Cool-headed Considerations on a Hot Technology: A Preliminary Analysis of the Application of Blockchain in Digital Copyright Management and Protection (Postprint)

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Abstract

In recent years, blockchain technology has gained immense popularity, with numerous fields actively discussing the feasibility of integrating blockchain into their respective domains; the copyright field is no exception. However, amidst the fervor surrounding emerging technologies, calm and rational reflection is particularly warranted. Therefore, this paper begins by examining the fundamental principles of blockchain and attempts to integrate blockchain technology with the management and protection of digital copyright. By comparing the advantages and existing challenges of combining blockchain technology with digital copyright, this paper ultimately offers reflections, recommendations, and prospective outlooks regarding the application of blockchain in the digital copyright domain.

Full Text

Preamble

Theoretical Research: Media Theory - A Cool-Headed Examination of Hot Technology: An Analysis of Blockchain Applications in Digital Copyright Management and Protection

Abstract: In recent years, blockchain technology has become a trending topic, with numerous fields exploring its potential integration—including the copyright domain. However, hot technologies demand cool-headed reflection. This paper begins with the fundamental principles of blockchain, attempting to integrate blockchain technology with digital copyright management and protection. By comparing the advantages and existing challenges of this combination, the paper

ultimately offers reflections, recommendations, and prospects for blockchain' s application in the digital copyright field.

Keywords: blockchain; digital copyright; copyright management; media convergence

Introduction: Bitcoin, Blockchain, and the Digital Copyright Era

As Bitcoin' s price has soared, public enthusiasm for Bitcoin and its underlying technology has intensified. Research and practice demonstrate that the blockchain technology powering Bitcoin may be even more "valuable" than Bitcoin itself, transforming blockchain from an obscure technical concept into a household name. Simultaneously, copyright protection and utilization face unprecedented challenges in the digital age. The cost of copyright objects has been dramatically compressed in network dissemination, while information flows at lightning speed, resulting in uncontrollable copyright infringement and making it difficult for creators to protect their intellectual achievements and obtain corresponding benefits. Based on this context, the author attempts to combine blockchain technology with digital copyright to explore whether it can address the enormous challenges facing digital copyright in this new era.

1. Technical Principles of Blockchain

Blockchain is a distributed, decentralized computing paradigm that utilizes cryptographically protected chain-block structures and distributed node consensus algorithms to execute data verification, storage, and updates. As the underlying technology of the digital currency Bitcoin, it first appeared in Satoshi Nakamoto' s 2008 paper *Bitcoin: A Peer-to-Peer Electronic Cash System*, which proposed that Bitcoin as a digital currency could enable online payments from one party to another without requiring any financial intermediary.

In essence, blockchain is a distributed shared ledger system for digital currencies, and its growing importance stems from several core technical characteristics. First, **distributed ledger and decentralization**: all activities related to transaction generation, verification, recording, and synchronization in blockchain are conducted through pure computer algorithms that establish trust relationships between points, with distributed networks completing transactions without third-party supervision, achieving decentralization. Second, **cryptographic security and immutability**: the foundation of blockchain is cryptographic algorithms, and newly generated transaction data must be verified by other nodes across the network and only added to the blockchain after receiving majority authentication. This record-keeping method, where all nodes jointly maintain the ledger, makes it impossible for any single node to alter records unless it simultaneously controls most network nodes—a theoretically

unfeasible scenario. Third, **convenient traceability and review enabled by data transparency**: the distributed network accounting method makes all transaction information public to every node, making transaction information review and utilization more convenient and transparent than traditional methods. The timestamp affixed to each transaction on the ledger not only prevents double-spending but also facilitates copyright information tracking. Fourth, **flexibility in recording methods**: the technical potential of blockchain itself far exceeds what has been demonstrated in Bitcoin transactions. Beyond the classifications of public chains, private chains, and consortium chains, more detailed side-chain extensions can be implemented on each block of the main chain. Moreover, thanks to its open-source scripting, the methods for extending utilization within individual blocks can be independently edited to meet specific user requirements.

2. Advantages of Blockchain Technology in Digital Copyright

2.1 Low-Cost Copyright Registration with Clear Ownership and Simplified Rights Protection

"Information wants to be free."The essence of intellectual property is information, and information' s lifeblood lies in circulation—particularly in the digital network era. Near-zero-cost information acquisition, second-speed dissemination, and the elimination of geographical limitations have made information control increasingly difficult. Unlike patent and trademark rights, creators obtain copyright automatically upon completing their works, with the current system presuming authorship through attribution. However, in the digital copyright era, the ease of data copying and alteration makes determining the "original"of a work extremely difficult. In other words, continuing to presume authorship through attribution for data transmitted across networks is prone to confusion from massive information flows and can lead to erroneous conclusions. Authors often face difficulties in evidence presentation, such as proving the initial upload time of a work and the consistency between online identity and real identity—common defenses in current judicial practice for copyright confirmation. Although China has established a copyright registration system to confirm ownership, the high registration costs disadvantage individual authors, and the requirement to provide real identity information hinders authors who habitually use pseudonyms or remain anonymous. By integrating digital copyright with blockchain, copyright registration no longer requires third-party institutions but directly establishes trust relationships through majority nodes, eliminating intermediary fees. A single copyright registration on the blockchain costs as little as 0.4 yuan and can be completed instantly, dramatically reducing the cost and time cycle of copyright confirmation. Blockchain' s distributed ledger characteristics also ensure the immutability, transparency, and openness of registered information, maintaining a complete and clear chain of copyright protection and utilization. The affixed timestamps also facilitate review and evidence presentation regard-

ing the specific timing of work creation and utilization dynamics, achieving the goal of "creation equals registration, discovery equals rights protection."

2.2 Enhanced Copyright Licensing Efficiency and More Reasonable Profit Distribution through Smart Contracts

In current business models, work utilization is primarily determined through layered contracts among "creators—intermediary platforms—work users." This approach essentially blocks direct "face-to-face" transactions between authors and transaction parties. On one hand, it increases the costs for transaction parties to obtain works; on the other hand, it reduces the direct benefits authors can receive from their works. Taking the fees for purchasing individual songs on music streaming platforms as an example, the cost calculation includes expensive monitoring contract agreements and complex profit distribution, with authors receiving only a small proportion of copyright fees. Most of the consumer' s payment actually goes to intermediaries, which contradicts the public' s preference for obtaining information directly from authors and indirectly contributes to piracy proliferation. By eliminating intermediaries through blockchain technology to enable direct communication between authors and consumers, this new business model not only reduces transaction costs and improves information exchange efficiency but also avoids problems of platform manipulation of consumption trends and unequal value acquisition caused by information asymmetry, truly encouraging authors to create various works and fulfilling the original intent of copyright law systems. Simultaneously, thanks to the flexibility of blockchain architecture and combined with smart contract technology, it is entirely possible to achieve coexistence of main chains and specific block utilization side chains, enabling reasonable utilization methods such as copyright acquisition for investment and financing, copyright pledging, and mortgages while maintaining clear ownership, thereby enhancing work utilization efficiency and truly transforming "knowledge into wealth."

2.3 Blockchain' s Role in Enhancing Public Copyright Awareness

Due to the relatively late start of China' s copyright law, public copyright awareness remains relatively weak, though it is gradually improving with the increase in copyright disputes in recent years. According to surveys by relevant research teams, in the internet domain, young digital natives are more willing to pay small fees for copyrighted content they appreciate. Combined with the aforementioned discussion about how blockchain technology can reduce consumer costs for obtaining copyrighted works, it can be concluded that the integration of blockchain technology and digital copyright helps increase consumer willingness to purchase small-scale copyrighted content—the very type of content currently most affected by piracy and infringement. At the proactive level, this adopts payment methods more acceptable to the public, thereby 排斥 ing the generation and circulation of pirated content. At the passive level, constraints from technology and law force the public to comply with copyright transaction

rules, invisibly promoting the purification of the online copyright ecosystem and enhancing public copyright awareness.

2.4 Application Examples

The above analysis of blockchain' s advantages is primarily based on idealized theoretical foundations. The following further analysis incorporates real-world cases.

A New York-based company developed a blockchain-based metadata protocol called Mediachain, which utilizes the IPFS (Interplanetary File System) to achieve digital work copyright protection. The blockchain timestamps declared in its distributed ledger are all stored in IPFS and can be obtained through search. Currently, Mediachain has created metadata records for over 2 million original images, with users including the Museum of Modern Art in New York, the Digital Public Library of America, and Europeana.

