하이퍼레저 패브릭 기반의 공급망 관리 시스템

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Using the supply chain based on the Hyperledger Fabric

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Abstract

Blockchain technology is rapidly being integrated into many industries across multiple functions, in some cases revolutionizing processes and transactions. Blockchain, the distributed ledger technology underpinning cryptocurrencies such as Bitcoin, represent a new and innovative technological approach to realizing decentralized trustless systems. Indeed, the inherent properties of this digital technology provide fault-tolerance, immutability, transparency and full traceability of the stored transaction records, as well as coherent digital representations of physical assets and autonomous transaction executions. The supply chain is one function that holds tremendous interest for the technology, in area such as supplier payments, product traceability and contract bids and execution. Blokchain has the potential to become the universal supply chain operating system-increasing security, improving transparency and creating scalability. This paper presents applying blockchain to supply chain, bitcoin and other cryptocurrencies have been fueling interest and examples are multiplying of blockchain being used for supply chain.

1. Introduction

In general, companies do not know enough about the products that they buy and sell to navigate the many complex challenges facing today's global supply chains. Some companies are realizing the business value of traceability for efficiency, cost savings, and achieving product premiums in the market. However, they must first overcome the mistrust associated with validating claims of product identity and traceability. Companies should prepare for every action or inaction to be closely scrutinized. More can be done to equip companies with real-time traceability of products within global food supply chains. Blockchain [1], a type of distributed ledger technology (DLT), has been increasingly gaining market traction in supply chains-for example, in proofing product provenance and implementing track-and-traced of products through the supply chain. While blockchain alone does not solve traceability [2], it can be a game changer. When implemented effectively, it can connect and enable efficiency, transparency and accountability among participating actors. Better and more reliable data can help optimized business decisions and reach higher standards for production, efficiency and sustainability.

Blockchain technology is now being used to improved tuna traceability to help stop illegal and unsustainable fishing practices in the Pacific Islands tuna industry. The aim is to stop illegal, unreported and unregulated fishing [3]and human rights abuses in the tuna industry. These have included reports and corruption, illegal trafficking and human slavery on tuna fishing boats. Blockchain technology is rapidly evolving beyond Bitcoin. Emerging applications are geared to improve business in many ways including supply chain transparency for all kinds of products. A blockchain is a digital ledger that is distributed, decentralized, verifiable and irreversible. It can be used to record transactions of almost anything of value. Essentially, it is a shared database that everyone in the network can see and update. This

system provides multiple benefits for supply chains, including high levels of transparency. This is because everyone in the network can see and verify the ledger, and no individual can alter or delete the history of transactions.

2. Blockchain Technology

A new digital technology [4] has been trialed to track fish from trawler to the supermarket in a breakthrough that could help stop human rights abuses and illegal fishing. The technology called blockchain and first used to power the currency Bitcion is expected to revolutionize the finance, property and food sectors replacing traditional contracts, paperwork and identification methods. Blockchain is a digital ledger or record of information that is accessible to everyone. In this case it details the origins of fish and allows anyone to see where the fish was caught, processed and sold on. It does not stop illegal fishing on its own but it opens up the supply chain for anyone to scrutinize. With the seafood industry notorious for human rights abuses and illegal fishing, campaigners hope the technology, piloted by a UK-based company Provenance, could help retailers, manufactures and restaurants prove the origins of their fish. Blockchain technology is just starting to change the way business is done. If it delivers on its promise of supply chain transparency, it will be a great tool to help ensure that industries including the tuna industry are doing the right things. This will give consumer more information on which to base their purchasing decisions. For the global tuna industry, which has historically struggled with illegal and environmentally dubious fishing practices, this could be a turning point as visionary fishing companies demonstrated true stewardship and begin to open up the industry to full transparency.

3. Supply Chain

Many supply chains [5] face challenges that have significant implications in terms of cost, speed, and product's quality, the most critical supply chain challenges, despite years of efforts and often significant investments are lack of transparency due to inconsistent or even unavailable data, high proportion of manual work, lack of interoperability and limited information on the product's lifecycle or transport history. In many cases, blockchain applications can counter these inefficiencies and add new value.

3.1. What is blockchain and how could it help supply chain?

While the most prominent use of blockchain is in the cryptocurrency [6]. Bitcoin, the reality is that blockchain essentially a distributed, digital ledger has many applications and can be used for any exchange, agreements, contracts, tracking and payment. Since every transaction is recorded on a block and across multiple copies of the ledger that are distributed over many nodes, it is highly transparent. It's also highly secure since every block links to the one before it and after it. There is not one central authority over the blockchain and it's extremely efficient and scalable. Ultimately, blockchain can increase the efficiency and transparency of supply chains and positively impact everything from warehousing to delivery to payment. Chain of command is essential for many things and blockchain has the chain of command built in. The very things that are necessary for reliability and integrity in a supply chain are provided by blockchain. Blockchain provides consensus there is no dispute in the chain regarding transactions because all entities on the chain have the same version of the ledger. Everyone on the blockchain can see the chain of ownership for an asset on the blockchain. Records on the blockchain cannot be erased which is important for a transparent supply chain.

