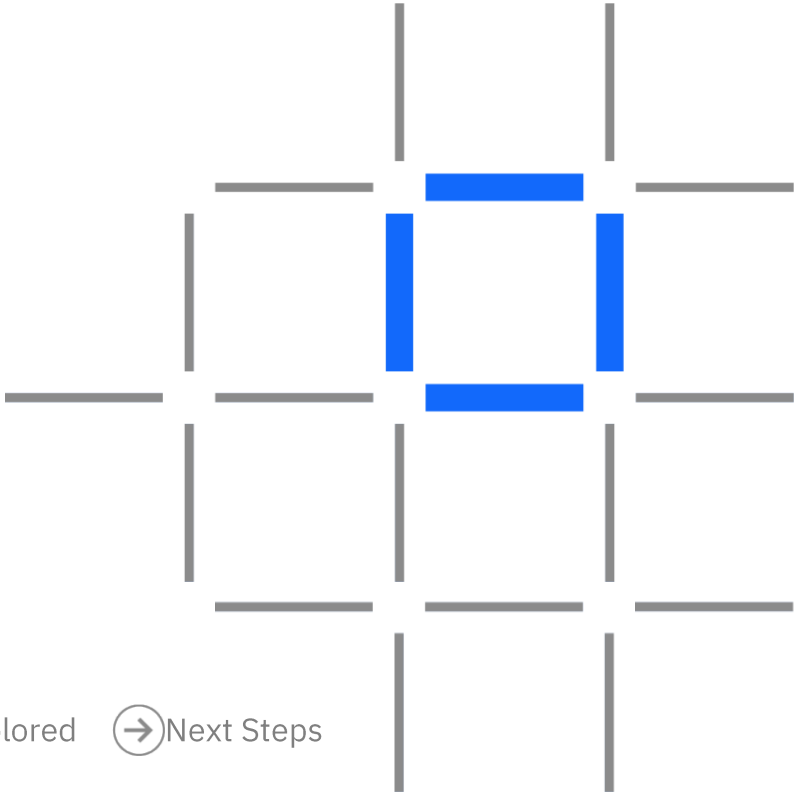
Blockchain Explained

An Introduction to Blockchain for Business

IBM **Blockchain**



Blockchain education series

Explained Solutions Composed Architected Explored Next Steps

V5.0, 23 August 2017

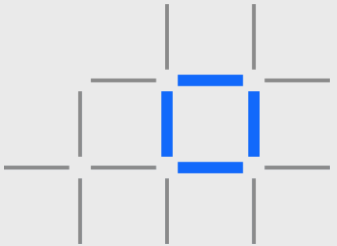
© 2017 IBM Corporation

Contents

What is Blockchain?

Why is it relevant for our business?

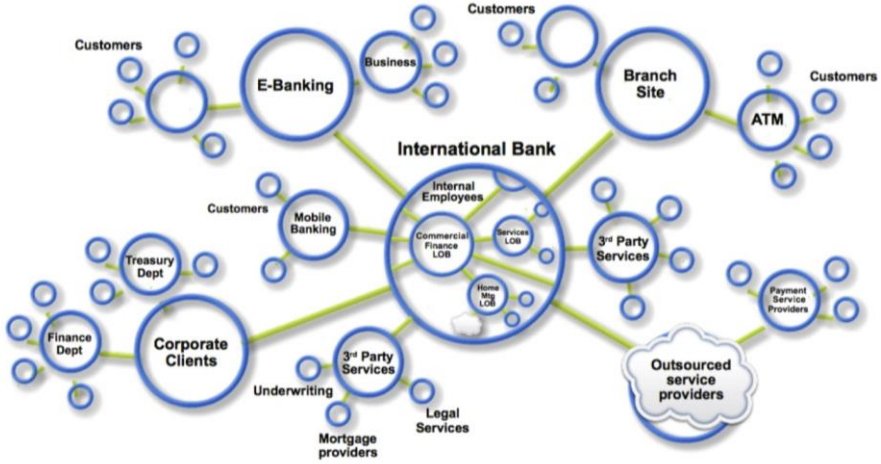
How can IBM help us apply blockchain?



© 2017 IBM Corporation

Business networks, wealth and markets

- Business Networks benefit from connectivity
  - Participants are customers, suppliers, banks, partners
  - Cross geography & regulatory boundary
- Wealth is generated by the flow of goods & 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)



© 2017 IBM Corporation

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

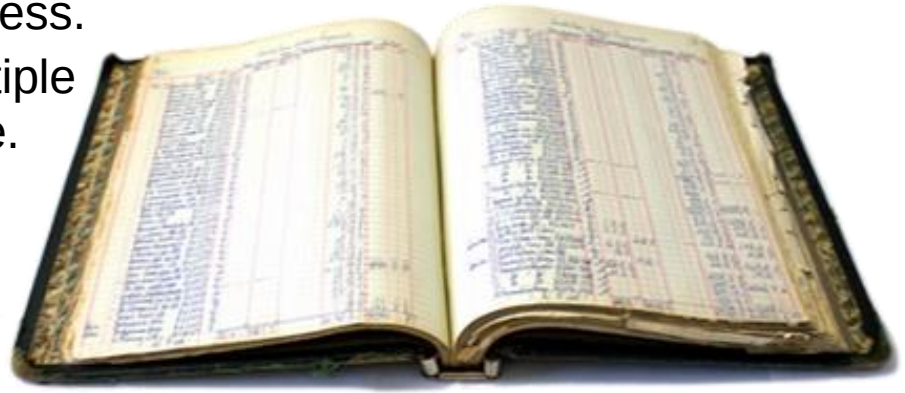
- Has property of anonymity

© 2017 IBM Corporation

Ledgers are key

Ledger is THE system of record for a business.

