ABSTRACT

Delay Tolerant Networks (DTNs) play a pivotal role in enabling communication in challenging environments where traditional infrastructure is inadequate. This study underscores vulnerabilities such as non-cooperative nodes and proposes the integration of blockchain technology to enhance security, privacy, and communication reliability within DTNs. The research delves into foundational DTN concepts, explores blockchain's broader applications beyond cryptocurrencies, and examines ad hoc network dynamics, particularly addressing intermittent connectivity issues and evaluating prominent routing protocols like Epidemic, Spray-And-Wait, MaxProp, First Contact, and Direct Delivery. The study integrates blockchain into The ONE Simulator framework for DTNs, leveraging smart contracts on private networks to fortify message validation and encryption processes. Detailed simulations optimize DTN performance metrics under blockchain integration, showcasing enhancements in delivery probabilities and reduced overhead, with Epidemic and MaxProp achieving up to 0.95 delivery probabilities and showing trends of 98.87% increase, and Spray-And-Wait demonstrating low overhead with an average of 223.94. Comprehensive simulations on The ONE Simulator underscore blockchain's efficacy in ensuring resilient message delivery and security under challenging conditions, including Sybil, Insider and DoS attacks. Future research directions aim to refine protocol performance further and expand network attack simulations, strengthening blockchain-enabled DTNs for critical applications in military and remote communication settings, thus advancing secure and resilient communication infrastructures.

Keywords: Delay Tolerant Network, Blockchain Integration, The ONE Simulator, Private Blockchain