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Advance Higher Throughput Communications and Networks for GEO and LEO satellites (3)

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BLOCKCHAIN & QUANTUM DATA PROCESSING FOR SECURE SATELLITE CONSTELLATIONS

Abstract

With evolving smart technologies, comes evolving threats. Meaning that one cannot pre-define the possible threats for an ever-rapidly-growing technology, making information repeatedly vulnerable to new threats. Traditional encryption methods are vulnerable to cyber threats, and centralized data management creates risks of single points of failure. The possible integration of blockchain technology with quantum data processing could very well be the solution to evolving threats, ensuring security, data integrity, and autonomous coordination with satellite network links for a rapid and robust system. With satellite constellations already becoming an integral part of life on earth (global communications, internet, GPS, Earth observation and more), essentially means that the need for an integral and well protected system is more now in need than ever. Vulnerabilities to satellite networks have the potential to destroy things at high stakes, from lives to economies.

This paper would aim to explore how blockchain could create decentralized, hack-proof data management across satellite constellations in specific. With the use of smart contracts, satellites could autonomously validate data exchanges, optimize orbital paths, and conduct self-repair protocols without relying on ground control to manage at every step. Further, quantum computing has the potential to revolutionize encryption through quantum key distribution (QKD), maybe even ensuring unbreakable cybersecurity against evolving threats posed by quantum decryption.

The paper would look into studying the feasibility of such an idea, of a blockchain-based quantum-secured satellite architecture and its possible vast applications, from space governance to spacecraft operations. Along with all that, the paper would also look into key challenges such as computational constraints, chain of operations, ground and space based systems, energy efficiency, cross-platform interoperability and more challenges that come with a complex yet innovative solution.

By looking at the possible merging of blockchain with quantum computing, this research proposes a secure and efficient framework for managing next-generation satellite constellations, towards a more resilient, autonomous and sustainable space infrastructure.