

AWS  
re:Invent

OPN217

# Enterprise blockchain: AWS's open-source approach

## **Tamara Dull**

Principal OS Technologist  
Amazon Web Services

## **Brian Behlendorf**

Executive Director of the  
Hyperledger Project  
The Linux Foundation

The three most common questions we get asked are:

1

What is blockchain?

2

Do I need a blockchain?

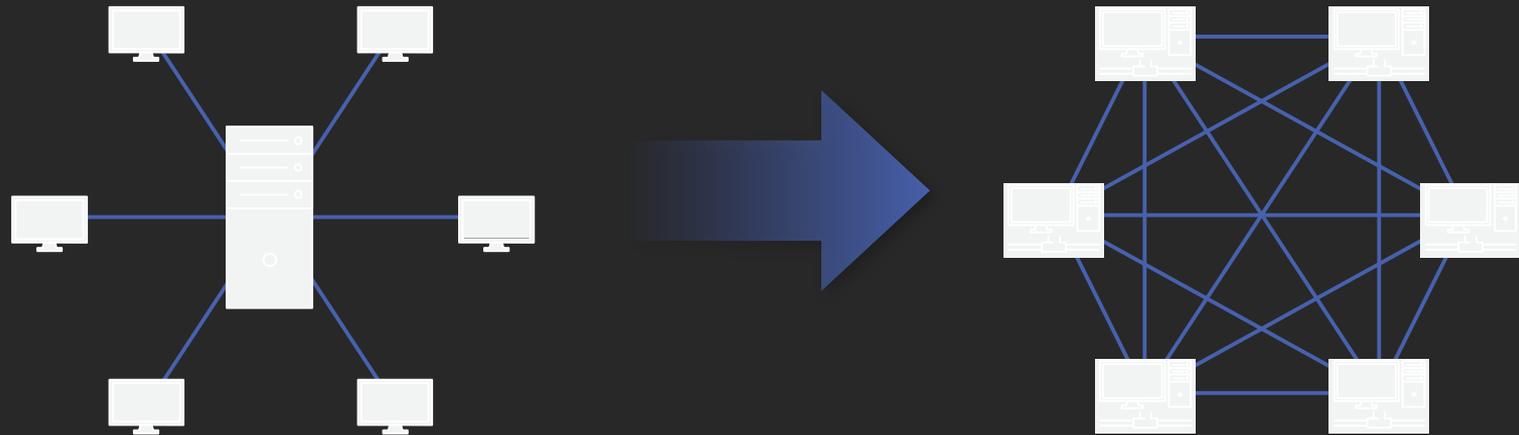
3

What is Amazon's view of blockchain?

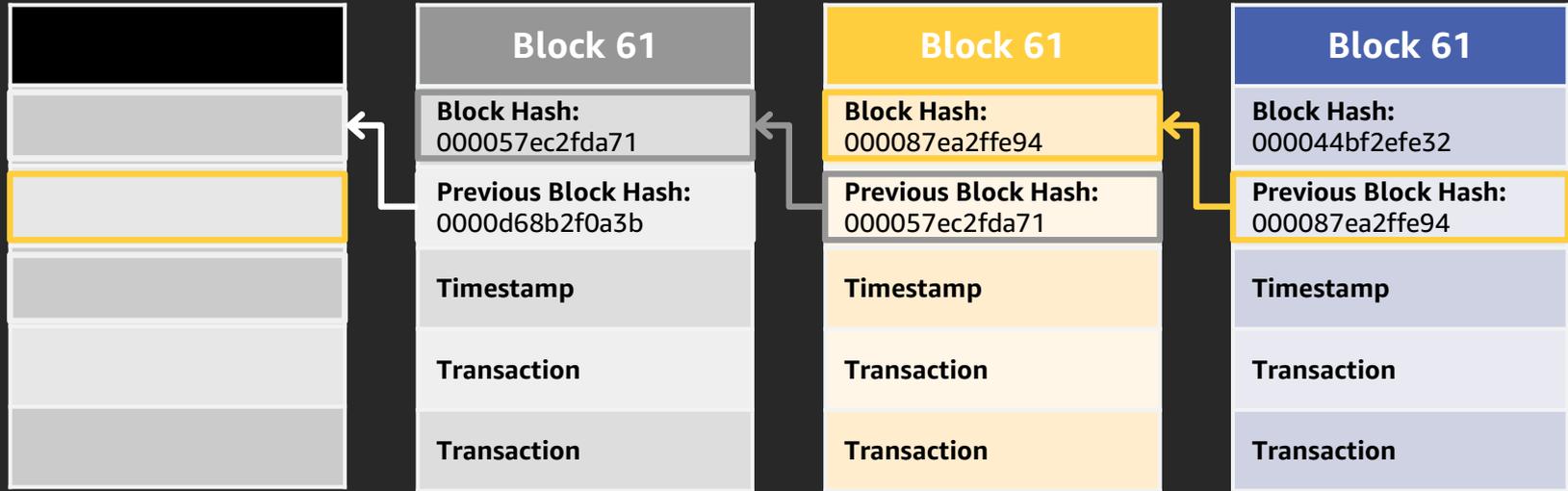
# Blockchain builds trust in a network

Eliminates the need for central authority in business networks

Three main components: **Distributed ledger**, **consensus mechanism**, and **“smart contract”** execution environment



