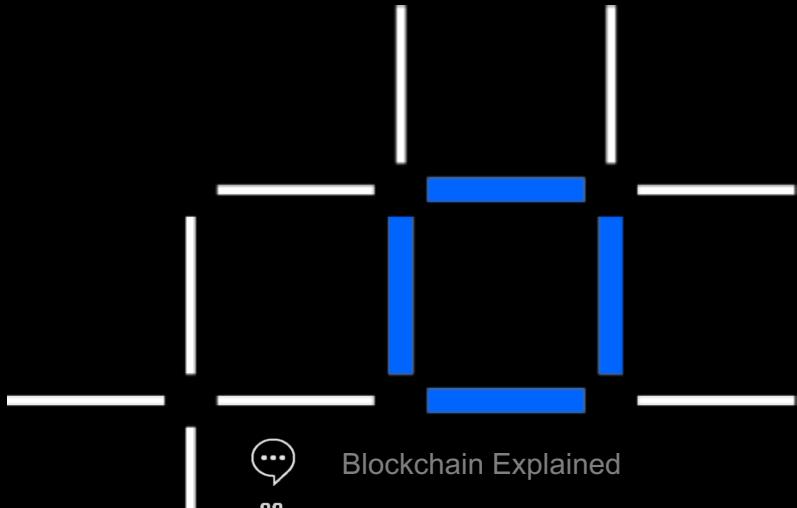


# IBM Blockchain Platform Explained

An Introduction to IBM Blockchain Platform

Jin VanStee



Blockchain Explained



**IBM Blockchain Platform**



Blockchain Solutions



Blockchain Composed



Blockchain Architected



Blockchain Explored



Next Steps





## IBM Blockchain Platform Overview

*What you need to know*



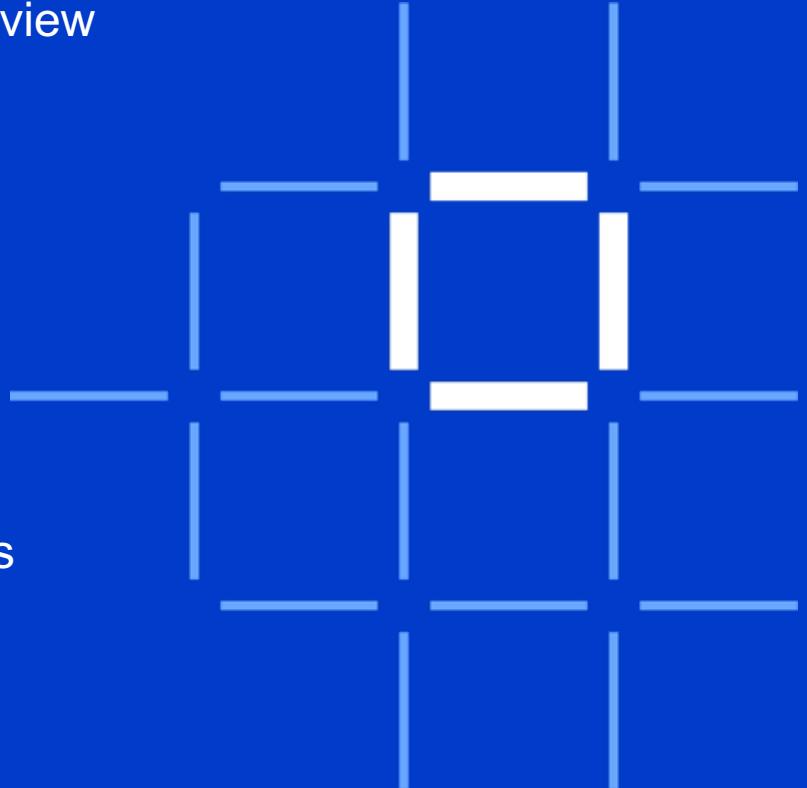
## Network roles and formation

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



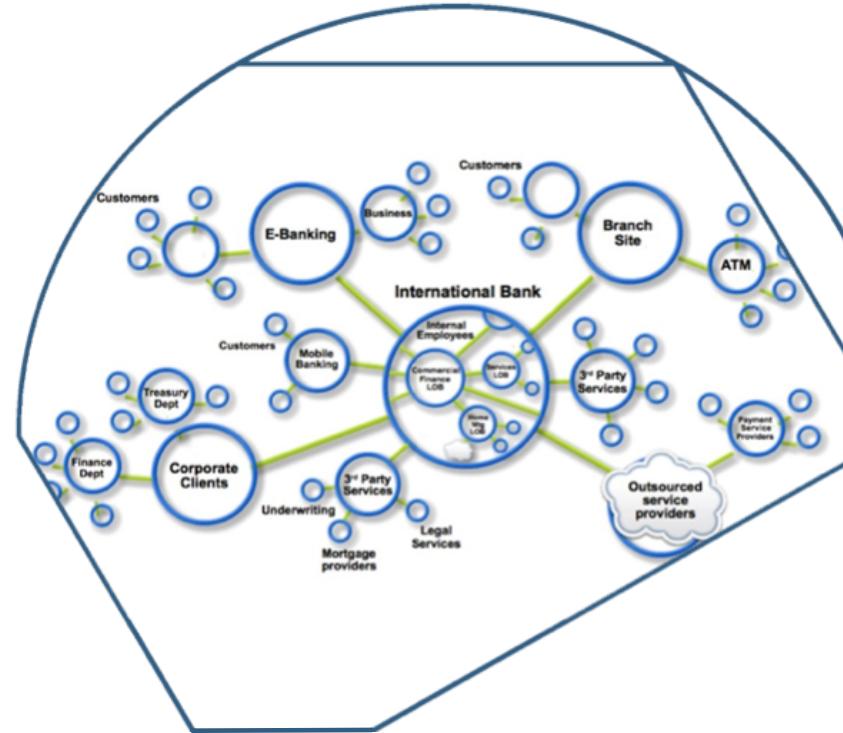
## Roadmap and technical details

*Where IBM Blockchain Platform is going and how it works*

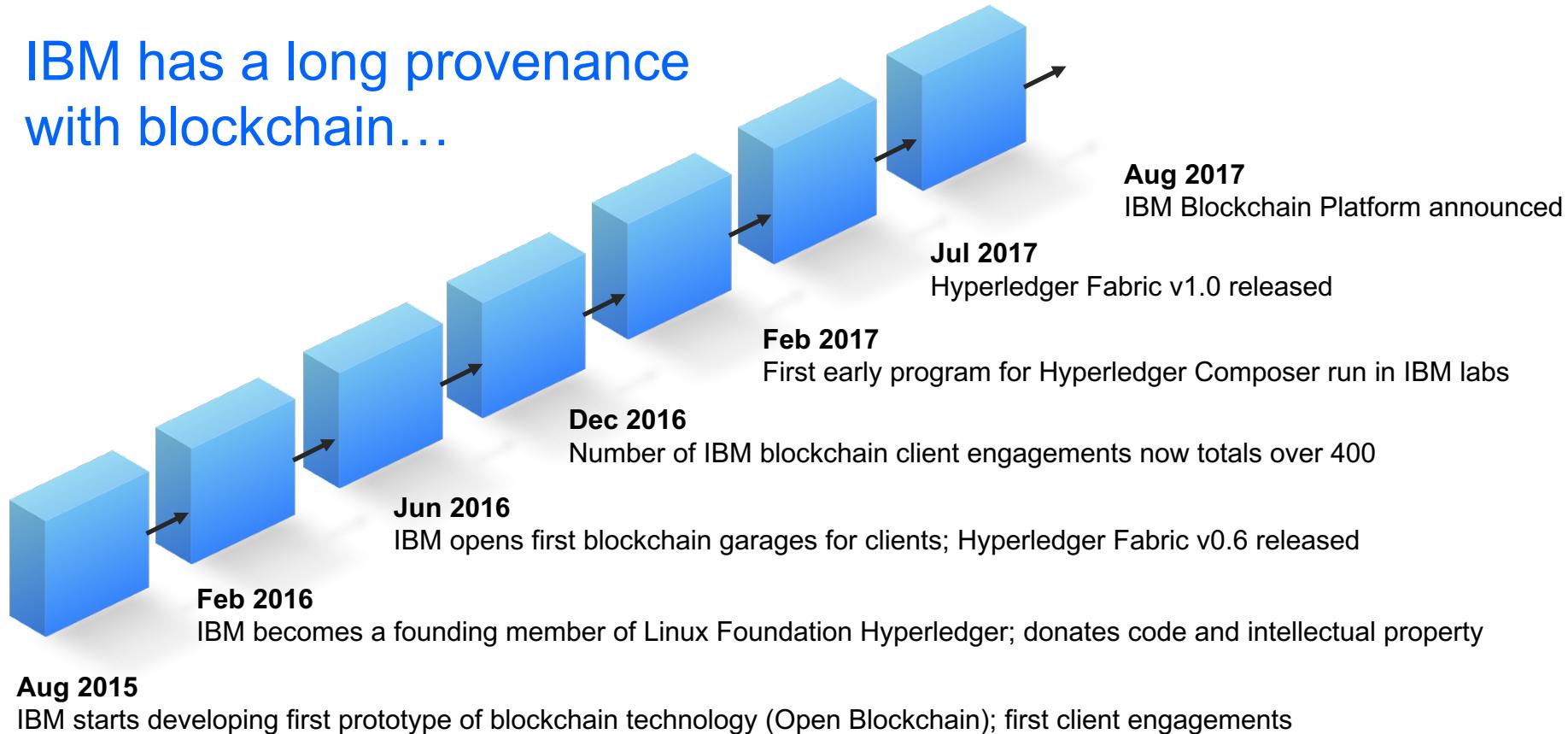


