



Design of Regional Sharing Model of Enterprise Accounting Information Based on Blockchain Technology

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Abstract. In practice, there are too many sharing channels in the regional network, which leads to the low practical performance of the traditional enterprise accounting information regional sharing model. In order to solve this problem, this paper proposes a regional sharing model of enterprise accounting information based on block chain technology. Building a shared model framework based on block chain technology, carrying accounting model in the framework, and sorting out accounting information. Then build the sharing channel for different types of accounting information and deploy the sharing protection mechanism to further protect the security of enterprise information. The experimental results show that compared with the traditional shared model, the proposed model has better fault tolerance and higher throughput, and its overall application practicality is superior to the traditional shared model.

Keywords: Blockchain technology · Enterprise accounting information · Regional sharing · Sharing protection mechanism

1 Introduction

At present, blockchain has attracted the attention of all walks of life in the world, and there are different opinions on blockchain technology. Blockchain is applied in various industries, but the research depth is not enough [1]. Some foreign financial institutions are studying the blockchain, while the domestic ones are studying the blockchain by people in various industries and at all stages, resulting in a flood of blockchain development, which inevitably leads to insufficient development depth and uneven results [2].

Blockchain has been applied in various industries, such as the following fields: in the financial field, blockchain technology can make use of the coherence and cohesion between nodes to reduce the participation of third-party intermediaries, so as to realize the direct contact between nodes, reduce costs and improve the efficiency of transactions; The application in the field of the Internet of Things mainly makes it possible to reduce the cost of logistics through some characteristics of the blockchain technology, record the production and transportation process of products, and form a comprehensive supply chain management mode. Applications in the field of public service, chain block

technology to the public management in the energy and transportation, etc. are inter-linked, let these technologies more close to the daily life, and be able to solve the quality problems in some areas, in the field of digital copyright applications, through regional chain technology, encryption feature to identify the true and false goods, to effectively lifecycle of digital rights management [3].

In enterprise management, there are great security risks in Regional Sharing of accounting information. In the process of information sharing, different regional channels or channel subnets may lead to the emergence of “information island” because of economic interests, data ownership and other factors. The private information owned by different subnets can not be circulated, which affects the social production efficiency and consumes repeated human and economic costs. In addition, it is contrary to the original intention of decentralization [4]. Usually, in an alliance chain environment with multiple channel structures, different channels need to communicate with each other, and all the organizations in the two channels can be added to a new channel, but this will force the unrelated organizations in the original channels to join them, which will make the whole network too bloated [5].

With the innovative development of science and technology, information construction is becoming more and more perfect, and the construction of regional sharing model of accounting information of various enterprises is also gradually improved. Later because of domestic block chain technology development, combined with industry is not very widely used, the chain blocks the development of technology is limited in certain areas, and can be used to make it to get comprehensive development difficult, which requires more and more people actively research and promote the application of the block chain technology, for the enterprise accounting information sharing model construction to provide technical support, Make its development more and more high-end, more and more high technical content.

Therefore, based on a large number of existing literature, in order to improve the application advantages of the sharing model, this study designed a regional sharing model of enterprise aggregated information based on blockchain technology. First of all, the sharing model framework is built based on blockchain technology, and the accounting model is equipped in the framework, so as to realize the analysis and sorting of accounting information. Then, special sharing channels are built for different types of accounting information, and sharing protection mechanism is deployed to further protect the security of enterprise information. The simulation results also prove that the model has the advantages of better fault tolerance and higher throughput.

2 Model Design

2.1 Model Frame Design

The model adopts the basic architecture of blockchain model, including P2P network, message propagation mechanism, block data structure, etc. the specific architecture is shown in Fig. 1.

In addition to the basic architecture of blockchain technology, the basic framework of the model also includes: the interaction between the credit reference institution and