# Component 1: Distributed ledger database



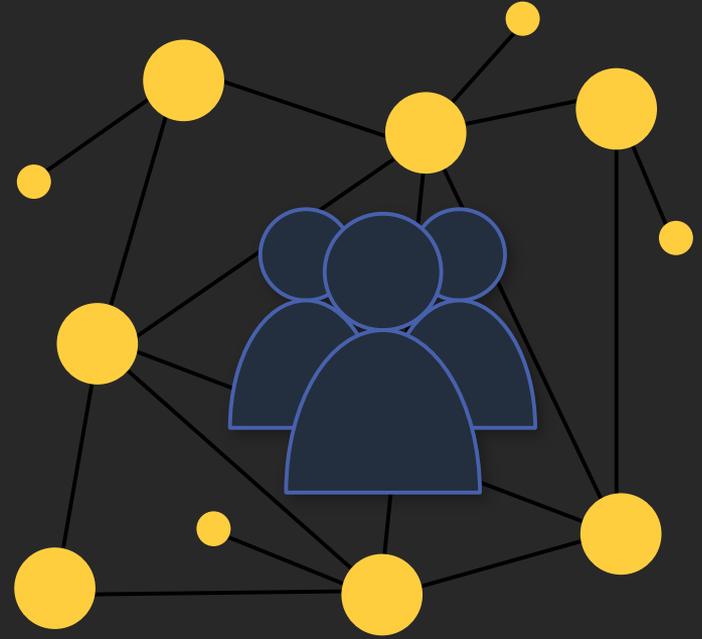
The journal records an immutable log of all transactions and is maintained by nodes in the blockchain network

# Component 2: Consensus mechanism

The method by which a network agrees on which transactions are valid and the order in which the transactions will be added to the blockchain

Ensures that the members in the network have an agreed-upon method to allow transactions and data to be committed to the ledger

Requires the participation of many members to achieve security, accuracy, and immutability



# Component 3: "Smart contracts"

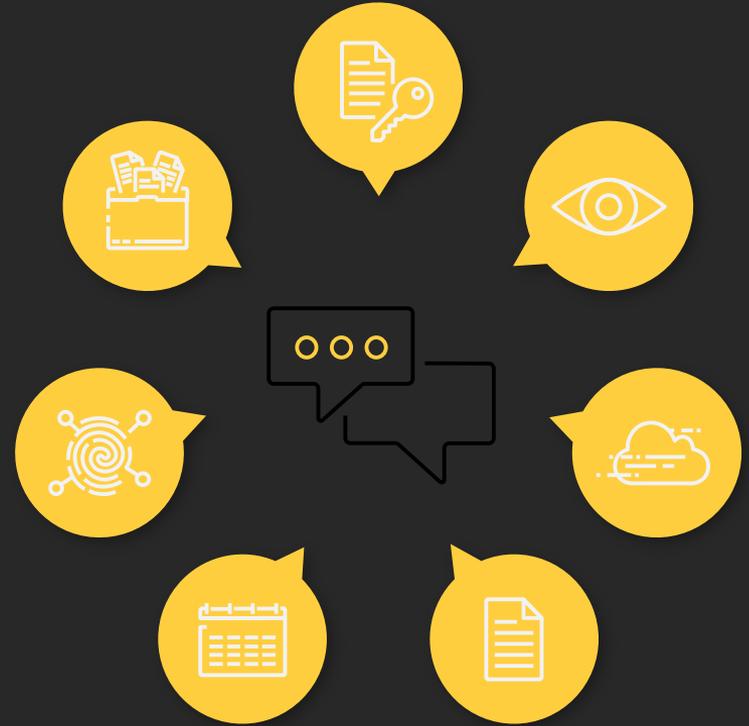
Business logic expressed as a computer program in the blockchain

Verified, predictable execution of code

Writes to distributed ledger

Can interact with components outside the blockchain network (off-chain)

Stored on every node in the blockchain network



Blockchain has a wide variety of use cases



# Our customers told us about their use cases

## Ledger with centralized trust



### Healthcare

Verify and track hospital equipment inventory



### DMV

Track vehicle title history



### Manufacturers

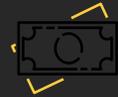
Track distribution of a recalled product