# Blockchain Recap

- 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...

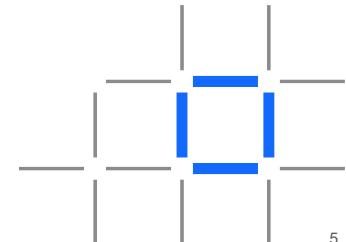
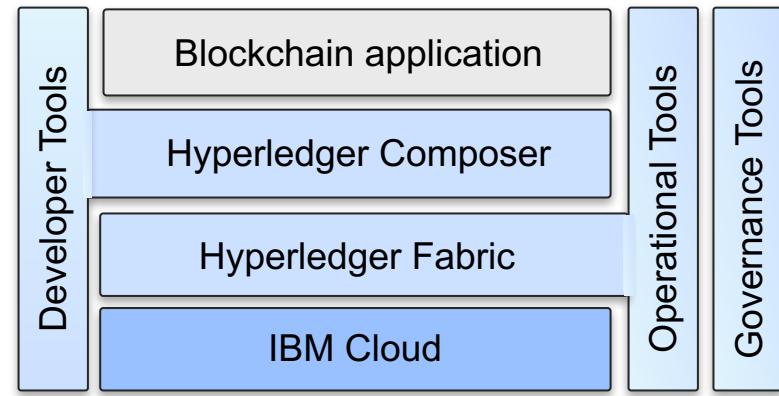


# Introducing the IBM Blockchain Platform

[http://ibm.biz/Platform\\_Demo](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

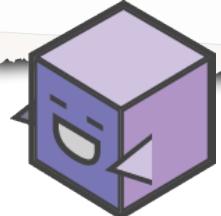
- Looking for **IBM support on Hyperledger Fabric or Composer?**
  - IBM produces signed Hyperledger Fabric images which can be supported for production usage outside of IBM Cloud
  - Hyperledger Composer supported within same plan
  - Available for LinuxONE (IBM Z), Power and x86 architectures
  - Subscription 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

