

## Research on New Model of Digital Copyright Service Based on Registration

Hu Guan  
BJDCRC  
Beijing, China  
hu.guan@ia.ac.cn

Ying Huang  
Institute of Automation, Chinese Academy of Sciences  
Beijing, China  
ying.huang@ia.ac.cn

ZhongHe Tian  
Harbin University of Science and Technology  
Harbin, Heilongjiang, China  
747645682@qq.com

Shuwu Zhang  
Institute of Automation, Chinese Academy of Sciences  
Beijing, China  
shuwu.zhang@ia.ac.cn

**Abstract**—In the current open network environment, with the widespread use and dissemination of digital content, digital copyright management and service methods have been paid more and more attention, and have become a current research hotspot. Based on the research and analysis of the existing copyright management and service models, a new digital copyright service model based on registration is proposed for the purpose of better realizing copyright management and infringement monitoring. Based on some of the core techniques such as copyright information registration, efficient extraction and comparison of media fingerprint, and blindly embedding and extraction of copyright identifier, a new model of network-based digital media copyright service based on registration, fingerprint comparison, and identifier tracking can be implemented to solve a series of market order chaos problems caused by online media piracy and infringement.

**Keywords**- *digital copyright service; copyright registration; media fingerprint; copyright identifier; infringement monitoring*

### I. INTRODUCTION

In recent years, with the rapid development of digital media technology and internet technology, a large number and diverse formats of digital media content have appeared on the internet and various mobile terminals. These contents have exploded with the development of technology and the continuation of time, and have the characteristics of easy copying and tampering, which makes the current piracy and infringement of digital content more and more serious. Therefore, digital content copyright protection and the owners' legal rights protection, have become important topics for research and discussion at home and abroad.

The copyright protection and infringement certification of digital contents must first rely on the laws. At present, domestic and foreign countries have issued laws and regulations that adapt to their respective national conditions and market characteristics in terms of digital copyright management and service. The developed countries in the digital content industry have adopted policies and regulations to ensure the disclosure and sharing of information and provide resource guarantees for industrial development. For example, the United States mainly relied on legal protection

when managing the development of the digital content industry, and formulated the United States Federal Information Resources Management Policy [1] in 1985. In September 2009, the French HADOPI Bill (Promotion of the Protection and Dissemination of Internet Creation) was passed, and according to this bill, the High Office for the Dissemination of Internet Works and the Protection of Rights (HADOP) was established to protect the right to network information dissemination of works. From 2001 to 2002, Japan successively promulgated the "Basic Law on the Promotion of Culture and Art", "Outline of Strategic Knowledge Property" and "Basic Law on Intellectual Property" to promote the development of digital content industry [2]. Meanwhile, in China, the "information network communication right" has been added to the "Copyright Law" revised in 2001, and promulgated the "Information Network Communication Right Protection Regulations" in 2006 [3]. But, the current copyright policy applicable to the digital content industry is still very weak, there is very little experience and results in the digital copyright protection area. A reasonable and scientific digital copyright order is aiming to promote the institutionalization of digital copyright registration. And also, the independent copyright service technical standards should be developed and promoted.

In addition to the legal support, it is more important to solve the infringement discovery, copyright tracking, content protection and other issues, of digital contents, in the open network environment, through technical means based on laws. For many years, the traditional copyright protection for digital contents is mostly realized by encryption, which has several problems such as the unreadable nature of cipher text and the ineffectiveness of decrypted content protection methods. With the increasing diversity of digital media types and piracy infringement methods and the people's increasing requirements of digital contents, the traditional encryption-based digital copyright protection model can no longer be applied to the current open network environment, and the new designs are required. The ideal digital copyright protection model and system should be able to continue to protect the content and copyright of digital media even after the content is decrypted. Compared with the traditional

encryption-based protection model, this new model can be called the tracking-based digital copyright protection one [4].

The advantage of the tracking-based model is that, it does not require encryption operations on digital contents, and can track and authenticate the copyright of digital contents without affecting their distribution and use. Rely on legal means to protect copyright through the discovery and confirmation of piracy and infringement afterwards. The realization of this copyright protection model requires mutual support from law and technology. It requires not only China's legislation on the copyright of digital contents to be gradually improved and perfected, but also relevant digital copyright protection techniques to support tracking-based digital copyright protection methods [4].

