Blockchain Explained

V4.05, 13 July 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 & 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

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

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
Smart contract

Business rules implied by the contract … embedded in the Blockchain and executed with the transaction

• Verifiable, signed
• Encoded in programming language
• Example:
  – Defines contractual conditions under which corporate Bond transfer occurs
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
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
Contents

What is Blockchain?

Why is it relevant for our business?

How can IBM help us apply Blockchain?
Blockchain benefits

**Saves time**
Transaction time from days to near instantaneous

**Removes cost**
Overheads and cost intermediaries

**Reduces risk**
Tampering, fraud & cyber crime

**Increases trust**
Through shared processes and recordkeeping
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
## 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
# 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?
How IBM can help

Technology

Hosting and Support

Making blockchain real for clients
Hyperledger: A Linux Foundation Project

– A collaborative effort created to advance cross-industry blockchain technologies for business
– Announced December 2015, now over 140 members
– Open source, open standards, open governance
– Five frameworks and three tools projects
– IBM is a premier member of Hyperledger
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 APIs transactions to interact with business network
  - Integrate existing systems of record using loopback/REST

- Fully open and part of Linux Foundation Hyperledger

- Try it in your web browser now: http://composer-playground.mybluemix.net/
### Selected References

<table>
<thead>
<tr>
<th>FX Netting</th>
<th>Settlements through digital currency</th>
<th>Identity management</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLS®</td>
<td>MIZUHO</td>
<td>Crédit Mutuel ARKEA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Food Safety</th>
<th>Private Equity</th>
<th>Channel Financing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walmart</td>
<td>NORTHERN TRUST</td>
<td>IBM Global Financing</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Low liquidity securities trading and settlement</th>
<th>Cross Border Supply Chain</th>
<th>Contract Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>JPX</td>
<td>IBM MAERSK</td>
<td>MUFG</td>
</tr>
</tbody>
</table>

© 2017 IBM Corporation
IBM Engagement model overview

Let’s Talk
1. Discuss Blockchain technology
2. Explore customer business model
3. Show Blockchain Application demo

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

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

Scale
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
Continuing your education journey...

**Explained**
- What is blockchain for business
- Why is it relevant
- What is IBM doing

**Solutions**
- Use cases, patterns and references
- How IBM can help

**Composed**
- What is Hyperledger Composer
- Assets, transactions & participants

**Architected**
- Learn key blockchain technical concepts
- Designing a solution

**Explored**
- Technical deep dive on Linux Foundation Hyperledger Fabric
- Covers V1 content

**Next Steps**
- How to proceed with a first project
- Design Thinking Workshop logistics
Thank you!

www.ibm.com/blockchain
developer.ibm.com/blockchain
www.hyperledger.org
Further Information – Use case Links