SingularDTV, a blockchain-based film and entertainment technology company headquartered in Switzerland and built on Ethereum, applies blockchain technology to launch a series of applications including crowdfunding, project release and production, and distribution promotion to build a decentralized ecosystem for the entire entertainment industry. In their words, they "help artists connect directly with audiences, eliminating all middlemen." To date, SingularDTV' s successfully financed film and entertainment projects have raised a combined total exceeding ten million US dollars, with branch offices established in multiple countries.

Additionally, there are similar examples in China, such as the micro-film blockchain copyright (transaction) service platform jointly created by Huaxia Microfilm Culture Media Center and the China Copyright Protection Center. These cases demonstrate that the combination of blockchain and digital copyright is not merely theoretical, and the advantages discussed above do exist. However, company executives also candidly admit that due to varying levels of public awareness and technological development of blockchain across different countries, the resistance encountered at both technical and social levels also differs, requiring judgment based on specific real-world circumstances.

3. Challenges in Applying Blockchain Technology to Digital Copyright Management and Protection

No technology is omnipotent, and blockchain has its limitations. The difficulties in its application to the digital copyright field are mainly manifested in the following two aspects.

3.1 Inherent Limitations of Blockchain Technology

First, **security issues**. Cryptography is the cornerstone of blockchain security, and the asymmetric encryption mechanism is an important technical support

for blockchain security. This means that with the rapid development of cryptography and related disciplines, as well as the upgrading of computer equipment, cracking blockchain' s encryption mechanism is only a matter of time. At that point, blockchain' s decentralized characteristics would instead result in individual helplessness in defending against hacker attacks. Second, **efficiency and resource issues**. The distributed ledger characteristic of blockchain requires each node to back up a copy of data, and as massive data continues to expand, storage space requirements will also increase. Judging from current Bitcoin financial transactions, the reality of processing only 7 transactions per second clearly cannot meet future large-scale copyright transaction demands. The expansion of block numbers will undoubtedly limit blockchain utilization efficiency. Furthermore, due to blockchain' s transparent and public information characteristics, block number expansion will consume substantial underlying network bandwidth, leading to collective network performance degradation or even paralysis. Simultaneously, the electricity resources consumed by its network computing power also make it a high-energy-consumption industry in the technology sector. Beyond these basic technical issues, how to select and trade off among the technological "impossible triangle" is also a challenge faced in blockchain application. Moreover, blockchain development remains in its infancy, and more new technical problems will inevitably emerge in the future.

3.2 New Problems Arising from Blockchain-Digital Copyright Integration

The copyright issues arising from the combination of blockchain and digital copyright are most fundamentally manifested in the difficulty of work determination. In reality, judgments regarding whether something constitutes a work and whether infringement exists between works are highly flexible, whereas blockchain' s determination of whether something constitutes a work or constitutes infringement solely through the hash value obtained from converting digital copyright works into binary numbers clearly presents difficulties. First, it may result in the confirmation of rights for information not protected by copyright law, such as ideas or facts. Its immutable characteristics would instead hinder the deletion of confirmed information that does not meet copyright law requirements for work composition, thereby monopolizing information that should belong to the public domain and causing an "anti-commons tragedy" in the copyright field. Second, since the hash value corresponds one-to-one with the binary numbers of digital copyright works, any minor change to a work can form a new hash value, obtain program recognition, and be confirmed as a "new work." This clearly does not align with the originality requirements in copyright law' s determination of new works and essentially represents merely a recorded method of producing infringing works. While it can provide evidence support for creators' rights protection, it cannot solve the problem of infringing work proliferation at the technical source level. Third, different countries have varying levels of copyright protection strength, yet the internet knows no borders. Therefore, how should blockchain be designed—unified or separate? What

is the hierarchy among different blockchains? How should technical standards be regulated? How should domestic and foreign copyrighted works be treated? Who should regulate it? These and many other difficult questions await further examination.

Conclusion: Reflections and Prospects on Blockchain-Digital Copyright Integration

In summary, blockchain' s application in digital copyright management and protection offers prominent advantages, but its current defects are also evident. Therefore, the author believes that with blockchain technology still immature, we should not blindly exaggerate its utility. Instead, we should adopt a business-thinking approach, comparing the costs consumed by blockchain, the problems arising during operation and in later stages, with the tangible benefits it can deliver. Based on market choices, we should judge whether it can replace existing intermediary platforms to better serve society, or whether it will become a new intermediary continuing the mission of capital accumulation. After all, technology often emerges not to replace an industry but to lead industry development through new methods.

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