The rest of this paper is organized as follows: Section II summarizes and analyzes the existing techniques and methods of digital copyright management and service, sorts out their main problems and proposes the main features of our proposed new model. Section III focuses on the implementation scheme of the new digital copyright service model based on registration and the application of some related techniques. Section IV gives the conclusions.

## II. ANALYSIS OF EXISTING DIGITAL COPYRIGHT MANAGEMENT AND SERVICE TECHNIQUES AND METHODS

In this section, we will focus on analysis of some commonly used copyright management and service techniques and methods at home and abroad, such as content protection based on encryption, digital copyright management technique, copyright service based on copyright protection techniques, etc. Clarify the current techniques and the limitations of the methods, and then put forward the core idea and innovative mode of our novel model.

### A. Digital content protection based on encryption

One of the copyright protection methods for the digital contents is cryptography, as one of the main traditional technologies in the field of information security. It is based on Shannon's information theory and cryptography theory. Existing digital content protection is usually realized by means of encryption, that is, the digital media file is first encrypted into ciphertext, which will be released instead of the original one, so that an illegal attacker who appears in the process of transferring encrypted digital media file cannot extract the ciphertext. Obtain confidential information to achieve the purpose of copyright protection and information security (covert communication). But this cannot completely solve the problem. On one hand, the encrypted file will hinder the spread of digital media information due to their incomprehensibility. On the other hand, the encrypted digital media information can easily attract the curiosity and attention of attackers, and even can increase the possibility of being cracked. Also, when the information has been received and decrypted, all the encrypted content will be the same as the ordinary one and will no longer be protected from infringement and piracy. In other words, cryptography can only protect the content in transit. While the content has been decrypted, there is no longer a protective effect for this purpose [4].

According to the above analysis, we can see that, the existing copyright protection based on encryption, to be precise, protects the content in transmission, but the content copyright is powerless, and the encryption technique has the disadvantages such as content incomprehensible, vulnerable to attack, and cannot protect the content periodically. Therefore, in the current open network environment, the limitation of encrypted content protection technology in the copyright service of digital content is obvious.

### B. Digital copyright management (DRM) technique

Digital copyright management technique is a systematic technology for the protection and management of intellectual property rights in the production, dissemination, sales, and use of digital content, which can provide effective protection for digital content and thus guarantee the orderly development of the digital content industry [5].

Since its creation, this technique has received extensive attention from industry and academia, and is regarded as a key technology for digital content trading and dissemination. Many well-known international research institutions and companies have launched their own digital copyright management systems and products. For example, Microsoft's WRM (Windows Media Rights Manager), InterTrust DigiBox and Rights System abroad, IBM's EMMS (Electronic Media Management System), RealNetworks Helix DRM, Apple's FairPlay system, etc. and Beijing Shusheng Electronic Technology Co.'s SEP DRM digital copyright management technology, Beijing Founder Apabi Technology Co.'s Apabi digital copyright protection technology. In addition, other research institutions such as the Chinese Academy of Sciences and the University of Hong Kong have also conducted in-depth exploration and research on the digital copyright management technology architecture and key algorithms [6].

Most of the existing digital copyright management systems are implemented by copyright protection based on content encryption. Although this scheme can partially prevent the occurrence of infringement and piracy problems, it is not absolutely safe enough. Most of the time, this technique cannot be used to protect copyright after infringement, but also can cause great inconvenience for genuine users and has obvious defects. It should be emphasized that digital copyright management and service are not equivalent to encryption-based digital copyright protection or simple content protection.

### C. Digital copyright service based on copyright protection techniques

The initial digital copyright protection technique hopes to solve the problem of unauthorized copying of digital content through secure encryption, which is, lock the digital content to limit the users. The protection objects are mostly based on the digital copyright protection of text information. The current digital copyright protection covers the identification, transaction, protection, monitoring and tracking of various forms of the use of copyright, including the management of the relationship between copyright holders.

International companies that have developed in the field of digital copyright protection include Microsoft, Adobe, Intertrust, etc. They have already launched corresponding products, but there are still deficiencies in many techniques such as the trusted count of digital content, digital copyright controlling, transaction process security and mutual, user identification collection etc. Presently, the representatives in the field of digital copyright protection mainly include Microsoft and Real Networks. Microsoft's WMRM system only supports its own media format. Real Networks' RMCS (Real system Media Commerce Suite) system currently only supports its codecs and basic usage rules [7, 8].

