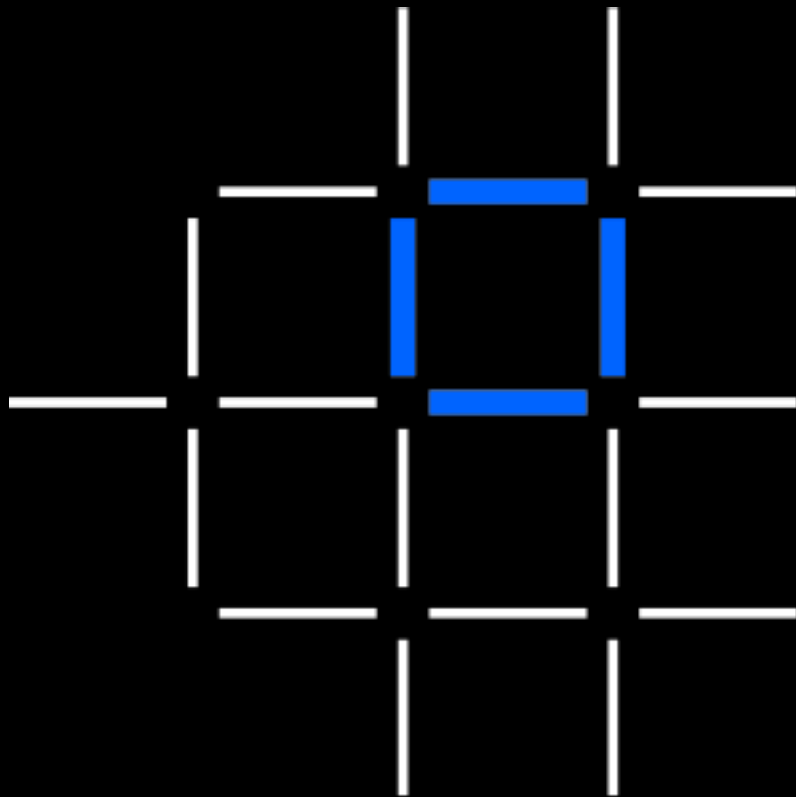


Blockchain Explained

An Introduction to Blockchain for Business

*Dr. Changrui Ren (任常锐)
IBM Research - China*





What is Blockchain?



Why is it relevant for our business?



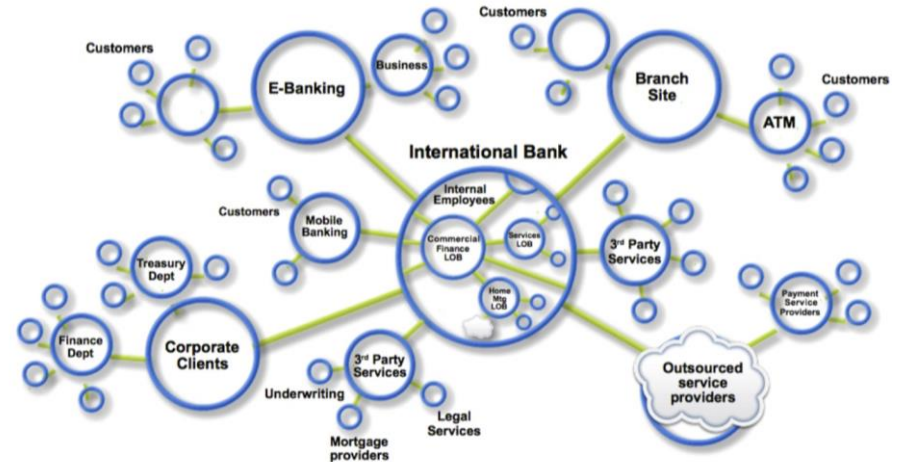
Trends & Challenges



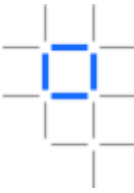
Business networks, wealth and markets



- **Business Networks** benefit from connectivity
 - Participants are customers, suppliers, banks, partners
 - Cross geography and regulatory boundary
- **Wealth** is generated by the flow of goods and services across business network in transactions and contracts
- **Markets** are central to this process:
 - Public (fruit market, car auction), or
 - Private (supply chain financing, bonds)



Transferring assets, building value



Anything that is capable of being owned or controlled to produce value, is an asset



Two fundamental types of asset

- Tangible, e.g. a house
- Intangible, e.g. a mortgage



Intangible assets subdivide

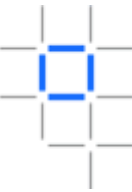
- Financial, e.g. bond
- Intellectual, e.g. patents
- Digital, e.g. music



