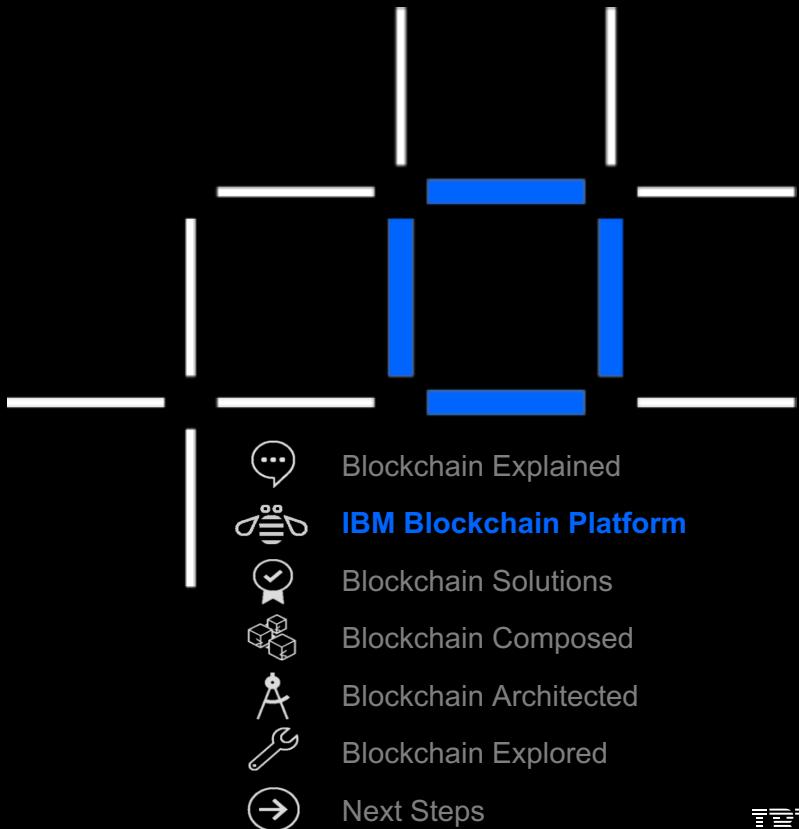


IBM Blockchain Platform Explained

An Introduction to IBM Blockchain Platform





IBM Blockchain Platform Overview

What you need to know



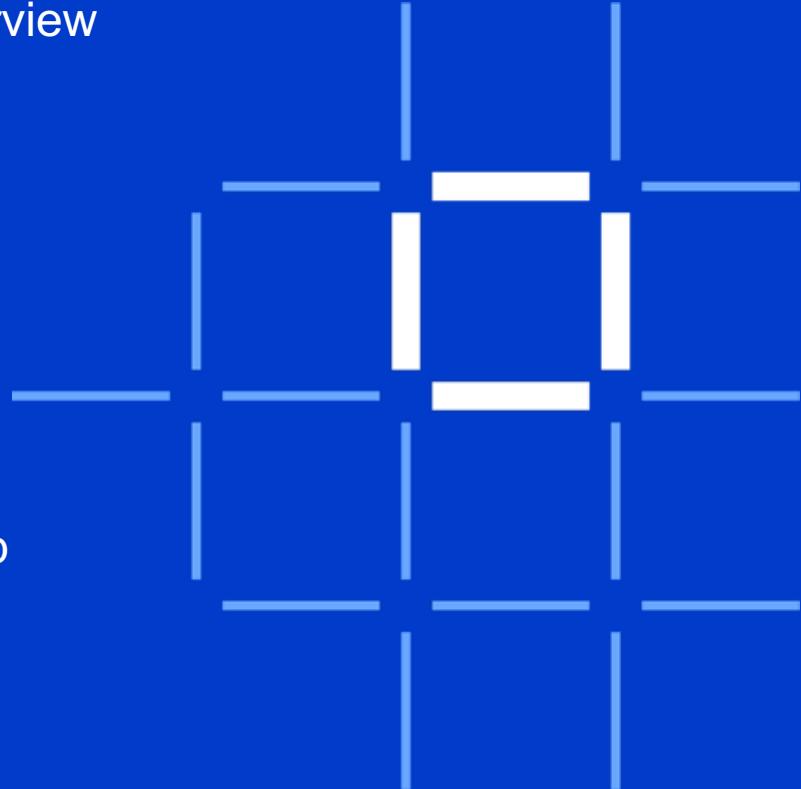
Network roles and formation

Who are the intended users and how can they get started?



