# Assignment Two

## Student Information

Name: Liguoze

Student Number: 2024140793

Class Number: 310

## Abstract Review

### Original Abstract

The global adoption of blockchain technology, driven by financial tools such as Bitcoin and Ethereum, has led to an increasing demand for high-performance systems. However, existing performance optimization approaches primarily focus on two directions: simplifying consensus protocols and parallelizing consensus processes. Simplified protocols aim to reduce consensus overhead and improve efficiency, yet they often fail to fundamentally resolve the inefficiencies of consensus mechanisms, especially in large-scale node environments where system throughput declines rapidly. Parallelization can enhance throughput but frequently introduces additional complexity and tightly coupled architectures, reducing system adaptability.

To address these limitations, we propose Streamline, a functionally decoupled multi-leader consensus protocol for permissioned blockchains that decouples transaction distribution from consensus processes. This innovative design achieves structural flexibility and high-throughput performance without added complexity. The proposed protocol integrates horizontal parallelism—enabling multiple consensus instances to operate simultaneously—with vertical decoupling, which separates data distribution from consensus. This dual-parallelism structure removes single-leader bottlenecks and provides a flexible, extensible framework for distributed ledgers consensus. Furthermore, the protocol incorporates an efficient and lightweight load-balancing mechanism to ensure balanced workload distribution and maintain consensus stability.

Compared to the latest consensus protocols, our approach demonstrates stable scalability and adaptability, incurring lower performance degradation as the network scales while maintaining more stable throughput and latency. Experimental results validate the protocol's scalability and adaptability in complex real-world environments.

### Structured Abstract

Background & Motivation: The global adoption of blockchain technology, driven by financial tools such as Bitcoin and Ethereum, has led to an increasing demand for high-performance systems. However, existing performance optimization approaches primarily focus on two directions: simplifying consensus protocols and parallelizing consensus processes. Simplified protocols aim to reduce consensus overhead and improve efficiency, yet they often fail to fundamentally resolve the inefficiencies of consensus mechanisms, especially in large-scale node environments where system throughput declines rapidly. Parallelization can enhance throughput but frequently introduces additional complexity and tightly coupled architectures, reducing system adaptability.

Methods: We propose Streamline, a functionally decoupled multi-leader consensus protocol for permissioned blockchains that decouples transaction distribution from consensus processes. The proposed protocol integrates horizontal parallelism—enabling multiple consensus instances to operate simultaneously—with vertical decoupling, which separates data distribution from consensus. This dual-parallelism structure removes single-leader bottlenecks and provides a flexible, extensible framework for distributed ledgers consensus. Furthermore, the protocol incorporates an efficient and lightweight load-balancing mechanism to ensure balanced workload distribution and maintain consensus stability.

Results: Compared to the latest consensus protocols, our approach demonstrates stable scalability and adaptability, incurring lower performance degradation as the network scales while maintaining more stable throughput and latency. Experimental results validate the protocol's scalability and adaptability in complex real-world environments.

Conclusions: The Streamline protocol successfully addresses the limitations of existing approaches by providing a novel solution that combines structural flexibility with high-throughput performance. The innovative design achieves these improvements without adding complexity, making it a promising solution for future blockchain implementations.

### Review Comments

The abstract is generally well-structured and comprehensive, but there are several aspects that could be enhanced to make it more impactful. Here are my suggestions:

In terms of content, I think it would be beneficial to include more quantitative data in the Results section. For instance, specific performance metrics or comparison data with existing protocols would strengthen the argument. The Background section could also benefit from concrete examples of current blockchain performance challenges to make the problem statement more tangible.

Structurally, I suggest splitting the Background section into two paragraphs - one for the general context and another for specific challenges. This would improve readability. Additionally, a brief section highlighting key innovations between Methods and Results would help emphasize the study's contributions.

Regarding language, some technical terms like "horizontal parallelism" and "vertical decoupling" might need brief explanations for readers who are not deeply familiar with the field. The Methods section could be more engaging by using active voice. Also, the transitions between sections could be smoother with better connecting phrases.

For presentation, I recommend using bullet points to list key features in the Methods section and a table format to compare performance metrics. The Conclusions section could be more focused by emphasizing the broader impact of the research.

## Reviewer Information

Name:

Student Number: