

# Research on Secure Data Transmission and Storage Based on Blockchain Technology

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## Abstract:

With the ongoing advancement of information technology, there has been a growing focus on the security issue of information transmission and storage. Ensuring the secure transmission and efficient storage of data in the digital age has emerged as a critical issue. This article explores innovative solutions based on blockchain technology, aiming to enhance the security and reliability of data management systems. Such systems can accelerate work efficiency across various sectors, safeguard the security of data applications, ensure the rationality of advanced data utilization, and offer fresh insights for the sustainable development and construction of our digital society.

## Keywords:

Blockchain technology  
Data transmission; Data storage  
Hash function

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## 1. Introduction

At present, with the increase in social business activities, the scale of data is also constantly expanding. The transmission and application of various data information are extensive and comprehensive, aiming to ensure the security and reliability of data application in this evolving background. In this development context, blockchain technology, as a decentralized distributed ledger system, has garnered increasing attention and is tamper-resistant. Currently, blockchain technology serves as an innovative approach to mitigating security risks in data transmission and storage, enhancing stability, and preventing data loss and issues <sup>[1]</sup>. This paper emphasizes secure data

transmission and accurate processing using blockchain technology. By combining the analysis of the basic characteristics of blockchain technology, we hope to build a verifiable and truly decentralized data management system.

## 2. Application of blockchain in data transmission

Presently, the volume of data in our country is continually increasing, possessing immense value and providing significant assistance to various aspects of production and life <sup>[2]</sup>. In this regard, it is necessary to combine the basic

characteristics of blockchain technology and understand the main trend of data growth in China; on this basis, the use of blockchain technology to store data reasonably can ensure the security of data storage and data transmission process, ensuring data integrity is crucial to prevent irreversible losses and problems, as it safeguards against data loss risks <sup>[3]</sup>.

### 2.1. Integrity verification of data transmission

Data must be utilized sensibly and efficiently, necessitating precise transmission. During data transmission, blockchain technology's distributed and immutable traits become particularly evident <sup>[4]</sup>. Hence, blockchain technology, when applied to data transmission, offers a more robust and comprehensive data integrity verification mechanism, whose significance cannot be overlooked. In the process of the application of blockchain technology, each data transaction will be fully recorded on the distributed ledger in the form of blocks, without any omissions. During data transmission, nodes can contain multiple hash values <sup>[5]</sup>, and each block links to the previous one through its hash value, forming a complete data chain. In the process of data transmission, nodes involved in data transmission can also form accurate verification with the help of consensus algorithms, and can fully guarantee the consistency of data, which is conducive to the efficient application of data. It is important to note that any attempt to tamper with the data may be detected by these systems in a timely manner, and the system can respond immediately to deal with and detect the behavior of data tampering, so as to avoid irreparable serious impact. Therefore, blockchain technology serves as a third-party trust institution in data transmission, ensuring data integrity and comprehensiveness, and effectively preventing potential damage or tampering. This process ensures the safe transmission of information and data, making data transmission and storage more reliable and reducing unnecessary risks as much as possible <sup>[6]</sup>.

### 2.2. Decentralized control

Promoting data transmission with blockchain technology showcases its unique decentralized control, forming a perfect mechanism that maximizes its positive role and comprehensive value. Eliminating centralized

authority allows for comprehensive management of the distributed network. Traditional data transmission relies on other technical means in the process of promotion, however, it fails to ensure security and rationality during the transmission <sup>[7]</sup>, potentially leading to increased issues of omission and data loss. Within this system, the central server or authority verifies and strictly controls the information flow, yet this results in an increasing number of organizations and third parties being exposed to data, thereby hindering strict security management and comprehensive utilization of the information. However, blockchain technology is different from these traditional technologies mentioned above, the blockchain is distributed in the network nodes, which participate in the verification and accurate recording of this data information, so as to eliminate the single point of control that exists in traditional systems. This fundamental feature of decentralization holds immense significance and value for data transmission, as it embodies the fairness and transparency of the process, which can minimize the risk of a single point of failure, and reduce the over-reliance on centralized entities. By effectively utilizing the node consensus mechanism, the security of data applications during transmission is fully ensured, enhancing the consistency of data transmission. This minimizes the risk of any omissions or losses. All staff involved in the data transmission process can gain greater trust, enabling a more seamless realization of data transmission objectives. A more open and democratic model of governance.