### HR & Payroll

Track changes to an individual's profile

## Transactions with decentralized trust



### Financial institutions

Peer-to-peer payments



### Mortgage lenders

Process syndicated loans



### Supply chain

Transact with suppliers and distributors



### Retail

Streamline customer rewards

# Amazon has two blockchain services

**Ledger with  
centralized trust**



**Amazon Quantum Ledger Database  
(Amazon QLDB)**

Fully managed ledger database with a  
central trusted authority

**Transactions with  
decentralized trust**



**Amazon Managed Blockchain**

Fully managed blockchain service,  
supporting both Hyperledger Fabric and  
Ethereum frameworks

# Amazon Managed Blockchain

## Easily create and manage scalable blockchain networks

### Fully managed



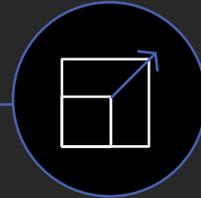
Quickly create blockchain networks that span multiple AWS accounts. Easily add or remove members and monitor the network

### Choice of Hyperledger Fabric or Ethereum



Choose the right framework for your needs, whether you are building a permissioned or public network

### Scalable and secure



Easily scale your blockchain network as the usage grows. Also, Managed Blockchain secures your network certificates with AWS Key Management Service (AWS KMS)

### Improves reliability



Managed Blockchain improves the reliability of the “ordering service,” by replacing the default technology with Amazon QLDB. This improves durability.

# Why Hyperledger Fabric and Ethereum?



## Hyperledger Fabric

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Useful for a finite set of known users

Well-suited for applications that require stringent privacy and permission controls with a known set of members

For example, a financial application where certain trade-related data is only shared with select banks and other members in the network don't have access to the data



## Ethereum

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Useful for an infinite number of unknown users

Well-suited for highly distributed blockchain networks where transparency of data for all members is important

For example, a digital identity network comprising farmers and government organizations, where an infinite number of farmers can join the network and information regarding their land, crop yields, etc., is shared across all members on the blockchain



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**HYPERLEDGER**

BLOCKCHAIN TECHNOLOGIES FOR BUSINESS



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# Agenda

- What is Hyperledger?
- Permissioned vs. permissionless, public vs. private
- Hyperledger Fabric
- Hyperledger Sawtooth
- Hyperledger Besu
- How to get involved as a developer



# What Is Hyperledger?



**Open source**  
collaborative effort  
to advance cross-  
industry **blockchain**  
**technologies**



Hosted by  
**The Linux**  
**Foundation**



**Global**  
**collaboration**  
spanning developers  
and employers in  
finance, technology,  
supply chain,  
healthcare and more



# Hyperledger's Goals



## Create enterprise-grade blockchain software

Open-source, distributed ledger frameworks & code bases to support business transactions



## Provide community-driven infrastructure

that are open, neutral, and supported by technical and business governance



## Build technical communities

to develop blockchain and shared ledger POCs, use cases, field trials and deployments



## Educate the public

about the market opportunity for blockchain technology



## Build the commercial ecosystem

to help ISVs, cloud providers, SIs, and end user organizations all realize commercial benefit from participation in the project, and demonstrate the economic power of this domain



# Everyone wants just a little DLT

Worldwide spending on blockchain solutions is forecast to be nearly \$2.9 billion in 2019, before surging to \$12.4 billion in 2022

Report by WEF 2019

White Paper

# Building Value with Blockchain Technology: How to Evaluate Blockchain's Benefits

In collaboration with Accenture

July 2019





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“Hyperledger immediately established itself as the gold standard for corporate blockchain projects.” - Forbes

Half of the ‘Forbes Blockchain 50’ is building on Hyperledger



**So who's using what?**

- **23 Hyperledger Fabric**

- +5 IBM Blockchain
- +2 DTCC & Google
- +1 Oracle Blockchain
- +1 Samsung Nexledger

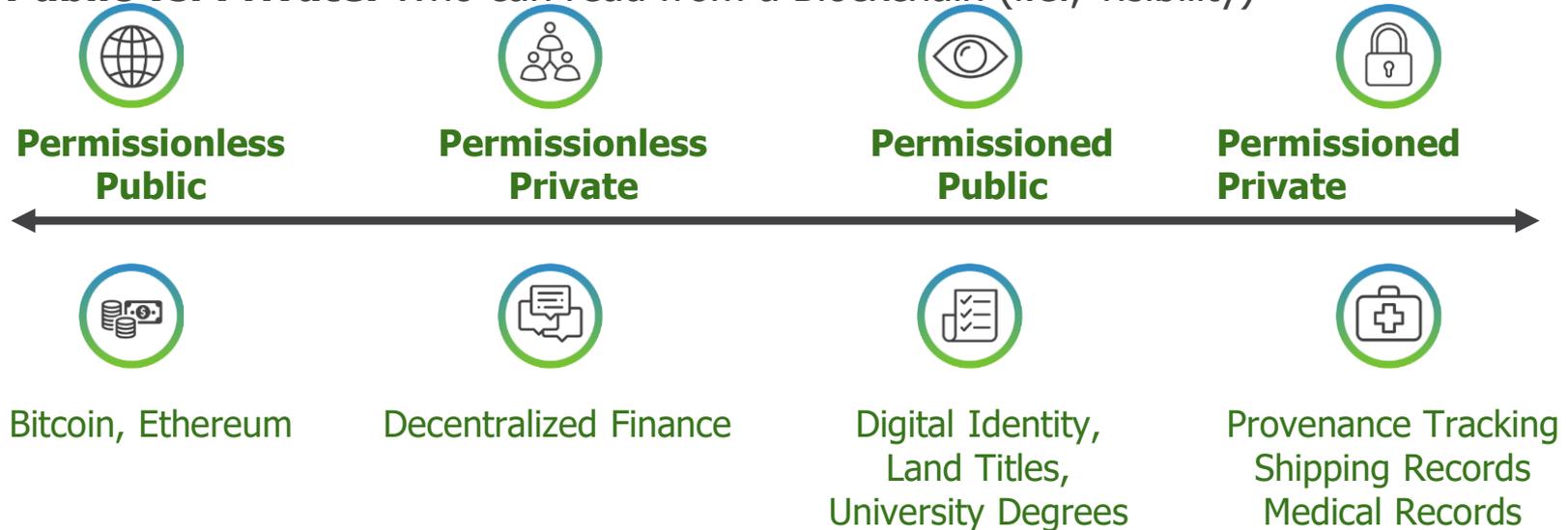
- **3 Hyperledger Indy**

- **3 Hyperledger Sawtooth**
- 21 (Public?) Ethereum
- 13 Corda
- 12 Quorum

# Open Blockchain Spectrum

**Permissioned vs. Permissionless:** Who can write to a Blockchain (i.e., accessibility)

**Public vs. Private:** Who can read from a Blockchain (i.e., visibility)



# Hyperledger's Greenhouse of Projects



**HYPERLEDGER**

## Distributed Ledgers



**HYPERLEDGER  
BESU**

Java-based  
Ethereum client



**HYPERLEDGER  
BURROW**

Permissionable smart  
contract machine (EVM)



**HYPERLEDGER  
FABRIC**

Enterprise-grade DLT  
with privacy support



**HYPERLEDGER  
INDY**

Decentralized identity



**HYPERLEDGER  
IROHA**

Mobile application focus



**HYPERLEDGER  
SAWTOOTH**

Permissioned & permissionless  
support; EVM transaction family

## Libraries



**HYPERLEDGER  
ARIES**



**HYPERLEDGER  
QUILT**



**HYPERLEDGER  
TRANSACTION**



**HYPERLEDGER  
URSA**

## Tools



**HYPERLEDGER  
AVALON**



**HYPERLEDGER  
CALIPER**



**HYPERLEDGER  
CELLO**



**HYPERLEDGER  
EXPLORER**

## Domain-Specific



**HYPERLEDGER  
GRID**



**HYPERLEDGER  
LABS**



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# HYPERLEDGER FABRIC

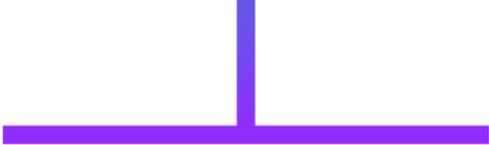




# HYPERLEDGER FABRIC v1.1

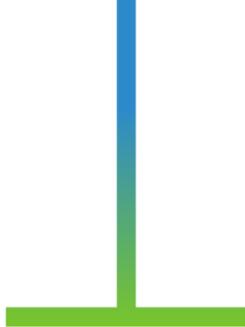
Javascript Chaincode  
Rolling Upgrade  
Connection Profile  
Performance and Scale  
improvements

Improved Documentation  
Technical Preview: Private  
channel data, Identity  
Mixer, Service Discovery



<b>Project</b>	 <b>HYPERLEDGER FABRIC</b>
<b>Status</b>	<b>ACTIVE</b>
<b>CII Badge</b>	cii best practices <b>passing</b>
<b>Description</b>	Distributed ledger in Golang

Platform for developing blockchain networks with a modular architecture for consensus and membership services.  
Fabric 1.4.3 most current; 2.0 in Alpha and expected by EOY.  
200+ devs across 100+ companies contributing.  
~Hundreds of pilot and production networks deployed.