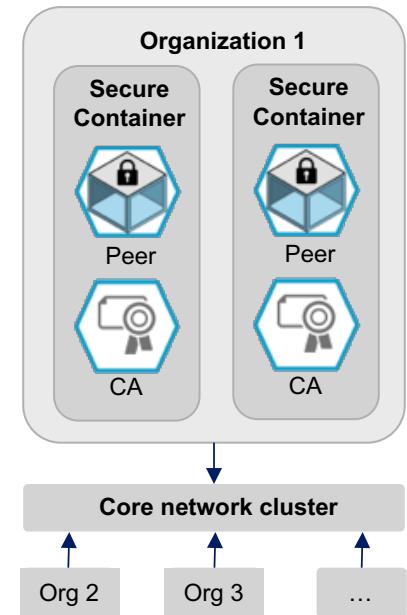
- IBM Blockchain Platform offers a **no-charge development and hosting environment** for blockchain applications
  - Based on Hyperledger Composer for development, and fully configured Hyperledger Fabric for testing
  - Community support by an active user base (e.g. Rocket Chat, Stack Overflow)
  - Deploy 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 managing business networks. The main window displays the 'Car Auction Network' with version v0.1.14-20171128175855. On the left, there's a sidebar with 'FILES' containing 'About README.md', 'Model File models/auction.cto', 'Script File lib/logic.js', and 'Access Control permissions.aci'. Below these are buttons for '+ Add a file...', 'Update', 'Import/Replace', and 'Export'. The main content area contains a detailed description of the network: '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: Henner Auctioneer', 'Assets: Vehicle VehicleListing', and 'Transactions: Offer CloseBidding'. A note explains the logic behind the 'makeOffer' and 'closeBidding' functions. At the bottom, it says 'To test this Business Network Definition in the Test tab:' followed by a 'Legal' link.



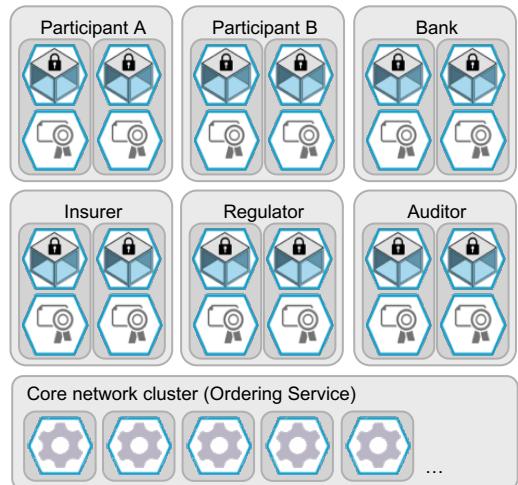
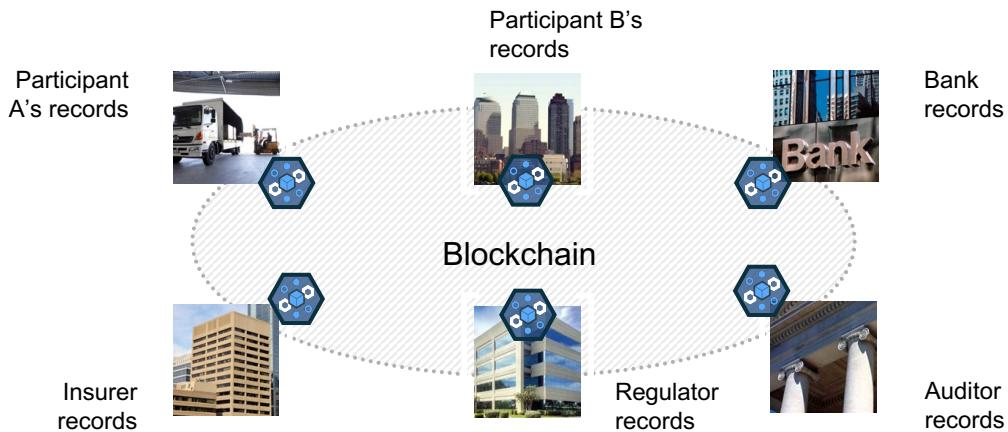
# Platform Configuration

- 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

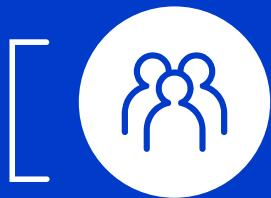
- More platform locations planned
- ↑ Complemented by a set of IBM Blockchain Garages to help you get started with IBM Blockchain Platform

Learn more at  
[www.ibm.com/blockchain](http://www.ibm.com/blockchain)



