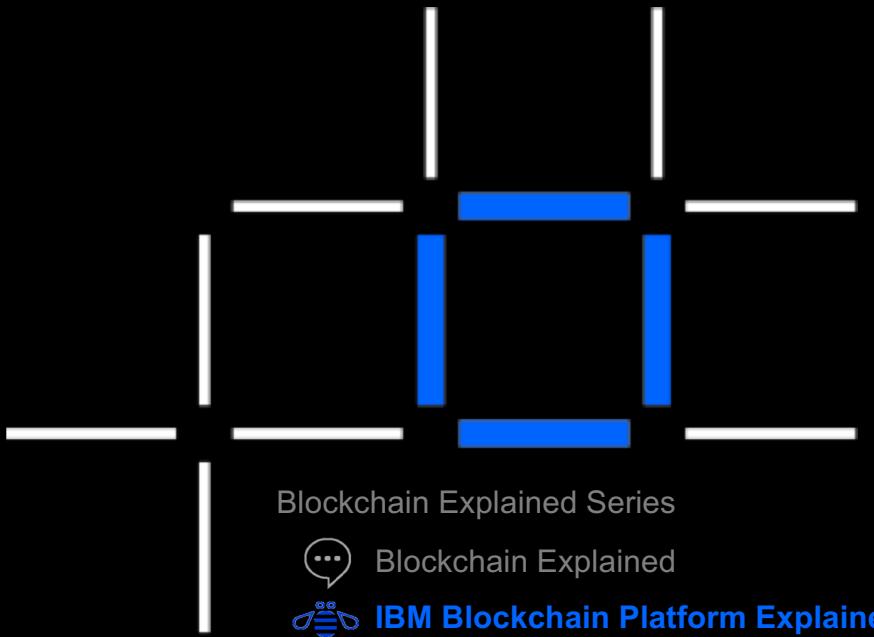


IBM Blockchain Platform Explained

An Introduction to the IBM Blockchain Platform



Blockchain Explained Series

- Blockchain Explained
- IBM Blockchain Platform Explained**
- Solutions Explained
- Garage Explained
- Next Steps

