

Enterprise Blockchain

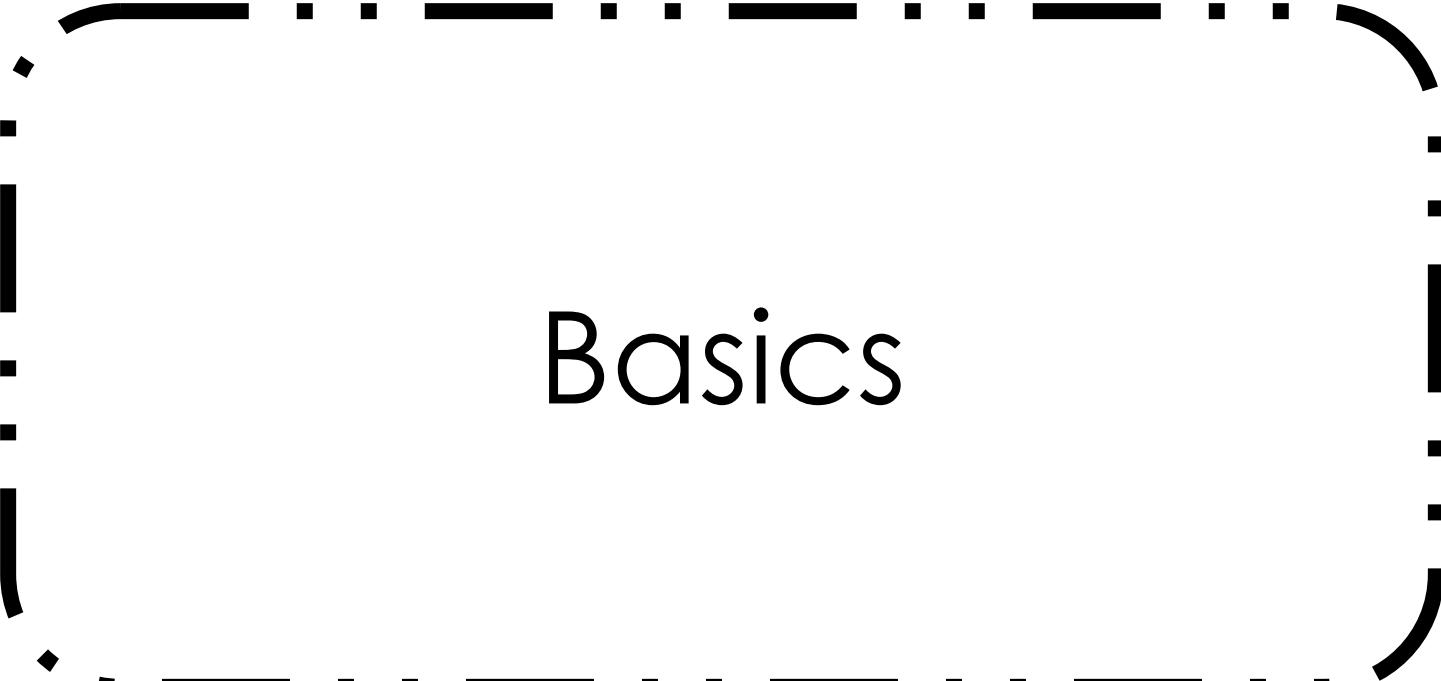
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By Samuel Tang, TIBA@TsinghuaUniversity

Content

 Basics

 Real-world Examples



Basics

Enterprise

Definition

- (Merriam-Webster) Enterprise:
 - a project or undertaking that is especially difficult, complicated, or risky
 - Enterprise == business or company or organization

Blockchain

Definition

- (Merriam-Webster) Blockchain:
 - a digital database containing information (such as records of financial transactions) that can be simultaneously used and shared within a large decentralized, publicly accessible network



Enterprise Blockchain

Centralized + Decentralized ?

