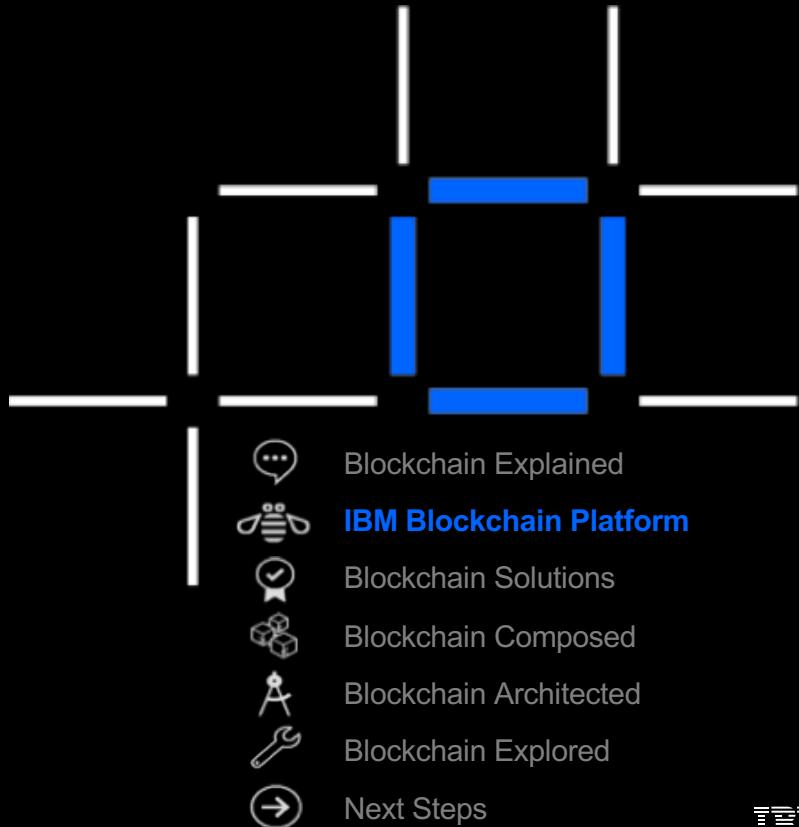


IBM Blockchain Platform Explained

An Introduction to IBM Blockchain Platform





IBM Blockchain Platform Overview

What you need to know



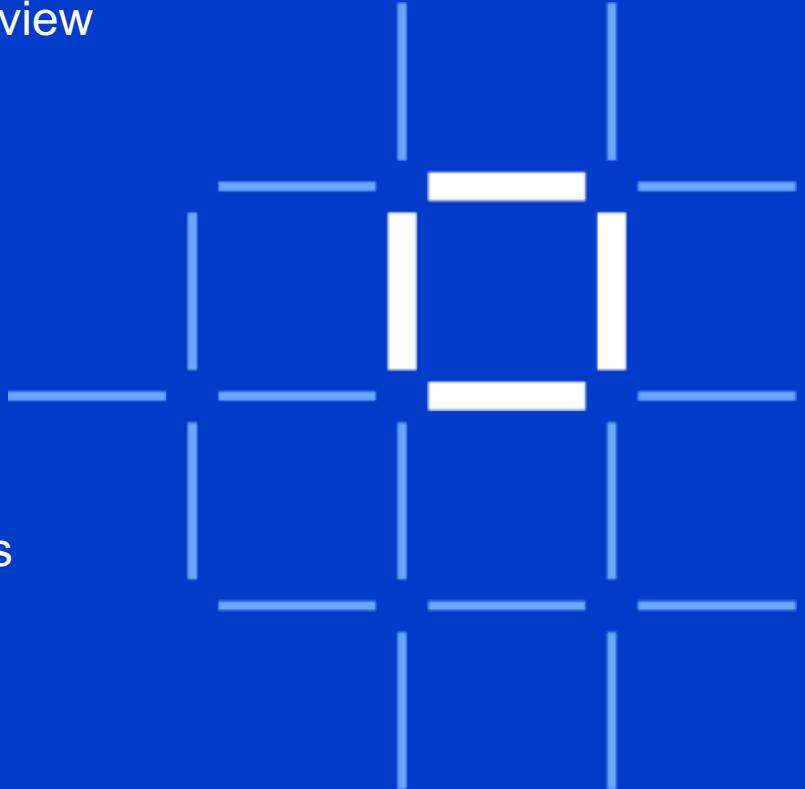
Network roles and formation

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



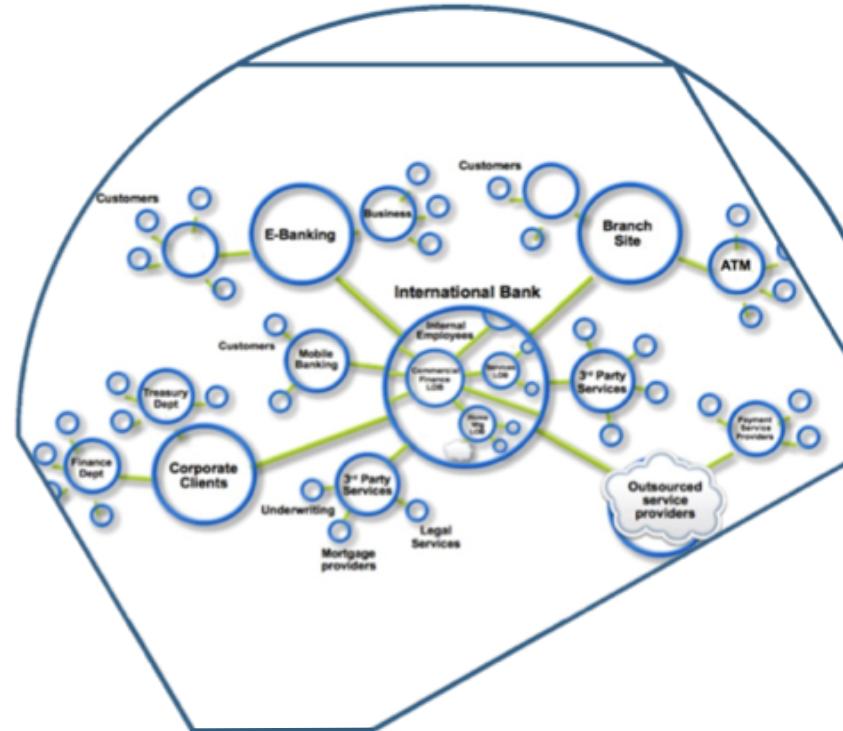
Roadmap and technical details

Where IBM Blockchain Platform is going and how it works

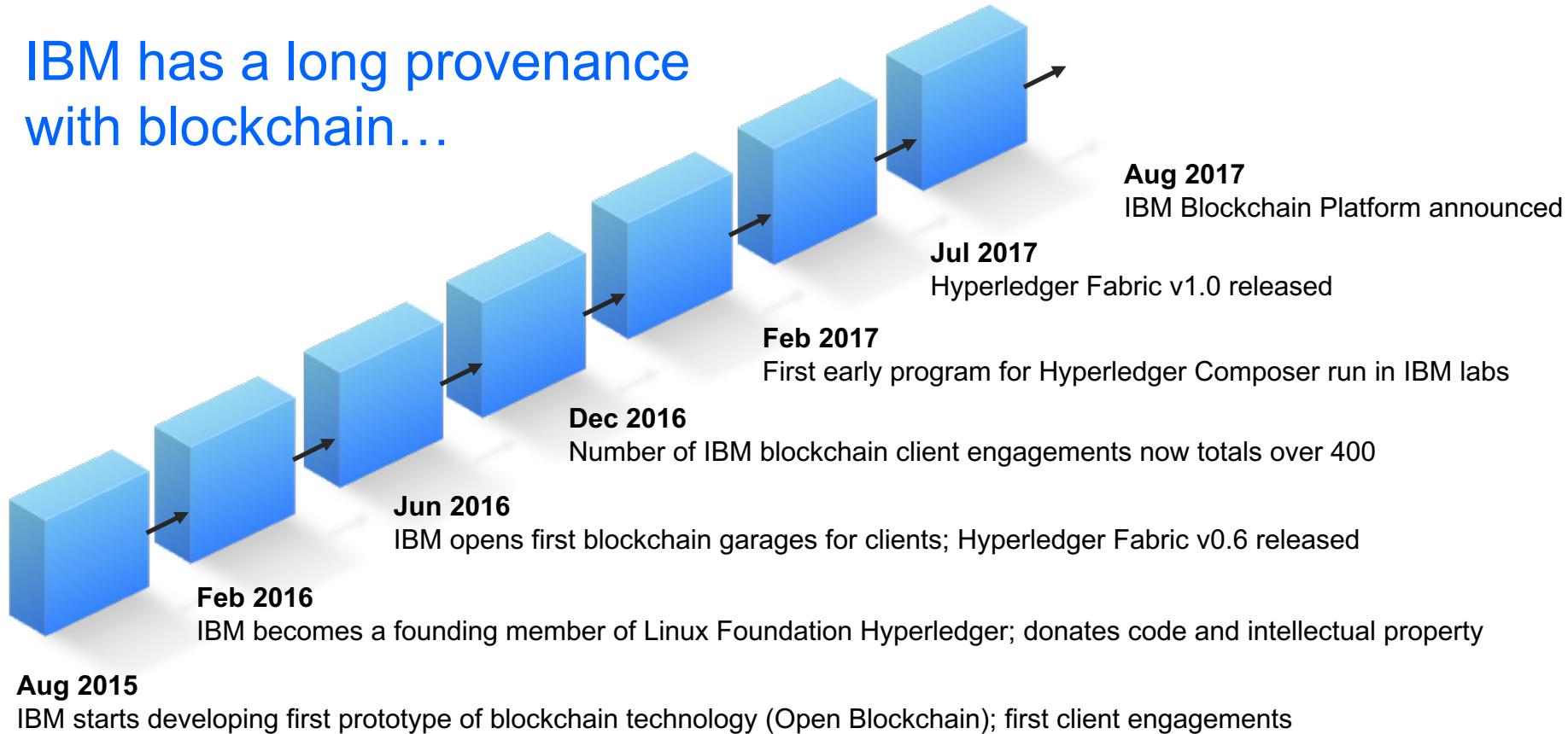


Blockchain Recap

- 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...

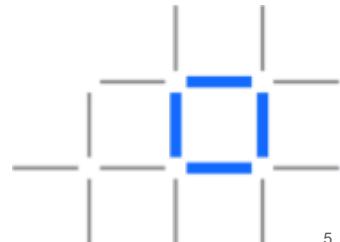
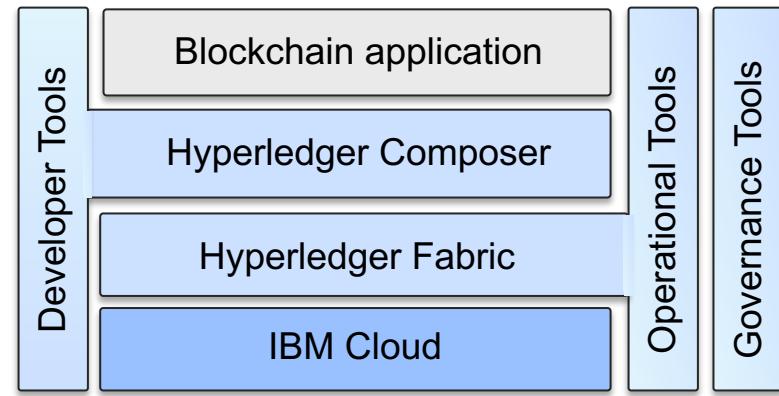


Introducing the IBM Blockchain Platform

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, which is managed through a set of intuitive **operational tools**
- **Governance tools** for democratic management of the business network
- Flexible deployment options, including a highly secure and performant **IBM Cloud** environment



End-to-end lifecycle coverage



Develop

- Accelerated creation of blockchain applications
- No-charge development and test tools hosted on IBM Cloud
- Based on popular Hyperledger Composer toolset

Govern

- Activate, customize and change complete blockchain business networks
- Secure democratic governance across organizations
- Implement rules for authorizing network updates

Operate

- Connect, deploy and manage blockchain peers with flexible deployment options
- Production ready, secure and scalable
- Based on Linux Foundation Hyperledger Fabric V1

Why IBM Blockchain Platform



Reduces risk

- Flexible pricing and support options for all sizes of deployments
- Democratic governance policies to help prevent unauthorized network changes



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
- Avoid vendor lock-in! 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 and Composer 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
* Starter	Easy on-ramp for blockchain-as-a-service; pay by hour	IBM Cloud

* Coming soon

Enterprise Plan

- Enterprise Plan is intended for **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 an additional 10%
 - Certificate authorities and access to the ordering service is not chargeable



Support-only Plans

- Looking for **IBM support on Hyperledger Fabric or Composer?**
 - IBM produces signed Hyperledger Fabric images which can be supported for production usage outside of IBM Cloud
 - Hyperledger Composer supported within same plan
 - Available for LinuxONE (IBM Z), Power and 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 local time; response target within 8 business hours
 - Single technical contact
 - Monthly cost \$500 per peer



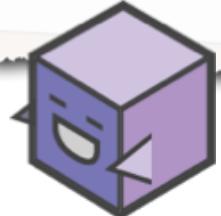
Developer Plan

- IBM Blockchain Platform offers a **no-charge development and hosting environment** for blockchain applications
 - Based on 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/>

The screenshot shows the IBM Blockchain Platform's interface for defining a business network. The network is named "Car Auction Network" and is versioned at v0.1.14-20171128175855. The interface displays various files and components of the network definition:

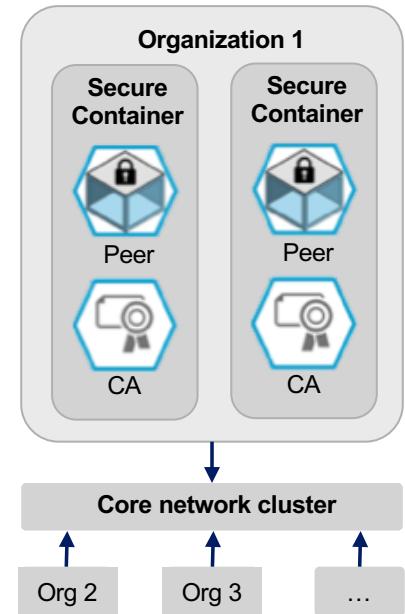
- Model File:** models/listing.cto
- Script File:** js/topic.js
- Access Control:** permissions.acd

Below these, there are buttons for "Import/Replace" and "Deploy". To the right, the network's purpose is described: "This is an interactive, distributed, car auction demo. List assets for sale (setting a reserve price), and watch as assets that have met their reserve price are automatically transferred to the highest bidder at the end of the auction." It also lists participants (Seller, Auctioneer), assets (Vehicle, VehicleListing), and transactions (Offer, CloseListing). A note explains the logic of the CloseListing transaction: "The closelisting function is called when a Closelisting transaction is submitted for processing. The logic checks that the listing is still for sale, sorts the offers by bid price, and then if the reserve has been met, transfers the ownership of the vehicle associated with the listing to the highest bidder. Money is transferred from the buyer's account to the seller's account, and then all the modified assets are updated in their respective registries." At the bottom, it says "To test this Business Network Definition in the Test tab!"



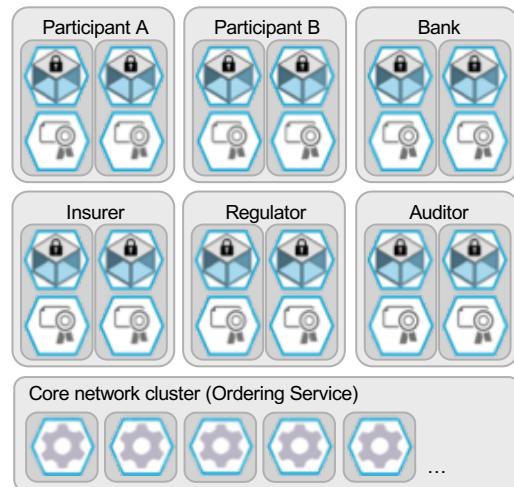
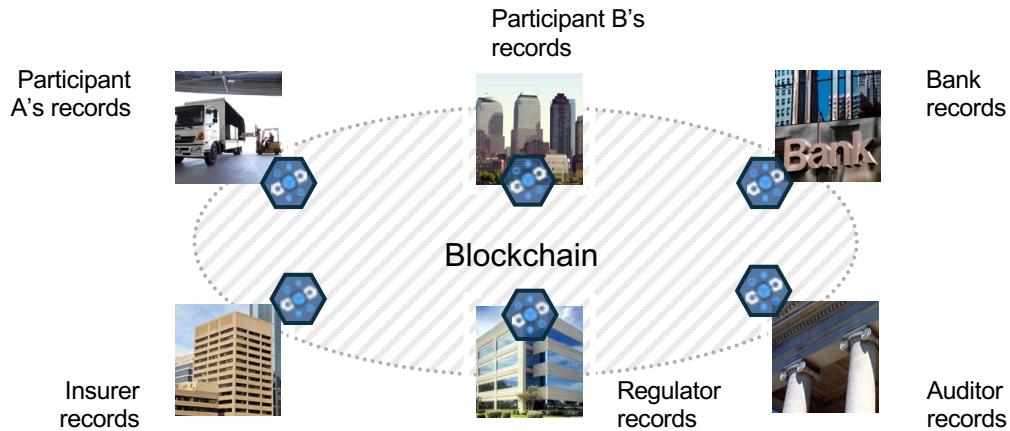
Platform Configuration

- 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 an in-production blockchain 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
Enterprise plan 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 you get started with IBM Blockchain Platform

Learn more at
www.ibm.com/blockchain

IBM can help you make your blockchain a success

The collage consists of three images:

- A whiteboard titled "#1 USE CASE IDEAS" listing various blockchain applications such as KYC/ID tokens, asset management, information exchange with Gov., and digital vault provision.
- A person writing on a wall with sticky notes during a workshop.
- A "Business Value Assessment" worksheet for a shipping problem, detailing metrics like 90% of goods in global trade are damaged, KPIs (e.g., 21% of damage), and potential solutions like digitizing shipping documents.

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



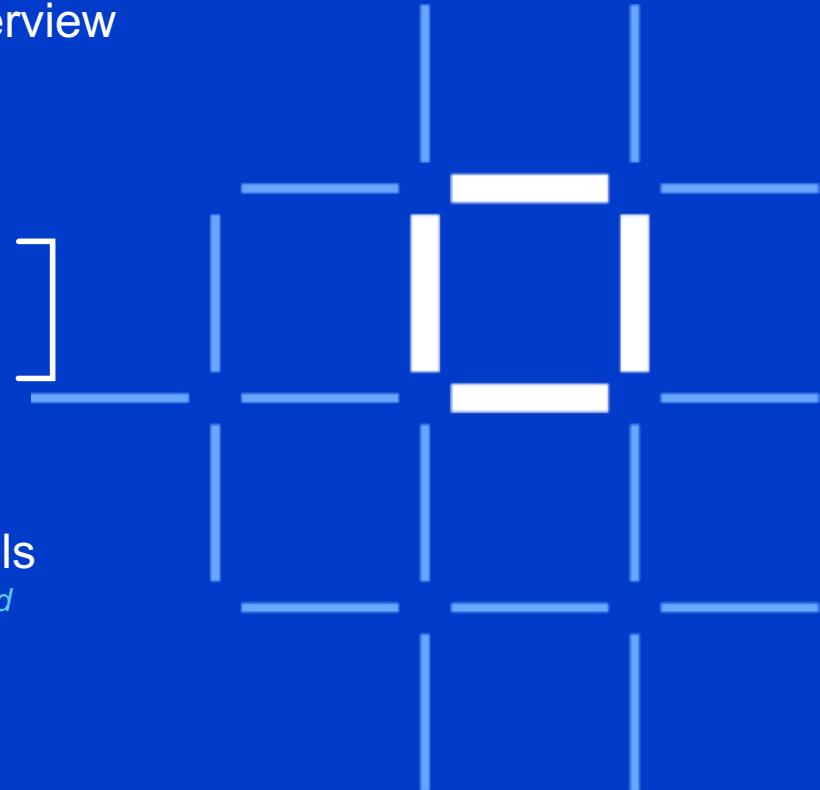
IBM Blockchain Platform Overview

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Roadmap and technical details

