Research on Trusted Computing Scheme Based on Block Chain and Internet of Things

Guowei Zhang1,*

1Cyberspace Security School, Shandong University of Political Science & Law, China, 250014

*Corresponding author e-mail: jones134@163.com

Abstract. The popularity of blockchain, Bitcoin and Ethereum in 2017 can be described as an empty alley. However, the reason why such a popular technology has strong vitality must be to find the most suitable application. In view of the security and privacy, lack of resources, network transmission delay and other issues in the current Internet of Things system, analyze the advantages brought by the introduction of blockchain technology, and compare the architecture of the blockchain Internet of Things with the traditional Internet of Things system. Aiming at the problems existing in the application of blockchain IoT, a blockchain IoT architecture based on edge computing is proposed. In this architecture, the data collected by the edge device is filtered and transmitted to the fog node of the fog layer through the multi-interface base station, and the fog node reports the data processing result to the distributed cloud layer based on the blockchain. The fog layer provides positioning, and the cloud layer provides wide-area monitoring. It provides large-scale event detection, behavior analysis and long-term pattern recognition through distributed computing and storage, and combines blockchain technology to provide scalable, reliable and highly available Internet of Things services. Therefore, the proposed architecture has important reference significance for subsequent computer technology application research based on blockchain IoT technology.

Keywords: Internet of Things, Blockchain, Security Mechanism

1. Main problems in the development of Internet of things

Since 2017, the Chinese government has issued the "Thirteenth Five-Year" Internet of Things and "Notice on Promoting the Construction and Development of Mobile Internet of Things (NB-IoT)". According to the statistics of the chain tower data platform, there are a total of 54 blockchain IoT projects, involving IoT platforms, smart manufacturing, automotive networking, agriculture, supply chain and other fields, including blockchain startups, supply chain companies, and the Internet Giants, Alley, JD, IBM and other well-known companies are all in the blockchain IoT Business industry.
The Internet of Things and blockchain technology have always been hailed as "made in heaven", and they are one of the best landing scenarios for blockchain technology. Whether the implementation of blockchain in the Internet of Things industry is a hype or a bright future requires more in-depth research and judgment, as well as conduct an in-depth analysis of the development status, infrastructure, typical projects and operations of the blockchain industry. The devices in the Internet of things ecosystem have produced a huge amount of data, and there is an urgent need for analysis. Big data analysis is widely used in many industries to optimize industry resources. However, the ability of Internet of things to analyze data and explore potential value has not been highlighted.[1]

2. Blockchain technology brings new ideas to solve the computer problems of Internet of things

2.1. It can effectively solve the fragmentation situation

Blockchain technology can effectively solve the problem of Internet of things terminal fragmentation. This technology does not rely on centralized authority, but also provides reliable and sustainable cross platform computer interconnection. In May 2018, the Shenzhen Taxation Bureau joined hands with Tencent to establish the "Intelligent Taxation" Innovation Laboratory, aiming to build a modern system of "Science and Technology Innovation +" tax management in Shenzhen through cooperation and complementary resources, and explore tax management based on the Internet of Things. It is a nationwide harvest of "blockchain + invoice" ecosystem application research results.

Especially with the advent of 5g era, IOT terminals will access the Internet of things in an open way. The traditional security protection mechanism based on the computer Intranet environment will be invalid and the security boundary will no longer exist. In this case, the application encryption represented by the blockchain will reconstruct the computer boundary of the Internet of things, form the trust domain between devices, and ensure the security of the Internet of things. [2] This organizational structure can support the sharing of data obtained by each computer device in a distributed way through the blockchain, so as to meet the usability challenges of the IOT system brought by the scale and cluster expansion.

2.2. Internet of things is one of the best application scenarios of blockchain in computer

In the era of Internet of Things, the value of data becomes more and more important, and the integration and innovation of Internet of Things + blockchain will become a new industry trend. How to create a differentiated competition path in the future? Using the safe and reliable execution environment of the IoT terminal equipment can make the IoT device trust on the chain, thereby solving the identity confirmation and data confirmation problems of the IoT terminal, and ensuring that the data on the chain is deeply bound with the IoT. Blockchain can ensure data security and privacy protection. (see figure 1)
In all aspects of the Internet of things industrial chain, the core point of centralized thinking is that users interact with computer centralized platform through mobile phones or smart speakers, and then the computer platform forwards relevant control commands to each terminal platform, and finally reaches the device to execute actions. The control command can only be initiated by the user, and the one-way arrival of computer intelligent terminal is a tree structure from root to leaf. The biggest difference of computer multi center core architecture is that platforms and platforms are interconnected to form a multi center network structure. Intelligent devices can interact with each other to form a flexible distributed system.

3. Computer application based on blockchain and Internet of things

In the overall system architecture, the edge computing node is to make up for the shortcomings of the weak computing power of IoT devices. An intermediate computing device is set close to the IoT device. This intermediate computing device can be connected to the network and provide comparison. Networked devices have a lot of computing power. Through this intermediate computing layer, IoT devices can be more reliably connected to the network, and can further transfer information and value freely.