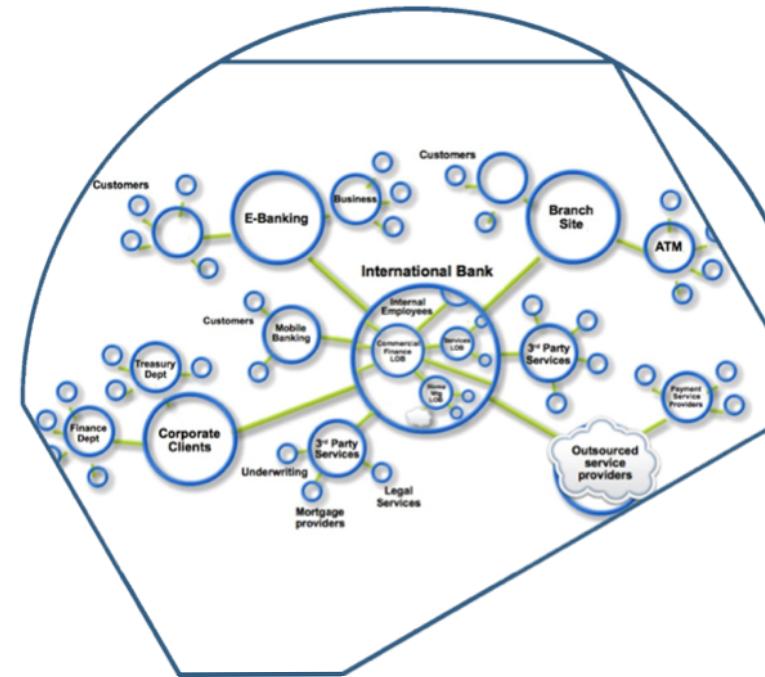
Technical details and roadmap

How IBM Blockchain Platform works and where it's going

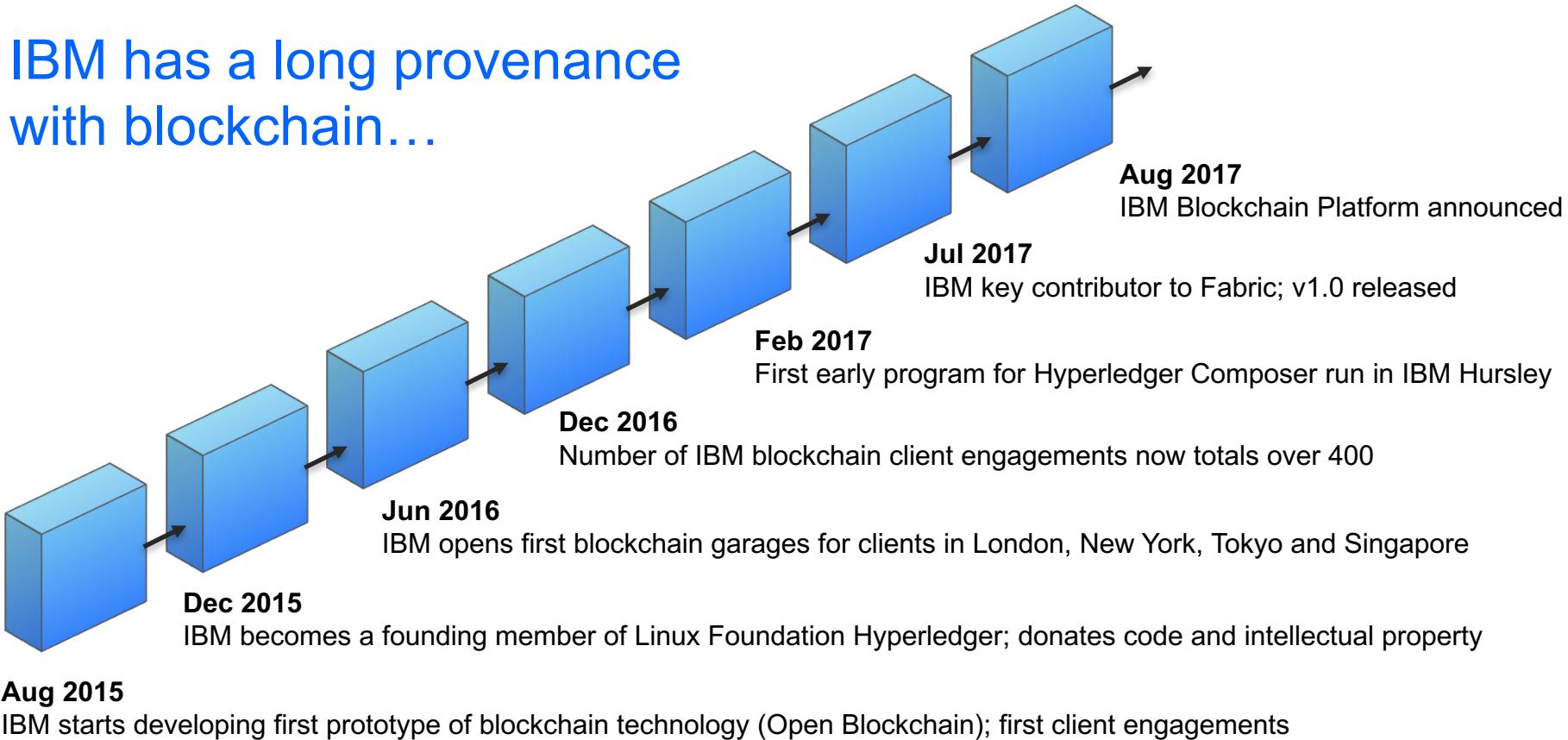


Blockchain Recap

- **Blockchain** is a shared, replicated ledger
 - Permissioned blockchains bring trust to business networks through consensus, provenance, immutability and finality
- **Linux Foundation Hyperledger** is a collaborative effort created to advance cross-industry blockchain technologies for business
 - Hyperledger **Fabric** is a blockchain providing implementation of a ledger, smart contracts, privacy and consensus
 - Hyperledger **Composer** is a suite of tools that make it easy to develop blockchain applications



IBM has a long provenance with blockchain...



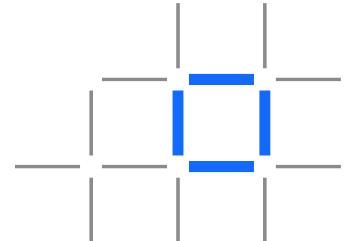
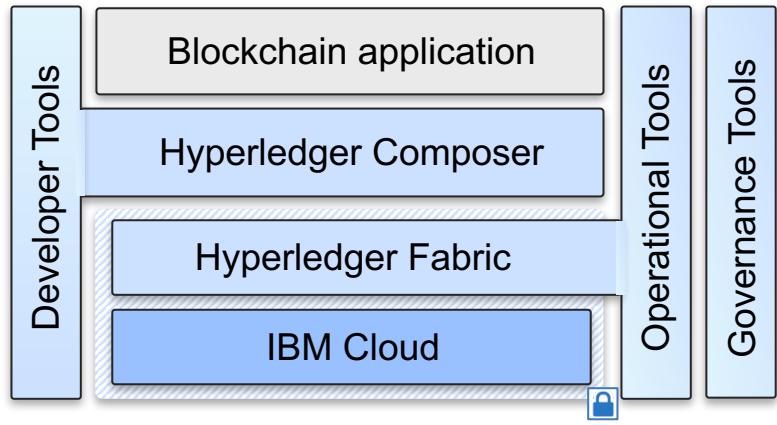
Introducing the IBM Blockchain Platform

IBM Blockchain

http://ibm.biz/Platform_Demo

IBM Blockchain Platform is a fully integrated enterprise-ready blockchain platform designed to accelerate the development, governance, and operation of a multi-institution business network

- **Developer tools** that make use of Hyperledger Composer to quickly build your blockchain application
- Hyperledger Fabric provides the ledger; managed through a set of intuitive **operational tools**
- **Governance tools** for democratic management of the business network
- Running on top of a highly secure and performant **IBM Cloud** environment



End-to-End Lifecycle Coverage



Develop

- Accelerated creation of blockchain applications
- Free development and test tools hosted on IBM Cloud
- Based on popular Hyperledger Composer toolset

Operate

- Connect, deploy and manage blockchain peers
- Production ready, secure and scalable
- Based on enterprise-ready Hyperledger Fabric V1

Govern

- Activate and customize complete blockchain business networks
- Secure democratic governance across organizations
- Management tools and APIs for administration tasks

Why IBM Blockchain Platform



Reduces risk

- 24x7x365 support backed by deep Hyperledger Fabric expertise
- Flexible pricing caters for all sizes of deployments



Saves time

- Implement blockchain projects more quickly
- Extensive toolset for development, governance and operation of blockchain networks