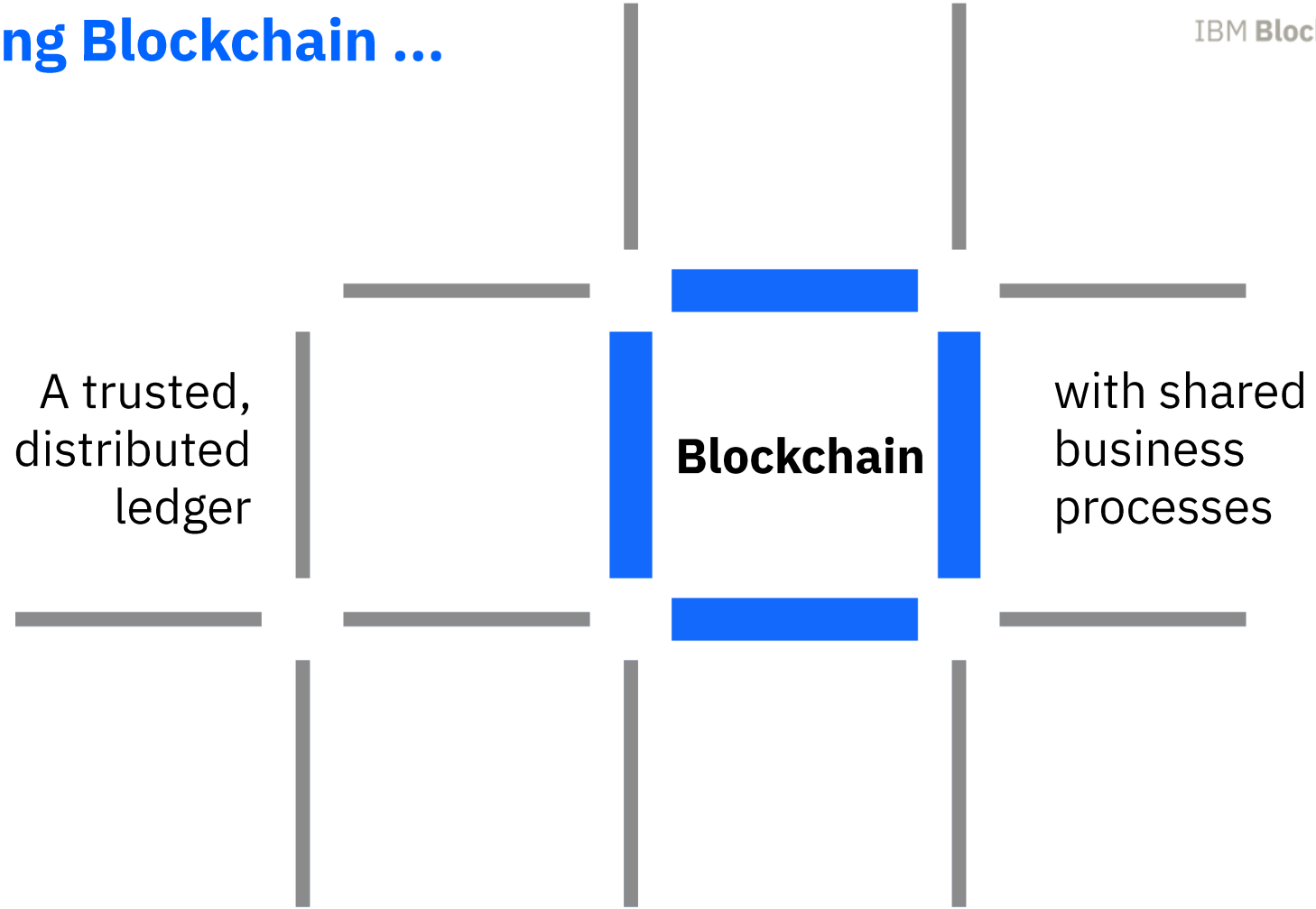
Business will have multiple ledgers for multiple business networks in which they participate.



- Transaction – an asset transfer onto or off the ledger
  - John gives a car to Anthony (simple)
- Contract – conditions for 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)

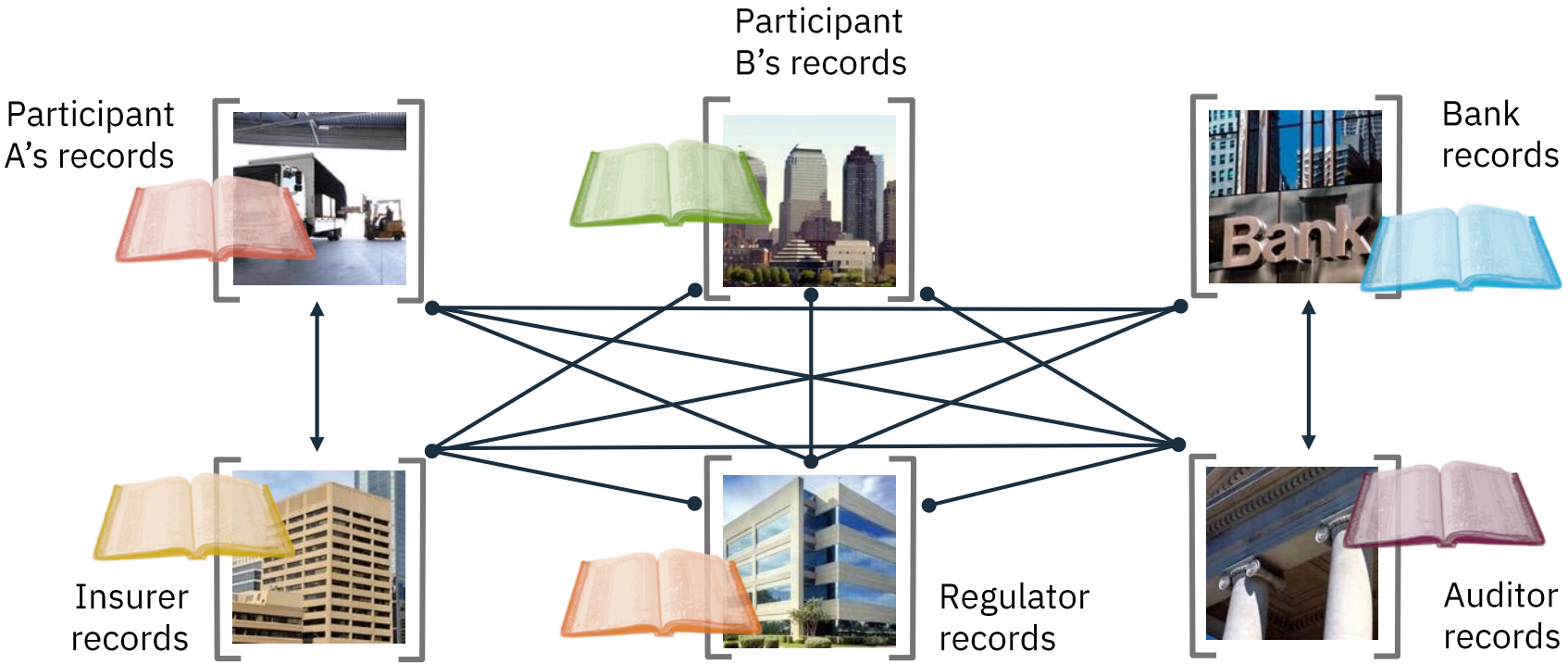
© 2017 IBM Corporation

Introducing Blockchain ...



© 2017 IBM Corporation

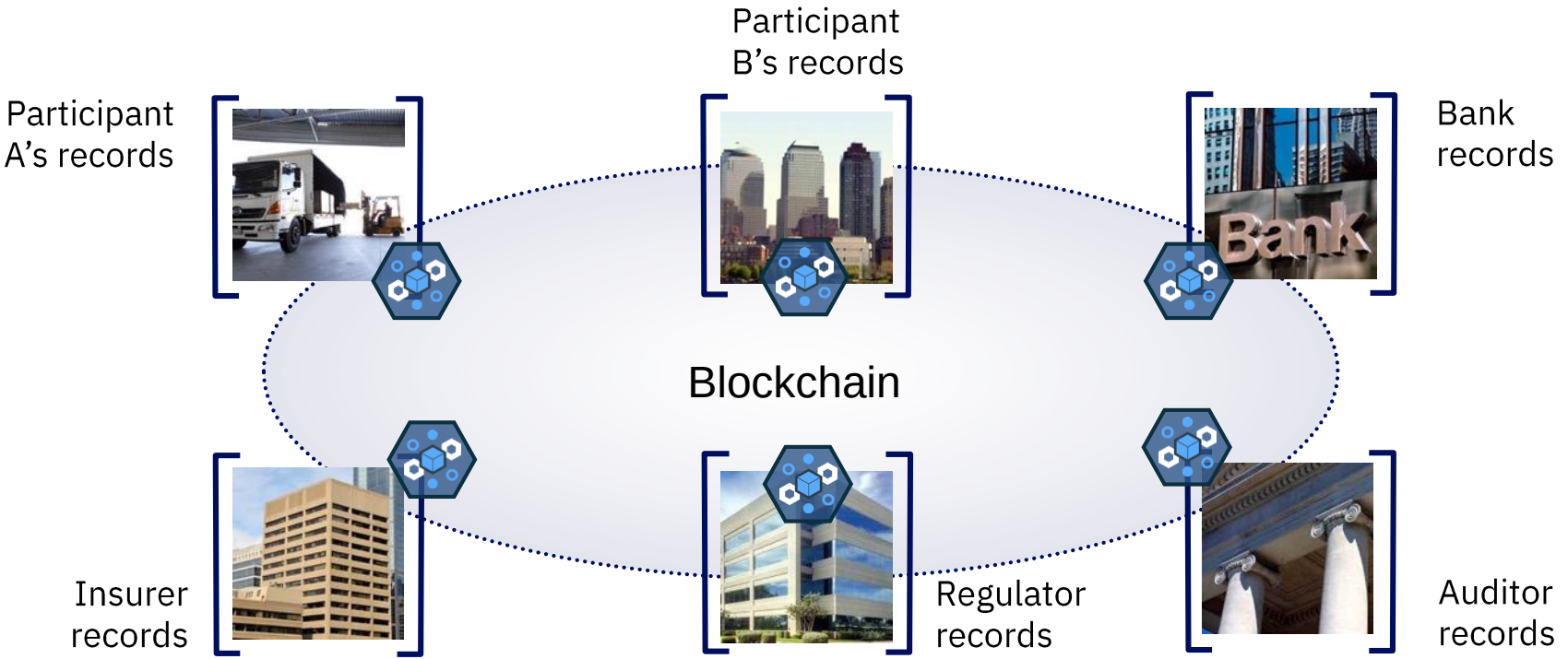
Problem ...