## 3. Effective application of blockchain technology in data storage

Combined with the above, it is evident that blockchain technology, apart from its comprehensive application in data transmission, also plays a significant and non-negligible role in data storage. The use of blockchain technology to store data can ensure the security and effectiveness of the data, can fully play the value and role of relevant technologies, and avoid irreversible risks in the process of storing data and data loss problems, affecting the value of these data and reasonable applications <sup>[8]</sup>.

### 3.1. Distributed storage

In the field of storing a large amount of data information,

the application of blockchain technology cannot be ignored. Blockchain technology, with its distributed storage mechanism, offers new opportunities for the storage and management of data information, providing a revolutionary solution to the problem. This represents a major innovation in the field of information data storage. In the process of data information storage, the traditional centralized storage system is commonly used, thus posing risks of data loss and issues related to a single point of failure. When these problems arise, the impact is severe, dealing a significant blow to the value of the data itself. Blockchain technology enables a novel approach to distributed data storage, distinct from traditional methods. This advanced technology facilitates decentralized storage by distributing data across numerous nodes, ensuring enhanced security and transparency. In the network, each node saves complete data copies, and the application effect is ideal. It should also be noted that the distributed storage method, with the help of smart contracts and decentralized protocols, can ensure the integrity and security of data applications, as well as the data involved. Distributed storage systems like HBase and Hive implement robust data recovery strategies. For instance, in a distributed storage environment with 16 physical servers, each hosting multiple virtual machines<sup>[9]</sup>, the integrity of HBase and Hive databases can be maintained by backing up physical servers, analyzing block file structures, and carefully piecing together and validating block files before importing them back into the databases. Effective implementation of this distributed storage method can significantly enhance the application efficiency of these data, while their robustness and anti-attack performance also experience rapid development and progress. This results in enhanced accessibility and more prominent availability of the data. Therefore, we must pay attention to the improvement of the distributed storage of these data, and change the backward storage technology means through the relevant technologies and methods of distributed storage, reflecting the efficient development of data technology storage and application.

### 3.2. Security and scalability

Blockchain technology, unlike previous technologies, offers a multitude of advantages and values. Among these, security and scalability stand out as particularly

significant. For instance, its decentralized nature ensures that transaction records are immutable and transparent, enhancing security. Additionally, blockchain's architecture allows for increased scalability by adding more network nodes, enabling it to handle large volumes of transactions more efficiently. In data storage, a well-designed blockchain application system can further emphasize its security and scalability, playing a crucial role. Blockchain leverages cryptographic techniques, hash functions, and asymmetric encryption algorithms to ensure the confidentiality and integrity of data, as evidenced by its application in financial industries and other sectors, but also makes these data more complete<sup>[10]</sup>. Smart contracts and distributed consensus mechanisms, once effectively implemented, can further bolster the consensus mechanism applied to these data, playing a crucial verification role and yielding positive outcomes. During the actual application of these data, the promotion of these technologies, coupled with various preventive measures, can effectively thwart malicious tampering and mitigate undesirable outcomes or unauthorized access as far as possible. This form obviously forms a comprehensive protection for this data information, which can effectively improve the application security of data information. After many practices, the application of blockchain technology has formed a perfect security framework, which can make the data in the process of storage and transmission comprehensive and provide more adequate and reliable protection<sup>[11]</sup>.

