Blockchain and Healthcare Privacy Laws Just Don’t Mix

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What We Will Cover Today

- History
- Bitcoin – The First Use of Blockchain Tech
- Key Characteristics of Blockchain
- Smart Contracts
- Real-World Applications / Legal Considerations
- Health Care Use Cases / Regulatory Challenges
History
In 1959, **Paul Baran**, researcher at RAND, took on the task of designing a survivable “command and control network.”

- *network of unmanned nodes*
- *routing information from one node to another to their final destinations*
- *using scheme called "hot-potato routing" or distributed communications*
Challenges Today

The Internet optimized existing processes...
Challenges Today - Centralization

history
Revolution of Business

The **Internet** optimized existing processes...

The **Blockchain** ... presents a new medium for assets eliminates processes provides a new paradigm for shared facts
Today and The Future of Data

The Internet optimized existing processes...

Distributed Ledger Technology...

.....a new “database” and information sharing paradigm
Bitcoin - First Use of Blockchain Tech
Introduced October 2009

Bitcoin: A Peer-to-Peer Electronic Cash System

Satoshi Nakamoto
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Abstract. A purely peer-to-peer version of electronic cash would allow online payments to be sent directly from one party to another without going through a financial institution. Digital signatures provide part of the solution, but the main benefits are lost if a trusted third party is still required to prevent double-spending. We propose a solution to the double-spending problem using a peer-to-peer network. The network timestamps transactions by hashing them into an ongoing chain of hash-based proof-of-work, forming a record that cannot be changed without redoing the proof-of-work. The longest chain not only serves as proof of the sequence of events witnessed, but proof that it came from the largest pool of CPU power. As long as a majority of CPU power is controlled by nodes that are not cooperating to attack the network, they'll generate the longest chain and outpace attackers. The attack the network itself requires minimal structure. Messages are broadcast on a best effort basis, and nodes can leave and rejoin the network at will, accepting the longest proof-of-work chain as proof of what happened while they were gone.
New Digital Asset

Peer to Peer version of electronic cash transfer

Relies on **cryptographic** proof rather than trust

No central banking authority

**Nodes** agree/verify the history of the chain

Solves the double-spend problem

Winners of computational race earn Bitcoin

$6.9b market cap / 6500+ nodes
Block Creation

Blockchains control information and avoid duplication.

How Blockchain Transactions Work

Blockchains solve two major challenges for digital transactions, controlling the information and avoiding duplication, at once.

There are four major pieces of information in a block:

1. An ID referred to as a “hash” or consensus identifier. In the example below, it’s called “proof of work.” This is a random set of encrypted numbers.

2. The hash number from the previous block, which sets the chronological order in the ledger.

3. Transactions that are included in the block. Can be one, but can also be thousands of transactions.

4. Public key (identities) for the sender and receiver to identify the transfer of information.

An example of a blockchain’s structure

Source: Autonomous Research
Blockchain Defined

key characteristics and ecosystem

a database (aka ledger)...
that is publicly distributed...
where data is stored by consensus
and can't be changed
secure by modern cryptography
more than encryption
"computational hardness"
New Blockchain Platforms

key characteristics and ecosystem

- Decentralized
- Distributed
- Immutable
- Permissionless
- Cryptography
- Trustless
- Public
- Consensus Protocol
- Private
- Permissionless
- Permissioned
- Network Effect
- Consortium blockchains
- Fully private blockchains
Emerging Economies and Use Cases

- New DLT Ecosystem
- Tokenization “cryptocurrency” “digital assets”
- smart contracts

transparency solves shared facts problem
Smart Contracts
Smart contracts enable execution based on conditions (same blockchain building blocks)
smart contracts

Coined by Nick Szabo, a computer scientist in *Smart Contracts: Building Blocks for Digital Markets* (1996)

self-executing
self-authenticating
immutable
reduces human factor
breach is expensive
Legal Agreements?

smart contracts

Allow for logic or rules to be coded on top of the blockchain
How should lawyers think about DLT?

Application of law to DLT

and

DLT changing the practice of law
Opportunities and Challenges

Skeptics / Recent Hacks

Privacy / New Shared Economy

Open Source / Intellectual Property

Regulatory

Idealological Motives

Interoperability / Fragmentation

Scalability

Technology-Driven v Solutions-Driven
Real-World Applications
Real-World Applications

- Identity
- Provenance / Supply Chain
- Finance / Trade Settlement
- Corporate Governance
- Prediction Markets
- Energy
- Healthcare / Clinical Trials / Provenance
Platforms and Services

real-world applications

Microsoft Azure

HYPERLEDGER

ethereum
Platforms - Smart Contracts

new DLT economy/ecosystems

Ethereum is a decentralized platform that runs smart contracts: applications that run exactly as programmed without any possibility of downtime, censorship, fraud or third party interference.
Corporate Governance

real-world applications

**BoardRoom** provides a complete governance platform that empowers organizations with the power of the blockchain.
**BlockNotary** is a software which allows a business to offer clients an efficient and quick way to prove his identity in order for a business to take further actions.
Supply Chain Management
real-world applications

Provenance is a real-time data platform that empowers brands to take steps toward greater transparency by tracing the origins and histories of products.
Factom is an irreversible publishing engine (write once, never erase), removing the need for blind trust by providing precise, verifiable, and immutable audit trail.
By leveraging its blockchain-based technology stack, Filament helps companies better manage physical mining operations or water flows over agricultural fields without relying on centralized cloud alternatives or pen-and-paper methods that result in human inefficiencies.
Ujo is a new shared infrastructure for the creative industries that allows creators and their customers to achieve greater levels of transparency, fairness and profitability.
Finance

real-world applications

NASDAQ Linq – first use of blockchain ledger technology to complete and record a private securities transaction for Chain.com.