Enterprise ready

- Architected for High Availability and Disaster Recovery
- Highly secured and suitable for transactional workloads



Open

- Based on popular and open Linux Foundation Hyperledger technologies
- Embraces open source, open standards and open governance

Flexible pricing plans

Plan	Key Features	Deployment
Enterprise	Production plan for industries comfortable with cloud	IBM Cloud
Support-only	Supported instances of Hyperledger Fabric running outside IBM Cloud Platform	Docker
Developer	Run blockchain development environment in Kubernetes on the IBM Container Service	IBM Cloud
* Enterprise Plus	Production plan for regulated industries, multi-region HA/DR and highest performance	IBM Cloud
* Self-managed	User-managed peers that you can install in a location of your own choosing connected to a blockchain on the IBM Blockchain Platform	Docker and IBM Cloud
* Entry	Easy on-ramp for blockchain-as-a-service; pay by hour	IBM Cloud

* Coming soon

Enterprise Plan

- Enterprise Plan is intended for stable, production or near-production scenarios
 - Includes governance tooling, service-level agreements and single-zone HA/DR
 - Requires at least one peer and one certificate authority
- Monthly cost starts at **US\$3000 per organization per network**
 - Assumes two peers for high availability (\$1000 per peer plus \$1000 membership fee)
 - Includes basic blockchain support only; support for services on IBM Cloud is additional 10%
 - Certificate authorities and access to the ordering service is not chargeable



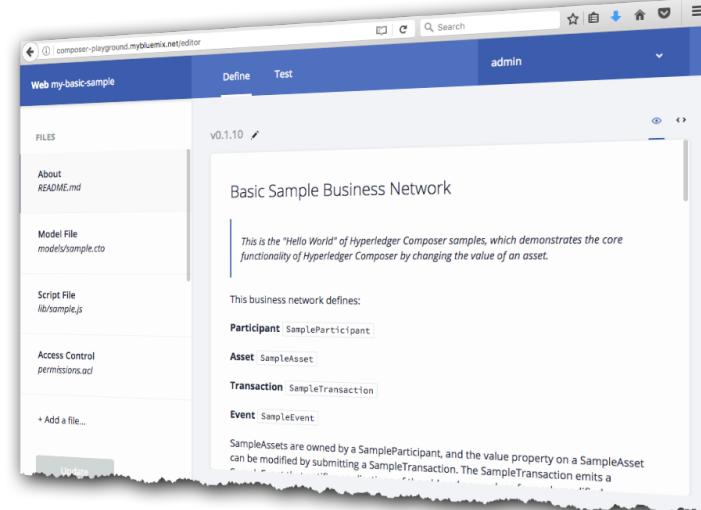
Support-only Plans

- Looking for IBM support on base Hyperledger Fabric?
 - IBM produces signed, supported Hyperledger Fabric images for deployment outside of IBM Cloud
 - Available for zSystems/LinuxONE, Power, x86 architectures
 - Subscription term one year
- **Elite tier (5737-E89/DV13ALL)**
 - Supported 24x7x365; response target within 2 business hours
 - Multiple technical contacts and developer assistance
 - Monthly cost \$2000 per peer
- **Entry tier (5737-E90/DV13BLL)**
 - Support hours Monday – Friday 8am-5pm; response target within 8 business hours
 - Single technical contact
 - Monthly cost \$500 per peer



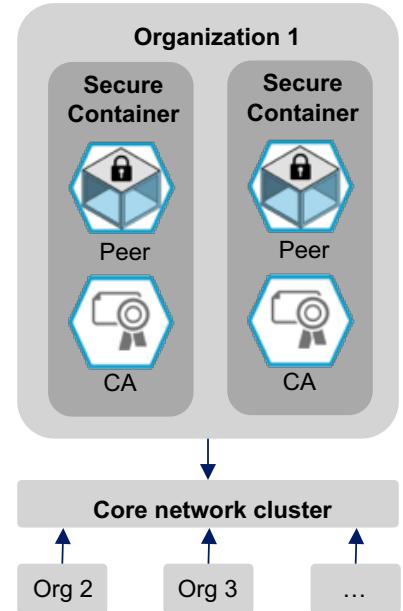
Developer Plan

- IBM Blockchain Platform offers a **no-charge development and hosting environment** for blockchain applications
 - Hyperledger Composer for development, and fully configured Hyperledger Fabric for testing
 - Community support by an active user base (e.g. Rocket Chat, Stack Overflow)
 - Deploy into paid production environment when appropriate
- Allows developers to get started quickly with popular open source blockchain tools
 - Runs in Kubernetes on the IBM Container Service on IBM Cloud
 - Simple install includes all tools including hosted Playground UI and sample networks
 - Get started today: <https://ibm-blockchain.github.io/>



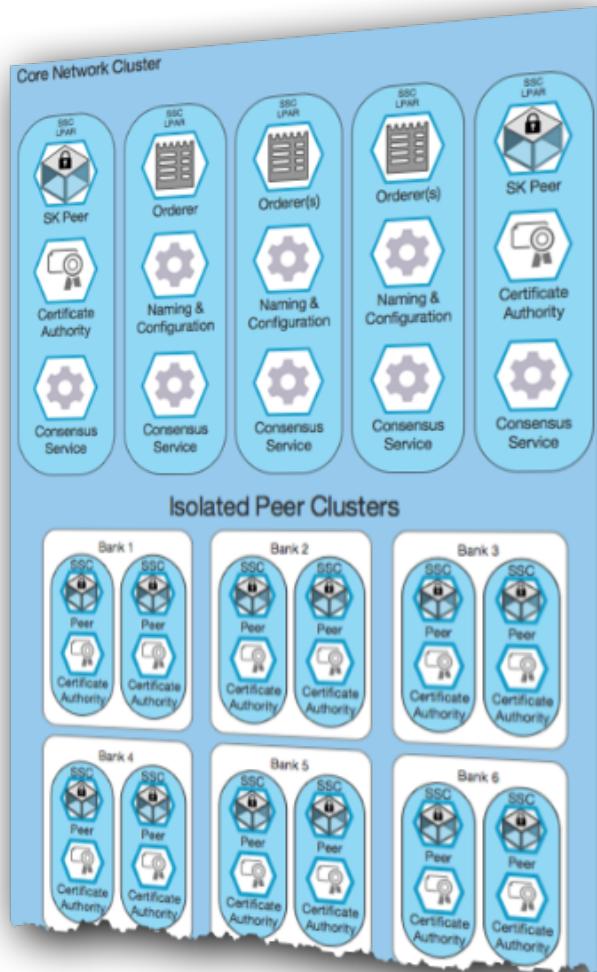
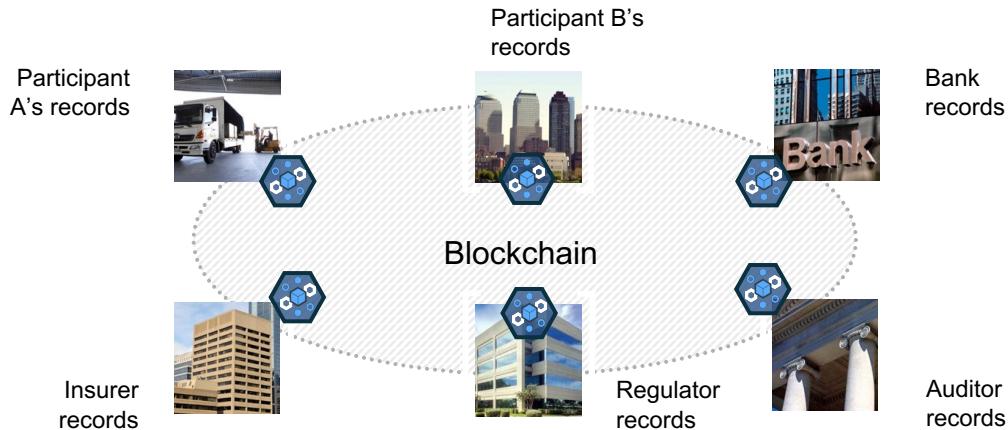
Platform Configuration

