Construction of Information Dissemination Mode in Metaverse Based on Blockchain

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Abstract. The concept of blockchain and metaverse has stirred widespread attention and discussion in society in recent years. From Web 1.0 to Web 2.0 to mobile Internet, dissemination of Internet information has almost reached a bottleneck. A new pattern in the speed, scope, positioning and real effectiveness of information dissemination need to be gradually established from the perspective of metaverse. At the same time, however, the information dissemination in the metaverse is facing great challenges, while the technical development of blockchain is gradually being widely used in various fields. Given the existing challenges that the information dissemination in the metaverse has encountered, This paper discusses the construction of metaverse information dissemination on block selection, algorithm recommendation and application fields under blockchain technology.

Keywords: blockchain, etaverse, dissemination of information, public blockchain, Consortium blockchain

1   Introduction

Since 2021, known as the "first year of metaverse", metaverse has started to get rapid development in China. Besides, the concept's outbreak of metaverse abroad is covering all walks of life in China. Facing the next era of information, relevant technology and computing power are the core forces of metaverse development. Among them, the digital technology of blockchain, as one of the technical foundations of metaverse, has attracted much attention in recent years. Over the past decade, blockchain has been mainly used in the digital currency sector. On October 25, 2019, General Secretary Xi Jinping stressed at the 18th collective study of the Political Bureau of the Central Committee of the CPC that it is necessary to accelerate the development of blockchain technology and industrial innovation, and actively integrate the blockchain into economic and social development. In 2023, the relevant domestic policy will continue to support the development of metaverse, standing at the historical node of the transition to metaverse ecology, because metaverse represents the future trend of technological development of media. Don Tapscott, the father of the digital economy, pointed out in an interview with the Harvard Business Review that blockchain represents the second industrial revolution of the Internet, which will realize the transformation from the Internet of Information to the Internet of Value. According to the unique technical attributes of blockchain, ensuring the security, accuracy, pertinence and speed of the dissemination of larger data information in metaverse is the significance of thinking about the dissemination of information through the support of blockchain technology. At the same time, it is also an

important measure to improve the metaverse ecosystem, better grasp its development landscape, and serve the national strategy.

2 The necessity and possibility of integrating blockchain and information dissemination in the metaverse

As a product accompanying digital virtual currencies, Blockchain first came out in 2008. In a broad sense, blockchain uses chain features to fully store and verify data. In a narrow sense, it is a new data structure that combines data blocks through specific connection patterns according to the flow of time. Moreover, this structure contains a cryptographic mechanism in the modern cryptology set by the blockchain. In the 1960s, McLuhan, a famous Canadian communication scholar, proposed that "the medium is information." In information communication, content is the dependent variable of communication, while media that conform to the nature of the times are the preconditions for changing the transformation of our information communication. Dissemination of metaverse information will once again confirm McLuhan's "advanced theory." In the metaverse context, everyone can participate in communication and creation, so information dissemination needs to be distributed faster. However, on the mobile Internet, information is often concentrated on a server, which is limited by the server's computing capacity and information transmission security. In the metaverse ecosystem, information dissemination requires lower latency and high security. To achieve the same effect as in real space, information dissemination needs to be distributed at the same time. As the authentication mechanism technology behind metaverse, blockchain is usually used to assist in the operation of digital currency. However, blockchain features including distribution and peer-to-peer also have the potential to be applied to information dissemination.

3 Selection of blockchain for the information dissemination in metaverse

3.1 Take the public blockchain as a common experience of information dissemination

The types of data chains covered by blockchain are diverse, which can be divided into public blockchain; consortium blockchain, combination chain and private blockchain according to the decreasing degree of openness. Among them, the characteristics of the public blockchain is that it is open to all nodes, which means that anyone has the right to enter the chain to read data, exchange data, and participate in transactions. Public blockchain belongs to the main channel of information dissemination in blockchain. [1]Whether it is human-computer interaction or digital character interaction in the virtual ecosystem, the rules of public chains need to gain common recognition. In the digital and virtual co-creation world in metaverse, the equipment and channels for the dissemination of information will be expanded. In addition, the audience is not only the recipient but also the producer of information. Various groups, including individuals, institutions, elites, and the grassroots, may have the right to release information at any time.