V1.11, 20 June 2018

IBM Blockchain





IBM Blockchain Platform Overview

What you need to know



Getting Started

The tools to make your blockchain real



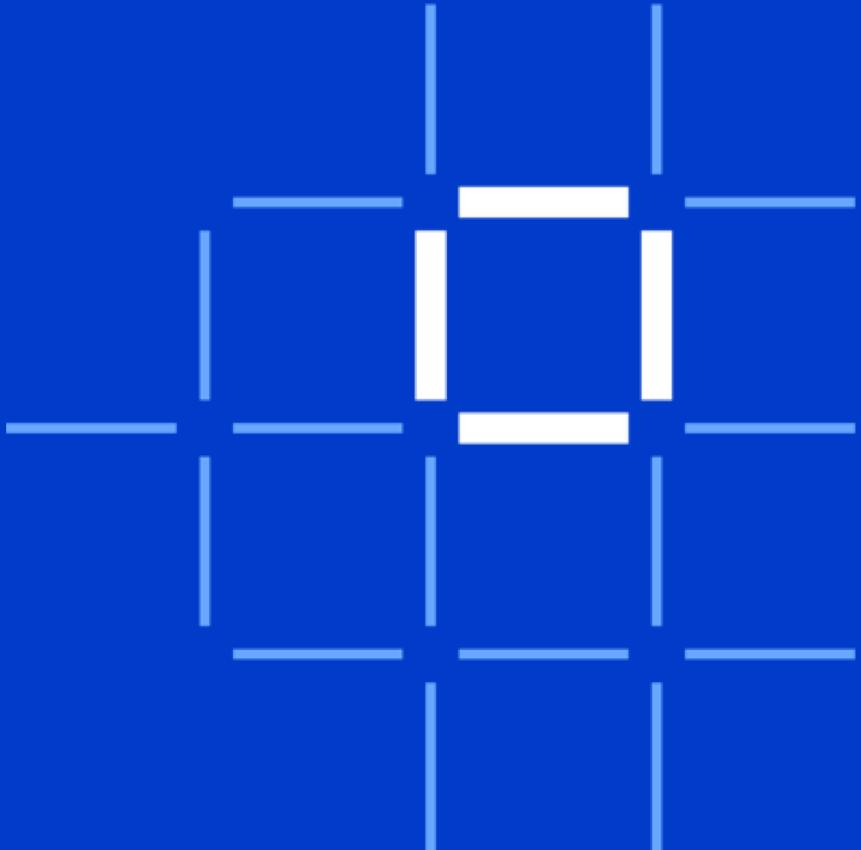
Roadmap

IBM's blockchain strategy and where the platform is going



Technical Details

The architecture behind IBM Blockchain Platform

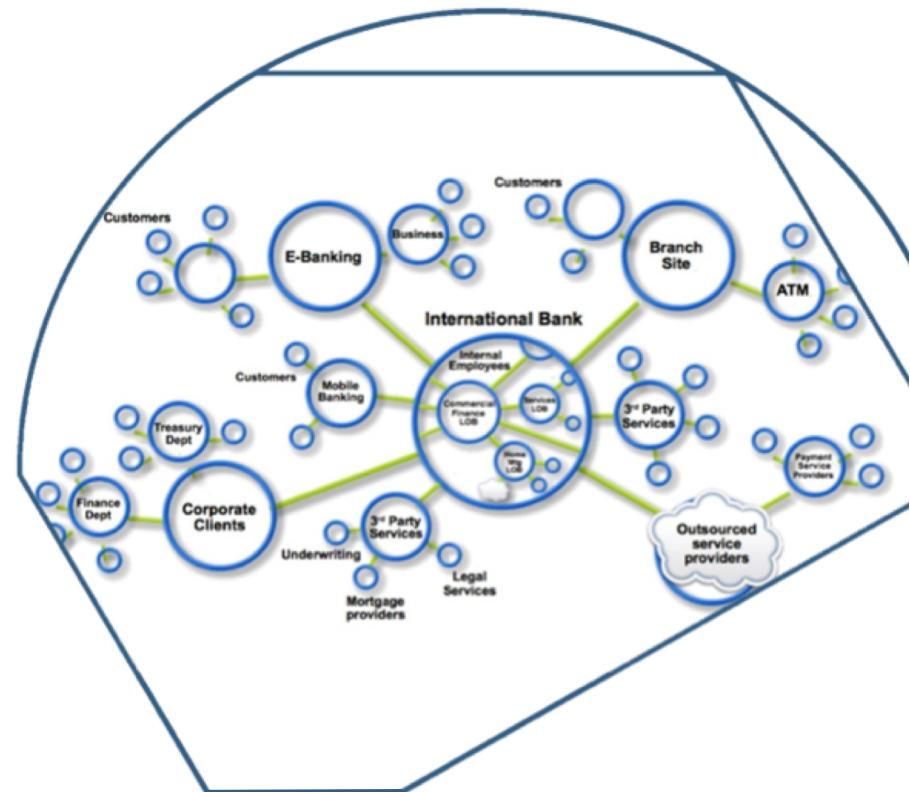


IBM Blockchain

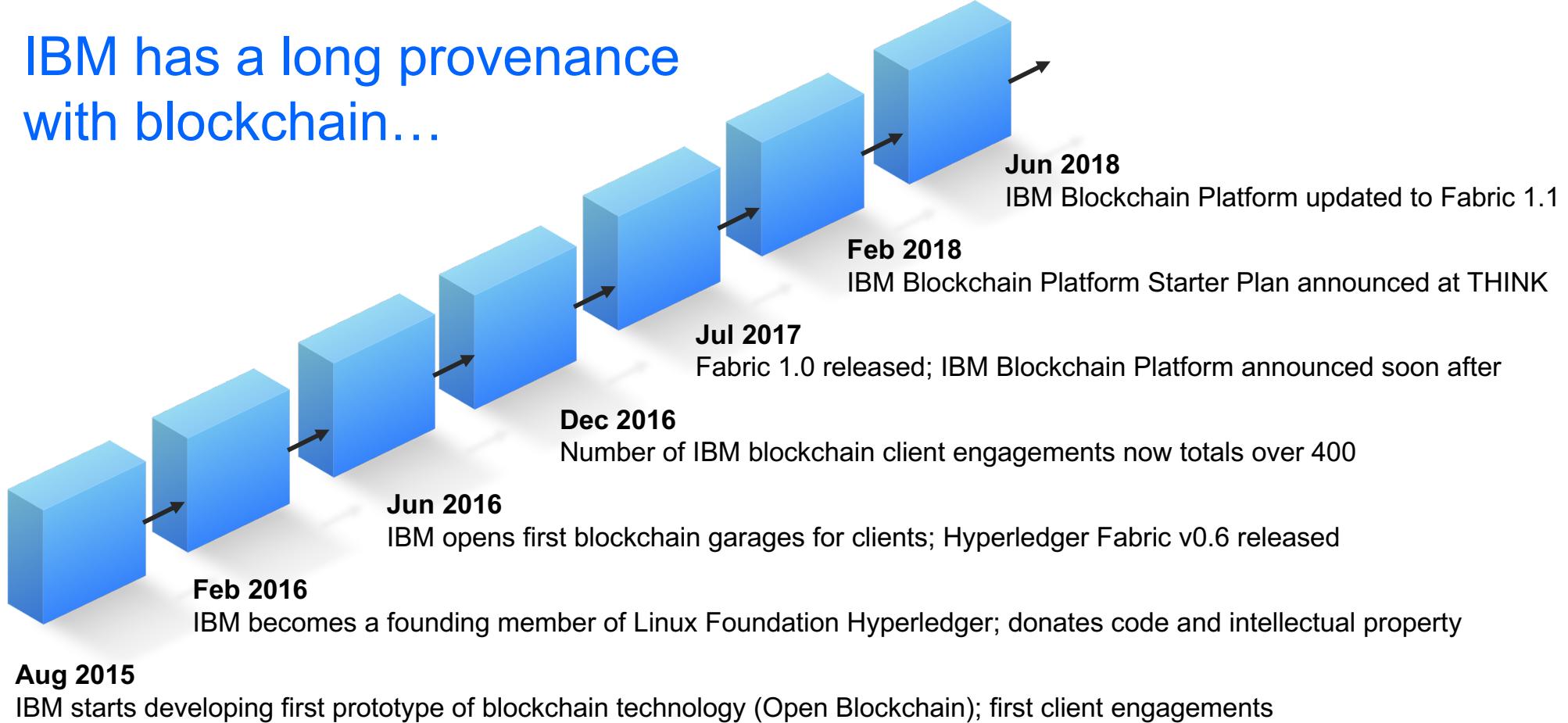
IBM

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

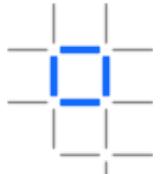


IBM has a long provenance with blockchain...



IBM is investing heavily in blockchain

"IBM is clearly regarded as having the strongest credentials in the blockchain sector, well ahead of competitor" – Juniper Research



Our People

24,000+

People enabled through IBM blockchain training

~6000

Practitioners trained at IBM

~3000

Consultants

~2500

Developers

700+

SME's in hiring pipeline

Our Experience

500+

Blockchain Engagements to learn from

35

IBM enabled active business networks

#1

Blockchain Expert (Juniper and HFS)

100+

Years of being a safe and reliable brand

3

Years supporting world's largest networks e.g. LSE

9000+

Patents in 2017

27

Patents in 2017 for BC

IBM Blockchain

IBM

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

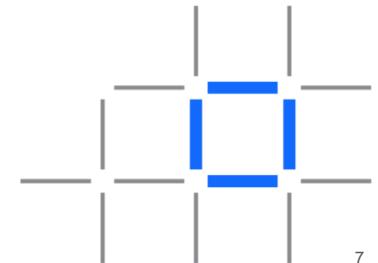
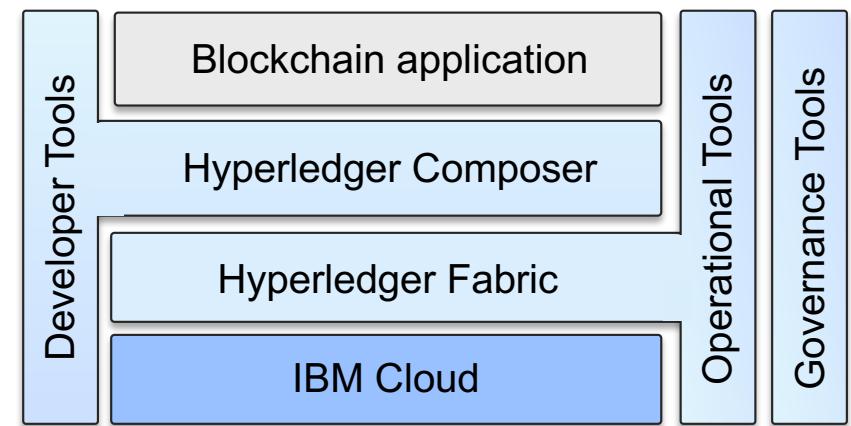
A founding, premier member of Hyperledger, IBM is committed to open source, standards & governance

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

Platform Value: *Simplicity in the face of overwhelming complexity*

	IBM Blockchain Platform	Community Code Deployment
Inviting members	5 seconds	20 minutes per instance
Installing and instantiating smart contracts	Single click installation	10 minutes per smart contract per peer
Deployment	Specify network parameters and automatically launch ordering service	Not available
Network alterations and additions	Add new members, channels and smart contracts through single clicks, text box or drop down via the UI	CLI driven, and more advanced skills required
Support	Complete support from the HW stack through the blockchain code base included	IBM support options available
Security	Secure container and highest level of security provided	Custom
Migration	Rolling migration and 99.999% availability provided under the covers	Not available

"IBM provides us with the easiest way to develop prototype blockchain applications for our clients. Thank you!"

-- Global consulting firm

"IBM has enabled our team to develop our blockchain demo with minimal hassle and gives us a clear path to scale with the tools to manage it"

-- Series backed start-up

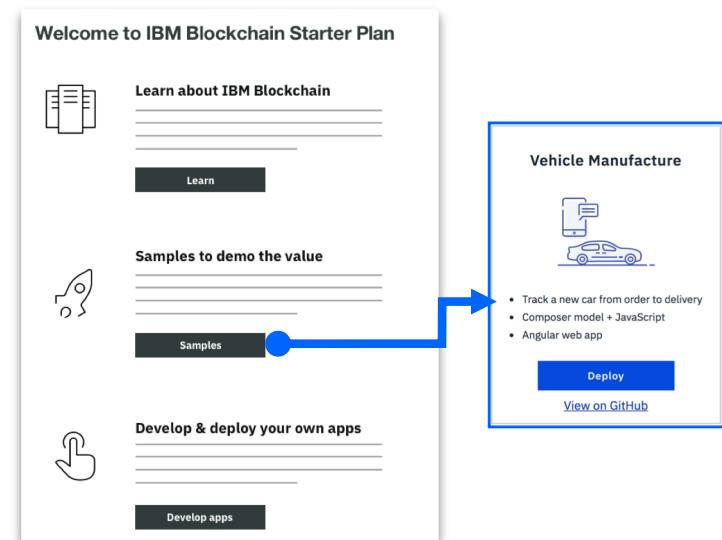
Flexible pricing plans

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

- Get started with IBM Blockchain Platform with **one-click setup and a fully functional network**
 - One-click network configuration, code samples and support for Hyperledger Fabric 1.1
 - Environment enables iterative development prior to production deployment
 - Same experience as Enterprise
 - Uses SOLO ordering for simplified configuration, development and testing
- **Monthly of charge of \$500** for two peers
 - \$250 membership fee per month, plus \$125 per peer
 - Receive \$500 in IBM Cloud credits on sign-up

Sign up at
www.ibm.com/blockchain



Enterprise Plan

- Everything in Starter, plus everything you need for a **full production** environment:
 - Fault-tolerant ordering service, added layers of security and premium support
 - Compliance certification: ISO27001, GDPR (coming soon), SOC 2 Type 2 (coming soon)
 - 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:
 - Data isolation
 - Customized compute for scaling performance
 - Multi-zone HA/DR (coming soon)
 - Virtual circuits: VPN access from your data center
- Currently limited availability
 - Contact IBM for pricing information



IBM Blockchain Platform Membership Plans	Starter	Enterprise	Enterprise Plus
Suitability	MVP		
Features	Deploy and run Composer apps		
Hyperledger Fabric features and capabilities			
Multiple org simulation			
Rolling migrations with no network outages			
Low-code interface			
Ability to scale			
Support options			
Fault tolerant ordering service			
Cryptographic Acceleration			
HSM Available		Coming soon	Coming soon
Advanced Secure container technology			
Isolated Compute Environment			
Multi-Geo/Site DR			