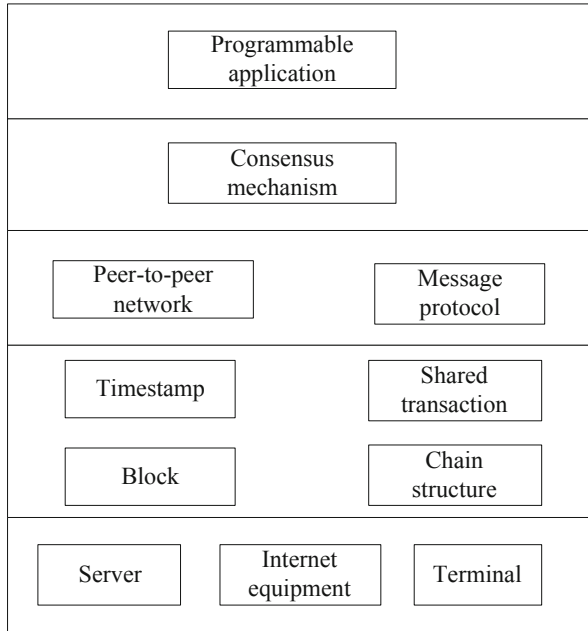


Fig. 1. Technical architecture of blockchain

the information subject. The credit reference institution needs to obtain the user's authorization for the requested data first, and then the credit reference institution can send a request to the credit information provider to obtain the corresponding data by virtue of the authorization information signed by the information subject [6]. In the interaction with the cloud server, after receiving the request, the credit information provider encrypts and uploads the relevant data to the cloud server according to certain data format requirements. In order to protect the rights and interests of the credit information provider, the credit information provider initiates the transaction containing the summary, request object, metadata and other information of the uploaded data to the blockchain node to obtain the upload voucher [7]. The request records of user authorization and credit reference institutions, as well as the data information uploaded by credit information providers are recorded on the blockchain. The blockchain has the characteristics of non tampering and traceability, and is jointly maintained by multiple nodes. Therefore, it can be used as the basis for conflict handling and provide a fair and reliable credit information sharing environment [8].

In the interaction with regulators, it is inevitable that there will be some disputes in the sharing of credit information. Therefore, the model includes regulators as the authority of dispute settlement to protect the rights and interests of all participants. The basic framework of enterprise credit information sharing model based on blockchain technology is shown in Fig. 2.

According to the actual needs of enterprises, the accounting model is carried on the shared model framework.

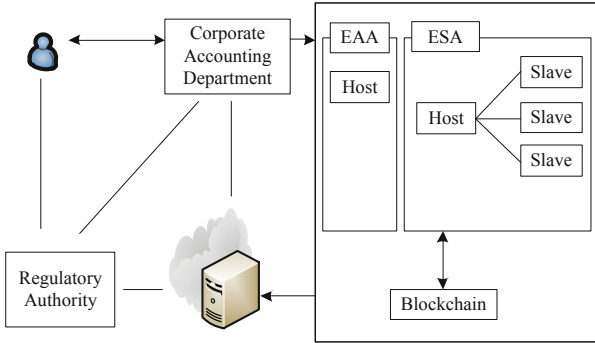


Fig. 2. Basic framework of enterprise accounting information regional sharing model

2.2 Design of Accounting Model

Under blockchain technology, the accounting mode has changed some technical means in the basic organization and the original concrete operation method before the continuation. The latest financial software is used in the accounting of colleges and universities, which can not only improve the efficiency of accountants, but also make the accounting work more accurate, scientific and systematic, improve the quality of accounting information in Colleges and universities, and enhance the timeliness of accounting information [9]. The application of financial software can accelerate the processing and application of financial information data in colleges and universities, and provide comprehensive and accurate financial information analysis and financial report to university managers and information users.

Under blockchain technology, the connection among accounting vouchers, accounting books and financial reports can be better realized. The design of accounting method should consider the relationship between voucher and voucher, voucher and account book, account book and account book, account book and report, report and report [10]. Only by coordinating these relations can accounting work smoothly be carried out. Block chain is composed of each block, and the next block is formed on the basis of the previous block. The connection between blocks can ensure that each financial data can be traced. The accounting book block is formed on the basis of financial information provided by the accounting voucher block, thus providing information support for financial report.

The design of accounting mode should simplify the process of handling work as much as possible and reduce repetitive work, such as registering the accounting voucher according to the original voucher, which will lead to repetitive work and increase the workload. Under the premise of following the actual situation, we can use the original voucher to replace the bookkeeping voucher and improve the summary method of bookkeeping voucher. Under the blockchain accounting mode, under the coordination of smart contracts, the system can automatically execute programs and reduce workload after meeting the set conditions. The non tamperability of the blockchain can ensure that the content of the contract will not be changed, and the system will execute automatically only when the conditions are met [11]. The functions of decentralization and whole network backup can reduce audit workload and simplify audit procedures.