Cash is also an asset

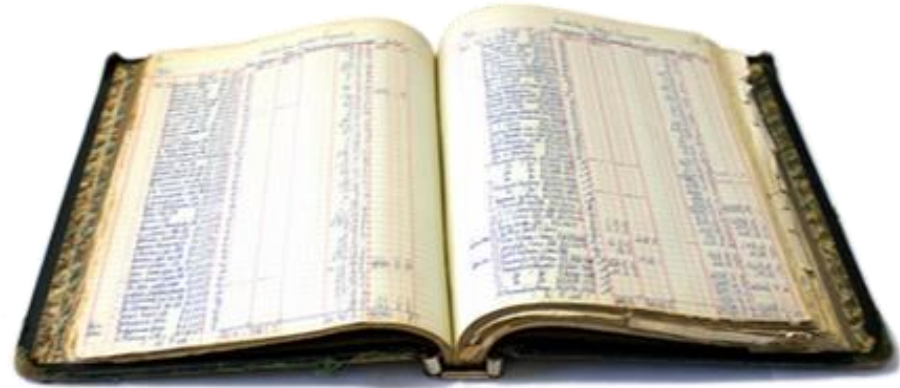
- Has property of anonymity

Ledgers are key

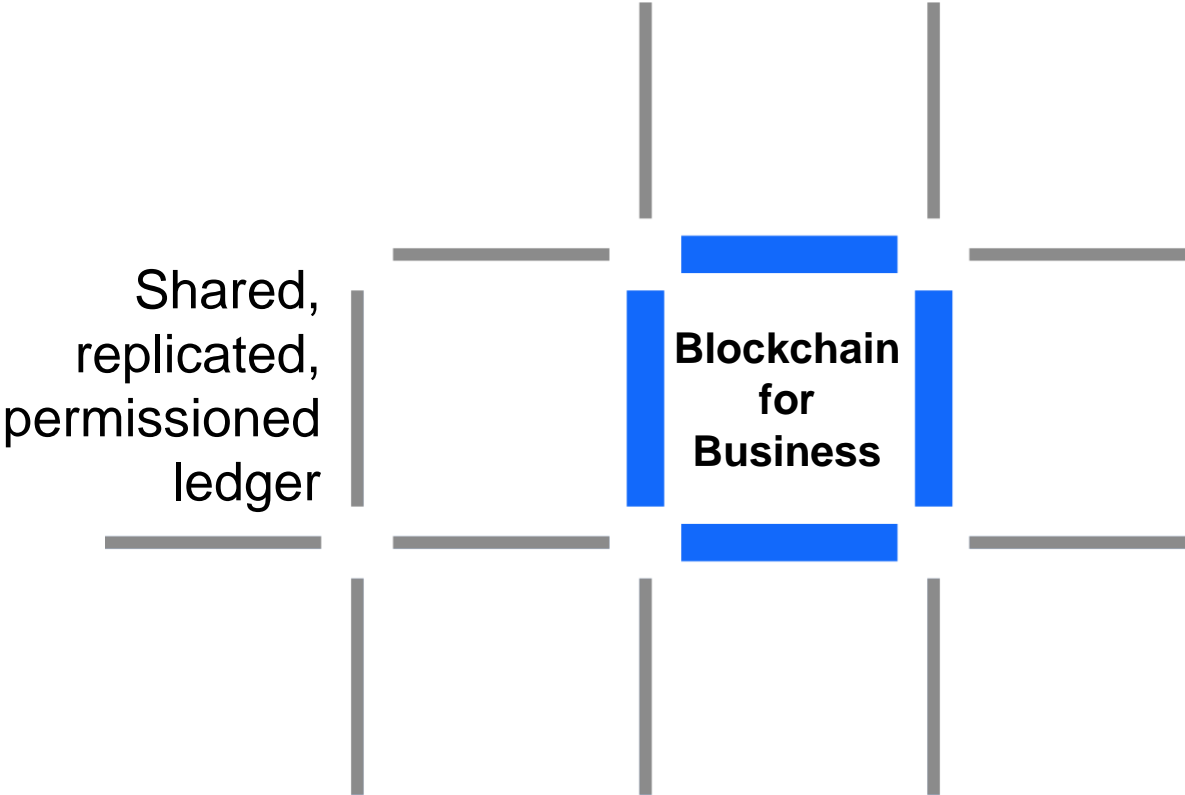
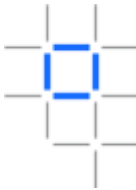


Ledgers are THE system of record for a business. Businesses will have multiple ledgers for the multiple business networks in which they participate.

