

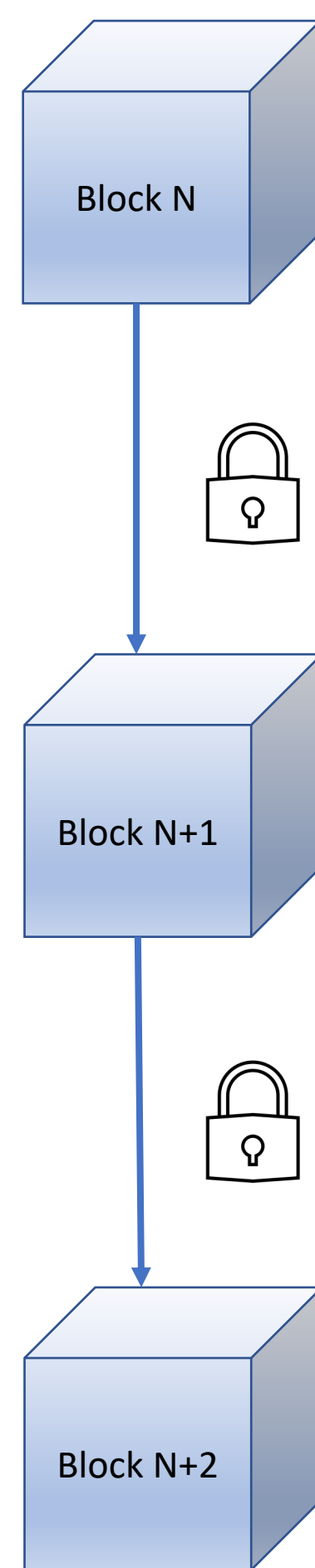
Homeland Security Challenge

Distributed ledger technologies (DLT) have received widespread attention in the past decade for their role in cryptocurrencies such as Bitcoin and Ether [5]. Recently, DLT has shown promise in enterprise applications such as supply chain management, finance, and digital ownership [1]. Many organizations are currently investigating the usefulness of DLT in their domain and parsing its true capabilities from the hype, including institutions within the United States government [8].

This summer, we worked with the United States Coast Guard (USCG) to study important aspects of DLT and prepare a summary for use by USCG leadership. We studied the foundations of DLT, analyzed DLT platforms developed for enterprise, and examined deployed DLT applications in USCG areas of interest. In this poster, we give a brief background on DLT technology and describe the utility of DLT with respect seafood traceability, inventory management, and counterfeit detection.

Background

- DLT is a **decentralized** system of accounting in which every participant maintains a full copy of the ledger, and all ledgers are kept in synch via **consensus mechanisms**.
- Blocks** store sets of transactions. The blocks are joined by cryptographic links, which prevent tampering with past transactions. The entire ledger is made up of these linked blocks, hence the term ‘**blockchain**’.
- An **asset** is any currency or object managed by a DLT.
- Smart contracts** provide a mechanism to automate transactions fairly via DLT. They are self-executing units of code that can govern assets.
 - Smart contracts may interface with additional software such as sensors and adapt chain operations accordingly.
- The early DLTs used for cryptocurrencies were **permissionless**, meaning anyone could join the system and contribute to consensus. In enterprise applications, **permissioned** blockchains are preferred to maintain a higher level of trust.



USCG Use Cases

Choice of Platform

We have determined that Hyperledger Fabric (HLF) is the preferred platform for enterprise DLT tools at this time. In [8], HLF was found to be both the most popular platform in enterprise and the platform with the highest percentage of market-ready projects. Furthermore, in [6] Hyperledger Fabric ranked the highest among 24 DLT platforms for its scalability, interoperability with existing software, ease-of-use, security, and community availability.



Use Case 1 – Seafood Traceability

Problem: Illegal, unregulated, and unreported (IUU) fishing threatens sustainability, food security, and the livelihoods of coastal workers. DLT has been proposed as a method of increasing visibility within the supply chain and validating the providence of legitimate seafood products.

DLT Solution: The IBM-developed **Food Trust** is HLF-based DLT designed to enhance traceability in food supply chains. Pilot studies are currently being evaluated by Wal-Mart, Nestle, and Unilever with promising initial results.



Use Case 2 – Inventory Management System (IMS) for Aircraft Spare Parts

Problem: Aircraft spare parts management (ASPM) requires extensive record keeping and tracking between entities to ensure safety and efficiency of operations. DLT could reduce errors and enhance data integrity between organizations.

DLT Solution: Honeywell has implemented a blockchain-based market called **GoDirect Trade** for aircraft spare parts. Honeywell credits the scalability of the online market to automation via smart contracts.



User Case 3 – Counterfeit Detection in Pharmaceuticals

Problem: Up to 10% of the world’s pharmaceuticals are counterfeit, posing serious and sometimes lethal risks to patients. The issue is compounded by a fragmented supply chain making recalls more difficult once a fraudulent drug has been identified [7].

DLT Solution: **Mediledger** is an HLF based system that allows patients and health officials to track drugs throughout the supply chain to ensure authenticity and aid with recalls if a counterfeit or contaminated products are identified. Gilead, Bayer, and Pfizer are currently involved with pilot testing for this system.



Conclusions

After surveying the existing platforms and use cases for DLT in enterprise, we have concluded that this technology could be useful to the missions of the USCG. Although enterprise DLT is still in its infancy, we have found either working tools or successful proof-of-concept projects based on DLT in each of the USCG’s domains of interest as well as evidence that a DLT solution could be effective where other technologies have failed. Additionally, we recommend Hyperledger Fabric as the platform of choice due to its permissioned nature, scalability, interoperability, expansive library, high customizability, and ease of use, especially with respect to smart contracts. Our work has cumulated into a comprehensive survey of DLT technologies in enterprise that will be delivered to USCG leadership at the conclusion of the summer. .

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