

# IBM Blockchain Platform Explained

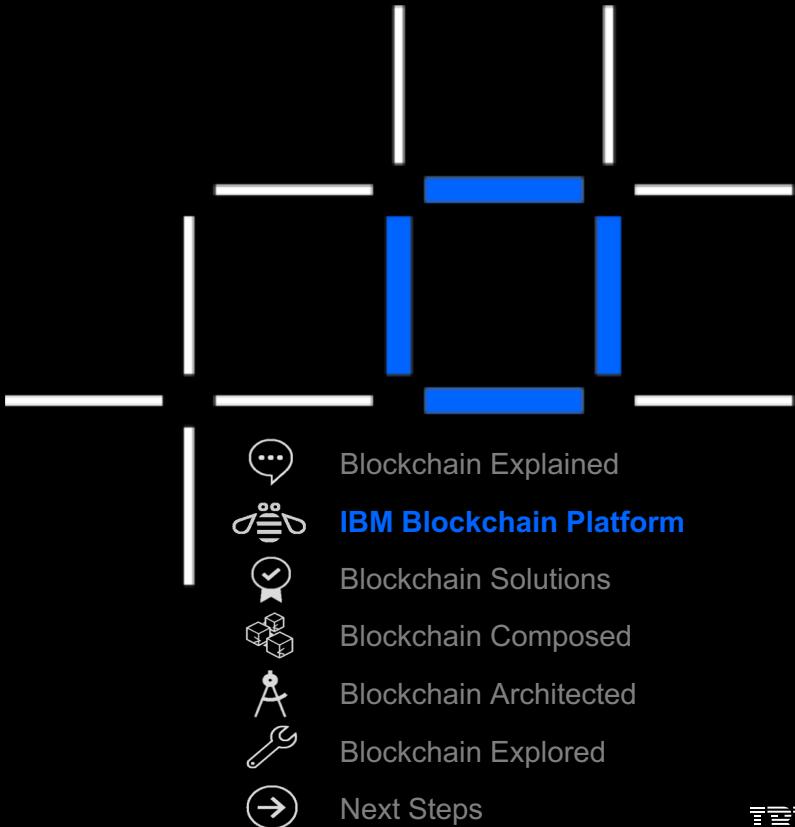
## An Introduction to IBM Blockchain Platform

Austin Grice  
Blockchain  
WSC

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Blockchain and Transformation Leader  
NA Z Tech Sales

V1.08, 3 April 2018

IBM Blockchain



IBM



## IBM Blockchain Platform Overview

*What you need to know*



## Getting Started

*The tools to make your blockchain real*



## Roadmap

*IBM's blockchain strategy and where the platform is going*



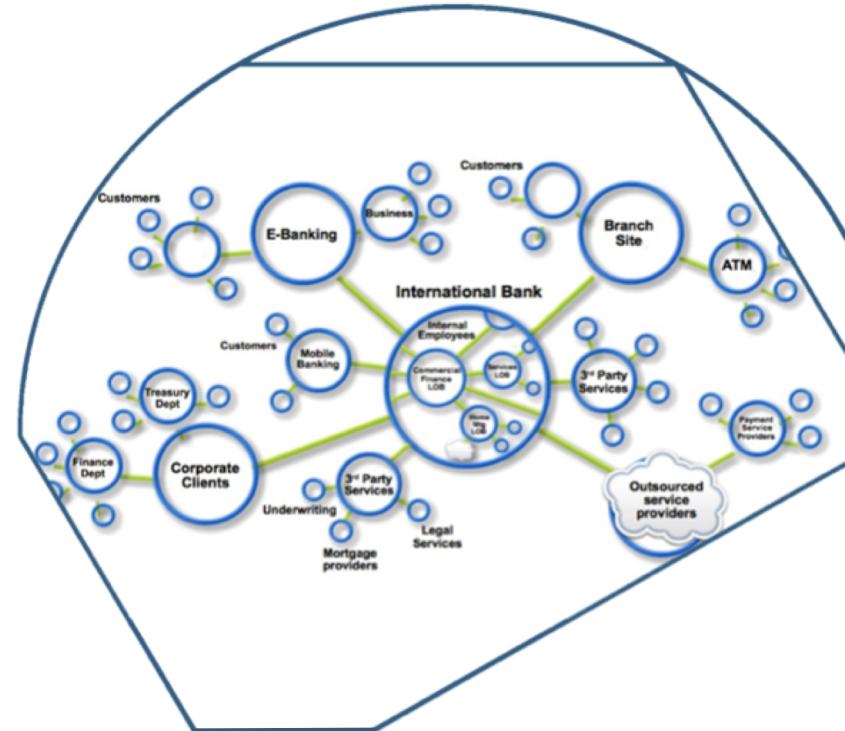
## Technical Details

*The architecture behind IBM Blockchain Platform*

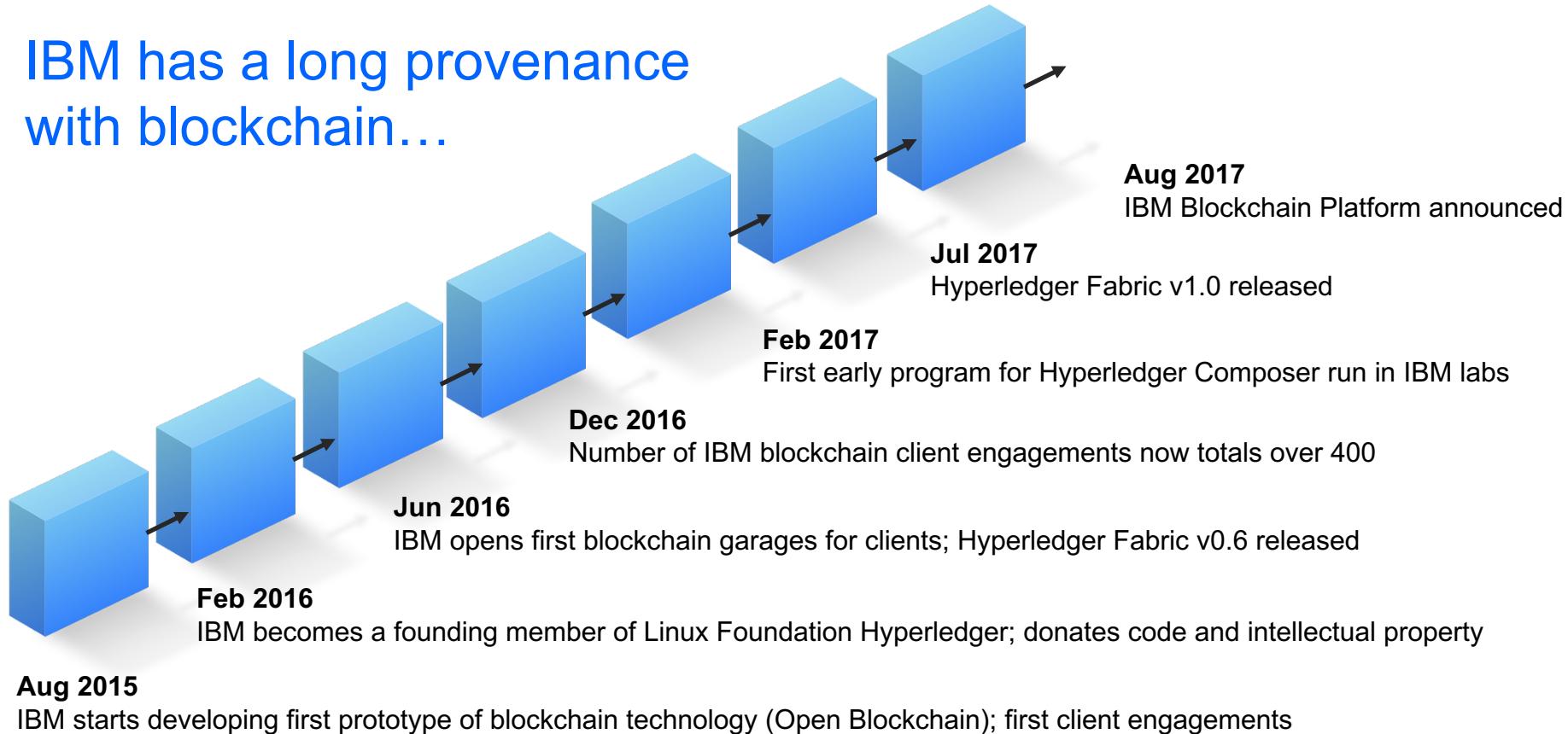


# Blockchain Recap

- 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...

