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PhD Dissertation Defense

Entitled

BLOCKCHAIN-BASED EHR SHARING USING SHARDING AND INTER-BLOCKCHAIN COMMUNICATION MODEL IN HEALTHCARE FEDERATION OF HOMOGENEOUS AND HETEROGENEOUS BLOCKCHAINS

by

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Abstract

Electronic health records (EHR) are important assets of the healthcare system and need to be shared among medical practitioners to improve the accuracy and efficiency of diagnosis. Blockchain technology has been investigated and adopted in healthcare as a solution for EHR sharing, enabling privacy and security to be preserved. Blockchain can revolutionize the healthcare system by providing a decentralized, distributed, immutable, and secure architecture. Due to healthcare security and privacy concerns, blockchain networks are adopted in private/consortium modes; thus, many blockchain networks work in silos in a federation. Scalability has always been a bottleneck in blockchain networks, as the number of participating nodes tends to increase in each network within the federation. The consensus mechanism in a blockchain establishes the rules for connected nodes to agree on maintaining a single view of the ledger with valid transactions among all peers so that all nodes can access the same information. Furthermore, achieving interoperability between independent blockchain networks (homogeneous and heterogeneous) constitutes a major hurdle for healthcare providers seeking to share EHR across a large-scale blockchain federation. This research aims to develop a blockchain federation for an EHR-sharing model in healthcare. Firstly, the main contribution of this research is to address the issue of scalability in healthcare blockchain networks by using a transaction-based sharding technique. Secondly, we propose an improved proof-of-authority (PoA) consensus algorithm for EHR sharing to provide a scalable mechanism for authority selection in PoA consensus algorithms. Finally, this research aims to solve interoperability challenges among independent blockchains using transaction-based inter-blockchain communication for EHR sharing in a federation of blockchains by incorporating the concept of global and local smart contracts in the network. The experimental results show the significance of our proposed methods in addressing the scalability and interoperability challenges in a blockchain federation for patient EHR sharing within the network and across independent blockchain networks deployed via different blockchain platforms.

Keywords: Healthcare blockchain, electronic health record sharing, consensus, scalability, interoperability, sharding, healthcare blockchain federation, inter-blockchain communication.