

THESIS

SECURE SUPPLY CHAIN MANAGEMENT USING ETHEREUM BLOCKCHAIN AND STATE CHANNELS

Blockchain has exploded as the technology of the future for several use cases including international payments, Peer to Peer transactions, Regulatory Compliance and Audit, Healthcare and Supply Chain Management. Blockchains tamper proof immutable ledger technology makes it particularly useful in tracking goods and services as they move and change hands in the supply chain. It enables new and innovative means of organizing tracking data and putting it to good use. Smart Contract platforms such as the Ethereum blockchain can use this tracking data for automating various functions and events in the supply chain life cycle. This has the added benefit of providing total transparency to all parties involved. In this Thesis I explore an Enterprise level solution for supply chain management and tracking using the Ethereum Blockchain. I will also use Raiden based state channels for efficiently establishing payment channels between an organization and its suppliers.

Scenario

In our scenario an organization has several suppliers spread across the globe. It uses these suppliers to deliver different components to its factory floor. The components need to be delivered on time and need to be stored, handled and transported under specific physical or environmental constraints. The organization agrees upon these constraints along with delivery date with all its suppliers and every transporter in advanced. This agreement is deployed in the form of a smart contract on the Ethereum blockchain, once this contract is deployed its terms cannot be altered. Consider a particular case in which an organization like Bosch uses a supplier overseas for some of the components in one of its new high tech products. The component should never be exposed to temperatures greater than 35 C and should be delivered within 3 days of placing the order. The organization then proceeds to deploy the smart contract stating these conditions. The supplier agrees and a payment channel between the supplier and the organization is established for the delivery of this component. The organization also has payment channels with individual transporters who would be handling transport duties during different stages of the delivery life cycle. The component is packaged with a smart device capable of communicating temperature and other sensor readings directly to the smart contract. Once the supplier packages the component and it leaves his warehouse the tracking starts. The tracking data is communicated continuously with the blockchain along with metadata identifying the transport stage and responsible party. The smart contract defines penalties for late delivery and for contract terms violations like the package being exposed to temperatures greater than 35C. If the package arrives on time and without any violations to the factory floor everyone gets paid. If, however the package arrives late, damaged or any other contract violations occur during the delivery stage the Ethereum smart contract will automatically penalize the party or parties responsible for those violations. The system will give organizations full control over how to configure it according to their own business needs i.e. contract terms and payment channels can be as granular or as coarse as they like. The organization can choose to have payment channels and smart contracts with each individual transporter or just have one Contract and Channel with the suppliers.