Blockchain: Securing a New Healthcare Interoperability Experience

ONC & NIST
Use of Blockchain for Healthcare Workshop

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Introductions

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Blockchain Overview
What is a blockchain?

Open Access – share same data

Consensus – record of transactions with systematic validation

Distributed Network – decentralized transaction ledger database

Secure – cryptographically secure

Some promising use cases for blockchain:

• Payments
• Clearing & Settlement
• Trade Finance
• Peer to Peer Networks (insurance, energy)

• Health Records – Secured & Trusted
• Linking Identities
• Recording Patient Consent
• Health Revenue Cycle
## Blockchain Overview

### What are core principles of blockchain technology?

<table>
<thead>
<tr>
<th>Key Attributes</th>
<th>Open Access</th>
<th>Distributed Network</th>
<th>Consensus</th>
<th>Secure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All participants share access to the same data.</td>
<td>Ledger database that is shared by all parties in a defined, distributed network.</td>
<td>Record of consensus that stores every transaction that occurs via systemic validation.</td>
<td>Data can't be tampered with, lost, or changed. Only the right people can access the right data.</td>
</tr>
<tr>
<td></td>
<td>Transparent</td>
<td>Database Consistency Unique (No Duplication) No Single Point of Failure Redundant (Single Truth)</td>
<td>High Quality Validation Immutable Tamper-Evident</td>
<td>Controlled Confidentiality Authentication Encryption</td>
</tr>
<tr>
<td></td>
<td>Ease of Access</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Value Proposition

<table>
<thead>
<tr>
<th></th>
<th>Borderless</th>
<th>Open P2P Network</th>
<th>Eliminates Reconciliation</th>
<th>Providence</th>
<th>Data Reliability</th>
<th>Trust</th>
</tr>
</thead>
</table>

### Challenge

<table>
<thead>
<tr>
<th></th>
<th>Pseudonyms</th>
<th>Regulators</th>
<th>Throughput</th>
<th>Scale</th>
<th>Common Standards</th>
<th>Resource Intensive</th>
<th>Infrastructure Investments</th>
<th>Privacy</th>
</tr>
</thead>
</table>
Blockchain Overview

What types of blockchain infrastructures are being implemented?

Semi- and fully-private Block Chains address concerns in privacy and permission management

Public blockchain:
- Permission less – anyone can use it
- “Proof” consensus – “Proof of Work” for Bitcoin
- Public nodes
- Cryptocurrency token
- Open wallet access/internet

Semi-private & private blockchain:
- Permissioned – defined group can participate
- Custom consensus engine – rules set by participators
- Private nodes – closed group
- Optional token
- Closed wallet access/VPN

Source: Accenture research
Blockchain Overview

Case Study: Bank to Bank Money Movement

Moving Money Today:
Clearing and settlement through one or more correspondent banks is slow, expensive and introduces counterparty risk.

Moving Money Tomorrow:
Direct clearing and settlement that reduces costs, delays and transaction risks.

Limited visibility, fees and FX spread
- Payment notification in minutes; settlement overnight; batch processing
- Intermediary charges processing fees; limited FX providers
- Counterparty risk due to intermediaries and long processing time
- Bank reserves provides liquidity; capital is tied up nostro accounts

Full visibility into transaction status, fees and FX spread
- Payment notification and settlement in seconds; processing 24/7/265
- No intermediary to charge processing fees; competitive FX rates
- Counterparty risk eliminated by straight through, instant processing
- Option of liquidity provider to fund transaction and reduce bank capital

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Healthcare Applications
What are important applications of blockchain relevant to ONC’s mission?

ONC Interoperability Roadmap Building Blocks

Core Technical Standards and Functions
Certification to support adoption and optimization of health IT products
Privacy and security protections for health information
A supportive business, clinical, cultural and regulatory environment
Rules of engagement and governance of the exchange of health information

Three most important applications of blockchain technologies relevant to the mission of the ONC:

Creating Secure & Trusted Records
Linking Identities
Recording Patient Consent
**Healthcare Applications**

**What is the current state of healthcare data exchange?**

Data is spread in silos across multiple healthcare stakeholders for the purposes of executing a process which is often prone to discrepancies, expensive reconciliation and storage costs.