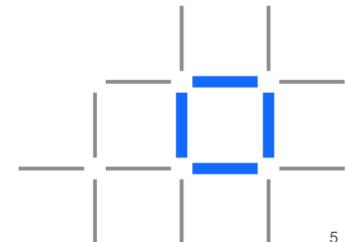
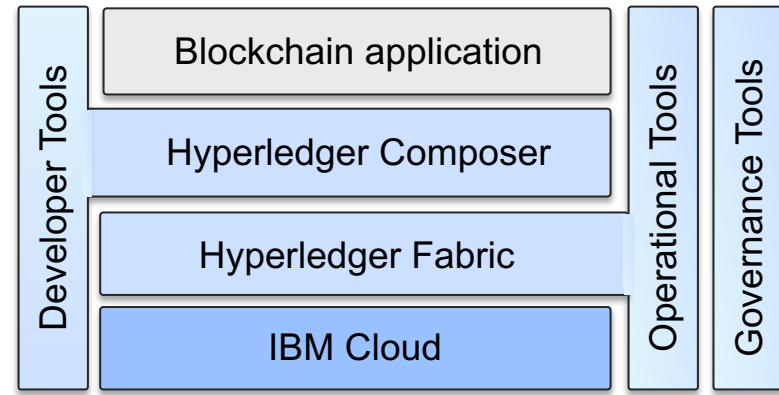


# Introducing the IBM Blockchain Platform

[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

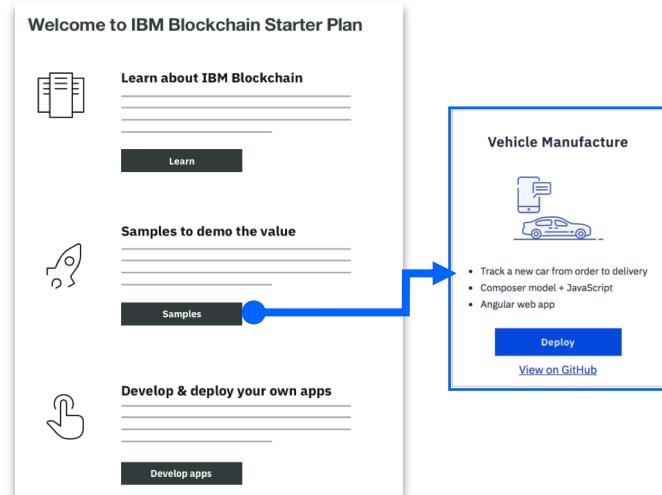
# Flexible pricing plans

| Plan         | Key Features  | Deployment |
|--------------|---|------------|
| Starter      | Easy on-ramp for blockchain-as-a-service  | IBM Cloud  |
| Enterprise   | Production plan for industries comfortable with cloud                                     | IBM Cloud  |
| Enterprise + | Production plan for regulated industries, multi-region HA/DR and highest performance      | IBM Cloud  |
| Support-only | Supported instances of Hyperledger Fabric and Composer running outside IBM Cloud Platform | Docker     |

# Starter Plan

Sign up at  
[www.ibm.com/blockchain](http://www.ibm.com/blockchain)

- Get started with IBM Blockchain Platform with **one-click setup and a fully functional network**
  - Configured for two organizations with one peer each, sample applications and informational tutorials
  - Environment enables iterative development prior to production deployment
  - Same experience as Enterprise
    - Uses SOLO ordering for simplified configuration, development and testing
- Currently in beta, and free until generally available
  - After that time, sign up for 30 day free trial
  - Expected charge: **\$500 per month**
    - Assumes a two organization network
    - Total membership fee \$250, plus per-peer cost of \$125



# Enterprise Plan

- Enterprise Plan is intended for **production or near-production** scenarios
  - Everything in Starter, plus everything you need for a full production environment
  - HSM availability, fault tolerant ordering service, added layers of securing and premium support
  - Single-zone HA/DR
- 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



# Enterprise+ Plan

- Enterprise+ Plan is also intended for **production or near-production** scenarios
  - Everything in Enterprise, plus multi-zone HA/DR and complete data isolation
  - Virtual circuits: VPN access from your data center
- Currently limited availability
  - Contact IBM for pricing information



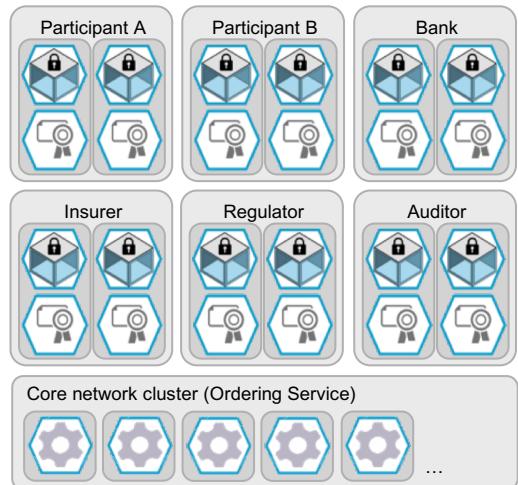
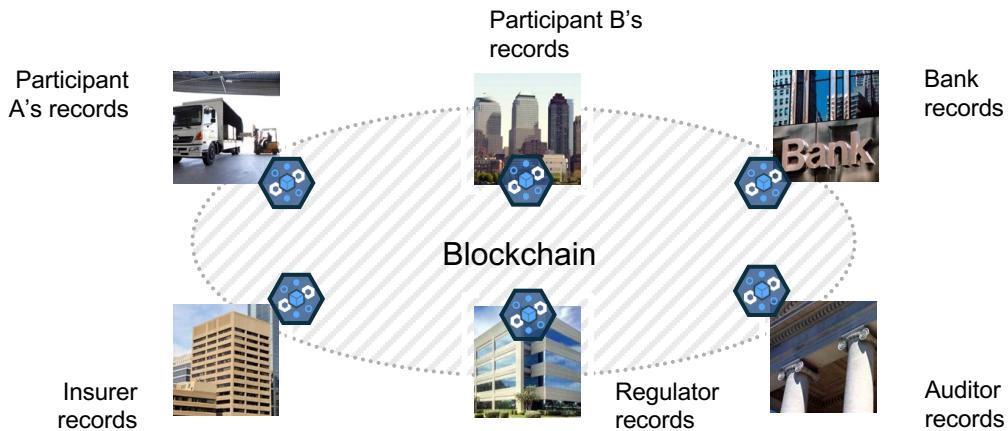
# Support-only Plans

- 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
  - Yearly cost \$24,000 per peer
- **Entry tier (5737-E90/DV13BLL)**
  - Support hours Monday – Friday 8am-5pm local time; response target within 8 business hours
  - Single technical contact
  - Yearly cost \$6,000 per peer

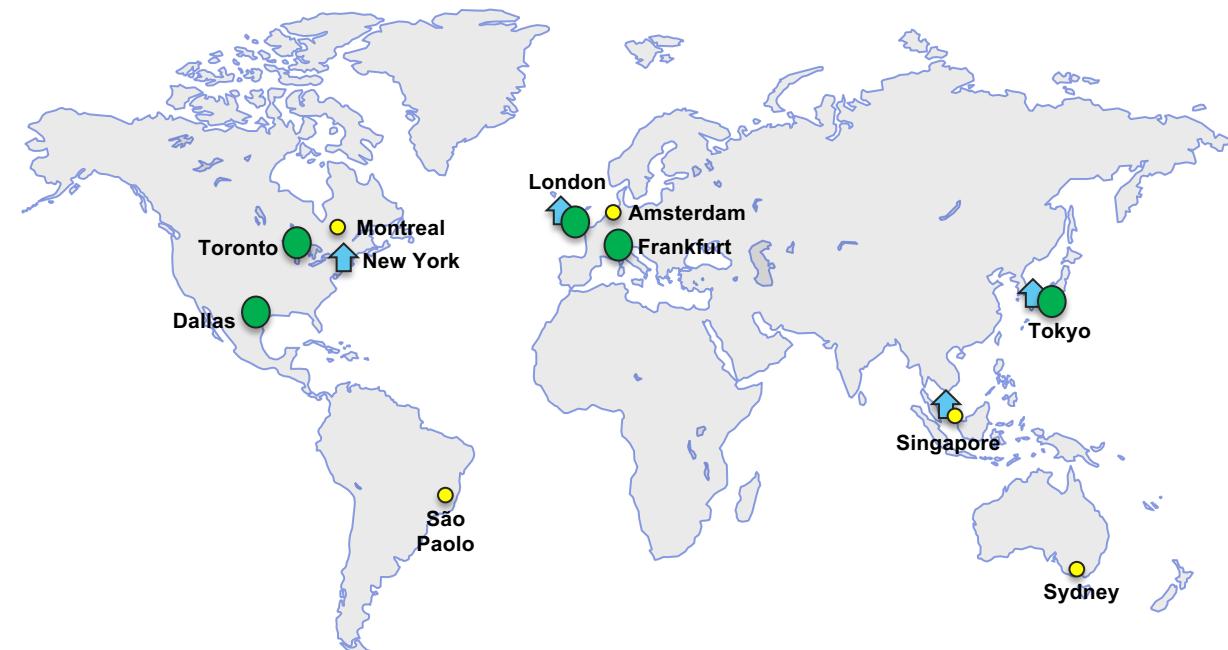


# Example Network

- 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 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 token sharing, asset management, information exchange with Gov., signed document handling, digital vault provision, loyalty programs, and mutual investment clubs.
- A person writing on a wall covered with colorful sticky notes during a workshop.
- A "Business Value Assessment" document for a shipping industry use case, detailing the problem (90% of goods in global trade are carried by the ocean shipping industry each year), 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), shippers and retailers), asset & trust (Need for trust around paperwork associated with a container), and transactions (Supplier prepares to ship, release container to courier, load to ship, clear customs, retailer receipt). It also includes a table comparing benchmarks across Baseline, Phase 1, Phase 2-3, and Blockchain, and a section on Design Points.