- Development environment
 - Try online, install locally or use free Kubernetes-based service on IBM Cloud
- Isolated peer clusters: one per organization
 - **Two active peers and two certificate authorities** per organization recommended (for high availability)
 - Each member provisions resources inside their IBM Cloud environment
- Core network cluster (for consensus)
 - Sits at the network level and is administered democratically by members in an administration group
 - Changes to the network occur democratically according to defined governance policies
 - Uses Kafka-based ordering service, providing crash fault tolerance

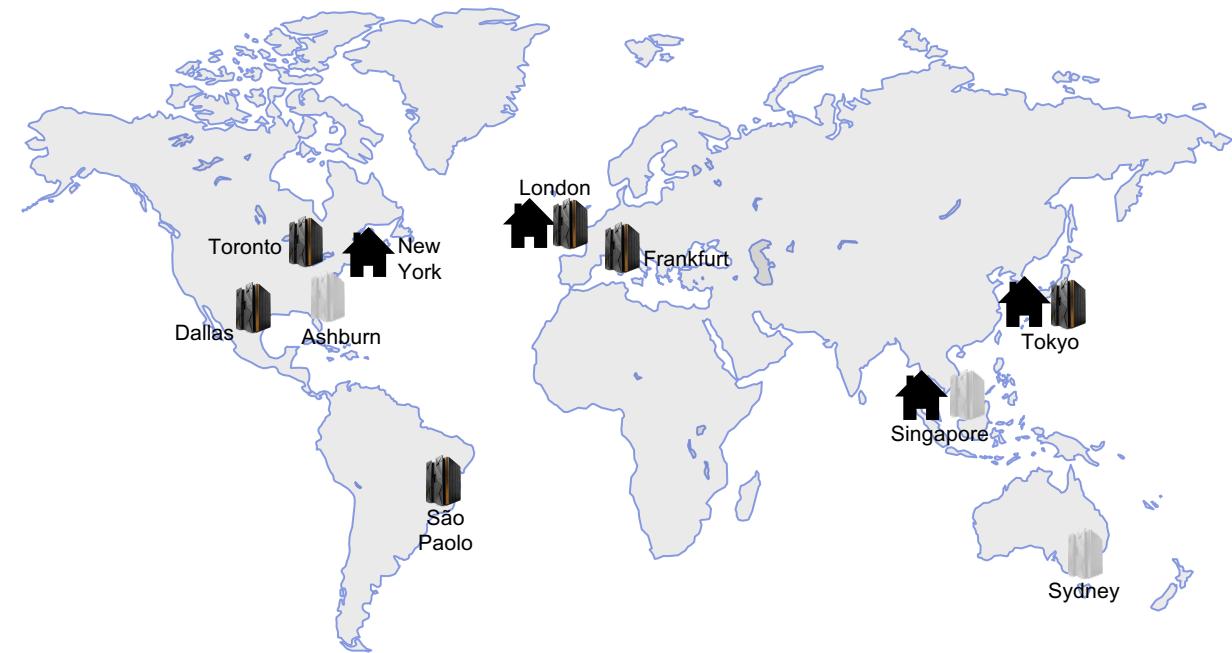


Example Network

- Consider a business network comprising multiple organizations running Enterprise Plan on IBM Cloud
 - Each organization has two peers and two certificate authorities
 - Blockchain cost per organization (two peers + membership fee) = US\$3000 per month
 - Support for IBM Cloud services @10% = US\$300
 - Cost for one year per organization = $12 \times \text{US\$3300} = \text{US\$39600}$



IBM Blockchain Platform Sites



 IBM Blockchain Platform is hosted in multiple sites to help you satisfy data residency requirements

 More platform locations planned

 Complemented by a set of IBM Blockchain Garages to help clients get started with IBM Blockchain Platform

- Learn more at www.ibm.com/blockchain

IBM can help you make your blockchain a success

Business Value Assessment

Problem	90% of goods in global trade are carried by the ocean shipping industry each year. Costs associated with trade documentation processing and administration are estimated to be up to 20% the actual physical transportation costs.				
Solution	Manage and track the paper trail of tens of millions of shipping containers across the world by digitizing the supply chain process				
Participants	Supplier, couriers (*2), customs (*2), ports (*2), shipper and retailer				
Asset & Trust	Need for trust around paperwork associated with a container				
Transactions	Supplier prepares to ship, release container to courier, load to ship, clear customs, retailer receipt				
Benefits benchmarks - Value Tree		Baseline	Phase 1	Phase 2-3	Pain Points
KPI's (e.g.)					Blockchain : Design Points
New revenue	# new value propositions	-	-	1 to 3	AND-2
Improve client experience	Increase in customer satisfaction	-	5%	10%	
	Increase in trade volumes	-	+5%	+15%	
Reduce transport costs	Cycle times (transit & shipping)	30 days	25 days	10 days	
	Waste as % of total shipped	6%	5%	1%	AND-2
	Fraud and errors as % of total costs	5%	4%	0.5%	
Documentation admin. as % of total costs		20%	15%	5%	

- Every business network is different!
- IBM can help you with all stages of your blockchain network, for example:
 - Business Value Assessments
 - Design Thinking Workshops
 - Architectural Review
 - Services and Support
- Make use of the expertise located in the Blockchain Garages and in other locations worldwide