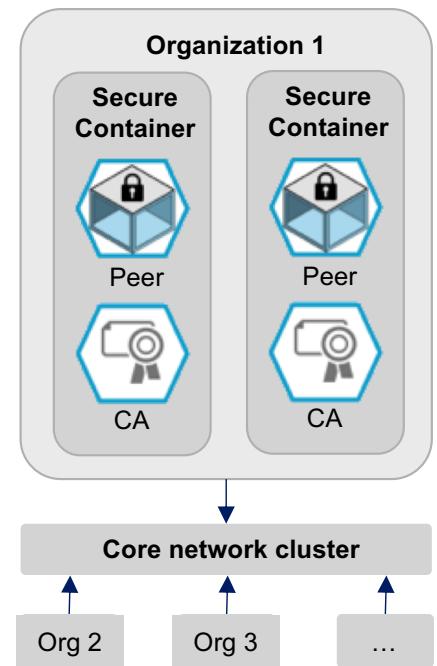
Support-only Plans

- 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



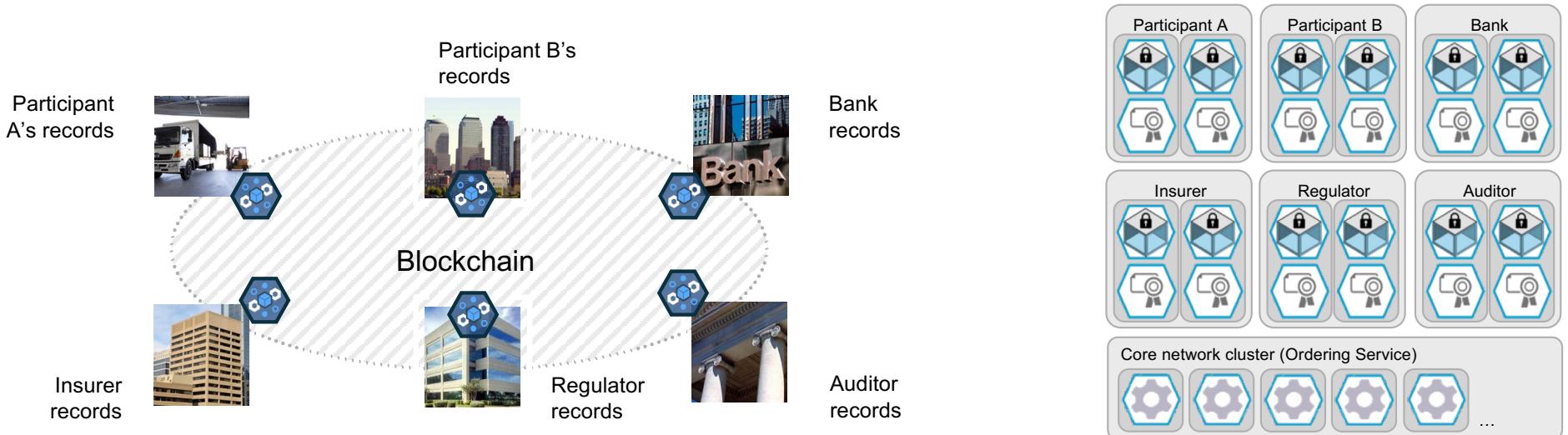
Platform Configuration

- Development environments
 - Try online, install locally or use Starter Edition
- Enterprise environments use 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
 - plan networks run inside secure containers
- Enterprise networks also have a 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

Business Value Assessment	
Problem	90% of goods in global trade are delayed by the ocean shipping industry each year. Costs associated with this documentation and related physical transportation costs.
Solution	Manage and track the paper trail of tens of millions of shipping containers across the world by digitizing the supply chain process.
Participants	Supplier, couriers (*2), customs (*2), ports (*2), shipper and retailer ...
Asset & Trust	Need for trust around paperwork associated with a container
Transactions	Supplier prepares to ship, release container to courier, load to ship, clear customs, retailer receipt
Benefits benchmarks - Value Tree KPI's (e.g.) New revenue Improve client experience Reduce transport costs	
Baseline Phase 1 Phase 2-3 Blockchain Design Points	
# new value propositions Increase in customer satisfaction Increase in trade volumes Cycle times (transit & shipping) Waste as % of total shipped Fraud and errors as % of total costs Documentation admin. as % of total costs	
1 to 3 5% 10% +5% +15% 10 days 20 days 25 days 6% 5% 1% 5% 4% 0.5% 20% 15% 5%	
+ Find new value propositions to exploit the network effect between members + Securely and transparently trace the container's path through the supply chain on the blockchain + Add trust (Irreversibility and Provenance) around the Bill of Lading and other container paperwork + Automate the tracking and shipping process with Smart Contracts - Reduce cycle times and delays - No re-validation or matching of documentation with near instant updates - eliminates the need for audit and verification - Removes paper and intermediaries	
AND-1 AND-2	

- 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

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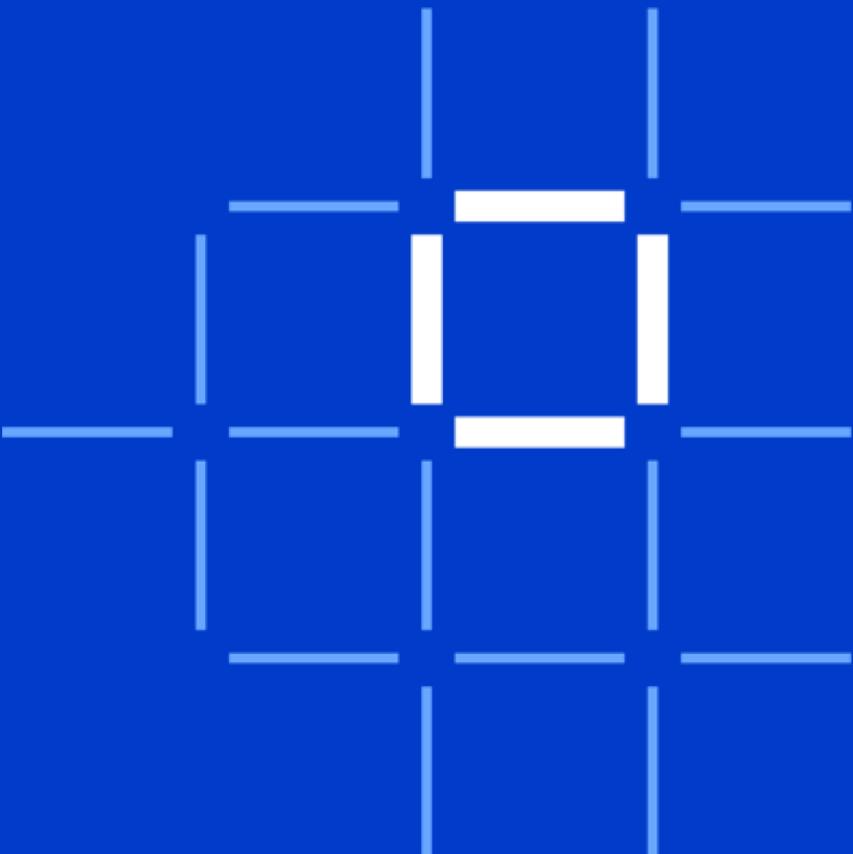


Technical Details

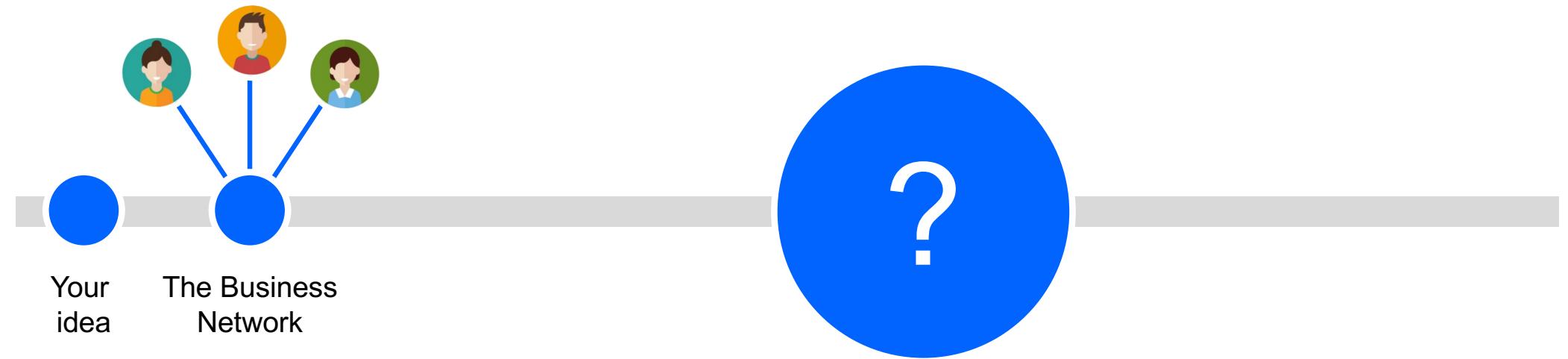
The architecture behind IBM Blockchain Platform

IBM Blockchain

]



IBM



IBM Blockchain Platform: Dev ×

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...

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 idea

The Business Network

Build



Model, Build
and Code

MY NETWORK

Overview

Members

Channels

Notifications

APIs

MY CODE

Write code

Install code

Try samples



Your idea

The Business Network

Build



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.

[View samples](#)

Get started with tips

[Develop apps](#)

Start deploying your app

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

[X](#)

Connection Profile

+ Add Peers

ACTIONS



energy-bc-chaincode-build-20

Secure | https://console.bluemix.net/devops/pipelines/f414b3fb-9964-4a92-8507-9f56bb2e3aa4?env_id=ibm:yp:us-south

IBM Cloud Catalog Docs Support Manage

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

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

INSTALLED STAGE PASSED

LAST INPUT Git URL

Last commit by Anil Lewis 2d ago reverted code in alectrainvocations after...

Jobs View logs and history

Install Chaincode Passed 2d ago

LAST EXECUTION RESULT No results

DEPLOYED STAGE PASSED

LAST INPUT Git URL

Lewis 2d ago invocations after...

View logs and history

Automated DevOps

Add Stage +

Your
idea

The Business
Network

Build

TLS networks LTD. ▾

MY NETWORK

Overview

Members

Channels

Notifications

APIs

MY CODE

Write code

Install code

Try samples



Your idea



The Business Network

Build

Grow

Members

View and manage
the organizations
that you own by

Members

Invite member

Organizations in addition to the two organizations
you are 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

+ Invite Members

ACTION

ed

ed

ed

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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.

02. Select members and set roles

Select the appropriate network members to participate in the channel. You must assign at least one operator for the channel.

Member Name:

All Available Members Have Been Added

Add Member

Member

Permissions 

Action

Company A
dave_gorman@uk.ibm.com

Operator Writer Reader

Company B
dave_gorman@uk.ibm.com

Operator Writer Reader

* Assign at least one operator for the channel and give at least one role for each member.

Reset

Cancel

Back

Next

Set policies

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?

Select

1 (Any)

2 (Majority)

Or

Email

kdwhite@us.ibm.com

kdwhite@us.ibm.com

kdwhite@us.ibm.com

Company A

Company B

Kayla Co

Cancel

Back

Submit Request

Your idea

The Business Network

Build

Grow

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
Network



Build



Grow



IBM Blockchain Platform Overview

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IBM's blockchain strategy and where the platform is going



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The architecture behind IBM Blockchain Platform

IBM Blockchain



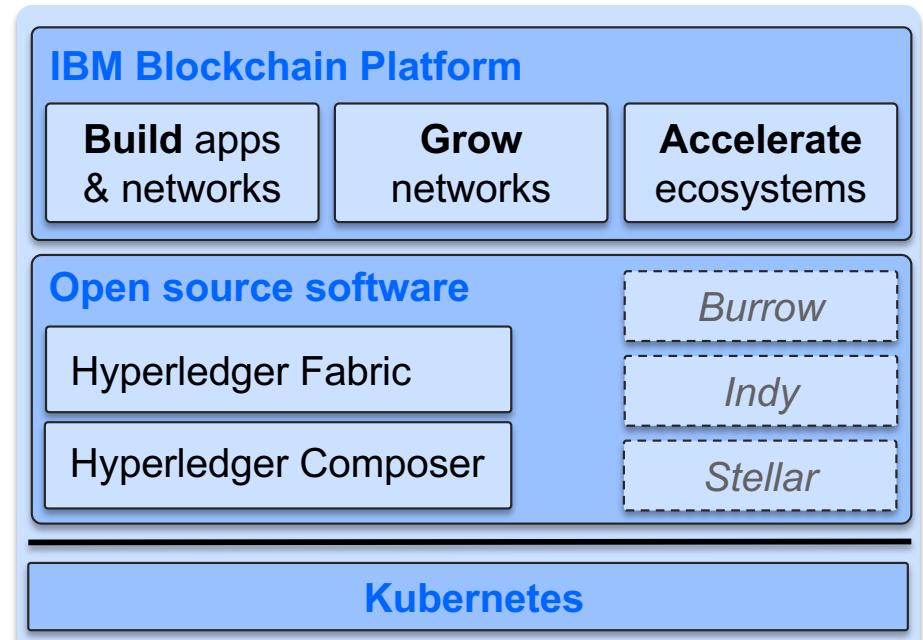
IBM

IBM Blockchain Platform – 2018 Strategy

IBM Blockchain

IBM Blockchain Platform is the catalyst that enables true blockchain innovators to disrupt industries:

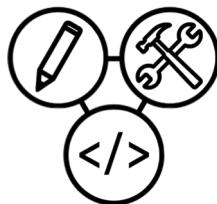
- **Best in market tools** to quickly build, launch, run enterprise applications on blockchain networks
- **Accelerated progression** path from POC to production by making it easy to create & join networks, integrate existing applications, and grow the ecosystem
- **Flexible deployment options** on Kubernetes architecture



Under consideration

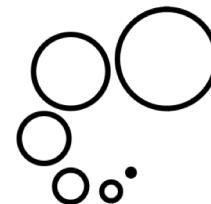
Core Capabilities for 2018

The IBM Blockchain Platform will give users the ability to...



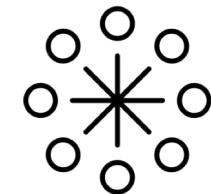
Build Apps & Networks

- **Development tools** to create applications which leverage blockchain networks
- **API endpoints and SDKs** for building and monetizing blockchain apps
- **Model for founders** to create business models enabled by blockchain



Grow Networks

- **Operational tools** to test, manage, monitor, troubleshoot, deploy, migrate and upgrade blockchain networks
- **Governance tools** to create and manage governance policies on permissioned networks



Accelerate Ecosystems

- **Network registry** to discover and join existing blockchain networks
- **Marketplace** to discover and use APIs, service components and applications
- **Public networks** to accelerate blockchain ecosystems

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
artsexpo Canada	Non-Profit		1	March 7th 2018, 2:41 AM
besthouse China	Real Estate, Real Estate Rental and Leasing		2	November 1st 2017, 9:48 AM
coffeeshopschain 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	
ecodisposal USA	Waste Mgmt. and Remediation Services		4	
ewewde		БИСИВСИВСИВС	3	
fishmarket	Agriculture, Supply Chain Management, Wholesale Trade	This is a Fish Market blockchain	3	March 7th 2018, 2:41 AM
friendsid			2	November 1st 2017, 8:42 AM
garicoin			4	November 1st 2017, 8:42 AM

Network Registry

Your idea

The Business Network

Build

Grow

Accelerate

Blockchain Asset Marketplace

SIGN UP / LOG IN

PUBLISH ASSETS

The screenshot shows a marketplace interface with three asset cards:

- Carbon Credit Model v3.4**: Type: Composer model, Added by: Organization, Used in: 3057 networks. Buttons: TRY NOW, BUY NOW.
- Simple Supply Chain v5.3.6**: Type: Composer model, Added by: OrganizationA, Used in: 208 networks. Buttons: TRY NOW, BUY NOW.
- Bilateral Config v1.2**: Type: Network template, Added by: OrganizationB, Used in: 12 networks. Buttons: TRY NOW, BUY NOW.