- Every business network is different!
- IBM can help you with all stages of your blockchain network, for example:
  - Hands-on workshops
  - Blockchain Value Design
  - 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

*What you need to know*



### Getting Started

*The tools to make your blockchain real*



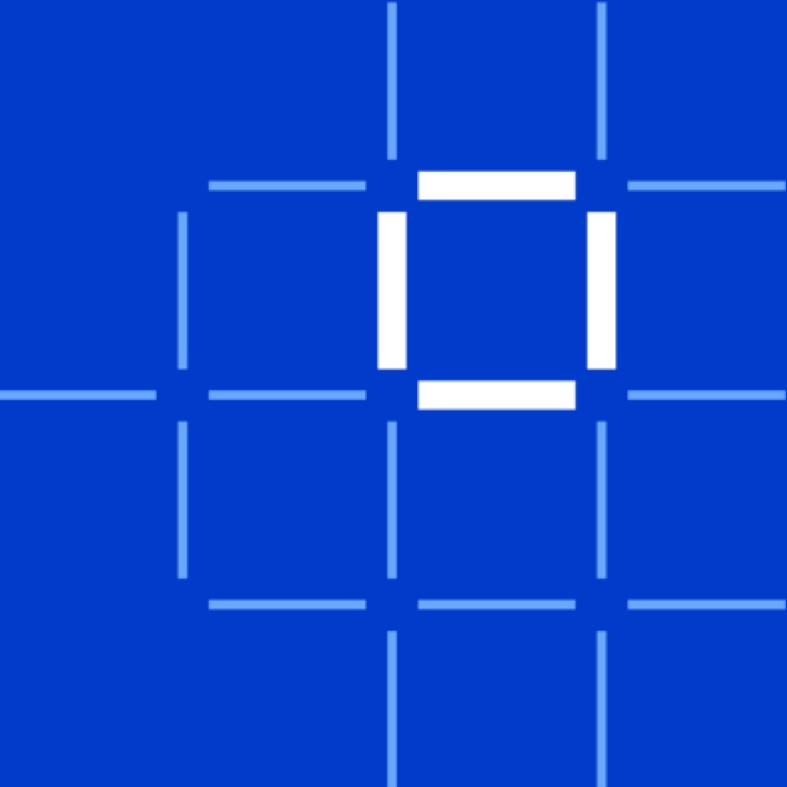
### Roadmap

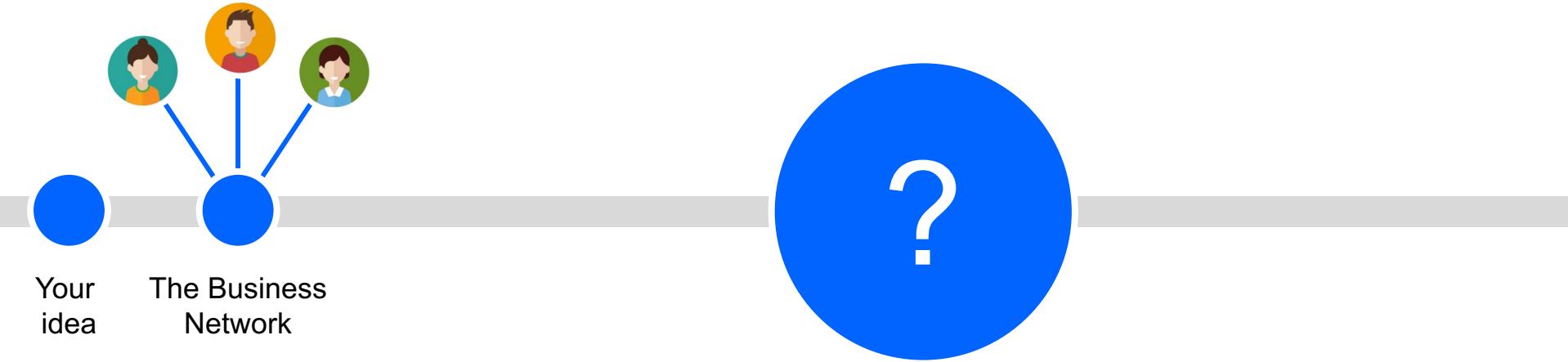
*IBM's blockchain strategy and where the platform is going*



### Technical Details

*The architecture behind IBM Blockchain Platform*





Web energy-network

Define Test

admin

▼

## FILES

## About

README.md

## Model File

models/energy-model.cto

## Script File

lib/business-logic.js

## Access Control

permissions.acl

+ Add a file...

Model, Build  
and Code33  
34 };

## Script File lib/business-logic.js



```
16  * Records the energy usage reading for a given household
17  * @param {com.energy.RecordEnergyReadingTX} tx the energy transaction instance
18  * @transaction
19  */
20  function recordEnergyReading(tx) {
21
22      // Get the asset registry for the energy readings.
23      return getAssetRegistry('com.energy.EnergyReading')
24          .then(function (assetRegistry) {
25              // Put the energy reading in the asset registry
26              return assetRegistry.add(tx.energyReading);
27          })
28          .then(function () {
29              // Emit an event when the ledger is updated
30              var event = getFactory().newEvent('com.energy', 'NewReadingEvent');
31              event.energyReading = tx.energyReading;
32              emit(event);
33
34      });
35  }
```

Your  
ideaThe Business  
Network

Develop

[Overview](#)[Members](#)[Channels](#)[Notifications](#)[APIs](#)[MY CODE](#)[Write code](#)[Install code](#)[Try samples](#)

## Lets get started!

Choose an option to begin your blockchain journey.



### Learn about the platform

Read tutorials and break down blockchain terminology to build your knowledge.

[Learn more](#)

### Deploy sample apps

Explore sample applications and learn how blockchain code is running on the platform.



### Get started with tips

[View samples](#)

### Start deploy your app

Install the developer tools, use them to create your own apps, and then deploy them to the platform.

[Develop apps](#)[X](#)[Connection Profile](#)[+ Add Peers](#)

### ACTIONS



Your idea

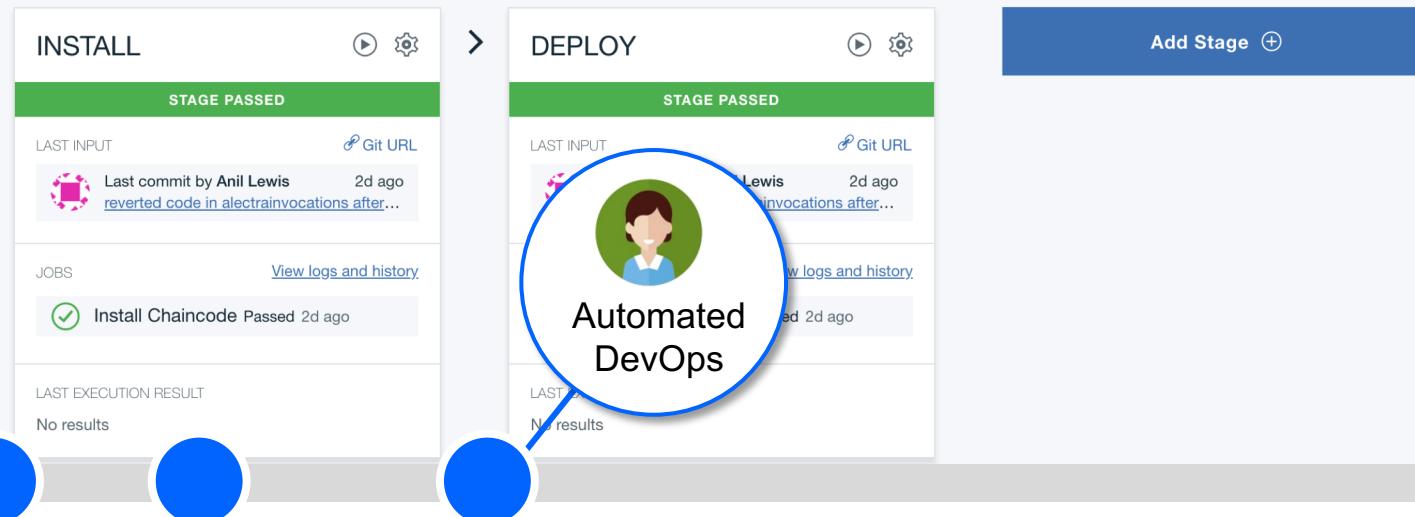


The Business Network

# Develop

Toolchains / energy-bc-toolchain... / energy-bc-chaincode-build-20180306150859885

## energy-bc-chaincode-build-20180306150859885 | Delivery Pipeline



Your idea

The Business Network

Develop

TLS networks LTD. ▾

MY NETWORK

Overview

Members

Channels

Notifications

APIs

MY CODE

Write code

Install code

Try samples



Your idea

The Business Network

Develop

Govern

# Members

View and manage  
the organizations  
that you own by

Members

MEMBERS (1)

Company A  
mdgallo@usCompany B  
mdgallo@usKayla  
kdwhite@usKayla  
kdwhite@usRick  
rlarose@us.i

## Invite member



Organizations in addition to the two organizations  
you're currently managing.

### Select a member for your network

#### Invite a member

Invite other organizations to join your network. Invited members will receive an email invitation with instructions to join your network and set up their own peers.

#### Add a member

Add a new organization to simulate multi-organization scenarios on your own. You can switch between your organizations to operate the network in the Network Monitor.

Organization Name

Enter (member)



## Add new members

Operator Email

Enter email

Add a note

Write a message to

+ Invite Members

ACTION

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ding

ding

# Request a new channel

Complete the steps to request a new channel. After the request is submitted, the invited members will be notified and vote for the request.

## 03. Review channel update policy

Define the policy to update the channel.