Overstock.com issues public shares of its stock on its tØ blockchain platform - traded, settled and recorded “entirely on a decentralized ledger.”
Corporate Governance and Issuance

real-world applications
Based on the open source, cryptographically secure decentralized application platform of Ethereum, TransActive Grid’s business logic layer delivers real-time metering of local energy generation and usage and other related data.
HealthCare and Regulatory
“Triple Aim” of Modern Healthcare

Increased quality

Lower costs

More effective care

Can blockchain be a potential solution?
Appropriate Applications of Blockchain Technology

- Is there a need for the secured distribution of data?  
  - yes: Blockchain may not be appropriate
  - no: Are numerous parties involved?  
    - no: Blockchain may be useful
    - yes: Is there a need for a trusted intermediary?  
      - no: Should the system be self-executing or automated?  
        - no: Is a decentralized system desirable?  
          - yes: Numerous parties?  
            - Trusted access needed?  
              - yes: Immutable data desirable?

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Setting the Stage: Inoperability Problem

- Patients are more mobile; care is more specialized
- Incomplete and fragmented data:
  - Records at each provider
  - Wearable devices
  - Mobile medical apps
- Lack of interoperability costs 150,000 lives and $18.6 billion per year
A Vision for Health Care Blockchain

MOVEMENT OF INFORMATION

1. Health information needs to be distributed.
2. Bits of information represented as blocks.
3. The information in the blocks is sent to all nodes on the network.
4. The nodes run algorithms to verify the accuracy of the information.
5. Once verified, the information is added to a blockchain ledger, immutable and unable to be deleted.
6. The data is stored and accessible to all devices on the network.
Potential Blockchain Applications

Medical records

Data integration with real-time medical devices

Track clinical trial information

Aggregate data on pharmaceutical drugs & prescriptions

Analyze large pools of de-identified data for research

Recordkeeping for physician licenses

Monitor public health trends and epidemics
Medical Records – Distribution and Access

1. Health providers collect and input data from their patients

As hospitals and other providers treat patients, they store data in already existing frameworks and that data is then directed into the blockchain database for verification.

2. Health information is verified and stored on the blockchain database

The blockchain database’s nodes analyze and verify the data and confirm its addition to the database.

3. A patient’s other health care providers and clinical researchers can be granted access

Patients provide access to these parties via a “key.” With access to this data, better treatment and more fruitful research can result.

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Blockchain Pros

- Provides a uniform, consistent structure for data management, helping solve a critical inoperability program for the industry
- Health care is efficiently and securely distributed to a patient’s providers, allowing for more seamless and effective care and decreased transaction cost
- Data is stored more securely, and parties can have confidence in data integrity
- Researchers could benefit from access to anonymized data
- Government entities could use the data to more effectively track public health trends in real time
Blockchain Cons

- Immediate access to expansive data, such as entire medical records, might be impossible under the current structure.
- Computing demands can be great.
- Payment issues—“miners” may not have as much incentive as in other blockchain applications.
- The immutable nature of the data on the blockchain database may not be HIPAA-compliant.
- No oversight of data governance.
Implementation Challenges

- Large amounts of data could slow transaction speeds
- Great demands on computer systems and networks
- Payment and incentive problem for “miners”
- Data analytics on the chain
- Privacy challenges may remain
As currently configured, blockchain technologies may not be HIPAA compliant:
- Immutability of data vs allowing patient amendments
- Stored data not necessarily private- miners allowed
- Test for de-identification
- Business associate agreements

Lack of government enforceability and governmental rules
Proposed Legislative Approaches

Notable State Legislative Efforts

**Arizona**: 2017 law regarding “electronic signatures” obtained via blockchain

**Nevada**: Same as Arizona; also prohibits state taxes, fees, or license requirements on blockchain

**Delaware**: Blockchain may be used to maintain corporate records

**Five other states** have floated bills calling for studies and evaluation task forces

▶ Modest federal legislative and regulatory efforts
  - Several hearings, but no legislation or guidance passed
  - Two bills dead in committee

▶ “Hands-off” approach by Congress invites states to experiment
Current Use Cases

- Medical Records
- Payment Exchange
- Research
- Licensure
Current Health Care Use Cases

- The **MIT Media Lab**’s project, **MedRec**, is aiming to tackle medical records with blockchain.

- **Change Healthcare** has launched a blockchain network allowing hospitals, physicians and payers to track the real-time status of claims and remittances to help with revenue cycle management.

- Startup **SimplyVital** health has developed a health care cryptocurrency token.
The Illinois Blockchain Initiative, a consortium of Illinois state and county agencies, is developing a blockchain program to track medical licenses and credentials.

The U.S. FDA and IBM Watson have teamed to explore research opportunities.

The U.S. CDC and the Department of Health and Human Services have solicited white papers and launched investigatory initiatives.
In summary

- The technology is advancing ahead of regulations and legislation
- Patient centric focus is essential
- Important to analyze where blockchain can be most effective in workflow
- The success of small projects in healthcare will dictate greater adoption
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