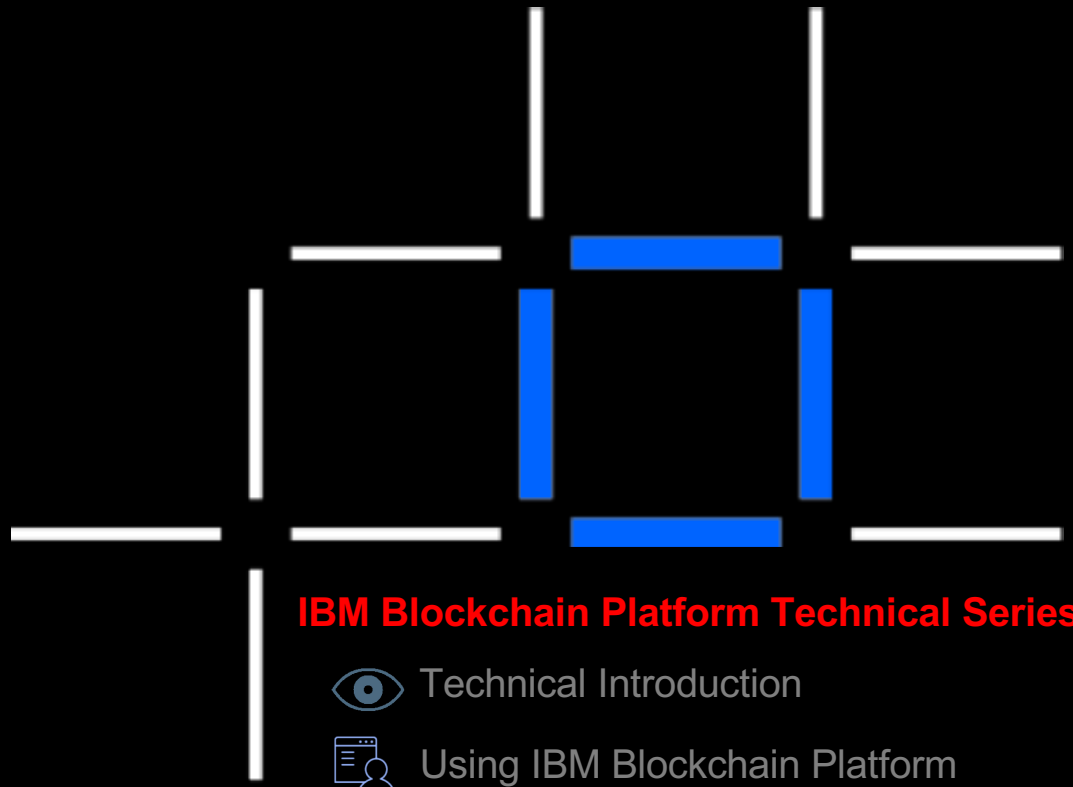
How to create a supply chain Blockchain App

