Transaction distributed management using self-organization map in DAG-based blockchain NFT

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1. Introduction

DAG (Directed acyclic graph)-based blockchain was devised as a solution to the scalability problem of traditional blockchain, which is attracting attention as a distributed management technology. Previous studies of transaction partitioning and management in DAG-based blockchain did not consider NFTs (Non-Fungible Tokens), and cannot be applied to NFT. In this study, we propose a novel clustering system that can apply NFT using NFT attribute information to the SOM (self-organization map) to solve this problem.

2. Conventional Schemes

Previous research in DAG-based blockchain has several schemes. One of them is a Graph-partition Based Storage Strategy for DAG-based blockchain in Edge-cloud IIoT (GpDB) [1]. Other distributed management methods such as sharding and SNS networks for cars have been proposed [2]. These proposed schemes can support IoT or SNS information, but cannot directly support digital content such as NFT.

3. Proposed System

The proposed system clusters transactions using SOM and assign each node to any one of the clusters (Fig. 1). All nodes in a cluster share the same transaction information. NFT is assumed to have multiple attribute information (e.g., author information, creation date, etc.), and this attribute information is converted into a vector. This vector is mapped by using it in the SOM and then clustered by x-means. By dividing the transaction information into clusters, it is possible to reduce the amount of transaction information held by each node. It is assumed that all nodes maintain cluster information, cluster center of gravity, self-organizing MAP, and metadata for all Nodes.

When a new transaction is created, the following process is performed. STEP1: Node_A generates an NFT transaction. STEP2: Node_A retrieves vector data using the NFT "token_id". STEP3: Node_A identifies clusters using the vector data and identifies the node belonging to the cluster (Node _B) are identified. Node_A sends the transaction to Node_B by searching of metadata of all Nodes. STEP4: Transaction received by Node_B is propagated through the clusters and stored in all nodes in the cluster of Node_B (Fig. 2).

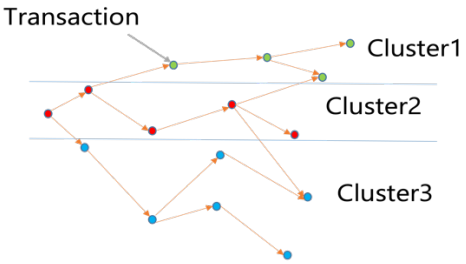

Fig. 1 Proposed system overview.

This system has two main features: one is that it is based on the NFT system so that each transaction can be classified in a self-reliant and decentralized manner using the information from the NFT. The other is that it is simple to determine the distributed placement using a self-organizing MAP.

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References

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[2] W. Yang, X. Dai, J. Xiao, and H. Jin, "LDV: A Lightweight DAG-Based Blockchain for Vehicular Social Networks", IEEE Transactions on Vehicular Technology, vol.69, no. 6, pp. 5749 - 5759, January 2020.

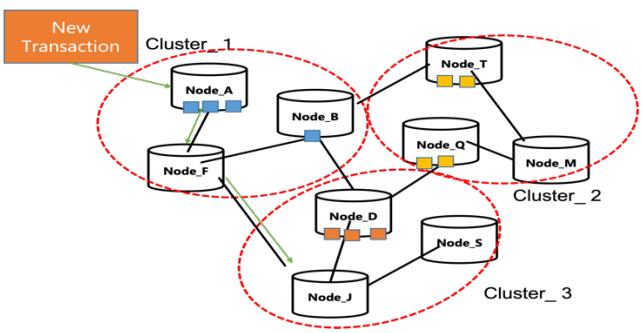

Fig. 2 New transaction generation in the proposed scheme .