Research on Government Information Sharing Model Using Blockchain Technology

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Abstract—**Research Purpose: The distributed, traceable and security of blockchain technology are applicable to the construction of new government information resource models, which could eliminate the barn effect and trust in government information sharing, as well as promoting the transformation of government affairs from management to service ,it is also of great significance to the sharing of government information and construction of service-oriented e-government. Propose Methods: By analyzing the current problems of government information sharing, combined with literature research, this paper proposes the theoretical framework and advantages of blockchain technology applied to government information management and sharing, expounds the blockchain-based solutionit also constructs a government information sharing model based on blockchain, and gives implementation strategies at the technical and management levels. Results and Conclusion: The government information sharing model based on the blockchain solution and the transparency of government information can be used as a research framework for information interaction analysis between the government and users. It can also promote the construction and development of information sharing for Chinese government, as well as providing unified information sharing solution at the departmental and regional levels for e-government.**

Index Terms—**Blockchain; Government Information Sharing; E-government; Barn Effect**

I. INTRODUCTION

With the transformation of Chinese government affairs from control-type to service-type, government information sharing which centering on client could promote the flattening of government organization structure and the transparency of data, as well as innovating the mode of government information sharing. The essence of blockchain is a distributed database jointly maintained by all of participants, it realizes information security and error traceability through distributed storage, consensus plugin, asymmetric encryption, etc., which can maximize security while expanding trust. The application of blockchain technology in the field of public decision-making responsibility mechanism and government governance has been partially studied [1]. Using blockchain to solve the government's public opinion crisis and applying its security and credibility to e-government is also at the beginning stage [2]. At the same time, it also be used in the specific application scenarios such as immigration management, case trail, citizen credit reporting solution [3]. There is also a basic study for blockchain reviews in the field of government information sharing [4].

The application of blockchain could build a technology-innovative government information sharing system, it could also keep the organizational structure, management system and functional modules of the government adaptable to technological development and improve the overall efficiency of the government information utilization [5]. This paper takes blockchain as the underlying technology to build a government information sharing mode, which is used to solve the barn-effect, security problem, credibility problem and service customization problem existing in government information sharing, at the same time, it expounds the implementation strategy of information sharing based on blockchain technology platform, providing solutions for e-government innovation with government information sharing and utilization.

II. CHINESE GOVERNMENT THEORETICAL FRAMEWORK OF INFORMATION SHARING

At the beginning of the 20th century, construction of government information sharing in China starting, due to the imbalanced development of economy, technology and society, governmental agencies using different software development company's information system and database according to their own requirements, it makes e-government systems have

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problems such as unclear positioning of information sharing mode, low degree of sharing customization, low security and the barn effect [6].

Blockchain comes in three forms, public blockchain, consortium blockchain and private blockchain, because the public blockchain with full disclosure could reduce the security of the blockchain system to some extent, and the closure of the private blockchain leads to decreased creativity, the technical basis of the government information sharing system is the consortium blockchain which has the characteristics of decentralization and could guarantee the access authorization. Within the consortium blockchain, information resources are jointly maintained by nodes, the entries and deletions do not affect the operation of the whole blockchain, at the same time, the consortium blockchain ensures that records in all nodes could not be tampered, as well as meeting the information sharing requirements of different government departments [7].

The theoretical framework of government information sharing uses three-tier architecture as software development, connecting the data and presentation layer through a blockchain-based logical layer (Figure 1). The data layer includes information storage mode based on blockchain, real-time information transmission based on Internet and Internet of things, as well as location-based services, it is the underlying foundation of the theoretical framework for government information management [8]. In the logic layer, distributed information storage and Byzantine Fault Tolerance, smart contract, proof of work, consensus plugin, etc., connecting the data layer and presentation layer. As for the presentation layer, it realizes the implementation of government information management system driven by big data and Internet of things through open API application interface, it also makes the information prediction possible. It could also stratify and classify government information at the service level, realize the systematization and precision of government administration, as well as improving the service level.
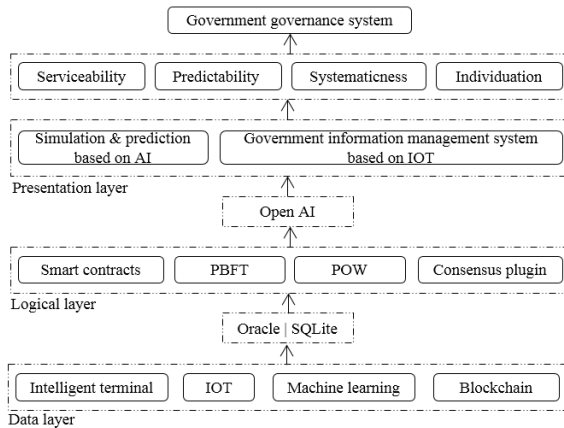

Fig. 1. Framework of government information sharing

III. GOVERNMENT INFORMATION SHARING MODE BASED ON BLOCKCHAIN

A. Characteristics of government information sharing based on blockchain

As the underlying technology of government information sharing, blockchain could exchange information among different departments, achieve decentralization and enhance credibility. This kind of technology also has the characteristics of information traceability and supervision, which could change the governance mode of government information resources.

1) The barn effect-broken: The reason for the barn effect in the sharing of government information is that there is only a vertical command system among government departments and it is difficult to work together horizontally, which leads to the lack of horizontal communication [9]. Block chain technology has the characteristics of P to P, the content of a node does not affected by other nodes, at the same time block chain has the characteristics of open architecture system, use of consensus plugin guarantees the data synchronization, and it is the consistency of the algorithm to ensure the safety of data. In addition, data sharing interface construction and client application implementation, testing tools, etc. jointly ensure that blockchain, as the underlying technology, supports the utilization of government information using (Figure 2).
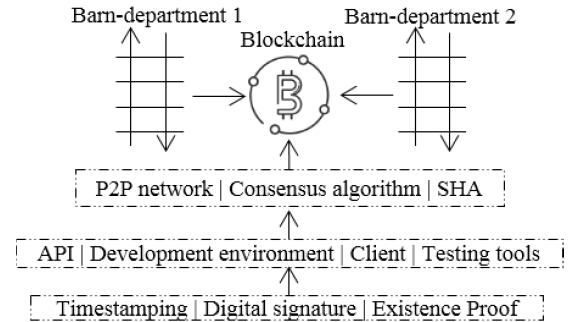

Fig. 2. Blockchain-based barn-breaking solution

2) Trust: Blockchain technology uses preset data synchronization rules for data syncing, it also has strong fault tolerance for abnormal operations such as information delay, message packet loss and downtime, at the same time, this kind of technology could maintain the consistency of node data in the complex network environment and keep the data of a node from being tampered (Figure 3). The traditional mode of government information sharing is based on non-technical forms of trust such as third-party supervision or governmental system. However, digital contracts and digital seals built with blockchain as the underlying technology could make the government information sharing system credible and capricious, as well as solving the credit cost problem of information sharing among government departments, especially cross-level and cross-regional departments. The government information data will be written into the signature after being verified by

the Secure Hash Algorithm (SHA) to prevent the tampering of the information content, and SHA value will be written into the blockchain to ensure the legitimacy of the data.
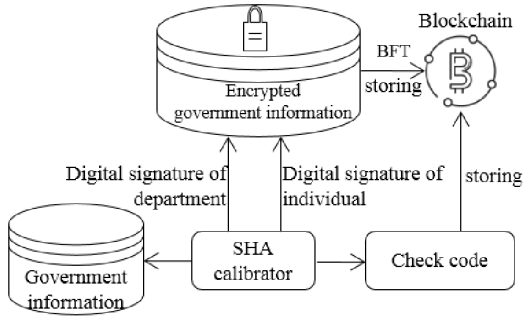

Fig. 3. Blockchain-based trust solutions

3) Customized: Government information sharing objects are complex, including various government departments, individual users, scientific research departments, etc., so it is necessary to establish customized information service structure to be applied to different service objects (Figure 4). With the distributed characteristics of blockchain, the specific services for different objects can be layered to achieve the pertinence of services. Furthermore, this technology could ensure coordination and balance through the participation of multiple subjects, then providing accurate services.
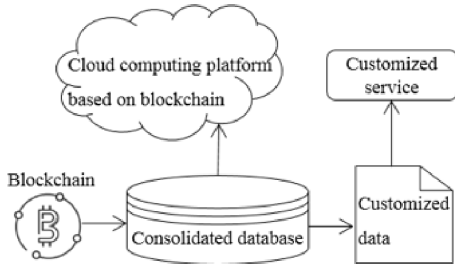

Fig. 4. Blockchain-based Customized solutions

4) Security: The distributed storage and encryption characteristics of government information based on the blockchain technology ensure that any problem in any node of the consortium blockchain will not affect the rest of the network, digital signature technology and asymmetric cryptographic algorithm in blockchain ensure the security of data among nodes of the consortium blockchain, Hash verification, timestamping and other technologies could realize the sequence of nodes in the network, so as to ensure the tampering of government information . Blockchain technology could also be used to ensure the uniqueness of the identity of data operators, while that access information of all data sets is recorded by the platform, thus ensuring data access security (Figure 5).