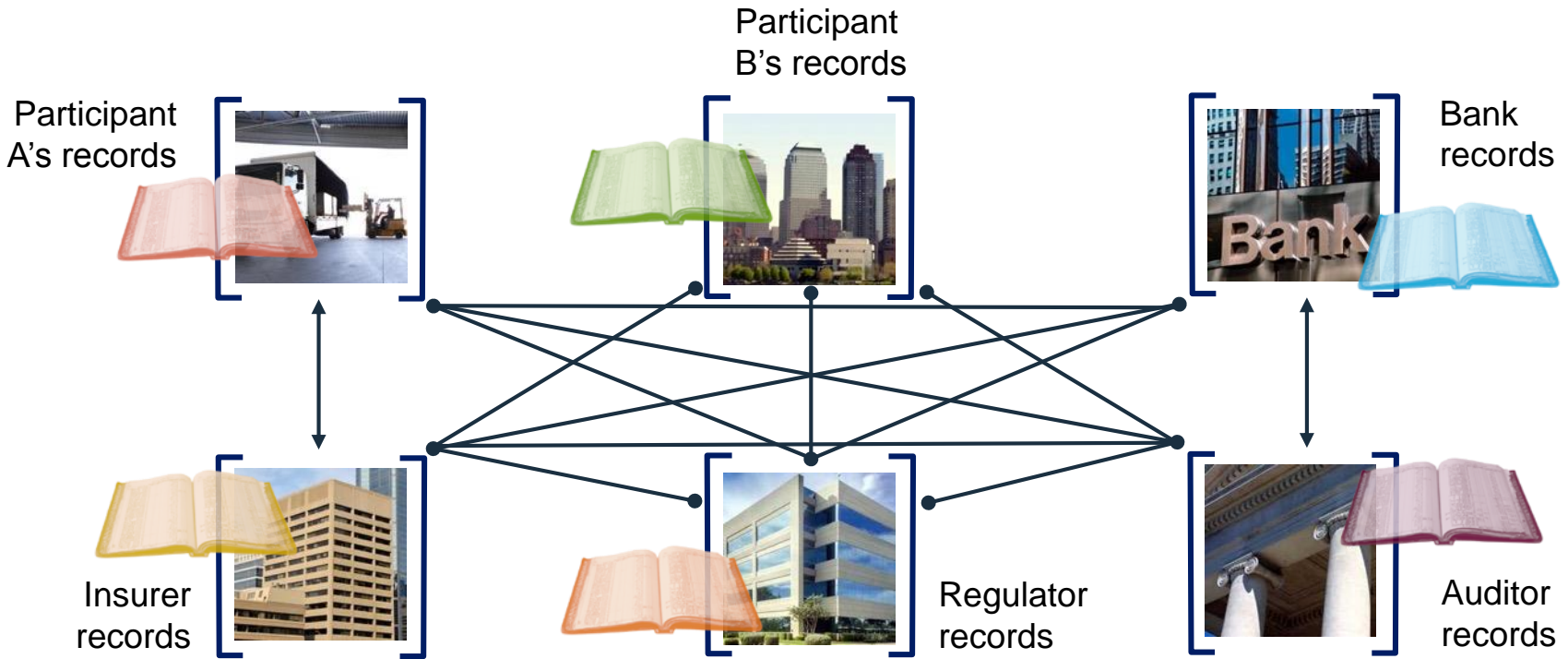
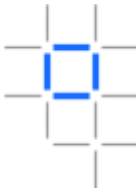
- **Transaction**: an asset transfer onto or off the ledger
 - John gives a car to Anthony (simple)
- **Contract**: the conditions for a transaction to occur
 - If Anthony pays John money, then car passes from John to Anthony (simple)
 - If car won't start, funds do not pass to John (as decided by third party arbitrator) (more complex)



Introducing Blockchain for Business...

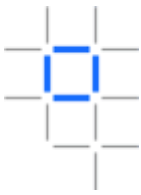


Problem...



... inefficient, expensive, vulnerable

A shared, replicated, permissioned ledger ...



Participant
A's records



Participant
B's records



Bank
records



Blockchain

Insurer
records



Regulator
records




Auditor
records



... with consensus, provenance, immutability and finality

Other types of blockchain exist

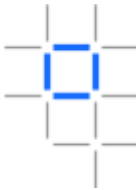


 **bitcoin** is an example of an unpermissioned, public ledger:

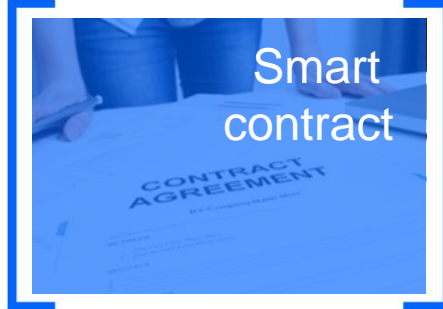
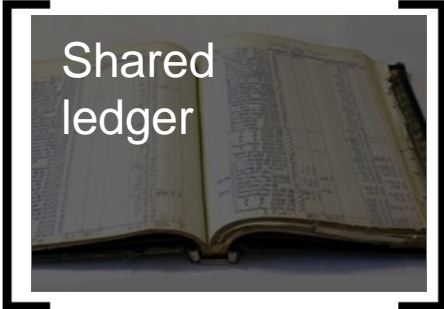
- The first blockchain application
 - Defines an unregulated shadow-currency
 - Resource intensive
- **Blockchains for business** are generally permissioned and private, and prioritize:
 - Identity over anonymity
 - Selective endorsement over proof of work
 - Assets over cryptocurrency



Blockchain for business requires trust

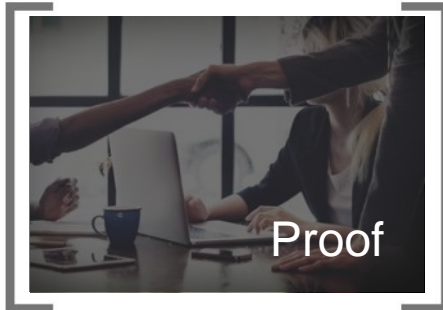


Append-only distributed system of record shared across business network



Business terms executed with transactions

Transactions are secure with appropriate visibility

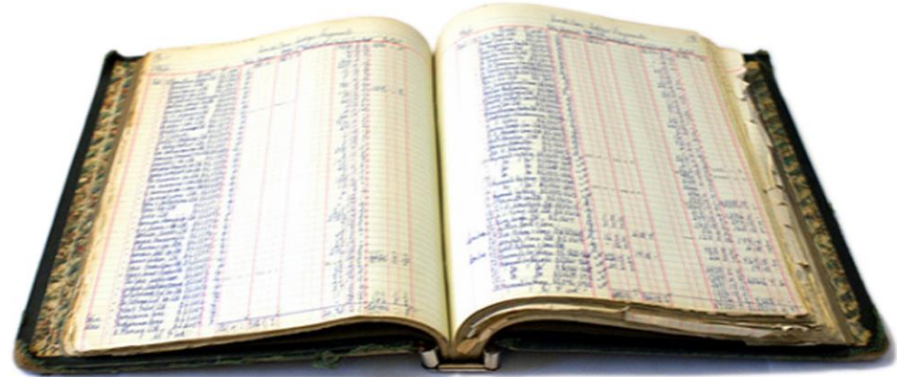


Transactions are provably endorsed by relevant participants

Shared ledger

- Shared between participants
- Participants have own copy through replication
- Permissioned, so participants see only appropriate transactions
- THE shared system of record

Records all transactions across business network



Smart contract

- Verifiable, signed
- Encoded in programming language
- Example:
 - Defines contractual conditions under which a bond transfer occurs

Business rules associated with the transaction



Privacy

- Participants need:
 - Appropriate confidentiality between subsets of participants
 - Identity not linked to a transaction
- Transactions need to be authenticated
- Cryptography central to these processes

The ledger is shared, but participants require privacy



Proof

- Participants endorse transactions
 - Business network decides who will endorse transactions
 - Endorsed transactions are added to the ledger with appropriate confidentiality
- Assets have a verifiable audit trail
 - Transactions cannot be modified, inserted or deleted
- Achieved through consensus, provenance, immutability and finality

The ledger is a trusted source of information





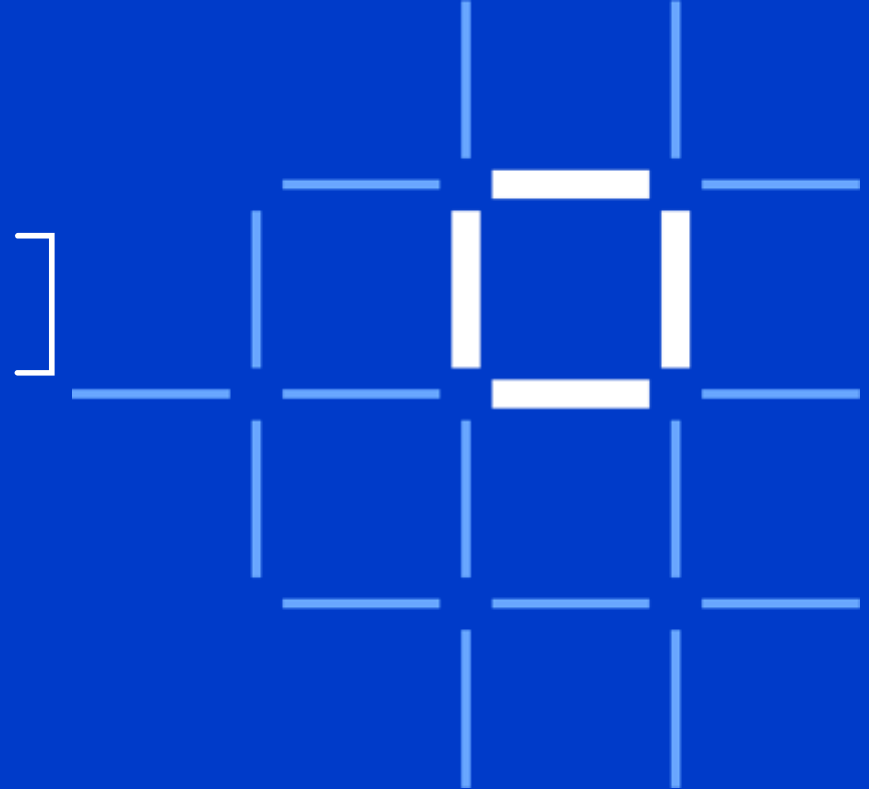
What is Blockchain?