... inefficient, expensive, vulnerable

© 2017 IBM Corporation

A shared, replicated, permissioned ledger …



… with consensus, provenance, immutability and finality

© 2017 IBM Corporation

Blockchain underpins Bitcoin

bitcoin is:

- An unregulated shadow-currency
- The first blockchain application
- Resource intensive

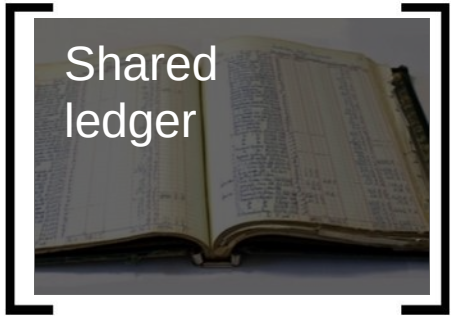
Blockchain for business differs in key areas:

- Identity over anonymity
- Selective endorsement over proof of work
- Assets over cryptocurrency

© 2017 IBM Corporation

Requirements of blockchain for business

Append-only distributed system of record shared across business network



Business terms embedded in transaction database & executed with transactions

Ensuring appropriate visibility; transactions are secure, authenticated & verifiable

Transactions are endorsed by relevant participants

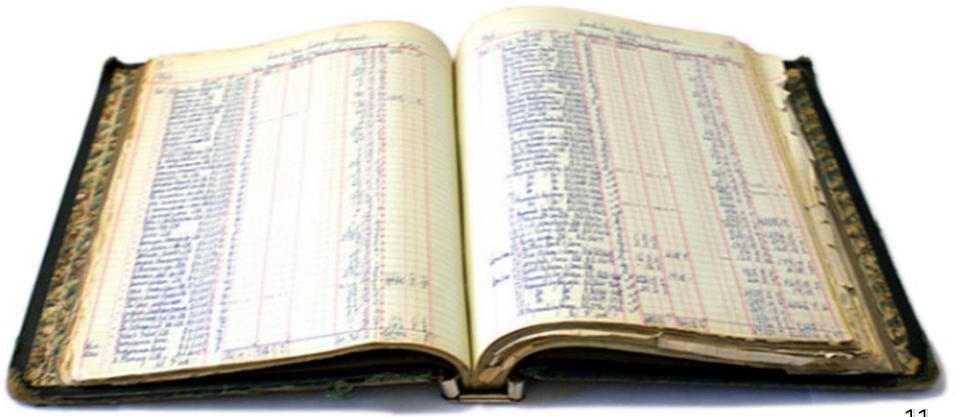
© 2017 IBM Corporation

Shared ledger

IBM **Blockchain**

Records all transactions across business network

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



© 2017 IBM Corporation

Smart contract

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

Business rules associated with the transaction

© 2017 IBM Corporation

Privacy

The ledger is shared, but participants require 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

© 2017 IBM Corporation

Trust

The ledger is a trusted source of information

- 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

© 2017 IBM Corporation

Contents

What is Blockchain?

Why is it relevant for our business?

How can IBM help us apply blockchain?

© 2017 IBM Corporation

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

IBM Blockchain

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

© 2017 IBM Corporation

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

© 2017 IBM Corporation

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

© 2017 IBM Corporation

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

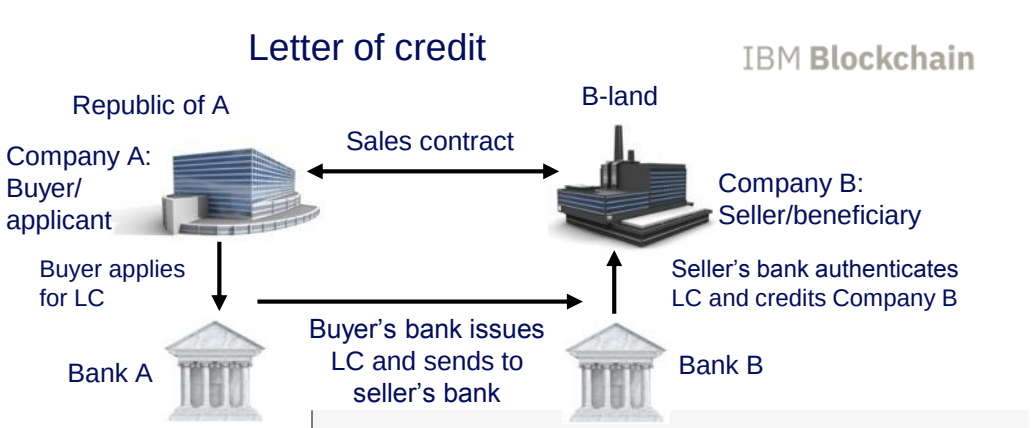
- Blockchain collects transaction records from diverse set of financial systems
- Append-only and tamperproof qualities create high confidence financial audit trail
- Privacy features to ensure authorized user access

