Blockchain and Smart Contracts in the Logistic and Transportation Industry: The Demurrage and Maritime Trade Use Case

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BLOCKCHAIN AND SMART CONTRACTS IN THE LOGISTIC AND TRANSPORTATION INDUSTRY: THE DEMURRAGE AND MARITIME TRADE USE CASE

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Abstract

Blockchain technology has recently attracted the interest of stakeholders across a wide span of industries. In the logistic and transportation industry, particularly, the blockchain, paired with smart contracts offer an opportunity to automate the demurrage process. Demurrage is a financial penalty imposed on a carrier on account of a failure to deliver shipment on time. Therefore, building on blockchain and smart contracts, the objective of this paper is to develop a promising use case that overcomes the challenges of the traditional demurrage process. Automating this process would improve reliability, auditability and time of execution.

Keywords
Demurrage, blockchain, smart contracts, Fintech, logistic, transportation

I. INTRODUCTION

Digital technologies have played a key role in the development of modern financial services (Collomb and Sok 2016). The rise of breakthrough technologies such as the blockchain promises even greater impact in the financial sector particularly in payment and cash recovery. Blockchain has the power to disintermediate many work layers in traditional banking processes (Collomb and Sok 2016). It can also change the logistic process of the physical commodity delivery as we know it. Among the challenges of this process is the cash claim of demurrage which is the penalty for exceeding the laytime

allowed for taking delivery of a shipment from the shipping or transporting company's warehouse.

Blockchain is a decentralized and distributed digital ledger of transactions that is cryptographically enabled and tamper-proof. It is the underlying technology enabling cryptocurrencies such as Bitcoin (Fowler and Fytatzi 2016). Blockchain creates trust by enabling users and organizations to perform a transaction without having to go through a neutral central authority to ensure its integrity (Schwab 2016). Blockchain 2.0 Frameworks, such as Ethereum, add smart contracts on top of the distributed ledger (Bussmann 2017). A smart contract is a bundle of coded logic and procedures that self-execute when certain conditions are met (Gibson and Kirk 2016).

In this paper, we suggest that blockchain and smart contracts are well suited to automate the demurrage process in the logistic industry. The objective is to develop a promising use case of the demurrage process based on these technologies. Such automation is expected to improve reliability, auditability, and time of execution.

In the remainder of this paper, we provide a succinct overview of the blockchain and smart contract technologies. After that, we describe the demurrage process and we propose a promising use case for running the process on a smart contract. We conclude the paper by presenting the practical implications of the research.

II. LITERATURE REVIEW

II.1 Blockchain technology

A blockchain is a decentralized and trustful database that contains all records of events or transactions that have been executed and shared between participating parties (Hans et al. 2017). A blockchain is made of series of an inextricably linked "blocks". Each block in the chain is timestamped and carries a transaction and a hash to the previous block (Christidis and Devetsikiotis 2016) (see figure 1). A hash is a short key (or an index) that refers to a set of characters – or a transaction –. The organization of transactions into blocks ensures that a given transaction belongs, for certain, to a blockchain (Garzik 2015). Any node with access to this ordered blocks can read and trace a transaction back in time (Christidis and Devetsikiotis 2016)
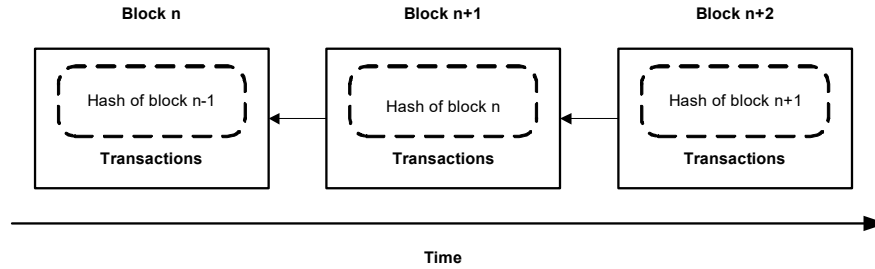
Figure 1 : A generic structure of a blockchain transaction (Christidis and Devetsikiotis 2016)

There are four types of blockchain which can be classified based on the mode of accessibility to data, namely, public, private, permission-less and permission (Garzik 2015). In a public blockchain, there are no restrictions on reading data and submitting transactions for inclusion. In a private blockchain, direct access to data and submitting transactions is limited to a predefined list of entities. In a permission-less blockchain there are no restrictions on identities of transaction processors (i.e., users that are eligible to create blocks of transactions). Finally, a permissioned blockchain is a blockchain, in which transaction processing is performed by a predefined list of subjects with known identities.