Blockchain technology can strengthen the internal control of accounting work. The design of accounting model should be combined with post responsibility system, clear division of labor and mutual restriction. Blockchain distributed ledger means that a transaction is completed by multiple nodes in multiple places, and each node records a complete account book, so they can supervise the legitimacy of the transaction with each other, and no node can record the account separately, so as to avoid the occurrence of a single bookkeeper being controlled or bribed to record false account. The independent completion and mutual supervision of each node ensure the internal control of accounting work. In addition, according to the characteristics of the blockchain smart contract, the setting rules of the blockchain will automatically determine whether its trading activities are effective [12]. Therefore, the trading party does not need to obtain the trust of the other party through the way of public identity, so as to avoid artificial collusion and make the transaction reasonable control.

2.3 Building a Shared Channel

In order to transmit data from the target subnet to the relay link ledger and from the relay link ledger to the request subnet, it is necessary to build a contact channel. You can call the API related to channel creation in SDK, or use configtxgen tool to generate offline configuration information related to channel creation and update. The new application channel mainly generates the following files: (1) generates the creation block that starts sorting service and supports checking the contents of the block; (2) Generate configuration trade files and support the inspection of trade contents; (3) Generate the configuration transaction file used to update the channel organization Anchor Peer.

Change the contents of the configTX.YAML configuration file. After adding the configuration template for the new channel, add an Application to specify the organization information of the Application channel and specify the name of the associated federation in the Profile section. Next, the channel configuration block is generated in turn, and the file to update the organization anchor node is generated. Create contact channel according to channel configuration transaction file, add organization nodes to contact channel in turn, update anchor node, install and instantiate chain code.

Considering the privacy of enterprise accounting information, the shared protection mechanism is loaded in the constructed shared link. For link separated working paths L_1 and L_2 , end-to-end shared protection paths P_{1r} and P_{2r} are established respectively. In addition, P_{1e} and P_{2e} constitute the protection for some working paths $0 \leftrightarrow 1$ and $0 \leftrightarrow 6 \leftrightarrow 7$. Let η_i denote the O type of each link, then the reliability of the working circuit, the sectional working circuit and the corresponding part of the protection circuit are respectively expressed as:

$$\eta_L = \prod_{i \in lp} \eta_i \quad (1)$$

$$\eta_e = \prod_{i \in lw} \eta_i \quad (2)$$

$$\eta_r = \prod_{i \in sp} \eta_i \quad (3)$$

The comprehensive reliability of the established business connection is:

$$\eta_c = \frac{\eta_L(\eta_e + \eta_r(1 - \eta_e))}{\eta_e} \quad (4)$$

Assuming that the reliability of each link is 0.98, the reliability requirement of service connection is 0.95, and the reliability of working path is 0.94, it obviously can not meet the reliability requirement. It is necessary to establish a protection path. For the actual network, due to the limitation of network connectivity, sometimes some protection paths can not be found. At this time, in order to ensure the establishment of business connection request, the complete protection path between the source and destination nodes should also become a necessary alternative to further protect the Regional Sharing Security of enterprise accounting information. So far, the regional sharing model of enterprise accounting information based on blockchain technology has been designed.

3 Experimental Research on Regional Sharing Model of Enterprise Accounting Information Based on Blockchain Technology

3.1 Design Shared Data Items

The implementation of blockchain technology in the sharing module first requires enterprises to join the blockchain network as blockchain nodes. In the experimental case, the process was started on ports 5000 to 5005 of the local machine, and six blockchain nodes were successfully constructed through the flash framework to simulate the registration of six enterprises, with ports 5000 and 5001 as EAA nodes and ports 5002 to 5005 as ESA nodes Registration.

Enterprises sharing credit information can encrypt and upload the relevant credit information to the cloud server according to the request, upload the encrypted summary and metadata of credit information to the blockchain network in the form of transaction, or directly upload the credit information to the blockchain network in the form of transaction. For example, when a bank decides whether to issue a short-term loan to an enterprise, it should focus on the historical credit records and capital turnover of the enterprise. The data items to be collected are the basic situation, historical credit records and financial status of the enterprise. Therefore, the format standard for uploading various data should be formulated. The experimental case uses the sample data of Guiyang big data exchange's "other financial activity enterprise big data" to simulate the enterprise credit information to be shared, and assumes that these data are scattered in six enterprises. The rest of the reference data format is shown in Table 1.

When simulating the process of enterprise information sending, the main information is sent to the sending interface by post request in the experiment, which is received by two EAA nodes. The EAA node verifies the structure of the information and the accuracy of the uploaded information. After the verification is successful, the accounting information is signed and encapsulated, and then broadcast to the master node in ESA. The master node collects the transactions signed by EAA node, verifies the signature and packages the transactions to generate blocks to prevent the transaction data, time and order from being tampered.