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

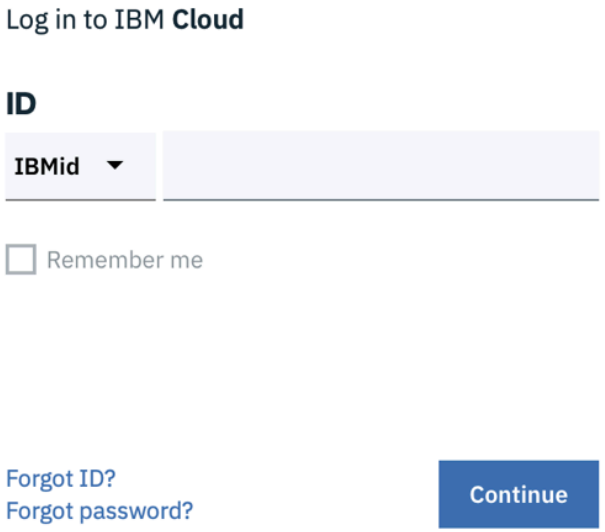
Feb 22 2020

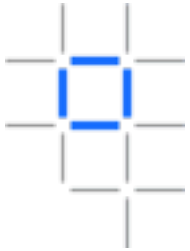
IBM **Blockchain**

IBM

Sign up to a free IBM Cloud Account

https://ibm.biz/BdqDWA



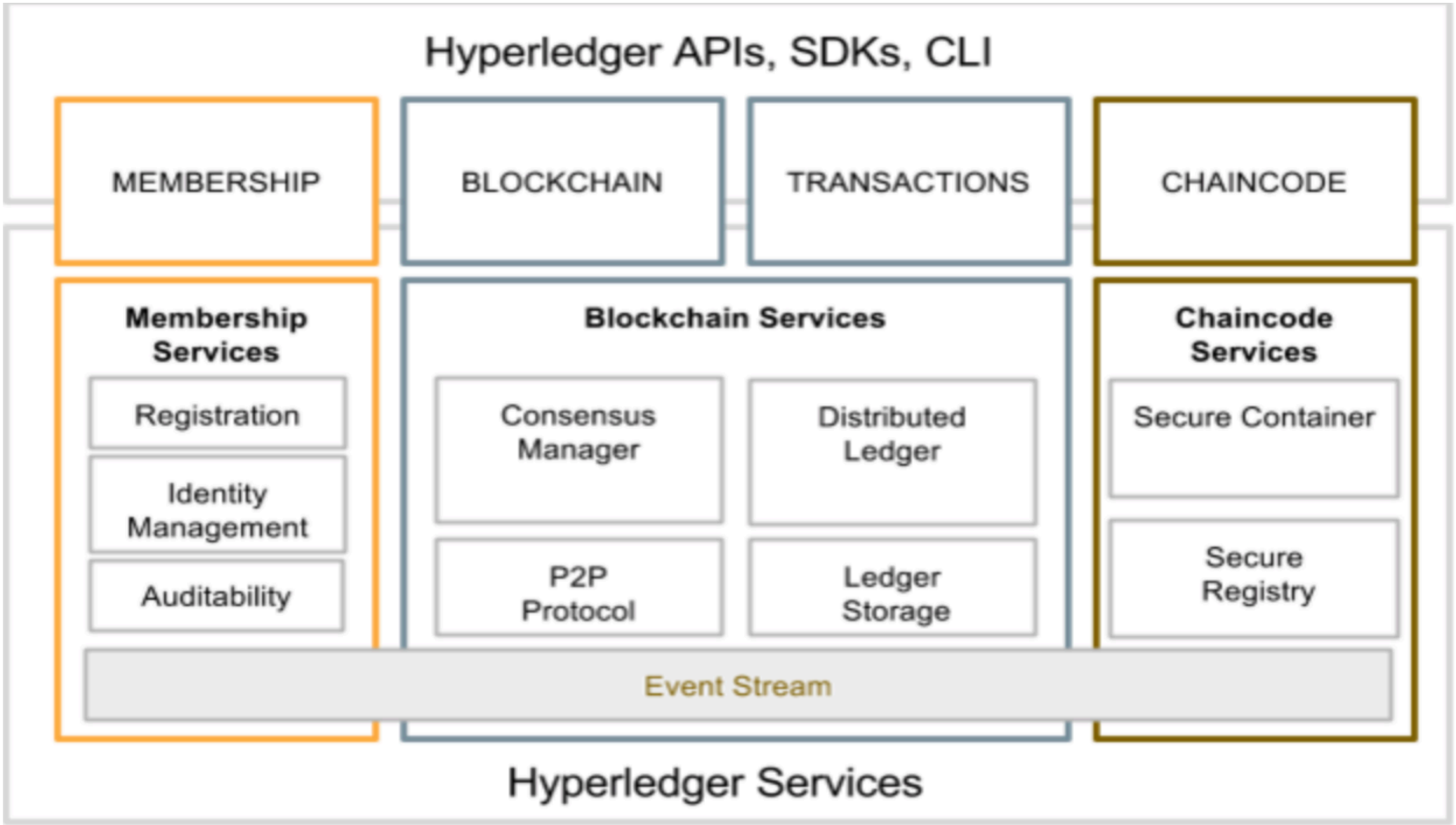


And now let’s go through the IBM Blockchain Platform architecture

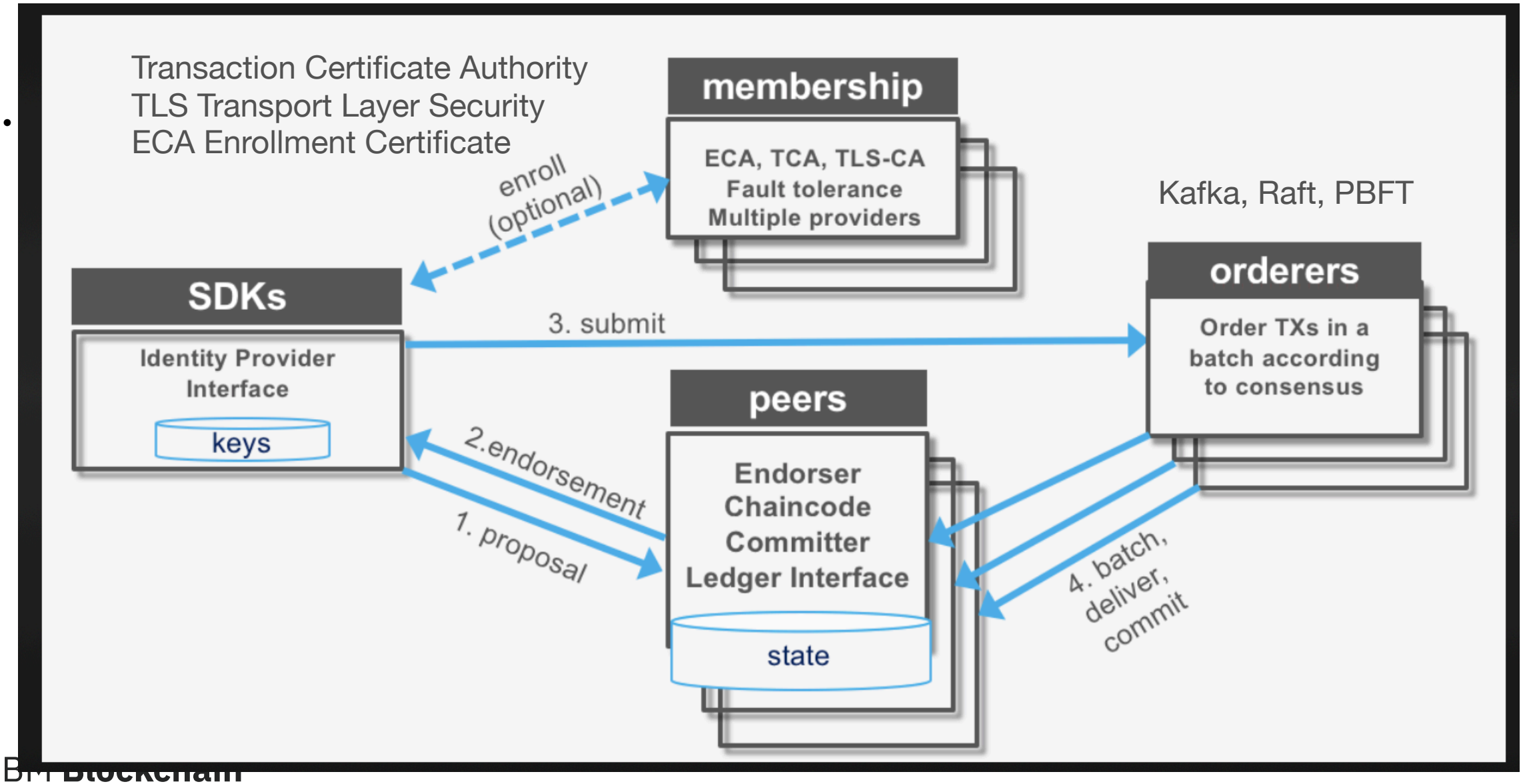
Open Source Hyperledger Fabric

- **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**

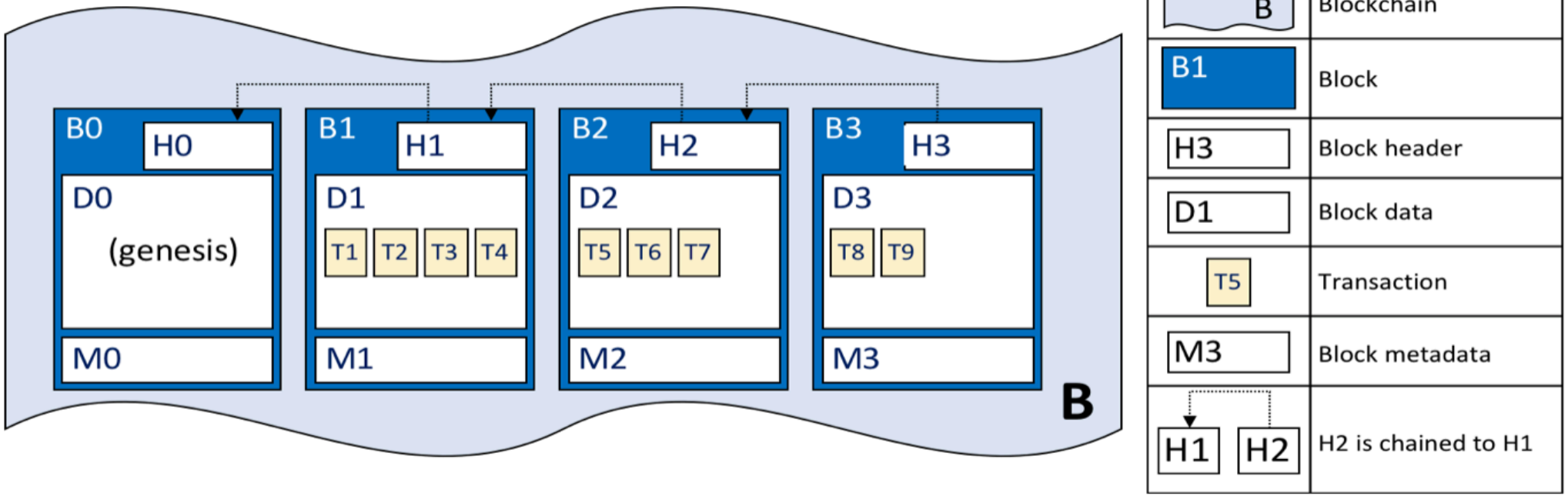
Hyperledger Fabric



Hyperledger Fabric



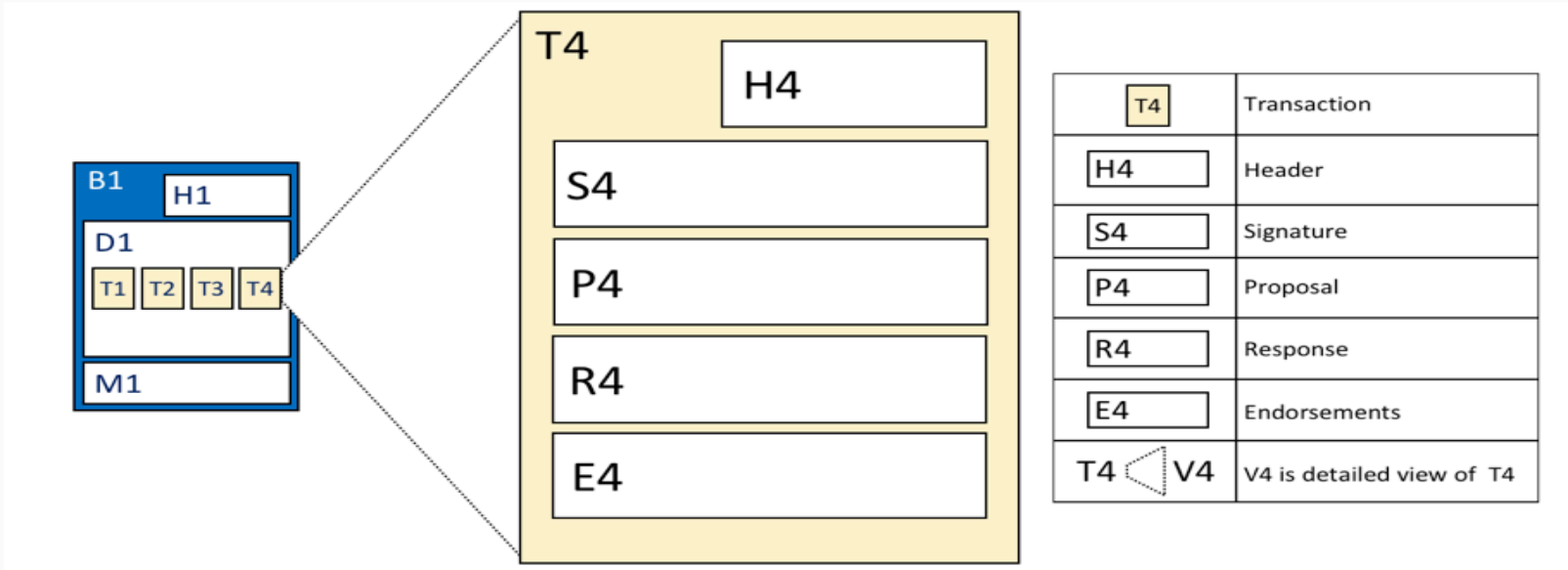
The Blockchain



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

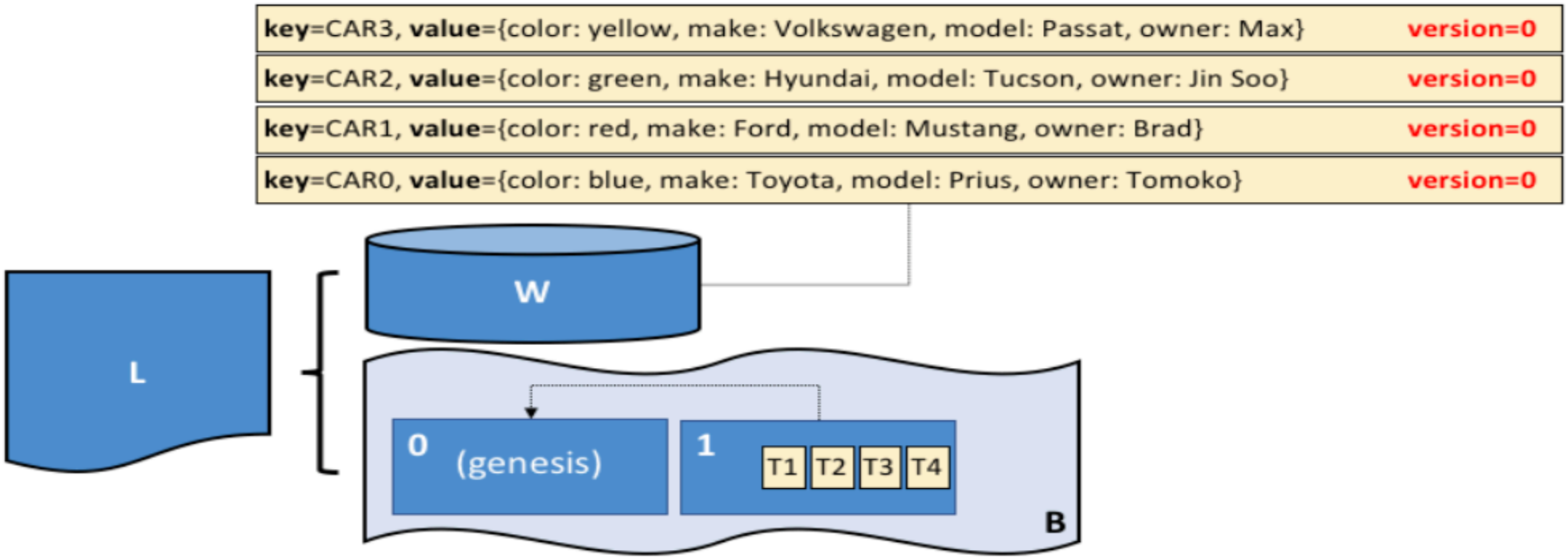
Transactions

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.

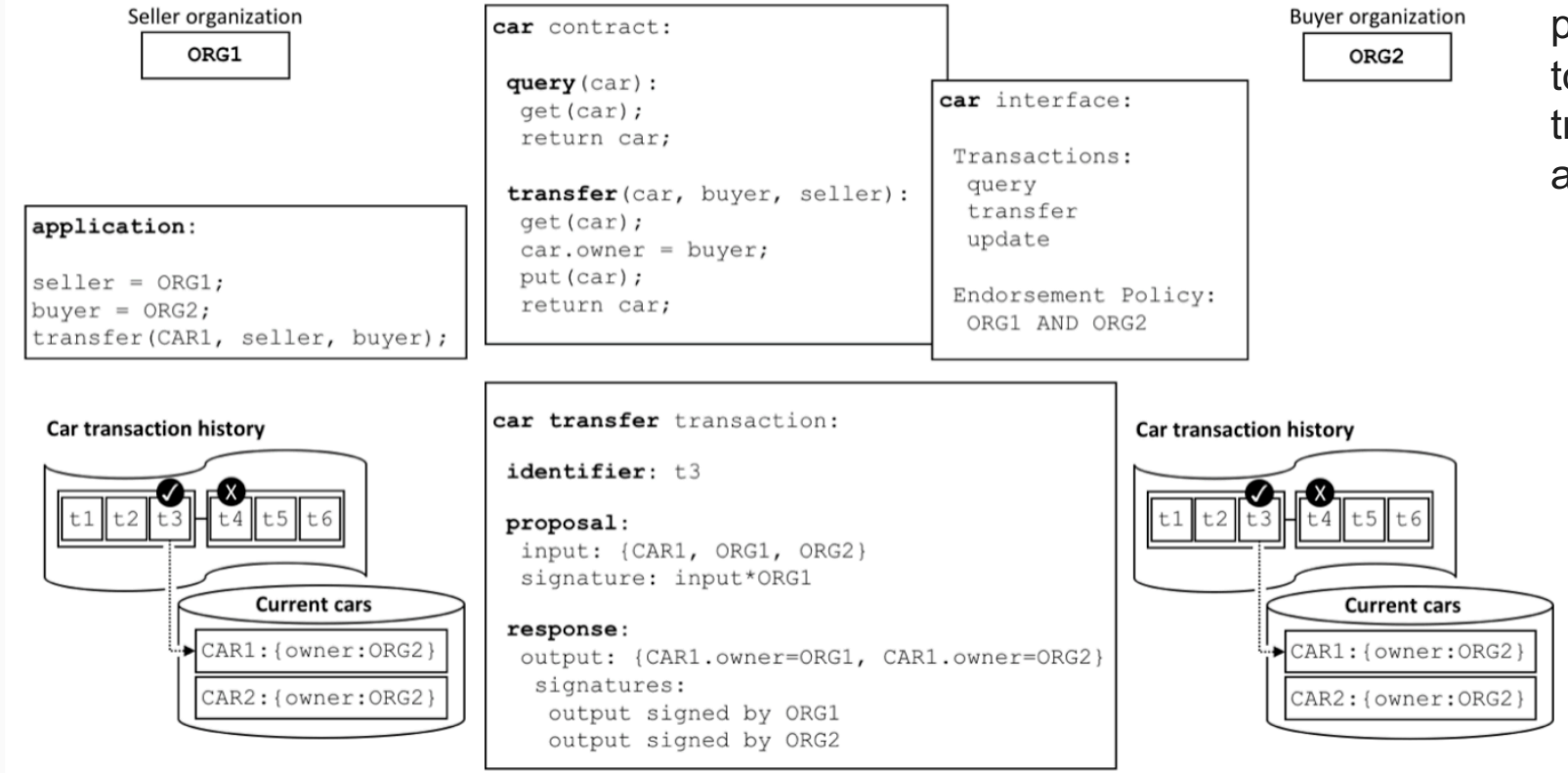
So what makes a Blockchain a Ledger?