**Current State**

- Redundant data stores
- Lack of trust/data integrity results in expensive data reconciliation at each step of the process
- Incomplete end-to-end view of health information exchanges, patient, and services; as required by regulators
- Opportunities for data breach
- Inconsistent data storage and use across parties

*Illustrative*
Healthcare Applications

What are example costs associated with the current state?

US National Health Care Expenditures, By Year as % of GDP

Healthcare Applications

What are example costs associated with the current state?

Number of healthcare data breaches impacting more than 500 individuals increased more than 40% over the past 5 years.

Sources: Accenture analysis based on data from the HHS Office for Civil Rights breach portal. Data accurate as of July 2015.
Healthcare Applications

What is a potential target state enabled by blockchain technology?

A centralized view of the data across all parties would allow for access to relevant data, guarantee data integrity and significantly reduce reconciliation costs – permissioned blockchain on existing Health IT Investments

**Target State**
- Central store or “golden state” of data
- Guarantee data quality and availability
- Improved security (e.g., data-level encryption)
- Entitlement-based access
- Consistent data storage and use
- End-to-end view
- Auditability
Healthcare Applications

Summary of the three applications of blockchain relevant to ONC’s mission

- **Data:** No Personal Health Information is stored on blockchain
- **Authentication:** Cryptographic keys used to authenticate a user
- **Authorization:** Governance rules predefine access & control permissions to ensure appropriate mix of privacy vs transparency

**Creating Secure & Trusted Records**

- **Distributed:** Complete record integrity and transparency
- **Nonrepudiation:** Ensures party cannot deny the authenticity of their signature on a document or sending of a message that they originated
- **Verification:** A number of other entities inside and outside of healthcare could provide, support and attest to identity claims

**Linking Identities**

- **Trust:** Patient consent statements captured in the immutable blockchain allowing health professionals and others to trust the consent
- **Empowerment:** Patients are empowered to add consents at any point in their care with confidence they will be secured
- **Directives:** Healthcare professionals can act upon consent statements with the assurance they are adhering to patient wishes

**Recording Patient Consent**
# Healthcare Applications

What are other potential applications of blockchain technology in healthcare?

<table>
<thead>
<tr>
<th>Patient profiling for population health</th>
<th>Improved audit logging</th>
<th>Patient data as a service</th>
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<tbody>
<tr>
<td>Improve health IT application development</td>
<td>New access points for healthcare data</td>
<td>Connecting traditional databases in a blockchain environment</td>
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</table>
Healthcare Applications

What are potential barriers to blockchain implementation in healthcare?

There are implementation barriers that must be overcome for blockchain technology to gain a legitimate place in the healthcare industry.

<table>
<thead>
<tr>
<th>Barriers</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>Regulatory</td>
<td>Redefining legal and regulatory frameworks to govern use of this new socio-political paradigm</td>
</tr>
<tr>
<td>Scalability</td>
<td>Finding solutions that can handle the required volume</td>
</tr>
<tr>
<td>Verification Speed</td>
<td>Determining optimal verification process to avoid latency over time as the data on the blockchain grows</td>
</tr>
<tr>
<td>Security Breaches</td>
<td>While blockchain protocol is stable and secure, supporting infrastructures have suffered from security breaches</td>
</tr>
<tr>
<td>Immutability</td>
<td>Governance models and solutions must exist for situations when users need to remove data from the blockchain, for privacy or legal reasons</td>
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Suggested Actions
What are suggested actions for ONC related to blockchain in healthcare?

ONC should support, track and highlight demonstration projects for the application of blockchain platforms to encourage private sector innovation and inform future policy.

1. Environmental Scans and industry outreach
2. ONC Blockchain White Paper
3. Blockchain Workshops
4. Federal Advisory Committees
5. Blockchain Demonstrations
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