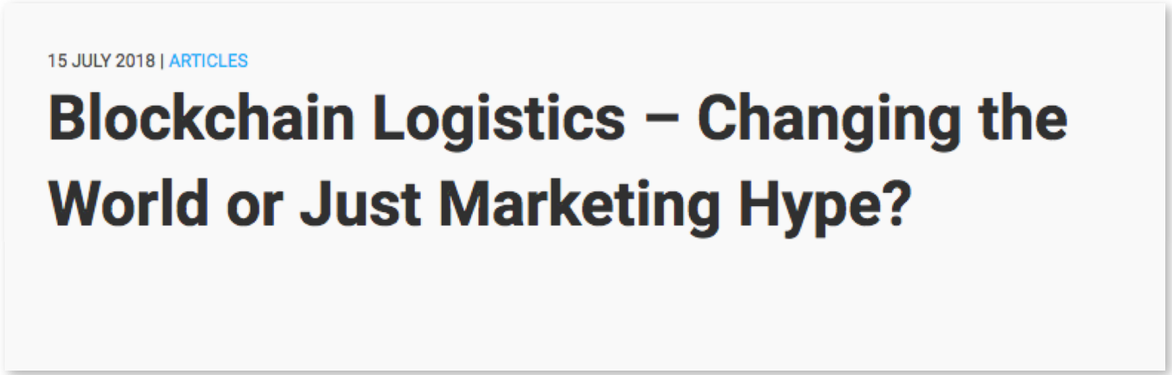
How do we think about blockchain?

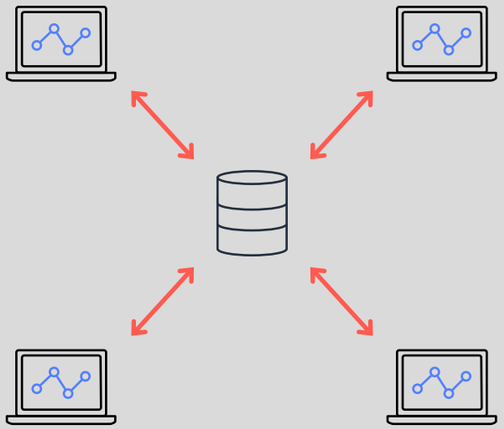




Need for a ledger with centralized trust

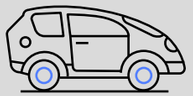
1 LEDGERS WITH CENTRALIZED TRUST

2 TRANSACTIONS WITH DECENTRALIZED TRUST



Healthcare

Verify and track hospital equipment inventory



DVLA

Track vehicle title history

Manufacturers

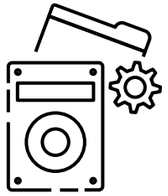
Track distribution of a recalled product

HR & Payroll

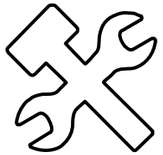
Track changes to an individual's profile

Challenges customers face

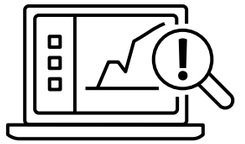
Building ledgers with traditional databases



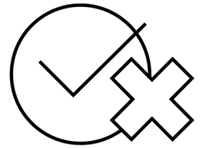
Resource intensive



Difficult to manage and scale

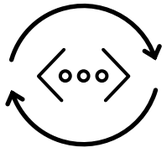


Error prone and incomplete

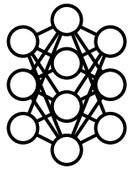


Impossible to verify

Blockchain approaches



Designed for a different purpose



Adds unnecessary complexity

PREVIEW

Amazon Quantum Ledger Database (Amazon QLDB)

Fully managed ledger database with a central trusted authority

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Theatre 5

3.05pm

Do you need a ledger database or a blockchain?

Michael Labib
Principal Solutions Architect
Amazon Web Services

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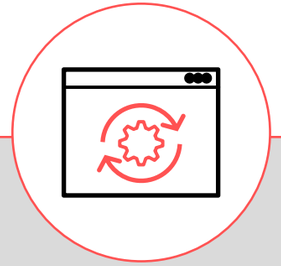
Amazon QLDB (Preview)

Fully managed ledger database
Track and verify history of all changes made to your application's data

Immutable

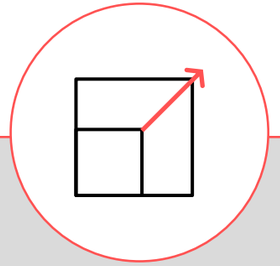


Maintains a sequenced record of all changes to your data, which cannot be deleted or modified; you have the ability to query and analyze the full history

Cryptographically verifiable

Uses cryptography to generate a secure output file of your data's history

Highly scalable



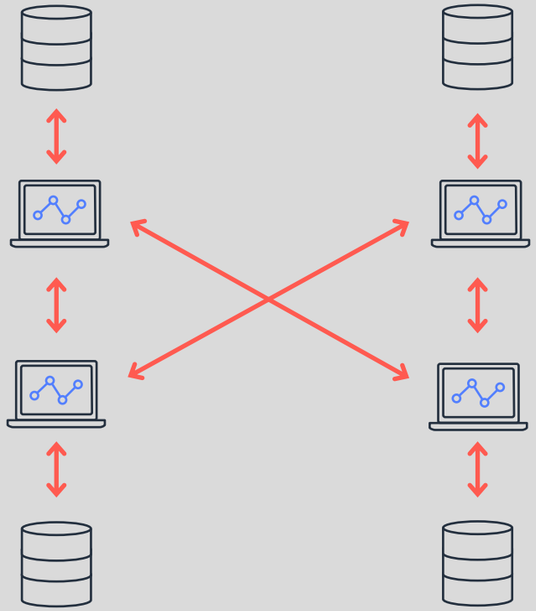
Executes 2–3X as many transactions as ledgers in common blockchain frameworks

Easy to use

Easy to use, letting you use familiar database capabilities like SQL APIs for querying the data

Need for running transactions with decentralized trust

1 LEDGERS WITH CENTRALIZED TRUST



2 TRANSACTIONS WITH DECENTRALIZED TRUST

Financial institutions
Peer-to-peer payments

Mortgage lenders
Process syndicated loans

Supply chain
Transact with suppliers and distributers

Retail
Streamline customer rewards

Customer problems with complex business networks

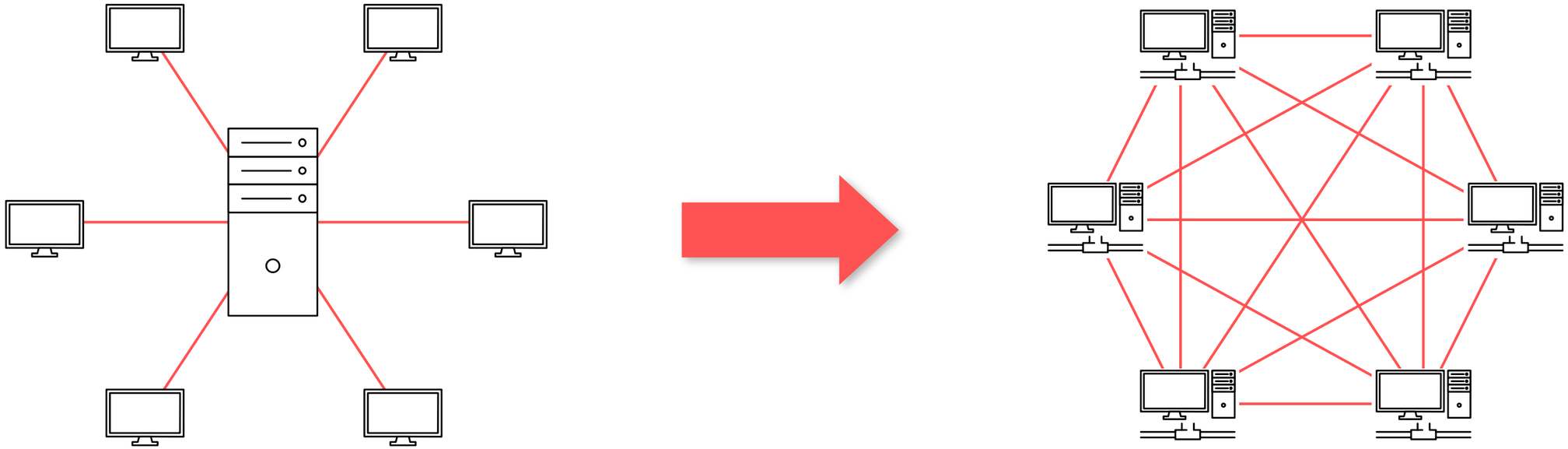
1. Networks rely on central authorities
2. Cannot agree on how data can be securely and fairly shared
3. Multiple organizations need a single, up-to-date view of data
4. Business logic among multiple organizations could be simplified
5. Asset transfers require escrow
6. Public networks needs a tamper-proof history of transactions

