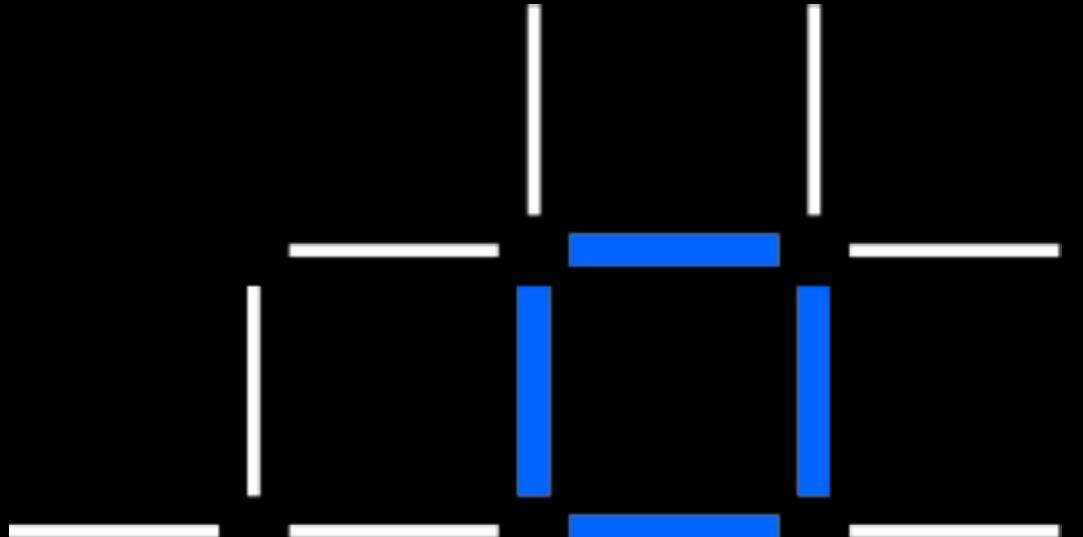


# How to create a supply chain Blockchain App

Introduction

*Lennart Frantzell*  
*Grant Steinfeld*



## IBM Blockchain Platform Technical Series

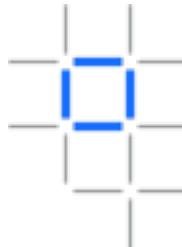
- Technical Introduction
- Using IBM Blockchain Platform
- Modeling Blockchain Applications**
- Architectural Good Practices
- What's New in Technology

Feb 22 2020

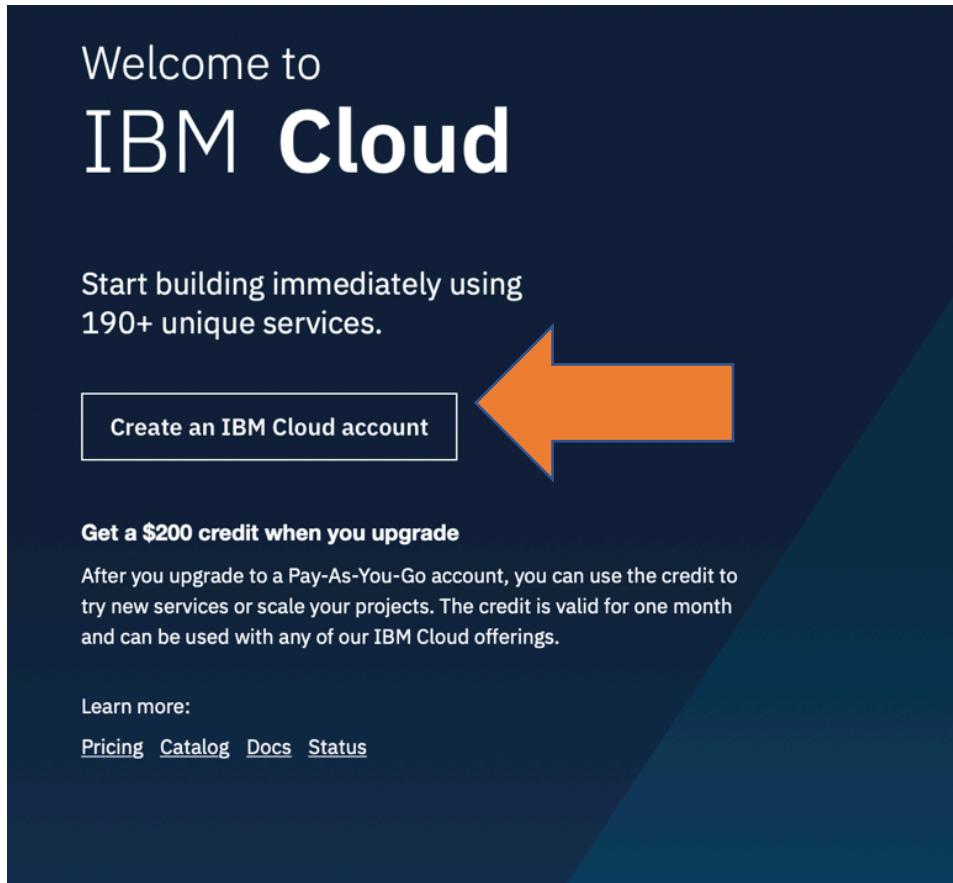
IBM Blockchain

IBM

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An orange arrow points from the "Create an IBM Cloud account" button to the "Create an IBM Cloud account" button on the right side of the slide.

Log in to IBM Cloud

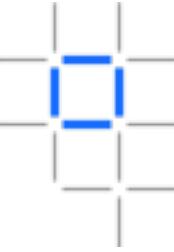
ID

IBMid ▾

Remember me

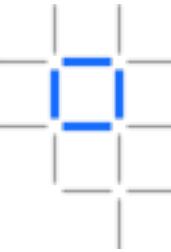
[Forgot ID?](#)  
[Forgot password?](#)

[Continue](#)



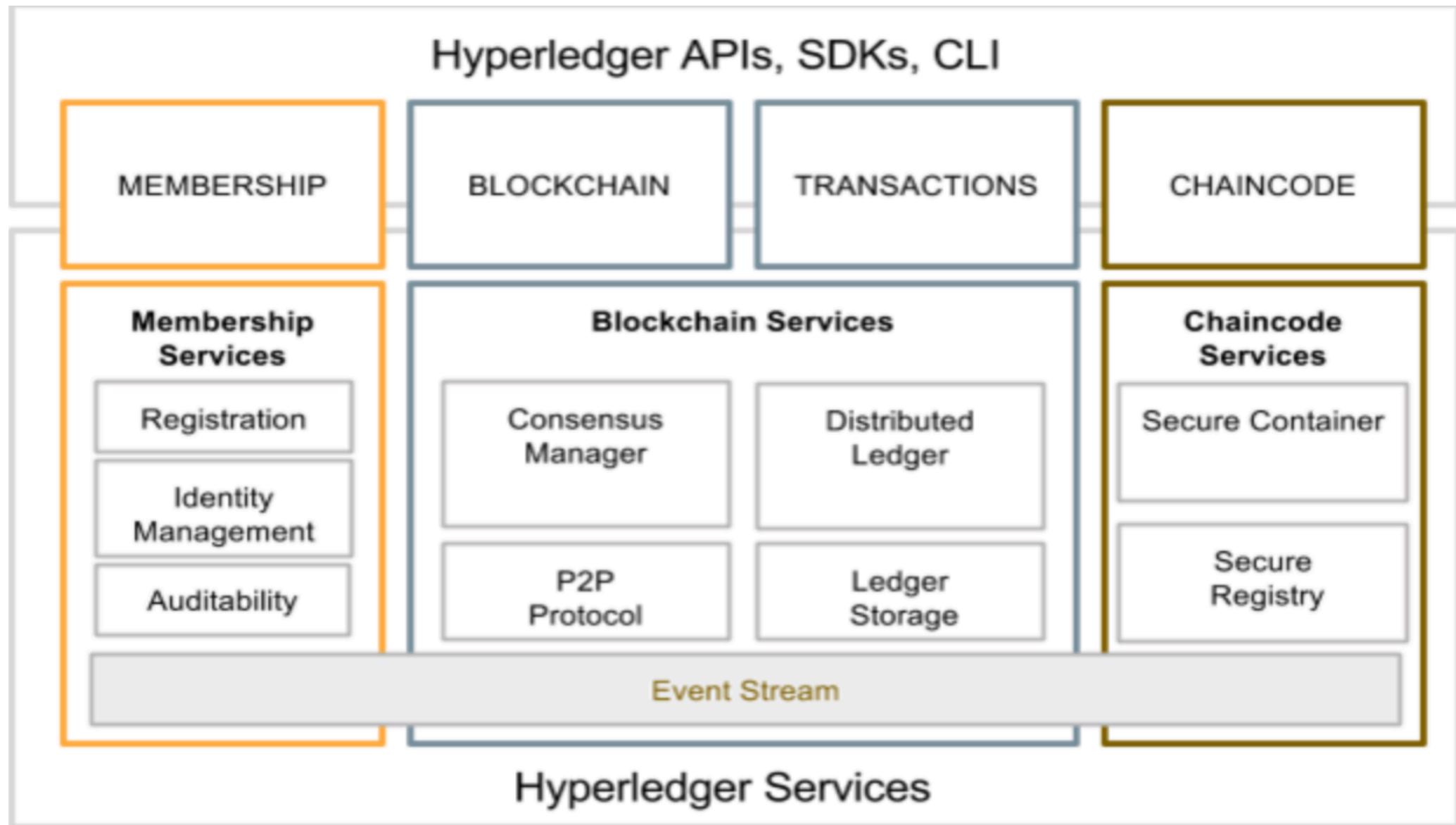
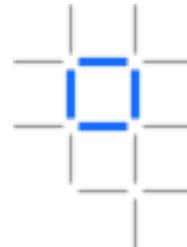
# And now let's go through the IBM Blockchain Platform architecture

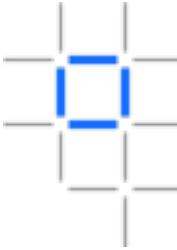
# Open Source Hyperledger Fabric



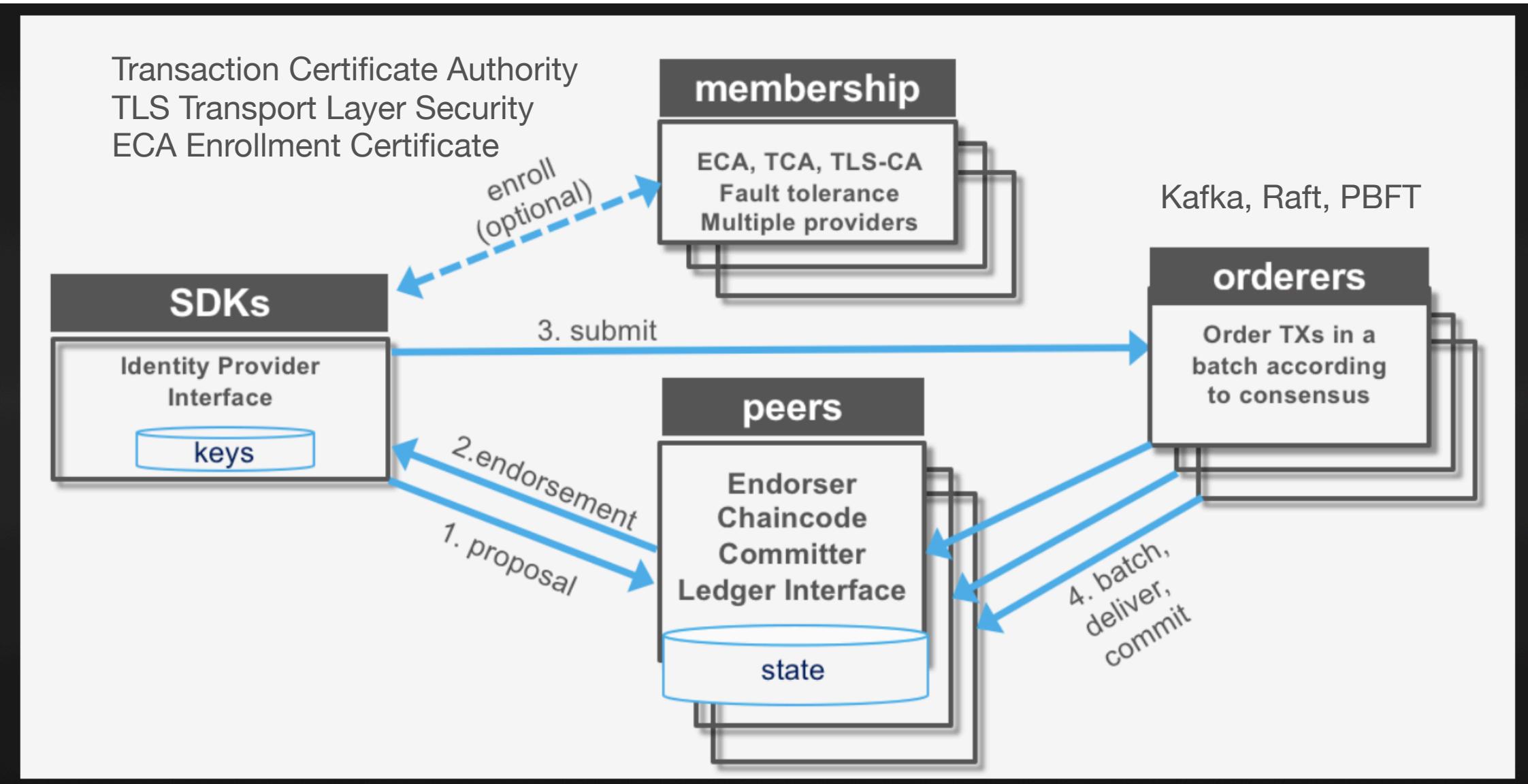
- **Hyperledger Fabric – from The Linux Foundation – is the modular blockchain framework** that has become the de facto standard for enterprise blockchain platforms.
- It offers a unique approach to consensus that enables **performance at scale** while also preserving the data privacy enterprises demand.  
<https://www.hyperledger.org/resources/publications/blockchain-performance-metrics>
- **Open source and open governance**
- <https://hyperledger-fabric.readthedocs.io/en/release-2.0/>
- <https://www.hyperledger.org/projects/fabric>

