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DECENTRALIZED GOVERNANCE: DECISION-MAKING BASED ON VOTING

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1. Introduction

Nowadays there is a trend toward decentralization of applications and services in business and social arenas. Distributed computer systems, although managed by a centralized authority, can still meet the demands for decentralization via an inbuilt voting mechanism. The main goal of this work is to develop approaches for decision-making in Decentralized Autonomous Organizations (DAOs) by voting on the Waterfall platform [1], [2], in particular, via the rule of choosing one alternative out of two, with the possibility for the voter to indicate their level of support for each alternative.

The use of the classical Borda [3] procedure with the implementation of

representative democracy is proposed, to choose one alternative out of several. In this procedure, the problems of scalability and the duration of a voter's ratings are avoided in such cases, as representative democracy and voting by the majority rule. We also provide an analysis of the influence of voters on decision-making in a DAO as a form of representative democracy. In this case, the interaction of voters is modeled as a cooperative game in which the solution is determined by the Shapley vector [4] – a sustainable distribution of payoffs of the grand coalition.

2. Waterfall Platform Overview

Waterfall is a highly scalable public smart contract platform for the development of various decentralized applications (Dapps) ([1], [2]) with a specially designed tokenomic model [5]. A native coin (Water) serves as a main network digital asset that allows for the transferring of transactions, running of smart contracts, governance voting, and auxiliary token creation, forming an ecosystem with the prospect of synergistic interaction of all its elements. The Waterfall platform ensures a favorable environment for the provision and consumption of a wide spectrum of enterprise-class services for business and social activities, in a convenient format within the framework of a public decentralized network. The efficiency of this platform is dependent on successful collaboration between the Coordinating network and Shard networks (Figure 1).

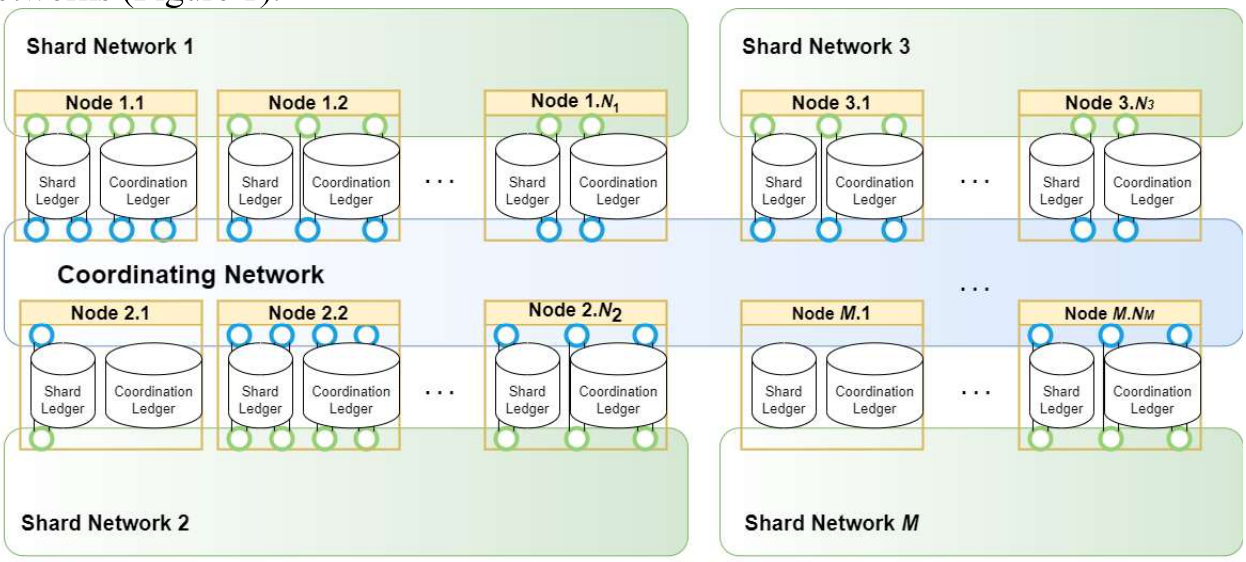

Figure 1 - Coordinating network and Shards

The Coordinating network manages Shards, thereby enhancing security and synchronization across the platform. Shards are created for specific tasks. They are built according to their principles (heterogeneously) and interact with the Coordinating network based on common requirements and a common interface. Therefore, this cohesive ecosystem fosters synergistic interactions among all its components, offering the promising potential for enhanced collaboration and interconnectivity of both individual users and enterprises.