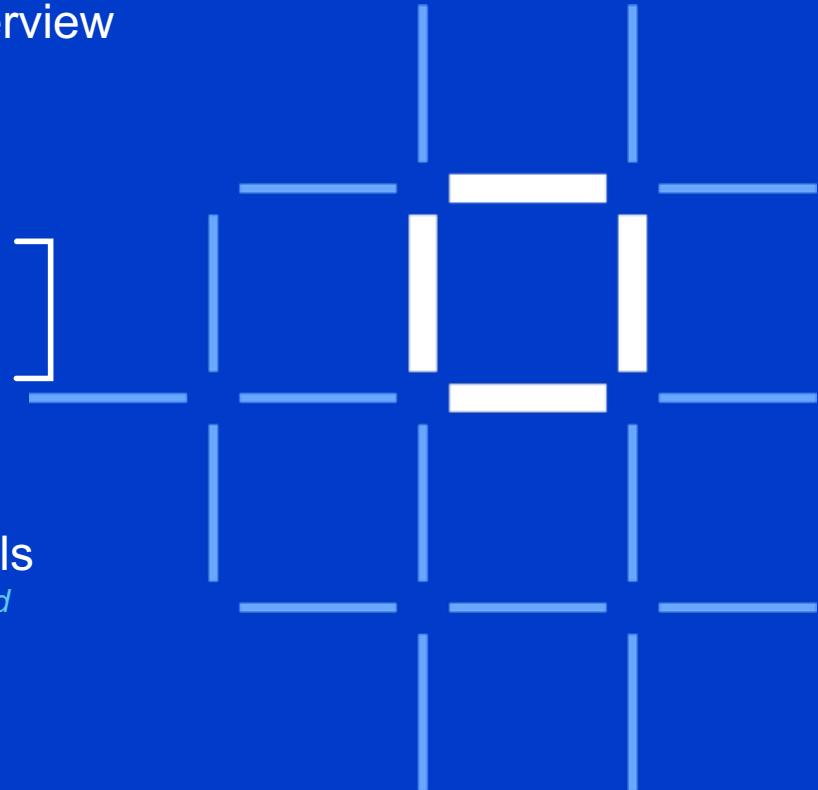
## IBM Blockchain Platform Overview

*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*

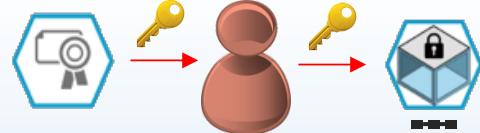
# Blockchain Technical Concepts



**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

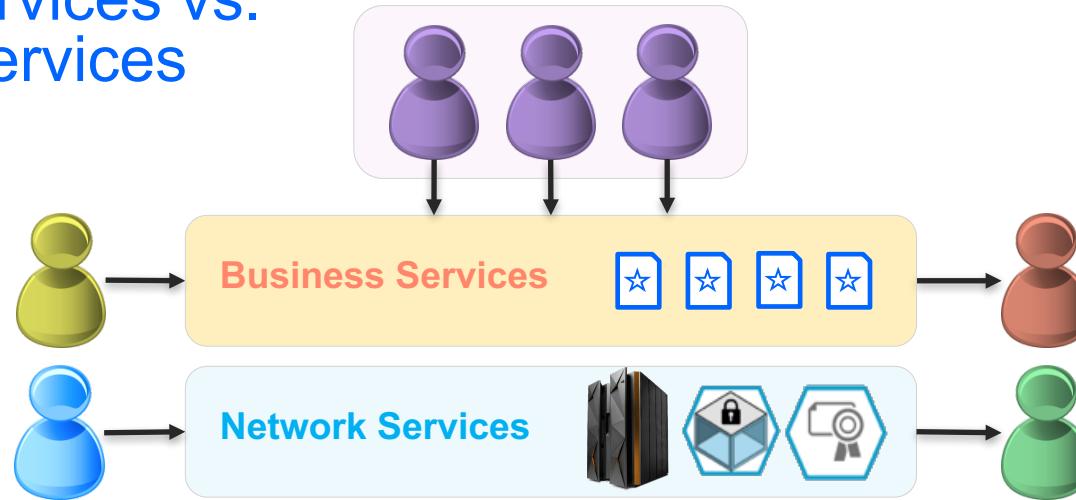


**Consensus** is the process by which agreement is obtained on the peer network



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

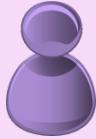
# Network Services vs. Business Services



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



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

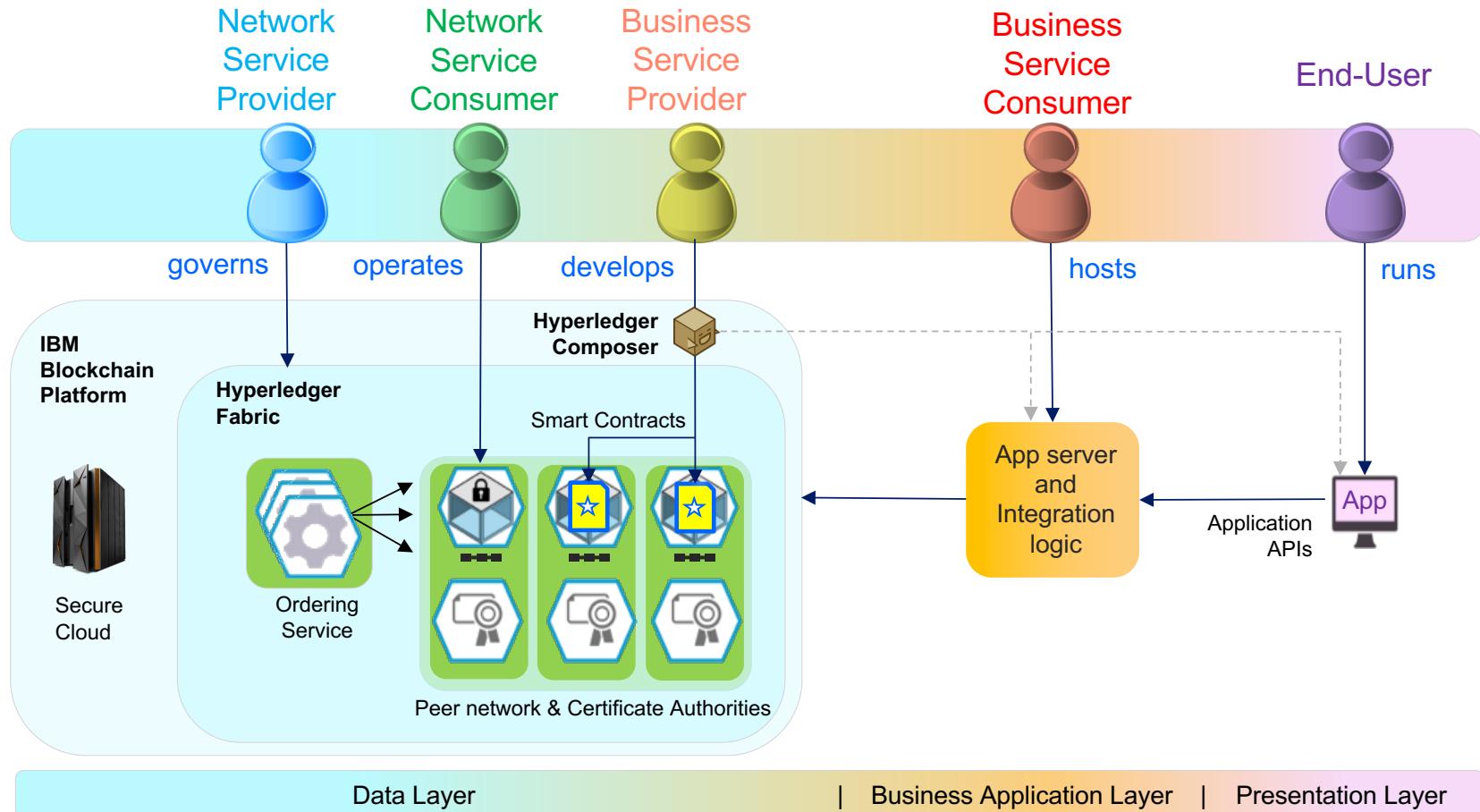


**Network Service Consumer** **operates** a set of peers and certificate authorities  
on the network; represents an organization on the business network



**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



The screenshot shows the 'Create Network' wizard in progress. The current step is 'Let's Get Started'. It includes fields for 'Start by giving your network a name' (with 'Required field' validation), 'Location' (set to 'Toronto'), and 'Institution Name' (with 'Required field' validation). 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 want to join that network. They will come online once they complete the onboarding process.' There is also a 'Documentation' link at the bottom.