# Hyperledger Fabric

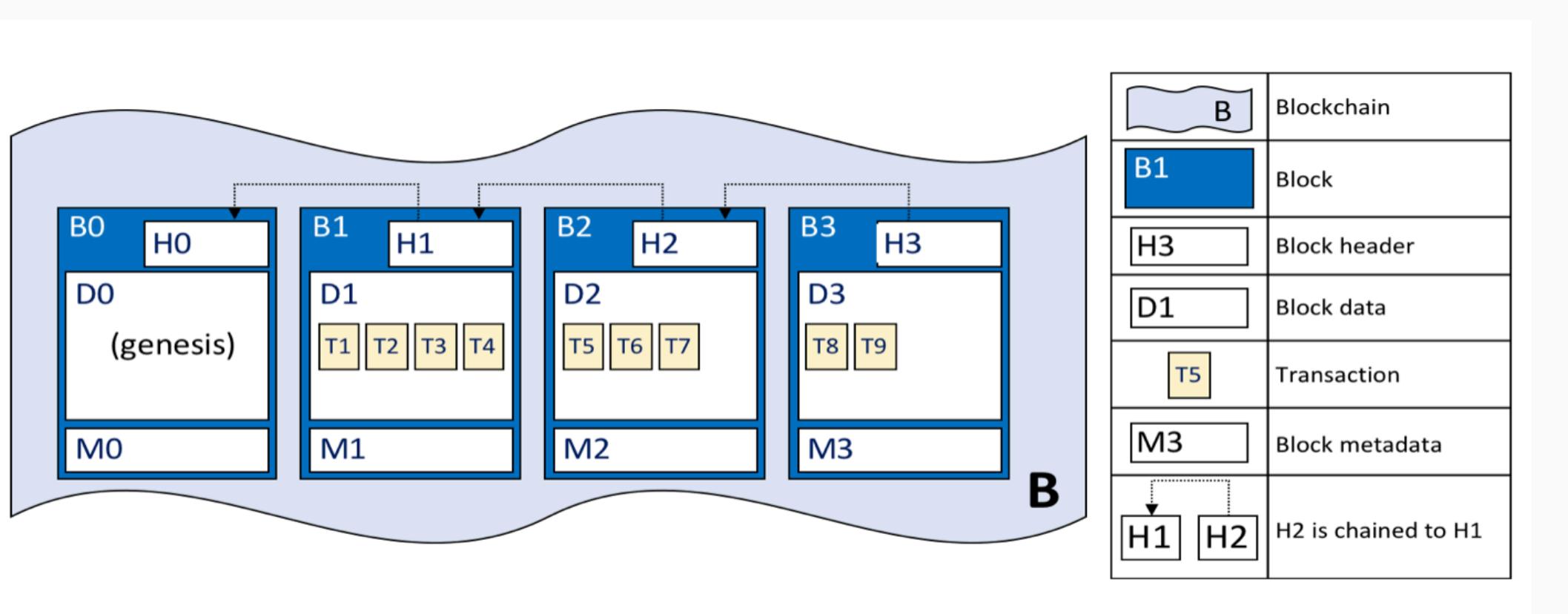
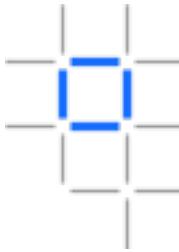




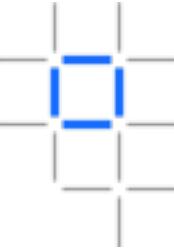
# Hyperledger Fabric



# The Blockchain

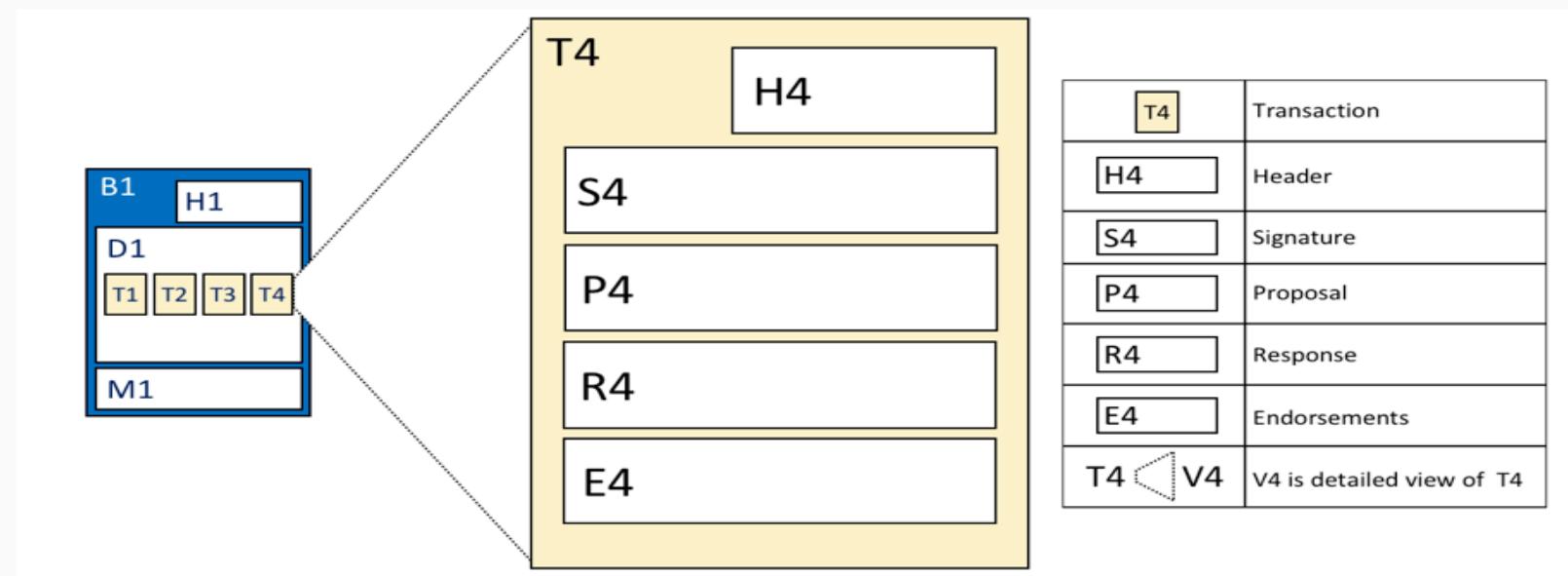


A *blockchain B* containing blocks *B0, B1, B2, B3*. *B0* is the first block in the blockchain, the *genesis block*.



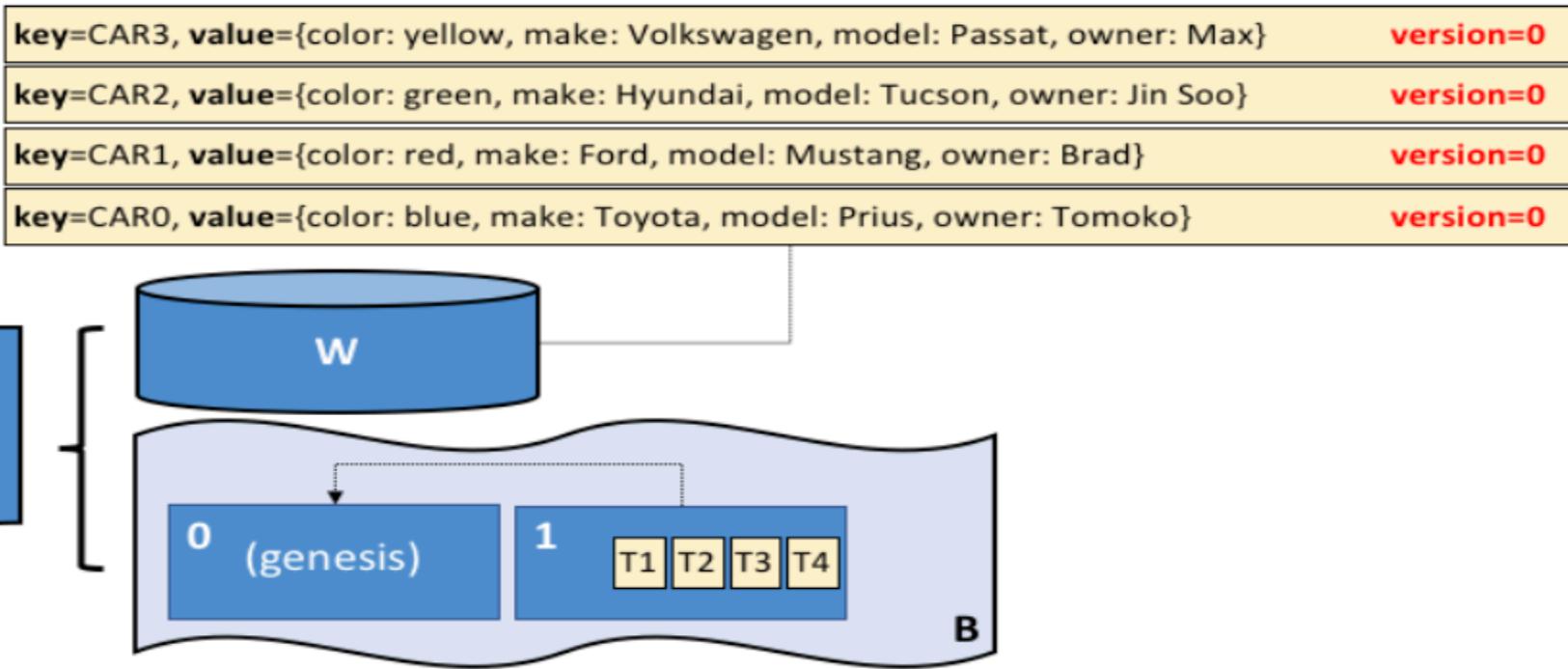
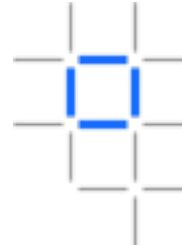
# Transactions

As we've seen, a transaction captures changes to the world state. Let's have a look at the detailed **blockdata** structure which contains the transactions in a block.