### Policy

How many operators need to accept the request to update the channel?

| Company   | Email              |
|-----------|--------------------|
| Company A | kdwhite@us.ibm.com |
| Company B | kdwhite@us.ibm.com |
| Kayla Co  | kdwhite@us.ibm.com |

Select

- 1 (Any)
- 2 (Majority)

Cancel Back Submit Request



Your idea

The Business Network

Develop

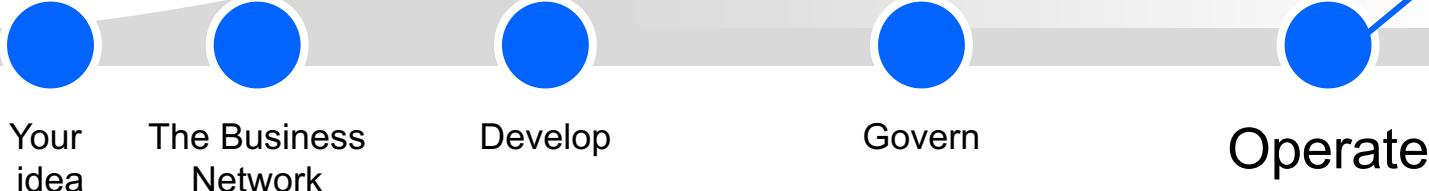
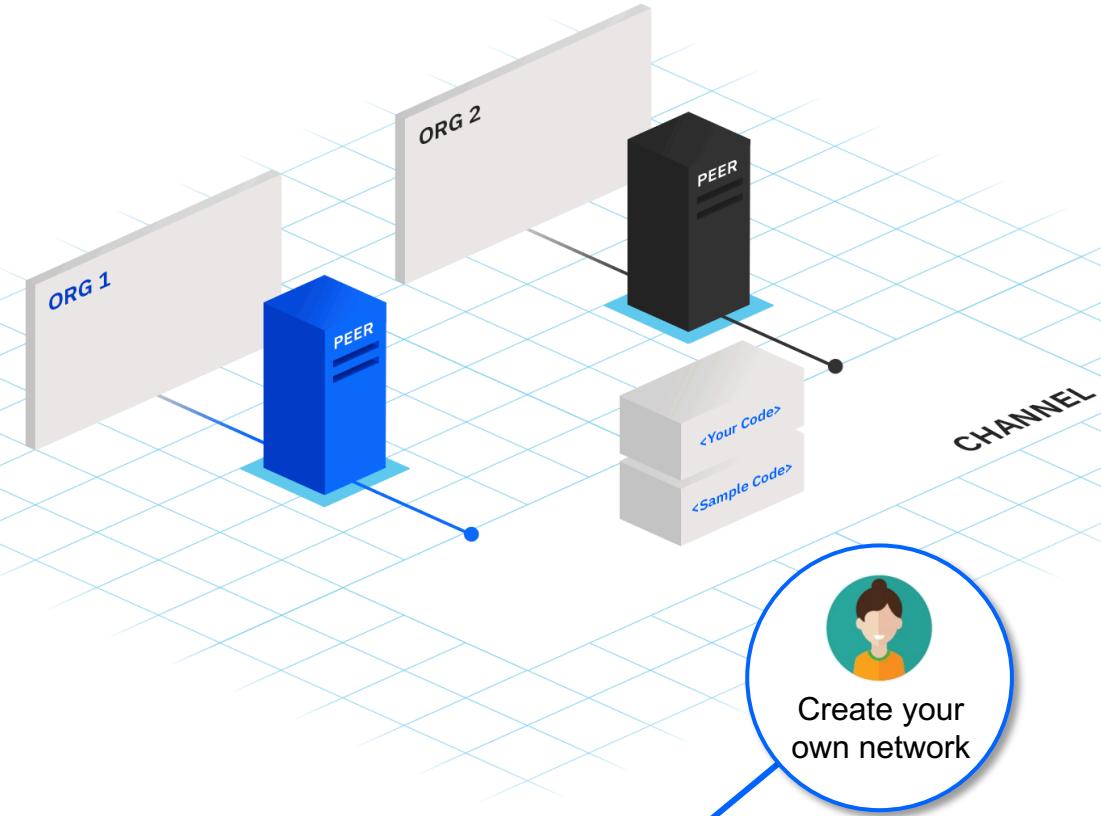
Govern

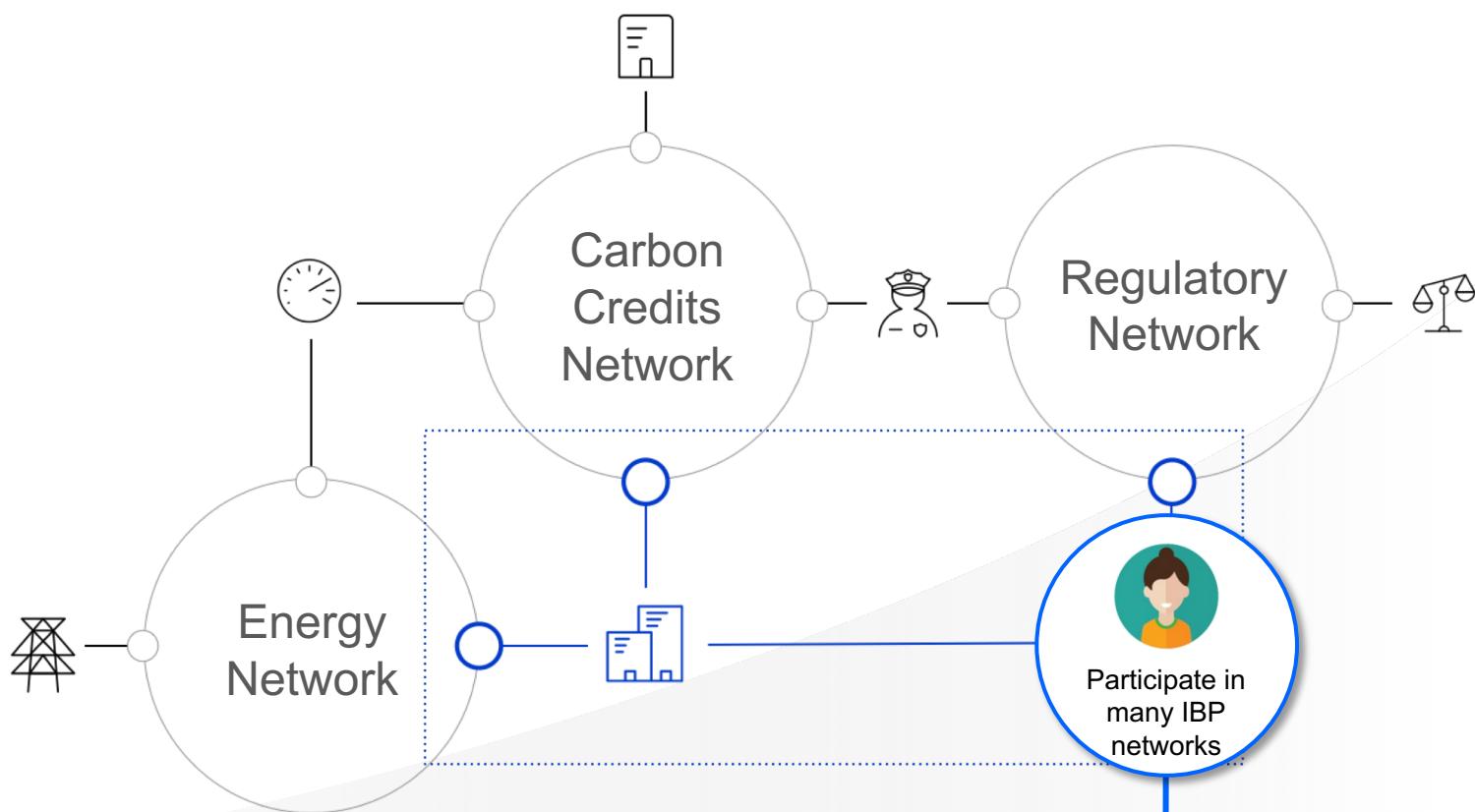
# Network created!

Your Starter Plan network has two organizations, each with its own peer.

With this network you can test chaincode, deploy samples, and invite other members to collaborate.

Launch





Your  
idea

The Business  
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Develop

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Operate



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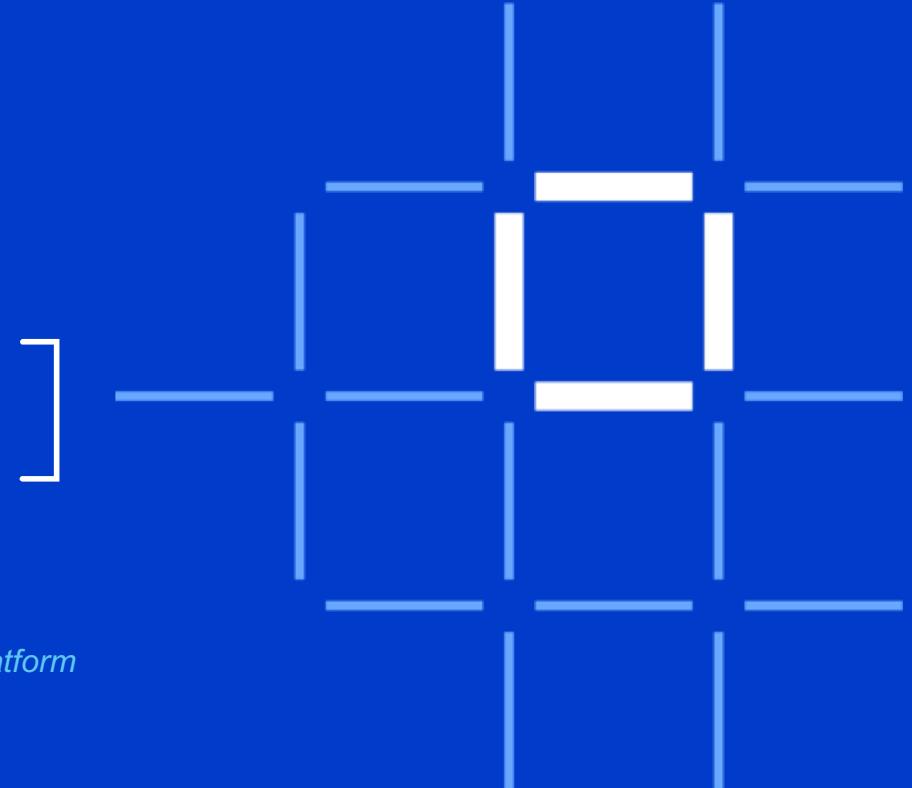
## Roadmap

*IBM's blockchain strategy and where the platform is going*



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*The architecture behind IBM Blockchain Platform*