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

© 2017 IBM Corporation

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

© 2017 IBM Corporation

Further examples by (selected) industry

Financial

- Trade Finance
- Cross currency payments
- Mortgages

Public Sector

- Asset Registration
- Citizen Identity
- Medical records
- Medicine supply chain

Retail

- Supply chain
- Loyalty programs
- Information sharing (supplier – retailer)

Insurance

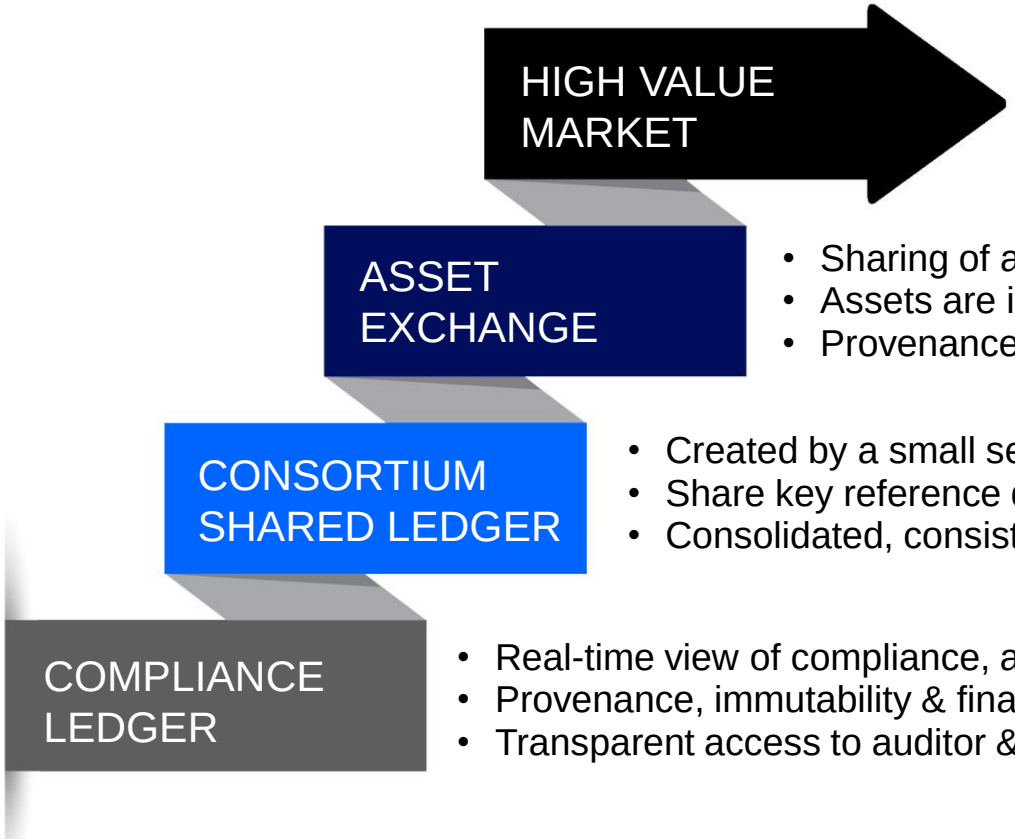
- Claims processing
- Risk provenance
- Asset usage history
- Claims file

Manufacturing

- Supply chain
- Product parts
- Maintenance tracking

© 2017 IBM Corporation

Patterns for customer adoption



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

- Sharing of assets (voting, dividend notification)
- Assets are information, not financial
- Provenance & finality are key