- Distributed Ledger Technology
- Permissioned Blockchain
 - Operates based on private members
 - Federated/Consortium blockchains
 - Private blockchains

Permissionless vs. Permissioned

Types of Blockchain

- **Permissionless**: where anyone can join and have full rights to use the blockchain
 - Bitcoin, Ethereum, ...
- **Permissioned**: a person needs to meet certain requirements to perform certain actions on the blockchain
 - pre-verified users who have already proven they are who they say they are
 - Or allow anyone to join, but only let trusted identities verify transactions on the blockchain



Permissioned Blockchain

Types of Permissioned Blockchain

- **Private:** Allows one party to have full control and they will select a few nodes that are predetermined
- **Federated/Consortium:** Provides many of the same benefits of the private blockchain (efficiency and transaction privacy, etc), without consolidating power with only one party



	Blockchain type		
	Public	Private	Consortium
Permissionless?	Yes	No	No
Who can read?	Anyone	Invited users only	Depends
Who can write?	Anyone	Approved participants	Approved participants
Ownership	Nobody	Single entity	Multiple entities
Participants known?	No	Yes	Yes
Transaction speed	Slow	Fast	Fast

Decentralized or no?

What People Want

- People still tend to use centralized systems even in systems that's meant to/could be decentralized
 - Crypto exchanges such as Mt. Gox, Coinbase,...
 - no need to remember your own private key
 - Ease of password reset
 - Faster payment system

Why Blockchain?

Bubble or Revolution?

- achieve trust in a new way and with its own set of costs, reduce the '**cost of trust**'
- secure, verifiable transfer of value between parties who do not trust each other, without the use of a mutually trusted third party
 - **No middlemen**, Uber, PayPal,...which usually takes a cut of the value being transferred
- allow **transparency** in record-keeping
- tolerate localized shutdowns or attacks

Blockchain Technical Challenge

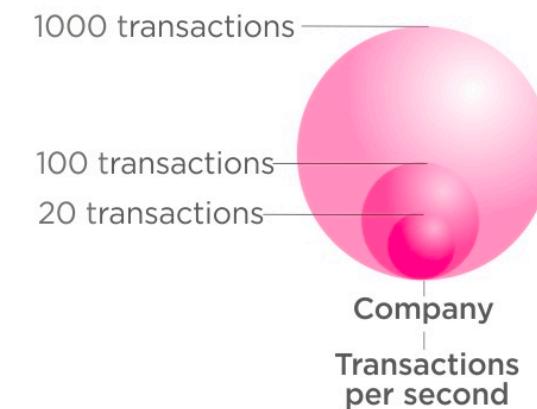
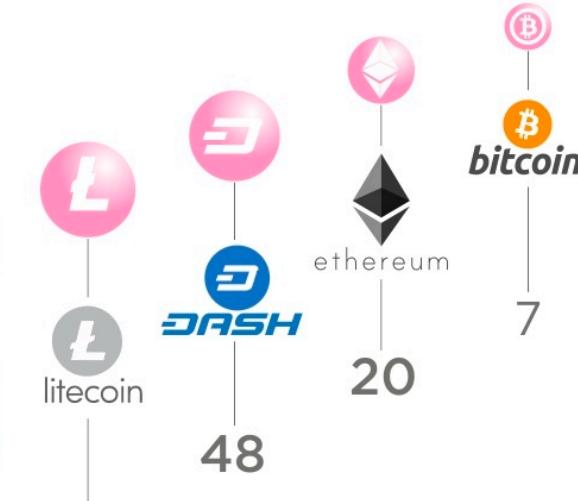
Measure what Matters

- Speed/Efficiency
 - Bitcoin: 7~10 transactions/second
 - Ethereum: ~20 transactions/second
 - Visa: ~24,000 transactions/second
- Energy Consumption
 - PoW uses significant energy resources
- Things that require low latency or high volumes will be better served by centralized database systems



VISA®

24,000

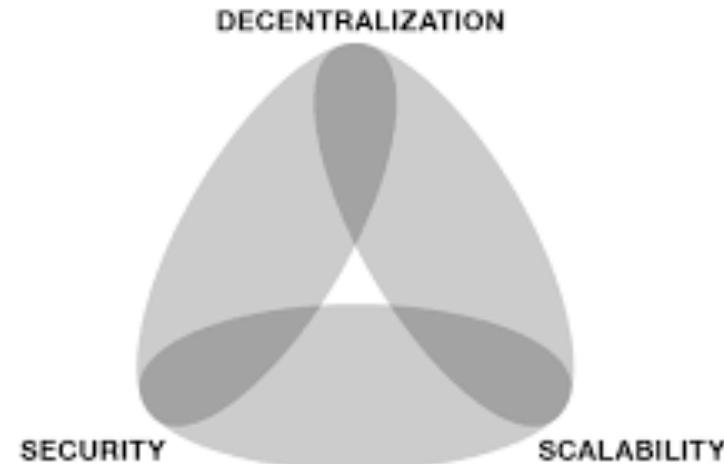




Scalability Trilemma

Two out of Three

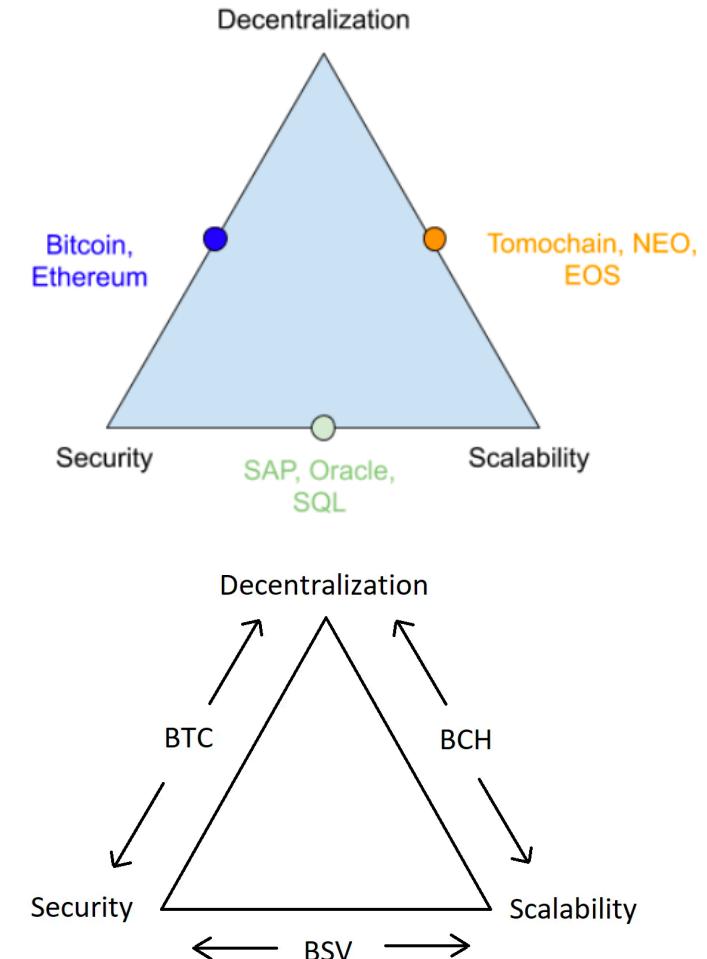
- Described by Ethereum's Vitalik Buterin
- For Blockchain systems:
 - Security, Decentralization, Scalability
 - Pick two of the three properties
 - Or pick one side of the triangle
 - Some people disagree and think we can achieve all three



Scalability Trilemma

Two out of Three

- **Decentralization:** defined as the system being able to run in a scenario where each participant only has access to $O(c)$ resources, ie. a regular laptop or small VPS
- **Scalability:** defined as being able to process $O(n) > O(c)$ transactions
- **Security:** defined as being secure against attackers with up to $O(n)$ resources





Blockchain Technical Challenge

Solutions

- ‘Layer 2’ / Sidechain solutions
 - Shifting small transactions to a cryptographically secure ‘off-chain’ and untimely settle ‘on-chain’
 - Bitcoin Lightning Network, Ethereum Plasma and Casper
- Alternative Consensus Protocols
 - Proof of Stake (PoS)
 - ...
- Zero Knowledge Proofs
- ...
- Permissioned blockchain (aka Enterprise Blockchain)

Enterprise Blockchains



Platforms

JP Morgan

Blockchain for Business

- **Quorum** - “an enterprise-focused version of Ethereum”
- Built on top of Ethereum code (soft fork)
- Consensus:
 - Raft (default) & Istanbul BFT
- Able to do both **public & private** transactions & smart contracts
- **State database** is split into private state and public state