# Hyperledger Fabric: Now Across All Major Clouds



Google Cloud



Microsoft  
Azure

Tencent  
腾讯



ORACLE®



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# Why Hyperledger Fabric?

- A **completely programmable** platform for writing distributed applications that replicate real-world cross-business processes.
- Smart contracts (“**Chaincode**”) can be implemented in **Go** (most secure), **Javascript** (easiest to learn), or **Java** (most familiar to the business world).
- Lots of SDKs in different languages, so your integrations and front-end applications can be **written in the language of your choice**.
- **High performance** in real-world environments.
- Crash-fault-tolerant and resilient.
- **Widespread support** from different vendors, development tools, and ISVs.

*As critical financial market infrastructure, the industry relies on us to provide innovative solutions that reduce risk, increase transparency and evolve with market and regulatory needs. We believe that blockchain technology represents a generational opportunity to re-imagine post-trade infrastructure. We are pleased to be using Amazon Managed Blockchain to explore possibilities with Hyperledger Fabric, where we can continue to lead industry initiatives around the exploration and adoption of Blockchain. Amazon Managed Blockchain automates the deployment of blockchain infrastructure, bringing high availability and durability in a fully managed package, accelerating the adoption of distributed ledger technology.”*



**Rob Palatnick - Hyperledger Governing Board Chair & DTCC Managing Director, Chief Technology Architect**



**DTCC**

Securing Today. Shaping Tomorrow.™

*“Transparency in supply chains is increasingly important to consumers, who want to know what is in their food and where it comes from. While Nestlé has begun to release information on its supply chains for its 15 key commodities, using blockchain technology enables a more precise tracking,” said Armin Nehzat, Digital Technology Manager, Nestlé Oceania. “With Amazon Managed Blockchain, we are able to set up our Hyperledger Fabric network and easily invite our partners to collaborate in our supply chain transparency efforts. Amazon Managed Blockchain will enable our customers to track their products on the blockchain from the farm all the way through to consumption.”*

**Armin Nehzat, Digital Technology Manager - Nestlé Oceania**





**HYPERLEDGER**  
**SAWTOOTH**



**HYPERLEDGER**  
**SAWTOOTH** v1.2

Dynamic consensus  
(Change consensus on the fly)

Proof of Elapsed Time  
(PoET) and PBFT consensus

Write smart contracts in  
almost any language

Ethereum contract support via  
Hyperledger Burrow integration

Supply Chain example  
out of the box

Parallel transaction execution  
for added throughput



<b>Project</b>	 <b>HYPERLEDGER</b> <b>SAWTOOTH</b>
<b>Status</b>	<b>ACTIVE</b>
<b>CII Badge</b>	<b>cii best practices</b> <b>passing</b>
<b>Description</b>	Distributed ledger with Multi-Language Support

A modular platform for building, deploying, and running distributed ledgers. Hyperledger Sawtooth includes a novel consensus algorithm, Proof of Elapsed Time (PoET), which targets large distributed validator populations with minimal resource consumption. Hyperledger's second project, released as 1.0 in January 2018 and 1.2 in Jul 2019.