3.1. Software platform and Hardware platform

A low-level public chain development platform based on the Internet of Things combined with blockchain. The underlying public chain is a Turing-complete blockchain ecosystem. The hardware platform of the IoT edge computing solution combined with the blockchain consists of IoT devices connected to the chain, such as smart door locks, smart set-top boxes, smart refrigerators, etc., and edge computing servers, blockchain node servers, data storage servers, and web servers and other composition.

COT(chains of things) is committed to the establishment of the infrastructure ecology of the Internet of things chain system, serving specialized, process oriented and standardized enterprises or organizations or individuals. COT will serve as infrastructure and universal connector for various kinds of transaction and interaction ecosystem based on things. To create the IOT intelligent hardware of the integrated scene of things and people, combine with the public chain system ecology of blockchain, focus on the business application support of three-dimensional trusted identification of things, and provide the basic customized development of the combination of vertical depth of IOT intelligent hardware scene and blockchain.
COT has produced the first batch of intelligent hardware smart cabinets, which can be used in retail and other actual scenarios. COT can provide encryption chip for customers who have their own hardware devices to save data. This chip is a cold wallet, which stores important privacy information such as digital identity, signature, private key, etc. the data stored in this chip will be linked up and no one can tamper with it. COT is a multi chain structure, which supports cross chain operation. In order to solve the contradiction between high-frequency data transmission of Internet of things equipment and low public chain TPS .COT puts forward such a solution: some unimportant data can be saved to the trusted level through the combination of Internet and artificial intelligence, without being linked. For some important but not real-time linked data, it can be synchronized to the chain once a day, and can be stored in the cache pool of the terminal before being linked. This can not only save data, but also solve the limitation that the public chain TPS cannot meet the production standard. (See figure 2)

![Figure 2. Hardware intelligent platform of blockchain based on Internet of things](image)

3.2. Data communication

The data communication of IOT devices is through 4G, 5G, NB-IoT, Ethernet, serial bus, parallel bus and other general physical communication. The communication protocol can support http, mqtt, Canbus, Modbus, CC-link, etc. In the value transfer application, data is communicated through the self-developed IMQTT protocol. The MQTT protocol is a communication protocol developed by IBM for Internet of Things devices. Because the MQTT protocol was developed without adding value transfer related content. In order to realize the concept that everything can be traded, the relevant content of value transfer was added to the MQTT protocol, and the IMQTT protocol was born. Through the IMQTT protocol, not only can the Internet of Things devices exchange information, but also realize the transfer of value.

3.3. Public shared ledger function of blockchain

This function can improve the efficiency of labor division and cooperation, but it does not directly involve value transfer. For example, in the supply chain finance, it is difficult for banks to understand the real transaction situation in the supply chain ecology, so as to accurately evaluate the information. Small and medium-sized enterprises at the end of the supply chain are easy to face the problem of "difficult financing and expensive financing". Core enterprises can not give full play to their role as credit carriers, and can not drive the whole ecological development to obtain greater benefits. The supply chain financial service platform based on the blockchain can accurately record the data information in the supply chain, alleviate the information asymmetry between banks and small and medium-sized enterprises at the end, and improve the efficiency of bank credit supply. Supply chain financial service
platform can balance the interests of upstream and downstream enterprises, optimize accounts receivable financing process, and promote the healthy development of industrial chain. Blockchain solution providers generally charge based on the amount of loans facilitated, which is more sustainable in the business model. [4]

3.4. Internet of things payment

The typical application of blockchain in the field of Internet of things payment is to use the blockchain technology to provide a person to machine or machine to machine payment solution for the existing Internet of things industry, establish the corresponding computer system, and establish the micro payment system based on the blockchain, so as to realize the real-time access payment of the Internet of things equipment, and effectively promote the transaction and exchange of Internet of things data Circulation.

3.5. Combined application of blockchain and Internet of things to assist computer running program

![Figure 3. Trust relationship between Internet of things devices](image)

The deep application of the Internet of things is currently troubled by the centralized mode. The central information exchange and control has become the bottleneck of the real effectiveness of the Internet of things. The blockchain is an effective tool to promote decentralization. [5] Only by decentralizing and allowing massive distributed nodes to exchange information more flexibly can we greatly reduce the cost of comprehensive management and control and avoid bottlenecks in any link. In addition, the maturity of computer technology will greatly accelerate the technology evolution under the decentralized scenario. Computer practice solves the problem of intelligent individuals, the Internet of things solves the problem of information exchange, and the blockchain solves the problem of group consensus and social contract. The difficulties and bottlenecks in their respective fields can be solved by the other two technologies to a large extent, so as to form a benign iteration of cross support and cyclic evolution. Computer technology, Internet of things and blockchain will become the three cornerstones of the machine society. (See figure 3)

4. Conclusion

Through edge computing technology and blockchain technology, it has promoted the establishment of the Internet of Things ecology, realized the interconnection and interoperability of all things, realized the interoperability of equipment, brought a better life experience to mankind, changed the human life
mode, created a new value ecosystem, and created a beautiful In the future, build a community with a shared future for mankind! [6]

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