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

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.



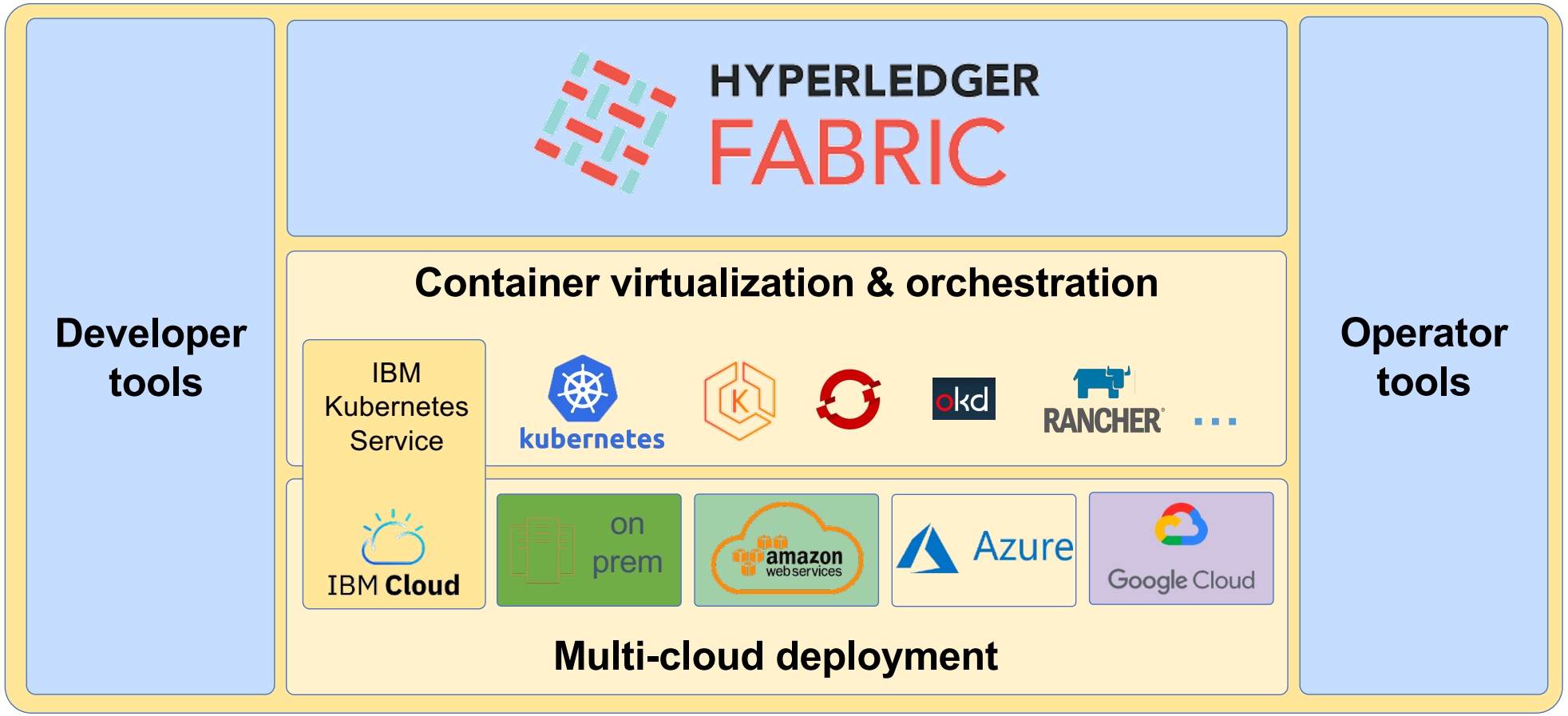
All transactions have an identifier, a proposal, and a response signed by a set of organizations. All transactions are recorded on the blockchain, whether valid or invalid, but only valid transactions contribute to the world state.

IBM **Blockchain**

Like Stored Procedures

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

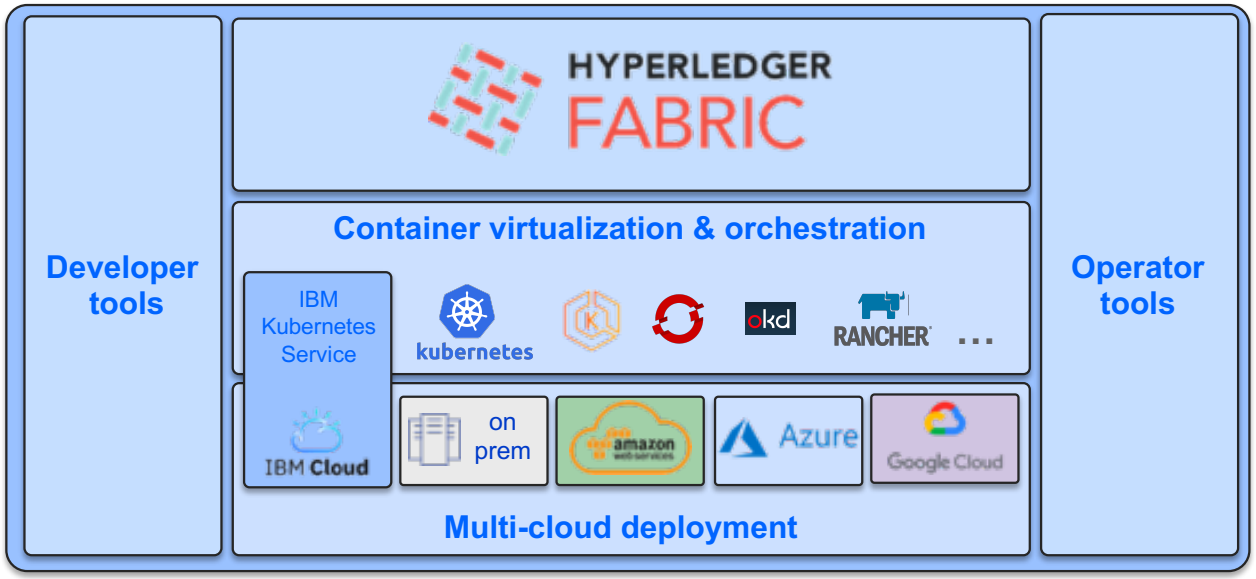
Deploy anywhere
Comprehensive cloud & on-premises options

IBM Blockchain Platform Deployment Options

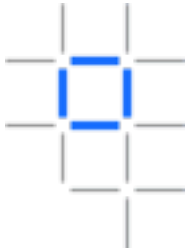
- There is just one IBM Blockchain Platform product regardless of where it is deployed
  - **It sits on a Kubernetes container infrastructure on your chosen provider**
  - Kubernetes provides common logging and management services of the IBM Blockchain Platform

- 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**

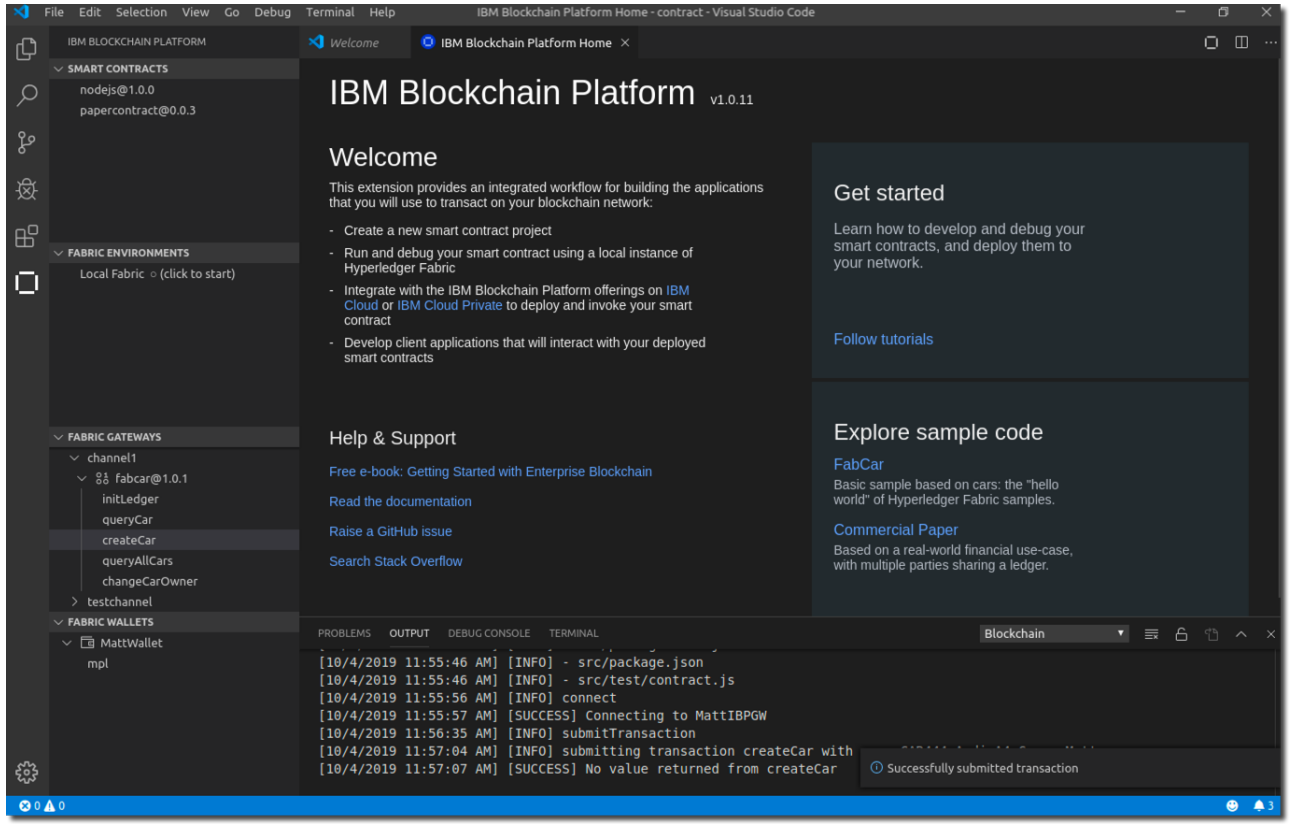
Build, operate and grow blockchain networks in heterogeneous environments

HYPERLEDGER

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

Getting Started with Hyperledger Fabric

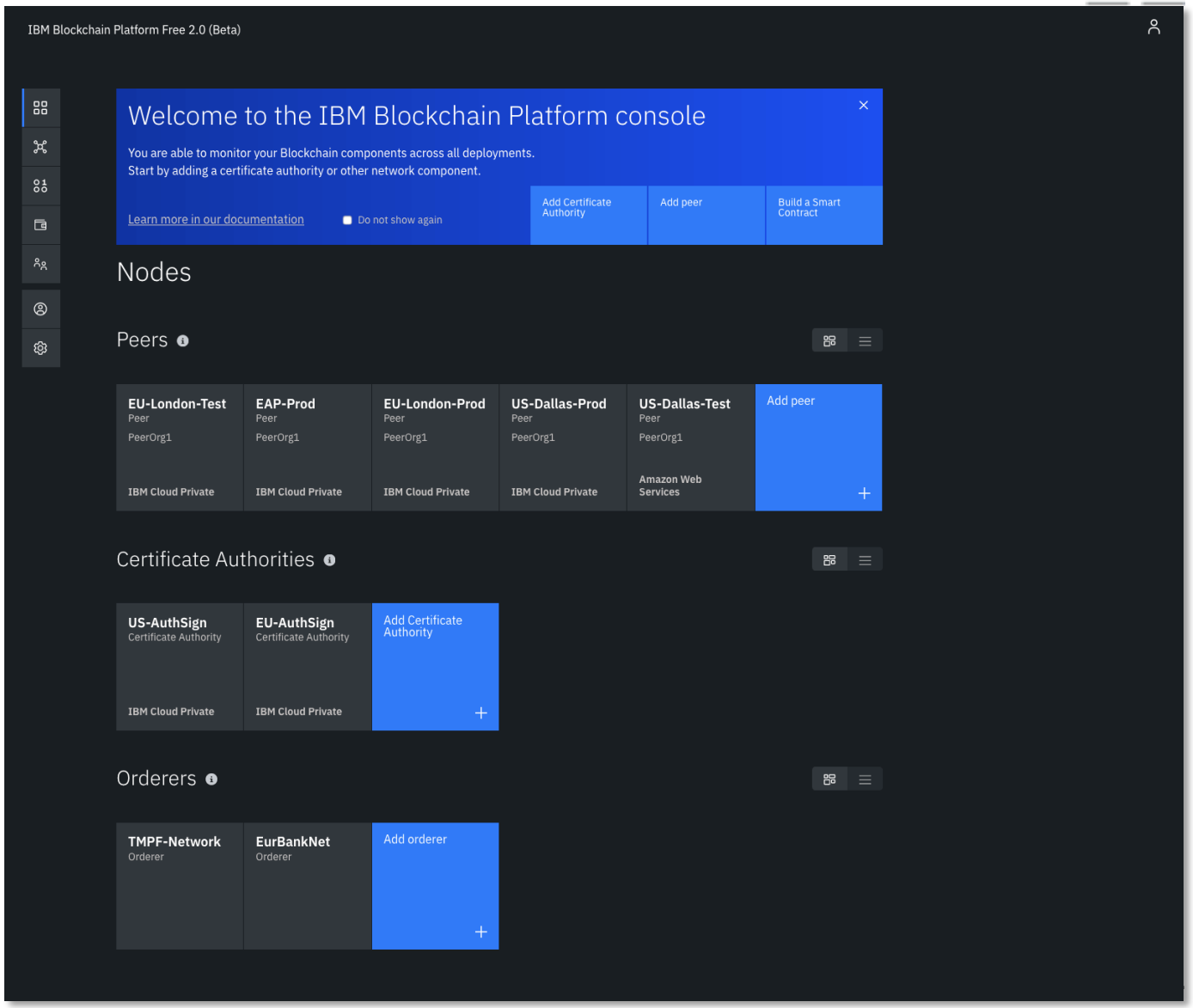
- The IBM Blockchain Platform makes it easy to get started with Hyperledger Fabric
- Download VSCode developer tool from VSCode marketplace. Linux, Windows and MacOS)
- Create local networks, smart contracts and applications. Move to multi-cloud when you're ready!



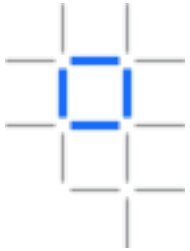
https://marketplace.visualstudio.com/items?itemName=IBMBlockchain.ibm-blockchain-platform

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



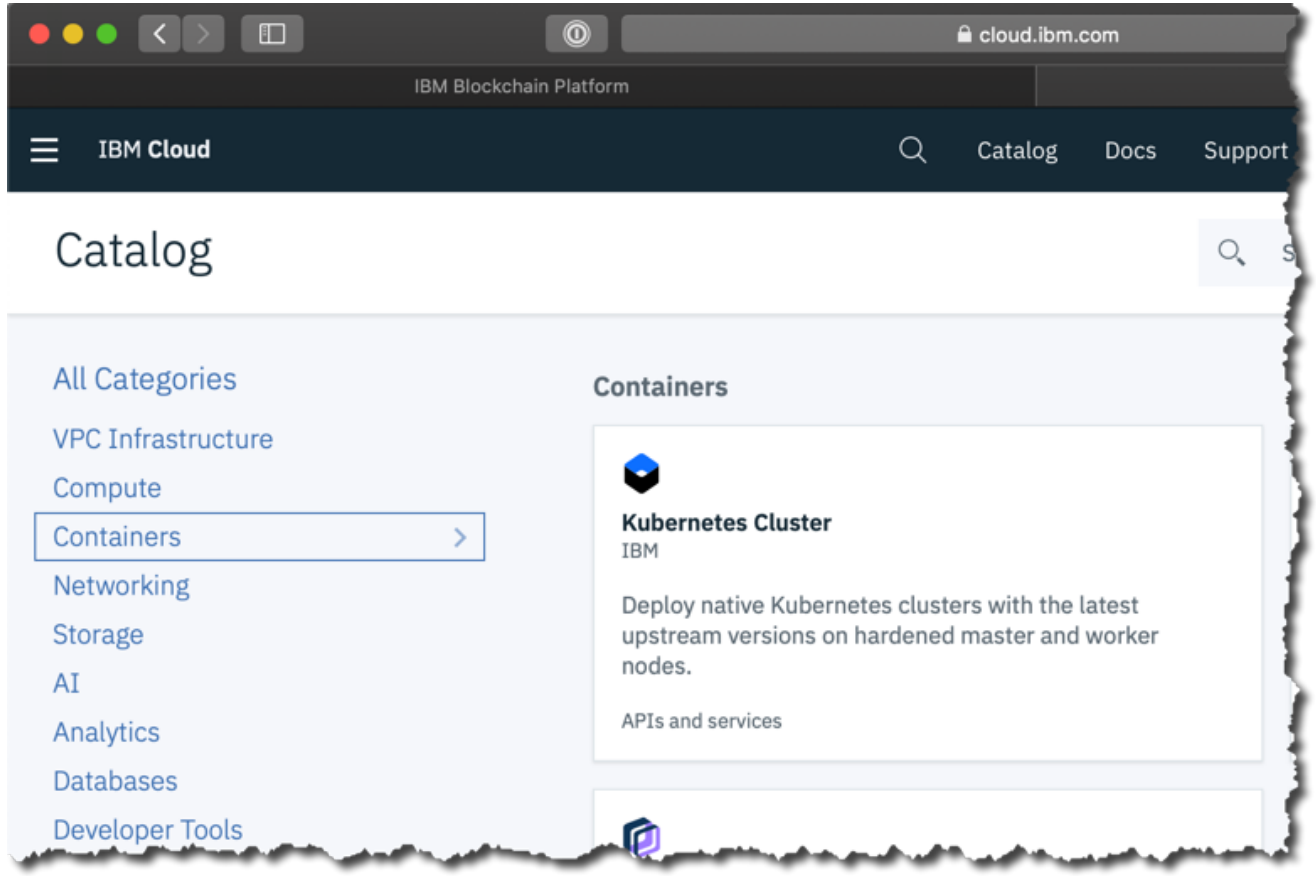
Blockchain Videos



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

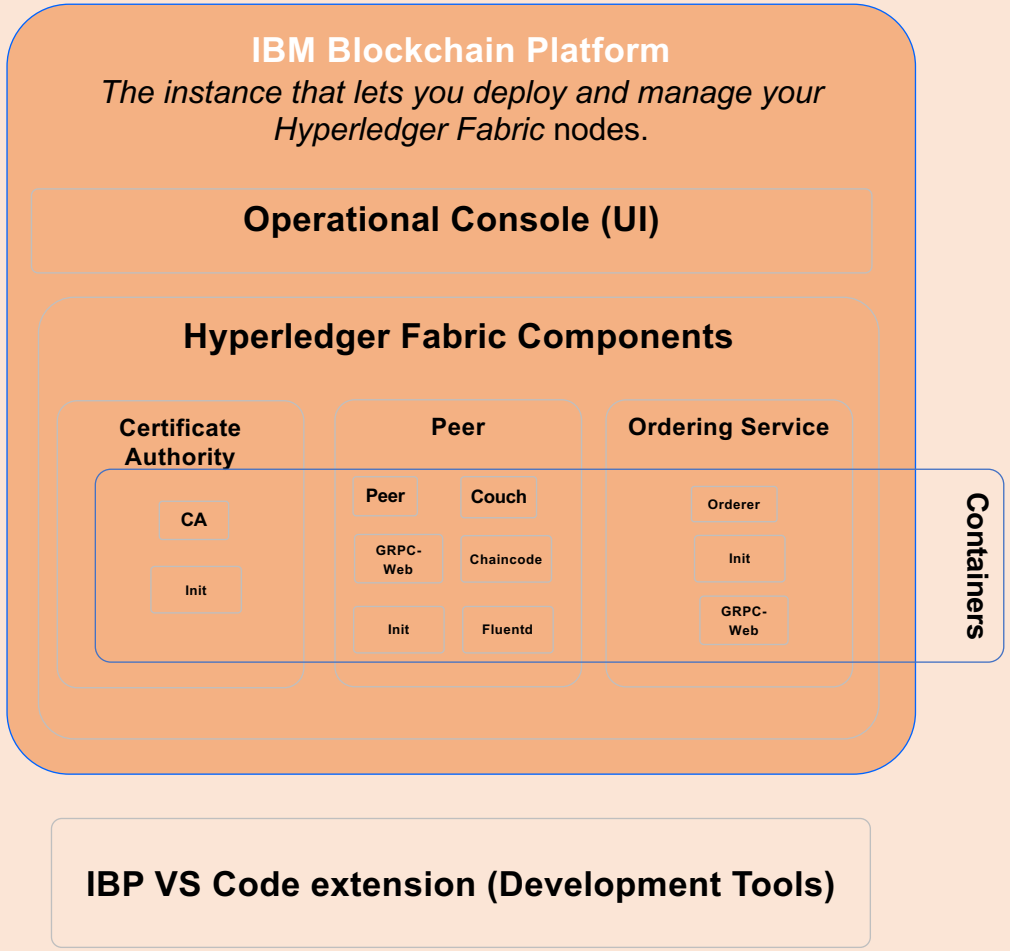
On IBM Cloud, your blockchain components are deployed to an IBM Kubernetes service

- 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



Deployment Overview: IBP & IKS & Storage

Your Blockchain Service



Your Infrastructure Resources

Learn more: https://cloud.ibm.com/docs/containers?topic=containers-ibm-cloud-kubernetes-service-technology

Deployment Overview: IBP & IKS & Storage

Your Blockchain Service

IBM Blockchain Platform

The instance that lets you deploy and manage your Hyperledger Fabric nodes.