5) Self-supervised: The P-to-P working mode based on the blockchain enables the network to contain confirmation information, meanwhile the transaction records of the data
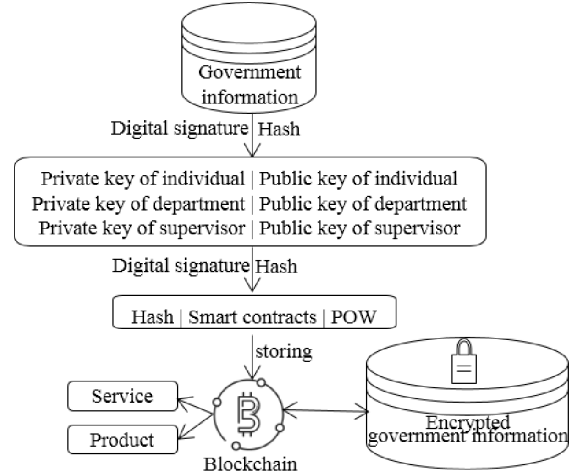

Fig. 5. Blockchain-based security solutions

set could be traced to the source [10]. When the government information is written into the blockchain, the timestamping is automatically added as the existence proof of data flow, which is used to ensure that the information itself and its' operation record cannot be falsified. Blockchain technology enables government information sharing to be audited by its' own technology without third-party supervision.

B. Construction of government information sharing platform based on blockchain

Different from the traditional e-government system based on government Intranet or private cloud, the government information sharing platform based on blockchain takes the Internet as the medium and serves each node in the network, it could meet the diversified information needs of different types of users such as government departments, individuals, scientific research institutions, audit institutions and so on [11].

The information generation and management centers of various government departments, including fiscal, tax, legal, medical and educational departments, jointly constitute the nodes of the government information sharing network based on the blockchain. The network realizes the data synchronization of the nodes with protocols such as POS (proof of stake) or POW (proof of work). Each node in the network realizes information routing through consensus plugin and smart contracts, every node is a combination of executant role, storing role and verifying role actually. The data of the government information sharing platform is encrypted using methods such as Hash to obtain the ciphertext with public key and private key. While reading the stored information, in order to reduce node instability, blockchain network will verify the ciphertext data and store the reading records, which is for error tracing and self-audit of this kind of network. Blockchain provides technology and service help for participating of multiple subjects in the government information sharing system, as
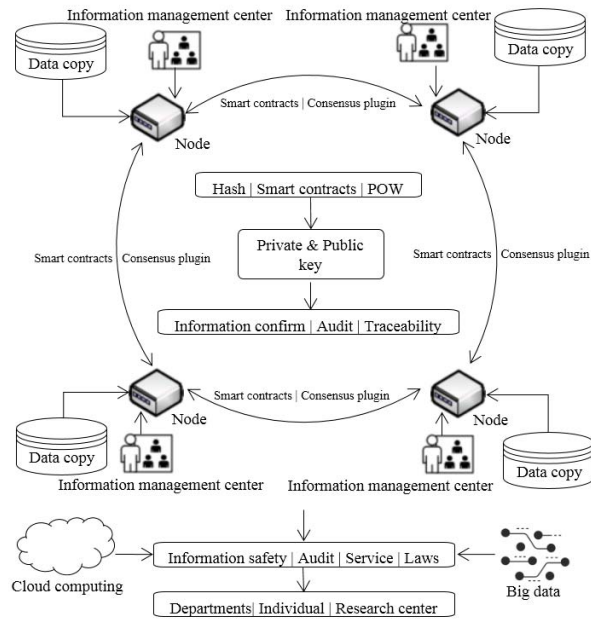
Fig. 6. Government information sharing platform

well as realizing the operation of the government information sharing platform healthy.

IV. CONCLUSIONS

The actual implementation of the government information sharing mode supported by the blockchain depends on the guarantee of technical dimension and management dimension. The strategy of technology dimension includes standardization implementation of blockchain platform and modularization of service application, at the same time, the strategy of management dimension includes rationalization of management system and cooperation integration of different departments.

This paper takes the government information sharing mode as the research object, on the basis of analyzing various problems of current government information sharing existing in China, and propose a theory system of government information sharing based on blockchain, based on the above analysis, the mode of information resource sharing is analyzed, then the paper analyzes the mode of information resource sharing, including the advantages of government information sharing from the perspective of blockchain and the construction of new platform. Finally, it describes the relevant countermeasures from the perspective of technology and management briefly. The reliability degree of all nodes in the blockchain described in this paper is consistent, however the subsequent studies could analyze the realization of government information sharing mode under different degrees of trust from the perspective of reliability verification, or some studies about the application of blockchain in specific fields such as the identification of personnel Exit-Entry and the construction of personal credit system.

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