Automation and fluidity of logistics transactions through blockchain technologies

Maxence Lambard, Cyrille Bertelle, Claude Duvallet

Automation and fluidity of logistics transactions through blockchain technologies

Maxence Lambard Cyrille Bertelle Claude Duvallet

Université Le Havre Normandie, LITIS (UR 4108), Le Havre, 76600

Introduction

The fast execution of logistics transactions is an important factor in logistics management. This speed is linked to the fluidity of transactions. Thus, an important aspect of logistics management is the development of digital solutions to automate and certify the transactions that need to be performed between a large number of actors.

Traditional contracts that use documentary credit as a means of payment are known to suffer from moral hazard and payment timing problems. In this research, we are interested in guaranteeing the proper execution of the contract between the partners using Smart Legal Contracts (SLCs). In addition, we present a model for a new generation of logistics transaction system that manages blockchain-based escrow and validation mechanisms to ensure the proper execution of the contract.

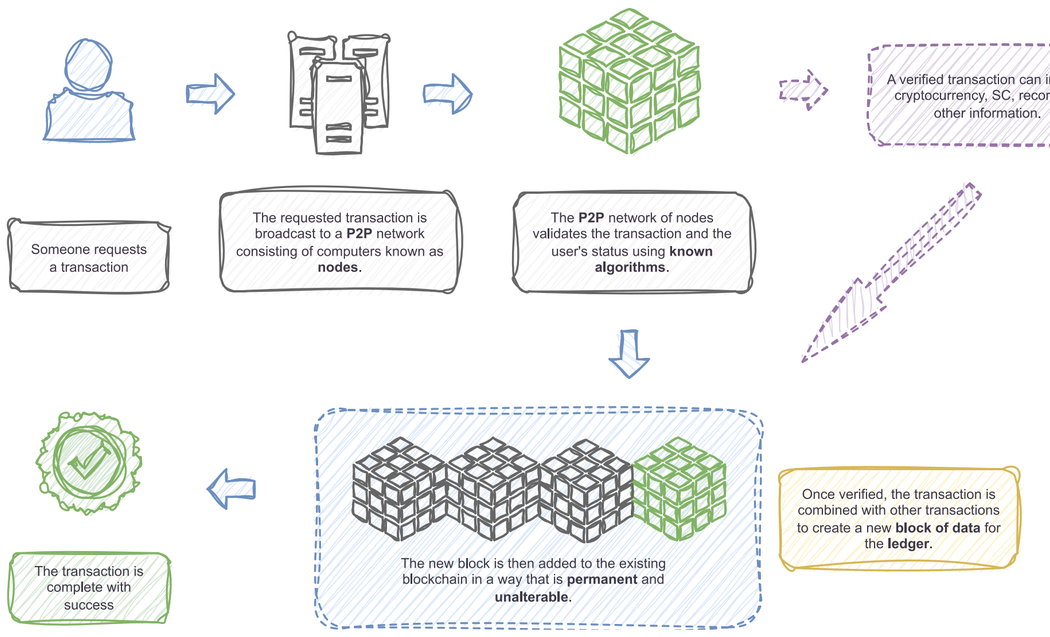

Figure 1. A representation of the flow of a transaction executed on a Distributed Ledger Technology (DLT)

Contribution

Our solution is based on a generic SLC developed on the Ethereum blockchain in the context of smart logistics. It will consist of:

- **Objective 1:** Providing an audit trail that documents the provenance of an asset at every stage of its journey through the blockchain technology.
- **Objective 2:** Enabling automatic, fast and low-cost execution of logistics transactions with a generic SLC.

The model

As you can see in Figure 2, our model is partitioned in 2 parts. The first one describes the events happening on the blockchain. This includes the storage of contractual information, the history of escrows or the rights of use for the different actors of the contract.

The second one represents the events happening outside the blockchain and allows to transmit information available outside the blockchain. In order to record the events emitted by the SLC but also to interact with it through an oracle to validate the conformity of the goods for example. We consider that the SLC is accessible by different actors such as buyers, sellers, oracles and lawyers. They are represented by Ethereum addresses in the SLC itself.

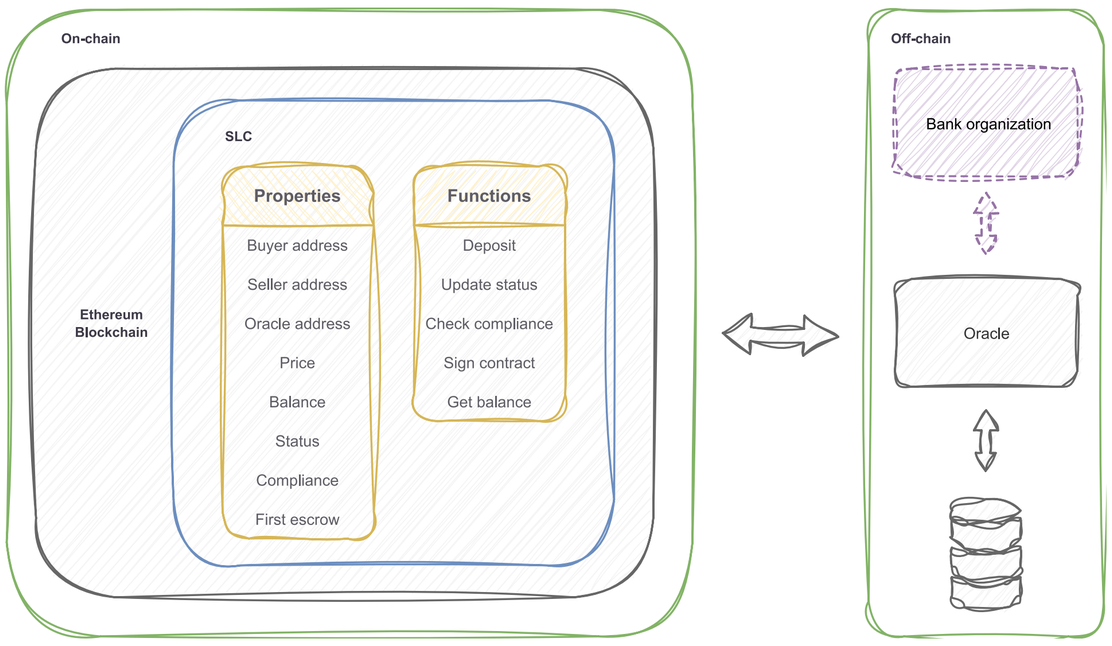

Figure 2. Model architecture with a basic SLC

Contract registration

The seller wishing to sell his merchandise enters the actual contract from an agreement with the buyer(s). The seller must provide the following information: the address of the buyer(s), the minimum escrow for goods, the desired price, the desired currency for payment (ETH, EUR, USD), the minimum compliance for validation by the oracle...