Operational Console (UI)

Hyperledger Fabric Components

Certificate Authority	Peer	Ordering Service
CA	Peer	Orderer
Init	Couch	Init
	GRPC-Web	GRPC-Web
	Chaincode	
	Init	
	Fluentd	

Containers

IBP VS Code extension (Development Tools)

Your Infrastructure Resources

IBM Cloud Kubernetes Service

Your compute and memory that you allocate to your blockchain instance

Cluster (e.g. 2CPU x 4GB RAM)

Worker Node

Pod

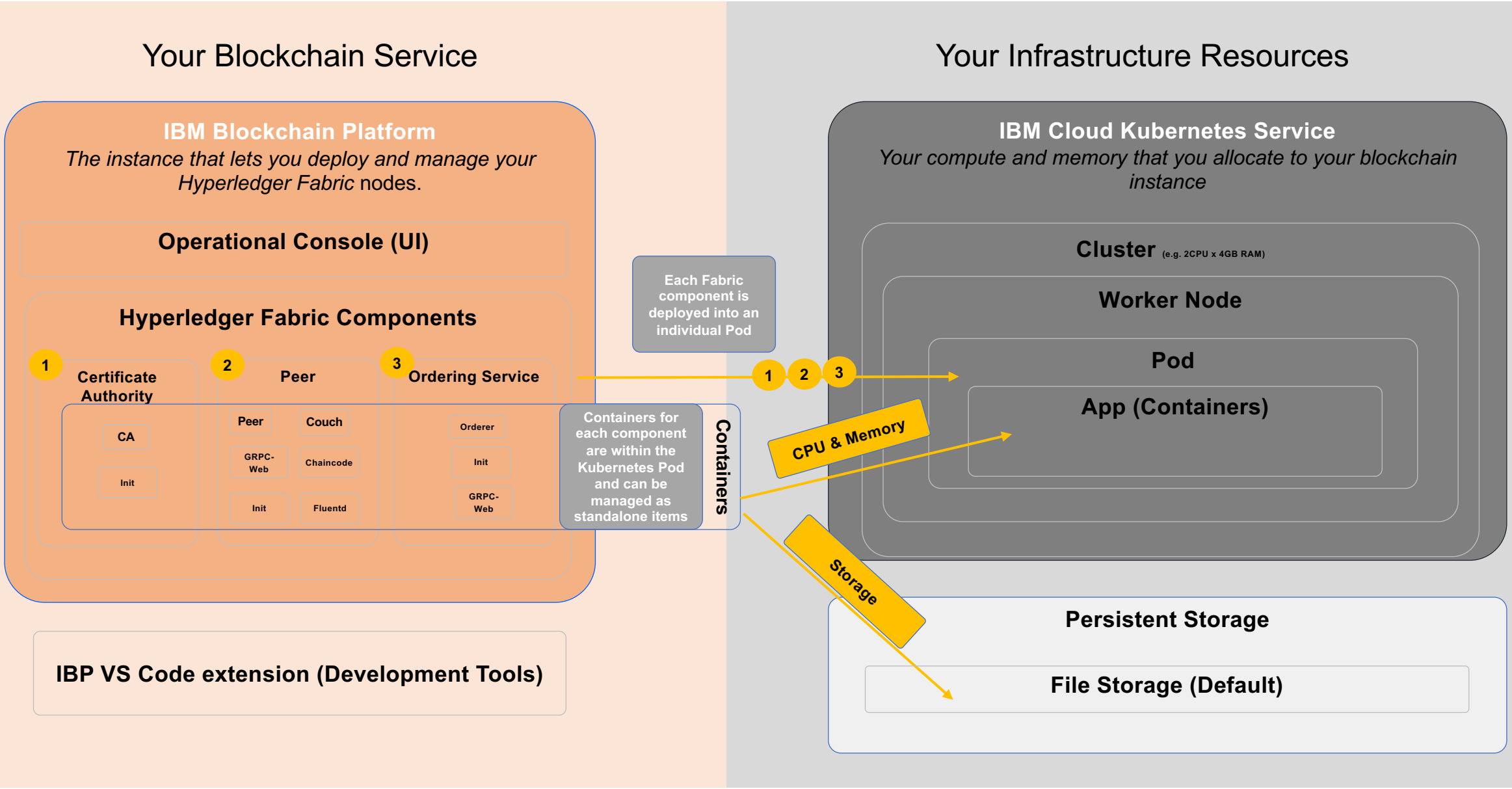
App (Containers)

Persistent Storage

File Storage (Default)

Learn more: https://cloud.ibm.com/docs/containers?topic=containers-ibm-cloud-kubernetes-service-technology

Deployment Overview: IBP & IKS & Storage



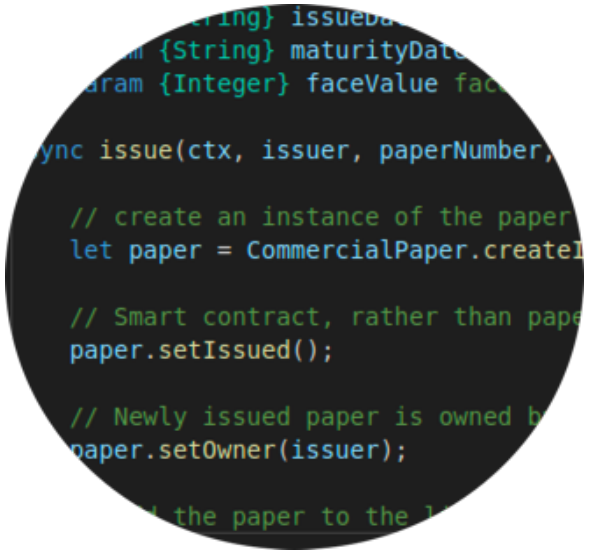
Learn more: https://cloud.ibm.com/docs/containers?topic=containers-ibm-cloud-kubernetes-service-technology

Summary

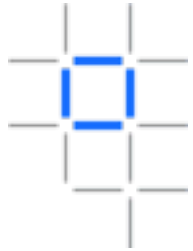
- The **Hyperledger Fabric transaction**
  - Structure drives system design and application architecture

- **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

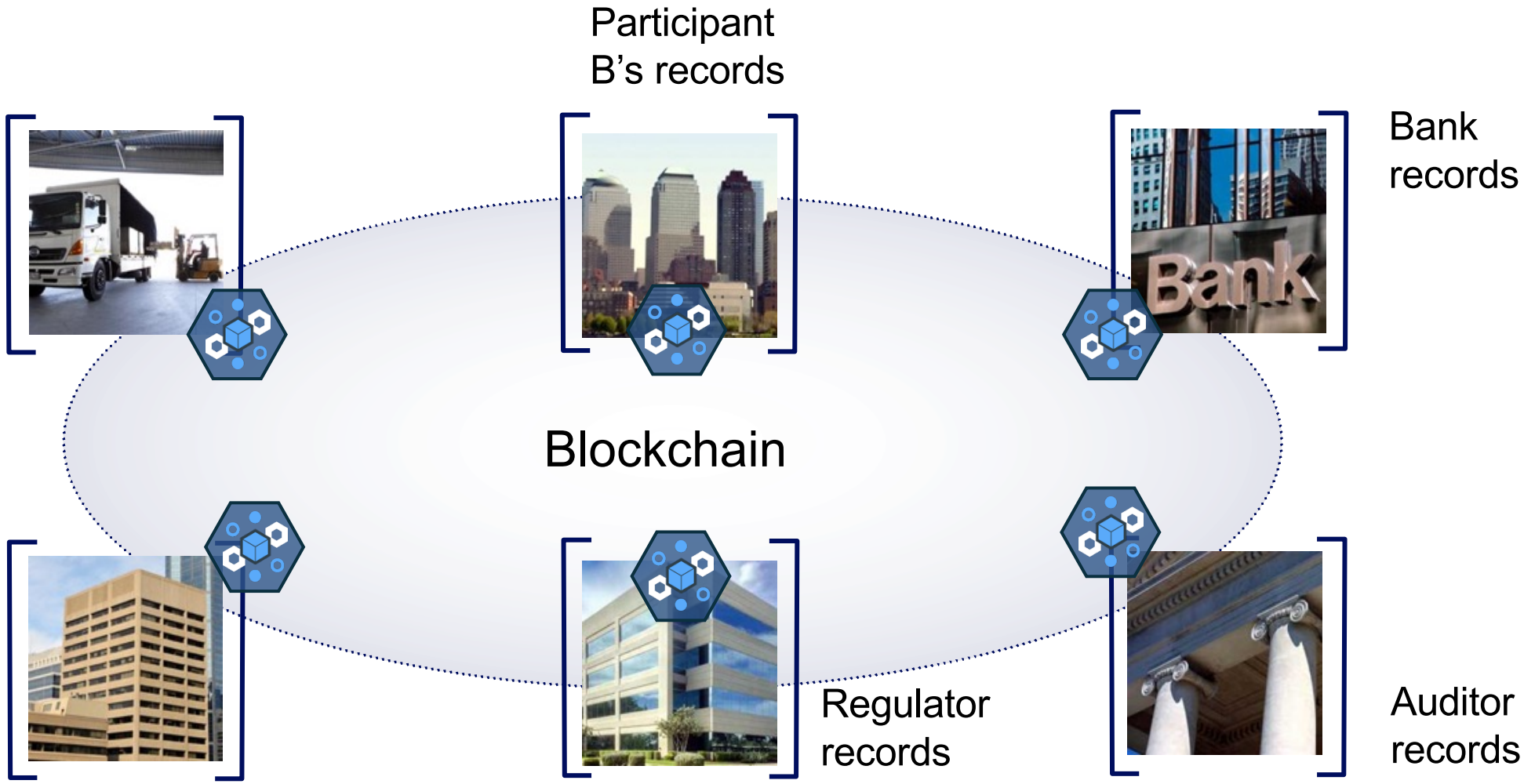


- The **IBM Blockchain Platform** difference
  - Multi-cloud networks, developer & operator tools, IBM service and support

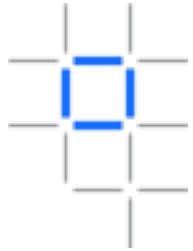


Supply Chain and Blockchain

A shared, replicated, permissioned ledger



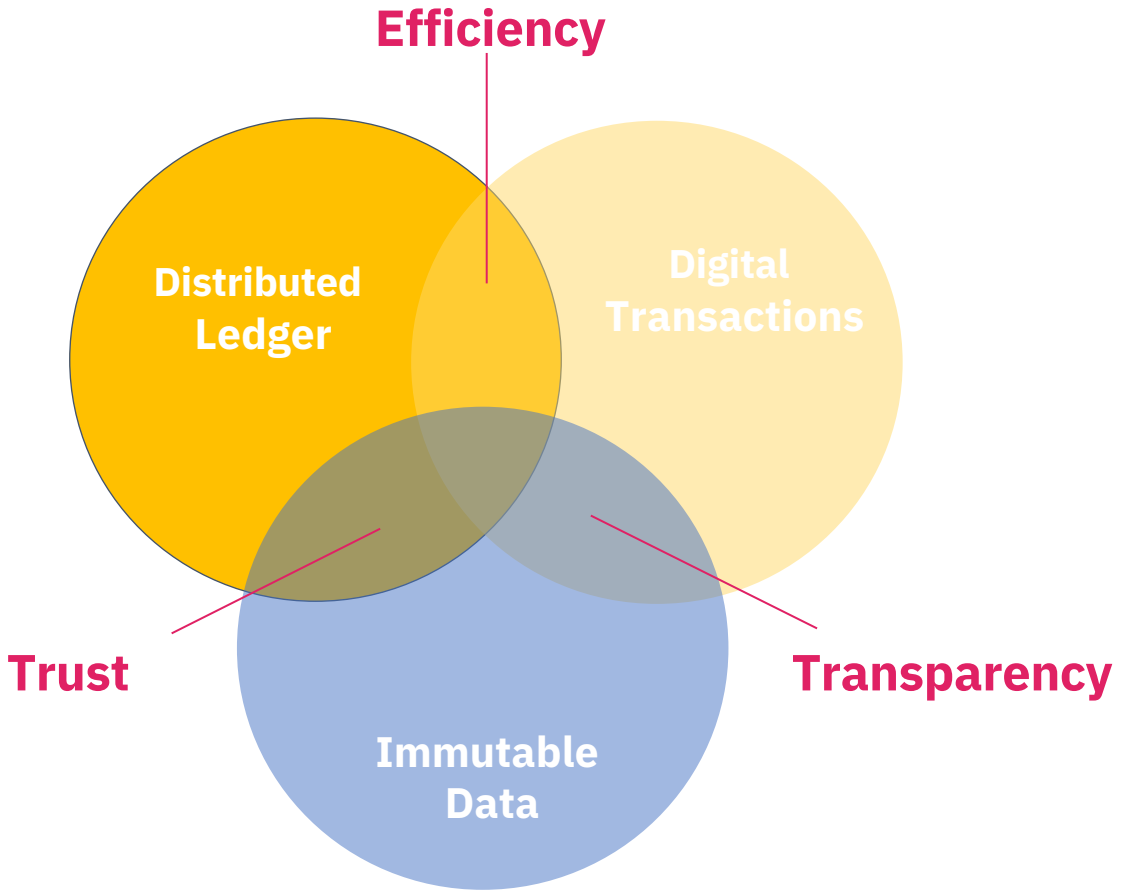
… with consensus, provenance, immutability and finality



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.

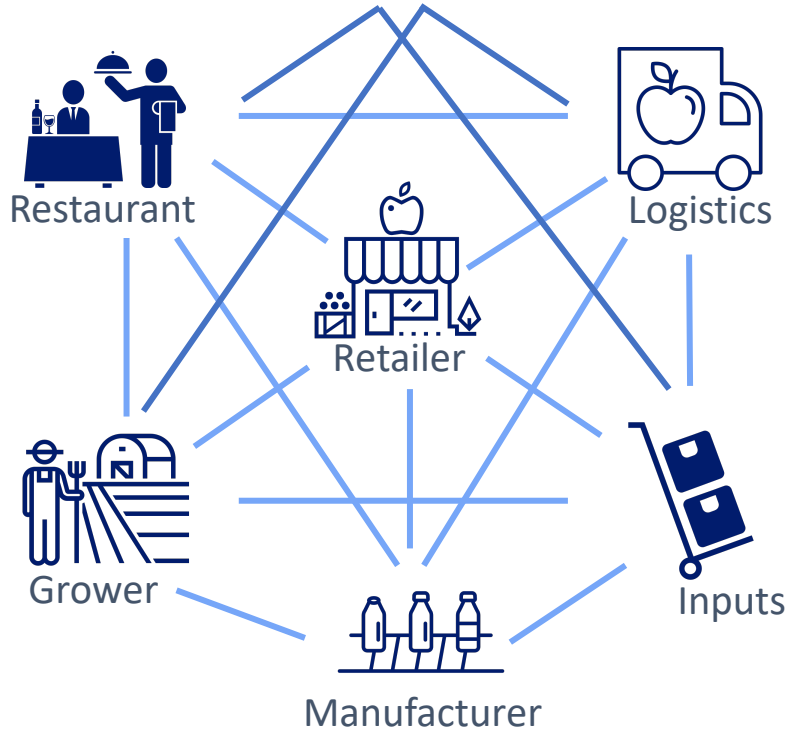


Today, traditional system constructs limit transparency

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

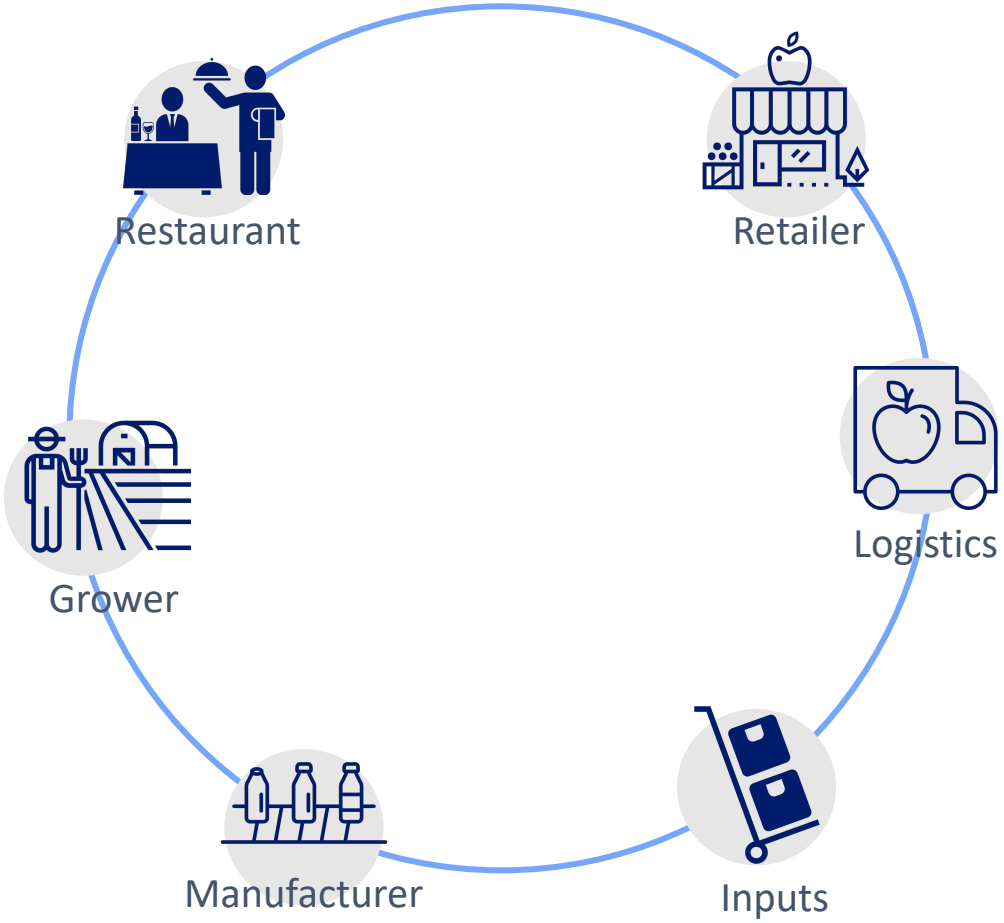


Blockchain transforms systems with trust and transparency

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



IBM Food Trust™

Fresh Insights

Product name:
Fresh Blueberries

GTIN:
00390290-bbery

Current inventory

Insights

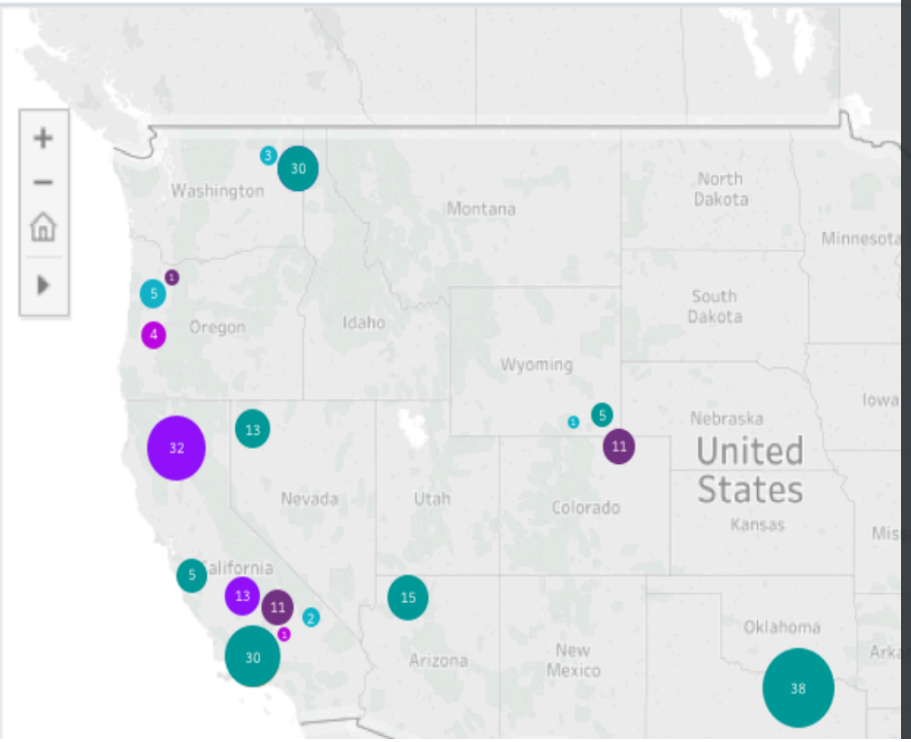
Inventory | At risk | Dwell time | Time since production | Time to expiration

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

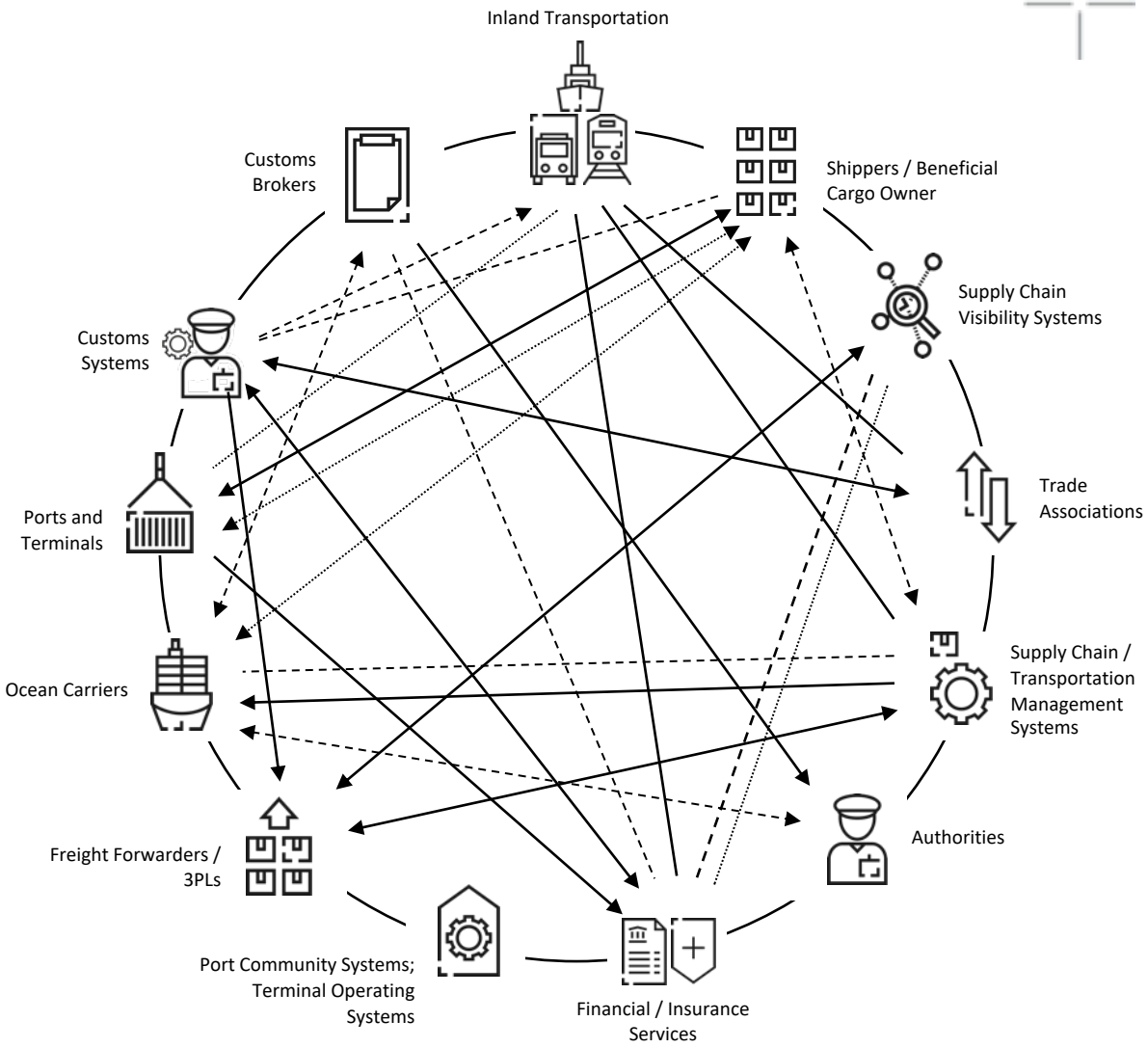


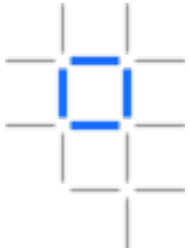
At-risk inventory data is provided at the product level.

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

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

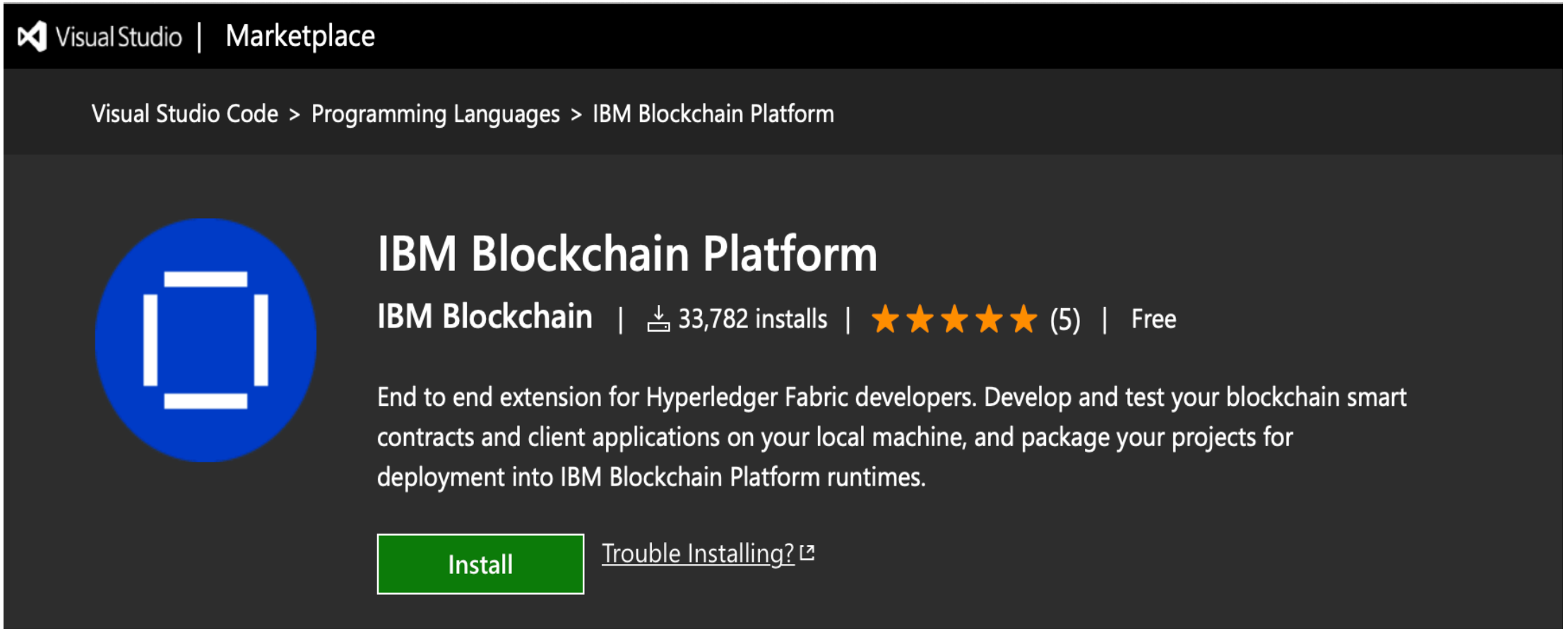
https://github.com/Grant-Steinfeld/coffee-supply-chain-blockchain

Development tools and Installation

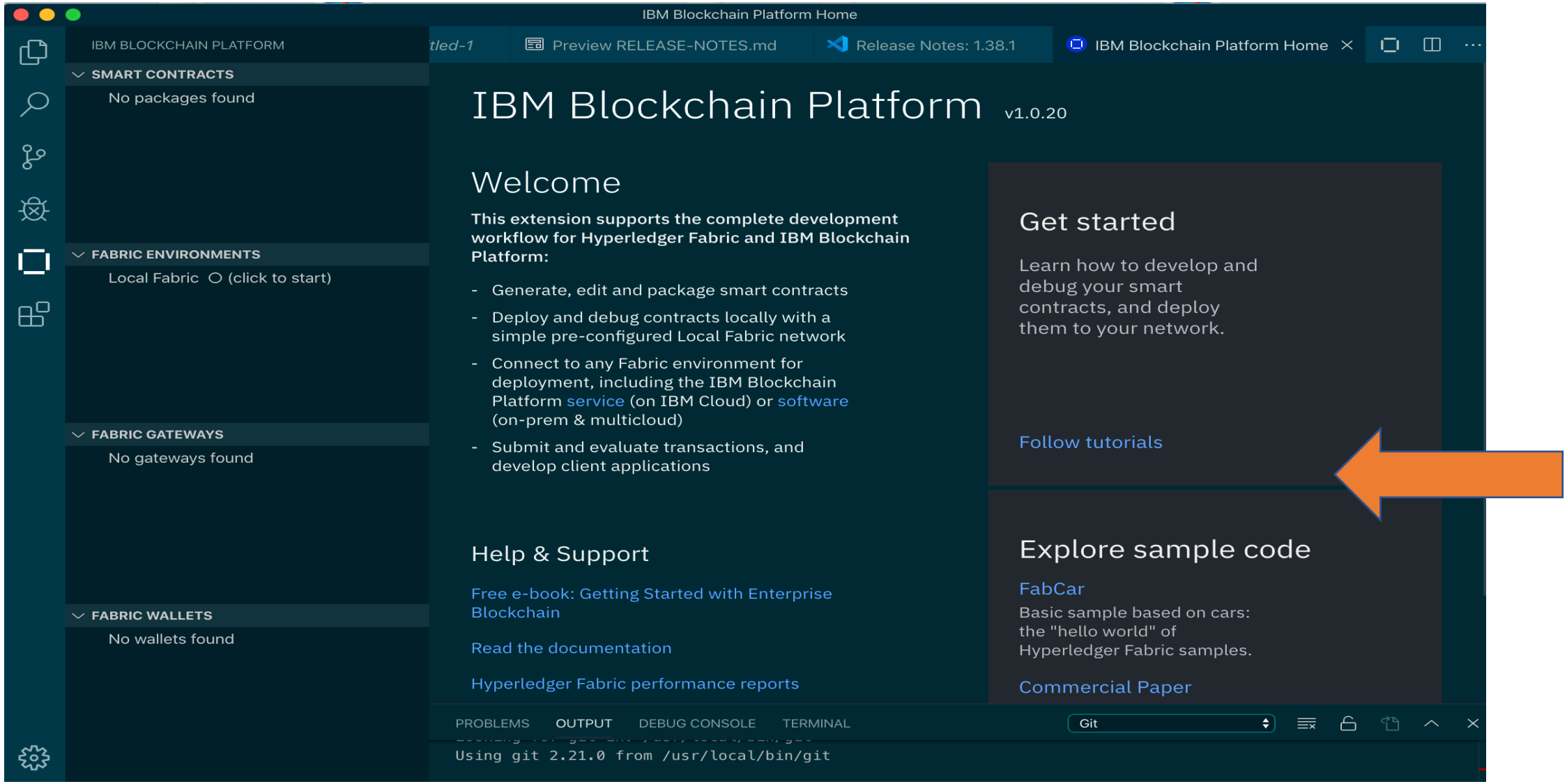
The current workshop uses all cloud components, no installation is necessary. After the workshop, you will need to install the following products:

- 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

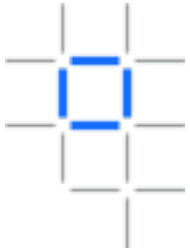
VSCode Extension



VS Code with VS Code extension

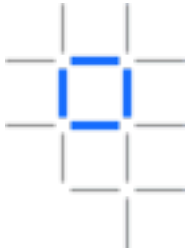


Additional Materials



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

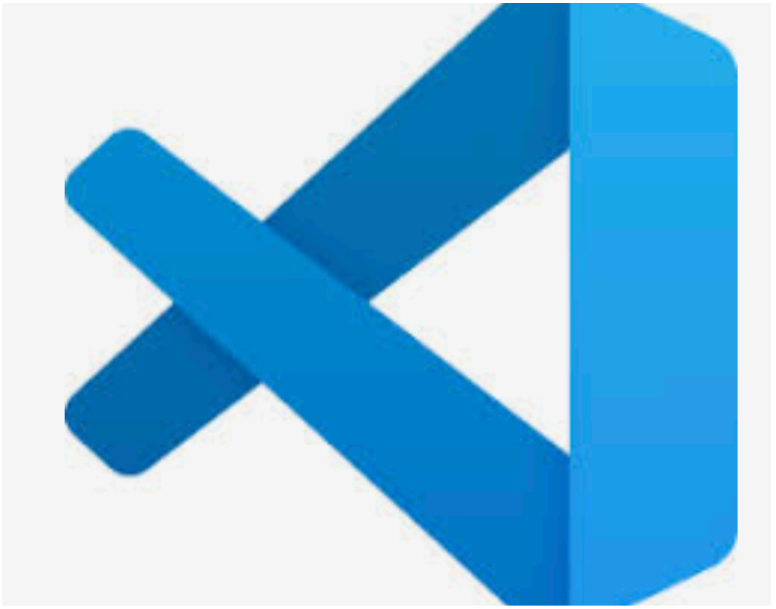
Lab 1



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.