*Transaction details. Transaction T4 in blockdata D1 of block B1 consists of transaction header, H4, a transaction signature, S4, a transaction proposal P4, a transaction response, R4, and a list of endorsements, E4.*

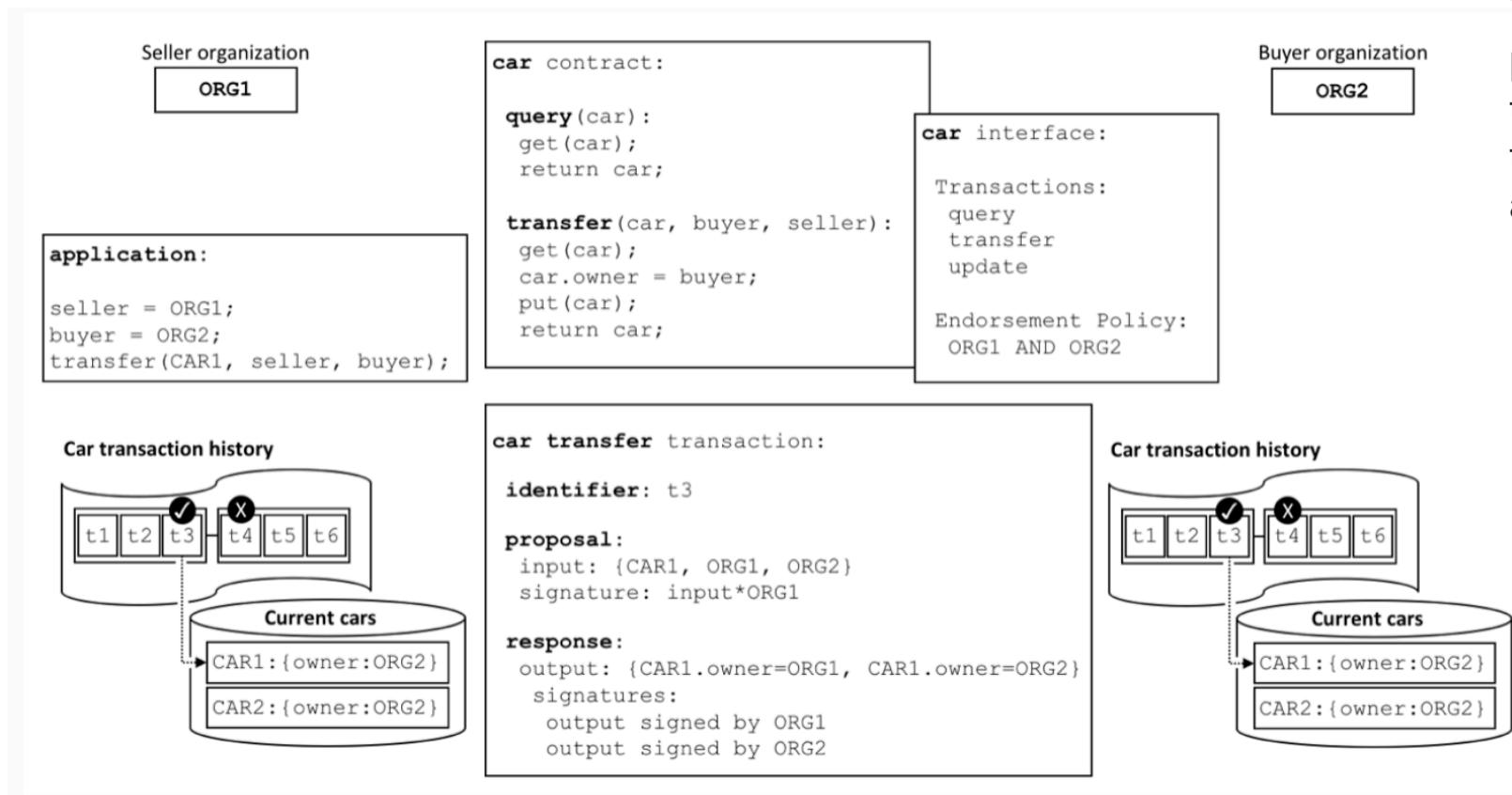
# So what makes a Blockchain a Ledger?



*The ledger, L, comprises a world state, W and a blockchain, B. W contains four states with keys: CAR1, CAR2, CAR3 and CAR4. B contains two blocks, 0 and 1. Block 1 contains four transactions: T1, T2, T3, T4.*



# Smart Contract

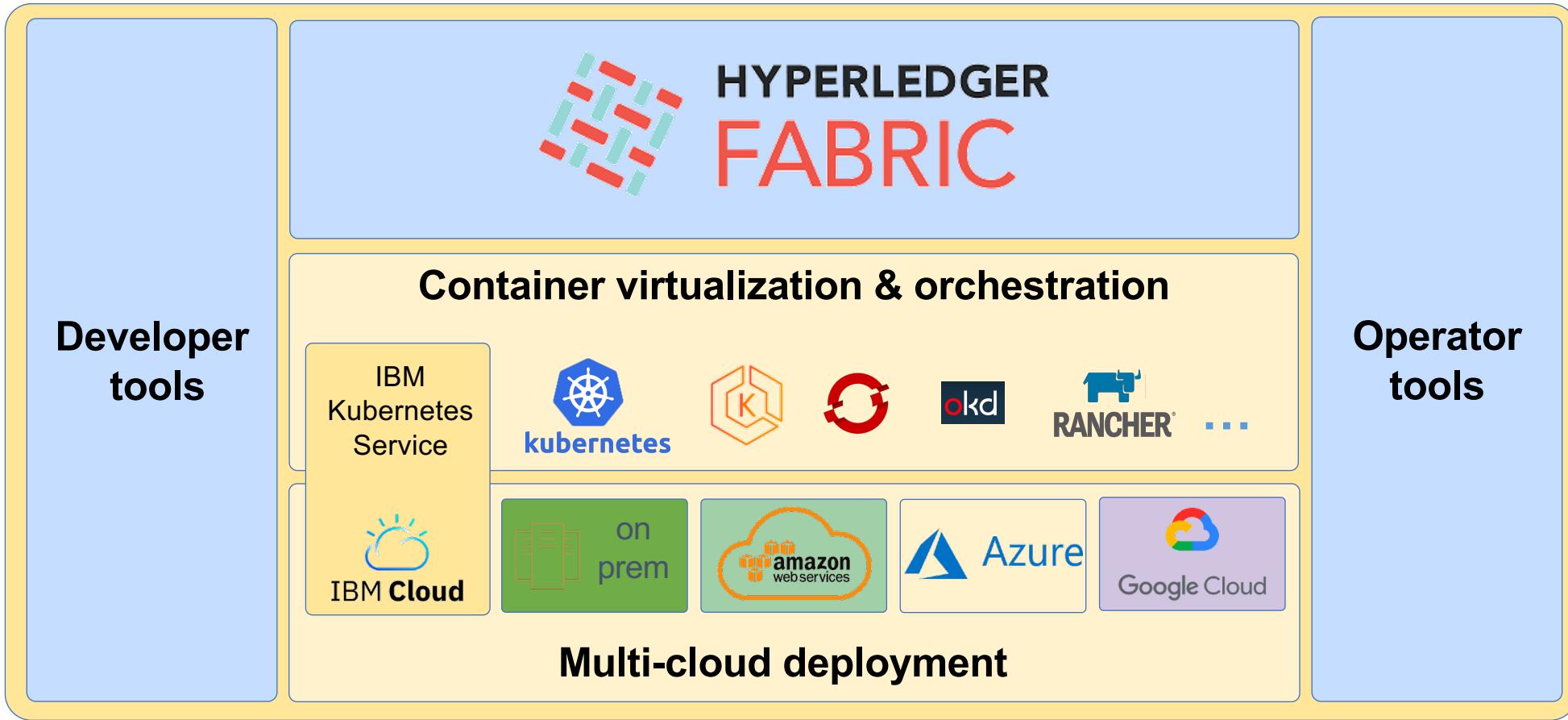
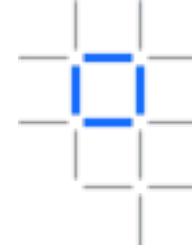


All transactions have an identifier, a proposal, and a response signed by a set of organizations. All transactions are recorded on the blockchain, whether valid or invalid, but only valid transactions contribute to the world state.

Hyperledger Fabric allows users to define policies around the execution of chaincode. These endorsement policies define which peers need to agree on the results of a transaction before it can be added to the ledger.

# Introducing IBM Blockchain Platform v2.1.2

*Build, operate and grow Hyperledger Fabric networks*



## Advanced tooling

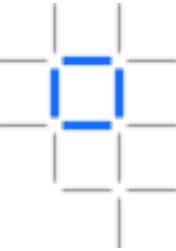
Create & manage smart contracts,  
applications & networks

## Open technology

Hyperledger Fabric,  
Containers, Kubernetes

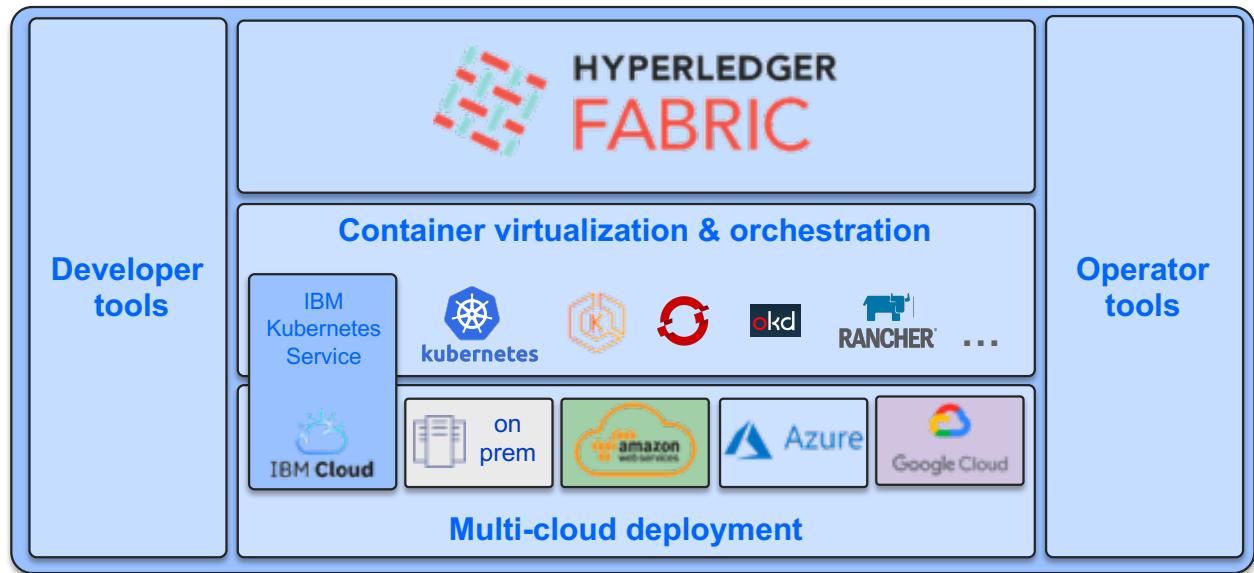
## Deploy anywhere

Comprehensive cloud &  
on-premises options

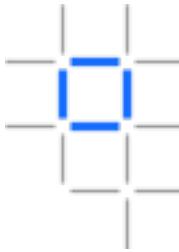


# IBM Blockchain Platform Deployment Options

- There is just one IBM Blockchain Platform product regardless of where it is deployed
  - **It sits on a Kubernetes container infrastructure on your chosen provider**
  - Kubernetes provides common logging and management services of the IBM Blockchain Platform
- When run on **IBM Cloud**, the IBM Blockchain Platform uses the IBM Cloud Kubernetes Service
  - **Use the free IBM Kubernetes tier for a free IBM Blockchain Platform, or a paid IBM Kubernetes tier for a paid IBM Blockchain Platform; free tiers expire after 30 days**
- When deployed **on-premises** or on any **non-IBM cloud**, IBM Blockchain Platform deploys to Kubernetes v1.11
  - Examples include OpenShift, OKD, Rancher & AEKS