Blockchain builds trust in a network

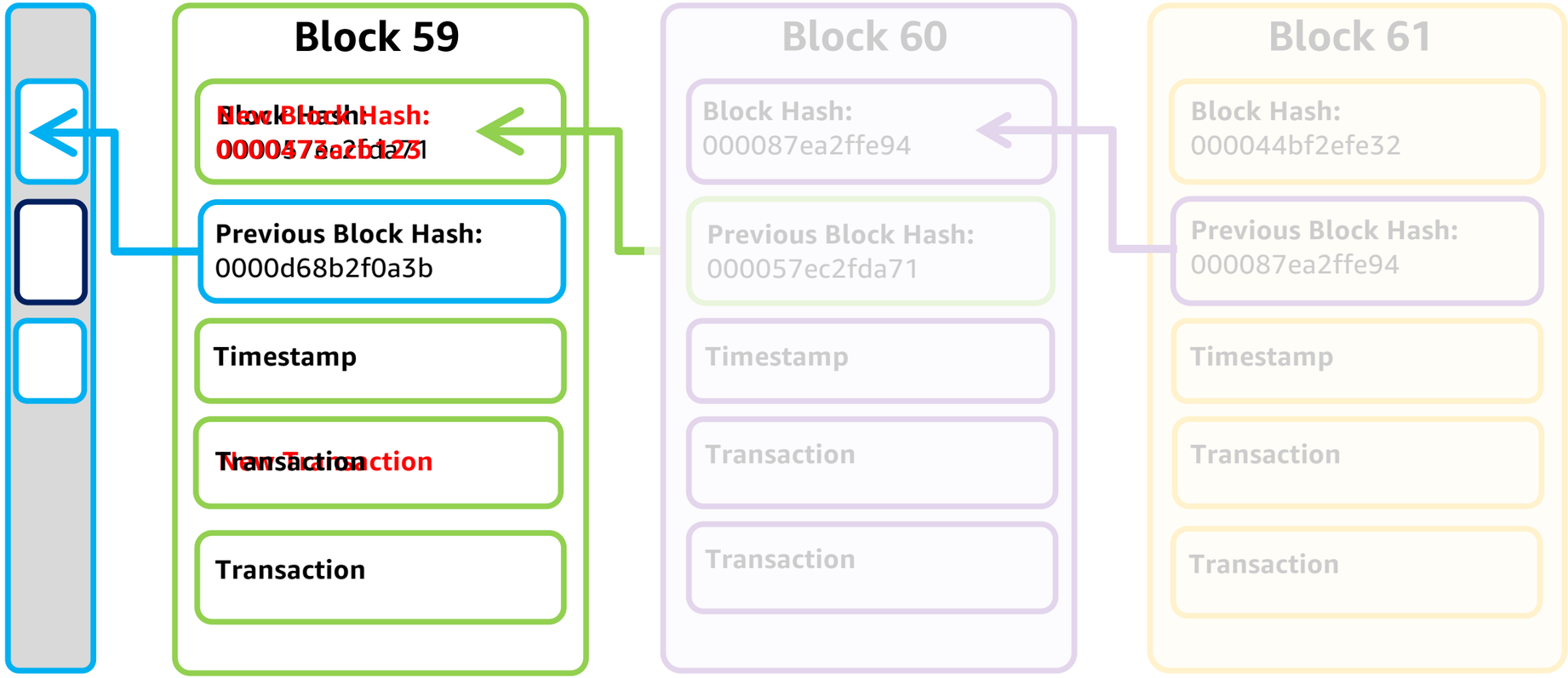
Eliminates the need for central authority in business networks

Three main components: distributed ledger, consensus mechanism,
and “smart contract” execution environment

Together these elements allow two parties to transact with one another by ensuring other parties consent to the transaction and record the transaction. This provides immutability and trust



Blockchain components: Distributed ledger database

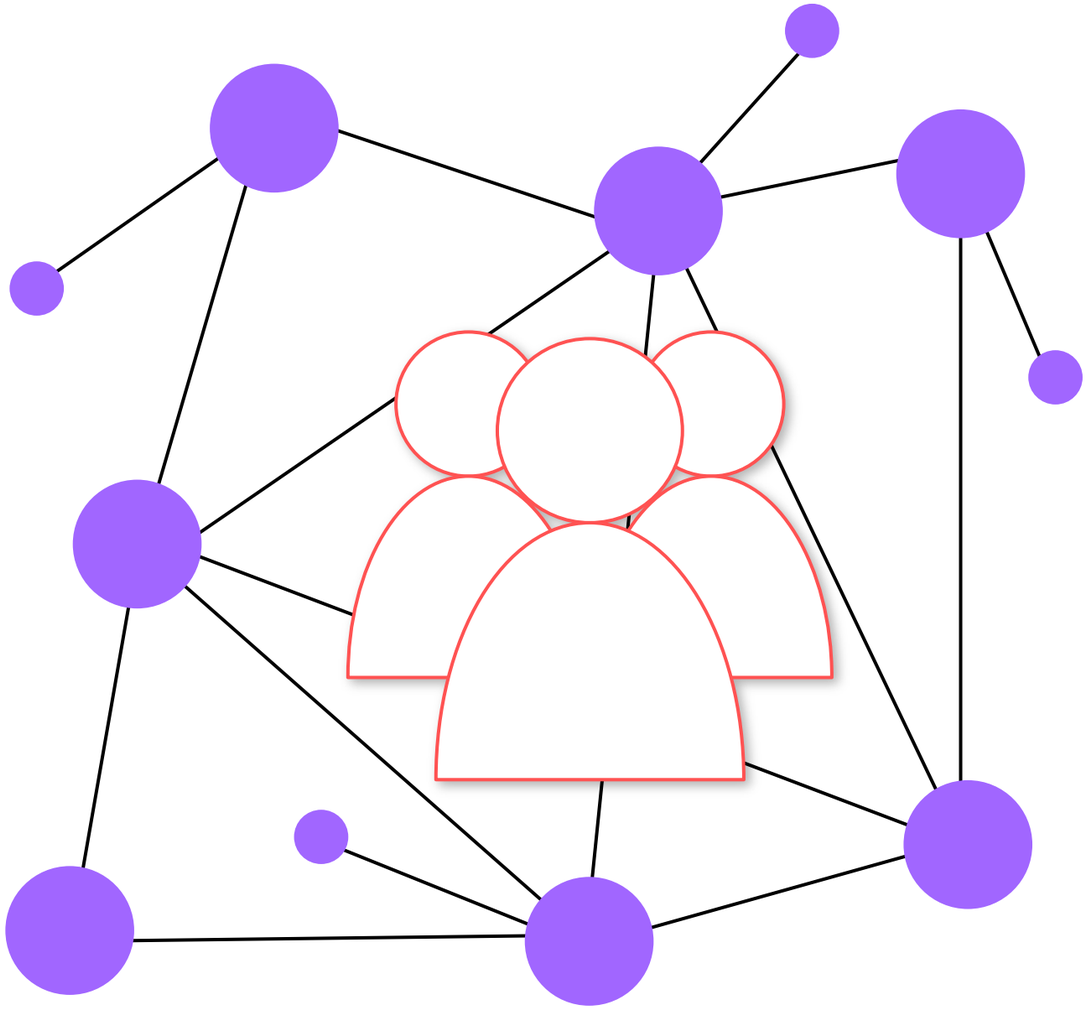


The journal records an immutable log of all transactions and is maintained by nodes in the blockchain network

Blockchain components: Consensus mechanism

Some important attributes

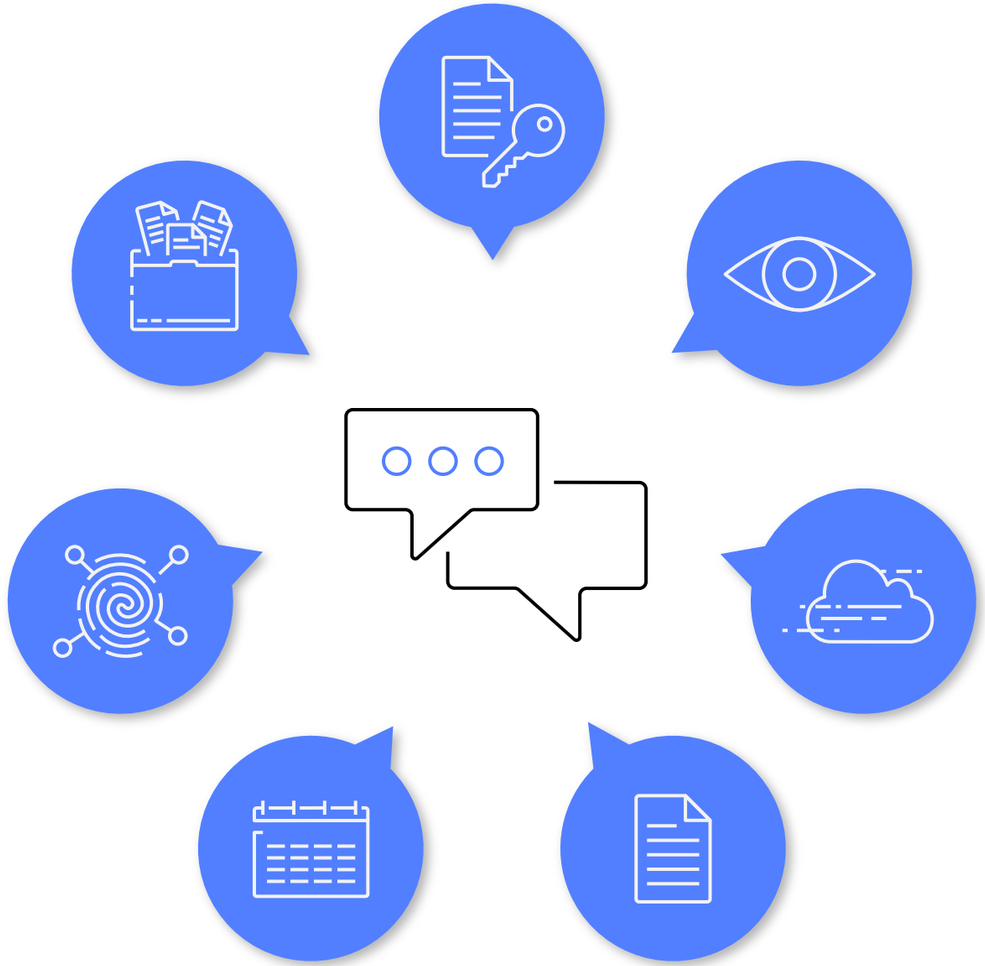
- Byzantine fault tolerance requirements
- Transaction rate, energy consumption
- Hardware requirements
- Security