4. Examples of Platforms and Functionality

Several products now offer blockchain functionality. In this paper, we simply mention two popular examples. Each has functionality that matches typical supply chain needs. In other words, they are not simply platforms with cool features that are trying to find a problem to solve. One example is Ethereum [7], offers two kinds of functionality over a network of computers. It records cryptocurrency Ether transactions. It also handles smart contracts. These are basically computer programs. What the bitcoin network does for data. Ethereum does for data and computation. Legalese in a supply or distribution contract can become clear-cut rules in a smart contract [8]. The business rule can be seen by all parties concerned. The authenticity of the smart contract is guaranteed by the multiple, tamperproof, replicated versions spread over the network. Other example is Hyperledger [9] Fabric is flexible about how users reach consensus. It lets you choose the mechanism the best matches the relationship s between the

blockchain users. At one end of the scale, things might be very structured. Groups working together in the same company are an example. Elsewhere, the model might be peer-to-peer. Think of third-party supply chain financing. The platform also lets you create subgroups of participants. Each subgroup can then have its own private, separate ledger of transactions. This is handy for managing competitive situations and rival suppliers. The following figure is the example of using hyperledger in fishing supply chain.

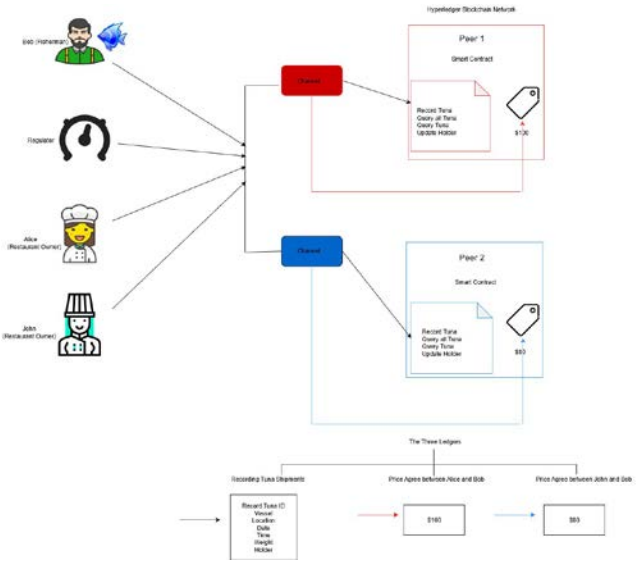

Figure.1. Using Hyperledger Fabric in fishing supply chain

4.1. Fisherman (Bob)

After each catch, Bob records information about each individual tuna, including; a unique ID number, the location and time of the catch, its weight, the vessel type, and who caught the fish. For the sake of simplicity, we will stick with these six data attributes. However, in an actual application, many more details would be recorded, from toxicology, to other physical characteristics. These details are saved in the world state a key/value pair based on the specifications of a chain code contract, allowing Bob's application to effectively create a transaction on the ledger.

4.2. Restaurant Owner (John) Buyer

John is a restaurant owner looking to source low cost and high quality tuna that have been responsibly caught. Whenever John buys tuna, he is always uncertain whether he can trust that the tuna he is purchasing is legally and sustainably caught, given the prominence of illegal and unreported tuna fishing. At the same time, as a legitimate and experienced fisherman, Bob strives to make a living selling his tuna at a reasonable price, He would also like autonomy over who she sells to and at what price.

4.3. Restaurant Owners (John & Alice) Sale

Normally, Bob sells his tuna to restaurateurs, such as Alice, for $100 per pound. However, Bob agrees to give John a special price of $80 per pound of tuna, rather than his usual rate. In a traditional public blockchain, once Bob and John have completed their transaction, the entire network is able to view the details of this agreement, especially the fact that Bob gave John a special price. As you can imagine, having order other restaurateurs, such as Alice, aware of this deal is not economically advantageous for Bob. To remedy this, Bob wants the specifics of the deal to not be available to everyone on the network, but still have every actor in the network be able to view the details of the fish he is selling. Using Hyperledger Fabric's feature of channels, Bob can privately agree on the terms with John, such that only the two of them can see them, without anyone else knowing the specifics. Additionally, other fishermen, who are not part of Bob and John's transaction, will not see this transaction on their ledger. This ensures that another fisherman cannot undercut the bid by having information about the prices that Bob is charging different restaurateurs.

4.4. Regulators Contract Enforcers

Regulators will also gain entry to this Hyperledger Fabric blockchain network to confirm, verify and view details from the ledger. Their application will allow these actors to query the ledger and see the details of each of Bob's catches to confirm that he is legally catching his fish. Regulators only need to have query access, and do not need to add entries to the ledger. With that being said, they may be able to adjust who can gain entry to the network and/or be able to remove fishermen from the network, if found to be partaking in illegal activities.

4.5. Gaining Network Membership

Hyperledger Fabric is a permissioned network, meaning that only participants who have been approved can gain entry to the network. To handle network membership and identity, membership

service providers (MS)) manage user IDs, and authenticate all the participate in the network.

In this paper, the regulator, the approved fishermen, and the approved restaurateurs should be the only ones allowed to join the network.

5. Conclusion

There are still much to do and to explore in applying blockchain and smart contract to supply chain. Supply chain managers and teams may need to enhance their understanding of the technology. It helps to know how it works, at least in a top-down way. Then we can make informed decisions about when and how much to invest in blockchain and related products.

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