# IBM Blockchain Platform is a key part of IBM's Blockchain Strategy



## 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



## IBM Blockchain Platform

Build, operate and grow blockchain networks in heterogeneous environments

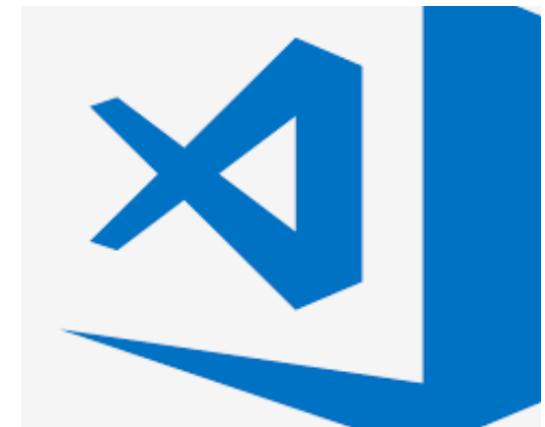
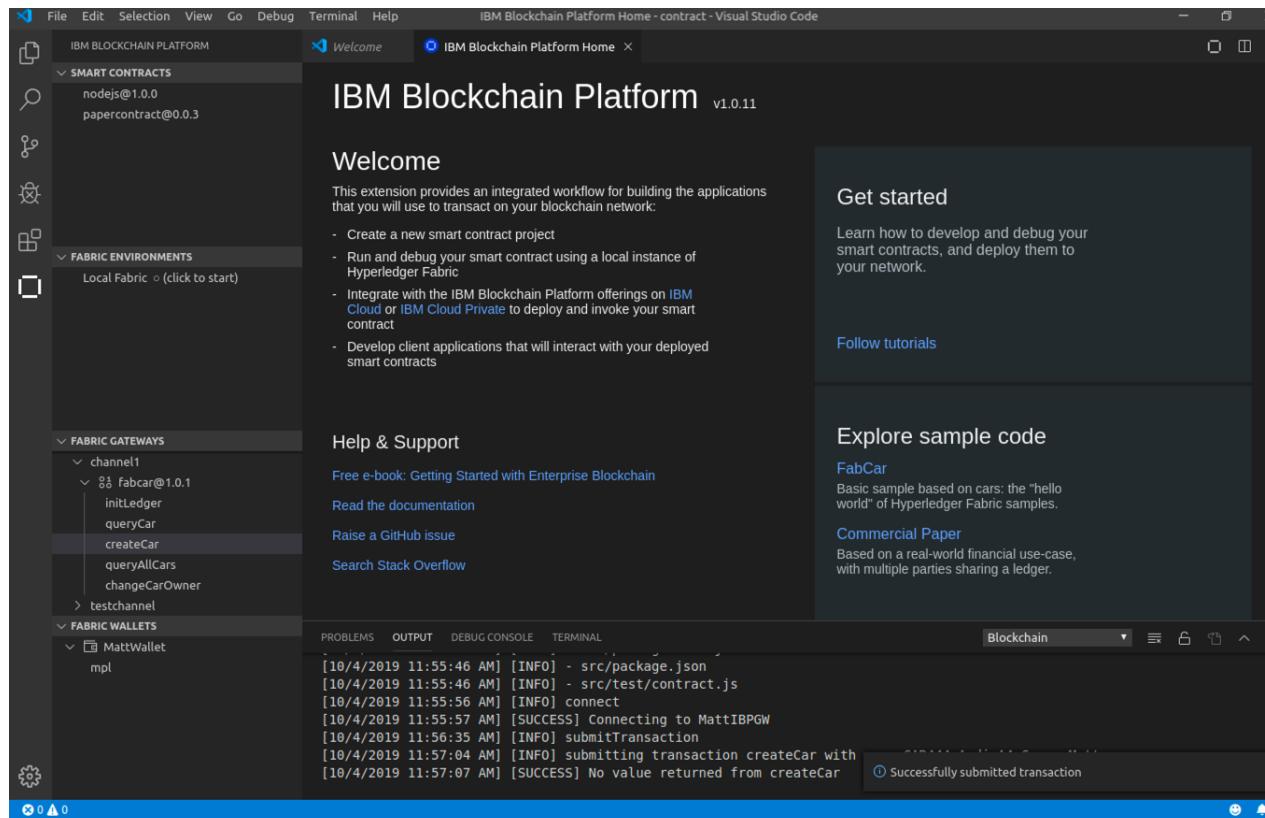


## HYPERLEDGER

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

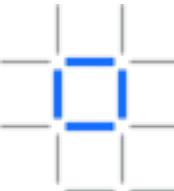
# Getting Started with Hyperledger Fabric

- The IBM Blockchain Platform makes it easy to get started with Hyperledger Fabric
- [Download VSCode developer](#) tool from VSCode marketplace. Linux, Windows and MacOS)
- Create local networks, smart contracts and applications. Move to multi-cloud when you're ready!



<https://marketplace.visualstudio.com/items?itemName=IBMBlockchain.ibm-blockchain-platform>

# IBM Blockchain Platform Admin Console



- Multi-cloud administration tool
  - Web UI to manage all IBP components
- Configure infrastructure on IBM Cloud
  - Configure IKS network, storage, compute
- Connect & Manage components
  - Peer, Orderer, CA, channel...
- Policy & Identity management
  - Create, update, display channel policies
- Smart contract package management
  - Install, instantiate, upgrade, discover

The screenshot shows the Admin Console interface for IBM Blockchain Platform Free 2.0 (Beta). The top navigation bar includes a user icon and a search bar. The main content area features a welcome message: "Welcome to the IBM Blockchain Platform console. You are able to monitor your Blockchain components across all deployments. Start by adding a certificate authority or other network component." Below this are sections for Nodes, Peers, Certificate Authorities, and Orderers, each with a list of components and a "Add [component]" button.

IBM Blockchain Platform Free 2.0 (Beta)

Welcome to the IBM Blockchain Platform console

You are able to monitor your Blockchain components across all deployments. Start by adding a certificate authority or other network component.

Learn more in our documentation  Do not show again

Add Certificate Authority Add peer Build a Smart Contract

Nodes

Peers ⓘ

EU-London-Test Peer PeerOrg1  IBM Cloud Private	EAP-Prod Peer PeerOrg1  IBM Cloud Private	EU-London-Prod Peer PeerOrg1  IBM Cloud Private	US-Dallas-Prod Peer PeerOrg1  IBM Cloud Private	US-Dallas-Test Peer PeerOrg1  Amazon Web Services	Add peer +
---	---	---	---	---	------------

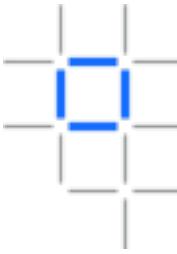
Certificate Authorities ⓘ

US-AuthSign Certificate Authority  IBM Cloud Private	EU-AuthSign Certificate Authority  IBM Cloud Private	Add Certificate Authority +
---	---	-----------------------------

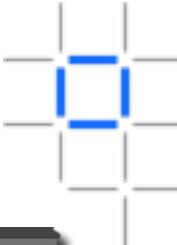
Orderers ⓘ

TMPF-Network Orderer	EurBankNet Orderer	Add orderer +
-------------------------	-----------------------	---------------

# Blockchain Videos



- <https://developer.ibm.com/technologies/blockchain/videos/>



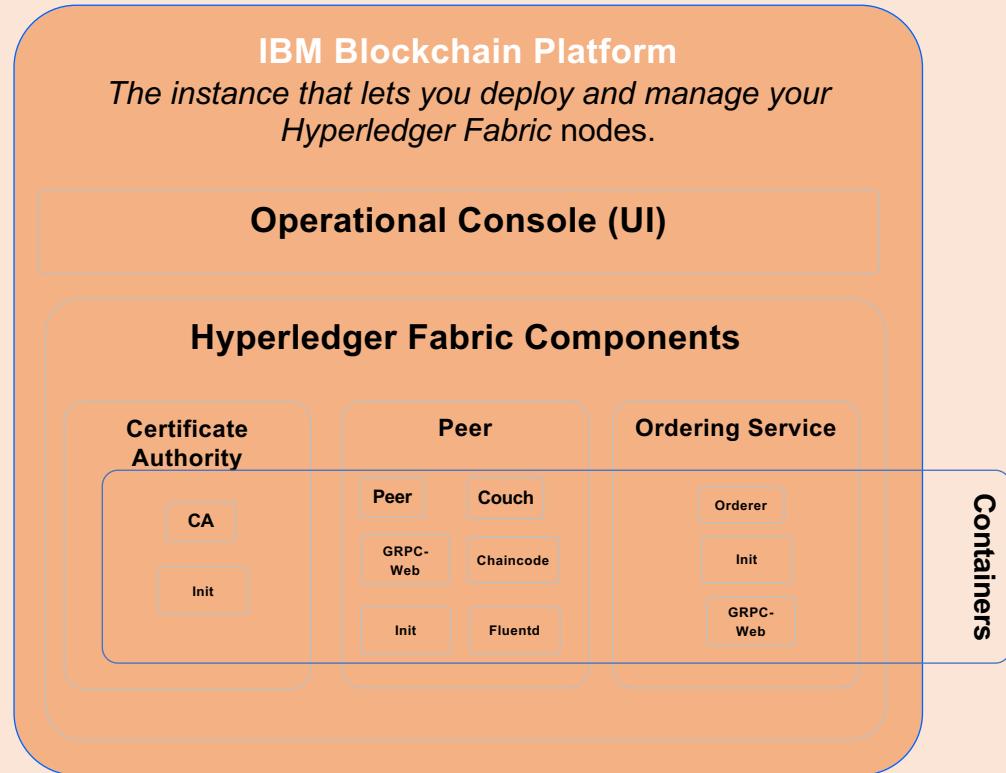
# On IBM Cloud, your blockchain components are deployed to an IBM Kubernetes service

- Blockchain resources are deployed into your own Kubernetes cluster
- This allows you to maintain control over your resources (CPU, storage, memory)
- Scale up or down as required for your blockchain environment
- Start small, pay as you grow for what you use with no upfront investment
- Maintain control of private keys

A screenshot of a web browser displaying the IBM Cloud Catalog. The URL in the address bar is 'cloud.ibm.com'. The page title is 'IBM Blockchain Platform'. The navigation bar includes 'IBM Cloud' (with a dropdown menu), a search icon, 'Catalog', 'Docs', and 'Support'. The main content area is titled 'Catalog'. On the left, there is a sidebar with 'All Categories' and a list of services: VPC Infrastructure, Compute (with 'Containers' highlighted in blue), Networking, Storage, AI, Analytics, Databases, and Developer Tools. On the right, there is a card for the 'Kubernetes Cluster' service, which is described as 'Deploy native Kubernetes clusters with the latest upstream versions on hardened master and worker nodes.' Below this card, another partially visible card shows a purple icon and the text 'APIs and services'.

# Deployment Overview: IBP & IKS & Storage

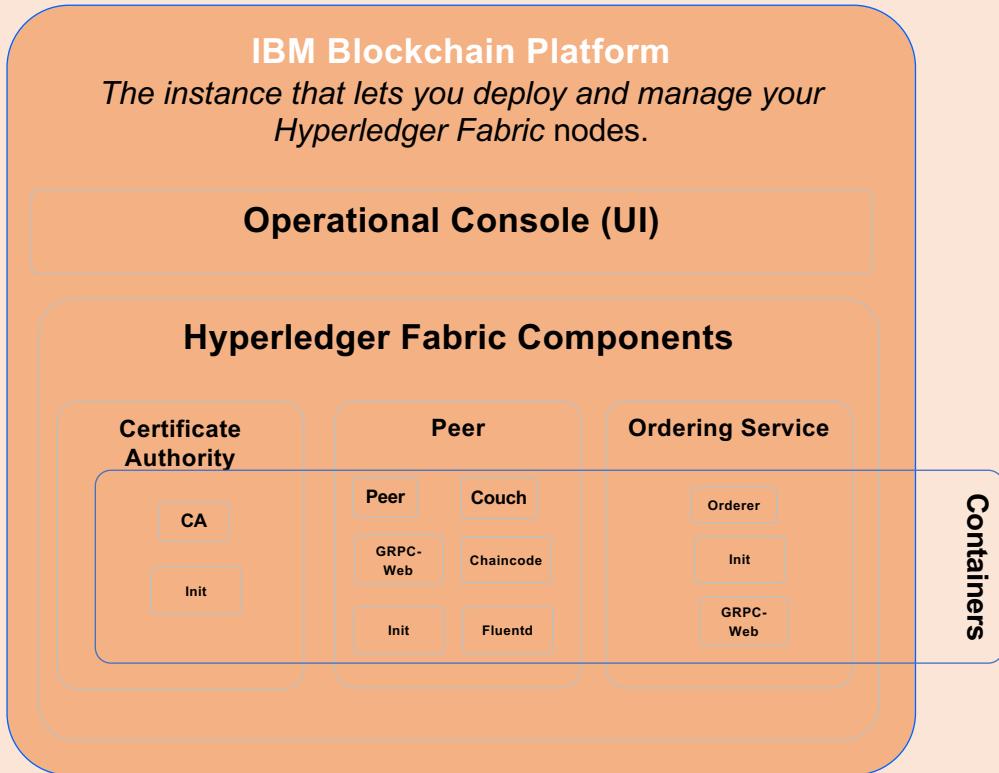
## Your Blockchain Service



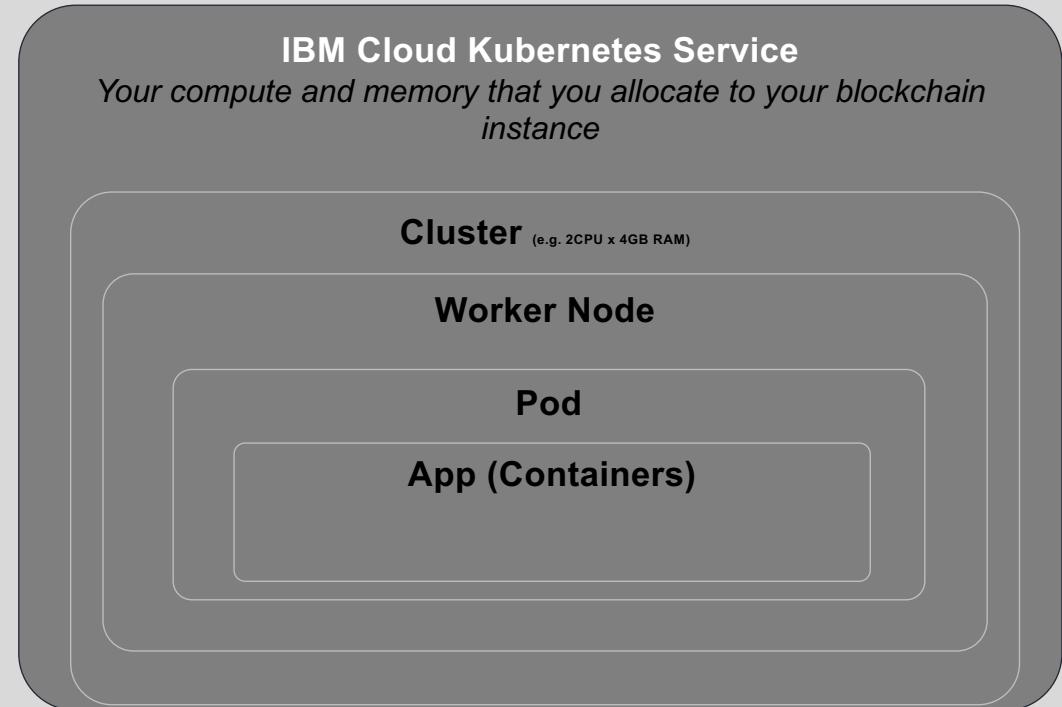
## Your Infrastructure Resources

# Deployment Overview: IBP & IKS & Storage

## Your Blockchain Service

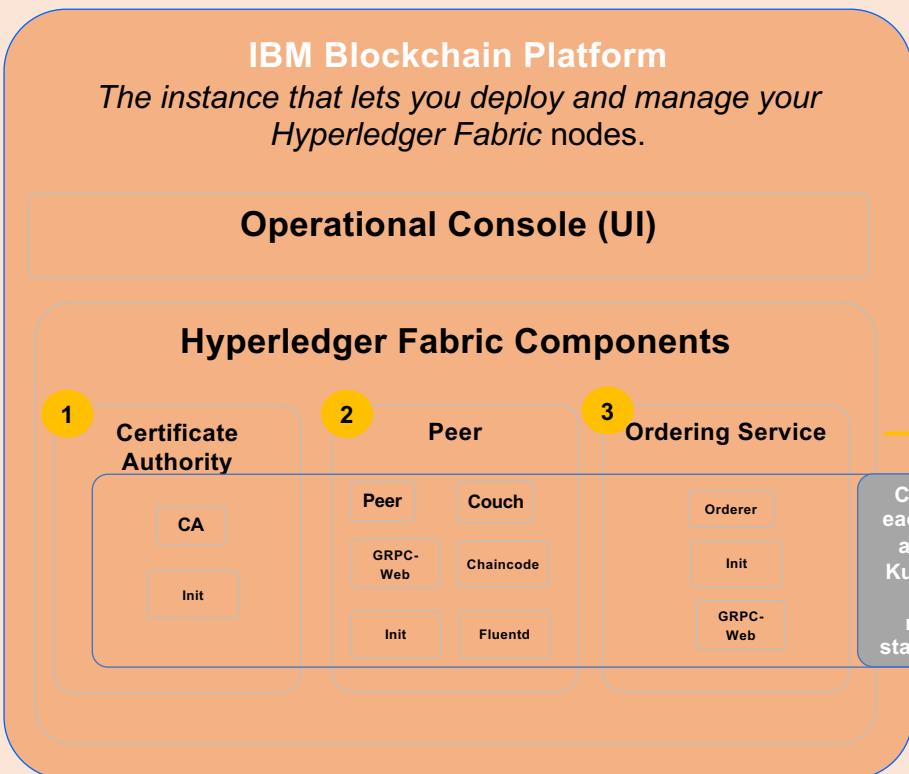


## Your Infrastructure Resources

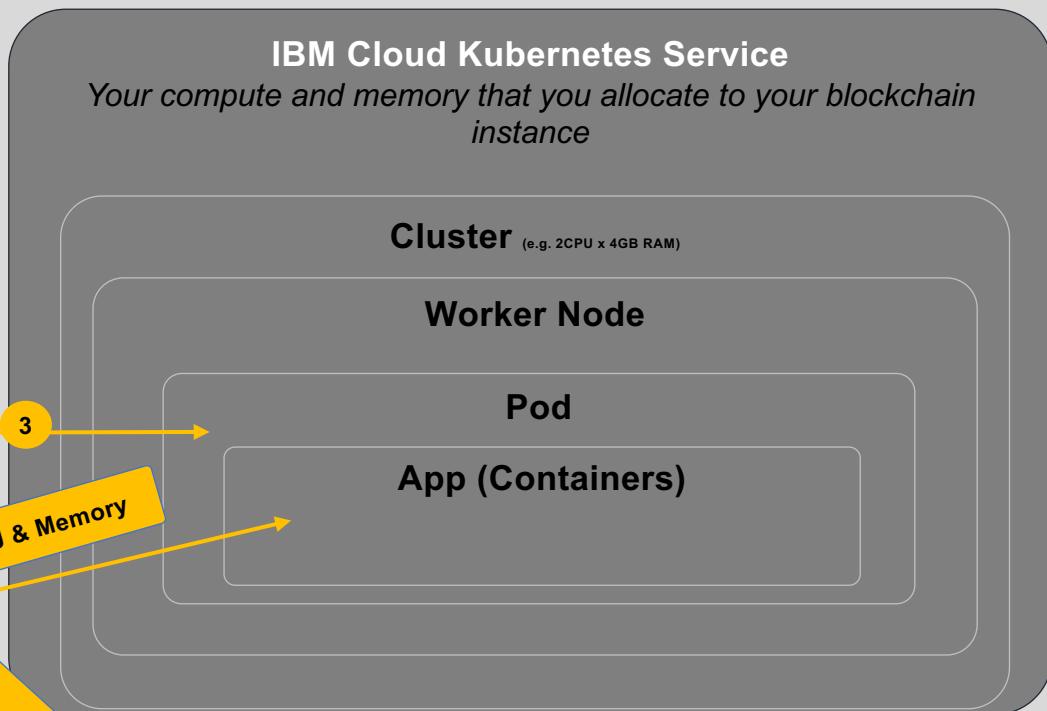


# Deployment Overview: IBM & IKS & Storage

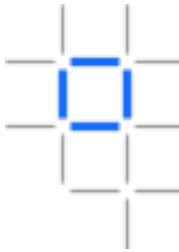
## Your Blockchain Service



## Your Infrastructure Resources

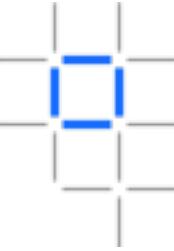


# Summary

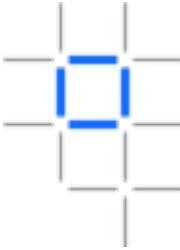


- The **Hyperledger Fabric transaction**
  - Structure drives system design and application architecture
- **Smart contract**
  - Contains transaction definitions for entire lifecycle of business object(s) stored in a decentralized ledger
  - built-in contract class makes programming easy
- **Application**
  - Consensus is complex, but the SDK makes it easy for applications
  - submitTransaction(), evaluateTransaction(), addListener()
  - gateway connectionOptions for ultimate customizability
- The **IBM Blockchain Platform** difference
  - Multi-cloud networks, developer & operator tools, IBM service and support