J.P.Morgan

 Quorum

R3

Blockchain for Business

- **Corda** - “ensures data is shared only with parties who have a ‘need to know’. [...]designed to bring transparency and trust to interactions, while maintaining privacy and security”
- Initially designed for the **financial sectors** for recording, managing and synchronizing contracts
- **CorDapps:** distributed apps created with Corda
- Smart contracts that can be written in Java and other JVM languages
- **Corda Enterprise:** more capabilities to the Corda platform for more general enterprise use



R3

Blockchain for Business

- **Corda Network** - enable any organization or individual on this open network to transact directly with each other
- **End-State Principles:**
 - legal footing, shared logic, ...
- Conclusion: Allow people to transact privately between legally-identifiable counter-parties on a single highly scalable network with the freedom to interoperate other applications



ConsenSys

Blockchain for Business

- Brooklyn-based software-production studio
- Ethereum-based venture studio
- founded by Joseph Lubin (co-founder of Ethereum)
 - Solutions - consulting
 - Labs - incubator
 - Academy - education resources



Codefi

A platform for digitizing financial instruments and optimizing business processes



Diligence

Security audits for Ethereum blockchain smart contracts



Infura

Instant, scalable API access to the Ethereum and IPFS networks



MetaMask

A crypto wallet and gateway to blockchain dApps



PegaSys

An Enterprise Ethereum platform with advanced privacy



TRUFFLE (spin off)



Linux Foundation

Blockchain for Business

- **Hyperledger** - an open source community developing enterprise-focused software solutions
 - Besu - ConsenSys
 - Burrow - Monax
 - Fabric - IBM
 - Indy - Sovrin
 - Iroha - Soramitsu
 - Sawtooth - Intel