Table 1. Reference format of shared data items

Sample field (parameter description)	Parameter name	Data type	Is it required?
Basic information of enterprise	Entall	String	Optional
Financial information	Financellist	String	Optional
Product competitors	Jzdslist	String	Optional
Related companies	Gglslist	String	Optional
Investment and financing events	Trzallist	String	Optional
Shareholder structure	Gdjglist	String	Optional
Trademark patent	Sbzllist	String	Optional
Customer relationship	Khgxlist	String	Optional
Negative news	Fmxwlist	String	Optional
Litigation record	Ssjllist	String	Optional
Foreign investment information	Dytz	String	Optional
Customs punishment	Cf_haiguan	String	Optional
Environmental punishment	Cf_huanjing	String	Optional
Industrial and commercial penalties	Cf_gongshang	String	Optional

The experiment is divided into fault tolerance test and throughput test, mainly based on comparative experiment. In the experiment, the traditional regional sharing model of enterprise accounting information is introduced. After the experiment, based on the experimental results, the practical application level of each sharing model is compared and analyzed.

3.2 Experimental Results and Analysis of Fault Tolerance

Fault tolerance is an important performance of shared model, which reflects the maximum number of node errors that shared model can tolerate. In order to test the fault-tolerant performance of the designed shared model, that is, whether the block chain module can recover itself without affecting the overall performance when the node fails. In the experimental study, the consensus process of shared model is simulated under the condition of 0, 1, 2 and 3 failure nodes. The experimental results are shown in Table 2.

According to the results in Table 2, under the sharing conditions of different number and different types of failure nodes, only the shared model in this paper can be identified correctly. Only the other two traditional shared models can ensure the recognition success without failure nodes and few failure nodes. In the other two cases, the recognition fails.

In conclusion, the proposed block chain based enterprise accounting information regional sharing model can effectively identify the transmission nodes and ensure the reliability of the sharing model.

Table 2. Experimental results of fault tolerance

	Number of failed nodes	Failure node type	Consensus results
Traditional sharing model 1	0	Nothing	Success
	1	Master node	Success
		Slave node 1	Success
		Slave node 2	Success
		Slave node 3	Success
	2	Master + Slave 1	Fail
		Slave node 1 + slave node 2	Fail
	3	Nodes other than master	Fail
		All nodes except one slave node	Fail
	Traditional sharing model 2	0	Nothing
1		Master node	Success
		Slave node 1	Success
		Slave node 2	Success
		Slave node 3	Success
2		Master + Slave 1	Fail
		Slave node 1 + slave node 2	Fail
3		Nodes other than master	Fail
		All nodes except one slave node	Fail
Article sharing model		0	Nothing
	1	Master node	Success
		Slave node 1	Success
		2-node slave	Success
		Slave node 3	Success
	2	Master + Slave 1	Success

(continued)

Table 2. (continued)

	Number of failed nodes	Failure node type	Consensus results
		Slave node 1 + slave node 2	Success
	3	Nodes other than master	Success
		All nodes except one slave node	Success

3.3 Experimental Results and Analysis of Shared Information Throughput

Throughput is a measure of the ability of a sharing model to process sharing requests per unit time. The higher the throughput, the more requests the model can process and the higher the performance of the model. The calculation formula of block throughput is as follows:

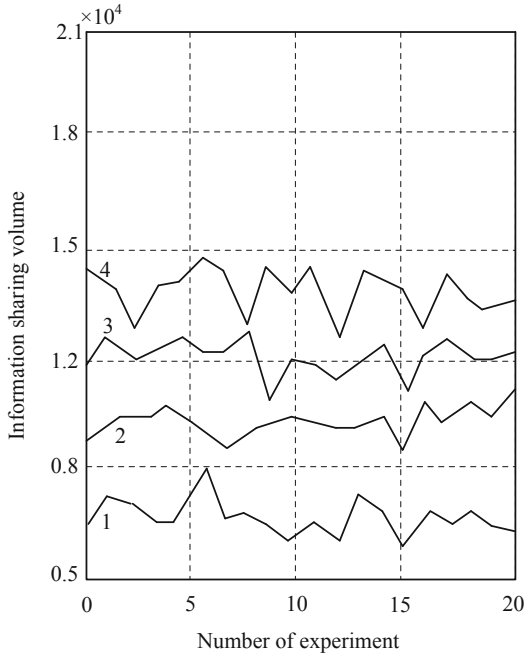
$$TPS_t = \frac{tras_t}{t} \quad (5)$$

In the formula, t represents the time interval from sending information sharing request to block confirmation, and $tras_t$ represents all information sharing requests contained in a block. In the experiment, the time interval for the master node to initiate a consensus is defined as t .

