Distributed Ledger Technology: A Possible Way forward for Securities Clearing

Ingo Fiedler, Lennart Ante, Fred Steinmetz, Sönke Häseler

- The current system of securities clearing and settlement is dysfunctional, slow, prone to (tax) fraud and expensive to operate.
- An alternative system based on distributed ledger technology could eradicate any uncertainty as to who holds a given security and the associated rights at any time allowing for a much more transparent and efficient clearing and settlement.

On many securities markets around the world, there is an increasing discrepancy between the frequency at which securities are traded and the time it takes to actually process these deals: Trading positions are often only consolidated once a day, whereas the very same positions may be held by investors for only a matter of minutes or indeed seconds. Not least due to practices of 'netting' or 'offsetting', situations routinely occur in which it is not entirely clear, at a given point in time, who exactly holds a specific security and / or the rights and obligations associated with it, such as voting rights, dividend claims and tax implications. Dividend pay-out days are a particular popular time for stock deals intended solely to abuse the existing uncertainty as to who actually owns the shares at that critical point in time. That uncertainty arises not least from the fact that it is indeed legally possible in a number of major jurisdictions for a security to be owned in a certain sense by multiple parties at the same time. Perhaps the most common scheme to exploit the existing regulatory loopholes and inappropriate clearing procedures is known as 'dividend stripping', which has been responsible for billions of lost tax income, as showcased for example by the recent 'cum/ex' scandal in Germany. Distributed ledger technology (DLT), which permits a continuous and complete record of all transactions, could facilitate a timelier, more efficient and safer system of securities clearing and settlement.

The first major step in the digital age consisted in the possibility to duplicate contents without any loss of information and to disseminate them at will. Yet assets such as securities are not intended for duplication; instead, it is imperative that they be assignable to only one (economic) owner at any point in time. So far, the digital transfer of property has always depended on a central player maintaining a central register. However, such systems are often inefficient because they create incentives for manipulation and fraud, and because of the administrative effort required to run them.

DLT now permits the second major step in the digital age: the transfer of (digital) property relations in decentralized transaction databases or account balance databases, which obviates the need for centrally controlled registers. The transaction data is disseminated and confirmed within a decentral network that requires no central entity. That way, the ownership of any asset is always distinct, definite and can be transferred at full transparency.

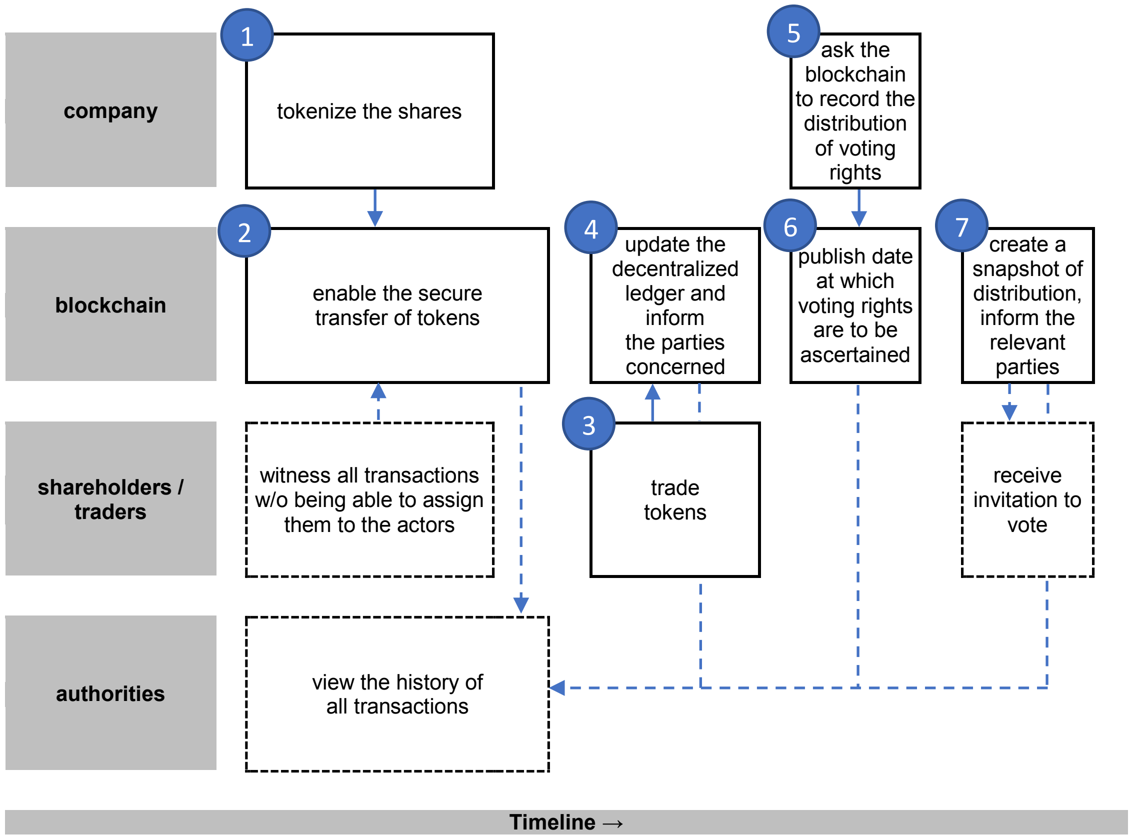
While the Internet protocol suite (TCP/IP) enables the transfer of information via the web, the consensus protocols of DLT form the basis of the secure transfer of assets and thereby uniquely allow for transferring values. These standardized consensus mechanisms can replace the intermediaries that assume the risks arising during asset transfers and the central authorities that safeguard the assignment of property rights. Consequently, substantial efficiency gains may be realized in a range of industries in which intermediaries are currently performing costly and time-consuming tasks in the processing of transactions. According to a 2016 report by the European Central Bank, the clearing and settlement of securities is a particularly important potential field of application for DLT. Similarly, in a recent survey among financial experts conducted by Blockchain Monitor, applying DLT in the field of security transaction processing is attributed to the greatest potential benefits among financial use cases.