Where IBM Blockchain Platform is going and how it works

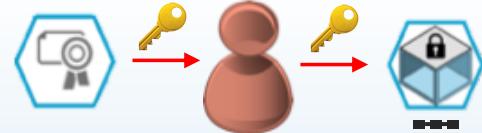
Blockchain Technical Concepts



Peers are the networked services that maintain ledger state and run smart contracts



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



Certificate authorities provide identity services to participants on the network



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

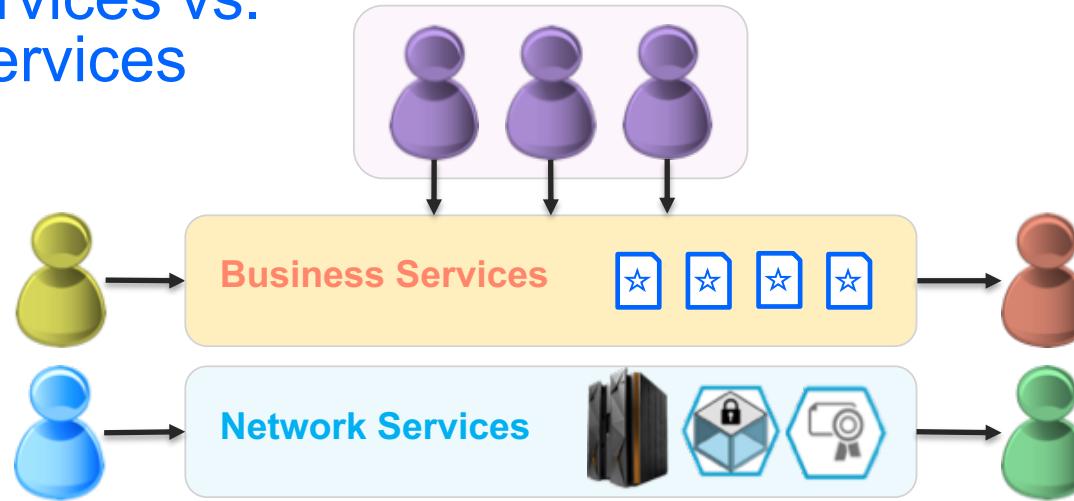


Consensus is the process by which agreement is obtained on the peer network



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

Network Services vs. Business Services



- A good enterprise architecture consists of **Network Services** and **Business Services**
 - Network Services provide a technical computing foundation
 - Business Services are an abstraction that provide meaningful business context
- A blockchain network also consists of Network Services and Business Services
 - Peers, Channels, Ordering Service, etc. are Network Services
 - Smart Contracts and the APIs that invoke them are Business Services
- Depending on their role, blockchain stakeholders each **provide** or **consume** these services...

Blockchain Participant Roles

(A single organization may play multiple roles!)



End-user **runs** presentation logic
(e.g. on mobile device or dashboard)



Business Service Consumer **hosts** application and integration logic which invoke blockchain transactions



Business Service Provider **develops** blockchain business applications, including transaction, app server, integration and presentation logic