Blockchain components: “smart contracts”

Smart Contracts

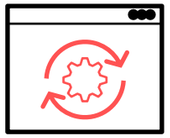
- Rules embedded in app
- Verified execution of code
- Conditional operators
- Application writes to ledger
- Contract can interact with components outside of the blockchain network (off-chain)



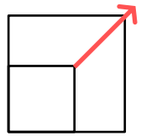
Traditional Contracts

- Require human action
- Open to manipulation
- Verified an enforced by third parties

Challenges with existing blockchain solutions

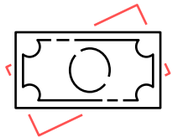


Setup is hard



Hard to scale

Complicated to manage



Expensive

NEW

Amazon Managed Blockchain

Fully managed blockchain service, supporting both Hyperledger Fabric and Ethereum frameworks

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Announcing General Availability of Amazon Managed Blockchain

Hyperledger Fabric available today and Ethereum coming soon

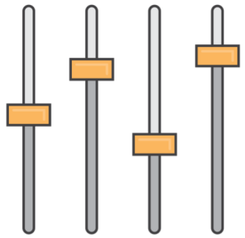
AMB is now ready for production workloads with availability in US East (N. Virginia)

- Customers can simply go to the AWS Management Console and get started
- For more info go to https://aws.amazon.com/managed-blockchain

What is Amazon Managed Blockchain?

Amazon Managed Blockchain is a fully managed service that makes it easy to create and manage scalable blockchain networks using popular open source frameworks:
Hyperledger Fabric and Ethereum

Amazon Managed Blockchain features

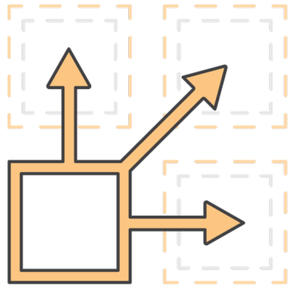


Fully managed
Create a blockchain network in minutes

HYPERLEDGER
FABRIC
ethereum

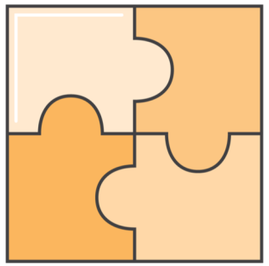
Open-source variety
Support for two frameworks

Decentralized
Democratically govern the network



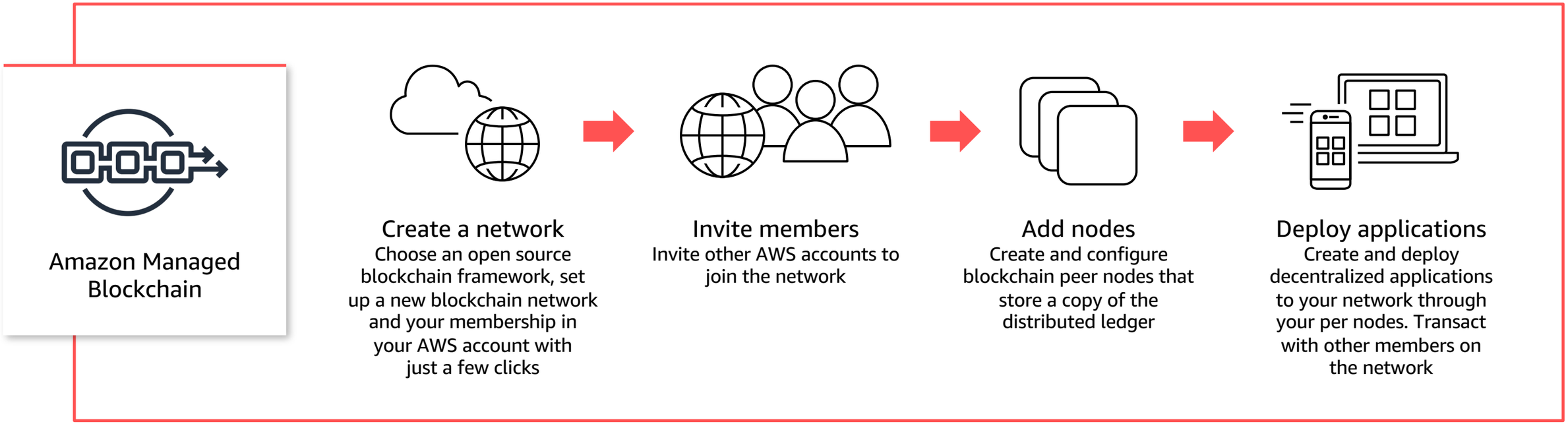
Reliable & secure
Backed with Amazon QLDB technology

Low cost
Only pay for resources used



Integrated
Send data to Amazon QLDB
for secure analytics

How Amazon Managed Blockchain works



Hyperledger Fabric

- Create permissioned networks with channels to limit the transactions on the ledger each member can see
- Chaincode (smart contracts) written in Go and are executed in Docker containers
- Validation policy for executing chaincode is configurable
- Does not require a native cryptocurrency for chaincode execution

Ethereum

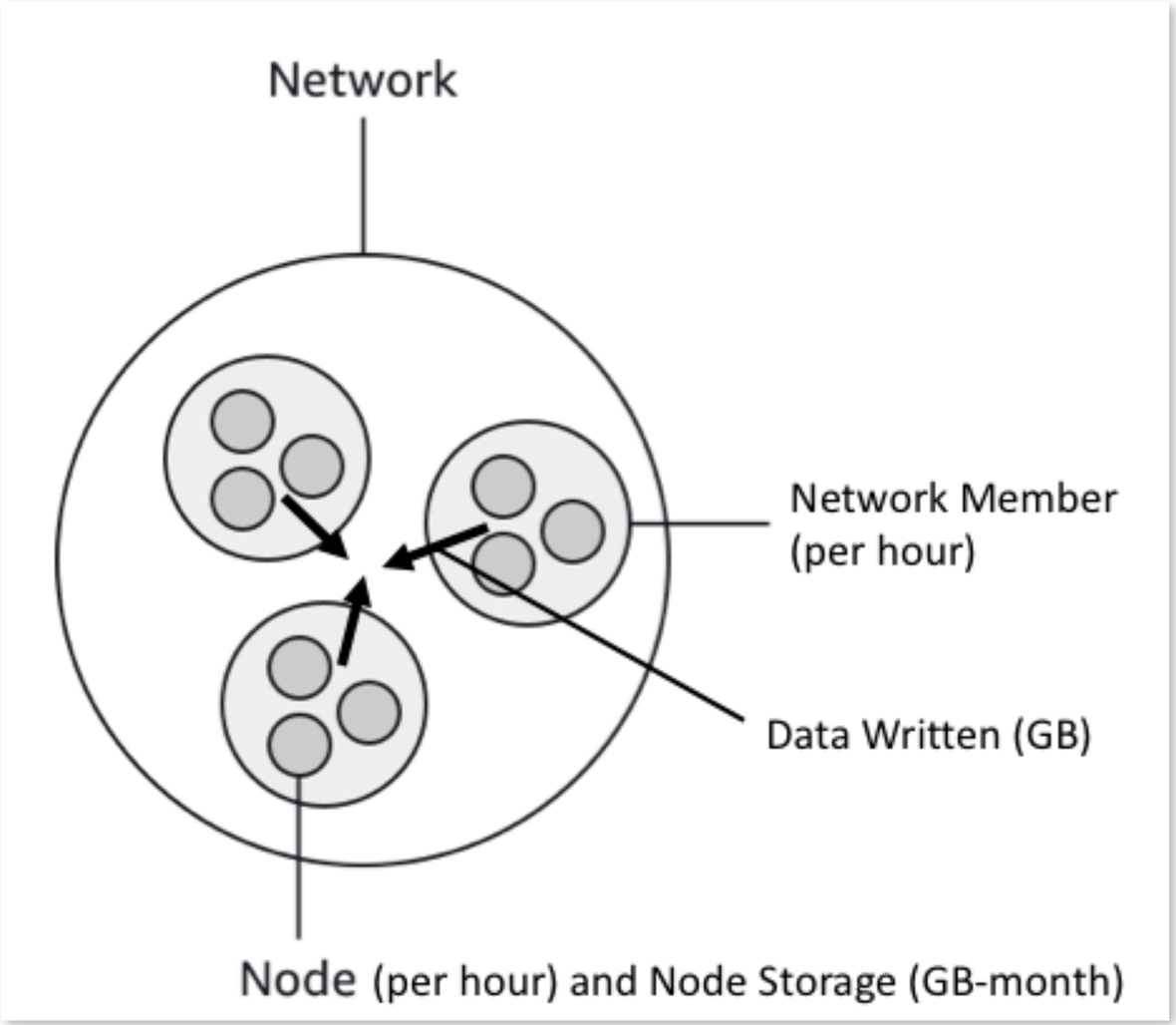
- Create smart contracts using the Solidity language that run across nodes in the network
- Very scalable
- Create permissioned networks or use public Ethereum network
- Configured to use Proof-of-Work consensus algorithm for public network and Proof-of-Authority for private networks
- Anyone who can access the network can see all data on the ledger

Who "owns" the network?

