How Blockchain Can Impact Healthcare

March 2018

By: James G. Gatto

Blockchain technology is finding its way into every industry. Healthcare is no exception. According to a recent report by Deloitte, "blockchain technology has the potential to transform health care, placing the patient at the center of the health care ecosystem and increasing the security, privacy, and interoperability of health data." Some of the proposed applications include truly patient-centric health records, provider licensure and credentialing, supply chain management in conjunction with predictive analytics and more accurate tracking capabilities, among many others.

What is blockchain technology?

Many types of blockchains exist, including public and private blockchains. At its core, a blockchain is a distributed ledger for recording transaction data. A ledger is merely a list of transactions. Traditional paper-based ledgers include consecutive pages where each line records a transaction and when the page is full, the process repeats on the next page. With many blockchains, each block is like a page. Transactions get verified and written into a block and when the block is full a new block is created. Unlike traditional ledgers, when a block is filled, the system creates a hash value, which is just a random number generated by an algorithm based on the contents of the block. This hash value is then written as the first entry in the new block, thereby "chaining" together the blocks, hence the term "blockchain." If someone ever attempts to change an entry in a prior block, the hash value would no longer match what was written into the new block and that attempt would be deemed invalid. In part, this is how blockchain creates unalterable records.

With public blockchains, the ledger is copied to and stored on multiple nodes (computers) across a network resulting in a distributed system where the data is stored in many locations. The system is decentralized because the system itself enforces rules that prevent a single entity from controlling the verification and storage of transaction data. With public blockchains, anyone can run a node or view the transaction data. With private blockchains, only users with permission can view the transaction data.

An important feature of blockchain technology is smart contracts. A smart contract (which is not necessarily a full legal contract) is self-executing computer code, stored on the blockchain, and receives data from a number of sources, causing actions to be triggered upon the occurrence of certain conditions programmed into the smart contract code. The Chamber of Digital Commerce published an insightful white paper on smart contracts.

Application of Blockchain to Healthcare

- **Health Records** – Blockchain technology has the potential to transform many aspects of healthcare, including health data. Current record-keeping systems are siloed in many different places, under the control of disparate entities. This means that records of patient consent and medical history can be incomplete, conflicting or ambiguous. Blockchain-stored records can provide complete health records for individuals, and give patients more control over their own information. Any consents given can be stored to the blockchain as well. Among other things, blockchain can enable 1) the creation of secure validated health record data; 2) anonymous linking of identities with other transactional data; and 3) recordation of patient consent. All of this can be done without a central gatekeeper. Some solutions may leverage a hybrid public-private blockchain solution where personal information is stored on a private blockchain and only those to whom the patient grants consent can access that data. The private blockchain can interact with a public blockchain, *e.g.*, using only anonymized data from the private blockchain to leverage other functionality.

- **Clinical Trial Management** – Similarly, blockchain technology can be used for clinical trial management. Blockchain tools can automatically aggregate clinical data and distribute it to various researchers and practitioners. Due to the immutability of the blockchain records, the auditability and validation of data can be simplified.

- **Provider Credentialing** – Provider credentialing is another task for which blockchain is well-suited as is health plan provider directories. These concepts are not theoretical. Just recently, Humana, MultiPlan, Optum, Quest Diagnostics and UnitedHealthcare announced a pilot program that will apply blockchain technology to improve data quality and reduce administrative costs around provider data management.

Smart Contracts

Smart contracts will increase efficiency in many industries, including healthcare. Smart contracts remove middlemen who add little value and automate tasks to increase efficiency and reduce costs. One example of how this applies to healthcare is payments and claims transparency. As a simple example, a smart contract can be used to record a transaction each time a patient receives care, trigger a reimbursement claim and cause automated payments to occur if certain conditions are met. In a more complex scenario, interactions between many stakeholders (patient, doctor, insurer, pharmacy, labs, etc.) can be subject to a smart contract. Smart contracts can also be used to automate supply chains and facilitate the tracking and tracing of products such as pharmaceuticals.

Legal Issues

The use of blockchain and smart contracts will create some interesting legal issues. Due to HIPPA, the storage of protected patient info on a public blockchain will be challenging. Storing such data on a private blockchain or "off-chain" with a system that communicates with a public blockchain may offer one solution. Structuring the interoperability and associated agreements will be key to keeping this legal.

Structuring smart contracts in a way to ensure enforceability will also be important. The term itself is a misnomer as they are not necessarily contracts. Rather, they are the code that implements the operational/ business logic of a contract. Often, there will be a separate legal agreement between the parties. This is similar to online services such as auto bill pay, where a user enters into a terms of service and the code actually implements the transaction.

Also, smart contracts are self-enforcing in that they implement in code actions to happen upon the default by a party. But what if the result is not what the parties intended? Often smart contracts are dependent on one or more data sources (often referred to as oracles). The parties may wish to contractually deal with scenarios where the data is bad or the smart contract code does not actually execute what the parties intended. International law and jurisdictional issues also may come into play. Many other issues will arise with smart contracts. A number of projects are underway to develop smart contract templates to address these and other issues.

- **Patents** – As with any new technology or new application of existing technology, patents will play a role. There has been a surge in patent filings for blockchain-related technology. For an overview on patentable aspects of blockchain technology please see our recent papers on Patent Strategies for Cryptocurrencies and Blockchain Technology and Drafting Effective Blockchain Patents.

These are just a few of the legal issues that will arise as blockchain applications are rolled out in the healthcare industry. As with many new technologies, particularly as applied to regulated industries, new legal issues are sure to arise.

For further details on blockchain and digital currency, please contact:

James G. Gatto
Team Leader, Blockchain
202.747.1945
jgatto@sheppardmullin.com

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