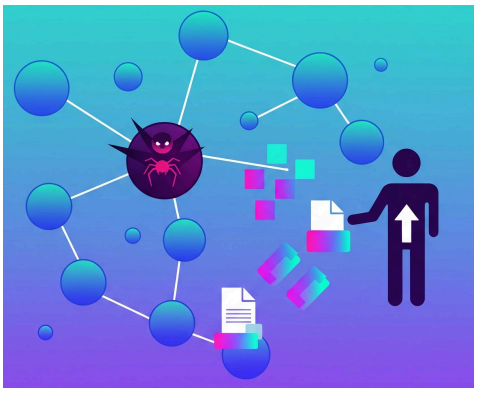
Optimizing Decentralized Storage in an Incentive-compatible way

The digital world is increasingly reliant on vast amounts of data, necessitating robust and scalable storage solutions. Traditional centralized systems have inherent vulnerabilities, including single points of failure, censorship risks, and privacy concerns. Decentralized storage offers a compelling alternative, distributing data across a network of independent nodes. While promising, making such systems truly effective and scalable requires clever protocols and implementations to minimize the overhead. Ideally, these protocols do not just keep the data volume stored and transferred low but ensure alignment with the motivation of the nodes' operators. This means incentives must be considered: how do we ensure participants are motivated to contribute bandwidth, storage, and processing power? Without proper mechanisms, rational actors might act selfishly, undermining the system's integrity or performance. These theoretical challenges directly impact practical issues: real-world networks suffer from unreliable connections, varying node capabilities, and the threat of malicious behavior.



This master's thesis will delve into these interconnected problems. You'll investigate how to make efficient decentralized storage protocols incentive-compatible, ensuring participants are aligned with the system's goals. You will work together with experienced researchers from DFINITY, the main contributor to the Internet Computer Protocol. Your research will focus on one or several aspects of the following:

- Develop and implement protocols that reduce communication and storage overhead during all operational tasks while maintaining strong data integrity and availability, even in the presence of unreliable networks or adversarial nodes.
- Explore incentive mechanisms that encourage honest and efficient behavior, directly impacting communication patterns and resource contribution.
- Analyze the trade-offs between theoretical communication efficiency, economic incentives, and the constraints of real-world deployment, identifying strategies for robust and practical decentralized storage.

Requirements

High motivation and strong foundation in distributed systems. A solid mathematical background is essential, and prior exposure to areas like blockchain technology and game theory is helpful. To ensure your ideas will work in practice, implementing prototypes and benchmarking performance will complement the theoretical part of the thesis. We'll provide weekly guidance and discussion sessions to support you.

Contact

Interested? Please reach out with a brief description of your motivation in the project, along with any relevant courses or prior projects (personal or academic)

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