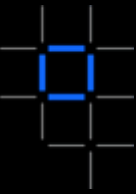
Why is it relevant for our business?



Trends & Challenges



Blockchain is creating extraordinary opportunities for businesses to come together in new ways



Create New Value

Exploit new business models and eliminate inefficiencies

Optimize Ecosystems

Streamline business processes and the exchange of value along your ecosystem

Reduce Risk

Replace uncertainty with transparency and a trusted decentralized ledger



Example: Shared reference data



What

- Competitors/collaborators in a business network need to share reference data, e.g. bank routing codes
- Each member maintains their own codes, and forwards changes to a central authority for collection and distribution
- An information subset can be owned by organizations

How

- Each participant maintains their own codes within a Blockchain network
- Blockchain creates single view of entire dataset

Benefits

1. Consolidated, consistent dataset reduces errors
2. Near real-time access to reference data
3. Naturally supports code editing and routing code transfers between participants

Example: Supply chain



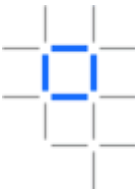
- What
- Provenance of each component part in complex system hard to track
 - Manufacturer, production date, batch and even the manufacturing machine program

- How
- Blockchain holds complete provenance details of each component part
 - Accessible by each manufacturer in the production process, the aircraft owners, maintainers and government regulators

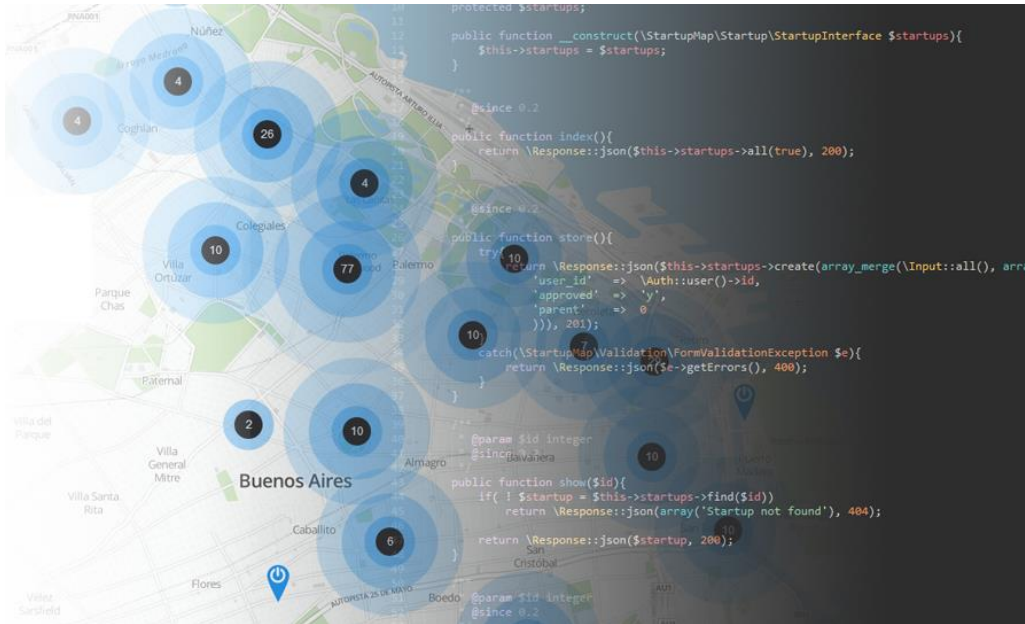
Benefits

1. Trust increased, no authority "owns" provenance
2. Improvement in system utilization
3. Recalls "specific" rather than cross fleet

Case study: EverLedger realizes end-to-end tracking for diamonds



Annually, frauds put about \$50B at risk in the diamond industry. The root cause is that the disconnected data islands (even no information system) allows the adulteration. The blockchain technology provides a trustworthy information sharing platform at a relatively low cost. In addition to the trade information, certificates, HD photos, parameters, payments, etc can be associated to provide joint intelligence and information.



Track and trace **from mines to consumers**

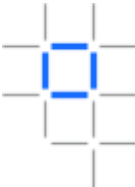
Disperse the **invisibility** brought by **bilateral** information exchange

Validate the **uniqueness** of a particular diamond

Transparent with visibility

Image processing for authentication

Case study: Walmart food traceability



Example: Audit and compliance



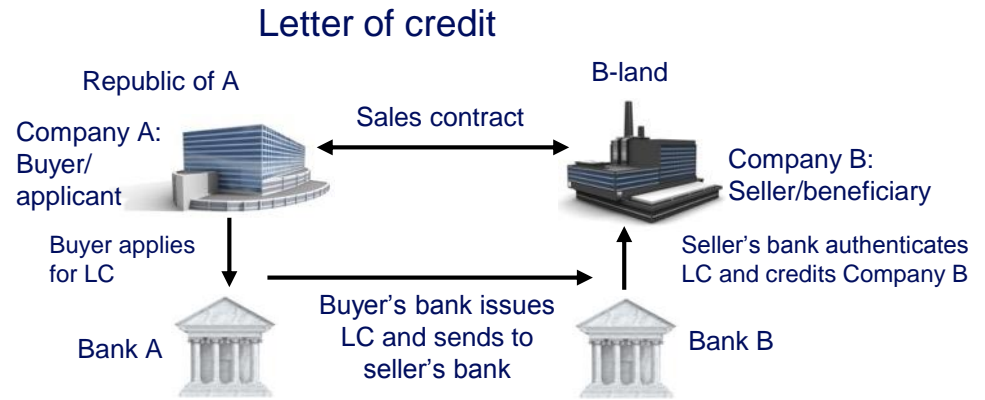
- What**
- Financial data in a large organization dispersed throughout many divisions and geographies
 - Audit and Compliance needs indelible record of all key transactions over reporting period

- How**
- Blockchain collects transaction records from diverse set of financial systems
 - Append-only and tamperproof qualities create high confidence financial audit trail
 - Privacy features to ensure authorized user access

Benefits

1. Lowers cost of audit and regulatory compliance
2. Provides “seek and find” access to auditors and regulators
3. Changes nature of compliance from passive to active

Example: Letter of credit



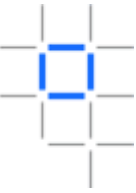
- What**
- Bank handling letters of credit (LOC) wants to offer them to a wider range of clients including startups
 - Currently constrained by costs & the time to execute

- How**
- Blockchain provides common ledger for letters of credit
 - Allows all counter-parties to have the same validated record of transaction and fulfillment

Benefits

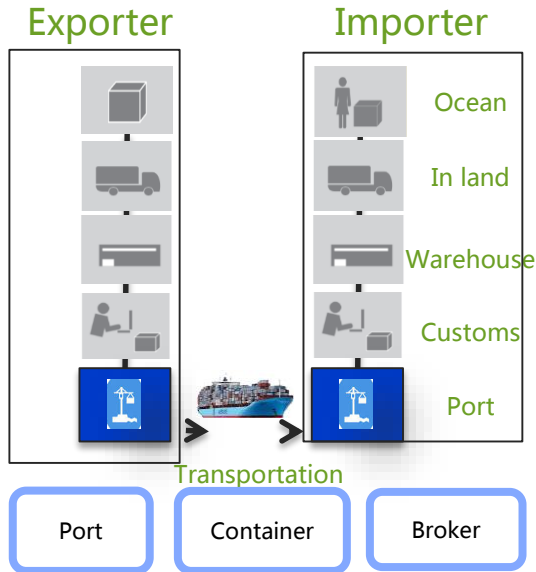
1. Increase speed of execution (less than 1 day)
2. Vastly reduced cost
3. Reduced risk, e.g. currency fluctuations
4. Value added services, e.g. incremental payment

Case study: Cross-border trade information digitalization and sharing



MAERSK

There are **MULTIPLE** parties in the cross border trade while the transfer of the title of goods is the very significant information to maintain. Usually there are bilateral or trilateral data exchange which caused invisibility, and associated trade time and capital. Maersk wants to lead to enable **THE** trustworthy multi-lateral platform using the blockchain technology.