At the same time, we must recognize that blockchain scalability hinges on optimizing the distributed node network. During data storage and distribution in blockchain technology, distributed ledger technology will be incorporated. There are multiple nodes in the network, and data is stored in these different nodes. Overall, a decentralized storage structure is formed. The implementation of this storage structure can continuously share the burden of data storage and processing, and can also rapidly improve the scalability of the system, and dynamically increase various nodes required in combination with the development and change of relevant needs. It can realize the flexible adjustment and optimal configuration of the existing system information resources. The purpose of data storage through such measures is to effectively cope with the growing amount

of data information and the expanding and evolving scale of data information, while meeting storage requirements without compromising security or performance. While ensuring data transmission security and data storage performance, it can also store a large number of multi-faceted and diversified data information content <sup>[12]</sup>.

## 4. Application of blockchain technology

In the above systematic description of the data transmission and data information storage process, the advantages and value of blockchain technology become evident, enabling the reasonable application of data information and tapping into its application value and underlying potential. In the subsequent analysis, we will delve into the application of blockchain technology and its foundational principles, aiming to enhance our understanding and facilitate more effective execution of various tasks in the reasonable application of these blockchain technologies <sup>[13,14]</sup>.

### 4.1. Integration method of blockchain

The main blockchain network constitutes the core content of the blockchain technology system, responsible for managing the overall distributed ledger and effectively maintaining the consensus mechanism. Its purpose is to enhance efforts in this field, ensuring system application security while fully showcasing decentralized characteristics. The backbone of the system is the main chain, which carries the infrastructure development and construction of the overall blockchain.

In addition to the network of the main blockchain mentioned above, there is a dedicated side chain, the role of the side chain is to accurately handle the security risks in the process of secure data transmission and data storage, with special work responsibilities, and the strategy is an independent blockchain connected with the main chain. Therefore, it also has relatively independent rules and covers smart contracts, which can provide flexibility and efficient preparation for the effective implementation of specific tasks, thereby enhancing the flexibility of the work <sup>[15]</sup>.

The customized data transmission function can be perfected in the policy, including the transmission, accurate verification of data, and the establishment of a

basic confirmation mechanism. The purpose is to ensure the integrity of these data in the process of transmission, reflecting the reliability of these data. Undoubtedly, the effective implementation of this mechanism can also make the application of various data information in the network more secure and ensure that the flow process can be more stable.

The smart contract deployed on the side chain covers the logic of data processing and transmission, is responsible for the validity and invisible verification of the data, manages the basic rights of each participant, and records key data information when needed. The design of this smart contract results in automatic operation and safe execution in the system.

The implementation of the side chain serves as a storage function, encompassing both the secure storage of these data and the efficient storage of vast amounts of diverse data. By leveraging smart contract data, the distribution of storage across different nodes of the side chain helps ensure data confidentiality and integrity and facilitates a more efficient system, thus providing more stable and reliable data storage solutions.

The main chain and side chain can achieve the goal of interactive development with the help of smart contracts, which are conducive to ensuring the safe transmission and stable storage of data. The verification of key source data and data information is transmitted to the main chain with the help of smart contracts, in the hope that the consistent needs of the system can be maintained. This interaction mechanism can realize the synergistic development of the main chain and the side chain, and ensure the safety and stability of the development and progress of the system.

### 4.2. Technical details of data transmission and storage

The choice of the hash function is crucial. During data transmission and storage, there is a tendency to utilize hash functions with enhanced security to guarantee efficient data processing in these processes. By applying the corresponding hash function selected, the data block can be hashed, and a fixed-length hash value can be generated. The original data uniquely identified by this hash value can be verified for data integrity, and the data identification can be completed.

## 5. Conclusion

This paper mainly focused on the role and value of blockchain technology in the safe transmission and storage of data. By applying blockchain technology, a robust and comprehensive data management system can be more effectively established, while the utilization

of hash functions and digital signatures with enhanced security further guarantees the secure transmission and storage of data. A substantial and more efficient digital data management system can be built in future development.

### Disclosure statement

The author declares no conflict of interest.

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