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Tentative Research Title: Enhanced Broadband Communication Systems Optimization in a 5G Era:
Analysis, Testing, Measurement Using Blockchain, AI and ML and 5G Broadband Networks Integration
for Cognitive Radio Networks

Period of performance: Spring 2023 – Spring 2026

Synopsis of the Research Project

In the era of 5G wireless broadband networks, future technologies are potentially being revolutionized. The 5G broadband technologies are expected to foresee the demands of diverse vertical applications with various requirements, including high traffic volume, massive connectivity, high quality of service, high security and low latency. To fulfill such requirements in 5G and beyond, new emerging technologies such as Software-Defined Networking (SDN), Network Functions Virtualization (NFV), Multi-access Edge Computing (MEC), and Creative Commons (CC) are being deployed. However, these technologies raise several issues regarding transparency, decentralization, and reliability. Furthermore, 5G broadband networks are expected to connect many heterogeneous devices and machines, which will raise several security concerns regarding users' confidentiality, data privacy, and trustworthiness. To work seamlessly and securely in such scenarios, future 5G broadband networks need to deploy smarter and more efficient security functions. In view of the aforementioned issues, this research proposes to explore how blockchain can be deployed to overcome the 5G issues because of its capacity to ensure transparency, data reliability, trustworthiness, and immutability in a distributed environment. In our previous work with blockchain, we noted that blockchain had gained momentum as a novel technology that gives rise to many new decentralized technologies [1]. In this research work, we will explore the integration of the blockchain with 5G broadband networks and beyond.

Contributions to knowledge are expected to be made through research into 5G broadband technologies with cognitive radio for efficient identification and utilization of bandwidth; security enhancement of 5G networks through blockchain research; and for enhanced resource management of 5G O-RAN cloud applications.

Research Expectations

We intend to explore the areas of new 5G broadband communication services and networks such as:

1. Develop a 5G network architecture in a lab setting for research and training in broadband communication systems
2. Develop the testbed for the implementation using Firecell's Lab Kit to implement the architecture in a lab research environment.
3. Explore the integration of the blockchain with 5G broadband networks and beyond.
4. Further, explore the application of artificial intelligence and machine learning in the management and application of 5G broadband communication systems network architecture.

Some of these 5G broadband communication systems network challenges become more of a concern with the tremendous growth in the wireless industry. Therefore, for your doctoral research task, starting Spring Semester 2023, do the following as a start:

1. Do a literature survey of about 20 most recent papers in the last 5 to 10 years in the areas mentioned above.
2. Summarize the papers in a report format.
3. Prepare Power Presentation of the Findings.
4. Prepare the paper summary in IEEE paper format for publication
5. Develop ideas on how to implement items (1) to (4) above.

Reference

- [1] K. Eze, C. M. Akujuobi, S. Hunter, S. Alam, S. Musa and J. Foreman, "A Blockchain-based Security Architecture for the Internet of Things," *WSEAS Transactions on Information Science and Applications*, vol. 19, no. 2, pp. 12-22, 2022.