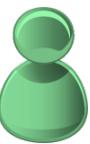
- Network Service Providers play a vital role in a blockchain network
  - Initiating the network
  - Creating membership, channel and smart contract policies
- Typically covers **changes to the network**; common recurring tasks (e.g. certificate management) are managed by Network Service Consumers
-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

The image displays two overlapping UI components. On the left, the 'Notifications' screen shows a table of pending items. The first item is a 'Channel Request' from 'IBMMorg1' dated '14 August, 2017 - 10:16:14 AM' with a status of 'Vote Accepted'. On the right, the 'Create a new channel request' screen is visible, showing fields for 'Policy' (set to 1 operator), 'Institution Name' ('IBMMorg1'), and 'Email' ('wjcheng@cn.ibm.com'). Buttons for 'Cancel', 'Back', and 'Submit Request' are at the bottom.

- 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 web interface. The left sidebar shows navigation options: Network, Your blockchain network (selected), Overview, Members, Channels (selected), Chaincode, Notifications, and Support. The main content area shows a summary for 'channel-a': 1 TOTAL BLOCKS, 43 mins TIME SINCE LAST TRANSACTION, and 0 RECENT INSTANTIATIONS. Below this is a timeline chart showing TIME (08/14/17 10:16 GMT+0800) and BLOCK NUMBER (0).

- 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)

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
  - Covers members, channels, smart contracts...
  - Full access to APIs and logs for transparent problem determination

# IBM Blockchain Platform for Business Service Providers

*Develop blockchain applications*

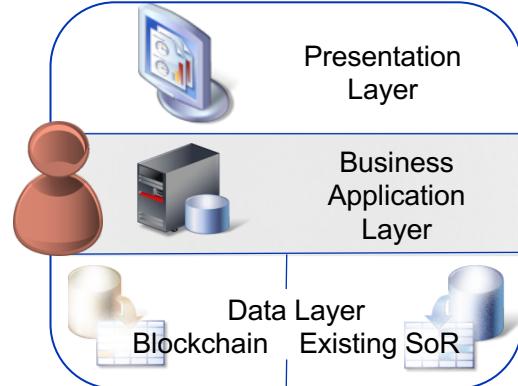


- A blockchain application consists of three components:
    - **Smart contracts**: transaction logic run on the distributed peer network (e.g. Composer BNA file)
    - **Business logic**: business applications and integration services that invoke smart contracts
    - **Presentation logic**: client 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)
- 
- 
- A brown 3D cube icon with a white play button symbol on its front face and a small arrow pointing towards it.
- **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

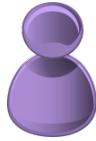
*Host applications and integration services that invoke smart contracts*

- 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



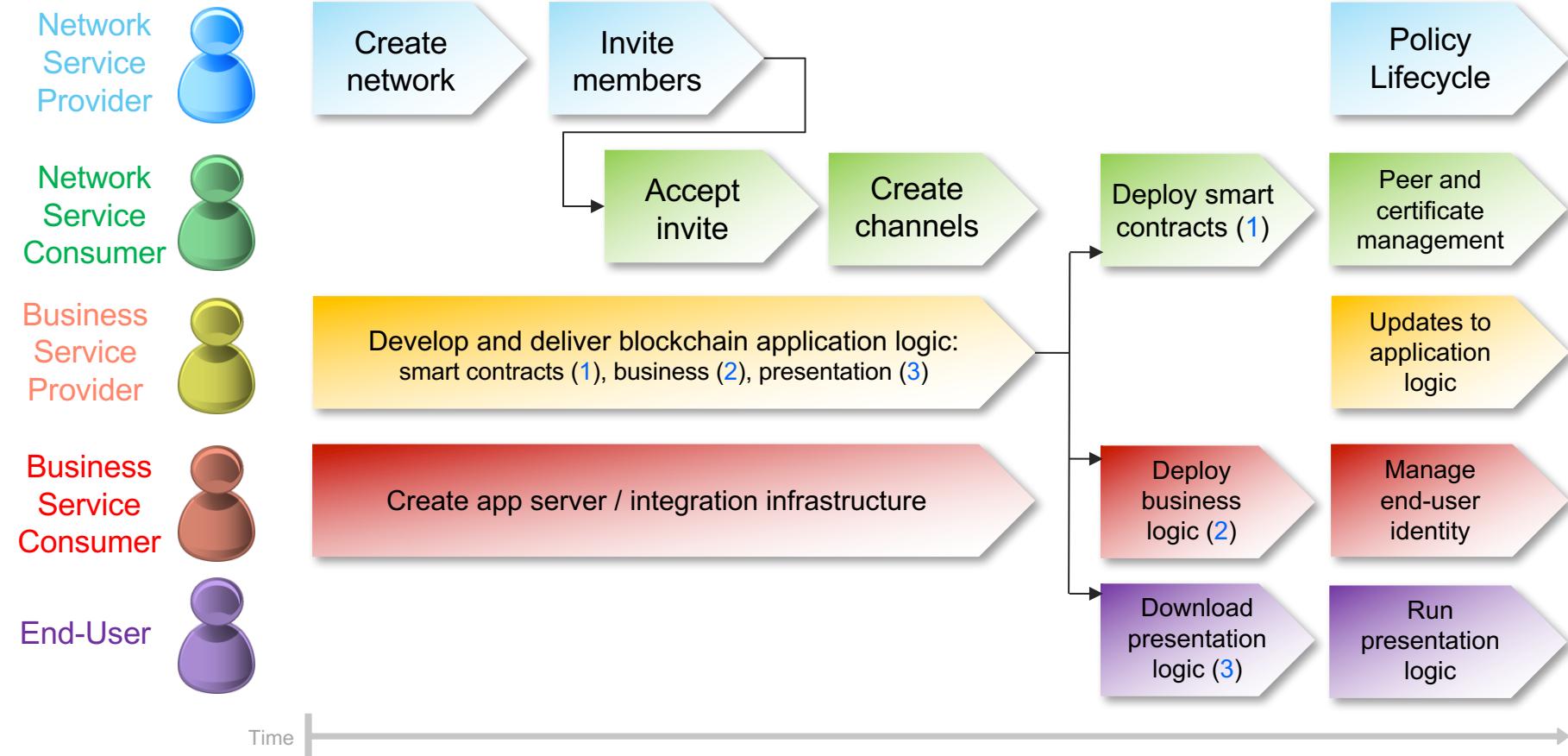
# How End-Users interact with the blockchain