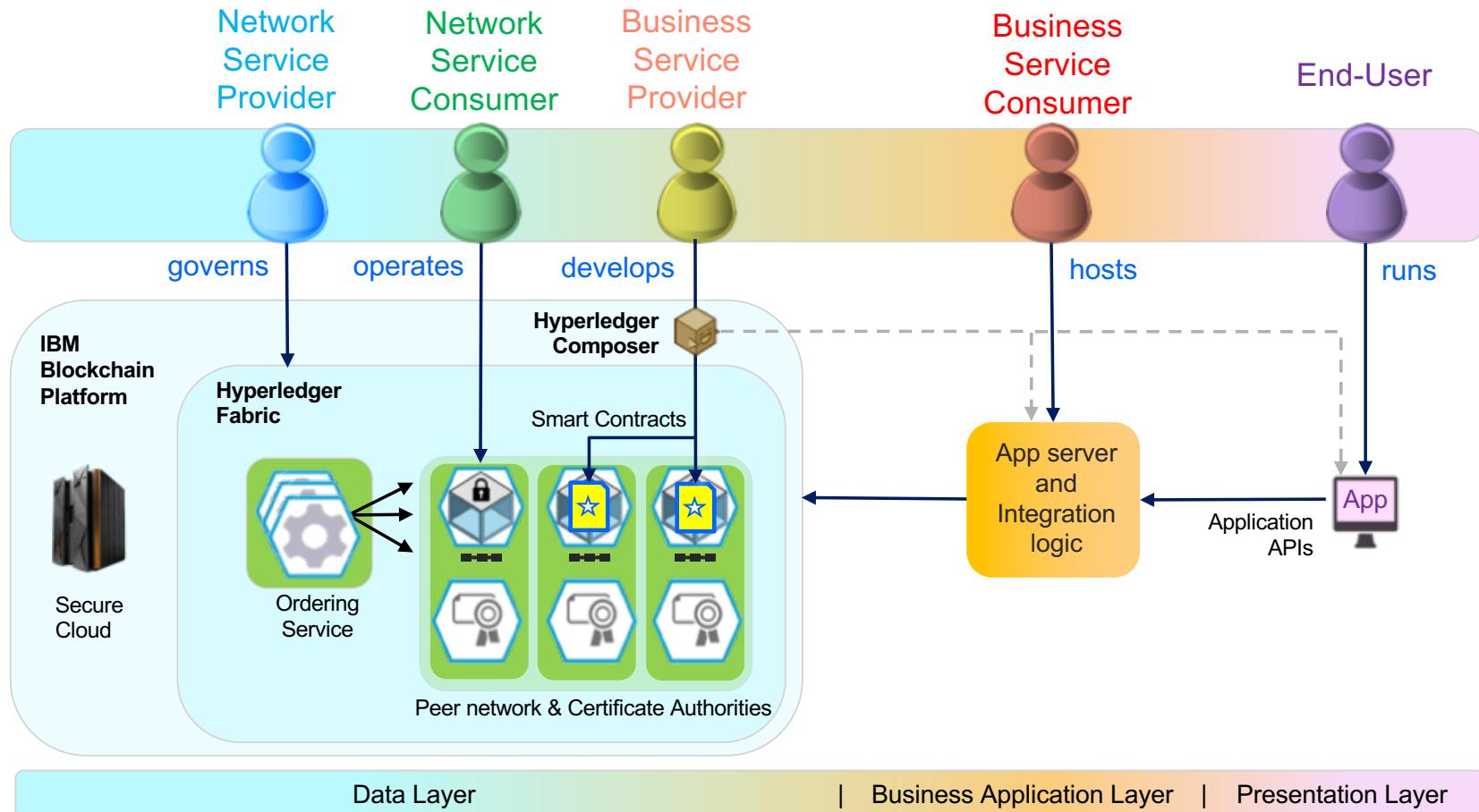


Network Service Consumer **operates** a set of peers and certificate authorities on the network; represents an organization on the business network



Network Service Provider **governs** changes to the network; a consortium of network members or designated authority

Network Architecture and Participant Roles



IBM Blockchain Platform for Network Service Providers

Governance of changes to the blockchain network



A screenshot of the 'Create Network' wizard. The current step is 'Let's Get Started'. It displays a brief description of the process: 'This quick start will help guide you, the network initiator, through the network creation process. You'll set governance rules, determine how network resources will be provisioned, and invite other members to join.' Below this is a form to 'Start by giving your network a name', with fields for 'Name' (set to 'Test'), 'Institution Name', and 'Requester'. A note below says: 'After completing the following steps, your network will be live and you will have sent out invites to the members you invited to join the network. They will come online once they complete the onboarding process. You can then use Network Model to manage resources, create channels, install blockchain applications, and run transactions.' At the bottom is a link to 'Looking for additional help? Information'.

- Network Service Providers play a vital role in a blockchain network
 - Initiating the network
 - Creating membership, channel and smart contract policies
- Typically covers **changes to the network**; common recurring tasks (e.g. certificate management) are managed by Network Service Consumers
- Either centralized (e.g. industry regulator) or decentralized (e.g. members of a consortium)

Two overlapping screenshots. The top one shows the 'Notifications' UI with a table of items: 'All (1)', 'Pending (0)', 'Completed (1)'. One item is listed: 'Channel Request Join "channel-a"' by 'IMeng1' on '14 August, 2017 - 10:16:14 AM' with a status 'Vote Accepted'. The bottom part shows the 'Create a new channel request' form. It includes sections for 'Review channel update policy' (with a dropdown showing '1 of 1 operator from the following organizations need to accept to update this channel.'), 'Policy' (dropdown set to '1'), 'Institution Name' (set to 'IMeng1'), 'Email' (set to 'wzjcheng@cn.ibm.com'), and buttons 'Cancel', 'Back', and 'Submit Request'.

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

IBM Blockchain Platform for Network Service Consumers

Operate a subset of peers in a blockchain network



A screenshot of the IBM Blockchain Platform's web-based management interface. The left sidebar shows navigation links: Network, Your blockchain network, Overview, Members, Channels (selected), Chaincode, Notifications, and Support. The main content area displays a summary for 'channel-a': 1 TOTAL BLOCKS, 43 ms TIME SINCE LAST TRANSACTION, and 0 RECENT INITIATIONS. Below this is a timeline chart showing 'TIME' from 06/14/17 10:16 GMT+0000 to 06/14/17 10:17 GMT+0000, and 'BLOCK NUMBER' from 0 to 1. A back-link 'Back to channels' is visible at the top of the main content area.

- Network Service Consumers operate an organization's peers and certificate authorities
 - Installing and instantiating smart contracts
 - Managing certificates for Business Service Consumers in their organization
 - Monitoring network resources
 - Creating channels (in accordance with defined policies)

Two screenshots of the IBM Blockchain Platform's web-based management interface. The top screenshot shows a table of nodes:

Type	Name	Status	Actions
Orderer	fabric-orderer-t3495b	Running	...
Orderer	fabric-orderer-t3495d	Running	...

The bottom screenshot shows a detailed view for a peer node named 'fabcar':

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

IBM Blockchain Platform for Business Service Providers

Develop blockchain applications

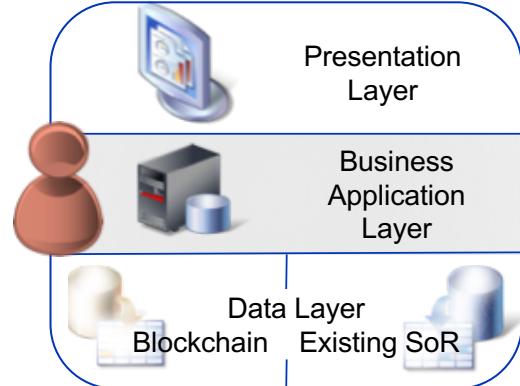


- A blockchain application consists of three components:
 - **Smart contracts**: transaction logic run on the distributed peer network (e.g. Composer BNA file)
 - **Business logic**: business applications and integration services that invoke smart contracts
 - **Presentation logic**: client applications 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
 - Smart contracts: deployed to the IBM Blockchain Platform as chaincode
 - Business logic: deployed to application server/integration tier
 - Presentation logic: made available to end-users

The role of Business Service Consumers

Host applications and integration services that invoke smart contracts

- Business Service Consumers are typically responsible for two things:
 - Hosting business logic that invokes smart contracts running on IBM Blockchain Platform
 - Managing End-User identity
- Business logic is **hosted on an application server**
 - Either off-premises (e.g. IBM Cloud) or on-premises
 - Typically connect via integration middleware (e.g. IBM Integration Bus)
- Invokes appropriate APIs to invoke smart contracts in the usual way
 - End-users authenticate and cause blockchain transactions to be invoked using a proxy identity provided by the Network Service Consumer's certificate authority
 - 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

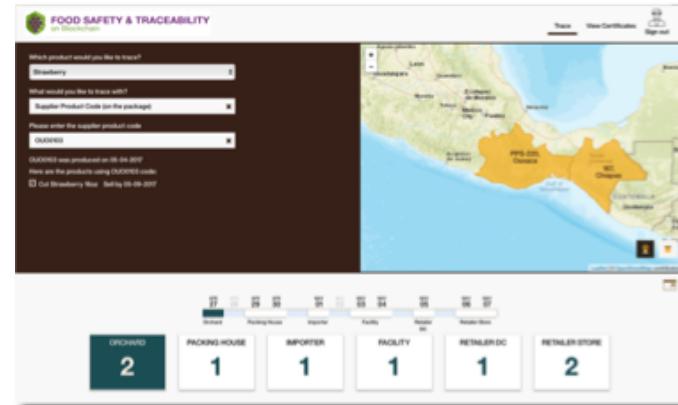


How End-Users interact with the blockchain

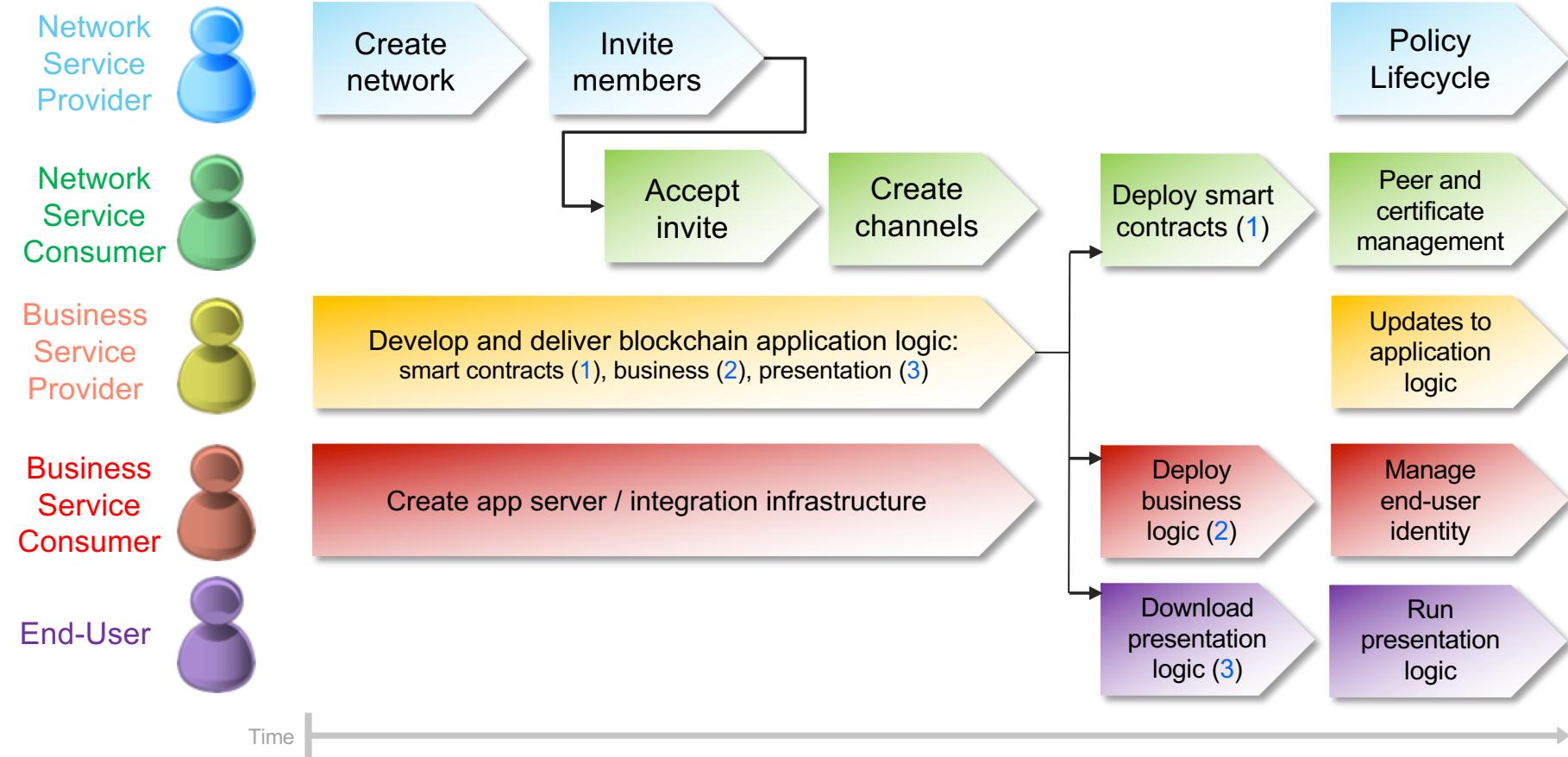
Exchange trustworthy information



- 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 an identity 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



Workflow for Network Formation





IBM Blockchain Platform Overview

What you need to know



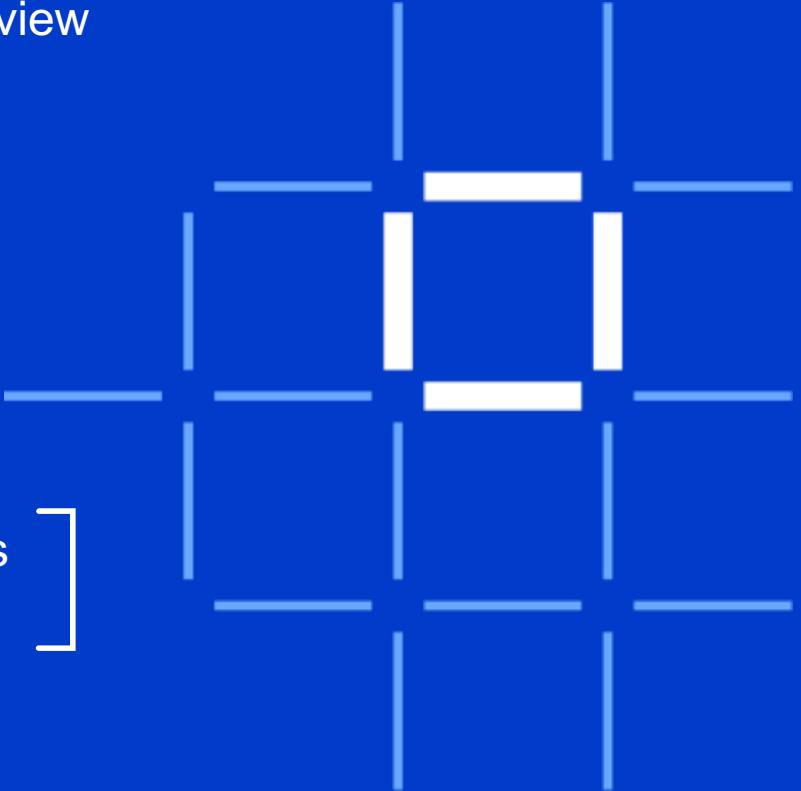
Network roles and formation

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



Roadmap and technical details

Where IBM Blockchain Platform is going and how it works



IBM Blockchain Strategy

Drive the development of **applications** for specific business use-cases, to be deployed to active **blockchain networks**



