Insight Driven Health

Blockchain
Securing a New Health Interoperability Experience

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Introductions

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Executive Summary: Blockchain & ONC’s Interoperability Roadmap

Blockchain’s Important Application to Enable ONC’s Mission:

- Creating secured and trusted care records
- Linking Identities
- Recording Patient Consent

To effectively explore Blockchain technology, ONC will need to:

- Understand Blockchain Technology
- Build Team of Skilled Resources Knowledgeable in Blockchain
- Connect with Private Sector and Academia
Blockchain Overview

What is Blockchain?

- **Open Access** – share same data
- **Distributed Network** - Decentralized transaction ledger database
- **Consensus/Autonomous validation**
- **Secure** - Cryptographically secure

Applicability and Usage Growing

Some of the most promising use cases for blockchain:

- Payments
- Clearing & settlement
- Trade finance
- Peer to peer networks (payments, insurance, energy)
- Health records – secured & trusted
- Linking Identities
- Recording patient consent
### Core Blockchain Principles

<table>
<thead>
<tr>
<th>Key Attributes</th>
<th>Open Access</th>
<th>Distributed Network</th>
<th>Consensus</th>
<th>Secure</th>
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</thead>
<tbody>
<tr>
<td>Transparent</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>Ease of Access</td>
<td>No Single Point of Failure</td>
<td>Unique (No Duplication)</td>
<td>High Quality Validation</td>
<td>Controlled Confidentiality</td>
</tr>
<tr>
<td></td>
<td>Redundant (Single Truth)</td>
<td>Immutable</td>
<td>Tamper-Evident</td>
<td>Authentication</td>
</tr>
<tr>
<td></td>
<td>Database Consistency</td>
<td>Consensus</td>
<td>Immutable</td>
<td>Encryption</td>
</tr>
<tr>
<td></td>
<td>Consensus</td>
<td>Consensus</td>
<td>High Quality Validation</td>
<td>Immutable</td>
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#### Value Proposition
- **Borderless**
- **Open P2P Network**
- **Eliminates Reconciliation**
- **Providence**
- **Data Reliability**
- **Trust**

#### Challenge
- **Pseudonyms**
- **Regulators**
- **Throughput**
- **Scale**
- **Common Standards**
- **Resource Intensive**
- **Infrastructure Investments**
- **Privacy**
Blockchains can be public or private
Permissioned vs Permission-less

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

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

**Semi-private & private block chain:**
- 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
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

- Payment notification and settlement in seconds; processing 24/7/365
- 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

Limited visibility, fees and FX spread

Full visibility into transaction status, fees and FX spread

- 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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Blockchain can Enable ONC’s Interoperability Roadmap

- Core technical standards and functions
- Certification to support the adoption and optimization of health IT products and services
- Privacy and security protections for health information
- Supportive business, clinical, cultural and regulatory environment
- Rules of engagement and governance of the exchange of health information
Three Important Applications for ONC’s Interoperability Roadmap

Creating secured and trusted care records
- Secure healthcare records created by healthcare professionals and patients
- Preserves provenance and integrity of the records while also allowing for anonymity

Linking Identities
- Single trusted source of identity data
- Strong identity proofing
- Preserves immutable record of identities of patients and healthcare professionals

Recording Patient Consent
- Record consent decisions and patient directives within secured healthcare record
- Empowers patients

Blockchain technology can advance ONC’s Interoperability Roadmap

Privacy

Security

Risk Management

- Enable Quadruple Aim
  - Root causes of waste in healthcare spending
  - Support an Interoperable Learning Health System
Current State: Decentralized data system

Data that is spread across multiple parties for the purposes of executing a process 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 transaction, customer, and product; as required by regulators
- Opportunities for data breach
- Inconsistent data storage and use across parties
Target State: Mutualized view of the data enabled via blockchain

A centralized view of the data across all parties would allow for access to relevant data, guarantee data integrity and significantly reduce reconciliation costs

- 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

Illustrative
Application: Creating Secure and Trusted Records

Permissioned blockchain that integrates with current health IT investments could be used to create secured and trusted care records.

In this model, risks related to sensitive data leaks are reduced:

- **Data**
  - No Personal Health Information is stored on blockchain

- **Authentication**
  - Cryptographic keys used to authenticate a user

- **Authorization**
  - Governance rules predefine access and control permissions to ensure appropriate mix of privacy vs transparency
Application: Linking Identities

Integrated nature of blockchain means the technology inherently links disparate identities authenticated at the point of care for both patients and healthcare professionals.

In this model, benefits of a Blockchain identity include:

- **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
Application: Recording Patient Consent

Patient consent statements may be captured in an immutable blockchain allowing healthcare professionals and others involved in the care cycle to trust the statements and act upon them accordingly.

In this model, benefits of a Blockchain identity include:

- **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
### Other Potential Blockchain Uses in the Healthcare Ecosystem

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<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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### Blockchain Faces Barriers to Implementation

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

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<th>Description</th>
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<tr>
<td>Regulatory</td>
<td>Redefining legal and regulatory frameworks to govern use of this new socio-political paradigm</td>
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<tr>
<td>Scalability</td>
<td>Finding solutions that can handle the required volume</td>
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<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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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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