Your
idea

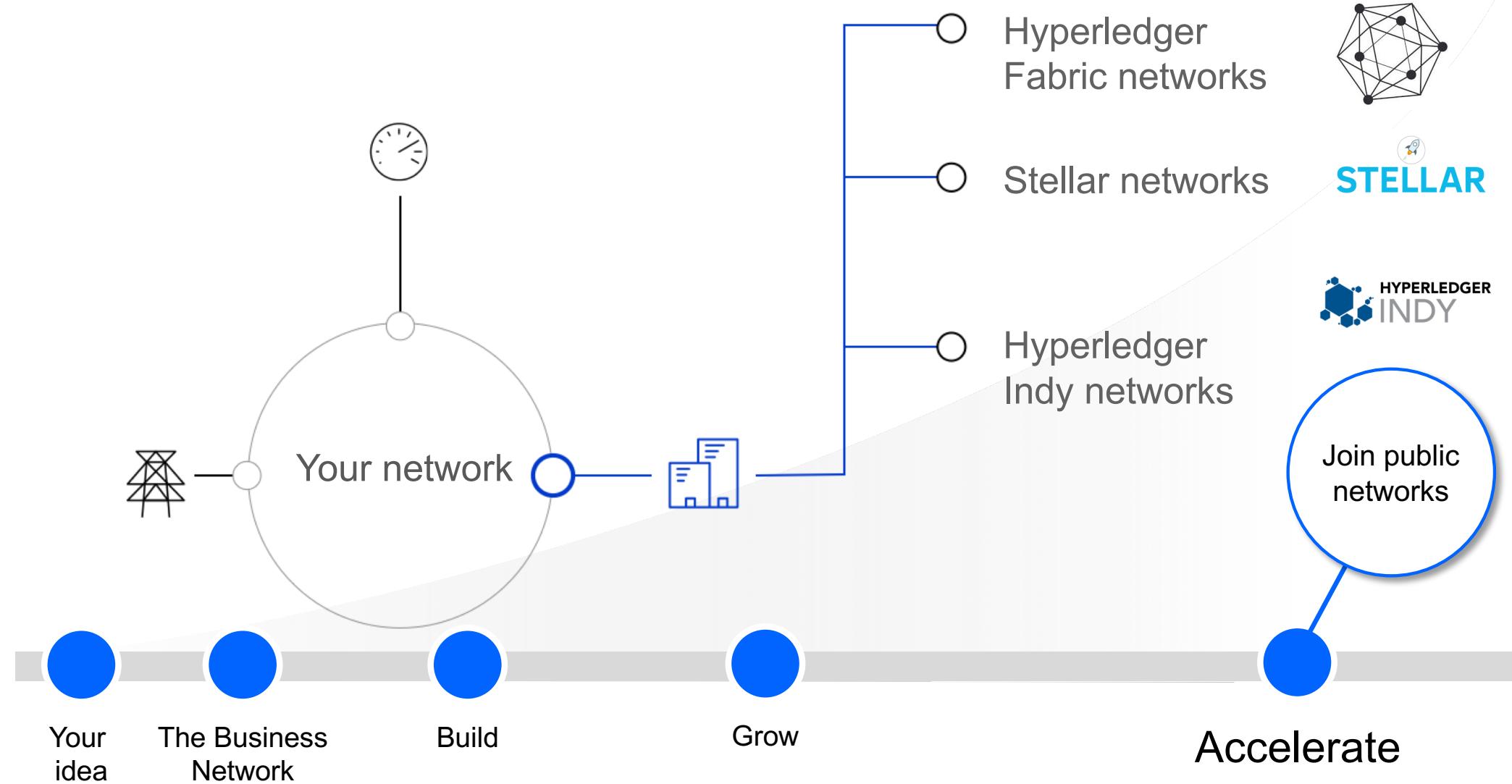
The Business
Network

Build

Grow

Accelerate

Marketplace





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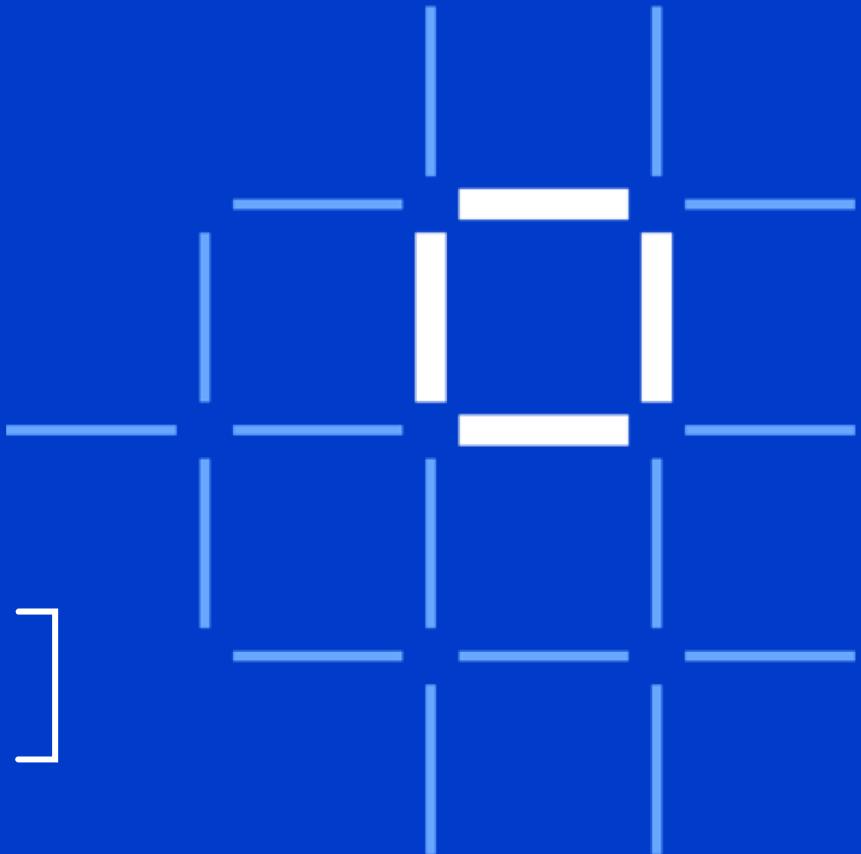
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IBM Blockchain

IBM



Blockchain Explored

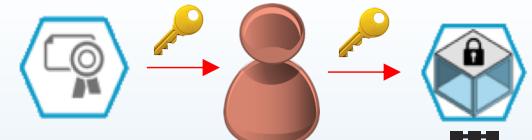
Blockchain Technical Concepts



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

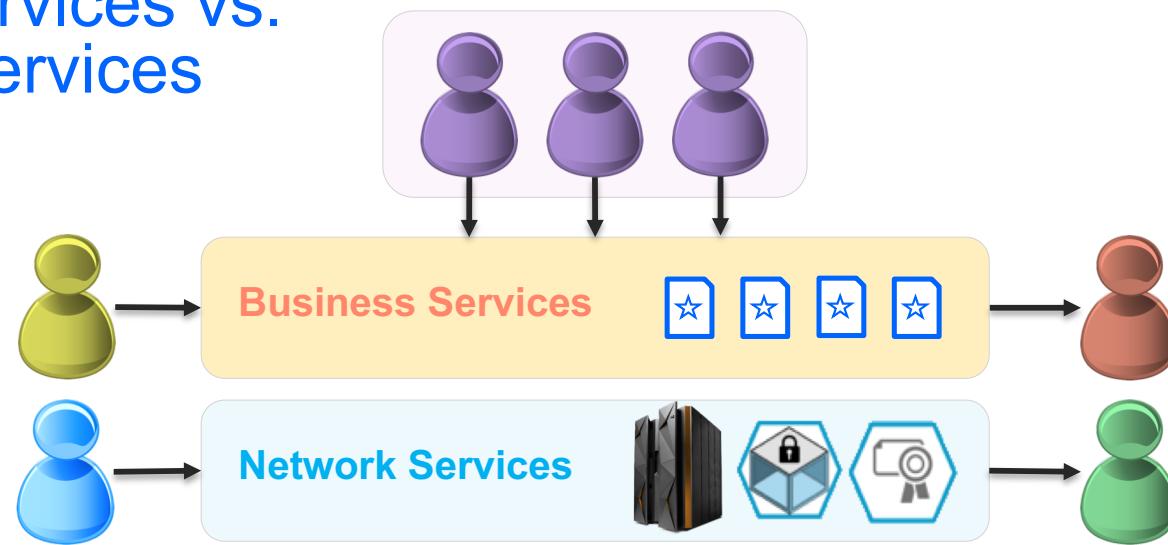


Consensus is the process by which agreement is obtained on the peer network



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

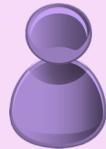
Network Services vs. Business Services



- 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!)

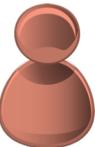


End-user **runs** presentation logic
(e.g. on mobile device or dashboard)