# 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

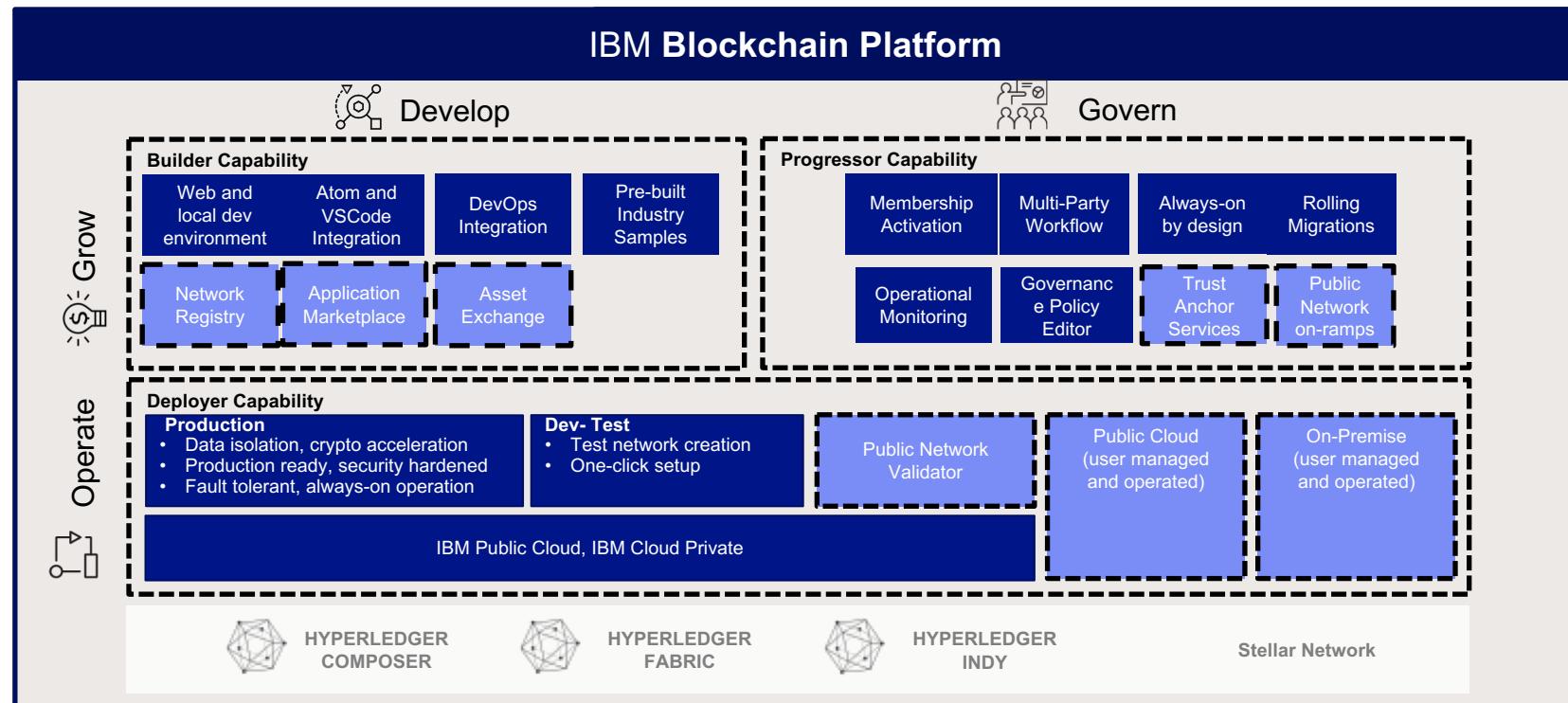
# IBM Blockchain Platform

## Solutions

Food Trust, universal payments, Global Trade Digitization, Identity, etc...

## IBM Extensions

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



# Hyperledger Fabric and Composer Roadmap (Linux Foundation)

|          | Q1  | Q2   | Q3  | Q4   |
|----------|---|--|---|--|
| Fabric   | <p><b>1.1 release</b></p> <ul style="list-style-type: none"><li>• JS Chaincode</li><li>• Channel events</li><li>• CouchDB indexes</li><li>• CRL</li><li>• Mutual TLS</li><li>• Connection profiles</li><li>• Performance and scale improvements</li><li>• Experimental: SideDB, fine-grained, access control etc.</li></ul> | <p><b>1.2 release</b></p> <ul style="list-style-type: none"><li>• UX improvements</li><li>• Technical debt</li><li>• Experimental from 1.1</li><li>• Native asset model</li><li>• Pluggable transaction mode</li><li>• State-based ownership</li><li>• Flexible policies for chain code governance</li><li>• Private transactions with SideDB</li><li>• Service Discovery</li><li>• Identity Mixer</li></ul> | <p><b>1.3 release</b></p> <ul style="list-style-type: none"><li>• Zero Knowledge Proof (confidential transactions)</li><li>• RAFT consensus</li><li>• Experimental: BFP consensus</li></ul> | <p><b>1.4 release</b></p> <ul style="list-style-type: none"><li>• TBD</li></ul>                        |
| Composer | <p><b>0.18 release</b></p> <ul style="list-style-type: none"><li>• Hyperledger Fabric JS Chaincode integration</li><li>• Cloud storage for network identities</li><li>• HSM support</li><li>• Enhanced data collection</li><li>• Application generator capability</li></ul>   | <p><b>1.0 release</b></p> <ul style="list-style-type: none"><li>• Standalone test tool</li><li>• Additional industry samples</li><li>• Integrated documentation</li></ul>  | <p><b>1.1 release</b></p> <ul style="list-style-type: none"><li>• Enhanced transaction processing function</li><li>• Onboarding and secure document store integrations</li></ul>            | <p><b>1.2 release</b></p> <ul style="list-style-type: none"><li>• Public network integration</li></ul> |

# IBM Blockchain Platform Roadmap

| Q1   | Q2   | Q3  | Q4 |
|--|--|---|----|
| <ul style="list-style-type: none"><li><b>Starter plan- beta</b><ul style="list-style-type: none"><li>Ideal for getting started with IBM Blockchain</li><li>Running Fabric 1.1 with CouchDB and Composer</li><li>Offered on IBM Cloud</li></ul></li><li><b>Continued Enterprise Availability</b></li><li><b>Enterprise+ Plan (limited availability)</b><ul style="list-style-type: none"><li>Highest levels of security, isolation and disaster recovery for regulated industries</li></ul></li><li><b>Smart contracts and analytics tech preview</b><ul style="list-style-type: none"><li>Get insights from the ledger</li></ul></li></ul> | <ul style="list-style-type: none"><li><b>Enterprise support for Fabric V1.1 with CouchDB and Composer</b></li><li><b>IBM Blockchain Platform with IBM Cloud Private Beta</b></li><li><b>Enterprise+ GA</b></li><li><b>Industry samples and templates</b> for financial services, supply chain and energy and utilities</li></ul> | <ul style="list-style-type: none"><li><b>On ramps for public blockchain networks</b> (first Stellar and then Hyperledger Indy)</li><li><b>Network Registry</b><ul style="list-style-type: none"><li>Find and join other blockchain networks</li></ul></li><li><b>Asset marketplace</b><ul style="list-style-type: none"><li>Use APIs, templates and other applications to accelerate your blockchain project</li></ul></li><li><b>IBM Blockchain Platform with IBM Cloud Private GA</b></li><li><b>Multi-site Disaster Recovery</b></li><li><b>Zero knowledge proofs, SideDB and token capabilities</b></li><li><b>Global blockchain footprint expanding to 20+ data centers</b><ul style="list-style-type: none"><li>IBP certified to ISO27001 industry standard compliance, SOC2 Type2 and HIPAA planned for 2H18</li></ul></li></ul> |    |

# Blockchain Network Finder

[SIGN UP / LOG IN](#)[RESERVE NETWORK](#)

## Industry

### All Categories

- Accommodation and Food Services
- Admin. and Support
- Agriculture
- Arts (Entertainment and Recreation)
- Construction
- Educational Services
- Energy
- Finance and Insurance
- Healthcare
- Identity Management
- IoT - Asset Tracking
- IoT - Healthcare
- IoT - Location Based Services
- Management of Companies and Enterprises
- Manufacturing
- Media
- Mining and Oil and Gas Extraction
- Non-Profit
- Real Estate
- Real Estate Rental and Leasing
- Record Management
- Retail Trade
- Supply Chain Management
- Transportation and Warehousing
- Utilities
- Voting
- Waste Mgmt. and Remediation Services

 Search

A B C E F G J M N O S V W Y {

| Name                                     | Industry  | Summary  | Peers | Created Date               |
|--|---|--|-------|----------------------------|
| {{2+9}}                                  |   |  | 3     | December 4th 2017, 4:21 AM |
| <b>artsexpo</b><br>Canada                | Non-Profit  |  | 1     | March 7th 2018, 2:41 AM    |
| <b>besthouse</b><br>China                | Real Estate, Real Estate Rental and Leasing           |  | 2     | November 1st 2017, 9:48 AM |
| <b>coffeeshopschain</b><br>United States | Retail Trade, Supply Chain Management                 | This is the main chain for updates regarding Coffeeshops in the US - look here for updates, deals, promotions, branches... | 3     | January 4th 2018, 11:53 AM |
| <b>ecodisposal</b><br>USA                | Waste Mgmt. and Remediation Services                  |  | 4     | November 1st 2017, 9:52 AM |
| <b>ewewde</b>                            |   | ВИСИВСИВСИВС   | 3     | March 7th 2018, 12:12 AM   |
| <b>fishmarket</b>                        | Agriculture, Supply Chain Management, Wholesale Trade | This is a Fish Market blockchain   | 3     | March 6th 2018, 7:41 AM    |
| <b>friendsid</b>                         |   |  | 2     | November 1st 2017, 8:42 AM |
| <b>garicoin</b>                          |   |  |       | November 1st 2017,         |

Discover  
other  
networks



Your  
idea

The Business  
Network



Develop



Govern



Operate



Grow

# Blockchain Asset Marketplace

[SIGN UP / LOG IN](#)[PUBLISH ASSETS](#)

## Carbon Credit Model

v3.4

Type: Composer model

Added by: Organization

Used in: 3057 networks

[TRY NOW](#)[BUY NOW](#)