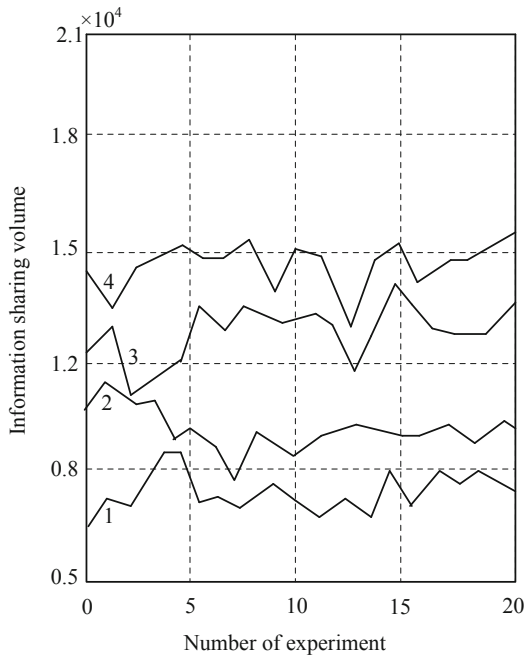
In order to simply test the ability of sharing model to process information sharing requests, JMeter performance testing tool is used to simulate 50 users to send transactions to a sharing process in a single machine environment. The shared content simulates the data information uploaded by enterprises. Four groups of experiments are conducted in 10s, 20s, 30s and 40s respectively. 20 experiments are repeated in each time interval, and 2 is selected. The average of 0 experiments is used as the throughput of this time interval. The test results of four time intervals are drawn by the third-party software MATLAB. The experimental results are shown in Fig. 3.

The experimental results in Fig. 3 show that the throughput of different models gradually increases with the increase of the transaction time of shared information. However, the information throughput of the two traditional sharing models varies greatly in the process of sharing, and the throughput level is low. In the experiment, the throughput variation of the sharing model proposed in this paper is relatively stable and the throughput is relatively high, which makes the information sharing efficiency higher.

By comprehensive analysis of the results of fault-tolerant experiment and throughput experiment, it can be seen that the regional sharing model of enterprise accounting information designed in this paper based on block chain technology has high fault-tolerant rate and high sharing efficiency, which proves that its application performance is better.

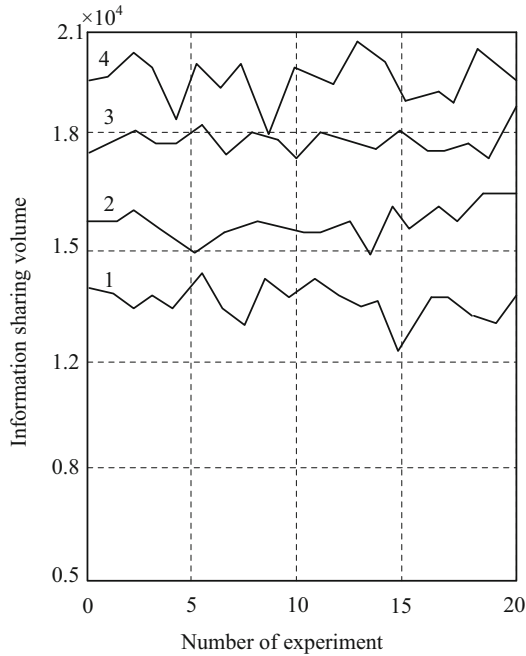


(a) Experimental results of traditional shared model 1



(b) Traditional shared model 2 experimental results

Fig. 3. Experimental results of information throughput of different sharing models



(c) This paper shares the experimental results of the model

Fig. 3. continued

4 Conclusion and Prospect

In this paper, the regional sharing model of enterprise accounting information is studied. On the basis of using block chain technology to build a sharing model framework, sharing channels are built for different types of accounting information, and sharing protection mechanisms are deployed to further protect the security of enterprise information. This study provides some referential significance for other institutions to build regional accounting information sharing model. However, from the perspective of the current development of blockchain technology, the research in this paper still has some deficiencies. In the design process, this paper mainly designs and adjusts the specific situation of regional sharing of accounting information and the development characteristics of block chain technology. However, in order to consider the timeliness of sharing, the process of sharing accounting information takes a long time. In the following research, the model of this paper will be further optimized from the perspective of improving the timeliness of sharing.

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