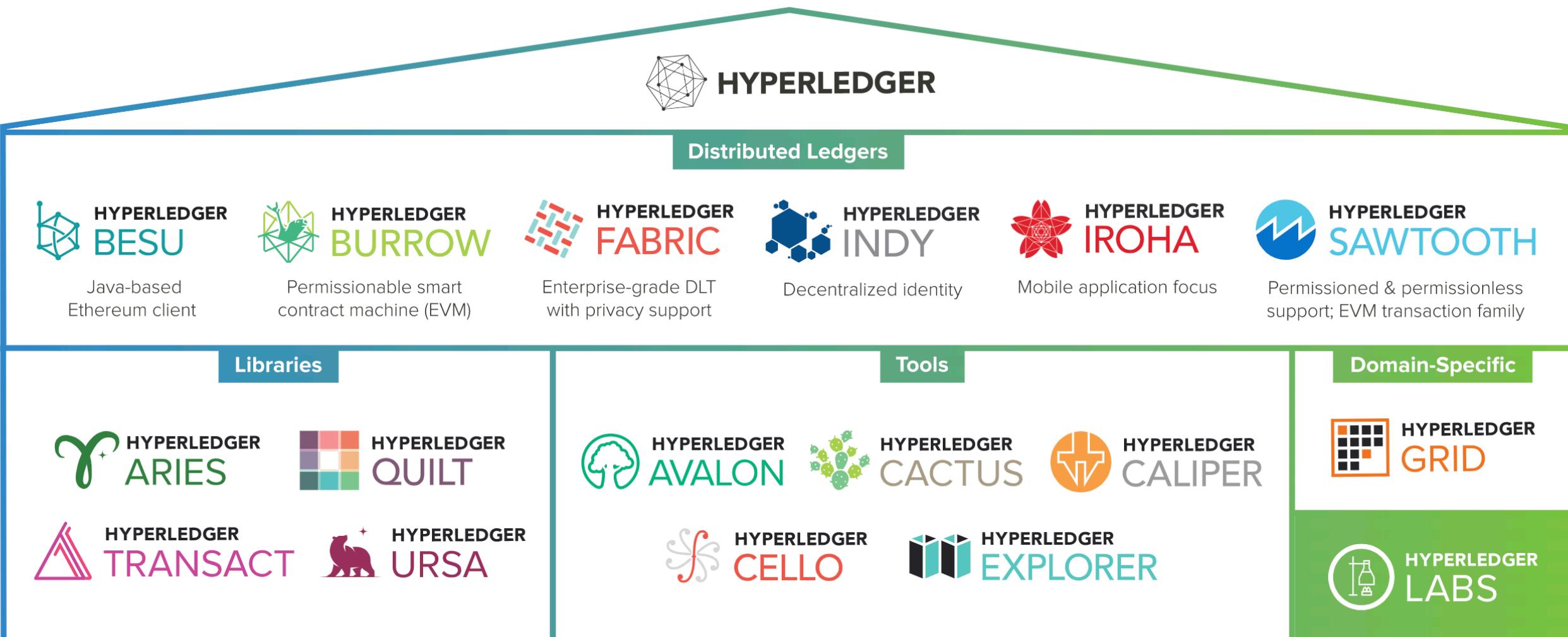


HYPERLEDGER





Hyperledger Greenhouse Structure



Linux Foundation

Blockchain for Business

- **Hyperledger Fabric**
- launched in December 2015
- initiated by Digital Asset and IBM
- all network participants must have known identities
- allows entities to conduct **confidential transactions** without passing information through a central authority
- **modular architecture** enables anyone to develop solutions or applications to plugin and play with different services



Ripple Labs

Blockchain for Finance

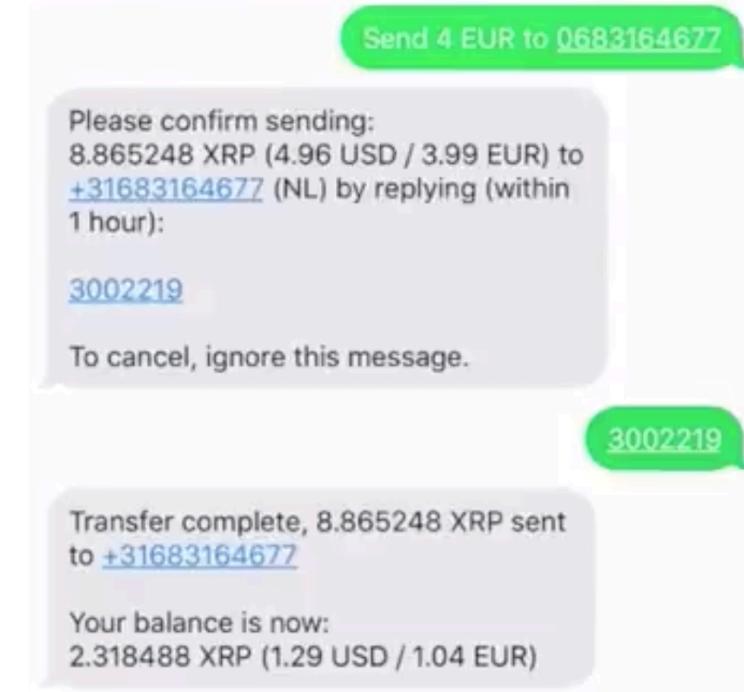
- **Ripple** - “Instantly Move Money to All Corners of the World”
- Founded by Chris Larsen & Jed McCaleb (founder of Mt. Gox)
- **RippleNet** - a payment system that enables global money transfers and offers its users cost efficiency, real-time transactions, and security



Ripple Labs

Blockchain for Finance

- **Network users**
 - SMEs, corporates, small banks, payment providers, consumers
 - can only send transactions
- **Network members**
 - banks and payment providers
 - process transactions and help improve liquidity on the platform
- XRP - name of cryptocurrency
- Ripple's protocol: RPCA (Ripple Protocol Consensus Algorithm)





Projects

UN World Food Program

Blockchain for Social Good

- **Building Blocks** - Blockchain for Zero Hunger
- Blockchain-base cash distribution system for people in need
- alternative to:
 - delivering bulk food
 - expensive
 - skew local market price
 - traditional money transfers
 - slow process
 - costly
 - financial & privacy risk



Source: <https://innovation.wfp.org/project/building-blocks>

Image Source: <https://www.mooncatchermeme.com/united-nations-world-food-programme-is-expanding-its-blockchain-testing-from-refugee-aid-in-the-middle-east-to-supply-chain-management-in-africa/>