## Simple Supply Chain

v5.3.6

Type: Composer model

Added by: OrganizationA

Used in: 208 networks

[TRY NOW](#)[BUY NOW](#)

## Bilateral Config

v1.2

Type: Network template

Added by: OrganizationB

Used in: 12 networks

[TRY NOW](#)[BUY NOW](#)

Asset  
marketplace



Your  
idea



The Business  
Network



Develop



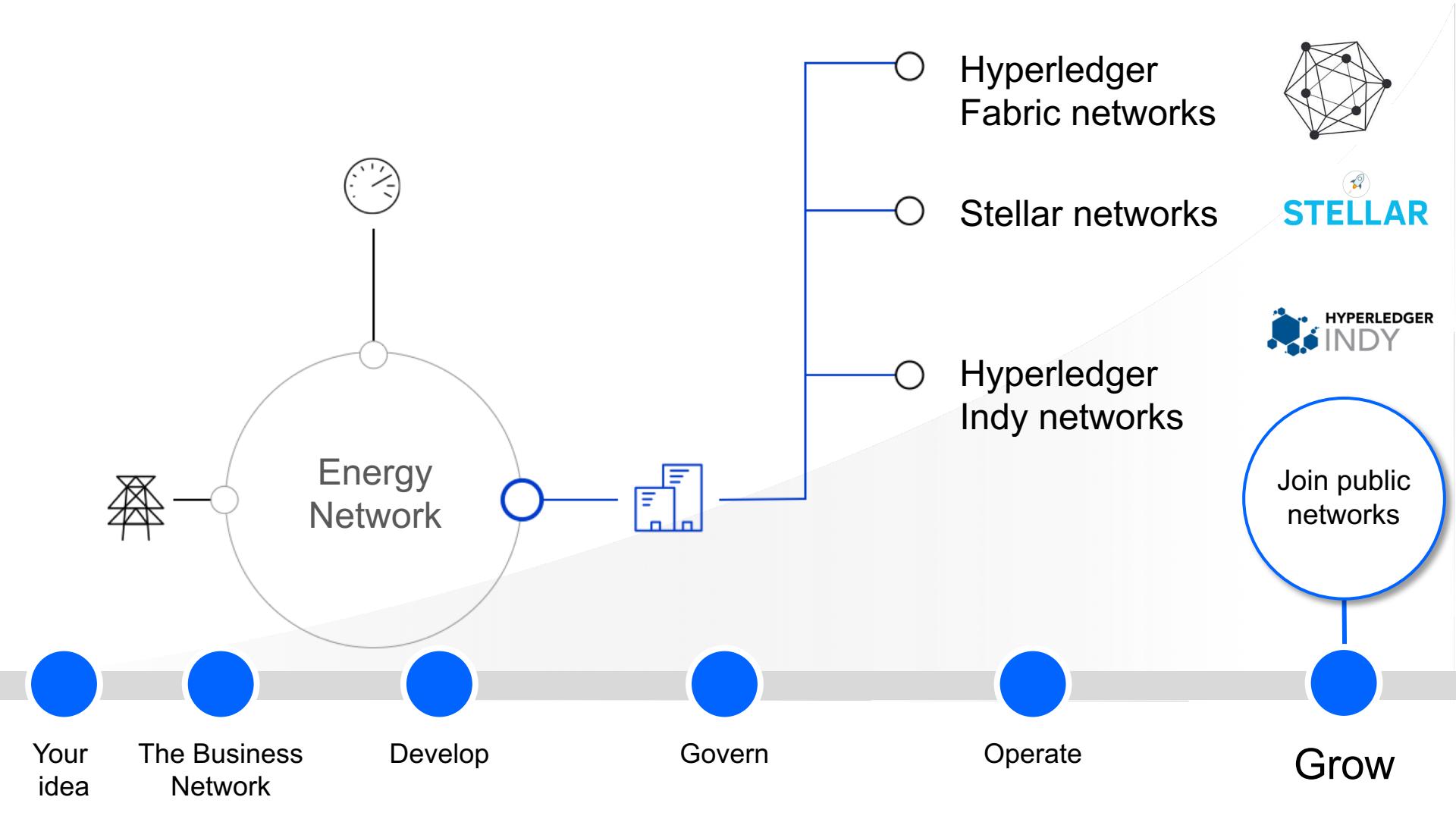
Govern



Operate



Grow





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*What you need to know*



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*The tools to make your blockchain real*



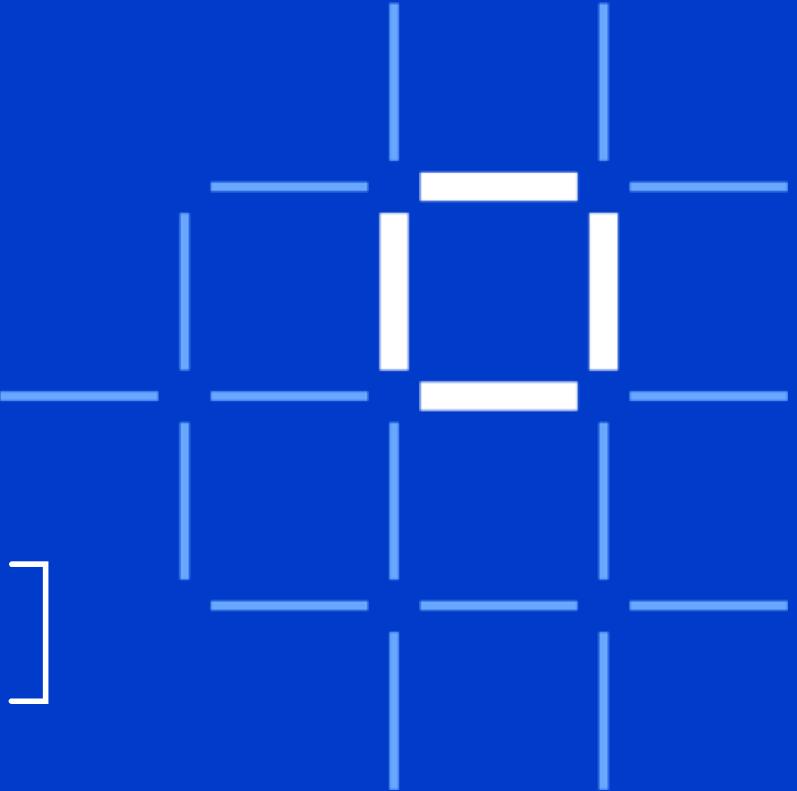
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*The architecture behind IBM Blockchain Platform*



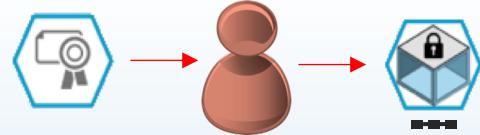
# Blockchain Technical Concepts



**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

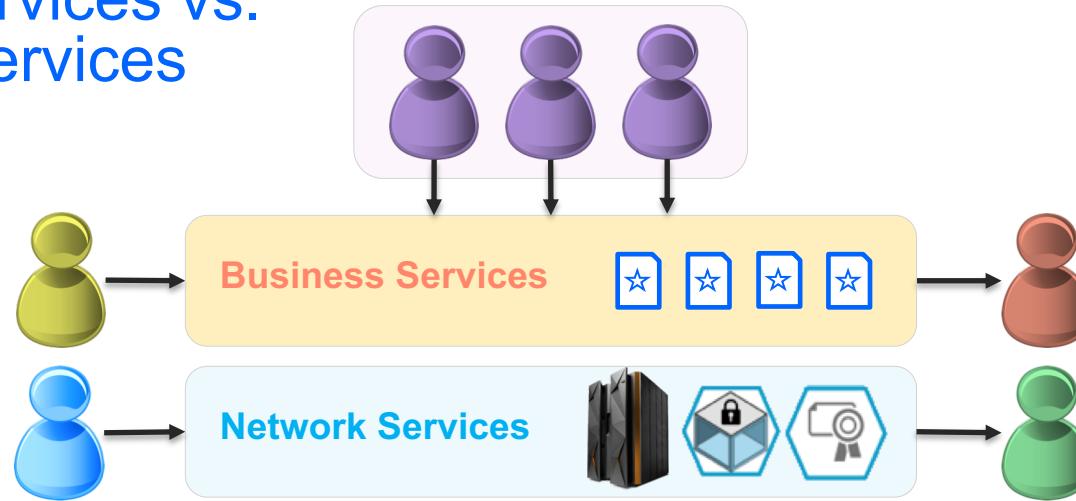


**Consensus** is the process by which agreement is obtained on the peer network



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

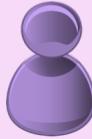
# Network Services vs. Business Services



- 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

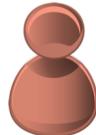
(A single organization may play multiple roles!)



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

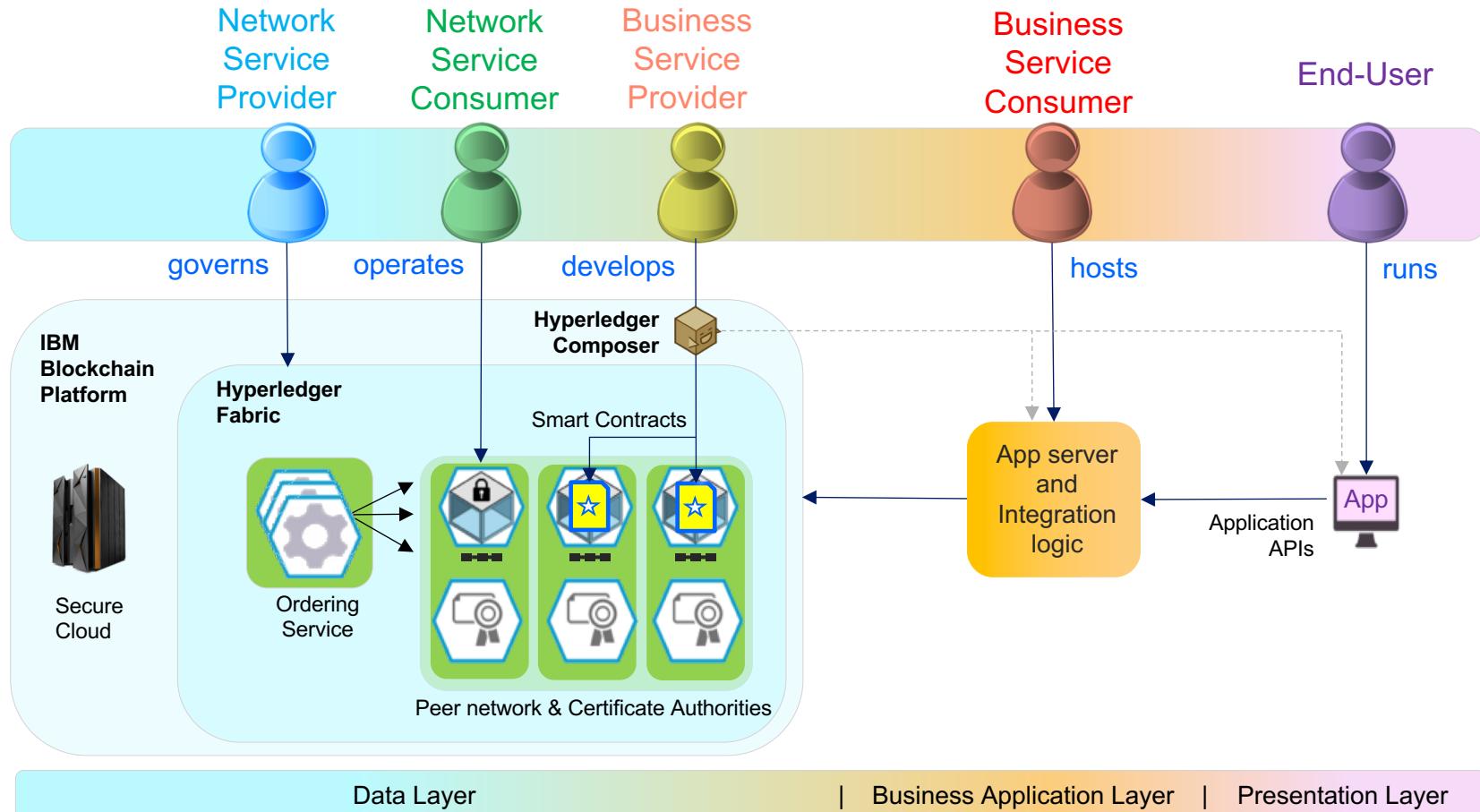


**Network Service Consumer** **operates** a set of peers and certificate authorities on the network; represents an organization on the business network



**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



The screenshot shows the 'Create Network' process. On the left, a sidebar lists steps: 'Let's Get Started' (selected), 'Invite Members', 'Define Governance Rules', 'Review Summary', and 'Network Created'. The main area is titled 'Let's Get Started' with a sub-section 'Start by giving your network a name'. It includes fields for 'Name' (required) and 'Location' (set to 'Toronto'). Below these are sections for 'Institution Name' (required) and 'Description' (optional). A note at the bottom explains the next steps: '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 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 screenshot displays two overlapping UI components. The top component is titled 'Create a new channel request' and contains a sub-step '03. Review channel update policy'. It asks 'Set this channel's update policy' and shows a dropdown for 'Policy' set to '1' (of 1 operator). The bottom component is titled 'Notifications' and shows a list of action items: 'All (1)', 'Pending (0)', and 'Completed (1)'. A search bar is above the list, which includes columns for 'NAME', 'DATE UPDATED', and 'STATUS'. One item is listed: 'Channel Request Join "channel-a"' by 'IBMorg1' on '14 August, 2017 - 10:16:14 AM' with a status 'Vote Accepted'. At the bottom right are buttons for '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*



The screenshot shows the main dashboard of the IBM Blockchain Platform. On the left, a sidebar lists navigation options: Network, Your blockchain network (selected), Overview, Members, Channels (highlighted in teal), Chaincode, Notifications, and Support. The main area displays 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 the progression of blocks over time, with a specific point labeled '08/14/17 12:16 GMT+0800'. The overall interface is clean and modern, using a dark grey background for the sidebar and light grey for 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)

| 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*

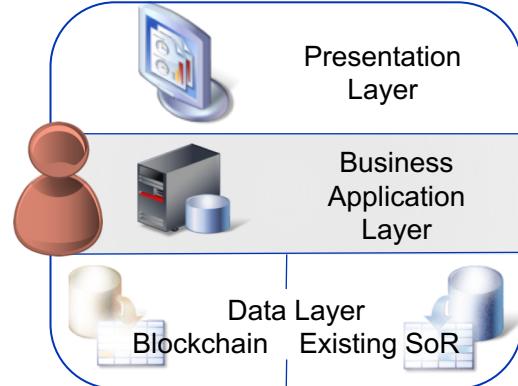


- A blockchain application consists of three components:
    - **Smart contracts**: transaction logic run on the distributed peer network (e.g. Composer BNA file)
    - **Business logic**: business applications and integration services that invoke smart contracts
    - **Presentation logic**: client 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 from the right side.
- **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

