Blockchain Explained

An Introduction to Blockchain for Business

Rachel Jackson
IBM Blockchain Development
Program Director

Blockchain education series

V5.0, 12th October 2017
© 2017 IBM Corporation
Contents

What is blockchain?

Why is it relevant for our business?

How can IBM help us apply blockchain?
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)
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

**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)
Introducing blockchain ...

A trusted, distributed ledger

Blockchain

with shared business processes
Problem …

… inefficient, expensive, vulnerable
A shared, replicated, permissioned ledger ... 

... with consensus, provenance, immutability and finality
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
Requirements of blockchain for business

Append-only distributed system of record shared across business network

Shared ledger

Business terms embedded in transaction database & executed with transactions

Smart contract

Ensuring appropriate visibility; transactions are secure, authenticated & verifiable

Privacy

Transactions are endorsed by relevant participants

Trust
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
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
Trust

• 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
Contents

- What is blockchain?
- Why is it relevant for our business?
- How can IBM help us apply blockchain?
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

<table>
<thead>
<tr>
<th>What</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Competitors/collaborators in a business network need to share reference data, e.g. bank routing codes</td>
<td>1. Consolidated, consistent dataset reduces errors</td>
</tr>
<tr>
<td>• Each member maintains their own codes, and forwards changes to a central authority for collection and distribution</td>
<td>2. Near real-time access to reference data</td>
</tr>
<tr>
<td>• An information subset can be owned by organizations</td>
<td>3. Naturally supports code editing and routing code transfers between participants</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Each participant maintains their own codes within a Blockchain network</td>
</tr>
<tr>
<td>• Blockchain creates single view of entire dataset</td>
</tr>
</tbody>
</table>
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
## Example: Audit and compliance

<table>
<thead>
<tr>
<th>What</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Financial data in a large organization dispersed throughout many divisions and geographies</td>
<td>1. Lowers cost of audit and regulatory compliance</td>
</tr>
<tr>
<td>• Audit and Compliance needs indelible record of all key transactions over reporting period</td>
<td>2. Provides “seek and find” access to auditors and regulators</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How</th>
<th>3. Changes nature of compliance from passive to active</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Blockchain collects transaction records from diverse set of financial systems</td>
<td></td>
</tr>
<tr>
<td>• Append-only and tamperproof qualities create high confidence financial audit trail</td>
<td></td>
</tr>
<tr>
<td>• Privacy features to ensure authorized user access</td>
<td></td>
</tr>
</tbody>
</table>
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
## Further examples by (selected) industry

<table>
<thead>
<tr>
<th>Financial</th>
<th>Public Sector</th>
<th>Retail</th>
<th>Insurance</th>
<th>Manufacturing</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Trade Finance</td>
<td>• Asset Registration</td>
<td>• Supply chain</td>
<td>• Claims processing</td>
<td>• Supply chain</td>
</tr>
<tr>
<td>• Cross currency payments</td>
<td>• Citizen Identity</td>
<td>• Loyalty programs</td>
<td>• Risk provenance</td>
<td>• Product parts</td>
</tr>
<tr>
<td>• Mortgages</td>
<td>• Medical records</td>
<td>• Information sharing (supplier – retailer)</td>
<td>• Asset usage history</td>
<td>• Maintenance tracking</td>
</tr>
<tr>
<td></td>
<td>• Medicine supply chain</td>
<td></td>
<td>• Claims file</td>
<td></td>
</tr>
</tbody>
</table>
Patterns for customer adoption

HIGH VALUE MARKET

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

ASSET EXCHANGE

- Sharing of assets (voting, dividend notification)
- Assets are information, not financial
- 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
Contents

What is blockchain?

Why is it relevant for our business?

How can IBM help us apply blockchain?
Bringing together the world’s most advanced expertise, technology and ecosystem to transform industries

**Experts**
Collaborate with comprehensive services teams from ideation all the way to production

**Solutions**
Solve critical industry challenges by building and joining new business networks

**Platform**
Develop, govern and operate enterprise blockchain networks with speed and security

**HYPERLEDGER**
As a founding and premier member of Hyperledger, we’re committed to open source, standards and governance
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

www.hyperledger.org
Hyperledger members

Premier
- Accenture
- Airbus
- American Express
- AIA
- Aesthetic Integration
- ADNARRO
- ADNB
- Apto
- Avanade
- BNP Paribas
- BNY Mellon
- Broadridge
- CME Group
- Cisco
- Deutsche Telekom
- Daimler
- Digital Asset
- DTCC
- Fujitsu
- Hitachi
- IBM
- Intel
- J.P. Morgan
- NEC
- r3
- SAP

General
- ANZ
- BBVA
- BNP Paribas
- BWS
- Block chain
- Bloomberg
- BNY Mellon
- Calastone
- Capgemini
- China CITIC
- Citibank
- Coinplug
- Coinbase
- Collector
- CLS
- Coinplug
- ConsenSys
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensus
- coinplug
- Consensus
- Consensu
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/
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/
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]
Making blockchain real for business with over 400 engagements and multiple active networks

<table>
<thead>
<tr>
<th>Trade Finance</th>
<th>Pre and Post Trade</th>
<th>Complex Risk Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital Trade Chain</td>
<td>DTCC</td>
<td>AIG</td>
</tr>
<tr>
<td>NATIXIS</td>
<td>CLS</td>
<td>Standard Chartered</td>
</tr>
<tr>
<td>TRAFIGURA</td>
<td>Bolsa Comercio Santiago</td>
<td></td>
</tr>
<tr>
<td>Mizuho</td>
<td>JPMorgan</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secure Key</td>
<td>DTCC</td>
<td>AIG</td>
</tr>
<tr>
<td>CRED</td>
<td>SEC</td>
<td>Standard Chartered</td>
</tr>
<tr>
<td>Travelequin</td>
<td>DTCC</td>
<td>AIG</td>
</tr>
<tr>
<td>DIAAC</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identity/ Know your customer (KYC)</td>
<td>Unlisted Securities/ Private Equity Funds</td>
<td>Loyalty Program</td>
</tr>
<tr>
<td>SEC</td>
<td>DTCC</td>
<td>AIG</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Standard Chartered</td>
</tr>
<tr>
<td>ARKEA</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medicated Health Data Exchange</td>
<td>Fraud/ Compliance Registry</td>
<td>Distributed Energy/ Carbon Credit</td>
</tr>
<tr>
<td>FDA</td>
<td>BSC</td>
<td>TENNET</td>
</tr>
<tr>
<td>Saudi Food and Drug Administration</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply Chain</td>
<td>Food Safety</td>
<td>Provenance/ Traceability</td>
</tr>
<tr>
<td>DGSE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walmart</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Driscoll’s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tyson</td>
<td></td>
<td></td>
</tr>
<tr>
<td>McLane</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSA</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

© 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
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
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.