

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 [4]. Recently, DLT has shown promise in enterprise applications such as supply chain management, finance, and digital ownership [3]. 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 [5].

This summer, we worked with the United States Coast Guard (USCG) to study several 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 potential use of smart contracts by USCG. 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. In this poster, we give a brief background on DLT technology structure and USCG usage of smart contracts.

Initial Approach

This was our initial exposure to blockchain technology, we explored tech blogs and research papers. One of the primary challenges during our basic research process was a lack of accurate sources. Many blogs and research papers that we explored during this initial phase had obvious and glaring factual errors.

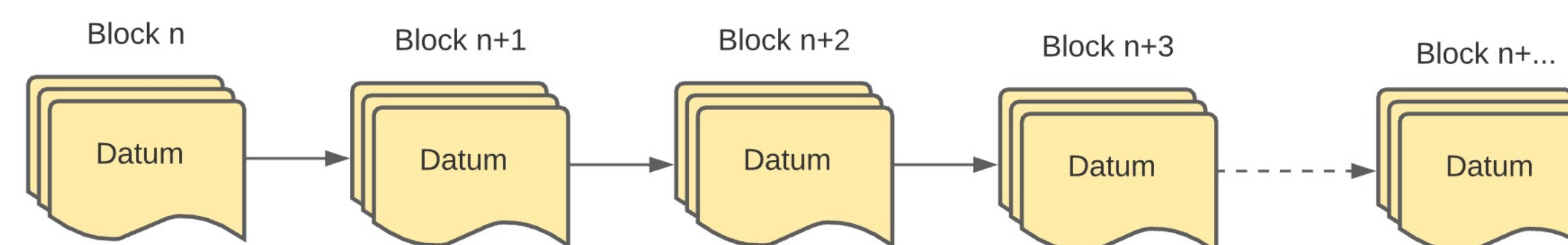
During the next phase, exploratory research, we explored implementing and using smart contracts to enforce fishing regulations.

References

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3. Al-Jaroodi, J., & Mohamed, N. (2019). Blockchain in Industries: A Survey. IEEE Access, 7, 36500–36515.
4. Nakamoto, S. (2008). *Bitcoin: A Peer-to-Peer Electronic Cash System*. 9.
5. Vadgama, N., & Tasca, P. (2021). An Analysis of Blockchain Adoption in Supply Chains Between 2010 and 2020. *Frontiers in Blockchain*, 4, 610476.

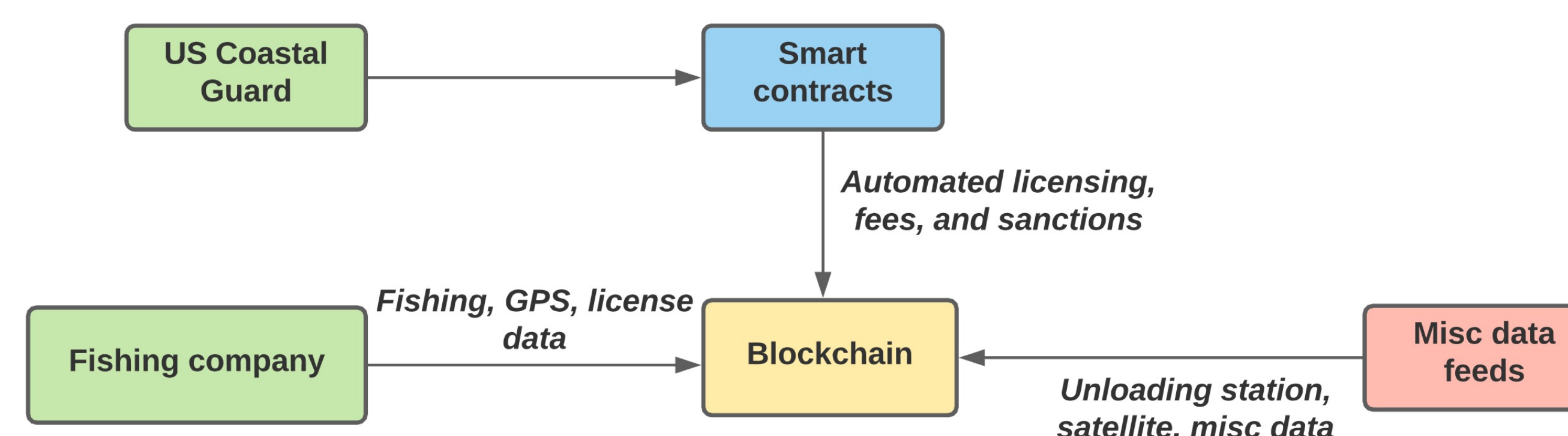
Outcomes / Results

Blockchain for Smart Contracts



- Blockchain is made of numerous blocks. Each block is connected to the previous one, and they are all composed of datum.
- Typically, each node on a blockchain network carries a local copy of the chain. This redundancy provides the chain with data integrity.
- The datum within each block may contain code for executable programs.
- The code for executable programs is mapped to specific accounts. These accounts are called Smart contracts.

USCG Fishing Smart Contracts



- Fishing companies are required to provide specific data to the blockchain. This includes fishing data, GPS coordinates, and licenses.
- USCG creates and controls smart contracts that monitor the blockchain.
- Fishing companies provide the blockchain with their documentation, once verified by a smart contract, a fishing license can be automatically issued.
- Smart contracts can monitor GPS and fishing data and issue warnings, fines and sanctions based on any detected discrepancies.

Contribution

Constructed detailed process diagrams for current cryptocurrency DLTs and simple smart contract use cases. Additionally, we created realistic USCG fishing licensing process use case and generated relevant process diagrams. We analyzed these diagrams to obtain insight about utilization of these technologies by the USCG.

Conclusions

Based on our current research, blockchain technology can be a useful tool for USCG operations, including licensing fishing companies and curbing IUU fishing. Blockchain requires fishing companies to provide data which creates immutable ledgers. This requires permanent logging of database updates. Additionally, the redundancy provided by this technology can guarantee that government audits have access to unaltered data.

Second, smart contracts are capable of actively monitoring the blockchain and data feeds; based on this information, a hypothetical smart contract can execute different tasks, including Issuing licenses, fines, and sanctions. For example, smart contracts can monitor vessel activity via GPS data. In the case that a unit is not reporting data for a set amount of time, USCG’s smart contracts can issue fines and revoke the fishing license. This can be done without human interaction.

Acknowledgements

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