In terms of information security, blockchain information presents distributed promotion. [2]The storage and recording of information and data no longer relies on only one central node, as shown in Figure (1), which better avoids the limitation and obstruction of one-stop dissemination in the process of information dissemination, and prevents information from being easily falsified when information is stored and disseminated.[3] The distributed organization structure opens up a huge and free space for the public blockchain, which is consistent with the original intention of metaverse. As shown in Figure 2, the dissemination of information is distributed faster on the public blockchain in the form of broadcasting, and everyone has the same right to know and access the information. At present, for the information shared by people on the platform as an individual unit, it is difficult for the content creation of the displayed information to get off the platform's operating mechanism to obtain fair communication benefits. However, unlike this situation, the public blockchain gives public information a big stage for equal dissemination. Meanwhile, the public blockchain will give incentive mechanisms for the users' high-quality production, such as Bitcoin rewards, which stimulates the enthusiasm of participants for information dissemination and production to a certain extent.[4]
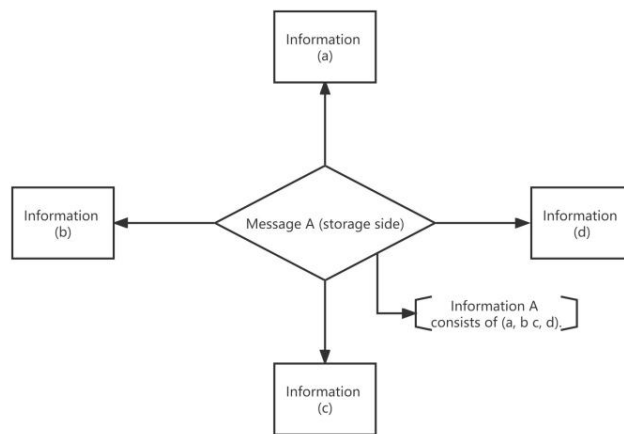

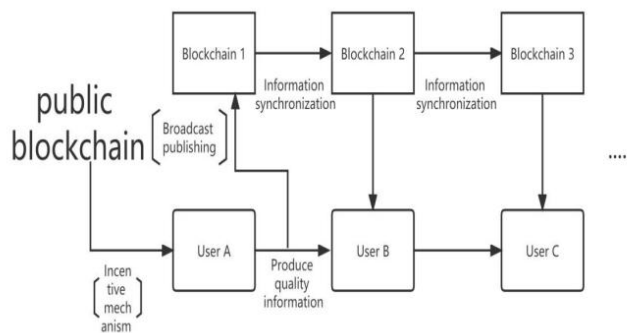**Fig.1.** Blockchain information storage and distribution.

Fig.2. Public chain information dissemination

3.2 Use the consortium chain as the oriented partition of information dissemination

If the public blockchain mechanism aims to spread mainstream information fairly, and to provide a decentralized system for national participation in informatization. In contrast, the consortium blockchain is to plan the specific route of information dissemination, and finally form a classified and refined channel for the closed-loop information dissemination. Therefore, the consortium blockchain faces members of a specific group or organization. Besides, the consortium blockchain also needs to operate normally under consensus. As shown in Figure (3), compared with the freedom of the public blockchain, the the consortium blockchain set access permission mechanism. With the help of smart contracts, the conditional screening of the consortium chain will be more stringent to achieve high quality standards for information content. The information content set by the authoritative institutions such as governments as well as governmental agencies on the consortium chain is more secure and credible. For example, foreign projects including IBM's consortium chain, Fabric, as well as Facebook's Libra, and Ripple have also gained a lot of support in China.[5]
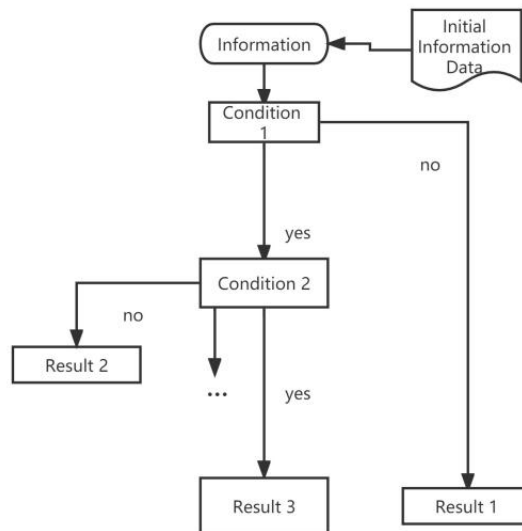

Fig.3. Smart contract conditional mechanism

4 Innovation of the information dissemination mode in metaverse based on the blockchain technology

4.1 Dual-track dissemination mode with the public blockchain as the main chain and the consortium chain as the supplement

Throughout the history of media development, the essence of media innovation is the development of technology. Qiao Yongqing, editorial board member and secretary general of People's Daily, once said at the "2020 China New Media Conference" that "integrated media development" is not only a media transformation brought about by the technological

revolution, but also the only way to transform traditional mainstream media. Moreover, it is even a profound change related to the overall development that affects various areas. In this process, direction is the soul of development, content is the foundation of advantage, technology is the source of vitality." The key to the transformation of information dissemination lies in the transformation of media, which depends on content architecture and technological innovation." The metaverse innovates transmission mode of the traditional Internet information under the technical level of blockchain. So the key is how to make the information dissemination in the metaverse autonomously oriented and highly liberalized through the authentication technology of blockchain. This paper proposes that the information dissemination in the metaverse requires the public blockchain and the consortium chain to complement each other, with the public chain as the main and the consortium chain as the supplement. As shown in Figure (4), based on technology of blockchain smart contract, the production of information is completed under the trust mechanism and consensus mechanism which makes sure that information content is uniformly managed. Information data has also been expanded under a certain degree of freedom in the public blockchain. The expansion of the amount of information has led to the transformation of dissemination. Information dissemination feeds back into the consumer environment and drives people's demand for cultural economy. At the same time, virtual currencies and value products such as tokens and NFTs can be used as incentive elements to encourage information transmitters to produce high-quality information content.[6]
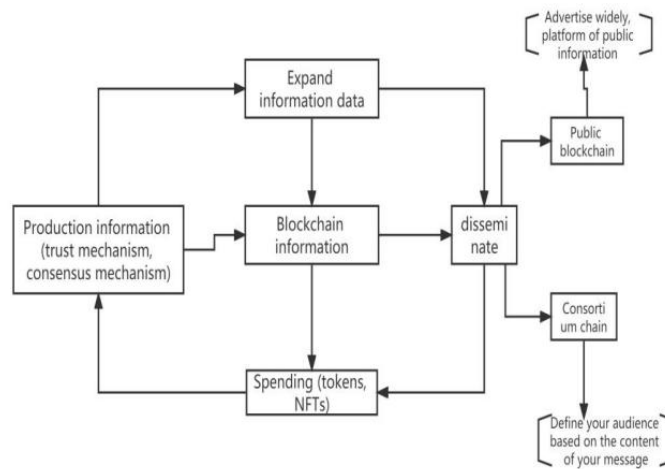

Fig.4. Double-chain parallel mode

4.2 Implementation level of dual-track dissemination mode

The dual-track communication management system based on blockchain includes physical infrastructure and subsystems, namely distributed storage, information transmission terminal in metaverse, subsystem of integrated management platform, as well as subsystem of data collection and security key.

The integrated management platform system organizes and collects the content of the information disseminated to facilitate the recipients of the information to trace the source of the information. As shown in Figure (5), the data collection system collects and stores login information for the transmission terminals linking public blockchain and the consortium blockchain respectively, and immediately verifies whether the identity of login information meets the consensus mechanism and access mechanism of the blockchain under the block chain network and the information transmission terminal connected through the REST server. The security key system manages the security of the entire execution process which protects the information transmission process through the distribution and escrow of keys.[7]
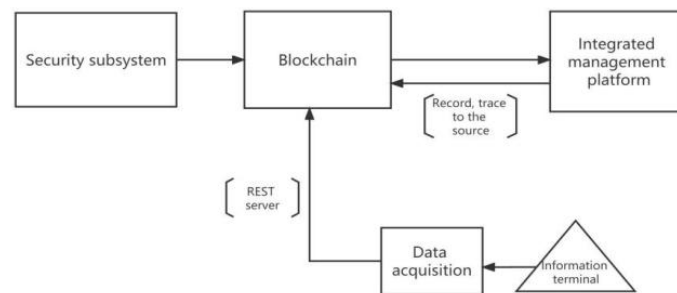

Fig.5. Execution system

4.3 Recommending the Algorithm Reference

In the dissemination of blockchain information, many excellent consensus algorithms have emerged to protect blockchain information from being operated by malicious nodes, such as CFT-style RAFT, BFT-style HotStuff, etc. However, from the perspective of information dissemination, blockchain needs to introduce recommended algorithms to improve the effectiveness of information dissemination. UF algorithm recommendation mainly focuses on counting the respective similarity among users, and finding user clusters with similar interests according to the similarity. As shown in (1), User-Based CF[8] calculates the similarity between user i and user j, and $I(i,j)$ represents the information that user i and user j have commented on, $R_{i,x}$ represents the amount of user i liking the content of the information x, $\bar{R}_i$ represents the average of user i likes. The reason why subtracting the average is because the users' evaluation criteria are different so as to avoid the impact of differences. Suppose user A is interested in information B and C, user B is interested in information B, and user C is interested in information A, C, D. Then after statistical calculation, if user C likes information D, we can infer that user A may also like information D, as a result, it is reasonable that information D can be recommended to user A.

[9]Although this kind of estimation can find the user's interest and needs, the cold start problem needs to be solved. Therefore, the UF recommendation algorithm is suitable for niche groups with similar interests, and the consortium blockchain collects certain data on users with the help of smart contracts, so that new user groups with attribute characteristics can enter the recommendation algorithm of consortium blockchain, and try to solve the cold start problem of UF recommendation algorithm.

$$sim(i,j) = \frac{\sum_{x \in I_{ij}} \left(R_{i,x} - \bar{R_i} \right) \left(R_{j,x} - \bar{R_j} \right)}{\sqrt{\sum_{x \in I_{ij}} \left(R_{i,x} - \bar{R_i} \right)^2} \sqrt{\sum_{x \in I_{ij}} \left(R_{j,x} - \bar{R_j} \right)^2}}$$

$$(1)$$

However, because the public chain data is more complex and diversified in information characteristics, the CTR recommendation algorithm can be used. (CTR = (clicks/ demonstration number) * 100%). Based on wide range of group attributes (age, income, interests, etc.) and information content attributes (creativity, value, utility, etc.), it extracts the click-through rate. The data of the public chain information platform is extensive and messy, and under the CTR algorithm recommendation, the information exposure and click volume are accurately calculated, and the macro prediction of information dissemination orientation is improved, and the relevant information exposure rate is improved according to the perfection of user attributes. On the CTR recommendation algorithm, the computational advertising training and smoothing ideas illustrate the effectiveness of the LR algorithm for prediction. As shown in (2),"w"is the weight vector and "x"is the eigenvector. LR (Logistic Regression) is a generalized linear model, which can divide the samples by rows and assign the sample features of each computing node during calculation. At the same time, LR is easy to parallelize, can be performed on different machines, and compared with simple collaborative filtering, LR model can use multiple interactive characteristics of users and information to generate more comprehensive recommendations.

$$LR(w,x) = w_0 + \sum_{i=1}^{n} wixi$$

$$(2)$$

5   The application direction of information dissemination mode in the metaverse based on the blockchain technology

On the basis of the open system, the information dissemination of the public chain presents an autonomous ecological environment. The metaverse is a grand world pattern, which is borderless from the perspective of the Internet. [10]The public blockchain can help the cultural exchange of global information and innovate the production of information content in the borderless information dissemination which makes contribution to the efficiency of Chinese cultural information dissemination in the information dissemination of the metaverse. At the press conference of the "Spark· Blockchain Network" digital native assets (DNA) service network of the China Academy of Information and Communications Technology, "Spark· Blockchain Network" was officially released as a national blockchain infrastructure, which has been recognized and supported by governments at all levels and all parties in the industry since its release in August 2020. "Spark· Blockchain Network" always adheres to building a decentralized, trusted, and global-oriented "digital foundation" and promotes sharing, exchange, and trusted circulation of data information , thus making data information truly become "assets."

Public blockchain information solves the problem of centralized information which also promotes the production and dissemination of blockchain-enabled information to a certain extent. However, the information content on the public blockchain must various and overwhelming. The guidance of the consortium blockchain is required to make information dissemination more adaptive and precise in positioning and to make information dissemination channels professional and authoritative. As seen in the Figure (6)
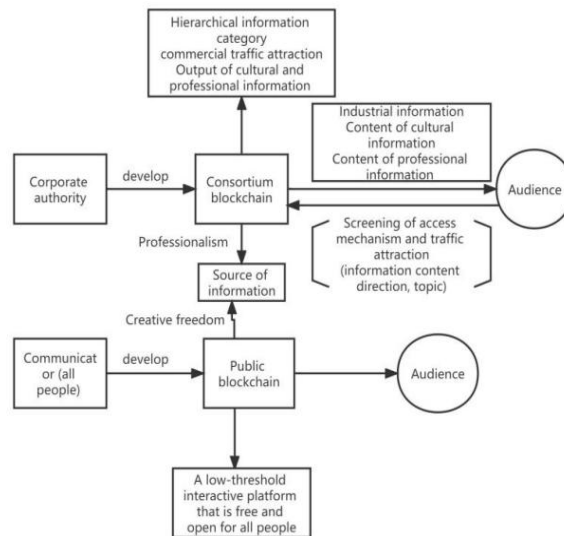

Fig.6. Apply mode

When the consortium blockchain establishes an access mechanism through smart contracts, it carries out the precise guidance of information dissemination. The information dissemination of the consortium blockchain does not fully disclose the information dissemination to ensure the consensus of the value of information content symbols. This creates an information dissemination on the consortium blockchain that can organize higher knowledge, literacy, and professionals to jointly process or accept information on a certain topic. At the same time, the consortium blockchain can empower the industry in publicity of commercial information, especially empower the cultural industry to form "blockchain plus culture". Advertising promotion can rely on traceability from the actual communication path and communication effect to effectively give feedback to accurate market assessment. Meanwhile, the untamperable characteristics of blockchain information can effectively avoid data distortion, gratuitous bad reviews and other undesirable phenomena.

In recent years, the application of the consortium blockchain has gradually expanded, and the Ant Blockchain's Open Consortium Blockchain is an open and inclusive blockchain service network with low-cost, and low-threshold. Relying on the strong technical foundation of the Ant Blockchain's Open Consortium Blockchain, it was built with the joint efforts of authoritative node partners in various industries and with innovative public licensing mechanism. Ant Blockchain's consortium blockchain mainly serves Ant Group. Information such as digital collections must be disseminated and made available to users through

consortium agreements. In the project of "Wenchang Star Tradition, Cultural Refreshing Plan" launched in May 2021, Ant blockchain promoted information such as design and production, as well as product design characteristics through the consortium blockchain, and accurately and intelligently matched the dissemination of information to users with requirements, which promoted the economic benefits and cultural publicity that are the goal of the project. It can be found that, in addition to publishing authoritative information settings, the consortium blockchain plays a better role in the accurate dissemination of information corresponding to users, and has certain commercial communication value. For example, the establishment of a cultural and creative consortium blockchain will not only facilitate the audience to quickly find authoritative information related to cultural and creative information, but also quickly absorb the user circle interested in cultural and creative information and related information under the rules of the access mechanism. On the one hand, users must strictly follow the rules of smart contracts for the production and dissemination of information. Smart contracts from the consortium blockchain, on the other hand, will automatically screen registered users.

6   Conclusion

[11]As for the intersection of virtual reality and blockchain, metaverse has broad application prospects and far-reaching social significance. On the one hand, the public blockchain brings wide dissemination and reception of information, with the characteristics of low threshold and large area, which is suitable for announcements, publicity, and the creation and dissemination of personal information. While consortium blockchain aims to concentrate on the high-quality and centralized processing of information at a certain point, continuously improve the media literacy of users disseminating information, and promote the quality of information content. All in all, the two complement each other to complete the dissemination and distribution of information in the metaverse. On the other hand, the public blockchain and the consortium blockchain are balanced against each other. The two can supervise each other's authenticity, security, creativity, and value in terms of related information content so as to cooperate in production, which is a combination of strict management and a high degree of freedom of information dissemination mode, thus forming a relaxed communication mode. But at the same time, the combination of metaverse and blockchain also needs to break down technical limitations and solve challenges such as legal and regulatory issues and social acceptance issues. In the future, it is necessary to explore and innovate in technology, law and society to promote the development and application of metaverse and blockchain in information dissemination.

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