UN World Food Program

Blockchain for Social Good

- Proof of Authority (PoA) Consensus
- Two technologies used in transactions:
 - blockchain
 - biometric identity management system
- In early 2019, sent 3 million USD per month to over 100,000 beneficiaries across two refugee camps in Jordan
- In 2019 distributed record of \$2.1 billion, reaching over 28 million people in 64 countries



Source: <https://innovation.wfp.org/project/building-blocks>; <https://news.itu.int/how-the-world-food-programme-uses-blockchain-to-better-serve-refugees/>

Image Source: <https://www.carbonbrief.org/interactive-how-climate-change-shapes-food-insecurity-across-the-world>

Bill & Melinda Gates Foundation

Blockchain for Financial Services

- **Mojaloop** - “increase financial inclusion by empowering organizations creating interoperable payments systems to enable digital financial services for all”
- Blockchain-powered mobile payment system
- Working with Ripple
- connecting all payment providers and banks on one platform

BILL & MELINDA
GATES *foundation*

mojaloop
foundation

World Wildlife Fund

Blockchain for Supply Chain

- **WWF** (New Zealand, Australia, Fiji) teamed up with
 - ConsenSys & TraSeable
 - Sea Quest Fiji Ltd (tuna fishing and processing company)
- Use blockchain to track tuna fish **supply chain** (RFID + QR codes)
- “a simple scan of tuna packaging using a smartphone app will tell the story of a tuna fish”
- Solve illegal & unreported fishing



IBM Blockchain

Blockchain as a Service

- IBM **Blockchain** - Blockchain as a Service
- Help developed Hyperledger Fabric and use as its framework
- IBM Food Trust - Food **Supply Chain**
 - used by Walmart  and many others
- Decentralized **Identity** Solutions
 - “Build internet’s missing layer of trust”
- Blockchain for **Natural Disaster**
- ...

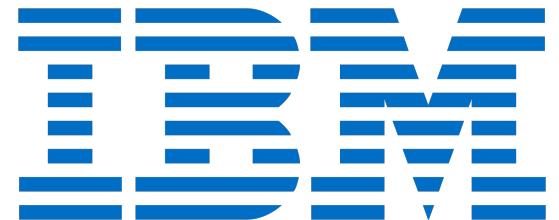
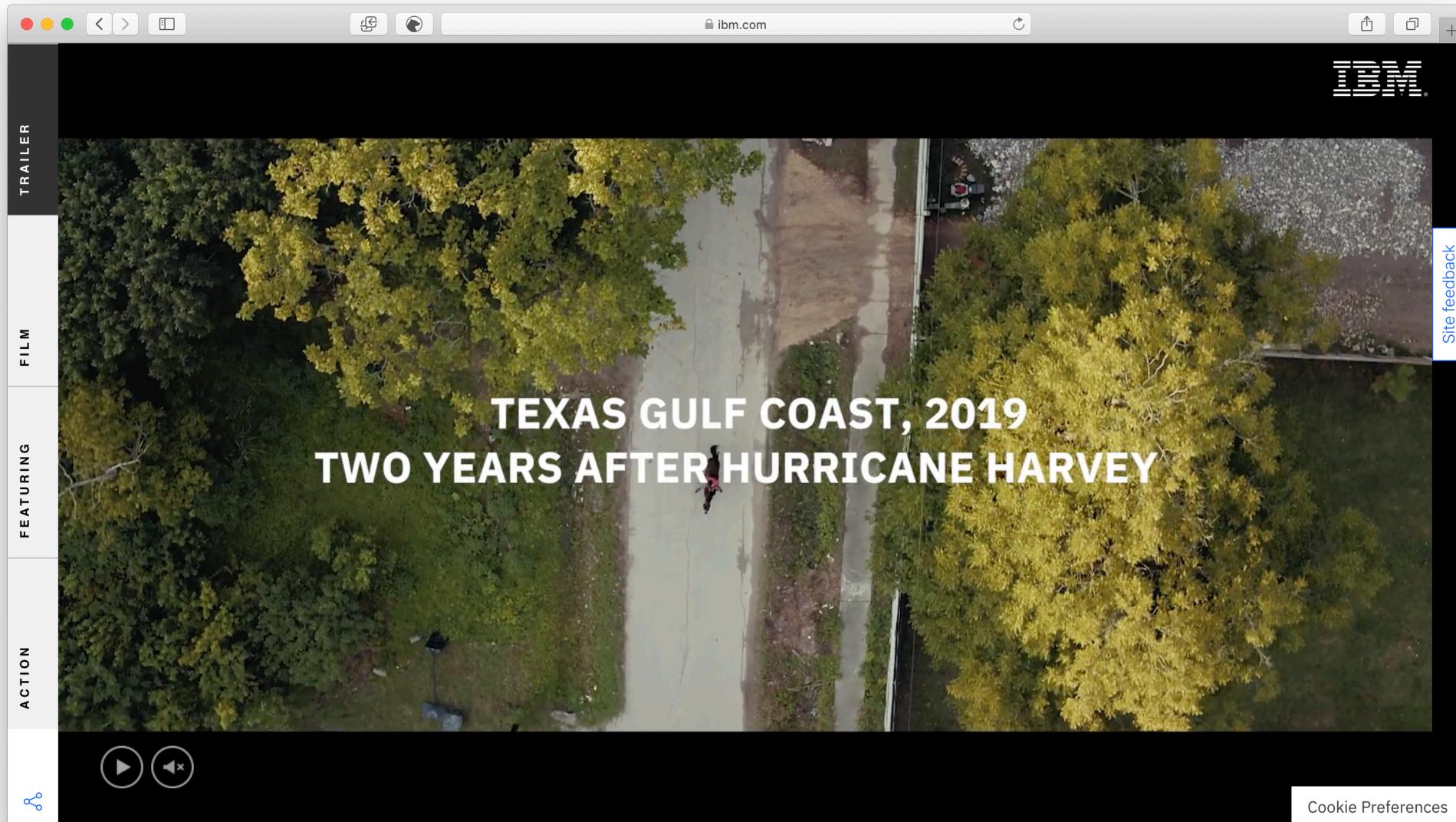