- Networks are decentralized and can remain active even after the initial creator leaves
- Inviting members to join: members vote on who to invite and remove
- Network-wide settings: members can vote on network-wide settings and configure the actual voting rules (e.g., majority rules or one member decides)
- Each member pays for their resources
- Amazon Managed Blockchain manages shared components like the ordering service and networking settings

Pricing dimensions

- Pay-as-you-go with no upfront costs
- Hourly rates billed per-second
- Each member pays for their own resources and the data it writes to the network
- VPC endpoints created to access resource endpoints are billed separately
- Standard data transfer rates



Starter edition and standard edition

Starter edition

- Test and small production networks
- Up to 5 members/network
- Up to 2 peer nodes/member
- bc.t3.small and bc.t3.medium
- Ordering service provisioned has lower transaction throughput and availability than that in a Standard Edition network

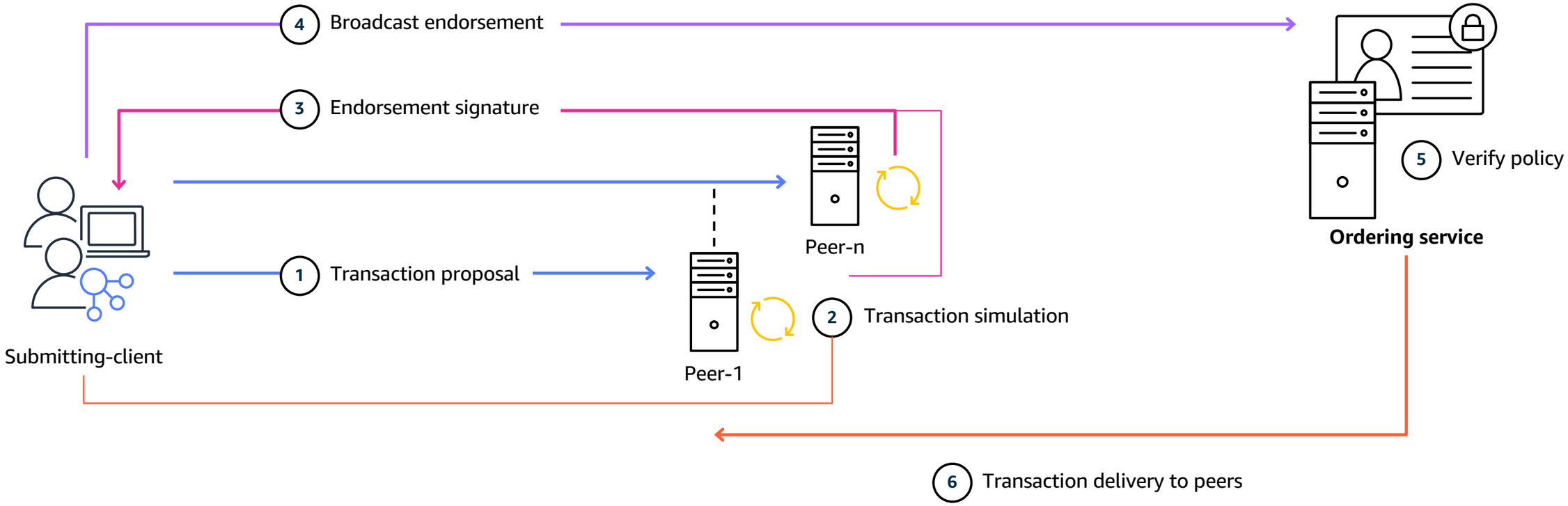
Standard edition

- Production networks
- Up to 14 members/network
- Up to 3 peer nodes/member
- bc.t3, bc.m5, and bc.c5 instance families
- Ordering service provisioned has higher transaction throughput and availability than that in a Starter Edition network

Membership pricing rate is different for each edition


What is Hyperledger Fabric?

Transaction flow with Hyperledger Fabric



Augmented Hyperledger Fabric

Ordering service

- Core component of a Fabric network to guarantee delivery and order of transactions
- Production grade networks using open source will utilize Apache Kafka for this component
- Managed Blockchain uses Amazon QLDB technology, increasing durability and reliability

Certificate authority

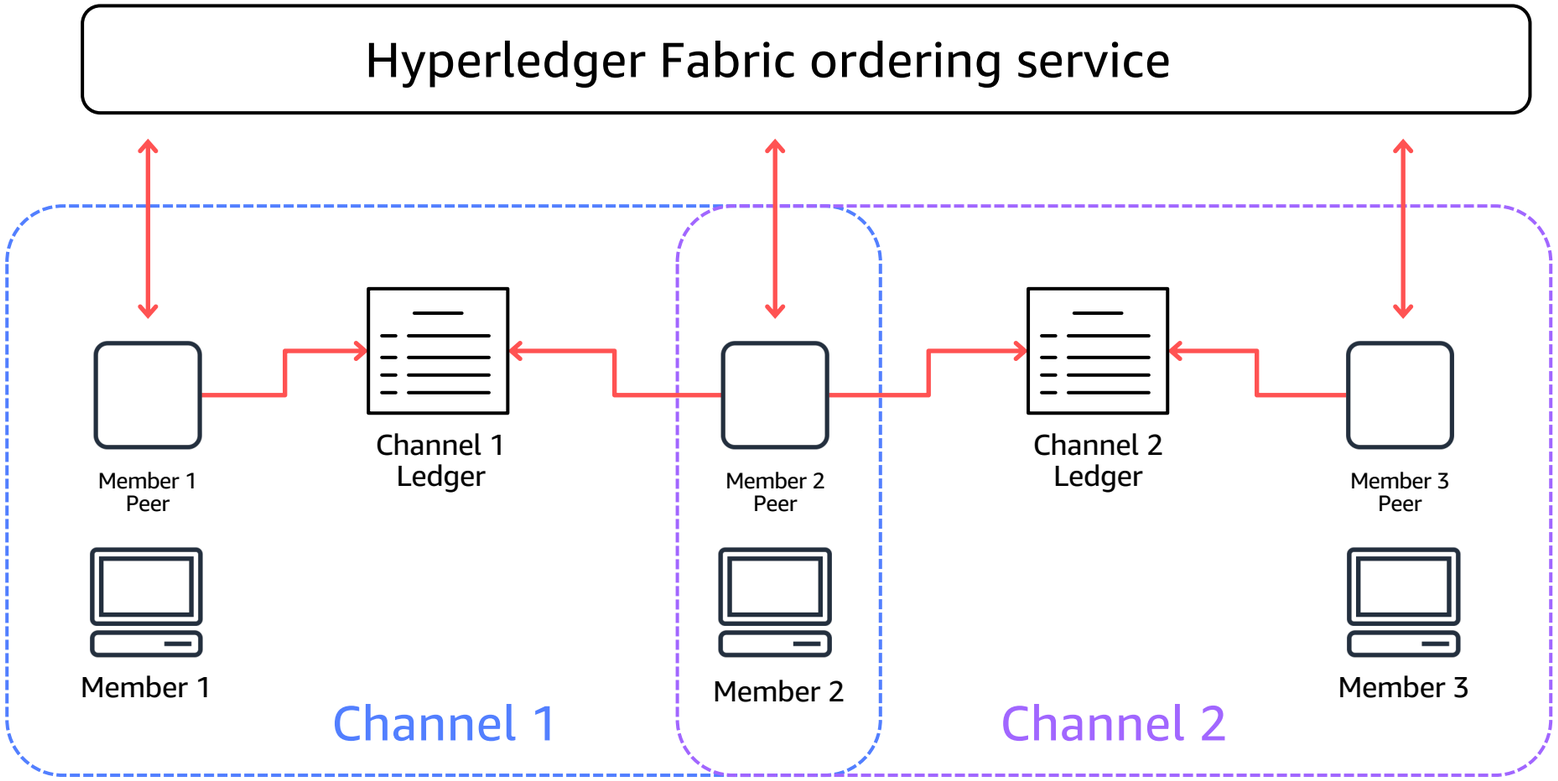
- Open source uses a “soft” HSM
- Managed Blockchain uses AWS Key Management Service (AWS KMS) to secure the Certificate Authority service

Channels and private data for access control

Channels allow isolation of transactions among specific members in the network

Create or update a channel with configuration transaction (configtx)