IBM Blockchain Platform Overview

What you need to know



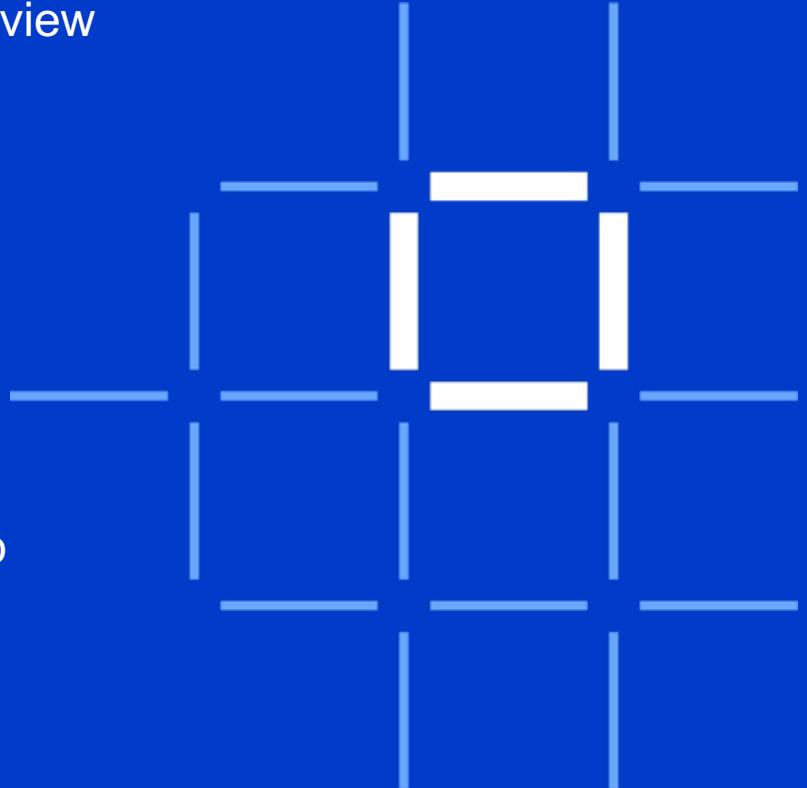
Network roles and formation

Who are the intended users and how can they get started?



Technical details and roadmap

How IBM Blockchain Platform works and where it's going



Blockchain Technical Concepts



Peers are the networked services that maintain ledger state and run chaincode



Smart contracts are transaction logic whose output is agreed by the peer network



Consensus is the process by which agreement is obtained on the peer network



Channels are defined subsets of the peer network that share a single ledger



The **Ordering Service** agrees transaction sequence and distributes blocks to peers



Certificate authorities provide identity services to participants on the network

Network Participant Roles



- Network Service Provider
 - **Governs** the network: channels, membership etc.
 - A consortium of network members or designated authority



- Network Service Consumer
 - **Operates** a logical peer and certificate authority on the network
 - Represents an organization on the business network



- Business Service Provider
 - **Develops** blockchain business applications
 - Includes transaction, app server, integration and presentation logic



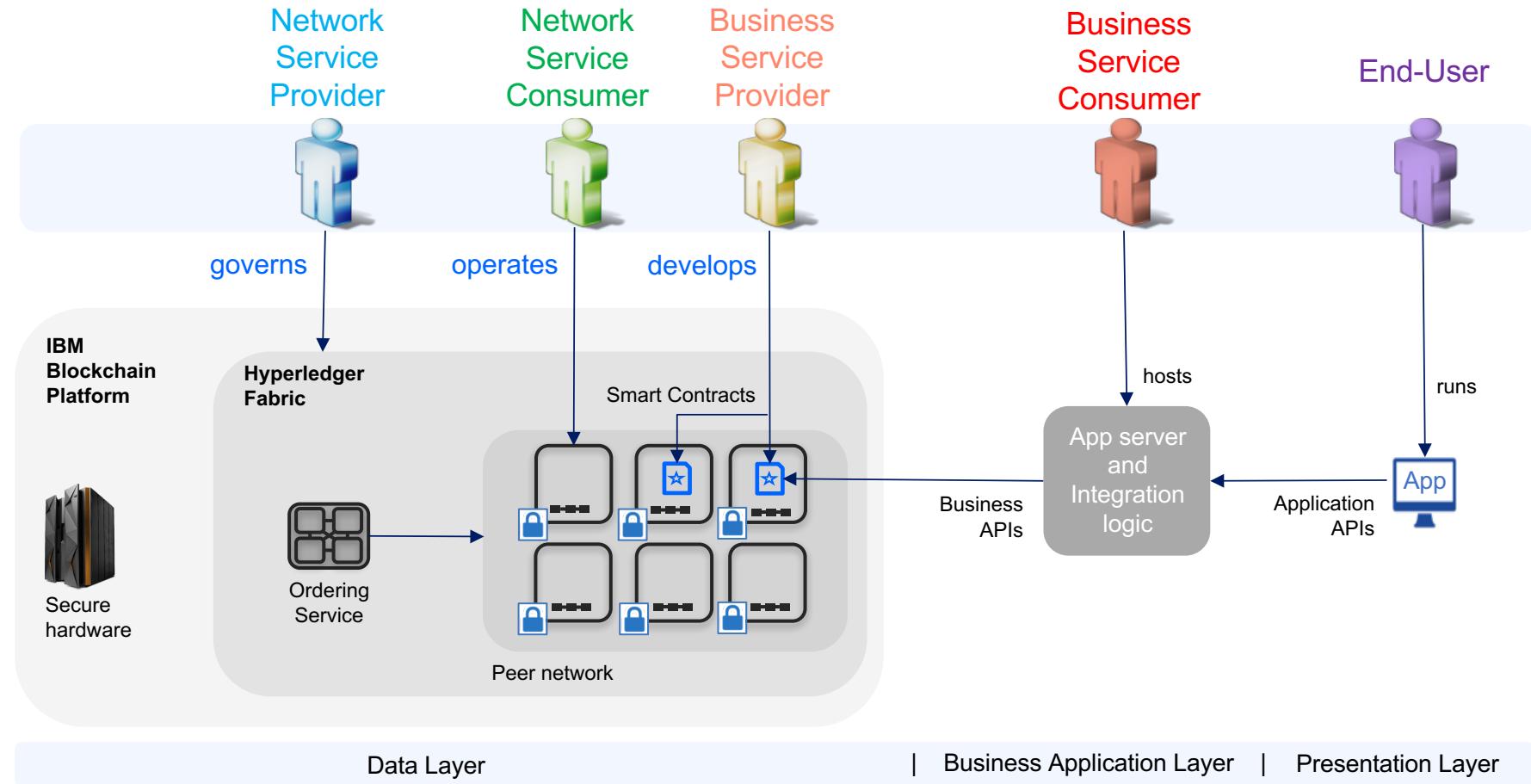
- Business Service Consumer
 - Hosts application and integration logic which invokes blockchain transactions



- End-user
 - Runs presentation logic e.g. on mobile device or dashboard

A single organization may play multiple roles!

