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Evaluation of Security and Performance of Master Node Protocol in the Bitcoin Peer-To-Peer Network

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Abstract : Bitcoin is a digital currency based on a peer-to-peer network to propagate and verify transactions. Bitcoin is gaining wider adoption than any previous crypto-currency. However, the mechanism of peers randomly choosing logical neighbors without any knowledge about underlying physical topology can cause a delay overhead in information propagation, which makes the system vulnerable to double-spend attacks. Aiming at alleviating the propagation delay problem, this paper introduces proximity-aware extensions to the current Bitcoin protocol, named Master Node Based Clustering (MNBC). The ultimate purpose of the proposed protocol, that are based on how clusters are formulated and how nodes can define their membership, is to improve the information propagation delay in the Bitcoin network. In MNBC protocol, physical internet connectivity increases, as well as the number of hops between nodes, decreases through assigning nodes to be responsible for maintaining clusters based on physical internet proximity. We show, through simulations, that the proposed protocol defines better clustering structures that optimize the performance of the transaction propagation over the Bitcoin protocol. The evaluation of partition attacks in the MNBC protocol, as well as the Bitcoin network, was done in this paper. Evaluation results prove that even though the Bitcoin network is more resistant against the partitioning attack than the MNBC protocol, more resources are needed to be spent to split the network in the MNBC protocol, especially with a higher number of nodes.

Keywords : Bitcoin network, propagation delay, clustering, scalability
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