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



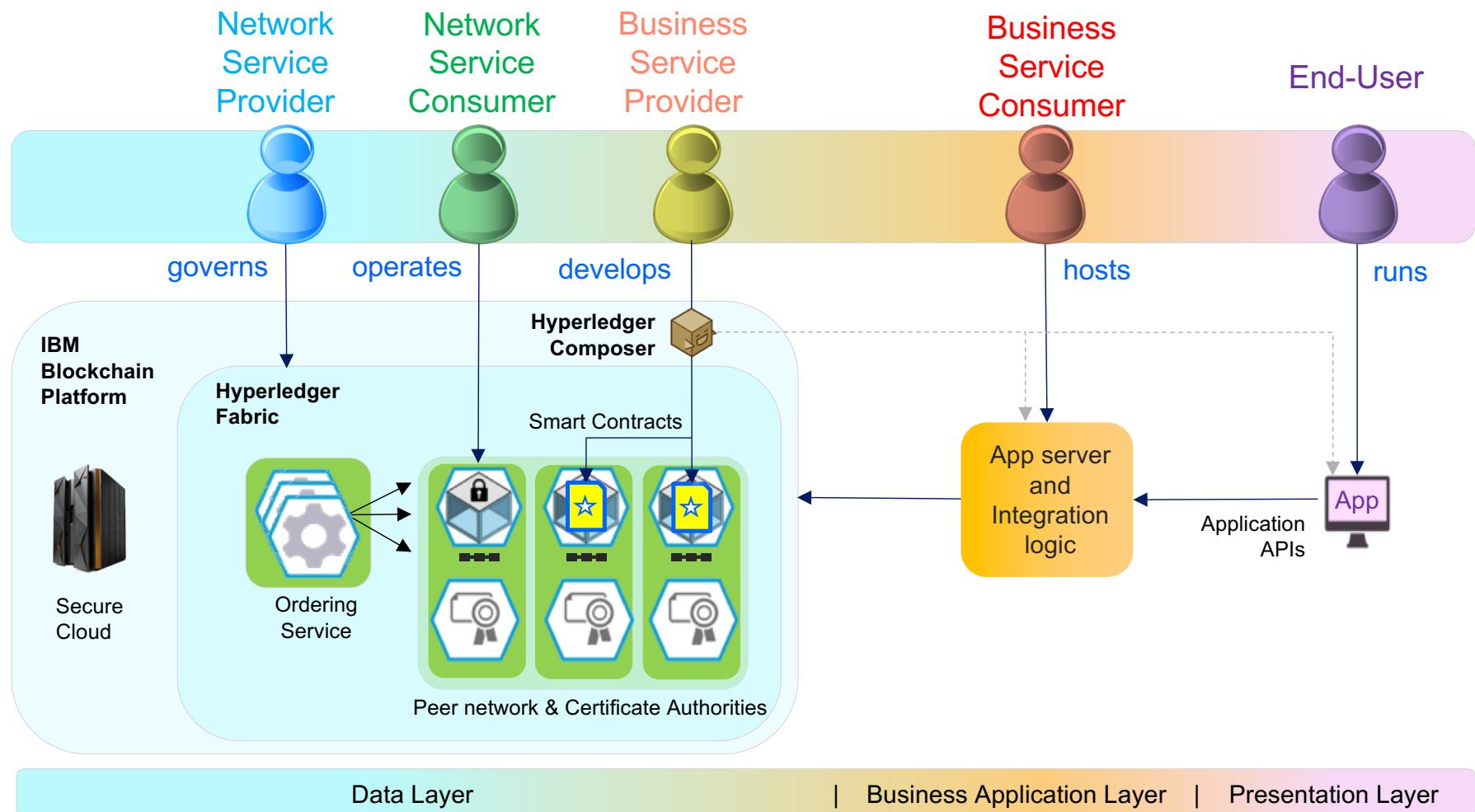
Network Service Consumer **operates** a set of peers and certificate authorities on the network; represents an organization on the business network



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

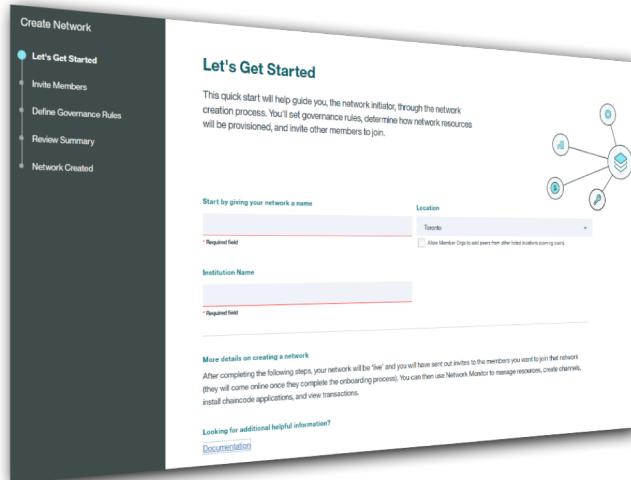


Network Architecture and Participant Roles



IBM Blockchain Platform for Network Service Providers

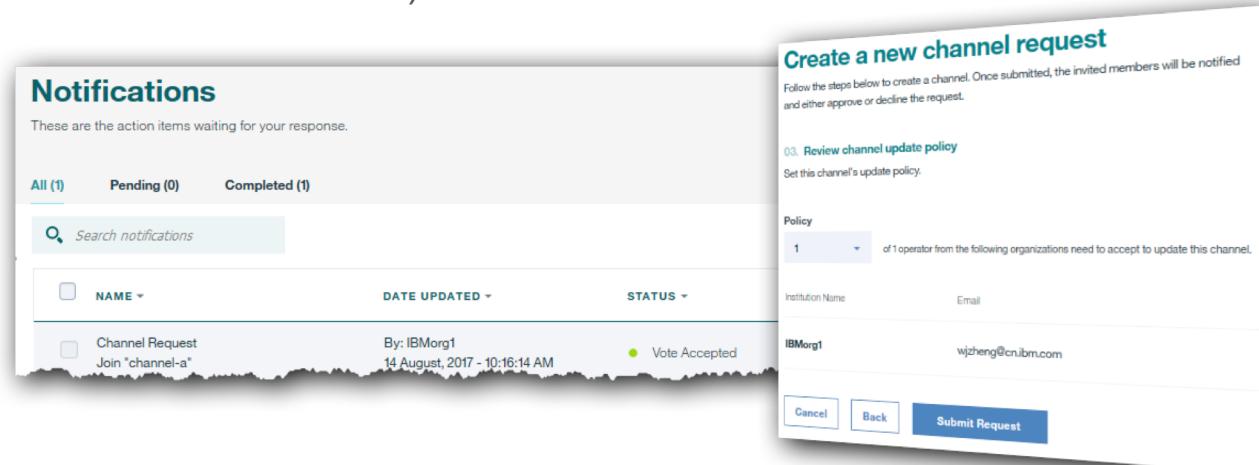
Governance of changes to the blockchain network



The screenshot shows the 'Create Network' process. The left sidebar lists steps: Let's Get Started, Invite Members, Define Governance Rules, Review Summary, and Network Created. The main panel is titled 'Let's Get Started' with a sub-section 'Start by giving your network a name'. It includes fields for 'Name' (Required field) and 'Location' (set to 'Toronto'). A note says 'Allow Member Orgs to add peers from other listed members to your network'. Below are fields for 'Institution Name' (Required field) and a note about network details. At the bottom is a 'Documentation' link.

- 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)

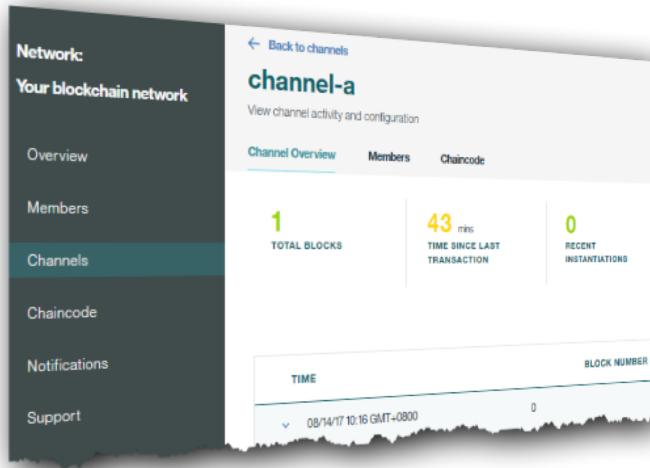
- Democratic voting policies handled through Notifications UI
 - Accept/Reject proposals
 - Review completed items



The image contains two screenshots of the IBM Blockchain Platform. The left screenshot shows the 'Notifications' page with a table of action items. The table has columns: 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 of 'Vote Accepted'. The right screenshot shows the 'Create a new channel request' form. It includes fields for 'Policy' (set to 1 operator), 'Institution Name' (IBMorg1), 'Email' (wjcheng@cn.ibm.com), and a 'Submit Request' button.

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 menu includes 'Network', 'Overview', 'Members', 'Channels' (selected), 'Chaincode', 'Notifications', and 'Support'. The main area displays a channel overview for 'channel-a'. Key metrics shown are 1 TOTAL BLOCKS, 43 ms TIME SINCE LAST TRANSACTION, and 0 RECENT INSTANTIATIONS. Below this is a timeline chart with a single data point at 08/14/17 10:16 GMT+0800.

