BLOCKCHAIN APPLICATION NOTE #2

Healthcare
Intel Health and Life Sciences

Blockchains for Physician Credentialing

Second of Intel's non-technical outlines of blockchain uses.

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Blockchain technologies have the potential to ameliorate one of the great annoyances of modern medical practice: credentialing.

This relatively simple use for blockchains can be explained by reviewing just a few concepts—done here at a non-technical level.

What is Credentialing?

Every hospital uses a "credentialing" process to ensure that each of its affiliated physicians (and other clinicians[1]) are competent and worthy of the trust that patients put in them.[2] In a sense, credentialing is the hospital's way of performing "due diligence" on a physician.

A physician who wishes to become affiliated with a hospital will begin the process by first gathering copies of all of his or her professional credentials including, for example:

- Medical school diploma
- Certificates of any residencies and fellowships the physician completed
- Copies of any specialty medical boards that have certified the physician
- All state medical licenses held by the physician
- Evaluations from peers
- Proof that the physician is current on continuing medical education requirements
- Letters from hospitals with which the physician was previously affiliated, explaining the circumstances under which the affiliation ended
- Details of any malpractice actions against the physician

Furthermore, written verification may be required for some or all of these documents. For example, in the case of the medical school diploma, many hospitals additionally require a signed letter from the dean of the medical school attesting that the diploma is genuine.

Step 2 of the credentialing process begins after the physician has submitted the required documentation to the hospital's credentials office. Credentialing is sufficiently frequent, and sufficiently involved, that almost every hospital has a dedicated office of full-time credentialing personnel.

The hospital's credentialing office checks the physician's documentation for completeness. This is an exacting task. Almost inevitably, they will find shortfalls, and will ask the physician to supply what's missing. In many cases, the hospital's credentialing office will themselves verify some or all of the physician's submitted documentation, e.g., telephoning the physician's medical school to confirm that the physician did indeed graduate from there.

It is not uncommon for weeks or months to elapse as the physician and credentials office work to satisfy all of the hospital's credentialing requirements.[3] These requirements may vary from hospital to hospital.

Only after the credentialing office deems the physician's credentialing package to be complete will the final step occur.

The hospital's credentialing committee, typically composed of both physicians and administrators, sits in judgment of the physician and decides whether or not to allow the physician to begin practicing in affiliation with the hospital.

How Can Blockchain Help?

As discussed in Intel's Blockchain Application Note 1 (March 2017), a blockchain is an on-line distributed ledger that tries to guarantee that no ledger item can be changed or deleted without detection. (See figure 1) Although no guarantee is foolproof or eternal, confidence in blockchain technology is generally high and widespread, given its years of stable function as the underpinning of alternative currencies such as Bitcoin.

Blockchains are well-suited to credentialing. Every piece of documentation supplied by the physician, and every verification action performed by the hospital credentialing office, can be viewed as transactions to be entered into a permanent ledger.

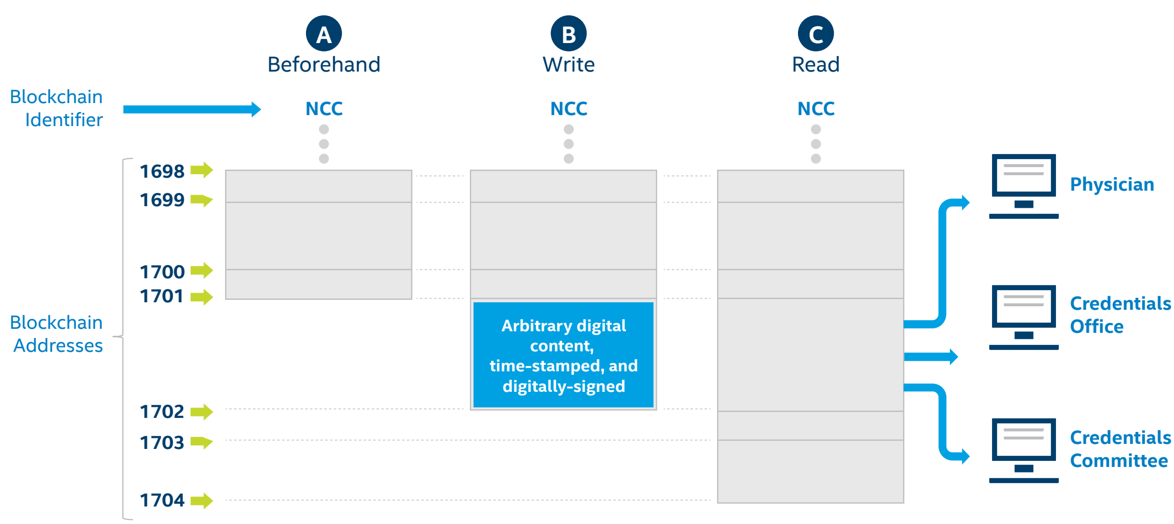

Figure 1. Schematic representation of a blockchain at three points in time. (A) A blockchain arbitrarily named "NCC" has 1700 blocks at this point in time, of which only the last three are shown. (B) A new block has been written to the NCC blockchain at location 1701; the contents of the new block have been digitally signed by two parties, which can be used to verify the origin of the contents. (C) The NCC 1701 block can now be read by any enabled parties, including the physician, the hospital credentials office, and the hospital credentials committee.