Image Source: <https://tokenpost.com/IBM-unveils-new-version-of-its-blockchain-platform-optimized-for-Red-Hat-OpenShift-3607>; <https://paris-saclay.business/ibm-recruit-400-ai-experts-paris-saclay/>; <https://www.hyperledger.org/use/fabric>

TIBA IBM Blockchain Bonds of Trust Short Film



Facebook

Blockchain for Financial Inclusion

- **Libra** - “A simple global payment system and financial infrastructure that empowers billions of people.”
- Secure, scalable, and reliable blockchain
- Backed by a reserve (**Libra Reserve**)
- Open to everyone to use the platform
- ‘Move’: programming language for smart contracts



Facebook

Blockchain for Financial Inclusion

- Governed by the independent **Libra Association**
 - members == validator nodes
 - not-for-profit
 - Headquartered in Geneva, Switzerland
- Start as permissioned but future ambition is to become permissionless
- Currently facing backlash from US regulators



Conclusion

Blockchain for Impact

- **Opportunities** can be **found** where there's:
 - Inefficiency in the way we record shared data pre-blockchain
 - Middleman/Third-party:
 - taking too much of the transferred value
 - slowing down the process to customers
 - being dangerous and not trust-worthy
- **Opportunities** can be **created** by:
 - changing the way people live in the centralized systems and build decentralized alternatives

Conclusion

Blockchain for Impact

- “People need to talk **less** about what **blockchain** technology is and **more** about what it can do for **people**....That's when the **power** of it comes out and is **understood**.”
 - IBM’s Design Lead for Blockchain Services Chelsey Delaney , *Bonds of Trust* Short Film



Enterprise
Blockchain
by
Samuel Tang



Thank you for listening!
See you again soon!





Questions?



More Resources - Blockchain

- Digital Gold by Nathaniel Popper
- Blockchain Revolution by Alex & Don Tapscott
- Blockchain at Berkeley Fundamentals Decal by University of California, Berkeley
- Bitcoin and Cryptocurrency Technologies by Princeton University
- Blockchain & Money by Prof. Gary Gensler, MIT



More Resources - Enterprise Blockchain

- [Enterprise Ethereum Alliance \(EEA\)](#)
- [Coindesk Enterprise Blockchain Articles](#)
- [What are Enterprise Blockchains?](#)
- [Blockchain in a nutshell: Building enterprise solutions](#)
- [How the Consortium Blockchain Works](#)