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

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

© 2017 IBM Corporation

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

© 2017 IBM Corporation

Contents

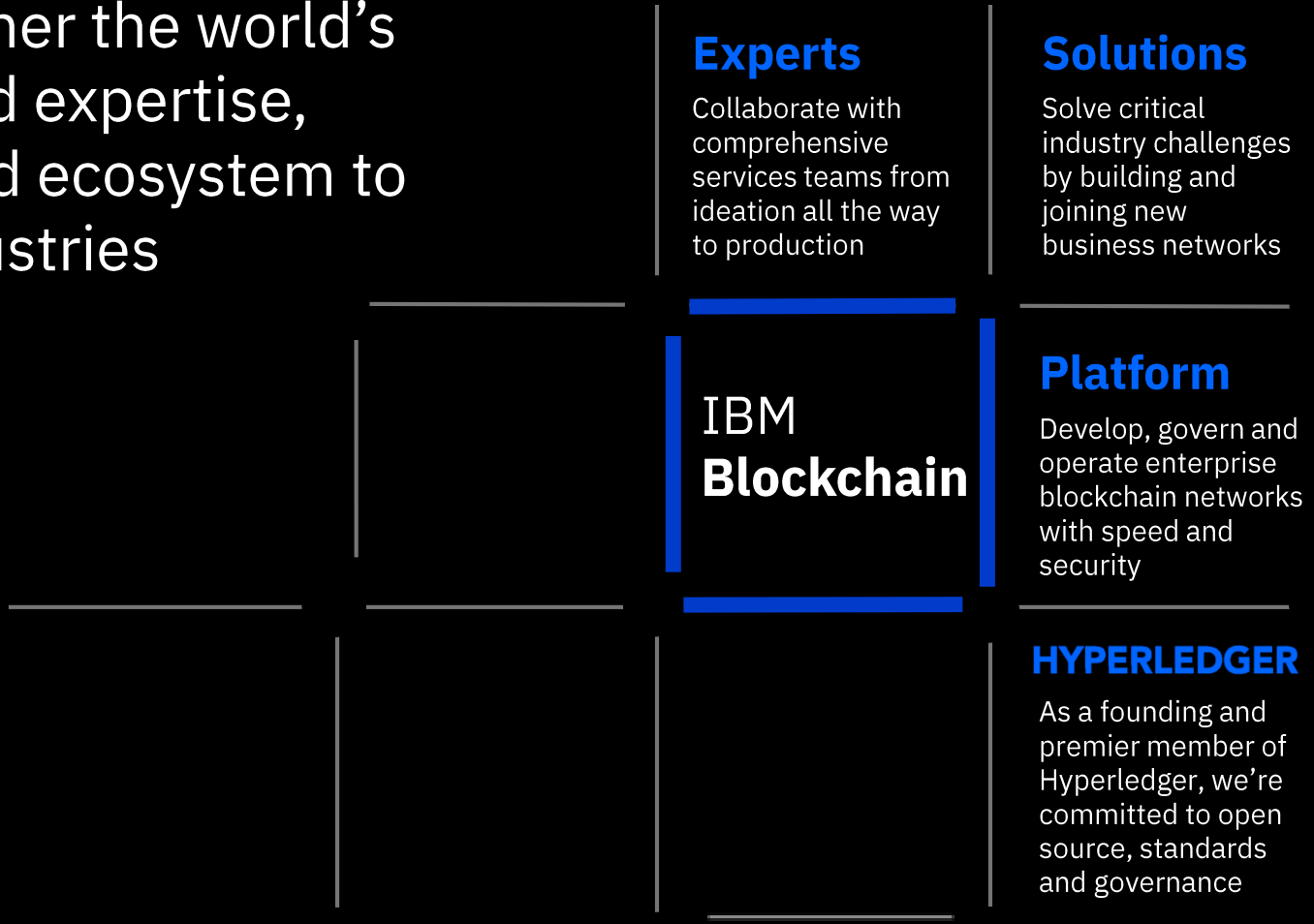
What is Blockchain?

Why is it relevant for our business?

How can IBM help us apply blockchain?

© 2017 IBM Corporation

Bringing together the world's most advanced expertise, technology and ecosystem to transform industries



© 2017 IBM Corporation

Hyperledger: A Linux Foundation project

- A collaborative effort created to advance cross-industry blockchain technologies for business
- Announced December 2015, now around 150 members
- Open source, open standards, open governance
- Five frameworks and three tools projects
- IBM is a premier member of Hyperledger