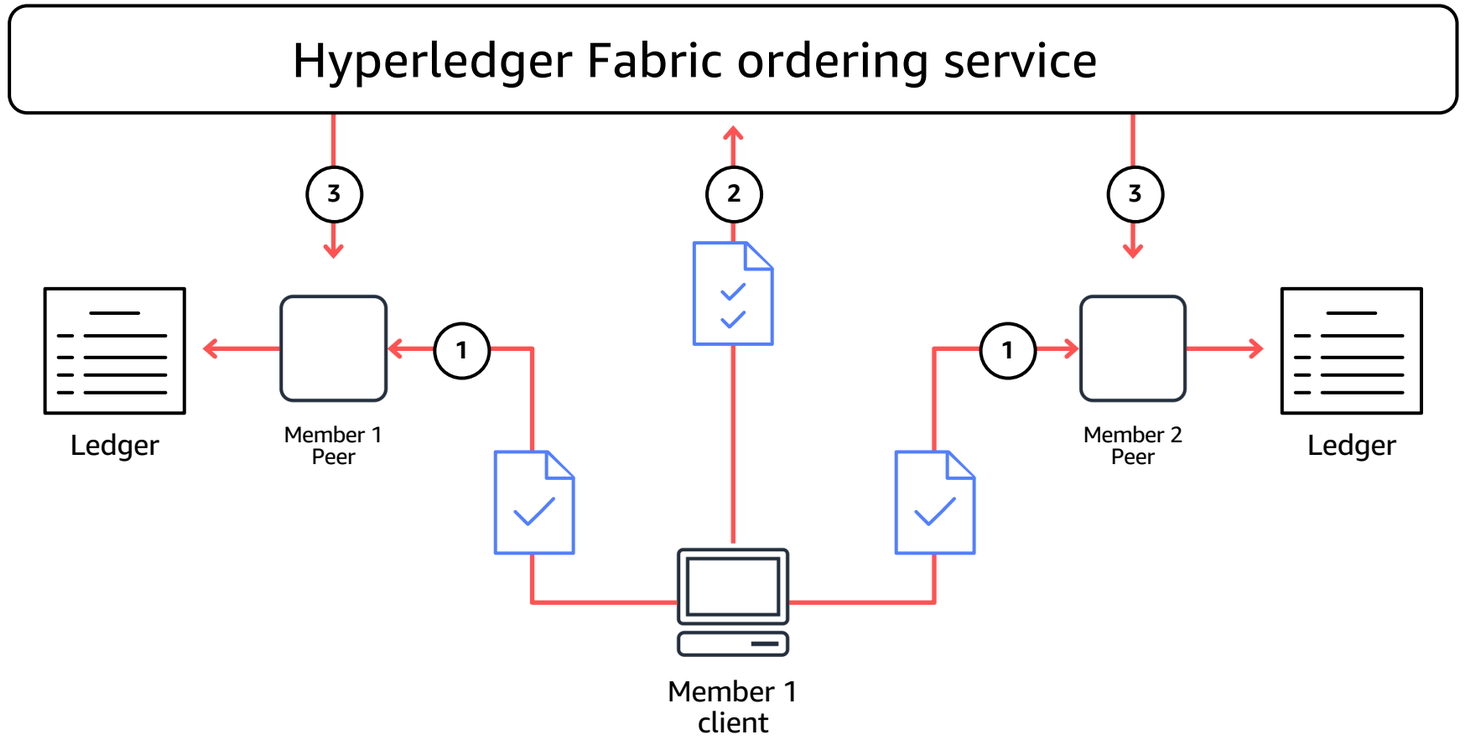
Private data enables sub-channel access control

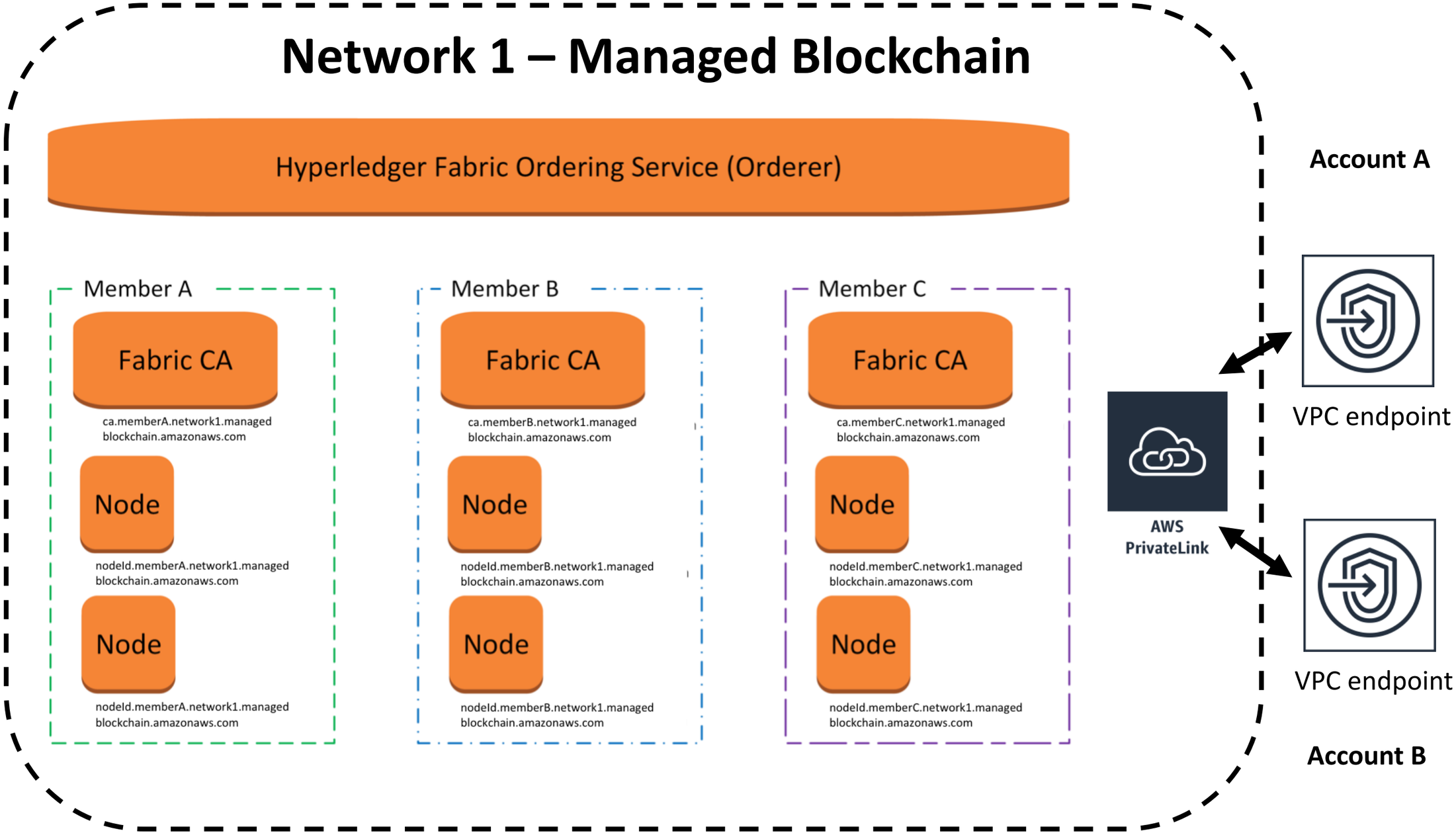


Endorsement policies

Endorsement policies allow chaincode to specify which members (or how many) need to validate a transaction before submitting

Endorsed transactions then get submitted to the ordering service and assembled into blocks




Network 1 – Managed Blockchain
Hyperledger Fabric Ordering Service (Orderer)
Member A
Fabric CA
ca.memberA.network1.managed blockchain.amazonaws.com
Node
nodeId.memberA.network1.managed blockchain.amazonaws.com
Node
nodeId.memberA.network1.managed blockchain.amazonaws.com
Member B
Fabric CA
ca.memberB.network1.managed blockchain.amazonaws.com
Node
nodeId.memberB.network1.managed blockchain.amazonaws.com
Node
nodeId.memberB.network1.managed blockchain.amazonaws.com
Member C
Fabric CA
ca.memberC.network1.managed blockchain.amazonaws.com
Node
nodeId.memberC.network1.managed blockchain.amazonaws.com
Node
nodeId.memberC.network1.managed blockchain.amazonaws.com
AWS PrivateLink
Account A
VPC endpoint
VPC endpoint
Account B

Customer use cases

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Customers are experimenting in many industries

Proof of Ownership

Documents/Contracts

Digital Security Trading

Enterprise Platforms

Mortgage Loans

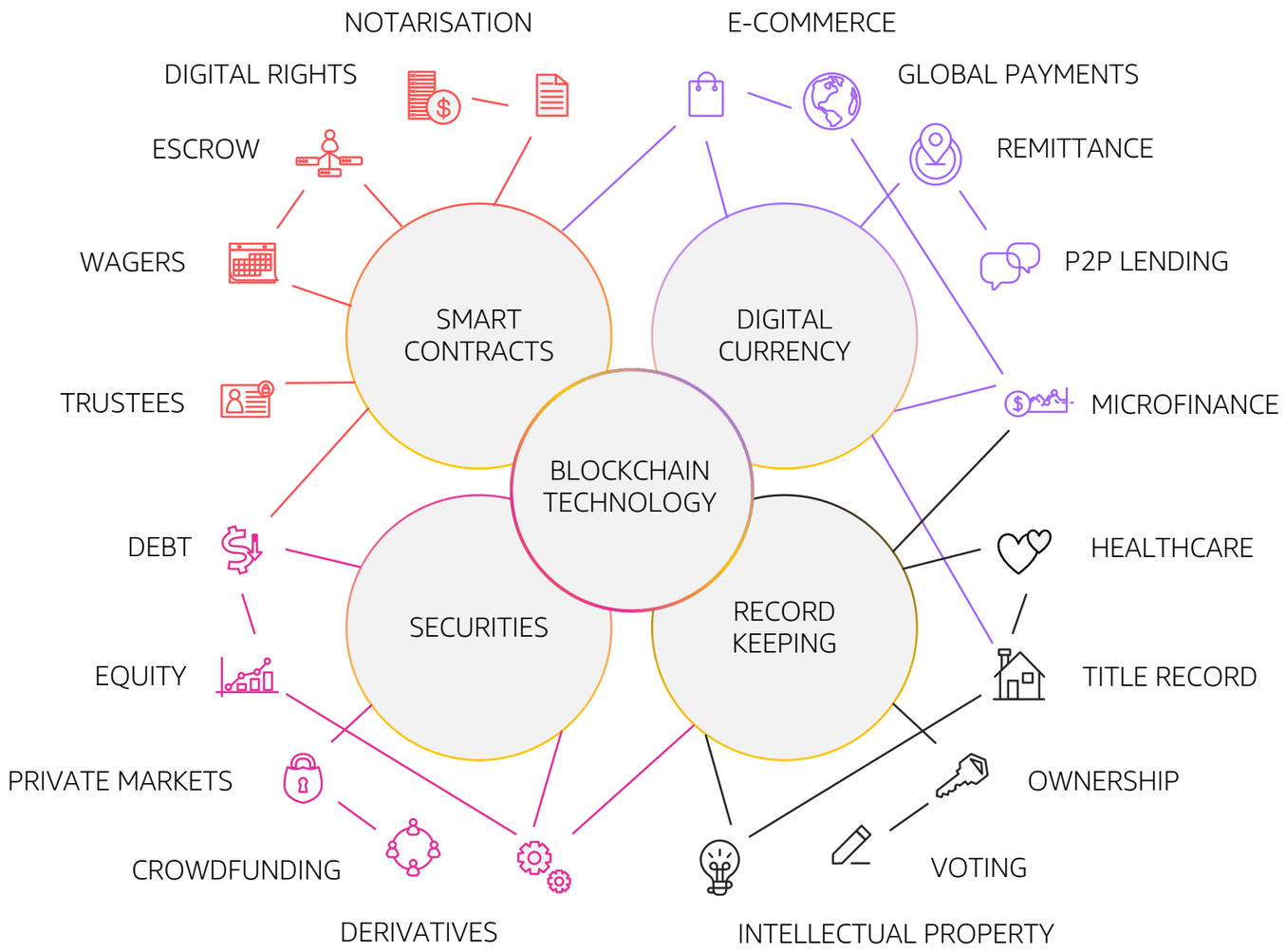
Voting Mechanisms

Patient Records

Corporate Governance

Financial

Insurance



Capital Markets

HCLS

Real Estate

Legal

Agriculture

Gaming

Transportation

M & E

Digital Advertising

Power/Utilities

Retail

Cloud

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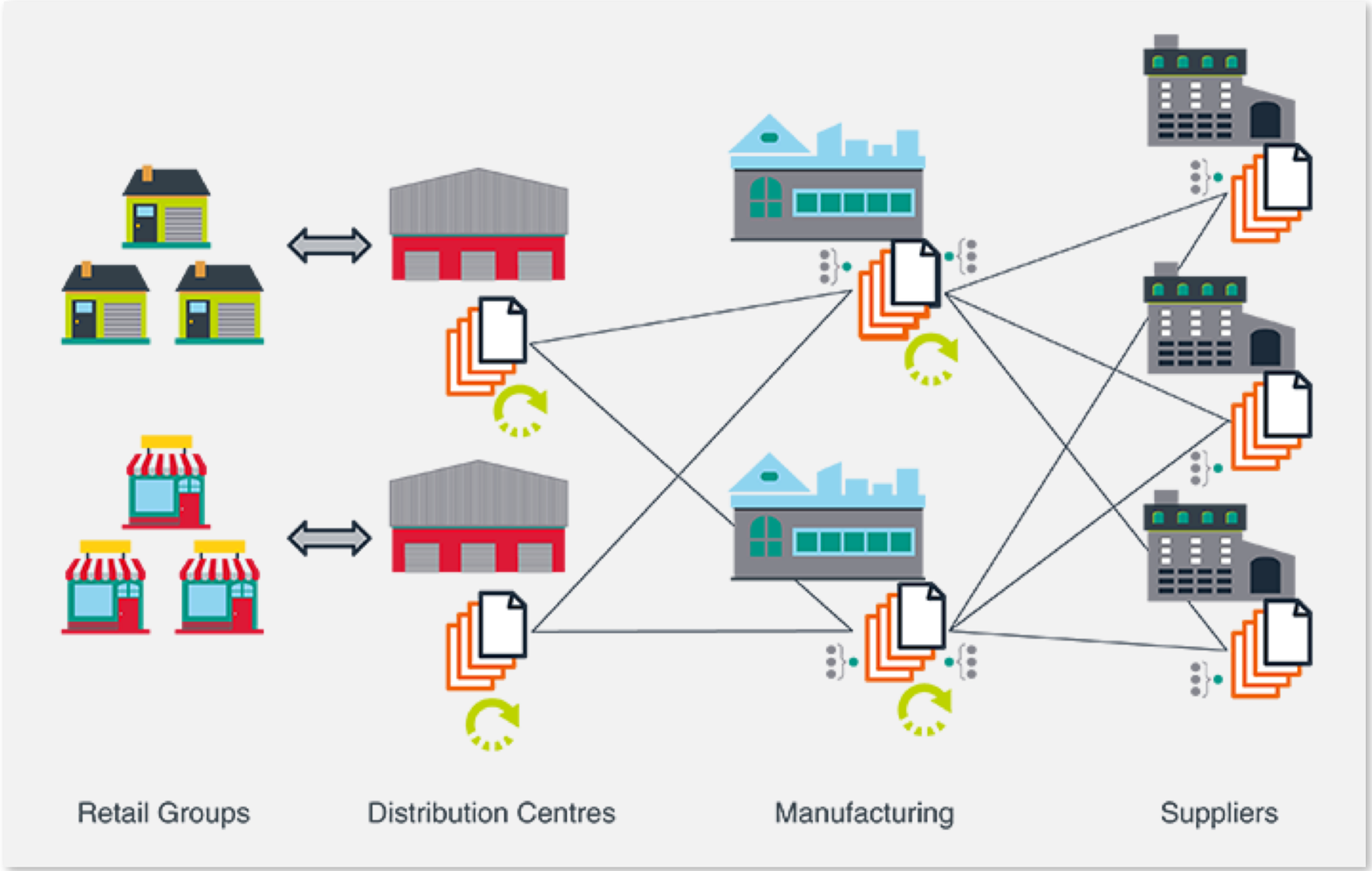
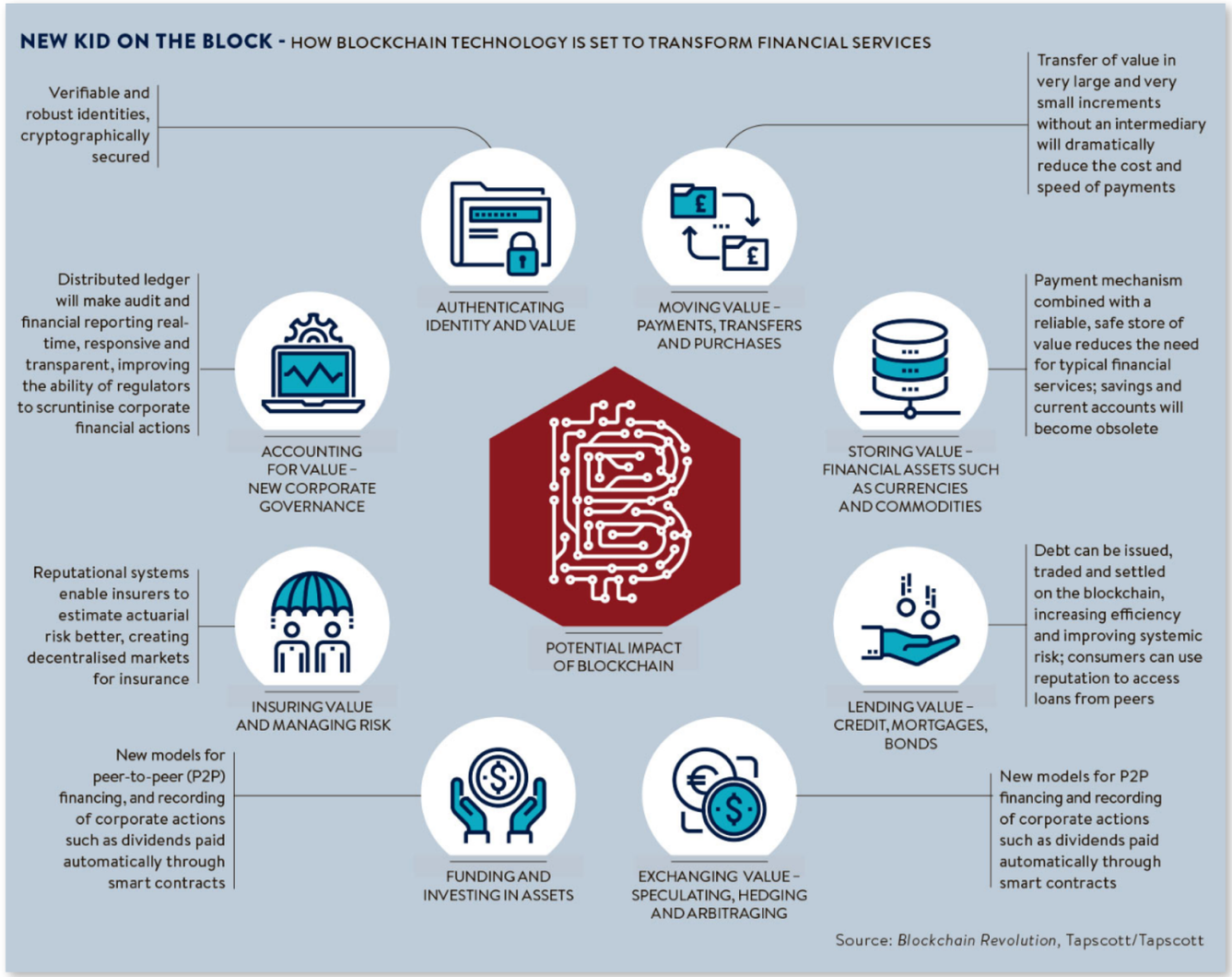
Blockchain in supply chain



- Each organization has a trusted copy of the supply chain data
- Payments can be automated through smart contracts
- Identity of components are immutably tracked as they move through the supply chain
- Quality of products can be monitored and immediately acted on

Blockchain in financial services



Guardian

"Given our vast partner ecosystem, we are exploring the decentralization and immutable tracking benefits of blockchain for potential applications in our insurance business. We believe blockchain can improve the transparency and efficiency for stakeholders in these networks to transact, while still maintaining an independently verifiable lineage of activities. However, blockchain frameworks are complex and difficult to operate. With Amazon Managed Blockchain, we can now easily create Hyperledger Fabric blockchain networks to test and learn without worrying about managing the underlying infrastructure, networking, and software configuration."