*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*



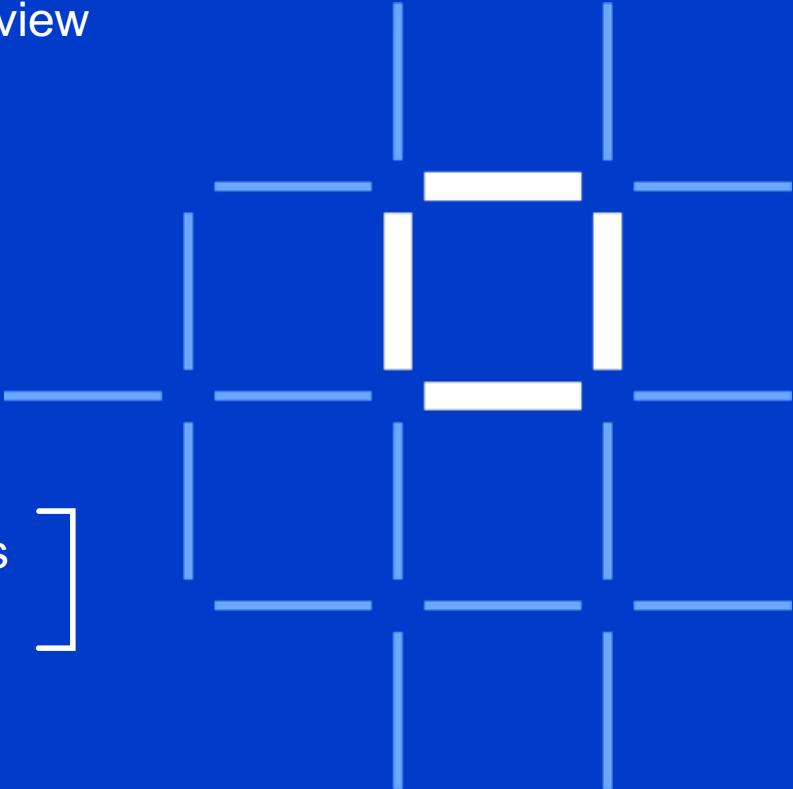
## Network roles and formation

*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	<b>Enterprise Plus Plan</b> <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
	<b>Enterprise Plan</b> <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
	<b>Starter</b> <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	<b>Developer Sandbox</b> <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

