Thesis Project Portfolio

Designing a Native AWS System to Classify Server Reboots in Real Time

(Technical Report)

Blockchain Technology For Carbon Credit Management: Assessing Organizational and Cultural Implications

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

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In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Table of Contents

Sociotechnical Synthesis

(Executive Summary)

Ethical Innovation: Exploring Cloud Computing and Blockchain in Sociotechnical Systems

As innovation continues to advance at a rapid rate, it is important to always consider the societal implications that constant development has. My thesis portfolio examines the unique intersection between technical solutions and characteristics of sociotechnical systems. The first section of the portfolio is a technical report centered around designing a real-time server reboot classification system, utilizing the advanced capabilities of Amazon Web Services (AWS). This report shows the efficiency and scalability of cloud computing, and also emphasizes the importance of responsive systems. The second section of the portfolio investigates the potential of blockchain as a tool for carbon credit management, and its solution to existing organizational and cultural problems within the system. By examining these two projects in this portfolio, my work illustrates the role of STS perspective in engineering. It demonstrates the importance of technologically driven solutions alongside the consideration of cultural and organizational values in fostering important change.

In the technical portion of my portfolio, I was tasked with creating a solution that would improve server classification within my respective AWS organization. This project involved designing a native AWS system capable of processing server logs in real time, addressing a critical need within the existing infrastructure. The solution utilized a multitude of AWS services, including the integration of S3 buckets for log storage, Lambda functions for string processing, and an Amazon Aurora Database for data management. The system was developed using GoLang, chosen for its efficiency and similarity to C/C++ in terms of speed and memory management. These choices in design helped achieve the goals of the project by reducing latency in server reboot classification from 15 minutes to just under a few seconds. The success of the project demonstrates the potential of cloud computing in real-time analytics as well as managing the health of hardware infrastructure.

In the STS research portion of my portfolio, I explored the topic of blockchain and its potential application in carbon credit management. A carbon credit represents the avoidance of emitting one metric ton of carbon dioxide into the atmosphere. They are generated by projects that reduce carbon emissions, such as renewable energy initiatives. Companies and individuals can purchase these credits as a way to offset their own carbon emissions. I decided to explore this topic based on the current challenges faced by the carbon credit system. These issues include fraud, inconsistent standards, lack of transparency, etc. Using IBM Food Trust as a case to study, I proposed blockchain, which has characteristics such as an immutable ledger, decentralization, and smart contracts, as a fix to the carbon credit system. This research proposed that blockchain could not only enhance the credibility of carbon credits, but also address key organizational and cultural challenges within the system. By focusing on the potential of blockchain in improving transparency, consistency, and accountability, the study highlights the role of STS perspectives in addressing global challenges. The impact of this research extends beyond the context of carbon

credits, as it suggests a framework for applying new technology to foster ethical and societal advancements.

The integration of these two distinct, yet complementary projects, highlights the importance of considering technical, organizational, and cultural aspects of a system. This approach exemplifies the principles of STS in engineering, especially the importance of innovating while maintaining ethical and social standards. The technical portion of this portfolio demonstrates the capabilities of cloud computing, in addition to raising awareness to real-time data processing and security. The STS research, on the other hand, focuses beyond the technical analysis of blockchain and carbon credits, diving into the organizational and cultural impacts of innovation. The incorporation of both projects in my portfolio highlights the role of technical solutions as not simply being evaluated on efficiency, but also by their compatibility with societal necessities and ethical norms. The comparison of the technical and STS research elements in this project serves as an illustration of how engineering solutions can be both innovative and socially responsible when viewed through an STS lens. Ultimately, this combination of technical and STS research serves as a reminder to engineers to evolve from problem-solvers to holistic thinkers who consider the relations between technology, society, and ethics. It emphasizes the importance of engineers as not only innovators, but also as drivers in the standard of ethical and societal properties.