



The Center of Excellence for Communication Systems Technology Research

## CECSTR CURRENT RESEARCH PROJECT ACTIVITIES

**Research Topic:** Development of a Blockchain and Edge Computing Security Integrated System Research for IoT Systems for Oil and Gas Industry

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### Synopsis of the Research Project

In the more than ten years since blockchain technology came into existence, there has been a steady trend in many industries in its application in cybersecurity. However it is only in the past two years that the oil and gas industry began to work with blockchain because it can significantly improve the management level, efficiency, and data security of the oil and gas industry. Hence, our interest in exploring how blockchain technology can be applied specifically to the oil and gas industry in the area of security and other relevant viable alternatives.

It has been found that blockchain has great potential in the oil and gas industry specifically in the areas of cybersecurity, trading, management and decision-making, and supervision [1], [2]. Blockchain is a major technology that can now be used in the management of decentralized systems. It has also gained momentum in many application areas such as healthcare systems, precision agriculture and smart grid. Blockchain operates as a decentralized ledger that can be used to verify and store records of transactions and has been shown to perform better than its counterpart systems that are based on centralized digital ledgers.

However, utilizing this core technology in resource-constrained mobile devices is very much limited because of high demands of resources and poor scalability with frequent-intensive transactions. This becomes absolutely necessary to look at edge computing which can be integrated to facilitate mobile devices in offloading their mining tasks to cloud resources in the era of millimeter communication systems. The main stumbling

blocks still remaining in this integration process is the realization of the security aspects and the decentralized management in edge computing. This integration process has the capability of ensuring key reliable access, distributed computation and untampered storage for scalable secure transactions. Many studies have been conducted in the exploration of suitable architectural requirements, and some of the researchers have applied the integration to deploy some of the specific applications.

Despite the ongoing efforts for a suitable platform for block chain deployment in the oil and gas industry applications; anonymity, adaptability and data integrity are crucial issues that are yet to be solved to ensure safe storage of data. Since only pseudonyms are guaranteed in blockchain, and integrity relies only on massive numbers of honest miners and Proof-of-Work's (PoW's) complexity (which also affects the scalability); investigation for appropriate technologies to provide stronger anonymity than just pseudonymity and achieve adaptable data integrity must be investigated further to achieve an edge-based practical, secure decentralized data storage which this study will do. This study will also explore the use of wavelets in the analysis of the information that may be needed in the cybersecurity applications.

Edge computing also faces cyber-attacks. The cyber-attack, such as the denial of attack, man-in-the-middle attack at the edge computing can cripple the oil and gas applications. Although the IT-based firewall protection can protect some of the cyber-attacks, it is not a bullet-proof solution. A zero-day attack is difficult to detect in any of the IoT environments applied to oil and gas. Artificial intelligence (AI) can be implemented to detect a zero day attack, but AI requires a good training dataset for IoT applications. There are not many suitable IoT datasets for this purpose. This study will also focus both on the blockchain to achieve an Internet of Things (IoT) design supported by edge computing to acquire security and scalability levels needed for integration and proper resource management, and network intrusion detection (NID) for edge computing system by developing a new IoT dataset and artificial intelligence-based NID system suitable for oil and gas industry.

## Research Expectations

This research is expected to yield the following results:

- Development of a blockchain-based edge computing security network for oil and gas industry.
- Suitable architectural network requirements applicable to the integration and deployment to some specific IoTs useable in oil and gas system applications.
- Development of a suitable platform for blockchain deployment in oil and gas industry IoT applications ensuring anonymity, adaptability and data integrity for safe storage of data.
- Investigation for appropriate technologies to provide stronger anonymity than just pseudonymity capable of achieving adaptable data integrity that must further achieve an edge-based practical, secure decentralized data storage.

- Implementation of an artificial intelligence (AI) that can detect a zero day attack with good training dataset for IoT oil and gas applications.
- Exploring the use of wavelets and wavelet transforms in the processing of information related to oil and gas cybersecurity.
- Finally, developing a test bed capable on focusing both on the blockchain to achieve an Internet of Things (IoT) design supported by edge computing to acquire security and scalability levels needed for integration and proper resource management, and network intrusion detection (NID) for edge computing system by developing a new IoT dataset and artificial intelligence-based NID system with specific applications to oil and gas.

## **Reference**

- [1] Deloitte. (2017). Blockchain: Overview of the Potential Applications for the Oil and Gas market and Related Taxation Implications. [Online]. Available: <https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Energy-and-Resources/gx-oil-gas-blockchain-article.pdf>
- [2] M. Koeppen, D. Shrier, and M. Bazillian. (2017). Is Blockchain's Future in Oil and Gas Transformative or Transient? Deloitte [Online]. Available: <https://www2.deloitte.com/content/dam/Deloitte/de/Documents/energy-resources/gx-blockchain-report-future-in-oil-and-gas.pdf>