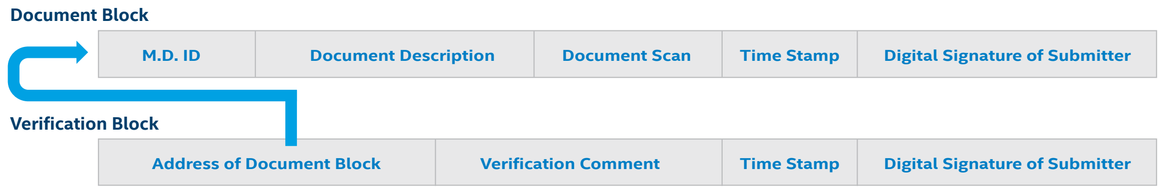

Figure 2. A credentialing blockchain could be built on two types of blocks. Top: the first type of block would result when a party uploaded a source document to the blockchain. This "document" block would contain several fields, including an identification code for the physician, a description of the document, a scan of the document, the time at which the document was uploaded (and the block created), and the digital signature of the person who performed the upload. **Bottom:** the second type of block would be created when a person verified a source document. It would refer to the documentation block via the blockchain address of the documentation block. It would also contain a comment such as "Verification confirmed" or "Verification denied," a well as a time stamp and a signature for whoever performed the verification.

Figure 2 shows how, in its simplest form, a credentialing blockchain would consist of just two types of blocks: one for documents, and one for verifications that refer to the documents. Figure 3 gives a more concrete strawman example.

The immutability of blockchain contents is particularly appealing for a credentialing application. It means that once a scanned document or a text file is uploaded, it cannot be changed. It further means that any verification of one of these immutable document blocks can be considered valid indefinitely. Therefore, once a certain number of verifications have been stored for a document, further verifications would be redundant and perhaps pointless.[4]

Skipping redundant verifications could significantly reduce the workload of hospital credentialing offices. However, an even greater benefit would accrue if medical schools, hospital residencies, training fellowships, specialty board examinations, state licensing departments, continuing education providers, peer reviewers, and others put their issued certifications into a blockchain themselves. This would provide substantial and immediate assurance to hospitals that these components of a physician's professional credentials were inarguably genuine, perhaps eliminating the need to verify these documents at all.

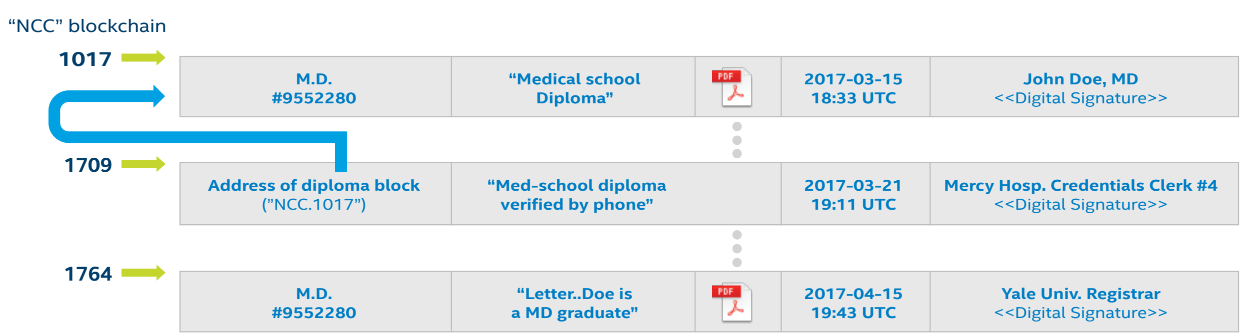

Figure 3. A partial example of a minimalist credentialing blockchain. This example shows only three blocks in a blockchain arbitrarily named "NCC." The address of each block is shown at left (1017, 1709, 1764—the blocks are not contiguous, as the vertical triplets of dots also indicate). The three blocks represent only a fraction of the blocks that would be needed to represent a full credentials package for a physician. It is safe to assume that other physicians would have blocks interlaced in this blockchain.

Block NCC.1017 was created when the physician, Dr. John Doe, uploaded a scan of his medical school diploma. The block contains his identification number (e.g., his National Practitioner Databank number), a description of the scanned document, the scan-file itself (shown with the icon of a PDF document), a time stamp that records when the block was created, and Dr. Doe's digital signature.

Block NCC.1709 is a verification block that was created by a clerk in the credentialing department at Mercy Hospital after telephoning Yale to confirm that Dr. Doe graduated from medical school there. This verification applies to Dr. Doe's medical school diploma, and so the clerk set this verification block to point explicitly to the block where the diploma is stored, NCC.1017. The clerk has added a comment that the diploma is verified. (In a more advanced implementation, this could be a structured field.)

Block NCC.1764 is another scanned document. It is a letter uploaded by the registrar's office at the medical school from which Dr. Doe graduated (Yale), providing a second level of proof that Dr. Doe is a medical school graduate. In this example, the registrar doesn't know anything about the pre-existing block containing Dr. Doe's diploma (NCC.1017), and so it is not a verification block, as NCC.1709 is. Thus, the credentialing office will have to manually correspond the diploma with the registrar's letter. In a more advanced implementation, the registrar's office could be guided to produce a verification block instead.

Credentialing blockchains would benefit physicians as well as hospitals. Today, physicians carry a substantial administrative burden. They must perpetually maintain a multitude of primary credentialing documents and secondary confirmation letters, each of which is viewed suspiciously by hospital credentialing personnel.[5] Depositing these materials in a blockchain would inaugurate a much less burdensome workflow: "upload once and forget about it."

Secondary effects would also occur. For example, physicians would likely find it easier to change jobs if credentialing processes were simplified. Physician groups and/or specialty societies could offer their members a credentialing blockchain service–a valuable service that would attract and retain members, thereby strengthening such societies. Or, commercial credentials-handling companies could improve the technical underpinnings and generalizability of their current offerings.

Most importantly, there would be no diminution of the protections that a rigorous examination of professional credentials provides to patients.

Caveats

Although blockchains deliver well-tested software solutions to many issues that vex physician credentialing, there are other important elements to consider.

First, a system must exist to manage the numerous digital signatures in a credentialing blockchain. This includes a mechanism for handling compromise of a digital signature.

Second, it is safe to assume that a specific software application would be desirable to collate the blocks for a particular physician and summarize them for efficient review by a human.

Third, "forgetting" and "disregarding" will also have to be built into the system. Erroneous documents—whether mistakenly generated or mis-assigned—will inevitably be loaded into the blockchain. Thus, a third type of block, the "retraction" block, will be necessary to inform reviewers to disregard some other block in the blockchain. Such blocks will, of course, be digitally signed.

Fourth, whether the contents of a credentialing blockchain should be readable by the public, or whether access should be restricted, is a question left to the profession to decide.

Finally, as in any blockchain solution, it is important to specify how documentary material appears in the blockchain. Typically, three options are available: (a) unencrypted, (b) encrypted, and (c) a combination of a hash signature of the document plus a pointer to the document as it is stored in a separate, mutable data system. These choices come into play when sensitive material is published into a blockchain, or if it is desirable to have the option to someday remove access to a document. Because credentialing blockchains will contain both sensitive and non-sensitive documents, and because encryption cannot be trusted to remain secure for decades, sensitive materials should be published via the hash-and-pointer method.

Final Thoughts

No one favors unnecessary spending of healthcare dollars on administrative matters. Blockchains offer the potential to lower costs, remove frustrations, and increase efficiency of a disagreeable yet vital administrative function.

To keep up with Intel's work with Blockchain, use this Google search: `blockchain site:intel.com`

[1] Non-physician hospital-based clinicians, such as nurse practitioners, physician assistants, optometrists, dentists, clinical pharmacists, physical therapists, surgical technicians who harvest veins, nurse anesthetists, and so on, must also go through the credentialing process. In some hospitals, registered nurses are credentialed, too. For simplicity, we will discuss only physician credentialing–the process is fundamentally the same for all clinicians.

[2] A related administrative process, called "privileging," defines the activities that an individual clinician is allowed to conduct in the hospital. Privileging usually follows credentialing, and typically uses information gathered during the credentialing process. It will not be further discussed herein.

[3] Potential problems and edge cases with the collection of credentialing documents reflect the full complexity of human life. Consider, for example, the seemingly reasonably requirement for a letter from the physician's medical school dean to verify the physician's diploma. In one actual case, this was impossible, because the physician's medical school in the Philippines had been destroyed decades earlier by a typhoon, had never been rebuilt, had all of its [paper] records swept into the Pacific Ocean, and the dean had long ago died.

[4] The possibilities of fraud cannot be removed solely by blockchain verifications. Other methods of compromise, such as identity theft and man-in-the-middle attacks, would have to be prevented by careful system design and operational procedures.

[5] The longer a physician remains in practice, the longer his or her credentialing paper trail extends, and the greater the burden to maintain the collection of requisite paperwork.

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