—Daniel Johnson
CTO and Head of Innovation, Guardian Life Insurance Company

Who is Singapore Exchange

A diversified exchange group that runs key market infrastructure including the Singapore stock market and a pan-Asian derivatives exchange covering all major asset classes.

High annual dividend of 28 cents for the past 5 years

Strong cash-flow with debt-free balance sheet

Anchored in Singapore, an AAA-rated economy

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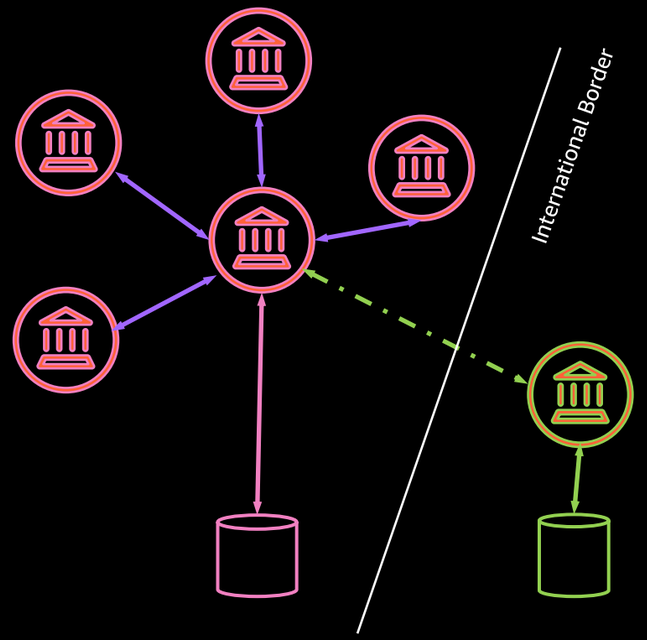
Singapore Exchange blockchain use case



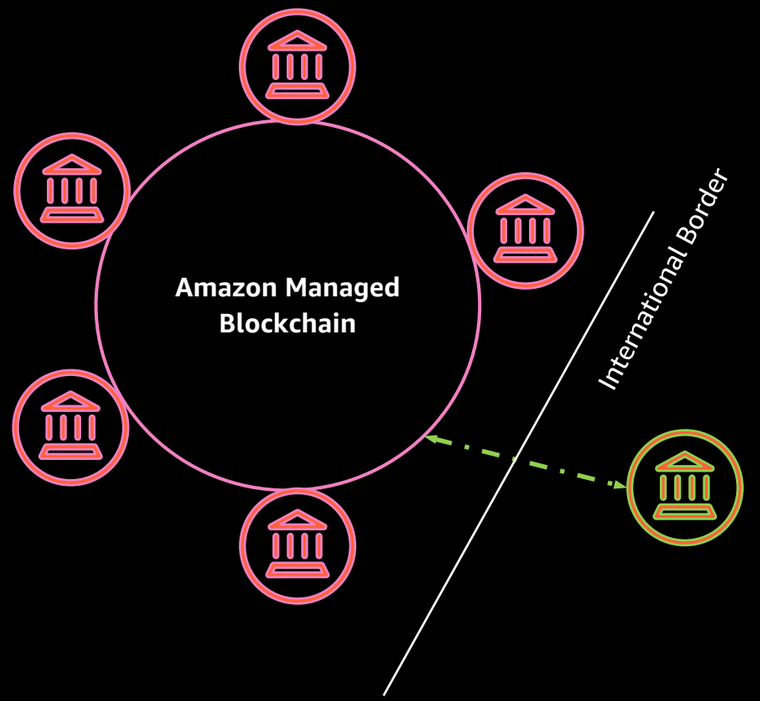
Challenges with existing financial systems:

- Lack of trust between multiple banks for settling trade transactions, and thus require an intermediary financial institution
- Inefficient processes for sending data across each other as extra hops result in delays, especially for international transfers
- API divergence is expensive and cumbersome to maintain as banks communicate with each other using API integrations from disparate systems

Singapore Exchange blockchain use case

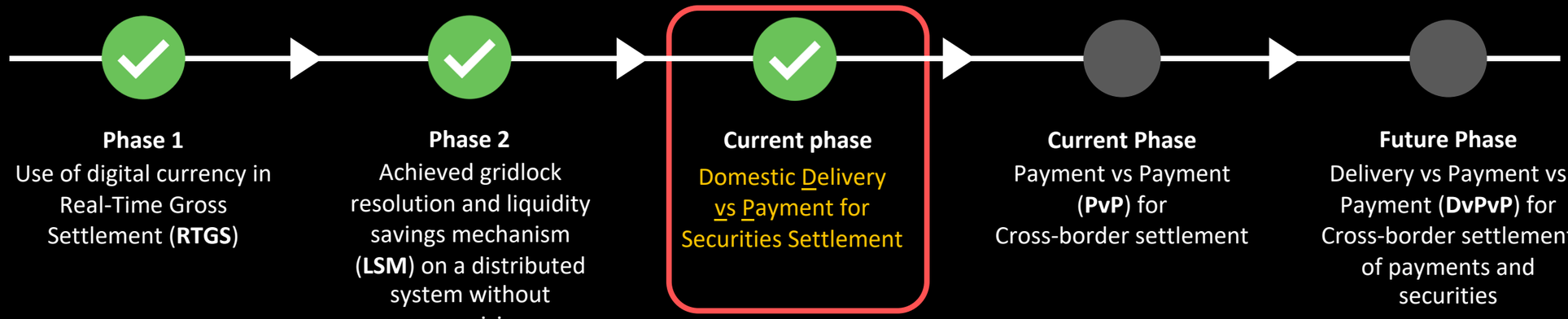
Benefits of implementing a blockchain

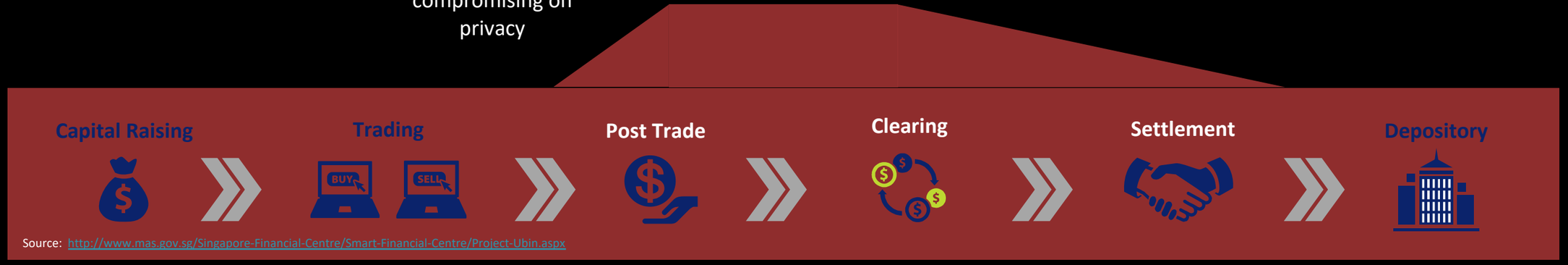
- Efficient transfer of data and transactions without intermediaries
- Enables distributed trust and allows for significant reduction in settlement time on trade by trade basis
- Compliance enforcement through smart contracts reduces costs (no more API spaghetti across disparate banking systems
- Easy to add new participating members