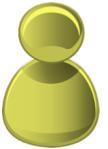
- Network Service Consumers operate an organization's peers and certificate authorities
 - Installing and instantiating smart contracts
 - Managing certificates for Business Service Consumers in their organization
 - Monitoring network resources
 - Creating channels (in accordance with defined policies)
- All administrative tasks accessible through web UI
 - Covers members, channels, smart contracts...
 - Full access to APIs and logs for transparent problem determination

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			

IBM Blockchain Platform for Business Service Providers

Develop blockchain applications



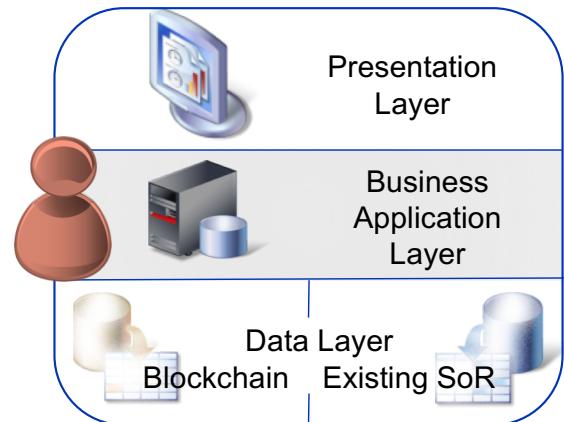
- A blockchain application consists of three components:
 - **Smart contracts**: transaction logic run on the distributed peer network (e.g. Composer BNA file)
 - **Business logic**: business applications and integration services that invoke smart contracts
 - **Presentation logic**: client applications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

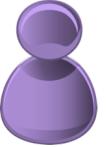
Host applications and integration services that invoke smart contracts

- 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

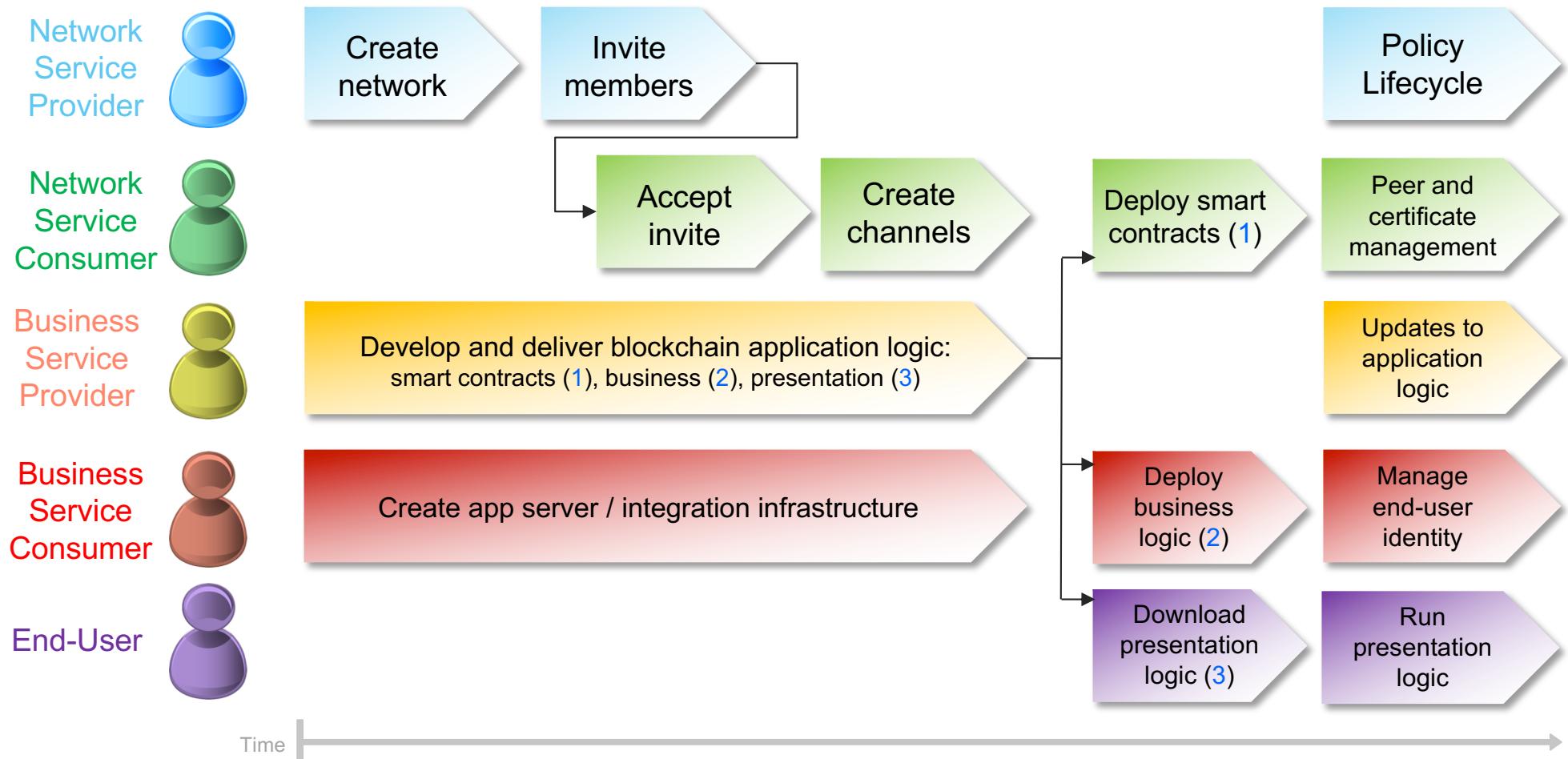


- End-users run presentation logic on an appropriate device
 - For example, mobile application or desktop dashboard
 - There may be multiple end-user applications (often one per organization or user role)
- The value proposition to end-users is that the information they see is **trustworthy**
 - Will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

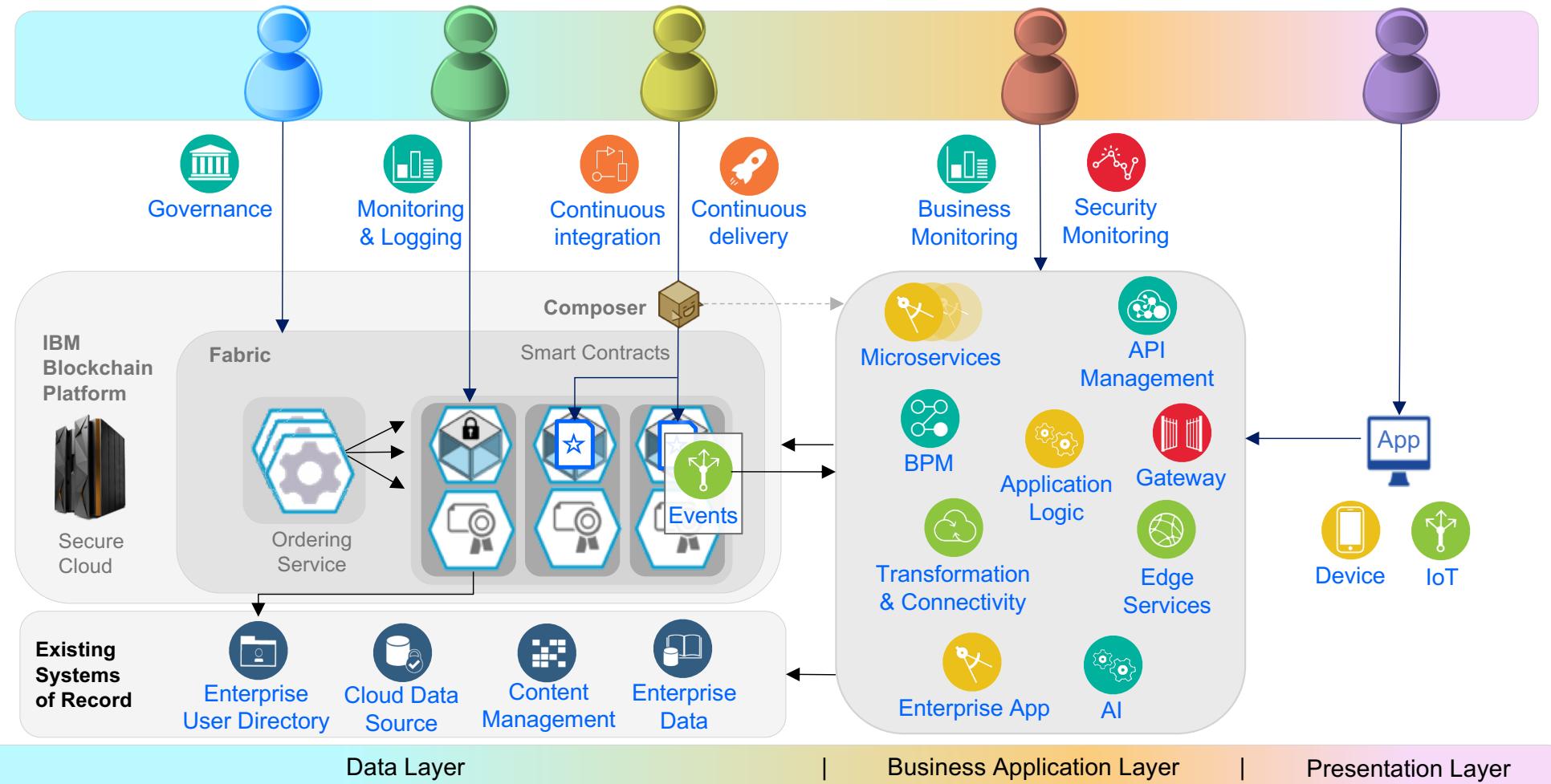
The screenshot shows a web-based application titled "FOOD SAFETY & TRACEABILITY on Blockchain". The interface includes a search bar for product tracing, input fields for supplier product code, and a map of Mexico and Central America showing strawberry cultivation areas. Below the map is a timeline and a grid showing the number of entities at each stage of the supply chain.

Stage	Count
Orchard	2
Packing House	1
Importer	1
Facility	1
Retailer DC	1
Retailer Store	2

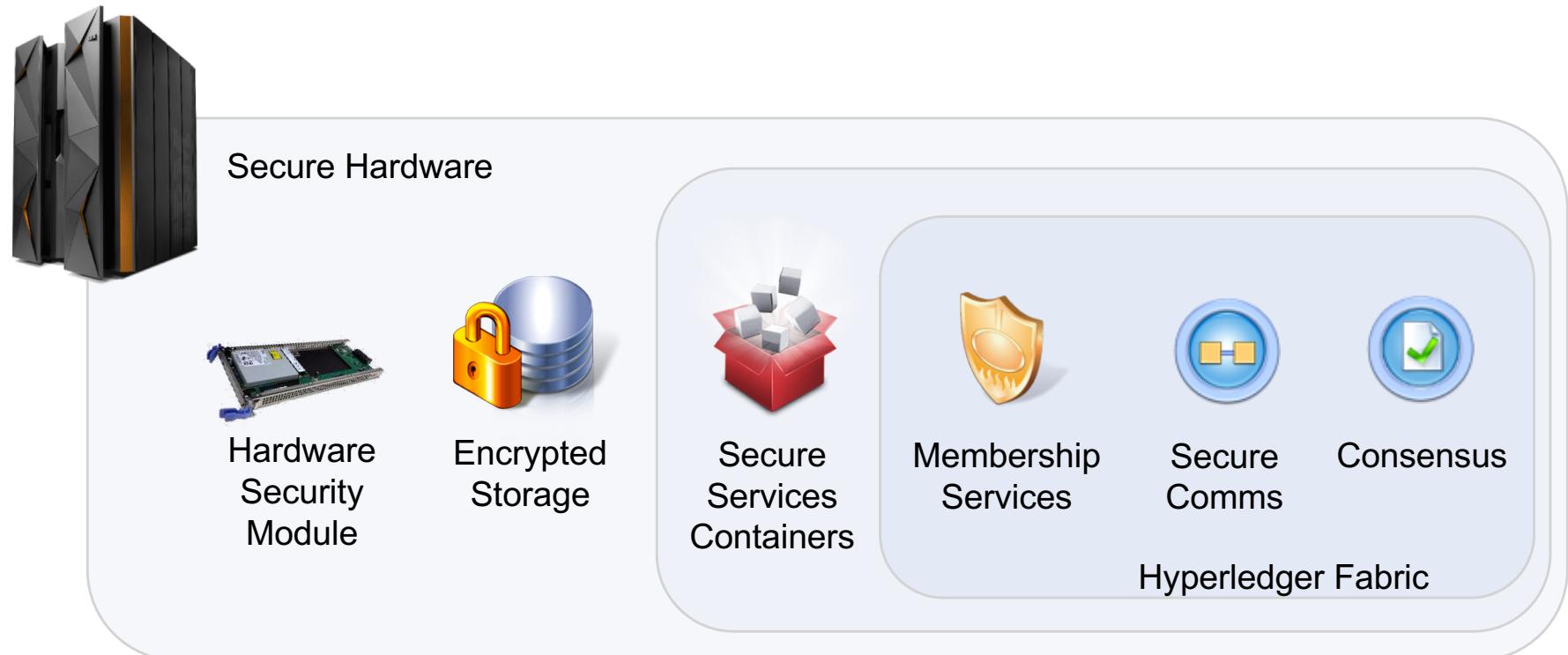
Workflow for Network Formation



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

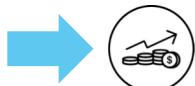
- Hyperledger Fabric
 - Membership Services: Organizations are invited to join and authenticated using an Enrollment Certificate
 - Transaction Consensus: Each transaction is endorsed and validated by multiple peers before committing to the ledger
 - Controlled Ledger Access: Channels restrict transactions 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
 - Hardware Security Module (HSM) is certified to FIPS 140-2 level 4
 - Fastest cryptographic acceleration: used by block hashing and digital signatures

Continuing your blockchain journey...



Business Stakeholder

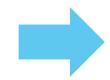
- Request a Blockchain Value Design from IBM
- Prove out technology with a first project



Blockchain BVD

Solution Architect

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



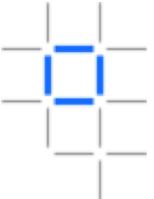
Solutions Explained

Developer

- Learn about IBM Blockchain Platform and Hyperledger
- Play with IBM Blockchain Platform Starter Edition



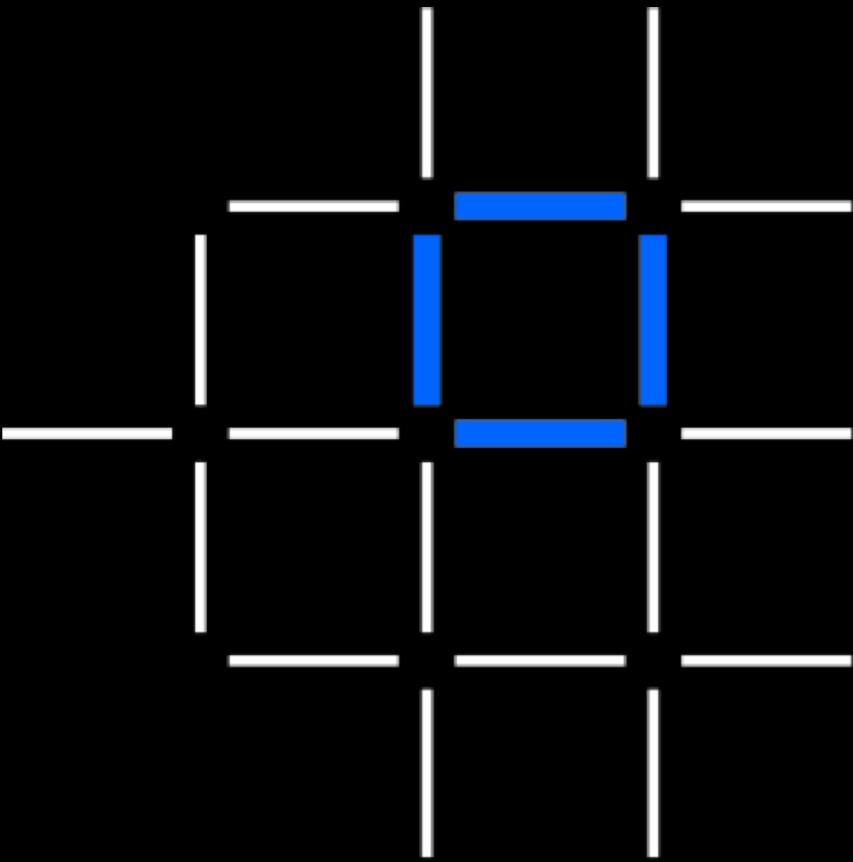
IBM Blockchain Platform Explored



Further information

- Platform Information
 - <https://www.ibm.com/blockchain/platform/>
- Technical Overview
 - https://www-01.ibm.com/marketing/iwm/dre/signup?source=urx-20950&S_PKG=ov61731
- Platform Service
 - <https://console.bluemix.net/catalog/services/blockchain>
- Platform Service Level Agreement
 - [http://www-03.ibm.com/software/sla/sladb.nsf/pdf/6605-12/\\$file/i126-6605-12_11-2017_en_US.pdf](http://www-03.ibm.com/software/sla/sladb.nsf/pdf/6605-12/$file/i126-6605-12_11-2017_en_US.pdf)
- ISO Certification
 - https://www-935.ibm.com/services/multimedia/saas_27k.pdf
 - https://www-935.ibm.com/services/us/en/it-services/pdf/ibmcloud_27017.pdf
 - https://www-935.ibm.com/services/multimedia/ibmcloud_27018.pdf

Thank you



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