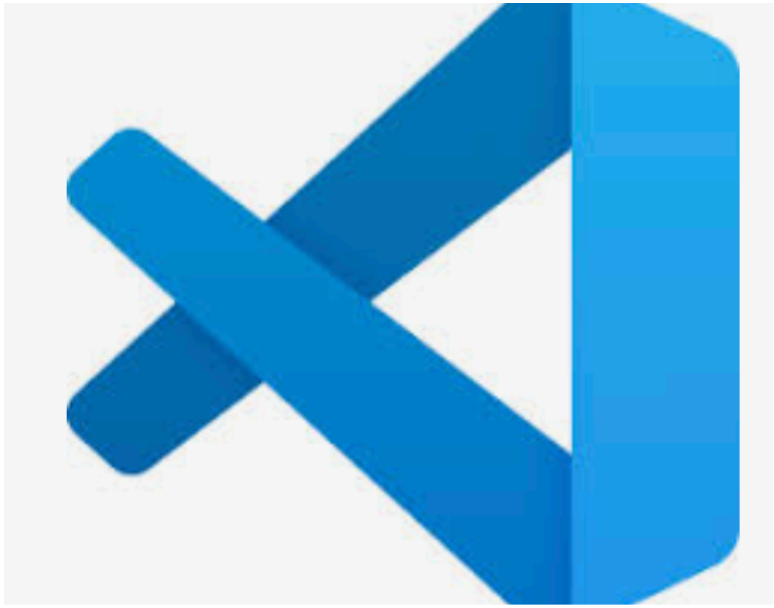


Lab 2

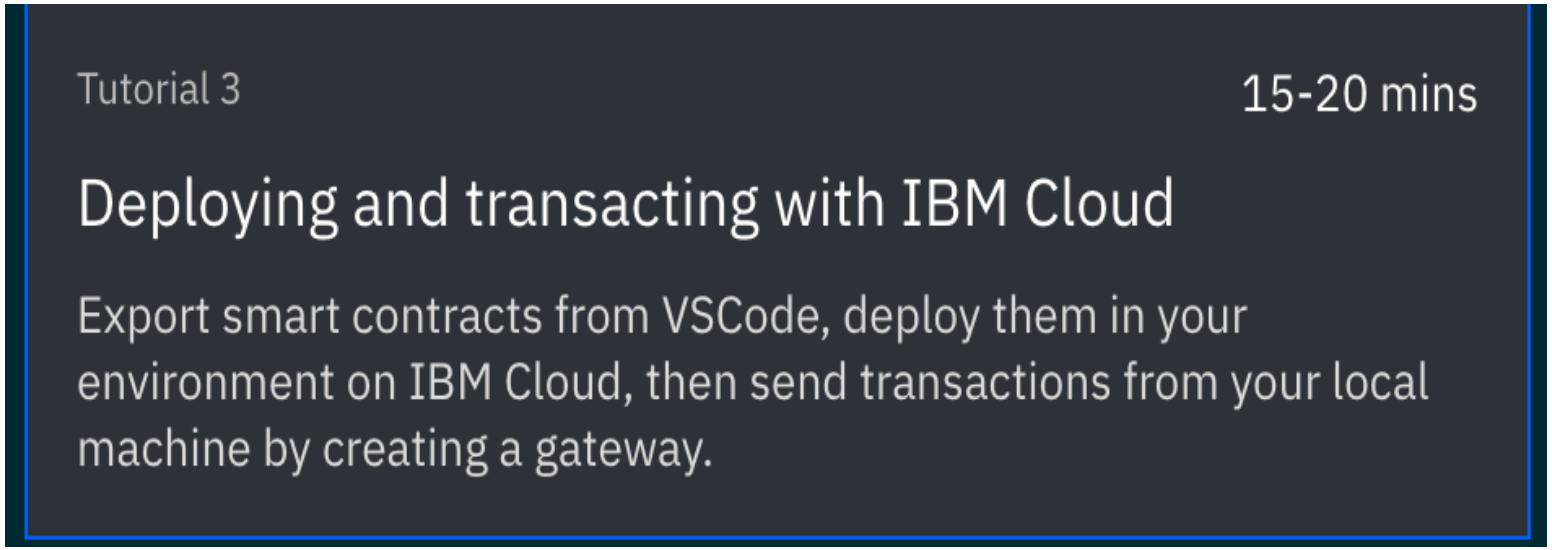
Tutorial 2 50-60 mins

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.



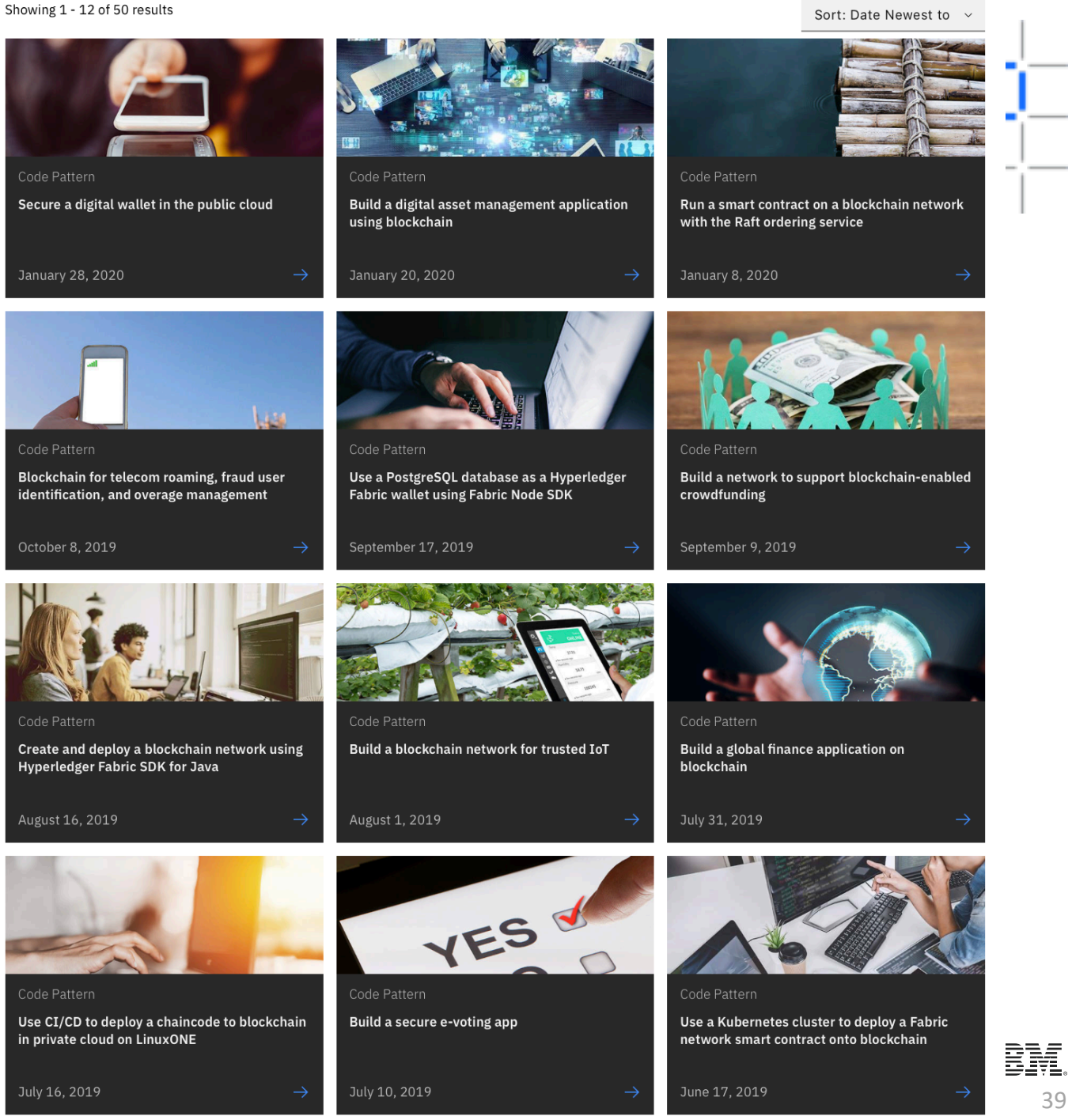
Additional labs.

- **Blockchain Bean 2:**

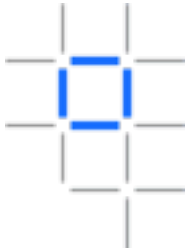
https://github.com/IBM/blockchainbean2

- **Blockchain code patterns**

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



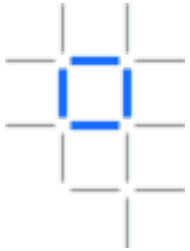
Housekeeping



- 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

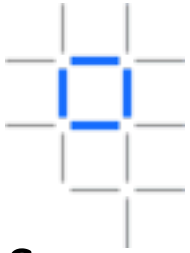
- https://cloud.ibm.com/registration?cm_mmc=Email_Events-_-Developer_Innovation-_-WW_WW-_-advocates:alf,max-katz\title:howtocreateasupplychainblockchainapp\eventid:5e2f89bbb1889fcaca174d52\date:Feb2020\type:workshop\team:global-devadvgrp-sanfrancisco\city:santaclara\country:unitedstates\tags:blockchain\contents:blockchain-disaster-management-solution&cm_mmca1=000019RS&cm_mmca2=10004805&cm_mmca3=M99938765&eventid=5e2f89bbb1889fcaca174d52&cvosrc=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



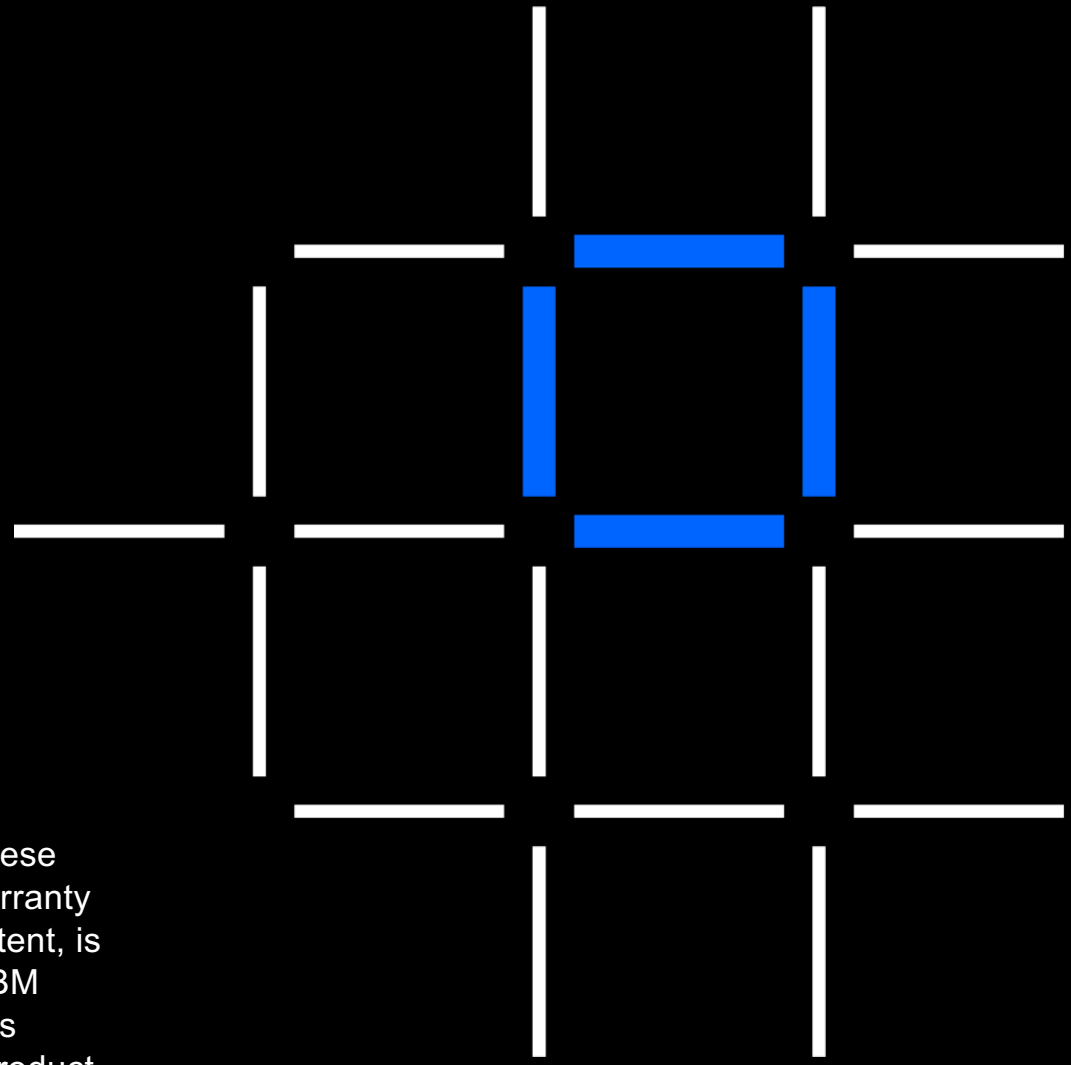
Blockchain increases visibility and efficiency in the supply chain like the coffee trade. See how blockchain can assist farmers, roaster and everyone between, bring you a fresher and fairer cup. Come out and we will walk you through design, development, and deployment of an illustrative blockchain network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



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