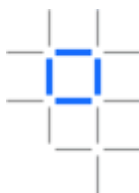


Secured **digitalization** and **workflow**

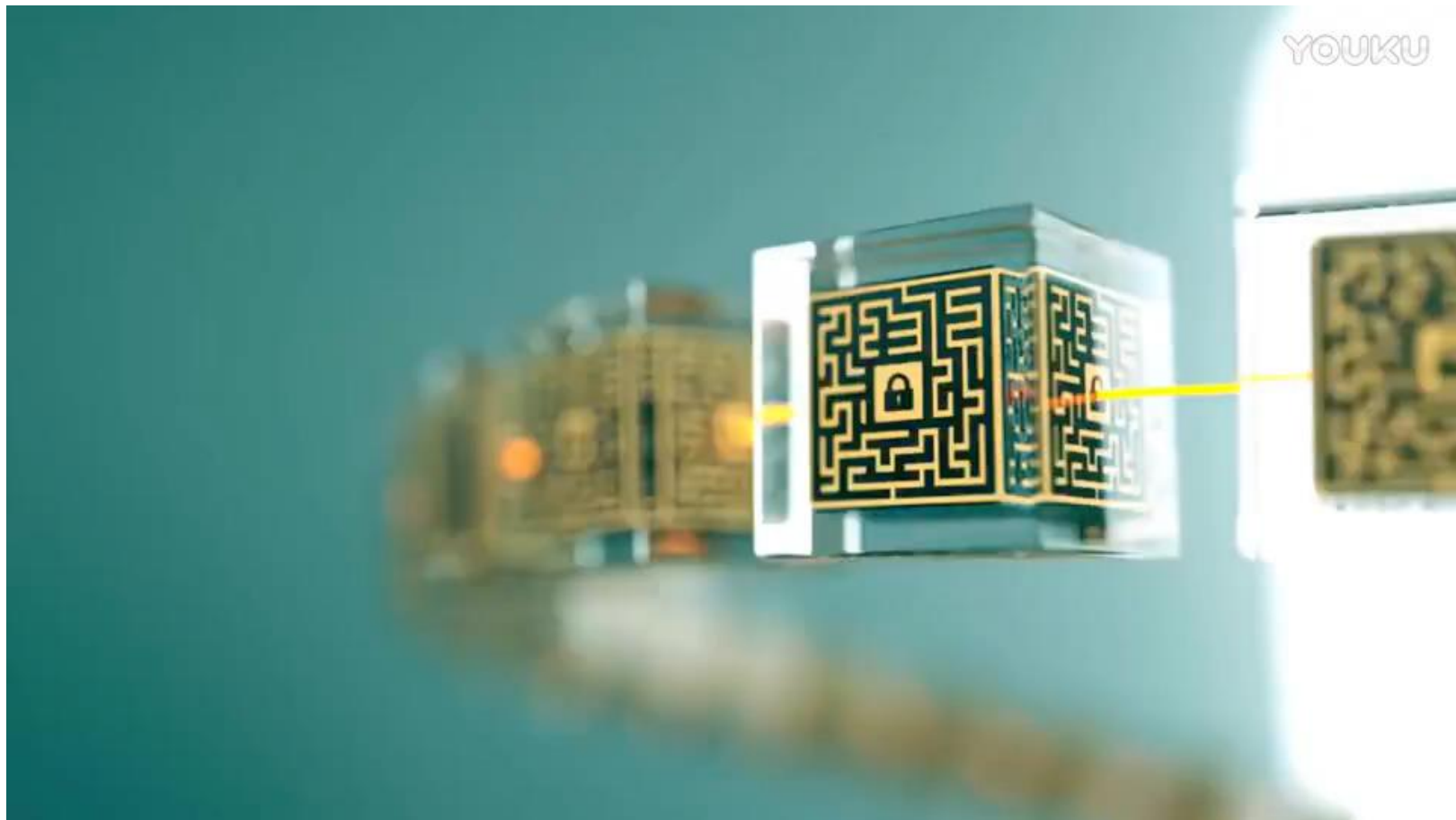
Five **regulation institutions** for trustworthiness

Provide **standard interface** to save the cost of system integrations among **multiple parties**

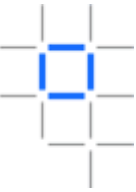
De-middleman for financial innovation



YOUKU



Further examples by (selected) industry



Financial	Public Sector	Retail	Insurance	Manufacturing
<ul style="list-style-type: none">• Trade Finance• Cross currency payments• Mortgages	<ul style="list-style-type: none">• Asset Registration• Citizen Identity• Medical records• Medicine supply chain	<ul style="list-style-type: none">• Supply chain• Loyalty programs• Information sharing (supplier – retailer)	<ul style="list-style-type: none">• Claims processing• Risk provenance• Asset usage history• Claims file	<ul style="list-style-type: none">• Supply chain• Product parts• Maintenance tracking

Patterns for customer adoption



HIGH VALUE MARKET

- Transfer of high value assets
- Between many participants in a market
- Regulatory timeframes

ASSET EXCHANGE

- Sharing of assets (voting, dividend notification)
- Assets are intangible
- Provenance & finality are key