2Q18

Forward

## ✓ 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!

## ✓ 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.

## ✓ 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

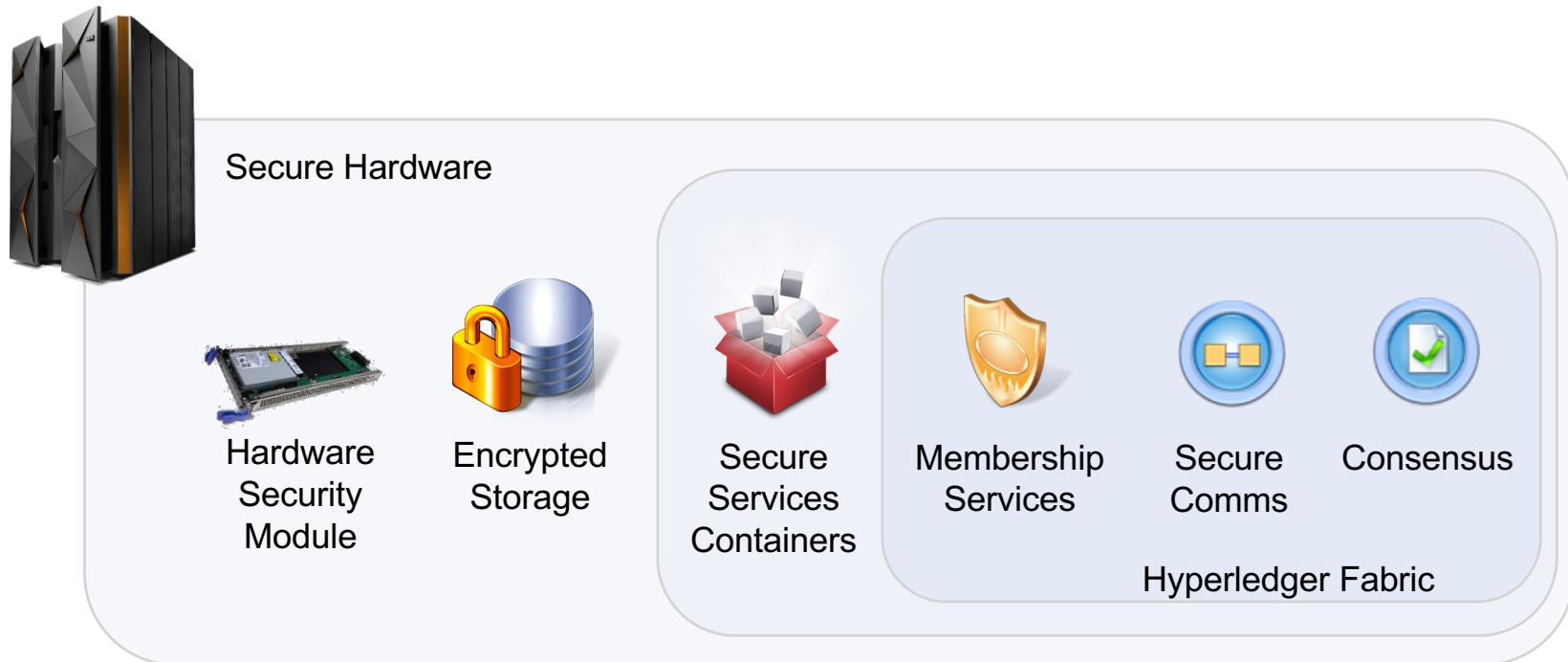
## ✓ Non-disruptive Hyperledger updates

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

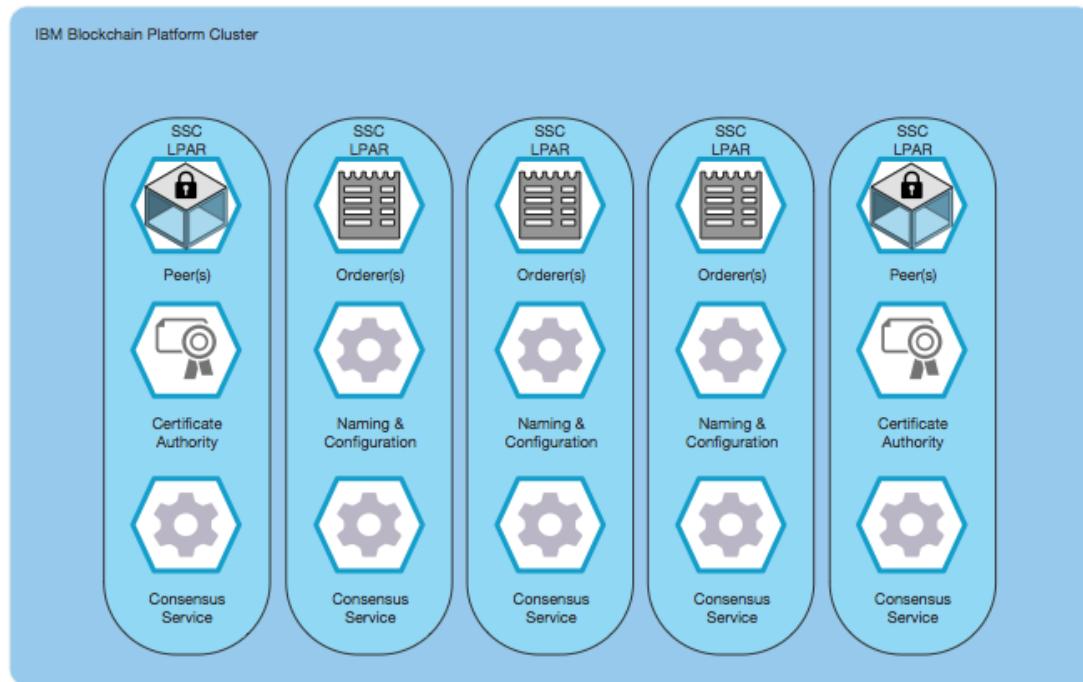


# Security is implemented at each layer of the architecture

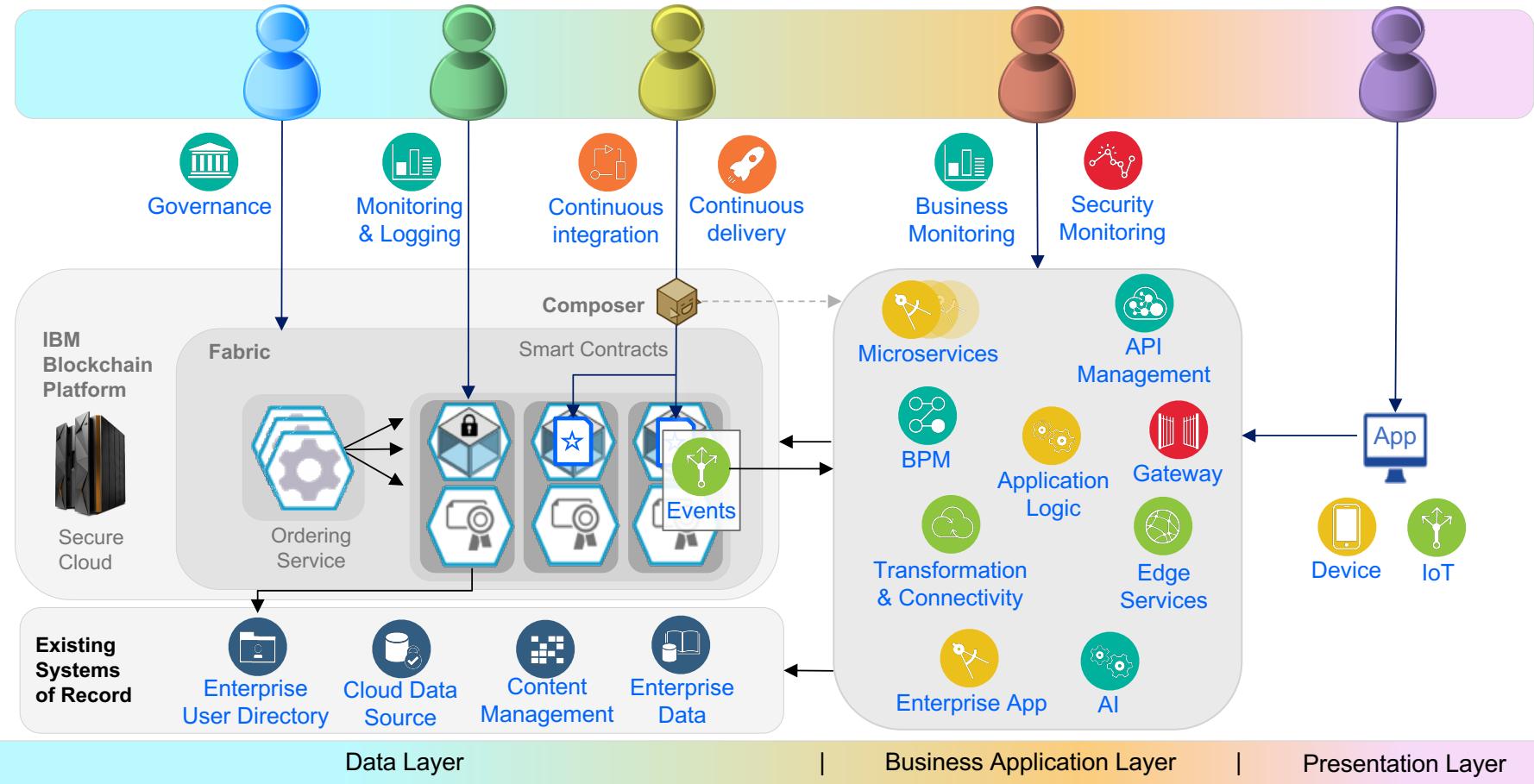
- Hyperledger Fabric
  - Membership Services: Organizations are invited to join and authenticated using an Enrollment Certificate
  - Transaction Consensus: Each transaction is endorsed and validated by multiple peers before committing to the ledger
  - Controlled Ledger Access: Channels restrict transactions 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