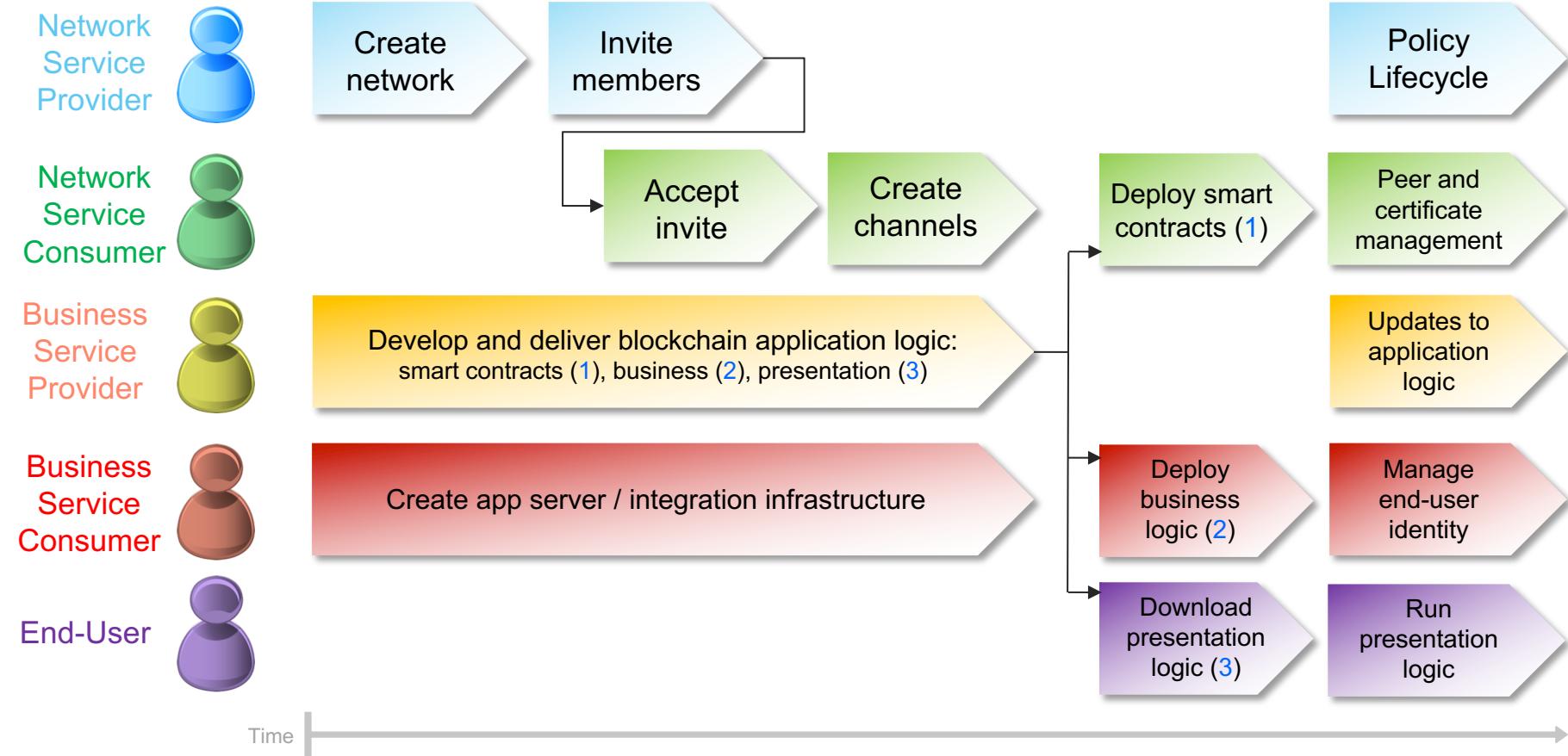
*Exchange trustworthy information*



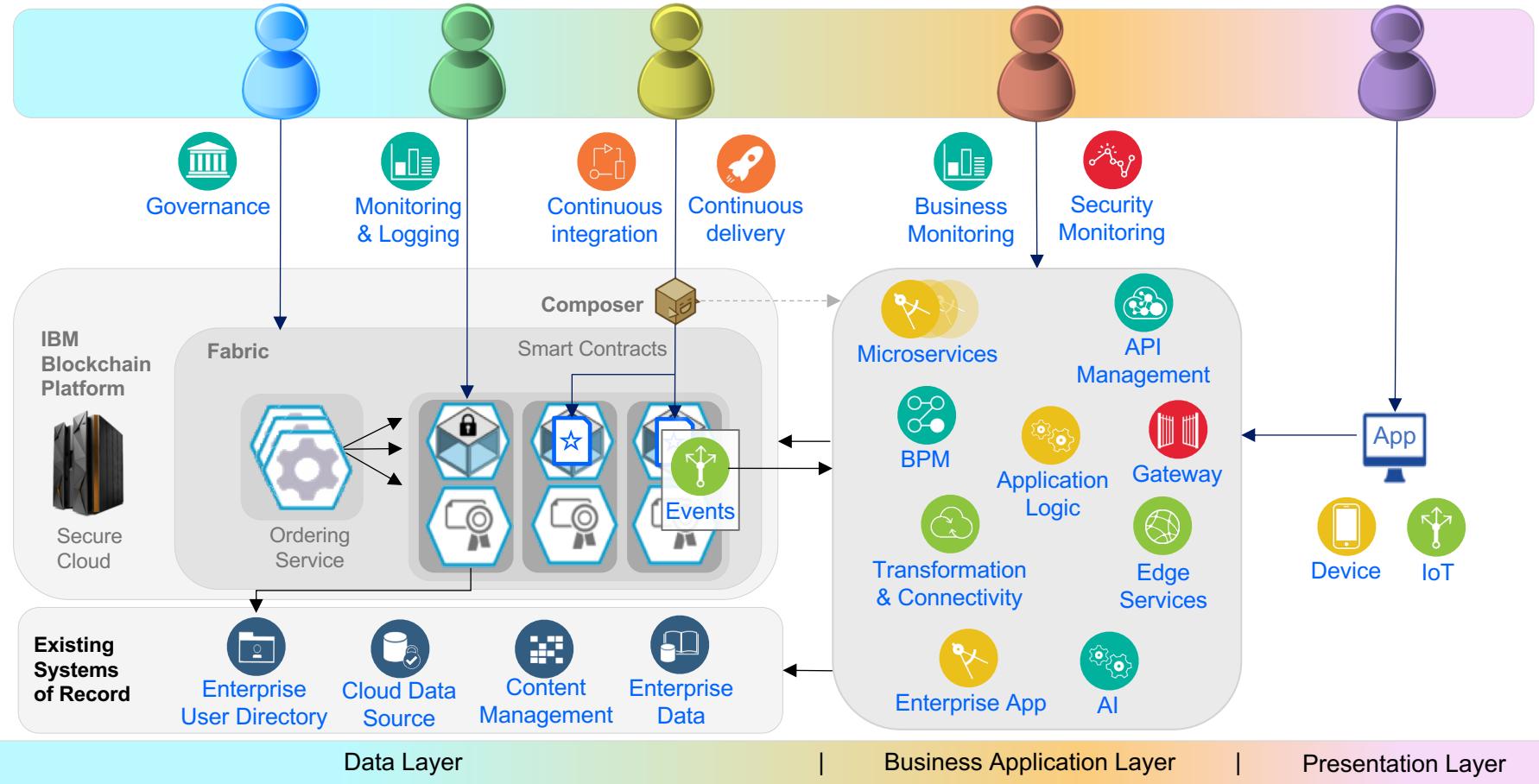
- End-users run presentation logic on an appropriate device
  - For example, mobile application or desktop dashboard
  - There may be multiple end-user applications (often one per organization or user role)
- The value proposition to end-users is that the information they see is **trustworthy**
  - Will 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

The screenshot displays a web-based application titled "FOOD SAFETY & TRACEABILITY on Blockchain". On the left, there's a search interface with dropdown menus for "Which product would you like to trace?" (Strawberry), "What would you like to trace with?" (Supplier Product Code on the package), and "Please enter the supplier product code" (OU00103). Below these fields, it says "OU00103 was produced on 05-04-2017. Here are the products using OU00103 code: Cut Strawberry Mix Sell by 05-09-2017". To the right of the search is a map of Central America, specifically showing Mexico, the Gulf of California, and parts of Guatemala and Chiapas. A yellow box highlights the state of Oaxaca in Mexico. Below the map is a timeline with icons for Orchard, Packing House, Importer, Facility, Retailer DC, and Retailer Store. The timeline shows the following sequence: Orchard (2), Packing House (1), Importer (1), Facility (1), Retailer DC (1), and Retailer Store (2). Above the timeline, there are buttons for "Trace", "View Certificates", and "Sign out".

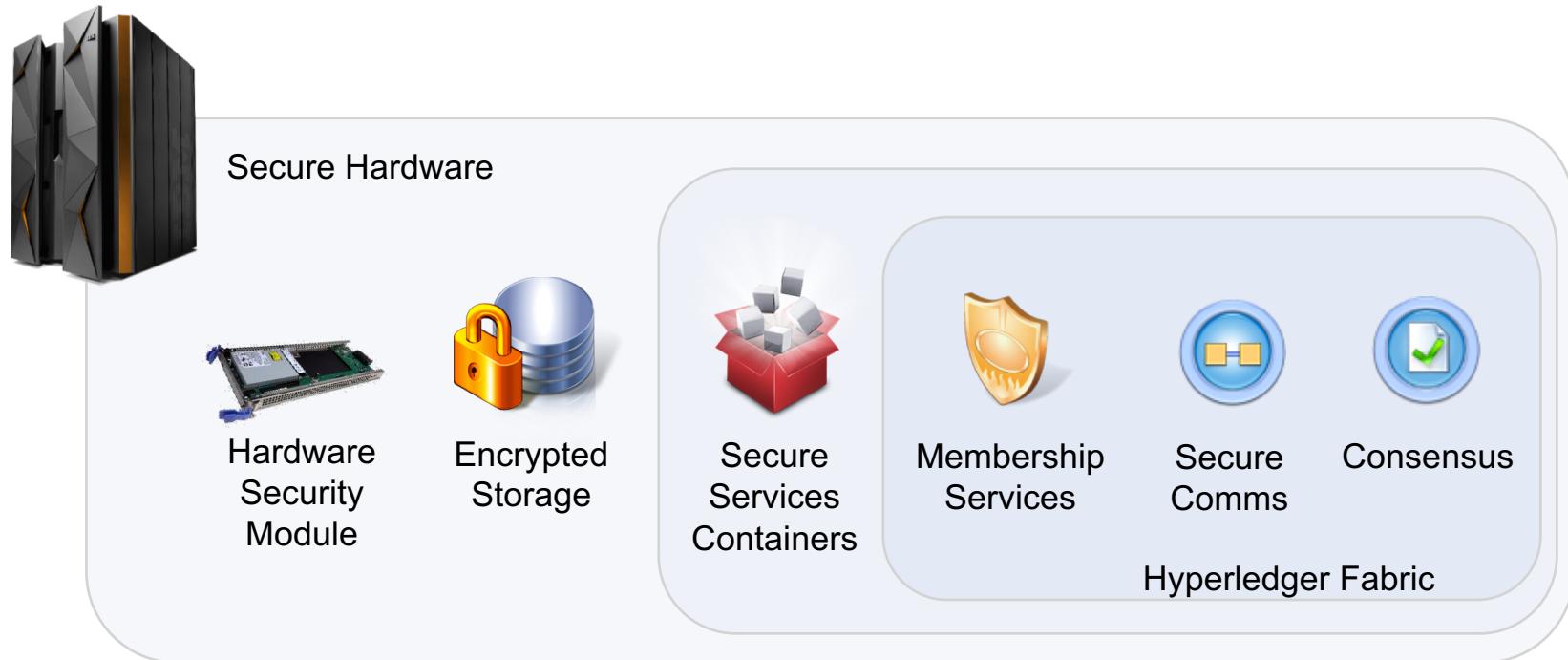
# Workflow for Network Formation



# How the architecture fits with enterprise services and processes



# 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

# 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

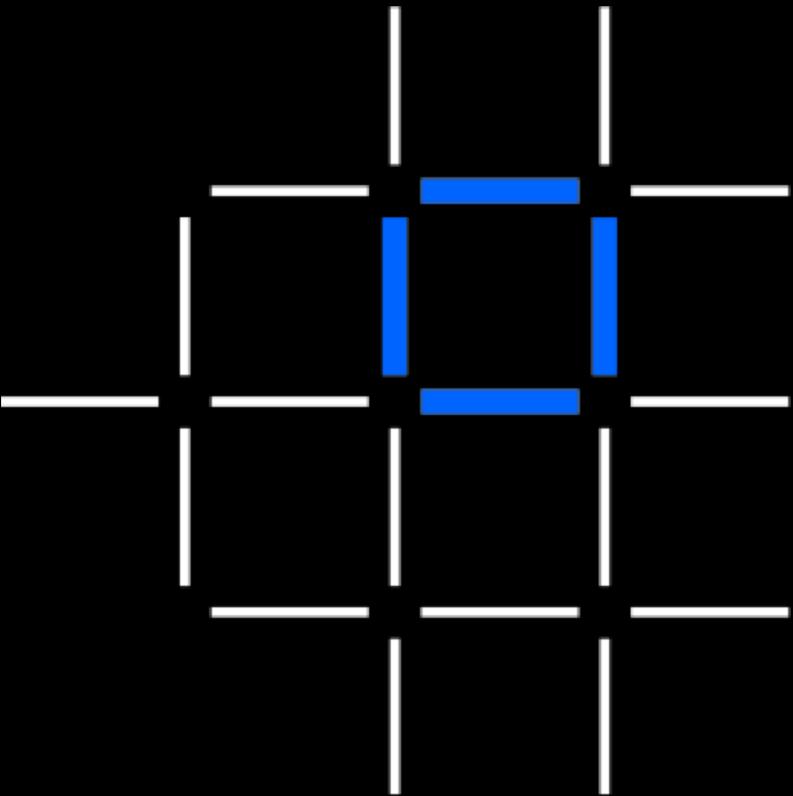
## Developer

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



Blockchain Composed

# Thank you



Questions? Tweet us or  
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