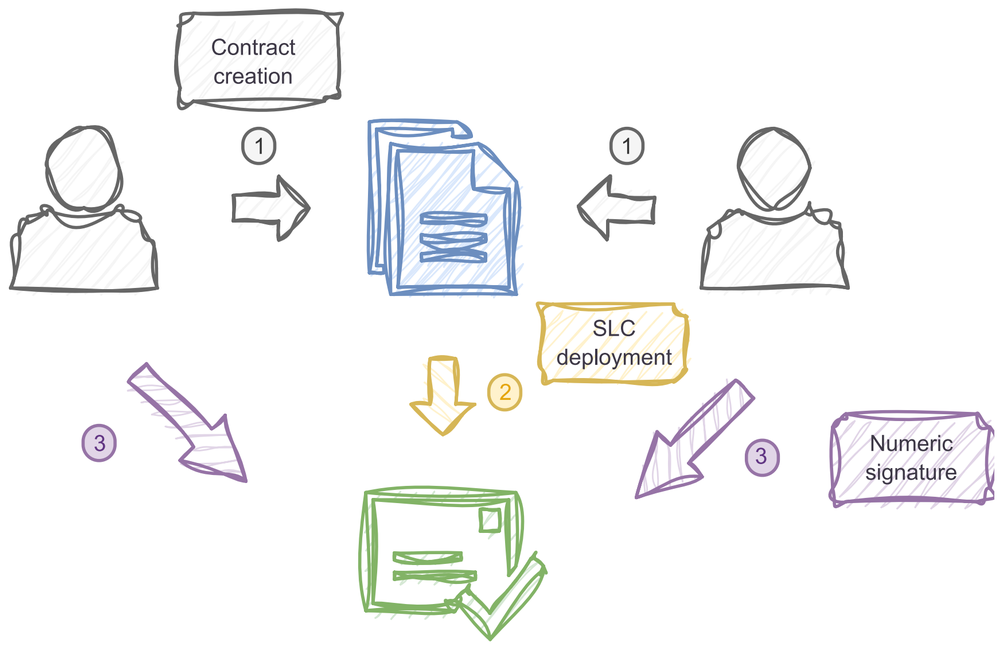

Figure 3. A contract link with a SLC

Delivery and validation of the goods

The oracle can give the following information:

- Status update according to data that can come from sensors, handlers...
- Conformity check

Sequestration

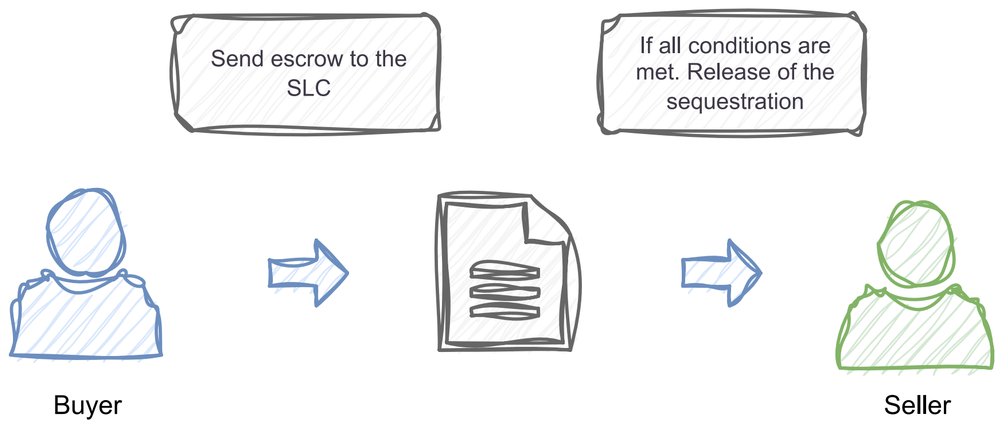

Figure 4. Simple SLC sequestration

An improvement can be made to the management of the escrow to avoid the payment timing problem. Indeed, J. Gans [1] has thought about a mechanism that would avoid any moral hazard with a penalty system.

Conclusion

The use of the blockchain is intended to provide confidence in the automation and fluidity of transactions of financial flows in a logistical operation. In case of conflict, a legal authority will then be able to reliably consult the entries in this non-falsifiable digital register if they are compatible with contractual rules, as proposed by the concept of SLC.

Future works

- Port this model to a hybrid blockchain to reduce the cost of transactions and increase the speedof them.
- Consider the payment timing problem in the SLC model following Gans solution [1].
- Try to solve the problem of non-execution of contract.

References

[1] J. Gans, "The fine print in smart contracts," *Social Science Research Network*, 2019.

[2] S. Nakamoto, "Bitcoin: Peer-to-peer electronic cash system," pp. 1–4, 2008.

[3] V. Buterin, "Ethereum white paper : A next generation smart contract & decentralized application platform," pp. 13–19, 2015.

[4] A. Beniiche, "A study of blockchain oracles," pp. 1–3, 2020.

Contact us!