About Project Ubin—a multiphase journey

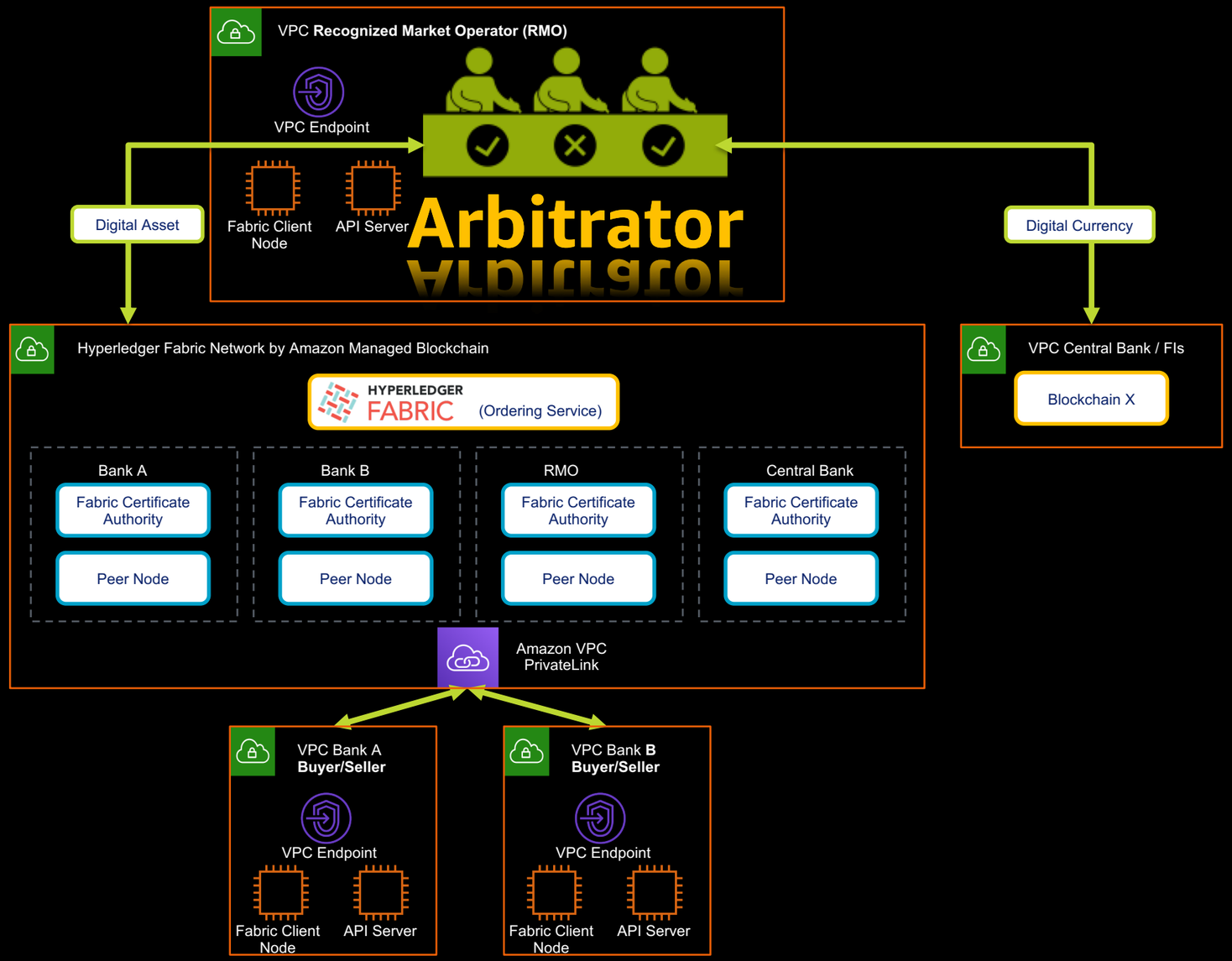
Project Ubin is a collaborative project between Singapore Exchange, the Monetary Authority of Singapore (MAS) and the industry to explore the use of blockchain for clearing and settlement of payments and securities.





Source: http://www.mas.gov.sg/Singapore-Financial-Centre/Smart-Financial-Centre/Project-Ubin.aspx

Our pilot on Amazon Managed Blockchain



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Our conclusions

"Flexibility to reduce Settlement time"

Tokenized currency coupled with smart contracts allows for significant reduction in settlement time on trade by trade basis

"Consistently" applied rights and obligations

- Smart contracts can be used to **apply obligations and rights** consistently and coherently
- Compliance enforcement through smart contracts reduces costs

"Higher investor confidence"
Design for arbitrator role

- Designing for arbitrator's role provide avenue for recourse for disputed transactions
- Maintains a central role to monitor and facilitate market functionalities

Enhances investors' security
Multi-Sig, off-chain, out-of-band secure secrets

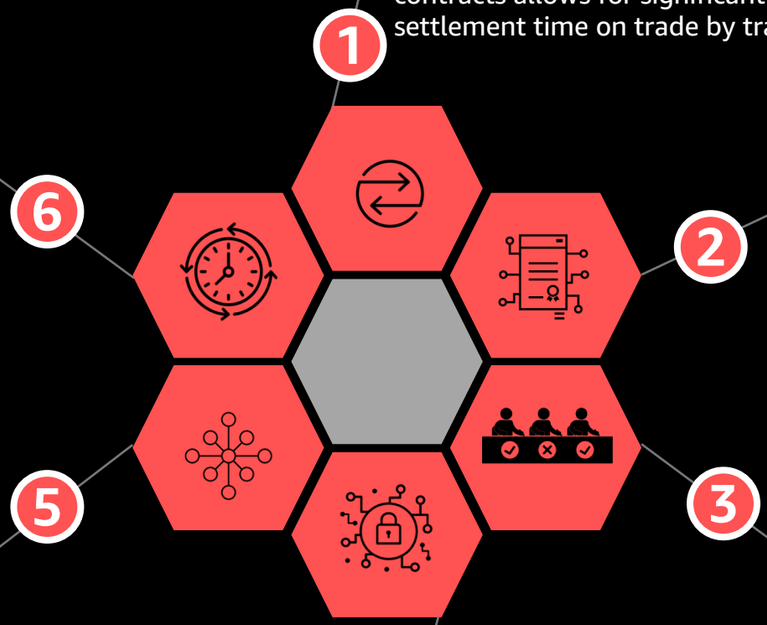
- Distributed control prevents account compromise
- Layered security with blockchain-independent transfer of secret

Potential broadening of asset classes & investor types

Project DvP's underlying design, architecture & benefits can be scaled for other asset classes beyond central bank-issued digital currencies including securities, corporate bonds, commodities etc. and other investor types such as retail etc.

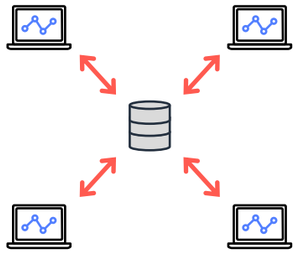
Potential for round-the-clock operations

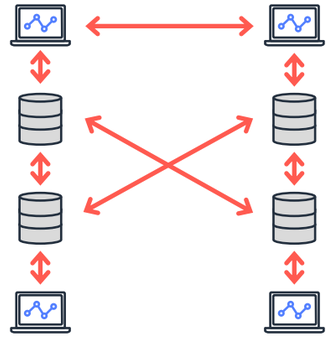
Underlying DvP Design can be further explored for cross-border transactions where time-zone differences could mean a delay in settlement time, exposing participants to unnecessary FX fluctuations and principal risks



Summary

Identifying the right AWS blockchain service

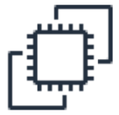




	Amazon QLDB	Amazon Managed Blockchain
Ownership	Owned by a single, trusted authority	No single owner of the ledger. Joint ownership by multiple parties
Addresses Need	Addresses core need of a immutable and verifiable transactional log	Addresses core need of enabling multiple parties to transact transparently and with trust with each other
Key Benefit	It's a database, so its fast, as it doesn't require consent from members	Removes intermediaries when a group of members needs to transact. So it makes business processes more efficient

Blockchain solution building blocks on AWS

AMAZON MANAGED BLOCKCHAIN



AMAZON EC2

AMAZON ECS

AMAZON EBS

Use AWS's managed blockchain service or other compute services as the foundation for your blockchain infrastructure

AMAZON API GATEWAY*

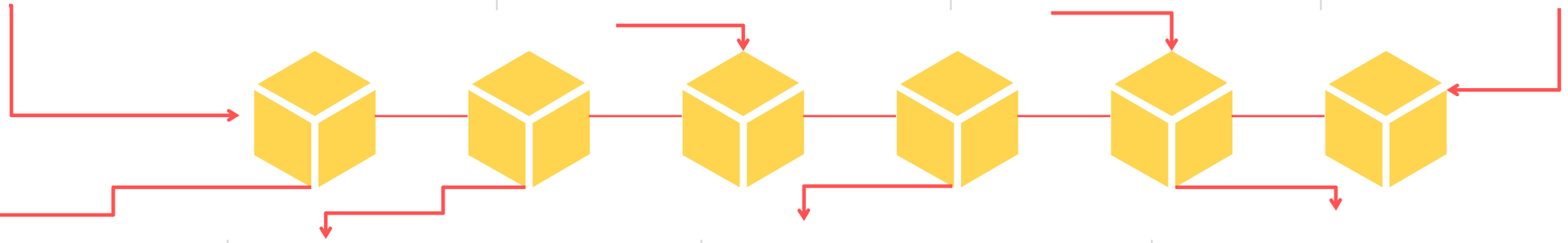
Amazon API Gateway lets you create custom REST API to power your blockchain apps

AWS CLOUDHSM

Use CloudHSM to manage blockchain participant's secret keys

AMAZON IOT

Connect IoT devices with unique identities to a common underlying data layer



AMAZON S3

Utilize S3 as your off-chain data storage for high availability

AMAZON QLDB

AMAZON DYNAMODB

Leverage off-chain database solutions to support blockchain applications and store metadata

AMAZON KINESIS

AMAZON REDSHIFT

Perform analytics and gain insights from your blockchain's data in near real time

AMAZON SQS

AMAZON SNS

AWS LAMBDA

Send notifications or leverage serverless compute to respond to events programmed into blockchain smart contracts

aws SUMMIT

AWS blockchain customers

Next steps

Learn more about our services!

Amazon Managed Blockchain (Generally available)

- Amazon Managed Blockchain webpage: https://aws.amazon.com/managed-blockchain
- Deploying a sample application: https://aws.amazon.com/blogs/database/build-and-deploy-an-application-for-hyperledger-fabric-on-amazon-managed-blockchain/
- Documentation: https://docs.aws.amazon.com/managed-blockchain/latest/managementguide/what-is-managed-blockchain.html

Amazon QLDB (Apply for preview)

- Amazon QLDB webpage: https://aws.amazon.com/qldb
- Preview sign-up: https://pages.awscloud.com/QuantumLedgerDatabase-preview.html

Thank you!

Dr. Andrew Kane
Principal Solutions Architect
Amazon Web Services

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Please complete the session survey.

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