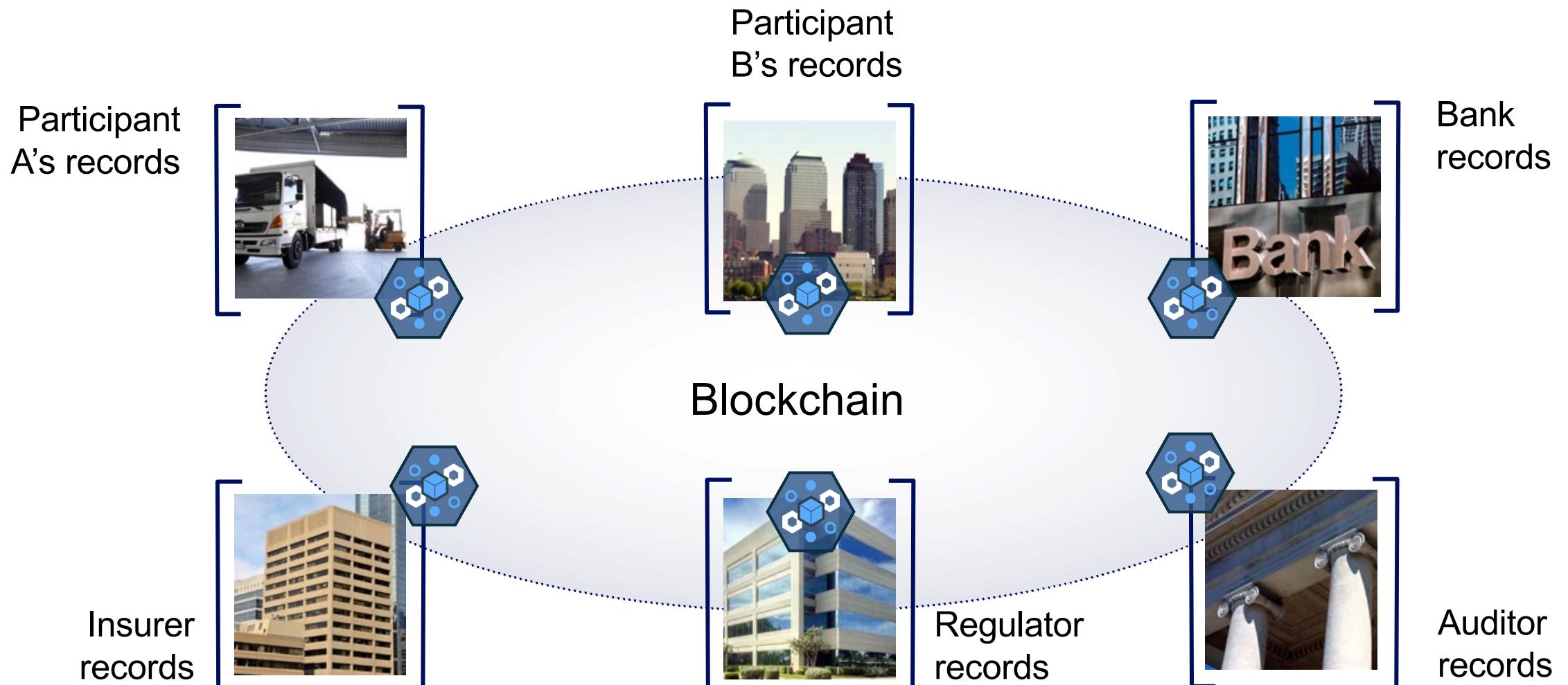
```
// Create a new paper  
// with some basic information  
// and set its issued status  
// to false by default.  
  
String issued = null;  
String maturityDate = null;  
Integer faceValue = null;  
  
async issue(ctx, issuer, paperNumber,  
           issued, maturityDate, faceValue)  
{  
    // Create an instance of the paper  
    let paper = CommercialPaper.create();  
  
    // Smart contract, rather than paper  
    paper.setIssued();  
  
    // Newly issued paper is owned by  
    // the issuer.  
    paper.setOwner(issuer);  
  
    // Add the paper to the ledger.  
    await ctx.stub.addHyperledgerFabric(paper);  
}  
  
// Create a new paper  
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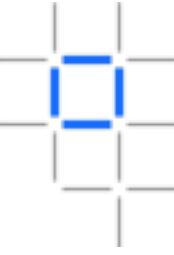
# Supply Chain and Blockchain



# A shared, replicated, permissioned ledger

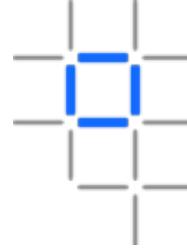


... with consensus, provenance, immutability and finality

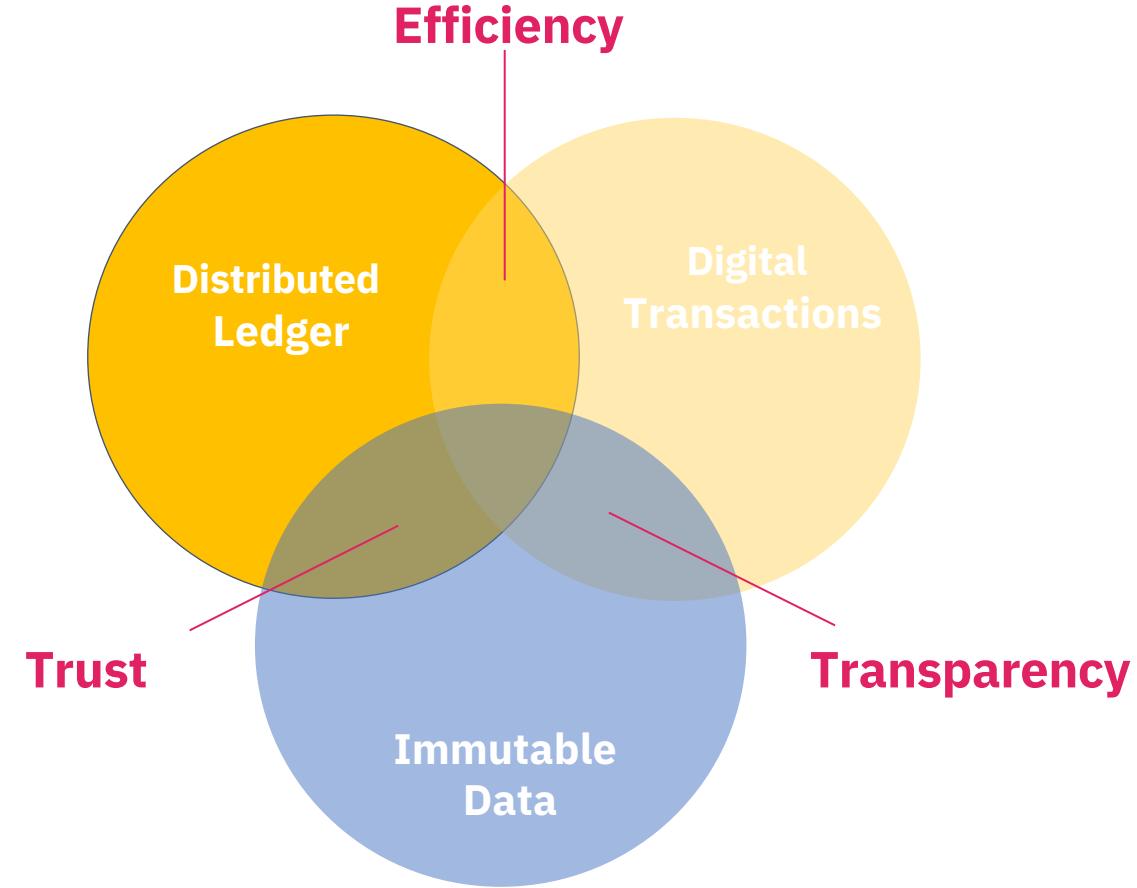


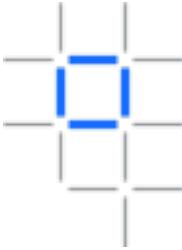
**No trusted third party**  
**No need for reconciliation**  
**between ledgers**

# Introducing IBM Food Trust™ built on Blockchain technology



- The IBM Food Trust solution is a set of modules providing traceability to improve food transparency and efficiency
- Blockchain is used to create a trusted connection with shared value for all ecosystem participants, including end consumers
- The solution offers connectors for interoperability and leveraging existing standards (e.g., GS1)
- Blockchain properties come together to create a more trusted, transparent, and efficient data-sharing platform.



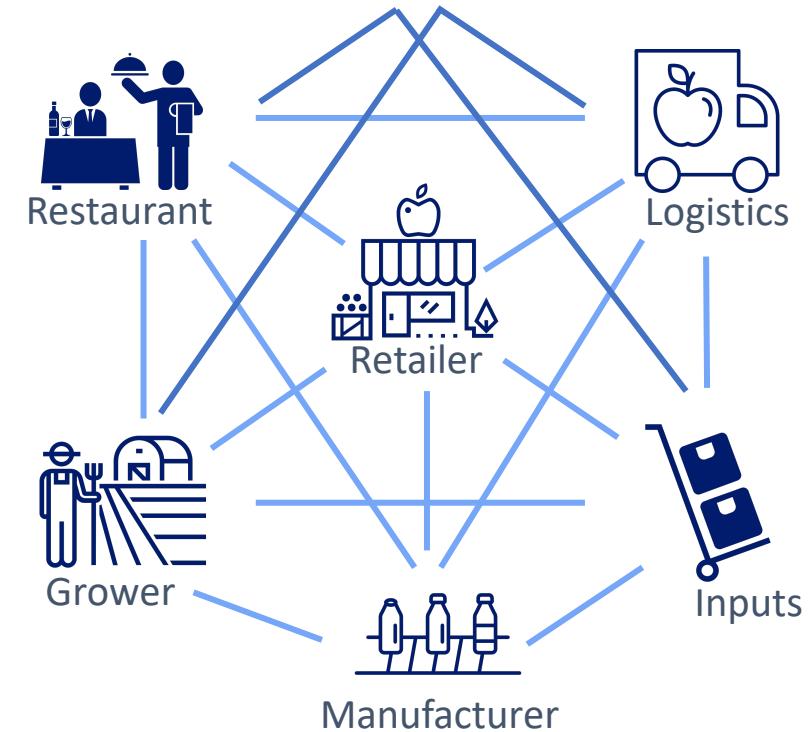


# Today, traditional system constructs limit transparency

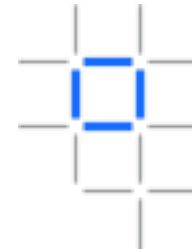
## The Problem:

- Data is siloed within each company and accessing it requires a request and time
- Exchange of information takes place between a pair of partners; to get information from a distant partner may require intermediaries, time, resources
- Most transactions are still paper-based, creating inefficiencies and opportunities for fraud
- Because everyone maintains their own record of transactions, differences take time and resources to reconcile

## The food industry today



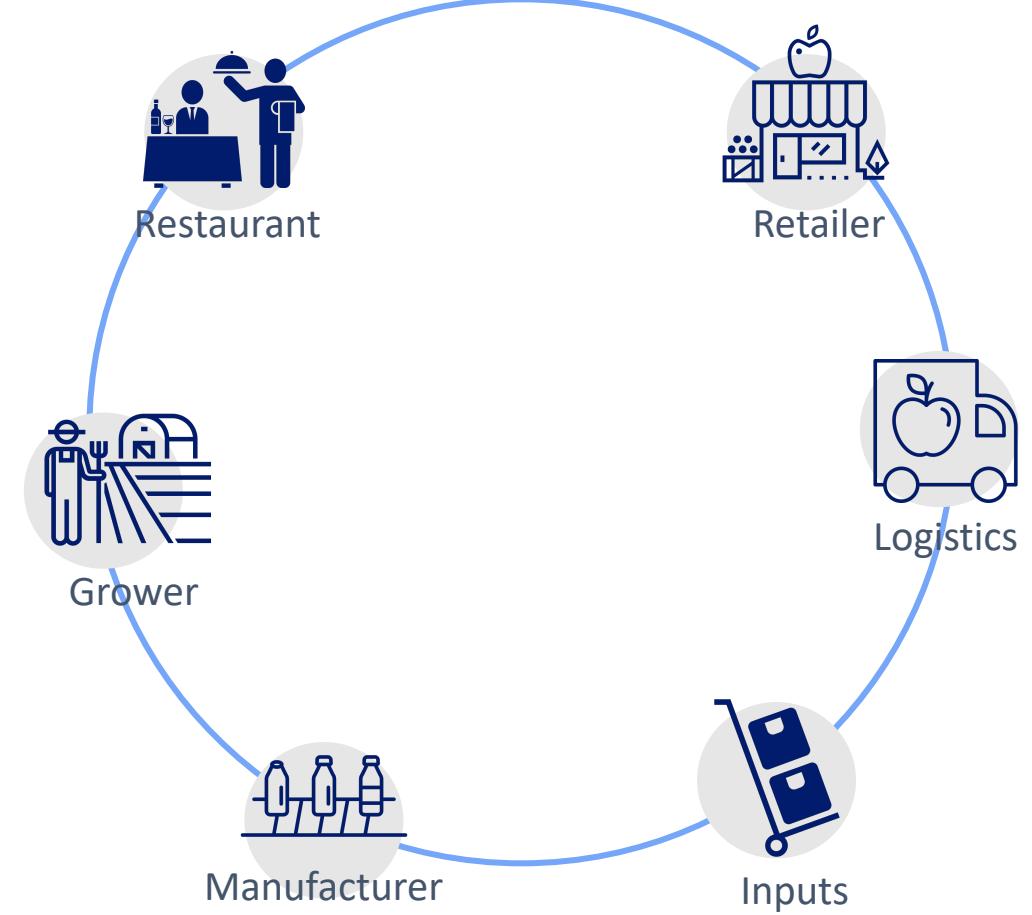
# Blockchain transforms systems with trust and transparency



## The Solution:

- Because blockchain provides an **independent data-sharing platform**, participants **trust it**
- Once data is shared in a single data-sharing platform, everyone has **instant transparency** into the transactions they are authorized to view; no intermediation required
- **Data immutability** creates an auditable record of all transactions, disincentivizing fraudulent behavior
- **Dispute resolution** from the shared ledger can be automated saving time and resources

The food industry with blockchain



Product name:  
Fresh Blueberries

GTIN:  
00390290-bbery

Current inventory

**Insights**

Inventory

At risk

Dwell time

Time since production

**At-risk inventory data is provided at the product level.**

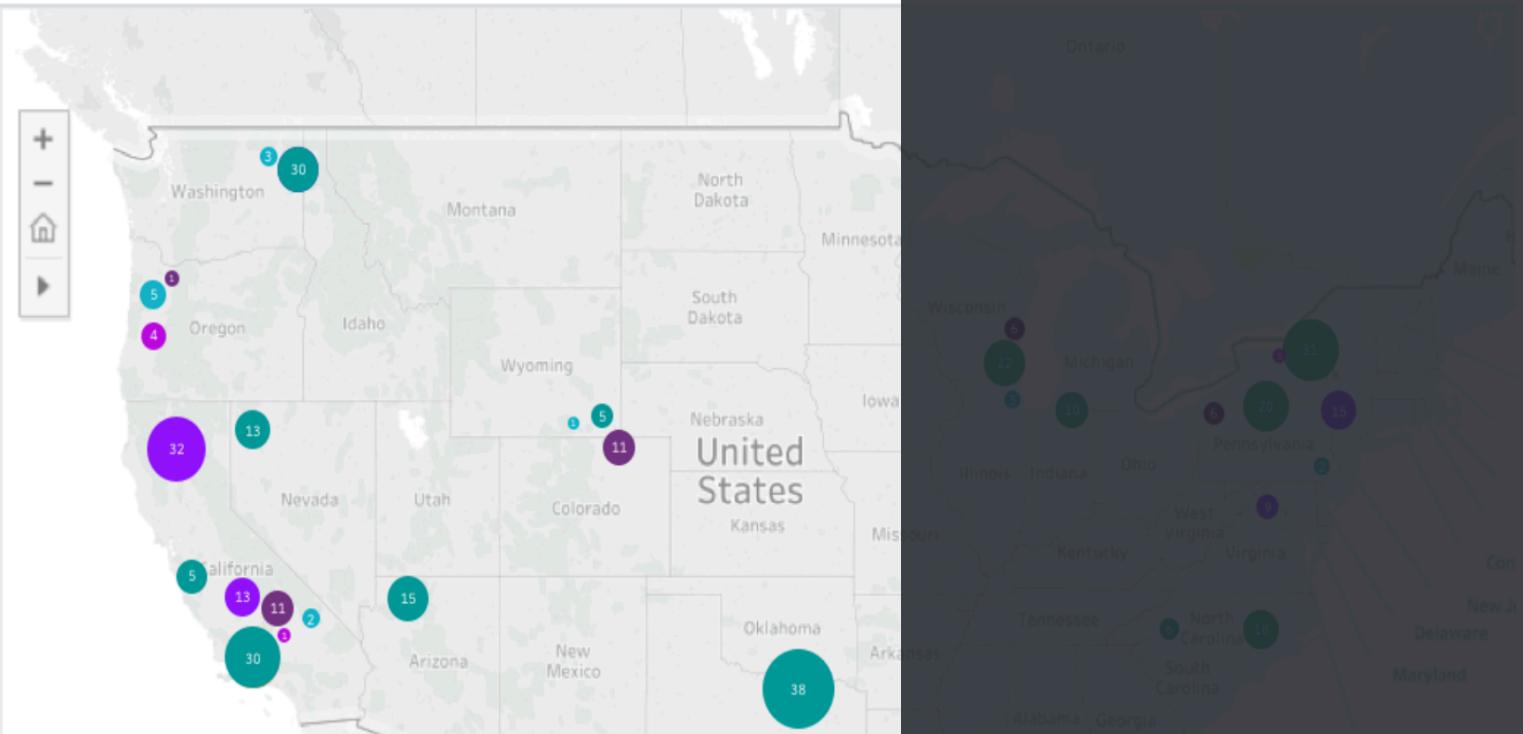
- Clicking on the facilities allows you to see which facilities have at-risk inventory, and the details for at-risk products.

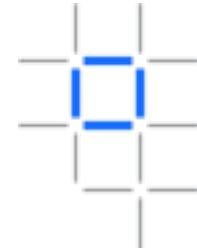
Daily data interval, with a date range:

29th March 2018 - 20th May 2018

 Update

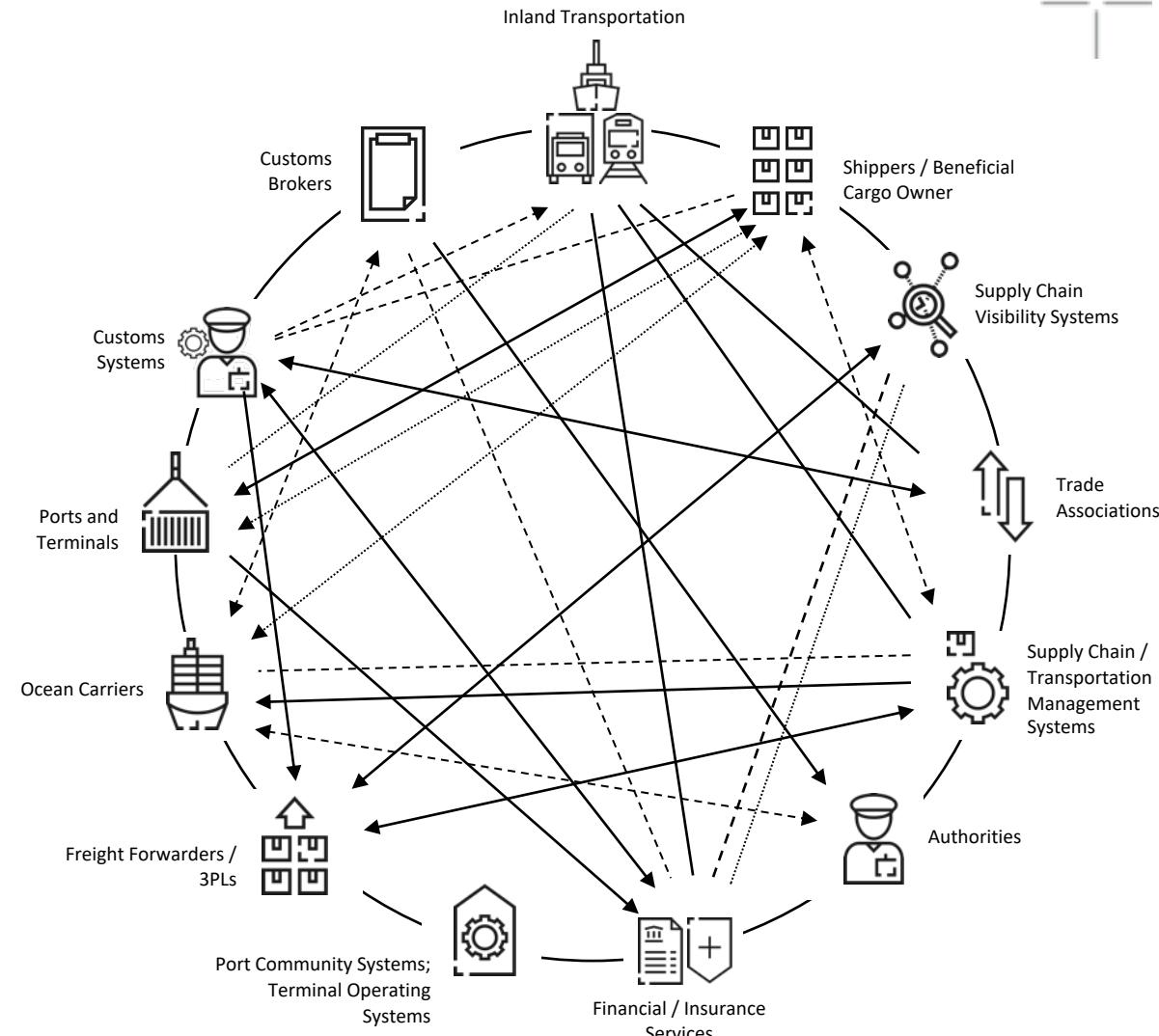
Facility	Total facilities
Farms	420
Packing houses	20