Network Architecture and Participant Roles



IBM Blockchain Platform for Network Service Providers

Govern a blockchain network



The screenshot shows the first step of the 'Create Network' wizard titled 'Let's Get Started'. It includes fields for 'Start by giving your network a name' (with 'Required field' validation) and 'Institution Name' (also with 'Required field' validation). A note below states: 'After completing the following steps, your network will be "live" and you will have sent out invites to the members you want to join that network. After completing the following steps, your network will be "live" and you will have sent out invites to the members you want to join that network. They will come online once they complete the onboarding process. You can then use Network Monitor to manage resources, create channels, install blockchain applications, and view transactions.' A 'Documentation' link is also present.

- Network Service Providers play a vital role in the governance of a blockchain network:
 - Initiating the network
 - Creating membership, channel and smart contract policies
 - May be centralized (e.g. industry regulator) or decentralized (e.g. members of a consortium)

The screenshot shows the 'Create a new channel request' page. It includes a header 'Create a new channel request' and instructions: 'Follow the steps below to create a channel. Once submitted, the invited members will be notified and either approve or decline the request.' Below this is a 'Policy' section with a dropdown set to '1' and the note: 'of 1 operator from the following organizations need to accept to update this channel.' There is a table for 'Notifications' with columns 'NAME', 'DATE UPDATED', and 'STATUS'. One item is listed: 'Channel Request Join "channel-a"' By: IBMorg1 14 August, 2017 - 10:16:14 AM Vote Accepted. At the bottom are 'Cancel', 'Back', and 'Submit Request' buttons.

- Democratic voting policies handled through Notifications UI
 - Accept/Reject proposals
 - Review completed items

IBM Blockchain Platform for Network Service Consumers

Operate a set of peers in a blockchain network



The screenshot shows the main dashboard of the IBM Blockchain Platform. On the left, a sidebar menu includes options like Network, Overview, Members, Channels (selected), Chaincode, Notifications, and Support. The main content area shows a summary of a channel named 'channel-a'. It displays metrics such as 'TOTAL BLOCKS' (1), 'TIME SINCE LAST TRANSACTION' (43 mins), and 'RECENT INSTANTIATIONS' (0). Below this is a chart titled 'TIME' vs 'BLOCK NUMBER' with a single data point at block 0, timestamped '08/14/17 10:16 GMT+0800'.

- Network Service Consumers operate a set of peers
 - Running a set of peers and certificate authorities
 - Installing and instantiating chaincode
 - Issuing identities for participants in their organization
 - Monitoring network resources
 - Creating channels (in accordance with defined policies)

Type	Name	Status	Actions
Orderer	fabric-orderer-13495b	Running	
Orderer	fabric-orderer-13495d	Running	

Peer	Chaincode Status	App Integration	Logs	Action
fabric-peer-org2-17439a	Running			

- All administrative tasks accessible through web UI
 - Members, channels, chaincode...
 - Full access to APIs and logs for transparent problem determination

IBM Blockchain Platform for Business Service Providers

Develop blockchain applications



- A blockchain application consists of three components:
 - **Transaction logic:** run on the distributed peer network and stored on the chain
 - **Business logic:** business applications and integration services that invoke transaction logic
 - **Presentation logic:** client applications run by end-users of the system
- The role of Business Service Providers is to develop these components
 - Separation of concerns between business logic and blockchain network (the what and the where)
- Hyperledger Composer comprises a set of tools for rapid blockchain application development
 - Transaction logic: deployed to the IBM Blockchain Platform as chaincode
 - Business logic: deployed to application server/integration tier
 - Presentation logic: made available to end-users

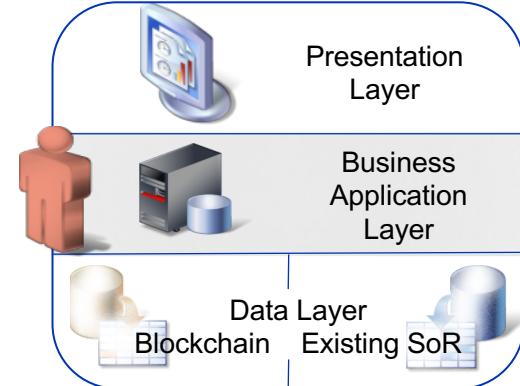


Blockchain Composed

The role of Business Service Consumers

Run business applications that invoke smart contracts

- Business Service Consumers are responsible for hosting business logic that invokes smart contracts running on IBM Blockchain Platform
- Business logic is hosted on an application server
 - Either run off-premises (e.g. IBM Cloud) or on-premises
 - Typically connect via integration middleware (e.g. IBM Integration Bus)
 - Responsible for managing end-user identity
- Application logic uses appropriate APIs to invoke smart contracts in the usual way
 - REST or Javascript are popular choices
 - Multiple applications can interact with the same blockchain
- Consider implementing a shadow chain and running existing systems of record in parallel
 - Allows for staged onboarding of new members and mitigation of risk



