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Ph.D. DISSERTATION DEFENSE

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Title:	Fast Data Dissemination In Blockchain Networks
Chairperson:	Dr, Shucheng Yu, Department of Electrical and Computer Engineering, Charles V. Schaefer, Jr. School of Engineering and Science
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ABSTRACT

Fast data dissemination in blockchain networks is crucial for efficient and timely data propagation, maintaining the blockchain ledger, and validating transactions. Slow propagation leads to network congestion, delays in transaction confirmations, and increased fees, which can make the network less attractive to users. This work aims to enhance data propagation speed through multiple optimizations, including network layer protocols, forwarding strategies, and network topology. Optimized protocols, such as Anchor, improve data transmission and routing by leveraging Named Data Networking (NDN), which significantly reduces bandwidth consumption and latency. For example, Anchor provides structured data transmission that ensures secure and efficient propagation across the network. Forwarding strategies, like the A-C protocol, integrate erasure coding with a two-layer publish-subscribe mechanism to enhance data reliability and reduce redundancy. Additionally, an interrupt response mechanism probabilistically terminates data forwarding to minimize unnecessary transmissions, resulting in significant reductions in data redundancies and latency. Optimized network topology, exemplified by Vital, employs a probability-based structure and a genetic algorithm-driven wake-up mechanism to reduce traffic overhead and enhance security. Vital also integrates an NDN-inspired publish-subscribe model, further improving data dissemination efficiency. These comprehensive optimizations collectively enhance the scalability, security, and efficiency of blockchain networks. By ensuring efficient and accurate data propagation, they address core challenges such as network congestion, transaction delays, and high fees, ultimately making blockchain networks more viable and attractive to users.