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



Platform

Develop, govern and operate enterprise blockchain networks with speed and security



HYPERLEDGER

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

How IBM Blockchain Platform plans to use Hyperledger

Deploy options	IBM Blockchain Platform Plans	3Q 2017	4Q 2017	1Q 2018	2Q 2018
Software as a Service	Enterprise Plus Plan <i>Most secure and performant Blockchain platform</i>		Limited release Fabric 1.0 Composer 0.16	Limited release Fabric 1.0 Composer 0.16	General Availability Fabric 1.1 Composer 1.0
	Enterprise Plan <i>Only blockchain platform for enterprise production</i>	General Availability Fabric 1.0 Composer 0.11	General Availability Fabric 1.0 Composer 0.16	General Availability Fabric 1.0 Composer 0.16	General Availability Fabric 1.1 Composer 1.0
	Starter <i>Easy on-ramp for enterprise</i>			Beta Release Fabric 1.0 Composer 0.16	General Availability Fabric 1.1 Composer 1.0
Docker	Elite Support for IBM Images of Hyperledger Fabric & Composer	Fabric 1.0 Composer 0.11	Fabric 1.0 Composer 0.16	Fabric 1.0 Composer 0.16	Fabric 1.1 Composer 1.0
	Entry Support for IBM Images of Hyperledger Fabric & Composer				
Kubernetes	Developer Sandbox <i>A developer can start for free with open source tools and Kubernetes environment</i>	Fabric 1.0 Composer 0.11	Fabric 1.0 Composer 0.16	Fabric 1.0 Composer 0.16	Fabric 1.1 Composer 1.0

N.B. Fabric and Composer release dates and content is decided by the Linux Foundation development community

What's planned for IBM Blockchain Platform?

1Q18

✓ New Starter Plan (Beta)

Get started using the IBM Blockchain Platform and experience production blockchain with a low cost plan built for pilot projects

✓ Smart Contracts & Analytics Tools

Tech preview of analytics and smart contracts tools make it straightforward to leverage samples, build applications, and capture insight from blockchain ledgers

✓ Ultimate in security and isolation

New, limited offer, Enterprise+ Plan is ideal for large enterprises in regulated industries that need more control to meet SLA's. Get the HA of Enterprise on dedicated compute. Build networks in your own clusters!

2Q18

✓ Starter & Enterprise Plus Plans GA

Refresh includes Fabric v.1.1 and Composer, with JavaScript chaincode; performance improvements, new security features, samples and CouchDB for high performance query

✓ Hybrid Networks

Integrate peers deployed across environments through the IBM Blockchain Platform to address data residency requirements

✓ Multi-Site Disaster Recovery

Multi-site Disaster Recovery solution, enabling business networks that are continuously available.

Forward

✓ DevOps & solution components

Manage accounts across network participants; onboard and manage members; manage secure documents, archive and ledger storage; identity and payment integrations; additional operational and governance tools

✓ New deployment & storage options

Enable clients to deploy blockchain in the environment of their choice and integrate with the IBM Blockchain Platform; extended storage capabilities

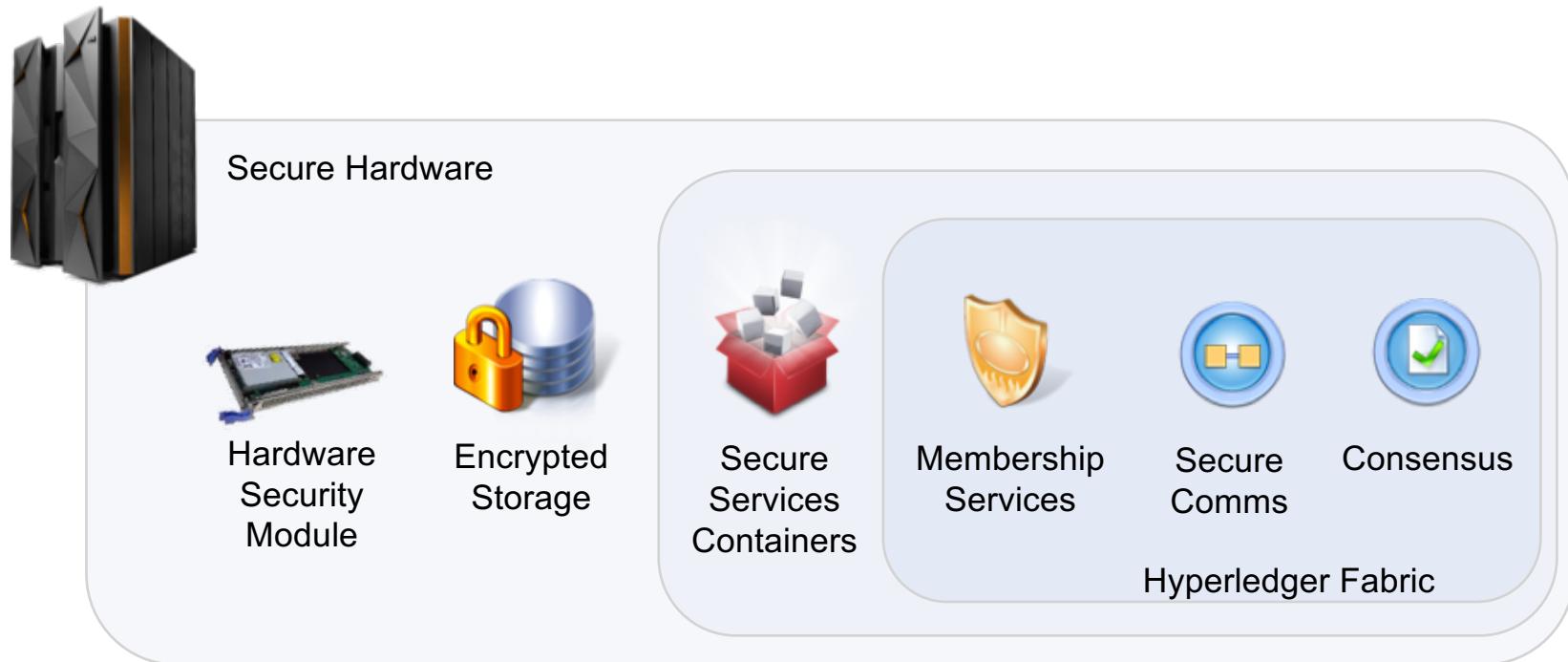
✓ Non-disruptive Hyperledger updates

Upcoming Hyperledger releases of Fabric, Composer and Indy. Delivering extended consensus models- RAFT, PBFT, Zero knowledge proofs; reuse of external packages; links; audit and archive