Research Resources - Quorum

- [JP Morgan Quorum Website](#)
- [Quorum Website](#)
- [Quorum Whitepaper](#)
- [Quorum Documentation](#)
 - See Background Reading -> presentation
- [What Is Quorum Blockchain? A Platform for The Enterprise](#)
- [Quorum 101: Getting started with Quorum](#)
- [JP Morgan Blockchain Center of Excellence](#)
- [Quorum: Enterprise Permissions Model in Smart Contracts](#)



Research Resources - Raft Consensus

- [Raft Website](#)
- [Raft White Paper](#)
- [Raft Wikipedia](#)
- [Raft GeeksforGeeks](#)



Research Resources - Corda

- [Corda Website](#)
- [Corda Github](#)
- [Corda Platform Whitepaper](#)
- [Meet Corda Enterprise](#)
- [What is Corda blockchain? Simply explained](#)



Research Resources - ConsenSys

- [ConsenSys Website](#)
- [ConsenSys Academy](#)
- [What is #ConsenSys & its Relationship to Ethereum? #Blockchain Explained with Joe Lubin - #1](#)
- [About ConsenSys, its Blockchain Projects & Vision for a Decentralized Future](#)
- [The ConsenSys 2019 Annual Report](#)
- [What is ConsenSys?](#)



Research Resources - Hyperledger

- [Hyperledger Website](#)
 - Click 'Use' for the Green House Graph
- [Hyperledger Whitepapers](#)
 - See [An Introduction to Hyperledger](#)
- [Hyperledger Case Studies](#)
- [edX Introduction to Hyperledger Blockchain Technologies](#)
- [Hyperledger Fabric Investopedia](#)
- [Hyperledger Fabric Website](#)
- [Hyperledger — Chapter 2 | Hyperledger Frameworks & Modules](#)



Research Resources - Ripple

- [Ripple Website](#)
- [What Is Ripple. Everything You Need To Know](#)
- [Ripple BitcoinWiki](#)



Research Resources - Building Blocks

- [WFP Building Blocks Website](#)
- [How the World Food Programme uses blockchain to better serve refugees](#)
- [World Food Programme Innovation Accelerator](#)



Research Resources - Mojaloop

- [Mojaloop Website](#)
- [The Gates Foundation Just Launched a Blockchain-Powered Mobile Payment System](#)
- [Mojaloop Github](#)
- [Mojaloop: The Future of Financial Interoperability](#)
- [Gates Foundation's Mojaloop Finance Code Gains in Africa And Asia](#)
- [Google and Gates Foundation to help spread digital payments in developing countries](#)



Research Resources - WWF Tuna Project

- [Look before you Blockchain](#)
- [Blockchain Tuna Project | WWF New Zealand](#)
- [How WWF Australia is using blockchain to help sustain critical Pacific tuna stocks](#)
- [WWF Launches Blockchain Tool to Track Food Along Supply Chain](#)
- [World first: revolutionary blockchain platform empowers all to track environmental and ethical impact of food and products](#)



Research Resources - IBM Blockchain

- [IBM Blockchain Website](#)
 - See under 'Solutions' for more
- [IBM Hyperledger Fabric Blog](#)
- [IBM Food Trust](#)
- [IBM unveils Blockchain as a Service based on open source Hyperledger Fabric technology](#)



Research Resources - Libra

- [Libra Website](#)
- [Libra Whitepaper](#)
- [Libra Blockchain Whitepaper](#)
- [In a big reversal, Libra reportedly could peg its cryptocurrencies to national currencies](#)
- [Watch Zuckerberg's congressional testimony](#)



Research Resources - More Exciting Projects

- Atrium - “help staff members from across the United Nations (UN) system to learn about and apply blockchain technology in their roles and for their organization’s needs”
 - The Atrium: UN blockchain solutions under one roof
- UNICEF Office of Innovation
 - UNICEF Invests In Six Emerging Market Blockchain Startups
 - Atix Labs from Argentina, Onesmart and Prescrypto from Mexico, Statwig from India, Utopixar from Tunisia, and W3 Engineers from Bangladesh
 - #Blockchain4BetterWorld INITIATIVE
- Treum - “bringing transparency, traceability and tradability to supply chains, using blockchain technology”