II.2 Smart contracts

A smart contract can be defined as an event and state-driven program that can run on a blockchain to administer its assets (Luu et al. 2016). Concretely, smart contracts are scripts stored on the blockchain. They have a unique address and can be triggered when a pre-defined event occurs or when a set of conditions are met. Then, they execute independently and automatically according to the contractual terms on every node in the network (Christidis and Devetsikiotis 2016)
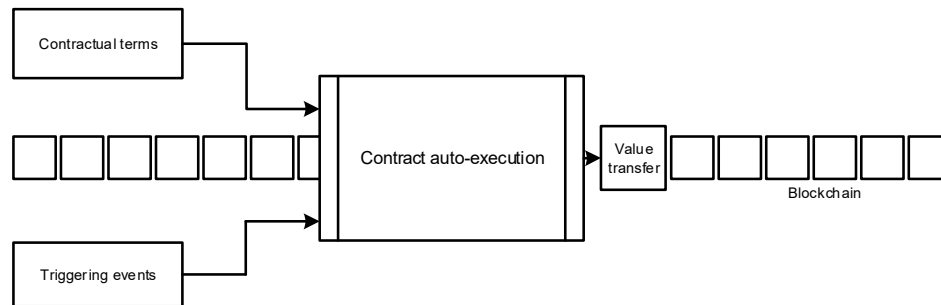
Smart contracts minimize the need for trusted intermediaries between transacting parties, and the occurrence of malicious or accidental exceptions (Christidis and Devetsikiotis 2016). They excel at managing data and value transfer between entities on the network (Eris-Industries 2016). One of the leading platforms for smart contracts is Ethereum. Ethereum is a public blockchain that uses its own cryptocurrency "ether" and provides a scripting language for the generation process of contracts (Hans et al. 2017). In addition, it allows agents to create decentralized applications such as Decentralized Autonomous Organizations (DAOs).

Ethereum guarantees transparent data records (Wood 2014). With blockchain and smart contracts, applications that could previously run only through a trusted intermediary, can now operate in a decentralized fashion, without the need for a central authority, and achieve the same functionality with the same amount of certainty (Christidis and Devetsikiotis, 2016).

III. THE DEMURRAGE USE CASE.

Accounts receivable management is a critical part of managing any business. Neglecting this aspect may result in a lack of liquidity which, in turn, may have serious consequences. If an accounts receivable aging demonstrates that a company's receivables are being collected much slower than normal, it may be a warning sign that business may be slowing down or that the company is taking greater credit risk in its sales practices. This can also lead to writing off bad receivable in the annual accounts.

There are multiple reasons behind aged receivables, including major bankruptcies. However, in the maritime industry, the main cause is post deal expenses or demurrage (Kirikova 2017). Demurrage is typically a charge exacted by a shipper from a carrier on account of a failure on the latter's part to deliver shipment on time (Christopher 2001). It

is best described as the monetary penalty imposed on transporting company for cargo ships' delayed deliveries (in hours or days) or on customers for delayed loading. It also refers to the charges that the ship-owner pays to the charterer for its delayed operations of loading/unloading (Figure 2).
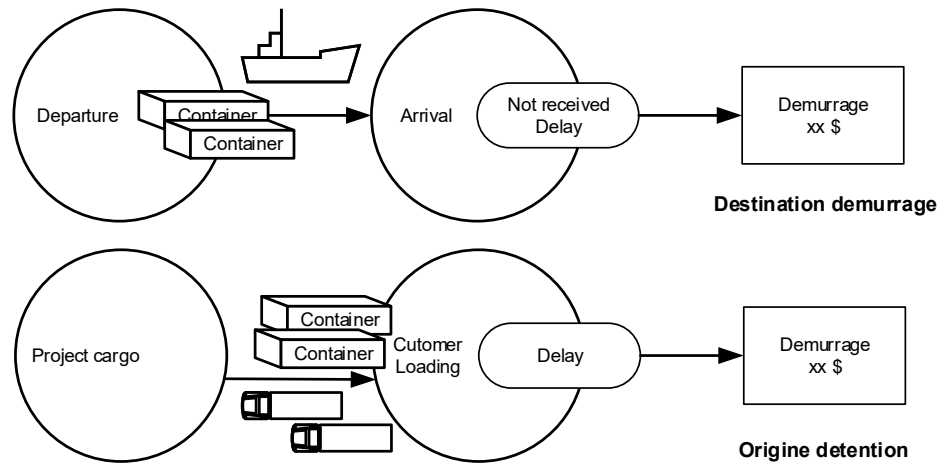

Figure 2: Overview of the demurrage process

Demurrage faces many challenges including, the complexity of shipping process, errors in the operational process, use of paperwork and small invoices' amounts, claim documentations and the legislation. Demurrage is a significant issue encountered by warehousemen on a daily basis. Cash collection of demurrage claims are complex. Observations indicate that, very often, charter parties choose to opt out rather than engage in regular dispute as the resources needed to chase a debt can easily exceed the value of the debt. As a result, the stakeholders often prefer to maintaining a long-term relationships rather than engaging a costly battle of debt collection (Kirikova 2017).