# Enterprise Plan Detail: High Availability

- Orderer: Kafka Cluster across 5 LPARs
- Peers: User-defined (at least 2 peers)
- CAs: User-defined based on peer config



# How the architecture fits with enterprise services and processes



# Thank you

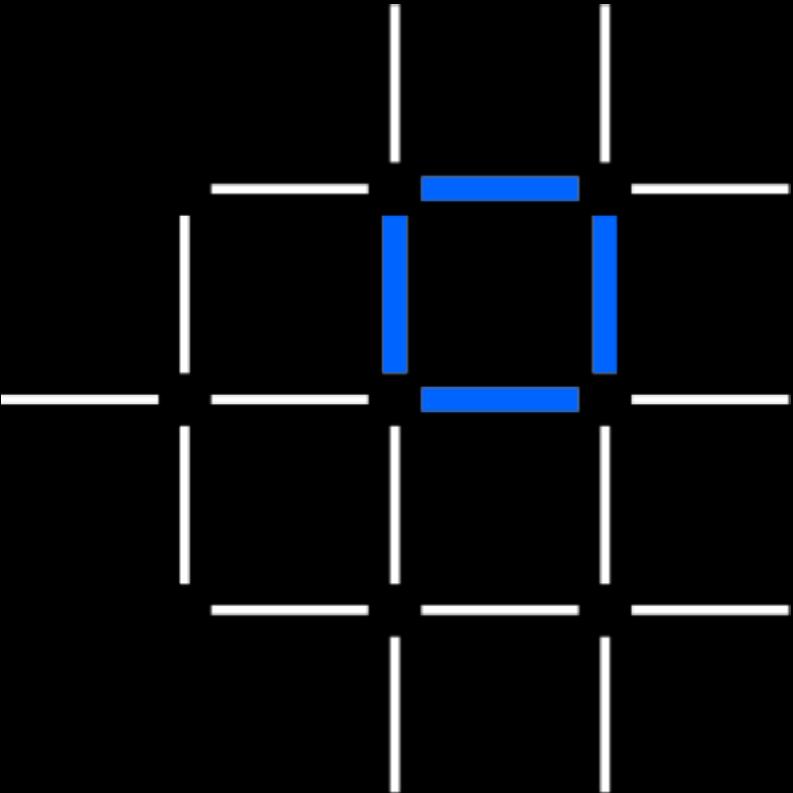
Jin VanStee  
[jinxiong@us.ibm.com](mailto:jinxiong@us.ibm.com)

Questions? Tweet us or  
go to [ibm.com/blockchain](http://ibm.com/blockchain)

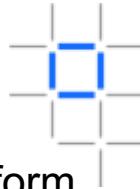
 @IBMBlockchain

 IBM Blockchain

 IBM Blockchain



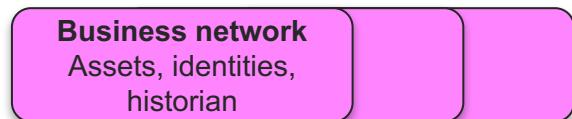
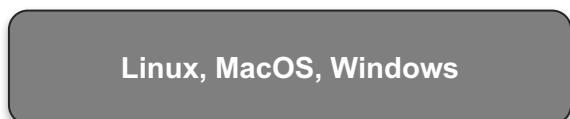
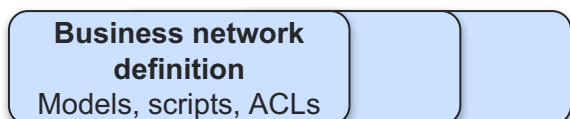
# IBM Blockchain Platform Enterprise Plan (Deployment)



Local/developer

Cloud (IaaS/PaaS)

IBM Blockchain Platform

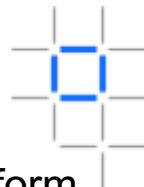


Develops

Deploys to

Starts

# IBM Blockchain Platform Enterprise Plan (Runtime)



Local/developer

Cloud (IaaS/PaaS)

IBM Blockchain Platform

## Client applications

Node.js APIs, LoopBack, REST APIs

Business network definition  
Models, scripts, ACLs

Composer development tools  
Playground, VSCode, Yeoman

Linux, MacOS, Windows

Interacts with

Business network  
Assets, identities, historian

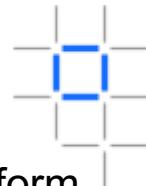
Fabric blockchain network  
Peers, orderers, CAs, CouchDB

IBM Linux ONE  
SSC, HA/DR, HSM

Calls

IBM

# IBM Blockchain Platform Enterprise Plan (Arium)



Local/developer

Vehicle lifecycle business network definition  
Models, scripts, ACLs

Composer development tools  
Playground, VSCode, Yeoman

Linux, MacOS, Windows

IBM Cloud (Container Service)

**Car Builder**  
Mobile application

**Manufacturing**  
Web dashboard

**Arium REST API**  
Composer REST server

Interacts with

IBM Blockchain Platform

**Vehicle lifecycle business network**  
Assets, identities, historian

**Fabric blockchain network**  
Peers, orderers, CAs, CouchDB

**IBM Linux ONE**  
SSC, HA/DR, HSM

Calls



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# 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