# Hyperledger & Ethereum Ecosystems





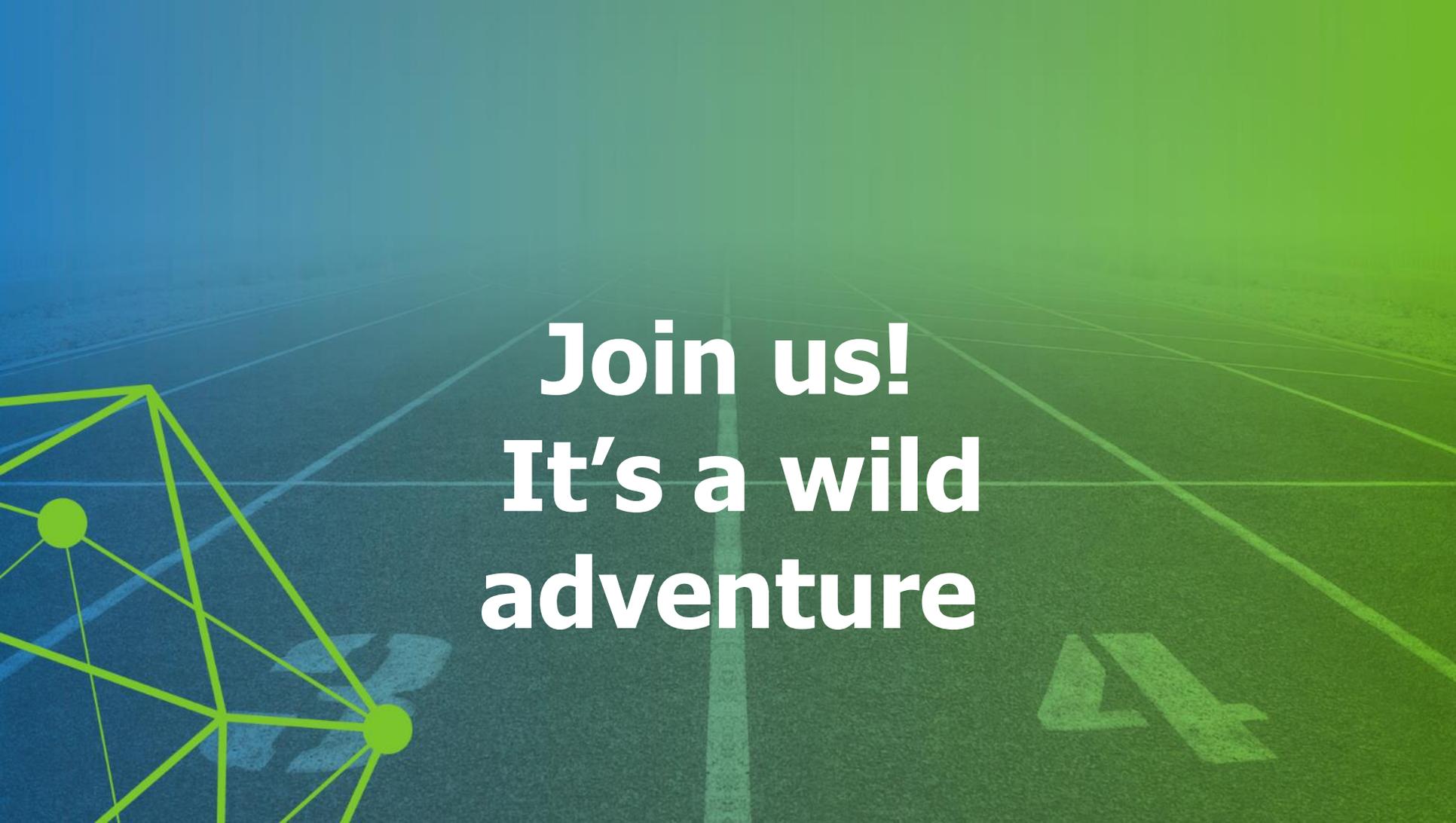
# HYPERLEDGER BESU





<b>Project</b>	 <b>HYPERLEDGER BESU</b>
<b>Status</b>	<b>INCUBATION</b>
<b>CII Badge</b>	<b>cii best practices</b> not started
<b>Description</b>	Besu is an Ethereum client that runs on the Ethereum public network, private networks, and test networks such as Rinkeby, Ropsten, and Görli.

Open-source Ethereum client written in Java. It can be run on the Ethereum public network or on private permissioned networks, as well as test networks such as Rinkeby, Ropsten, and Görli. Hyperledger Besu includes several consensus algorithms including PoW, PoA, and IBFT, and has comprehensive permissioning schemes designed specifically for uses in a consortium environment.



**Join us!**  
**It's a wild  
adventure**

# Learn Build Participate



### Webinars

Register for upcoming Hyperledger webinars or watch them on-demand.



### Videos

Explore how-to videos and community spotlights on Hyperledger topics.



### Training

Discover and enroll for training courses on Hyperledger technologies.



### Tutorials

Find resources for self-taught learning about the Hyperledger projects.



### Publications

Read popular white papers, position papers and case studies.



### Vendor Directory

Search for business blockchain products and services built by our members with Hyperledger code.



### Blockchain Showcase

Check out the cross-industry pilots and production deployments use today, built with Hyperledger frameworks and tools.



### Jobs

Search for Hyperledger and business blockchain job listings.



### Industries

See how different industries are adopting Hyperledger projects.



There are many ways you can make an impact on Hyperledger projects. To be successful we need community members like you to get involved and contribute. Please be sure to follow our Code of Conduct when participating.

Learn the basics about Hyperledger projects

LEARN MORE

Check out our collaboration tools

LEARN MORE

Join or start a Hyperledger meetup

LEARN MORE

Spread the word about Hyperledger

LEARN MORE

Improve our training material

LEARN MORE

Get involved with coding and development

LEARN MORE

# Community Working Groups (WGs)

Technical Working Groups are open to the public



[Technical Steering Committee](#)



[Smart Contracts Working Group](#)



[Architecture Working Group](#)



[Technical Working Group China](#)



[Identity Working Group](#)



[Learning & Materials Development Working Group](#)



[Performance and Scalability Working Group](#)



[Diversity, Civility and Inclusion Working Group \(DCI\)](#)



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Visit:

<https://wiki.hyperledger.org/display/HYP/Working+Groups>

# Community Special Interest Groups (SIGs)

Sector Groups are open to the public



**HYPERLEDGER**  
**Healthcare**  
SPECIAL INTEREST GROUP



**HYPERLEDGER**  
**Public Sector**  
SPECIAL INTEREST GROUP



**HYPERLEDGER**  
**Telecom**  
SPECIAL INTEREST GROUP



**HYPERLEDGER**  
**Social Impact**  
SPECIAL INTEREST GROUP



**HYPERLEDGER**  
**Trade Finance**  
SPECIAL INTEREST GROUP



**HYPERLEDGER**  
**Supply Chain**  
SPECIAL INTEREST GROUP



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**Education Architecture**  
SPECIAL INTEREST GROUP



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Visit:

<https://wiki.hyperledger.org/display/HYP/Special+Interest+Groups>

# Training and Certifications

Technical training courses and professional certifications to get up-to-speed on Hyperledger Fabric or Sawtooth. (More projects to follow.)



BLOCKCHAIN MOOCs

- Blockchain: Understanding Its Uses and Implications
- Introduction to Hyperledger Technologies
- Hyperledger Fabric Fundamentals
- Hyperledger Sawtooth Administration
- Hyperledger Fabric Administration
- Hyperledger Fabric Developer (Q1)

## Professional Certifications

- **Certified Hyperledger Sawtooth Administrator (CHSA)**
- **Certified Hyperledger Fabric Administrator (CHFA)**
- **Certified Hyperledger Fabric Developer (Q1 2020)**



**HYPERLEDGER**  
TRAINING PARTNER



Visit:

<https://www.hyperledger.org/resources/training>



HYPERLEDGER  
**GLOBAL FORUM**

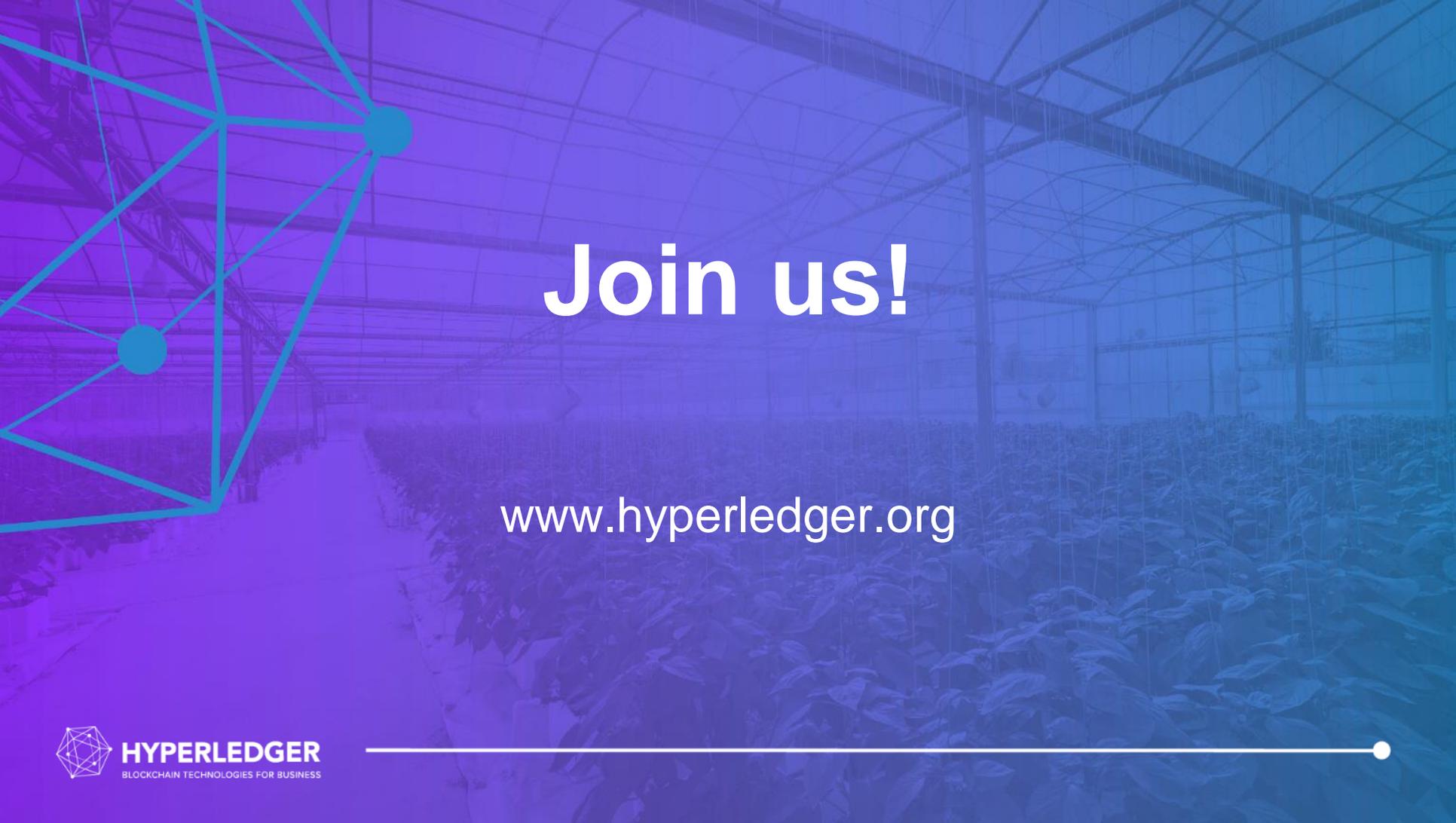
———— **Save the Date!** ————

PHOENIX, AZ  
MARCH 3-6, 2020

**CFP  
Deadline**

**OCT 4th**

<https://events.linuxfoundation.org/events/hyperledger-global-forum-2020/>



# Join us!

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



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BLOCKCHAIN TECHNOLOGIES FOR BUSINESS

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# Let's blockchain!

# AWS customers are blockchain innovators



DTCC



# Guardian

**“Given our vast partner ecosystem, we are exploring the decentralization and immutable tracking benefits of blockchain for potential applications in our insurance business. We believe blockchain can improve the transparency and efficiency for stakeholders in these networks to transact, while still maintaining an independently verifiable lineage of activities. However, blockchain frameworks are complex and difficult to operate. With Amazon Managed Blockchain, we can now easily create Hyperledger Fabric blockchain networks to test and learn without worrying about managing the underlying infrastructure, networking, and software configuration.”**



—Daniel Johnson  
CTO and Head of Innovation, Guardian Life Insurance Company

# Learn more

## Amazon Managed Blockchain (AMB)

- AMB landing page: <https://aws.amazon.com/managed-blockchain/>
- Deep dive on AMB: <https://www.youtube.com/watch?v=B9tlH8lzKI4>
- How to deploy an app for Hyperledger Fabric on AMB: <https://aws.amazon.com/blogs/database/build-and-deploy-an-application-for-hyperledger-fabric-on-amazon-managed-blockchain/>

## Hyperledger

- Project site: <https://www.hyperledger.org/>
- Hyperledger Fabric: <https://www.hyperledger.org/projects/fabric>

# Blockchain Beer Pub and Cafe

- Learn how blockchain can provide the end-to-end visibility that today's supply chains need
- Try single origin blockchain-powered coffee from Nestle: 9 AM to 3 PM
- Happy Hour every evening from 4 to 6 PM
- The Quad in Aria, Pinyon Ballroom, Booth 100



PLUS, answer trivia and win an AMB shirt at the Quad!



# Attend other Amazon Managed Blockchain sessions:

[BLC208 – Builders Session - Build your first blockchain network and invite members](#)

12/2, 1 PM, Mirage, Events Center C1 - Table 2

[BLC207 – Chalk talk - Trade finance goes high tech using Amazon Managed Blockchain](#)

12/2, 4 PM, Bellagio Ballroom 7

[BLC206 – Chalk talk - Smart supply chain management systems based on blockchain, IoT & AI](#)

12/3, 2:30 PM, Aria Level 3 West Starvine 4

[BLC303 – Builders Session - Gain operational understanding of your blockchain application](#)

12/3, 2:30 PM, Mirage, Grand Ballroom B – Table 8

**[BLC204 – Breakout - Enterprise solutions with blockchain: Use cases from Nestlé, Sony Music, and Workday](#)**

12/3, 4 PM, MGM Level 1, Boulevard Ballroom 158

[BLC302 – Workshop - Build an interbank asset-transfer application with blockchain](#)

12/4, 9.15 AM, MGM Level 3, Premier Ballroom 318

[GPSTEC339 – Integrate Managed Blockchain & Amazon QLDB in your solutions portfolio](#)

12/4, 1:00 PM, Bellagio, Grand Ballroom 5 Green

**[BLC301 – Breakout - Dive deep into Managed Blockchain](#)**

12/4, 4.45 PM, MGM Level 3, Premier Ballroom 313

[BLC207 – R1- Chalk talk - Trade finance goes high tech using Amazon Managed Blockchain - Repeat](#)

12/4, 5.30 PM, Bellagio Ballroom 7

[BLC201 – Workshop - Building your first blockchain application with Managed Blockchain](#)

12/5, 12:15PM, MGM Level 3, Premier Ballroom 311

**[BLC301 – R1 Breakout - Dive deep into Managed Blockchain – REPEAT](#)**

12/5, 1:45 PM, Bellagio, Grand Ballroom 5 RED

# Thank you!

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Please complete the session survey in the mobile app.