How End-Users interact with the blockchain

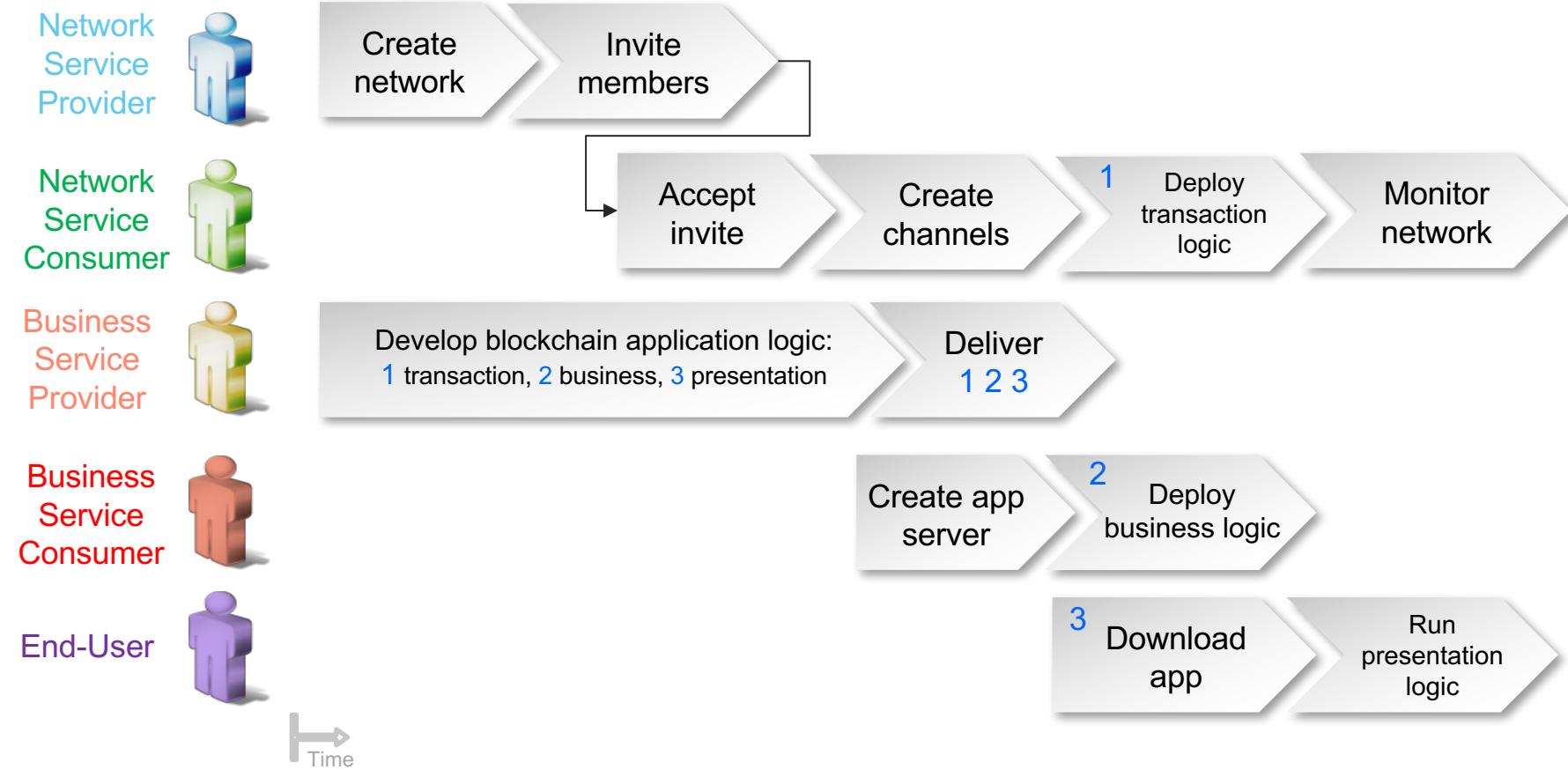
Exchange trustworthy information with the presentation layer



- End-users run presentation logic on an appropriate device
 - For example, mobile application or desktop dashboard
 - There may be multiple end-user applications (often one per organization or user role)
- The value proposition to end-users is that the information they see is **trustworthy**
 - Will probably be unaware of blockchain back-end
 - Uses identities managed by the business application layer
- Many options for presentation logic implementation
 - IBM Blockchain Platform can use Hyperledger Composer to generate skeleton Angular or command-line applications
 - Application usually interacts with the business logic layer via REST

The screenshot displays a user interface for food safety and traceability built on a blockchain platform. At the top, there's a navigation bar with 'Trace', 'View Certificates', and 'Sign out' options. Below the navigation is a search interface with fields for 'Which product would you like to trace?' (Strawberry), 'What would you like to trace with?' (Supplier Product Code), and 'Please enter the supplier product code' (CU00003). A message below the code indicates it was produced on 08-04-2017 and lists products using this code. The main area features a map of Central America with specific regions highlighted in orange, labeled 'PPB-220', 'Oncinal', and '102 Chiquis'. At the bottom, a timeline shows the product's journey through various stages: Orchard (2), Packing House (1), Importer (1), Facility (1), Retailer DC (1), and Retailer Store (2).

Workflow for Network Formation





IBM Blockchain Platform Overview

What you need to know



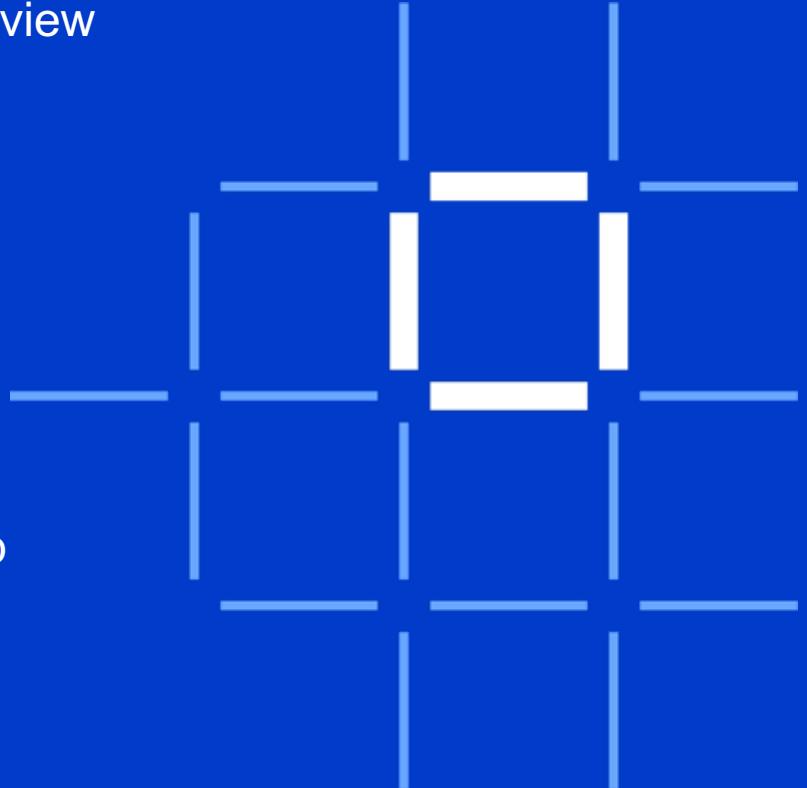
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How IBM Blockchain Platform works and where it's going



