

Permissioned Blockchain Model for End-to-End Trackability in Supply Chain Management

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ABSTRACT

Supply chain management or logistics is a crucial aspect of any business, be it agriculture, food, healthcare, and more. However, it also involves a communication among a host of actors performing different roles in the chain. Integration of these actors in a transparent yet secure way is needed, which blockchain technology has the potential to do so. In this article, different models of blockchain application in logistics are discussed and how the permissioned blockchains can be used in realizing the business case. An overview of different frameworks which enable permissioned blockchains are discussed in this article. Based on this, the authors propose an asset transfer model which can be employed to enhance supply chain trackability using permissioned blockchain.

KEYWORDS

Blockchain, Ethereum, Hyperledger, Permissioned Blockchain, Smart Contract, Supply Chain Management, Trackability

INTRODUCTION

Blockchain is poised to be a disrupting technology in many business use cases, like in finance, identity management, intellectual property, land title registration and supply chain management to name a few. Supply Chain is one of the most complex processes for any enterprise and is like a backbone for the business. For a global enterprise, the supply chain becomes increasingly complex due to a network of retailers, distributors, transporters, warehouses. Any mishap can impact the production or delivery of products and services. All the participants in the supply chain have their own records and databases of transactions that have happened but there is a lack of integration among them. There is very little knowledge of how, when and where these products were manufactured and transported via which channels before they finally land in the hands of the consumer. In simpler terms, there is a lack of traceability and real time visibility of the products when it travels in the supply chain.

In finance, bitcoin (Nakamoto, 2008), ripple, stellar are some examples. For many other business use cases, private blockchain platforms and frameworks have been developed, viz. Hyperledger, Ethereum, and Corda, using which trackability and traceability in supply chain management can be implemented.

The paper is structured in 5 sections. First, we introduce blockchain and its need in supply chain in Section 1. Different designs and models which have been proposed shall be discussed in Section 2. All the actors and their roles in the supply chain shall be discussed. Section 3 is a review of the three blockchain frameworks, which are currently enabling business use cases via permissioned blockchains. Section 4 discusses the proposed permissioned model of blockchain for supply chain trackability. Pseudocode of the smart contract is also discussed in the section. Section 5 concludes the paper with gaps and the future scope of this research.

BACKGROUND

According to Dobrovnik et al., (2018), application of blockchain in logistics and supply chain management can provide an edge over conventional systems. These relative advantages are based on the inherent features of the blockchain technology, namely, immutability, transparency, and decentralisation.

Blockchain as an amalgamation of different fields of Computer Science and Information Technology provides immutable records of transactions called as blocks which are chained together using hash algorithms. These chains of blocks represent the public ledger which is transparently shared over the network. Since the data and the business logic using smart contracts is shared to all the participants of a peer-to-peer network, it enables the system to have a higher order of decentralization. Each of the participant in the network shares the same data and the changes are also reflected in real time, which was not possible in local copies of centralized data being fetched from the conventional centralized server. Being a single point of failure, relying on the centralized server for storage and management of sensitive data questions the trust of the whole system.

Supply chain management, as a vital pillar of businesses, involves multiple parties for the product to travel from manufacturer to the end consumer. In case of food supply chain, visibility and transparency can help create a different flow of food, starting from the farmers to the end customer, via the whole chain of intermediaries. All actors in the conventional supply chain, like, farmer, distributors, wholesalers, retailers and consumers become the participants of the blockchain network, all of which have access to the public ledger at all times.

This end-to-end supply chain functions because of transactions between any two participants at any stage. For example, when a wholesaler transports the goods to distributor, both of them must come to an agreement over the price and the quantity. This agreement is enforced using a contract in the conventional supply chain. Now, this creates a point of vulnerability in the whole supply chain, as one of the two parties of the transaction might not adhere what is written in the contract, and

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