Brian Behlendorf
Executive Director

Blythe Masters
Board Chair

Chris Ferris
TSC Chair

www.hyperledger.org

© 2017 IBM Corporation

Hyperledger members

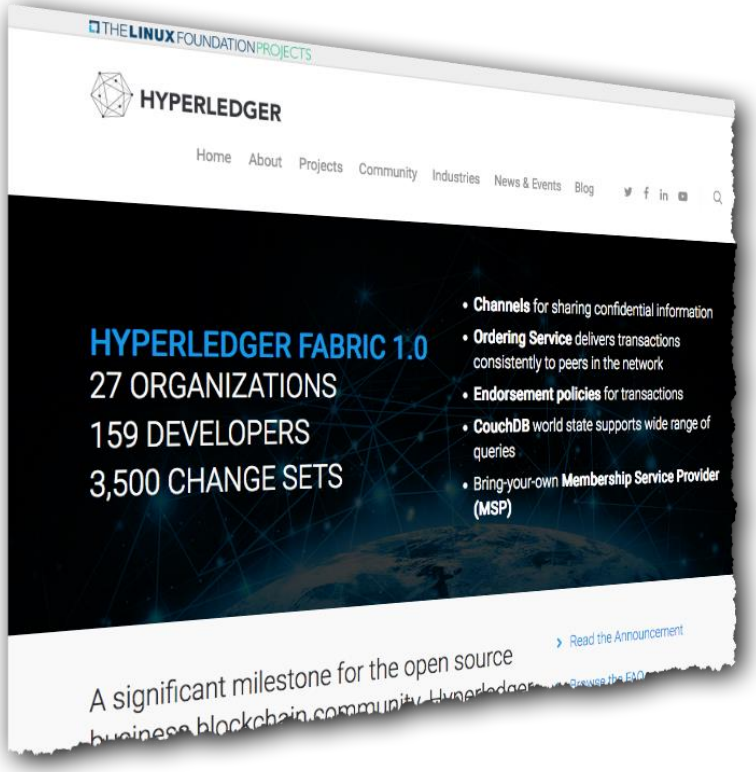
Premier

General

Associate

Source: https://www.hyperledger.org/about/members
Updated 21 August 2017

Hyperledger Fabric: Distributed ledger platform

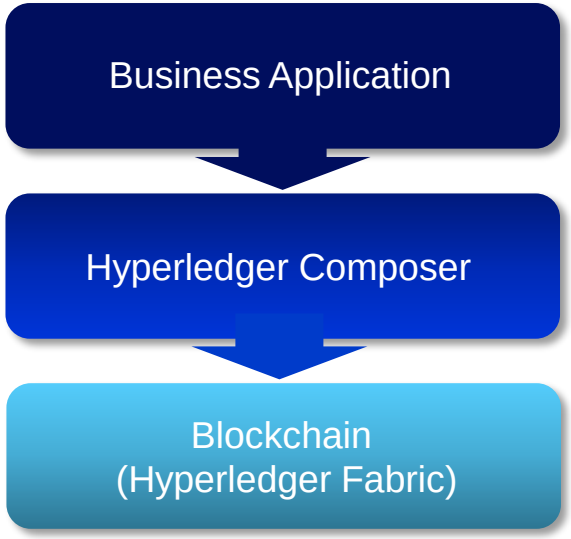


- An implementation of blockchain technology that is a foundation for developing blockchain applications
- Emphasis on ledger, smart contracts, consensus, confidentiality, resiliency and scalability.
- V1.0 released July 2017
  - 159 developers from 27 organizations
  - IBM is one contributor of code,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

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

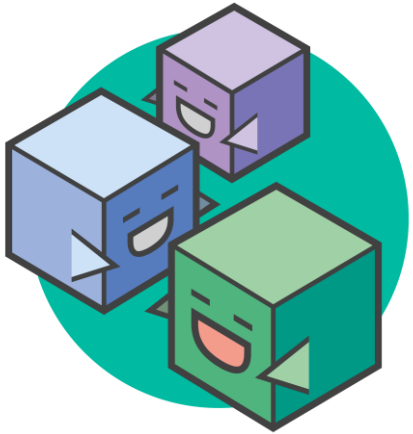
© 2017 IBM Corporation

Hyperledger Composer: Accelerating Time to Value



https://hyperledger.github.io/composer/

- A suite of high level application abstractions for business networks
- Emphasis on **business-centric vocabulary** for quick solution creation
- Reduce risk, and increase understanding and flexibility



- Features
  - Model your business networks, test and expose via APIs
  - Applications invoke transactions to interact with business network
  - Integrate existing systems of record
- Fully open and part of Linux Foundation Hyperledger
- Try it in your web browser now: http://composer-playground.mybluemix.net/

© 2017 IBM Corporation

Introducing the IBM Blockchain Platform

The only fully integrated enterprise-ready blockchain platform designed to accelerate the development, governance, and operation of a multi-institution business network

- Based on Hyperledger Fabric V1 runtime optimized for enterprise requirements
- Specialized compute for security, performance and resilience
- Delivered via the IBM Cloud on a global footprint with 24x7 Integrated Support
- Full lifecycle tooling to speed activation and management of your network

[http://ibm.biz/Platform_Demo]

© 2017 IBM Corporation

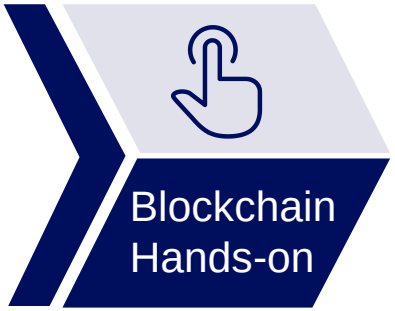
Making blockchain real for business with over 400 engagements and multiple active networks

Trade Finance	Pre and Post Trade	Complex Risk Coverage
Digital Trade Chain, MIZUHO, NATIXIS, TRAFIGURA	DTCC, CLS Fundamental to FX, Bolsa Comercio Santiago, JPX	AIG, Standard Chartered
Identity/ Know your customer (KYC)	**Unlisted Securities/ Private Equity Funds**	**Loyalty Program**
SECURE KEY, Crédit Mutuel ARKEA, DIACC	NORTHERN TRUST, BORSA ITALIANA, SBI GROUP SBI証券	UnionPay 银联
Medicated Health Data Exchange	**Fraud/ Compliance Registry**	**Distributed Energy/ Carbon Credit**
FDA	دبي الذكية SMART DUBAI	TenneT, Energy Blockchain Labs
Supply Chain	**Food Safety**	**Provenance/ Traceability**
MÆRSK, PSA The World's Port of Call	Walmart, Driscoll's Only the Finest Berries, Tyson, McLane, Dole, Kroger, Nestlé, Unilever, gsf golden state foods	everledger