Manufacturing of goods	15
Warehouses	13
Stores	1,230

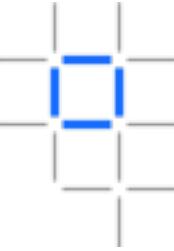




# TradeLens: Global trade is highly inefficient and burdened by paper-based processes

- Data trapped in organizational silos
- Manual, time-consuming, paper-based processes
- Clearance takes too long and is often subject to fraud
- High costs and poor customer service





# Let's get coding!

# Visual Studio Code

For this workshop you will need to confirm you have the ***Sept 2019 version 1.39.x*** of Visual Studio Code installed.

As well as the correct versions of docker, docker-compose and node.js

- Please follow instructions on our github here

<https://github.com/Grant-Steinfeld/coffee-supply-chain-blockchain>

# Development tools and Installation

The current workshop uses all cloud components, no installation is necessary. After the workshop, you will need to install the following products:

- Visual Studio Code: <https://code.visualstudio.com>
- Followed by the Visual Studio Platform plug-in:  
<https://bit.ly/2RS2R02>
- An account on the IBM Cloud: <https://www.ibm.com/cloud>
- Followed by the signing up to the IBM Blockchain Platform Service: <https://ibm.co/398sxeT>

# VSCode Extension

Visual Studio | Marketplace

Visual Studio Code > Programming Languages > IBM Blockchain Platform



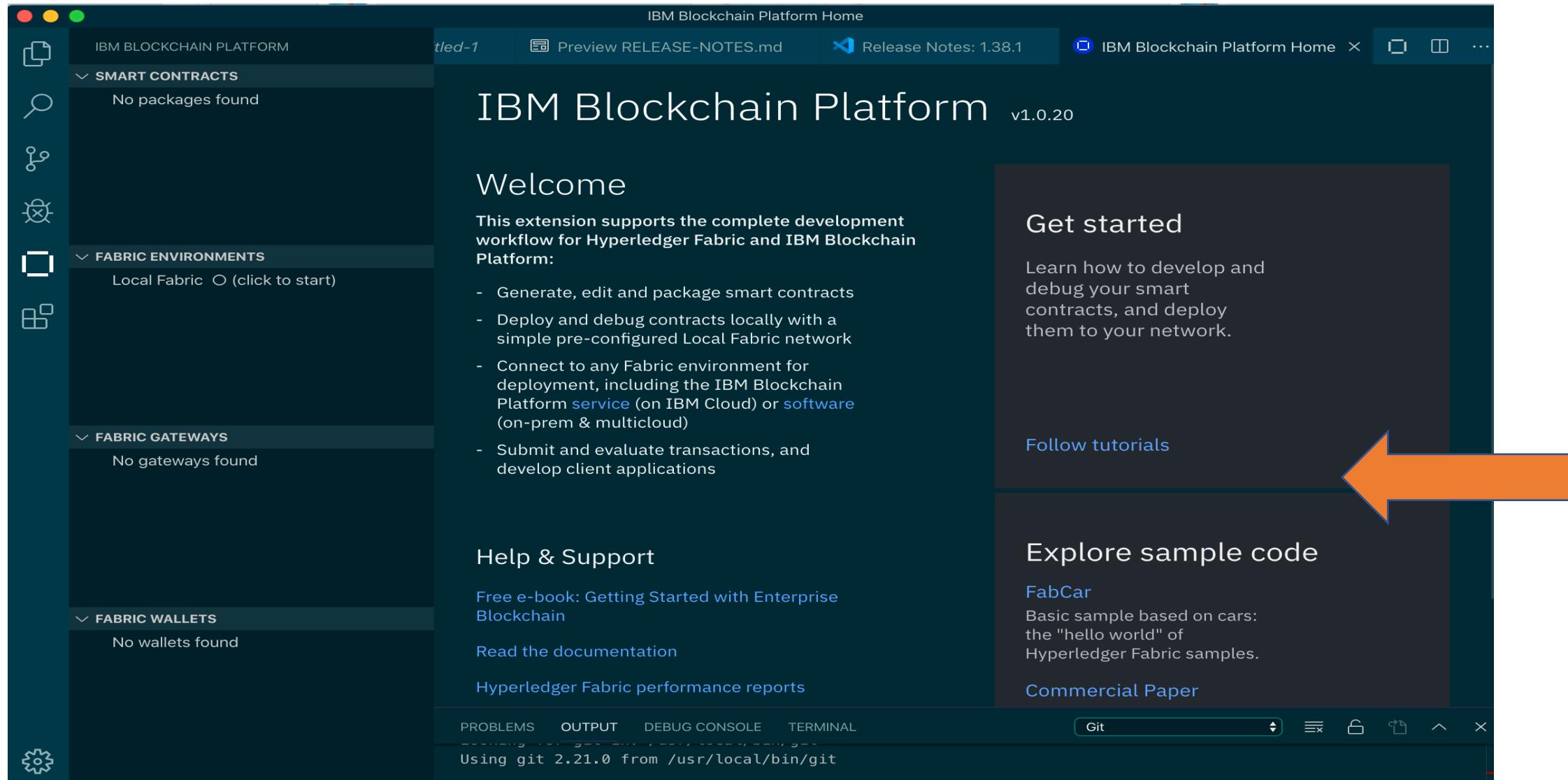
**IBM Blockchain Platform**

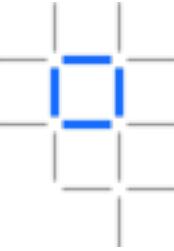
**IBM Blockchain** | 33,782 installs | ★★★★★ (5) | Free

End to end extension for Hyperledger Fabric developers. Develop and test your blockchain smart contracts and client applications on your local machine, and package your projects for deployment into IBM Blockchain Platform runtimes.

[Install](#) [Trouble Installing?](#)

# VS Code with VS Code extension

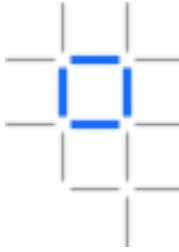




# Additional Materials

- IBM Blockchain 101: <https://ibm.co/36U1QZM>
- Blockchain code patterns: <https://ibm.co/2GROsL0>

# Lab 1

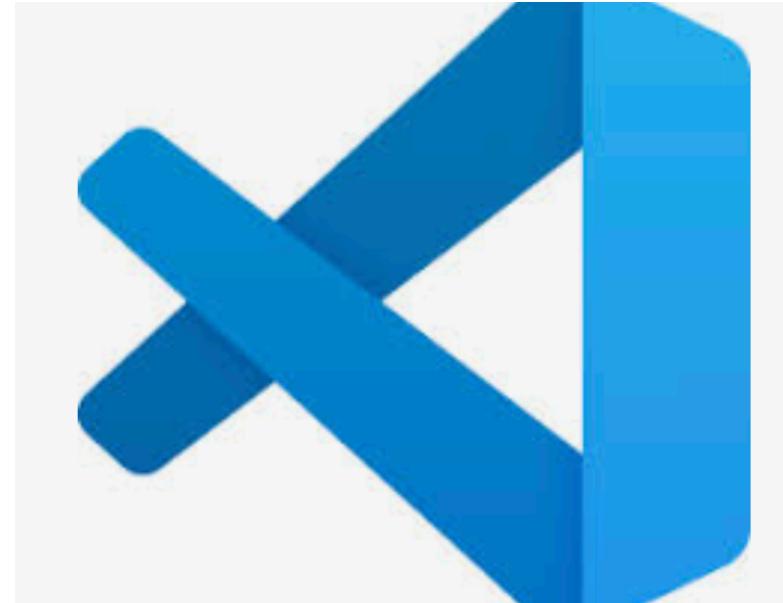


Tutorial 1

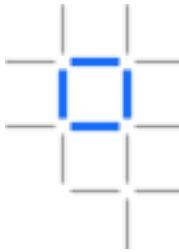
20-30 mins

## Local smart contract development

Follow the typical workflow from generating a new smart contract project, deploying code to the Local Fabric runtime, and testing your transactions via an application gateway.



# Lab 2



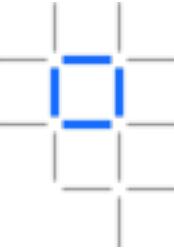
Tutorial 2

50-60 mins

## Create a cloud blockchain deployment

Sign up for the IBM Blockchain Platform service on IBM Cloud, and configure a simple environment ready to deploy your smart contracts to.





# Lab 3, stretch goal.

Tutorial 3

15-20 mins

## Deploying and transacting with IBM Cloud

Export smart contracts from VSCode, deploy them in your environment on IBM Cloud, then send transactions from your local machine by creating a gateway.

# Additional labs.

Showing 1 - 12 of 50 results

Sort: Date Newest to ▾

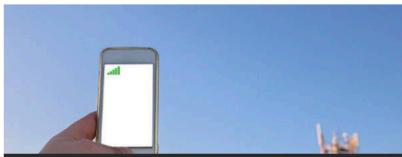


- Blockchain Bean 2:

<https://github.com/IBM/blockchainbean2>

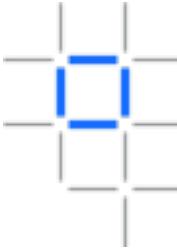
- Blockchain code patterns

<https://developer.ibm.com/patterns/category/blockchain/>

 Code Pattern <a href="#">Secure a digital wallet in the public cloud</a> January 28, 2020 →	 Code Pattern <a href="#">Build a digital asset management application using blockchain</a> January 20, 2020 →	 Code Pattern <a href="#">Run a smart contract on a blockchain network with the Raft ordering service</a> January 8, 2020 →