A blockchain-based system of securities clearing and settlement could most suitably be implemented as a closed system, a so-called 'permissioned ledger'. The details of implementation would depend on a number of technical specifications, facilitating the required scalability of the system, and including access constraints in the form of read and write permissions, procedures to validate the transactions and the data structure of the blockchain. Bearing in mind these parameters, existing blockchains may be evaluated with regard to their suitability for the task at hand or, if none fit the bill, new blockchains may be specifically designed.

0% → degree of centralization → 100%

permissionless, public, shared leger	permissioned, public, shared ledger	permissioned, private, shared ledger	centralized ledger
e.g. Ethereum	e.g. Ripple	e.g. clearing chain for securities	e.g. traditional bank account

In the following, the potential of DLT shall be demonstrated using the simple example of a blockchain-based determination of voting rights. Facing high-frequency trading and the common practice of shareholders transferring their voting rights to a third party (typically their bank), imagine a stock company that needs to determine exactly who is entitled to vote at its shareholders' meeting. We will show how this can be achieved elegantly and cheaply thanks to the complete traceability of stock ownership afforded by a blockchain-based system. The basic elements of such a system are depicted in the figure below.



The process comprises the following essential steps:

1. All of the company's shares are tokenized, i.e. a token is created and uniquely assigned to each share.
2. The tokens (and thereby the shares) can be securely traded amongst the participants of the network. Each transaction is recorded on a distributed ledger, which thus contains the complete record of past and current share ownership. (A single blockchain could cover the entire set of transactions for any number of companies simultaneously.) At any point in time, the distributed ledger will thus provide a comprehensive and up-to-date picture of who owns which portion of the company's shares. The degree to which the participants of the network can access the ledger depends on their level of authorization: Shareholders and traders can witness all transactions but cannot assign them to the individual actors, whereas the authorities have full access to all information contained in the distributed ledger.
3. With respect to trading, there are two variants of the system: Firstly, the tokens could fully replace the shares, in which case all aspects of trading and settlement are conducted on the distributed ledger, which thus becomes a transaction and monitoring instrument. Alternatively, the tokens may merely represent the shares. In that case, the actual trades are processed off the distributed ledger, which consequently only provides a monitoring instrument.
4. After each successful transaction, the transaction data, which conclusively represents the (economic) ownership structure of the company, is updated on the distributed ledger and relayed to the actors in accordance with their access rights.
5. To ascertain the distribution of voting rights for an upcoming shareholder meeting, the company sends a request to the distributed ledger.
6. The point in time at which ownership of a share entails the right to vote at the meeting is announced within the network and to the general public.
7. At that point in time, a snapshot of the shareholdings is taken and the current shareholders are invited to vote at the meeting.

The cryptographic methods that underpin DLT can also be used to conduct the voting procedure itself on the basis of a distributed ledger, e.g. via signed messages on the distributed ledger or by means of additionally created, transferable tokens that represent the voting rights. That way, it is also possible for shareholders to authorize third parties to vote on their behalf. If the vote is conveyed purely by a message, a shareholder signs the vote with a cryptographic key that only he can possess because the signature is unmistakably associated with the portfolio of shares. In the alternative scenario, an additional token is created for each voting right and thus for each share. The token's validity for the purpose of voting can be limited to a certain period of time. A transaction of the token then corresponds to the act of voting. In both cases, the validity of a vote is checked fully automatically. The application of DLT ostensibly does not imply any change to the voting process itself, the shareholders may not even notice the new technical infrastructure. Changes apply merely to the background processes, specifically regarding the verification of the validity of the votes submitted, the ascertainment of the number of shares held by each shareholder, and the distinct distribution of shares.

In our example, efficiency benefits arise from the greater ease of ascertaining who holds the company's shares at a relevant point in time. With today's infrastructure for the processing of securities transactions, by contrast, the voting process is much more costly and also more prone to fraud. The complete processing of a transaction may consume several days, making it difficult to pinpoint the exact distribution of the shareholdings and thus obscuring voting rights.

Moreover, a decentralized database such as a distributed ledger provides a great deal of transparency for regulatory supervision, as well as substantial cost savings, as the need for harmonizing proprietary databases diminishes. By applying specific cryptographic methods and selectively adjusting reading rights, sensitive business data in the shared ledger can be protected while being selectively accessible for supervisory authorities. Consequently, DLT can enable a system of securities trading that is transparent, efficient and much less prone to fraud.