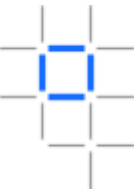
CONSORTIUM SHARED LEDGER

- Created by a small set of participants
- Share key reference data
- Consolidated, consistent real-time view

COMPLIANCE LEDGER

- Real-time view of compliance, audit & risk data
- Provenance, immutability & finality are key
- Transparent access to auditor & regulator

Key players for blockchain adoption



Regulator

- An organization who enforces the rules of play
- Regulators are keen to support Blockchain based innovations
- Concern is systemic risk – new technology, distributed data, security



Industry Group

- Often funded by members of a business network
- Provide technical advice on industry trends
- Encourages best practice by making recommendations to members



Market Maker

- In financial markets, takes buy-side and sell-side to provide liquidity
- More generally, the organization who innovates
 - Creates a new good or service, and business process (likely)
 - Creates a new business process for an existing good or service



What is Blockchain?



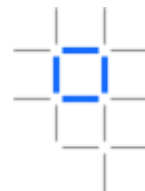
Why is it relevant for our business?



Trends & Challenges



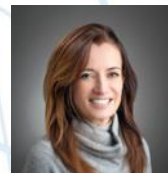
Hyperledger: A Linux Foundation project



- A collaborative effort created to advance cross-industry blockchain technologies for business
- Announced December 2015, now over 180 members
- Open source, open standards, open governance
- Five frameworks and four tools projects
- IBM is a premier member of Hyperledger



Brian Behlendorf
Executive Director



Blythe Masters
Board Chair



Chris Ferris
TSC Chair

www.hyperledger.org

Hyperledger Members

Premier



General



General

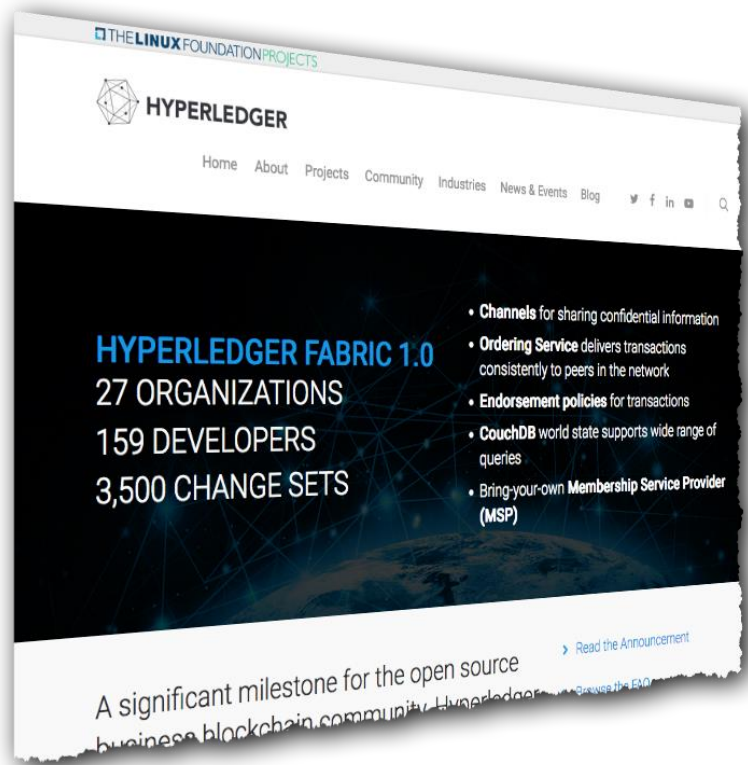
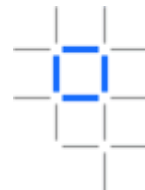


Associate



Source: <https://www.hyperledger.org/members>
 Updated 30 November 2017

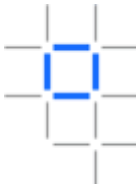
Hyperledger Fabric: Distributed ledger platform



- An implementation of blockchain technology that is a foundation for developing blockchain applications
- Emphasis on ledger, smart contracts, consensus, confidentiality, resiliency and scalability.
- V1.0 released July 2017
 - 159 developers from 27 organizations
 - IBM is one contributor of code, IP and development effort to Hyperledger Fabric

<http://hyperledger-fabric.readthedocs.io/>

Making blockchain real for business with over 400 engagements and multiple active networks



<p>Trade Finance</p>	<p>Pre and Post Trade</p>	<p>Complex Risk Coverage</p>
<p>Identity/ Know your customer (KYC)</p>	<p>Unlisted Securities/ Private Equity Funds</p>	<p>Loyalty Program</p>
<p>Medicated Health Data Exchange</p>	<p>Fraud/ Compliance Registry</p>	<p>Distributed Energy/ Carbon Credit</p>
<p>Supply Chain</p>	<p>Food Safety</p>	<p>Provenance/ Traceability</p>

Thank you