 Code Pattern <a href="#">Blockchain for telecom roaming, fraud user identification, and overage management</a> October 8, 2019 →	 Code Pattern <a href="#">Use a PostgreSQL database as a Hyperledger Fabric wallet using Fabric Node SDK</a> September 17, 2019 →	 Code Pattern <a href="#">Build a network to support blockchain-enabled crowdfunding</a> September 9, 2019 →
 Code Pattern <a href="#">Create and deploy a blockchain network using Hyperledger Fabric SDK for Java</a> August 16, 2019 →	 Code Pattern <a href="#">Build a blockchain network for trusted IoT</a> August 1, 2019 →	 Code Pattern <a href="#">Build a global finance application on blockchain</a> July 31, 2019 →
 Code Pattern <a href="#">Use CI/CD to deploy a chaincode to blockchain in private cloud on LinuxONE</a> July 16, 2019 →	 Code Pattern <a href="#">Build a secure e-voting app</a> July 10, 2019 →	 Code Pattern <a href="#">Use a Kubernetes cluster to deploy a Fabric network smart contract onto blockchain</a> June 17, 2019 →



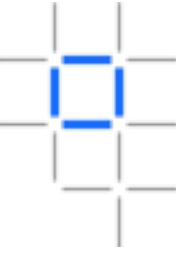
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# Housekeeping

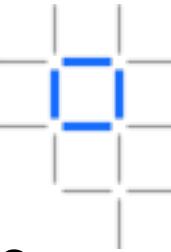
- VCPI link SF: <https://ibm.biz/BdqDWA>
  - Whitelisting: <https://cloud.ibm.com/registration/whitelist>
  - IBM Careers: <https://careers.ibm.com>
  - IBM Partner world: <https://www.ibm.com/partnerworld/public>
  - Sign up to the IBM Cloud: <https://ibm.biz/BdqDWA>
- 
- [https://cloud.ibm.com/registration?cm\\_mmc>Email\\_Events\\_-\\_Developer\\_Innovation\\_-\\_WW\\_WW\\_-\\_advocates:alf,max-katz\title:howtoreateasupplychainblockchainapp\eventid:5e2f89bbb1889fcaca174d52\date:Feb2020\type:workshop\team:global-devadvgrp-sanfrancisco\city:santaclaral\country:unitedstates\tags:blockchain\contents:blockchain-disaster-management-solution&cm\\_mmca1=000019RS&cm\\_mmca2=10004805&cm\\_mmca3=M99938765&eventid=5e2f89bbb1889fcaca174d52&cvo\\_src=email.Events.M99938765&cvo\\_campaign=000019RS](https://cloud.ibm.com/registration?cm_mmc>Email_Events_-_Developer_Innovation_-_WW_WW_-_advocates:alf,max-katz\title:howtoreateasupplychainblockchainapp\eventid:5e2f89bbb1889fcaca174d52\date:Feb2020\type:workshop\team:global-devadvgrp-sanfrancisco\city:santaclaral\country:unitedstates\tags:blockchain\contents:blockchain-disaster-management-solution&cm_mmca1=000019RS&cm_mmca2=10004805&cm_mmca3=M99938765&eventid=5e2f89bbb1889fcaca174d52&cvo_src=email.Events.M99938765&cvo_campaign=000019RS)

# Event format



- Two hour workshop on 2/24 NYC and 2/27 SF
- Intro, presentation 30 minutes
- Workshop 1 hour using new IBM OpenLabs environment
- Wrapup 30 minutes

# Event Overview



Blockchain increases visibility and efficiency in the supply chain like the coffee trade. See how blockchain can assist farmers, roaster and everyone between, bring you a fresher and fairer cup. Come out and we will walk you through design, development, and deployment of an illustrative blockchain network and application.

In this hands-on workshop, you will learn about:

- Developing a supply chain blockchain application with VS Code
- Deploying it on the IBM Blockchain Platform.
- Successful Blockchain applications in the Supply Chain space such as IBM Food Trust and others
- Best practices for developing blockchain applications today and looking forward to the future

# Thank you

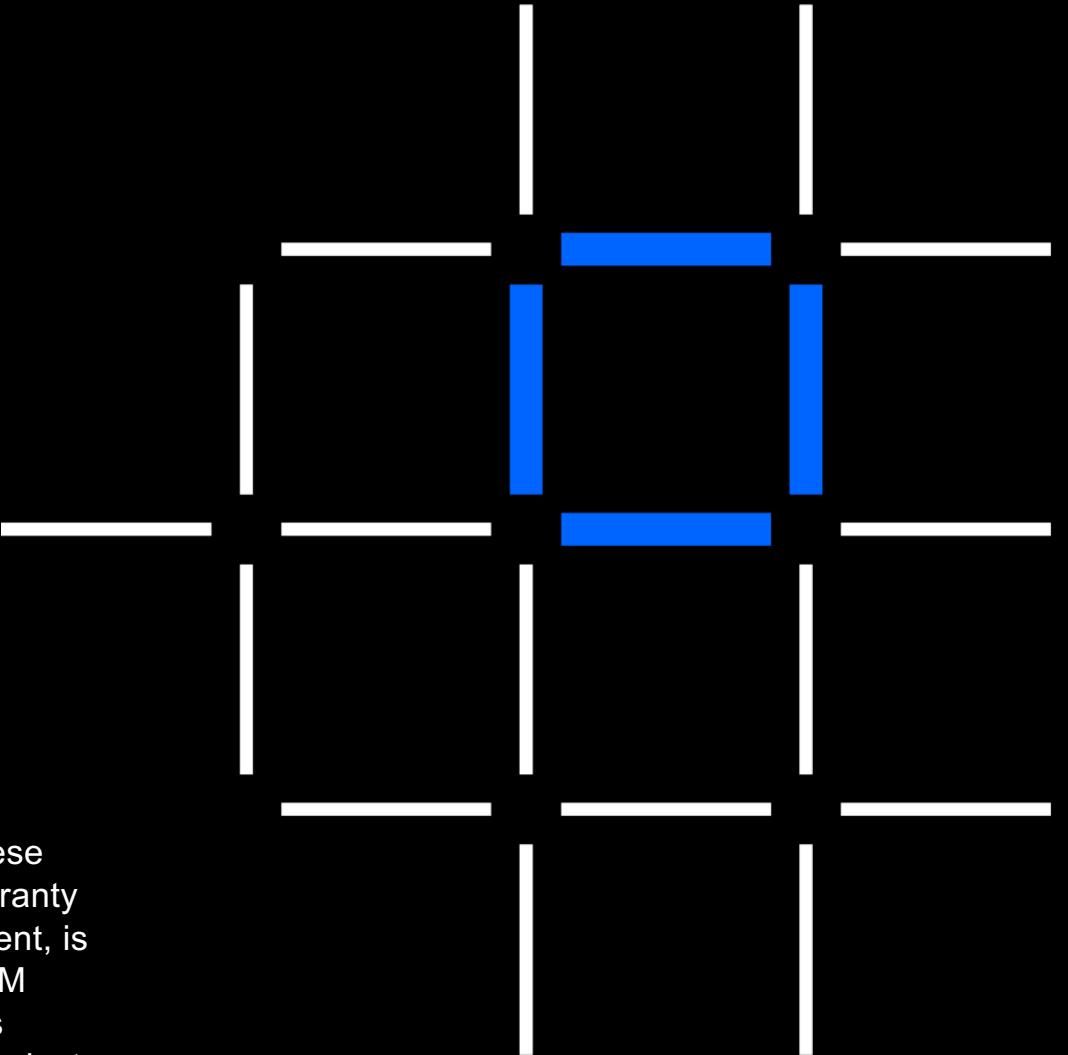
*Lennart Frantzell  
Grant Steinfeld*

## IBM Blockchain

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

[developer.ibm.com/blockchain](http://developer.ibm.com/blockchain)

[www.hyperledger.org](http://www.hyperledger.org)



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