✓ Global blockchain footprint

Expanding data centers to worldwide with over 20+ sites in scope including disaster recovery, SOC2 Type 2 and FedRamp All data centers certified to ISO27001 industry standard compliance

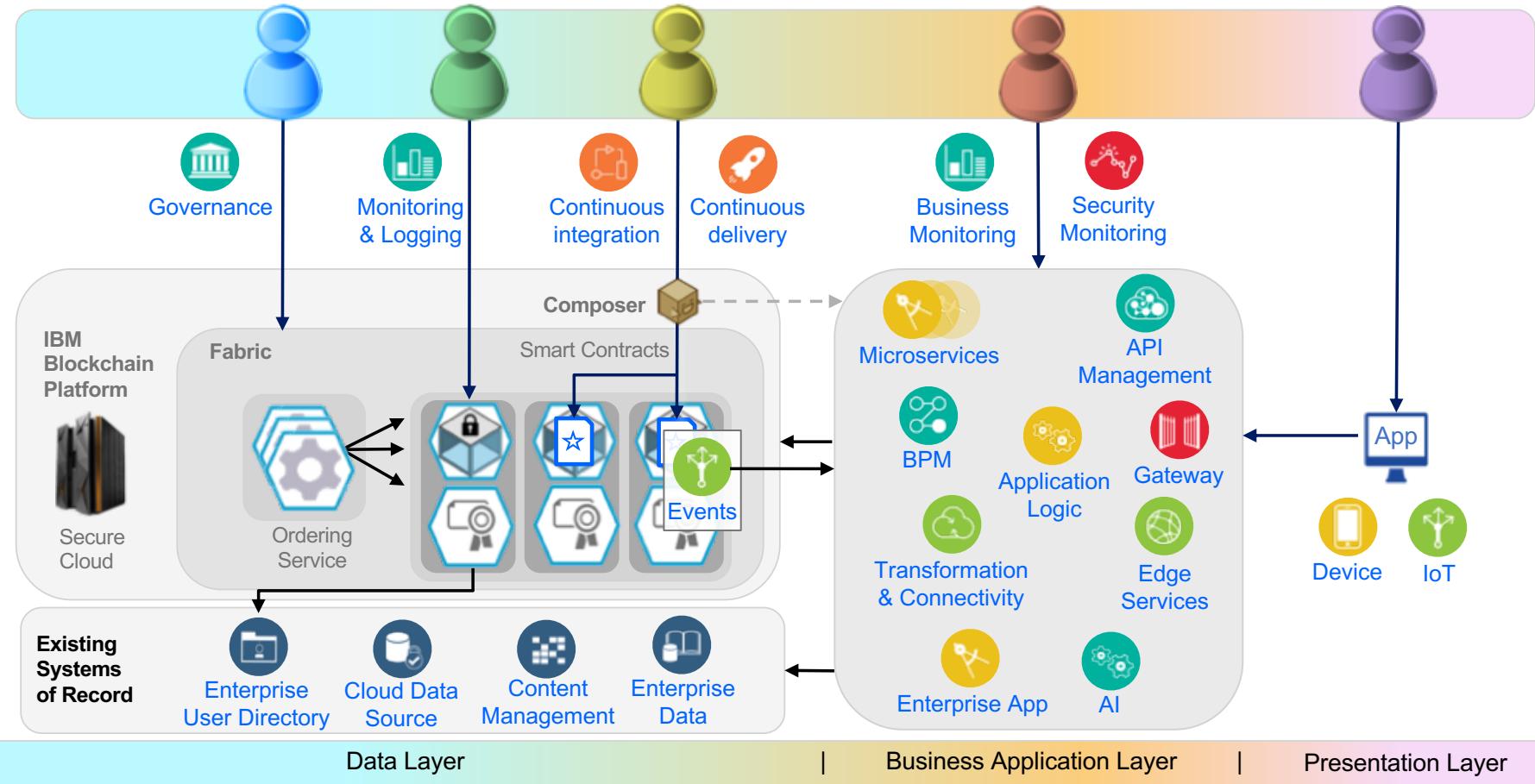
Security is implemented at each layer of the architecture



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 end-user application and smart contract is secure
 - Extensive security scans and audits performed by IBM, and independently by IBM and Linux Foundation sponsored 3rd-party penetration testing and code audits
- 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

How the architecture fits with enterprise services and processes



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

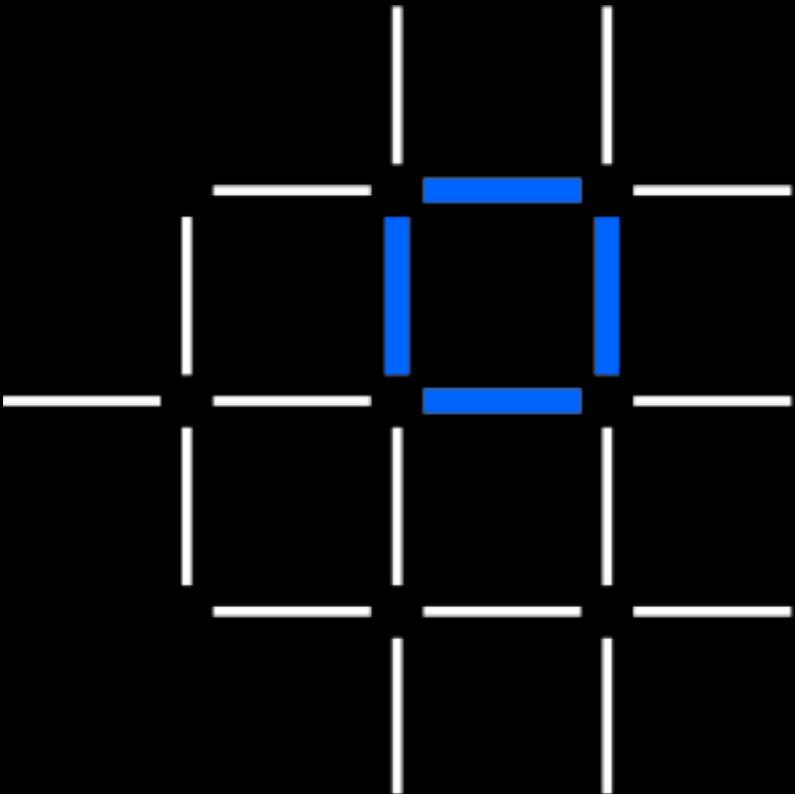
Developer

- 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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