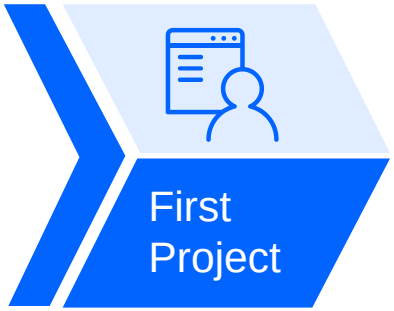
© 2017 IBM Corporation

IBM Engagement Model overview

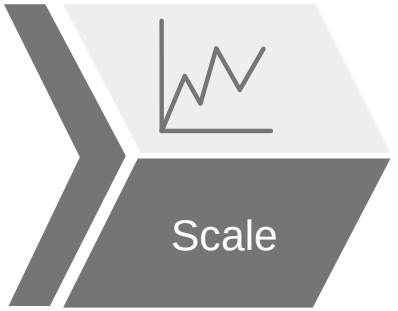
1. Discuss Blockchain technology
2. Explore customer business model
3. Show Blockchain Application demo



1. Understand Blockchain concepts & elements
2. Hands on with Blockchain on Bluemix
3. Standard demo customization



1. Design Thinking workshop to define business challenge
2. Agile iterations incrementally build project functionality
3. Enterprise integration

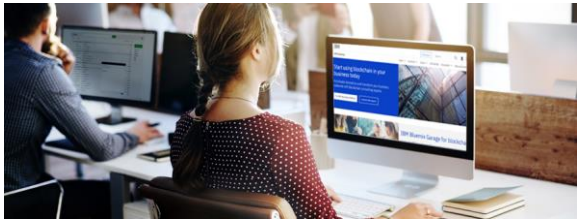


1. Scale up pilot or Scale out to new projects
2. Business Process Re-engineering
3. Systems Integration

Remote	Digital	Face to face	Face to face

© 2017 IBM Corporation

Getting started on your blockchain journey



[Learn More About IBM Blockchain]

[Schedule an IBM Blockchain Workshop]

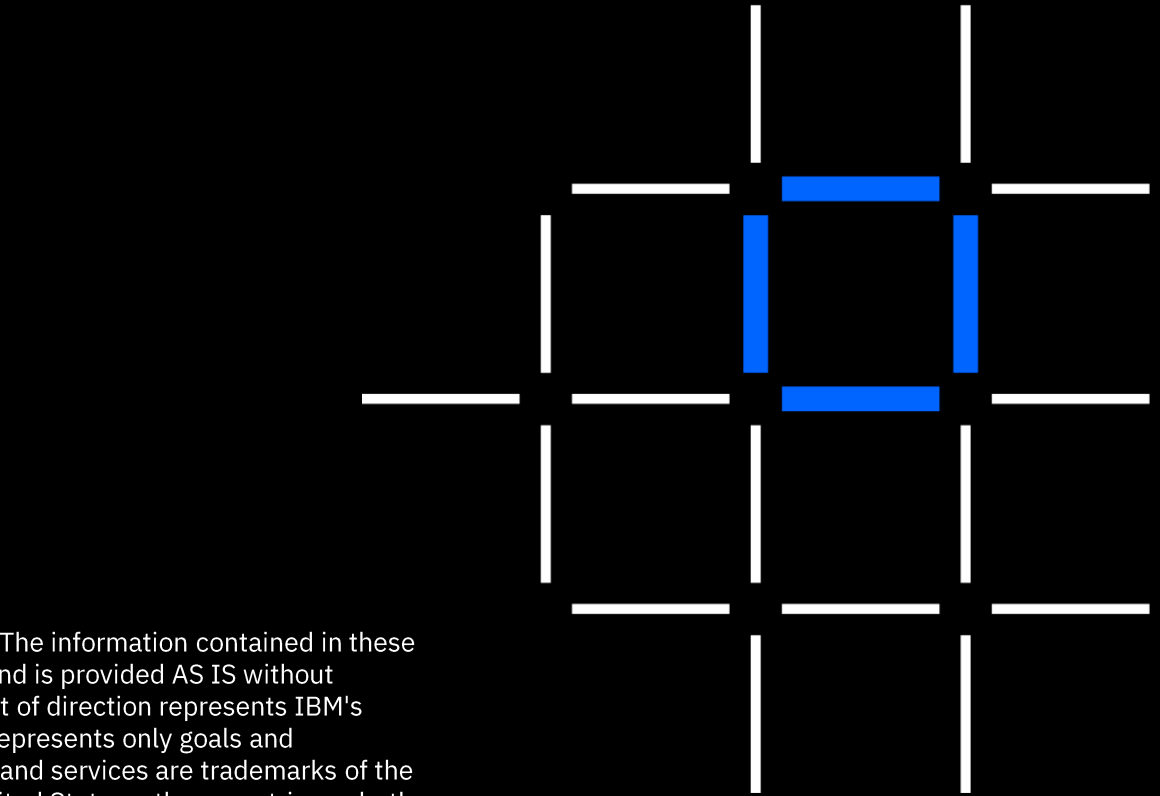
[Develop a Blockchain Application]

[Activate and Grow your Blockchain Network]

© 2017 IBM Corporation

Thank you

IBM **Blockchain**



www.ibm.com/blockchain

developer.ibm.com/blockchain

www.hyperledger.org

© Copyright IBM Corporation 2017. All rights reserved. The information contained in these materials is provided for informational purposes only, and is provided AS IS without warranty of any kind, express or implied. Any statement of direction represents IBM's current intent, is subject to change or withdrawal, and represents only goals and objectives. IBM, the IBM logo, and other IBM products and services are trademarks of the International Business Machines Corporation, in the United States, other countries or both. Other company, product, or service names may be trademarks or service marks of others.

IBM

IBM