Security is implemented at each layer of the architecture



Secure Hardware



Hardware
Security
Module



Encrypted
Storage



Secure
Services
Containers



Membership
Services



Secure
Comms



Consensus

Hyperledger Fabric

Security is implemented at each layer of the architecture

- Hyperledger Fabric
 - Membership Services: Organizations are invited to join and authenticated using an Enrollment Certificate
 - Transaction Consensus: Each transaction is endorsed and validated by multiple peers before committing to the ledger
 - Controlled Ledger Access: Channels restrict transactions to a set of organizations that are shared on the ledger
 - Secure Communications: Between the application (end user) and Smart Contract (chain code) is secure
- Secure Service Containers
 - Secure appliance framework providing infrastructure services encapsulating the Hyperledger Fabric
 - No root access: Access system and software only through API's; even trusted administrators
 - Impervious to the injection of malware: Installed from encrypted, signed boot image
 - Data Privacy: Encryption of data in flight and at rest on the ledger
- Secure Performant Hardware
 - Keys stored in HSM certified to FIPS 140-2 level 4
 - Fastest cryptographic acceleration: used by block hashing and digital signatures

IBM Blockchain Platform Architecture

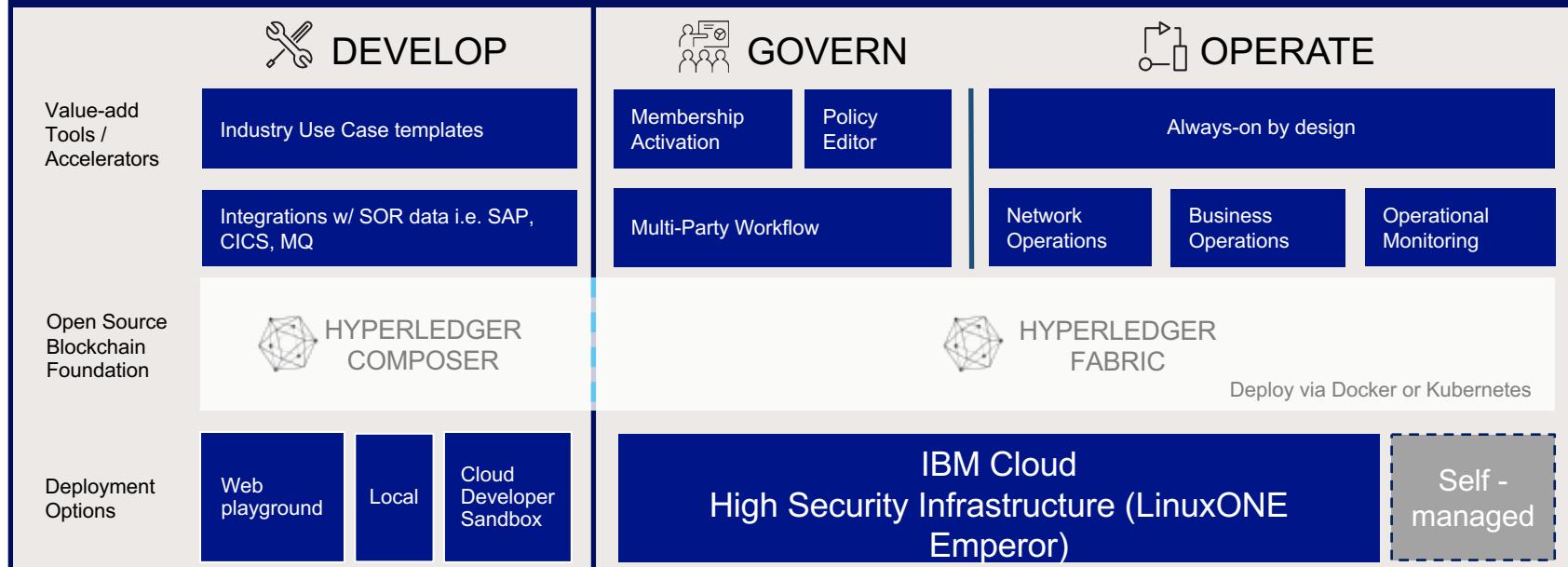
Solutions

Food Safety, Universal Blockchain Payments Network, Identity, Private Equity etc...

IBM Extensions

Watson IOT, API Management, Messaging, Workflow...

IBM Blockchain Platform



Included in IBM Blockchain Platform



Supported via IBM Certified Docker Images



Coming soon

Continuing your blockchain journey...



Business Stakeholder

- Request a business value assessment from IBM
- Prove out technology with a first project



Blockchain BVA



Solution Architect

- Learn about blockchain use-cases and references
- Understand blockchain solution best practices



Blockchain Solutions



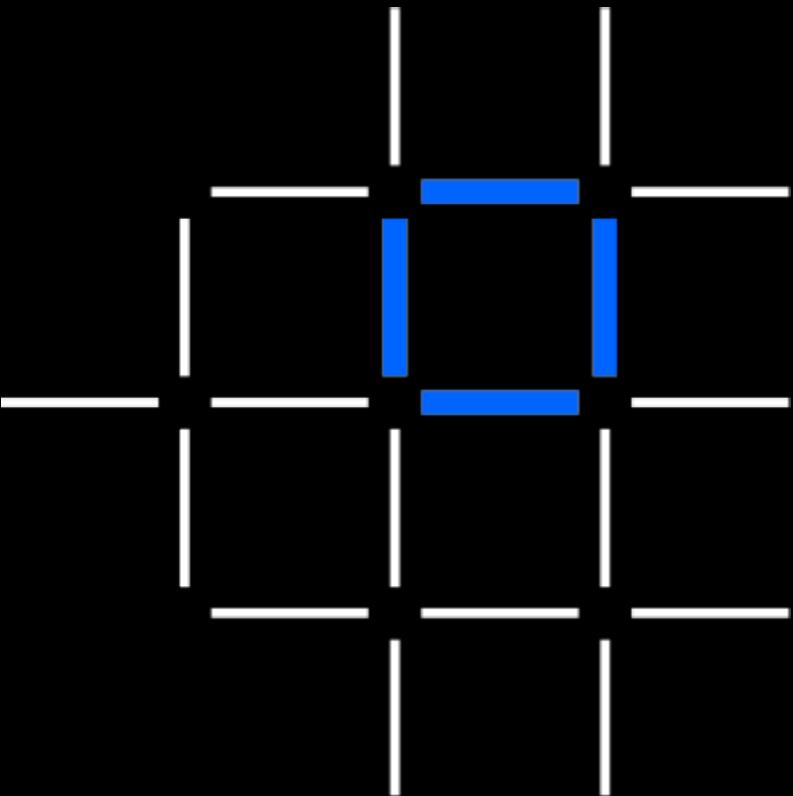
Developer

- Play with IBM Blockchain Developer Tools
- Learn about Hyperledger Composer



Blockchain Composed

Thank you



Questions? Tweet us or
go to ibm.com/blockchain

 @IBMBlockchain

 IBM Blockchain

 IBM Blockchain



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