3. Decentralized Governance

Decentralization in contemporary computing systems mainly means the independent functioning of a sufficiently large number of autonomous servers (nodes), coordinating input data and work results, with a special system of

governance in which no concentration of authority exists in any single element of the system. Generally, DAOs are regulated as a set of rules recorded in computer software that covers the full spectrum of participants' interactions. However, such software and system rules should be upgraded over time to account for new technical capacities and business possibilities. Therefore, those interested in the successful development of a platform must periodically change its technical and economic mechanisms by making some proposals for improvements. Communities should also be able to select which new promising development projects they will support and implement. This will provide the platform with greater transparency and credibility, allowing it to respond to societal demands, and to change external circumstances to ensure its further sustainable functioning and effective growth. When a platform lacks a centralized governing authority, certain questions arise that must be examined in detail. Who determines the list of proposals to be considered? How to discuss and predict possible effects on the platform as a whole? Who has the right to make decisions? What is the process for evaluating and accepting/declining the presented proposals? How will the accepted decisions be implemented?

We should note that, generally, participants can join or leave public platforms at will. When doing so, some of them may be incompetent, unreliable, or malicious, and may even be involved in a conspiracy. Therefore, an effective governance system is crucial for the self-sustainable functioning of public platforms. In most cases, such platforms have an ad-hoc model to support decision-making.

Our prime aim was to analyze the voting procedures used as a form of governance and decision-making in DAOs and to develop decision-making procedures based on voting for the Waterfall platform. The voting-based decision-making mechanisms we have developed provide for the implementation of both a direct form of democracy (each subject can cast its vote directly) and a form of representative democracy (a certain set of voters is allocated to represent other subjects of the blockchain system in voting, and those other subjects can transfer their vote to one of the voters from this set). In this case, we additionally analyze the degree of influence of each voter and all possible coalitions. The interaction of voters in this case is modeled after a cooperative game.

The main difficulties in designing a DAO are the communication and coordination issues of an online decision-making system with a managed process or organization. Building a secure electronic voting system that ensures fairness and privacy while providing transparency and flexibility has long been a challenge. Centralization of the voting system was convenient for a centralized form of government and was considered natural. However centralized voting has disadvantages. For onsite voting, characteristic disadvantages include challenges of voter turnout, high costs, the possibility of manipulating ballots, and lack of confidence in the vote count. For online voting, disadvantages include vulnerability to cyberattacks, lack of anonymity, the possibility of data manipulation, lack of confidence in the vote count, etc.

4. Results

Ensuring open and fair democratic governance based on decentralized platforms is a good basis for any system of sustainable development and the preservation of the

environment. We have developed and proposed approaches for decision-making in DAOs by voting on the Waterfall platform, in particular, the rule of choosing one alternative out of two, with the possibility for the voter to indicate their level of support for each alternative. This procedure prevents the loss of the opinion of those voters who practically do not like any of the alternatives and also determines the overall level of support for each alternative.

To select one alternative out of several, it is proposed to use the majority procedure – a modification of the relative majority rule with elimination, which involves the implementation of the electoral process in two rounds. To choose one alternative out of several, the application of the classical Borda procedure with the implementation of representative democracy is proposed. It is shown in this case the problem of scalability and the problem of the duration of voters' ratings are avoided.

Also, in the case of the implementation of representative democracy and voting by majority rule, an analysis of the influence on the decision-making of voters to whom other subjects of the DAO have delegated their votes is provided. In this case, the interaction of voters is modeled as a cooperative game, in which the solution is determined by the Shapley vector – the sustainable distribution of the winnings of the grand coalition.

At the time of writing the work, the Waterfall platform is implemented as a test network, and load experiments are conducted with 2,048 AWS (Amazon Web Services) nodes. The main network is going to be launched in the first quarter of 2024.

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