In this paper, we tackle the demurrage process with the objective of improving the cash flow recoverability of the post-transaction expenses. The implementation of terms of an agreement between various parties can be enabled based on predefined, i.e., programmed, rules. These rules can be realized in self-executing code and are triggered automatically when a delay is registered.

Our argument, herein, is that the terms and the conditions of the agreement between charter parties can be written as a smart contract code into a blockchain. When a trigging event happens (delay), the contract execute automatically according to the code terms and apply possible demurrage charge. To execute the contract, both parties must validate the trigger event.
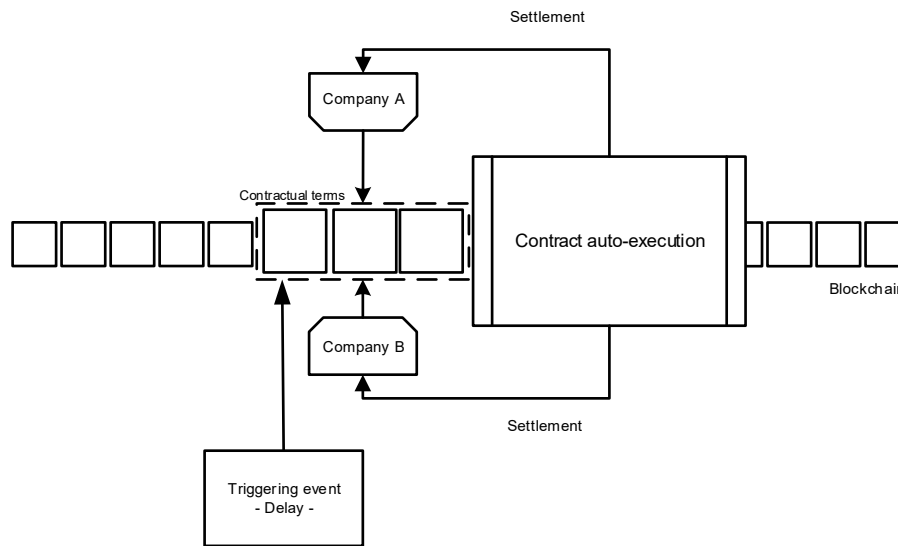

Figure 3 : Overview of demurrage process running on a smart contract

The use of smart contracts in the demurrage claim process will improve cash collection, eliminate the costs of legal pursuits and save the partners relationships. It will also provide an unalterable transactional record facilitating auditing.   All events, such as term agreements, shipments, or payments can be traced back and the likelihood of erroneous events is minimized.

IV. DISCUSSION AND CONCLUSION

The blockchain and smart contracts technologies offer noteworthy improvements for the demurrage process. This includes increased real-time execution of the contractual clause,

improved accuracy, lower execution risk, reduced number of insurance intermediaries and lower costs. Decentralized smart contracts ensure that participants can safely perform transactions between them. This is achieved while solving the problem of requiring accredited intermediaries which often provokes significant costs (Mainelli and Smith 2015).

In addition to demurrage, maritime transactions involve many paper documents, including multiple bills of lading, letters of credit, sales contracts and/or charter contracts, and the transmission of such documents and payment by various means involves several parts. Until now, there were good reasons for these multiple transactions and the obligations they imposed. Each part of the transaction chain wished to obtain payment insurance for its performance and protection against the unauthorized delivery of the goods transported. There was no security-proof mechanism to ensure that the carrier could deliver the goods to the authorized recipient without error (Keith B. Letourneau, 2017).

In conclusion, the blockchain technology has recently attracted the interest of stakeholders across a wide span of industries such as finance (Taft 2016), healthcare (Kar 2017), utilities (Lacey 2016), real estate (Oparah 2016) and the government and military sectors (Alcazar 2017). In the logistic and transportation industry, particularly, the blockchain, paired with smart contracts offer an opportunity to automate the demurrage process. This paper goes some way towards enhancing the process as it is based on these technologies. Our approach would lend itself well for use in the transport industry as the blockchain-based process can effectively allow transport partners to create trusted relationships without the need to incur the post deal expenses and do business much more quickly and inexpensively.

In our view, blockchain technology promises not only to reduce the cost of demurrage but also to transform the maritime trade industry and replace centuries-old maritime business practices by substituting order letters and transaction documents with a secure on-line mechanism to deliver, buy and sell assets. But in order to succeed, many challenges are to be tackled like the initial investment and the conservative nature of the maritime industry.

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