Blockchain technology: the last mile for Electronic Property Registry System

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Introduction

Since the advent of blockchain – the technology underlying cryptocurrencies that allows permanent registry in a distributed digital ledger – property and land registry was pointed out as one of the most promising business to be transformed, replacing traditional trust intermediaries by blockchain peer-to-peer transactions. Many initiatives around the world (in a number of countries such as Sweden, Honduras and Gana), for various purposes considering each regional scenario, have started to undertake the necessary efforts to migrate their property registry systems to blockchain envisioning its modernization: automation, data interoperability, service convenience, cost savings and enhancement of security and transparency in land property exchange activities.

Beyond technology hype around blockchain, migrating a not rarely centennial paper-based property registry system that relies on well-established trust authorities to a totally digital system based on blockchain is a challenge that should not be underestimated. Values such as registries longevity and integrity, authenticity of identity, registry data structure standards, took for granted in the old system may not be replicated in the new system, if not considered with due importance in the architecture of electronic property registry system. Conversely, long-held registry practices that could be well-suited for a paper-based registry system may be reproduced in the digital system, in a process of using technology to apply automation to an inefficient operation which will magnify this inefficiency.

Blockchain and the Property Registry

Since the beginning of Internet with the first e-commerce endeavours, one difference between bits and atoms became clear: unlike atoms, bits can be copied indefinitely while maintaining its content and integrity. In one hand, this aspect made possible massive spread of information and democratization of communication around the world, since bits can be shared and exchanged freely in the web. On the other hand, commercializing digital assets over the Internet (such as music, movies or news) has always been a tough challenge, for the same reason. One of the biggest innovations blockchain technology brings to the surface is the possibility of having a unique digital asset (one unit of cryptocurrency, for example) being exchanged over the Internet in a fraud-proof way.

The advent of applications based on blockchains in the end of last decade sparked a new interest on the development of fully decentralized, autonomous systems. The concept of blockchain was first introduced by Bitcoin [Nak08], a peer-to-peer electronic cash system. Its security is based on cryptographic primitives, and for this reason it is known as the first cryptocurrency to have widespread presence. More recently, blockchain-based systems have been proposed as means to implement other kinds of decentralized applications [Fer16, Laz15, LSZ15, Nor15, PDKB] in which nodes are capable of trusting the information that flows along the system, even though they are not expected to trust each other (nor there is a central source of truth).

Blockchain is grounded on the notion of a distributed ledger, which acts like a database available to all peers. Each peer has their own copy of the ledger, containing information about the history of transactions in the system. It is constantly audited by groups of agents (selected according to different policies, depending on the application domain). The result of each auditing round is stored in a block and broadcast to the network. Blocks are sequentially appended to the ledger, forming a cryptographically-linked chain. Attempts to tamper with blocks or to alter their order can be easily detected. The whole community of agents may accept or reject the reliability of any block, according to a predefined set of rules. If an agent receives several valid additions to their local copy of the ledger, they always choose the longest chain of valid blocks (or the earliest one, if they have the same length), ignoring other conflicting and less relevant chains. This ensures that consensus is eventually reached, even in scenarios where propagation is slow due to high network latency. Similarly, ill-intentioned agents may try to insert malicious entries in the ledger, but the community will simply reject their blocks and ignore their chain, effectively forcing them to abide to the rules.

Ethereum [Woo14] is a blockchain-based platform for fully decentralized applications. It is based on the notion of smart contracts, which are procedures that determine sequences of actions in order for peers to interact with each other. It is a step further in the scale of autonomous systems: while in Bitcoin it is only possible to define transactions such as “transfer X tokens to account Y”, in this more elaborate scenario it is possible to define interactions like “transfer X tokens to account Y if, and only if, they can prove that they have finished the job they have been hired for”. This effectively works as real-world contracts in a completely autonomous fashion. Based on this platform, it is possible to define decentralized reliable systems in which transactions can only happen if they fulfill the rules defined in each smart contract (if one is defined).

Because of its flexibility and support for the definition of arbitrary smart contracts, the Ethereum platform can be considered as a viable alternative for the implementation of a property registry electronic system. Furthermore, the facts that it is open-source and supported by various entities, including big technology and financial corporations [Hac17] also weight positively in its favor.

Fist things first

Architecting an Electronic Property Registry System is a challenging but imperative task to undertake any project of digitalization of property registries. All aspects of security requirements (privacy, authenticity and integrity) must be considered in order to guarantee that the purpose of the property registry business process will be maintained in the new system.

A digital standard for data structure to be recorded on the blockchain must also be defined, considering not only the legacy of registry data currently available, but also expected new functionalities such as data interoperability and georeference.

In Brazil, the SREI project [IRI12] was developed to analyze current paper-based property registry system and define the architecture of a new Electronic Property Registry System. The proposed architecture kept the registry system of property rights, allowing registry offices to act in the legal role of anticipating and preventing judicial disputes involving properties. In addition, it offered a complete redesign of updates on property legal status, enabling operation efficiency of registry offices to be largely improved. Moreover, data exchange requirements demanded the architecture to consider a molecularized network of registry offices, as opposed to previously atomized and isolated registry offices. This new organization and data standardization needs led to the creation of a regulation organism (National Registry Operator), responsible for coordinating all efforts to keep the new Electronic Property Registry System working and evolving.

The last mile

The SREI project defined a security mechanism for electronic registry as chain of data blocks secured by series of cryptographic signatures, yet still centralized. The advent of blockchain technology offers enhanced possibilities of implementation of such mechanisms in the Electronic Property Registry System, without discarding any of the valuable results of the new architecture to the overall improvement of national property registry system.

After main foundations of and Electronic Property Registry System have been defined, it is easier to focus on the technological challenges of blockchain implementation itself, as the core of the electronic property registry. Any blockchain initiative should be preceded by a careful benchmark for selection of technology platform, considering specific features and purpose of the property registry system. Despite Ethrereum smart contracts may seem very suitable to implement property registry business rules, many other distributed ledger-based technologies are currently being developed, considering the wide range of applications addressed by the blockchain technology. Furthermore, more recent advances on private blockchains development and their ability to interact with public blockchains may offer an interesting solution to address the problem of keeping privacy of property registries while allowing publicity of registry acts.

Conclusion

Emergence of new technologies usually brings up threats to established business and, at the same time, opportunities for new business and transformation of business relationships. Blockchain for property registry is no different in this aspect, since at a first glance, it endangers current property registrars to lose their role of trust intermediaries, being replaced by the new technology. However, looking carefully to recent blockchain business cases, mostly in the financial industry, it can be noticed that mainstream companies are the ones who are most investing in blockchain development, in such a way that trust chain might be transformed but not replaced, as soon as interested players are involved in the development of the new technology.

In this sense, advent of blockchain technology represents a huge opportunity, especially in developing countries (like the Brazilian example above), to leverage a national property registry system to the state of the art of digital technology.

In any case, a previous analysis and redesign of business process of current property registry system is highly recommended and makes it easier to face the many technological challenges that blockchain implementation to property registry will unavoidably offer.

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