In China, the main representative in digital copyright management is Beijing Founder Apabi Technology Co.'s Apabi series products [9]. Beijing Rainbow World Information Technology Co., Ltd. proposed the RG2DRM digital copyright protection solution [7]. The applications of these products are copyright management for digital contents in specific formats or specific fields. At present, there is still a lack of digital media content copyright management or service systems or platforms which can basically cover most of the mainstream content types and formats. The Copyright Protection Center of China proposed a digital copyright service model based on DCI (Digital Copyright Identifier) [10], focused on basic services such as electronic contract and electronic document filing and retrieval. This platform can be regarded as a relatively representative and authoritative service one in the field of digital copyright service. It integrates a digital copyright management and service model based on trusted third parties such as unique copyright identification and registration, but has the following disadvantages. Firstly, the registration platform has the requirement that users must upload the complete digital content which is needed to be registered, which can lead some users to be reluctant to upload their contents completely. Meanwhile, this will also increase the storage and management burden of the background system. Secondly, the binding of the unique copyright identifier and digital content is realized based on the registration platform. The content itself and its unique identifier do not implement a permanent binding method. Thirdly, the infringement or suspected infringement of the content can only be known to the registration platform by way of reporting, and a kind of active monitoring mechanism for infringement is needed.

Based on the above summary and analysis of the existing digital copyright management and service methods in terms of technology and system application, we can find that, the current digital copyright management and service models have the following problems that need to be resolved:

(1) The digital copyright management method based on encryption is no longer applicable to the current open network environment. While protecting digital content, it should not excessively restrict the spread and use of it, and new technical solutions need to be explored.

(2) The digital content management method based on registration has the problems that the original content storage load is too large and the original content is also not easy to be obtained. It is necessary to explore a new registration way to improve the copyright service efficiency and quality.

(3) The current copyright management and service systems are fighting with each other, each of which has its own emphasis on the various types of content protection. It is difficult to achieve system docking and cascading. There is a lack of copyright registration systems or platforms that can accommodate various media types and formats and corresponding management and service model.

Based on the analysis and consideration of the above problems, this paper proposes a new digital copyright service model based on digital content and copyright information registration, which has the following characteristics:

(1) The copyright service platform does not restrict the use and dissemination of digital contents themselves, and users do not need to upload all their contents to the platform. They only need to provide corresponding metadata and copyright information for registration and management according to the rules. It can solve the problems such as limited usage, heavy platform load, and difficulty in obtaining original contents.

(2) Based on the registration information, the copyright service platform generates a unique and resolvable copyright identifier for the digital content, and binds the copyright identifier with the digital content itself permanently and imperceptibly, which is able to realize copyright certification and infringement proof of digital content at any time.

(3) The copyright service platform can support the registration of digital contents in various mainstream formats, unify the specifications and standards, and realize the convenient and friendly use for various users. While realizing copyright registration, it can also conduct real-time network-wide monitoring of content based on the registration information, and also, the active discovery and proof of piracy and infringement.

In Section III, we will focus on the specific design scheme of the novel digital copyright service model based on registration we proposed.

### III. DIGITAL COPYRIGHT SERVICE MODEL BASED ON REGISTRATION

Based on the research and analysis of the existing traditional digital copyright management and protection key techniques and systems, we can find that, in order to truly realize the services of digital content copyright inquiry, authentication and tracking, digital content and its copyright need to be registered. A digital copyright service model based on digital content and its copyright registration should be innovated. To register the copyright of digital content, a unique copyright identifier should be assigned for the digital content, which will also be embedded into the corresponding digital content in a covert manner, so that it will accompany the spread and use of the digital content. Meanwhile, the stable digital fingerprint information of the digital content should be extracted, which will be used as the only abstract of the content. Registering the assigned copyright identifier and the extracted fingerprint in the same way, supplied with some other core key techniques, a comprehensive and practical solution can be provided for the copyright service [4].

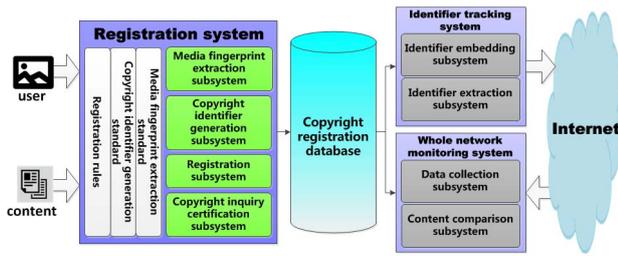


Figure 1. Flow chart of novel copyright service model.

#### A. Digital copyright service model based on registration

Here we propose a new model of digital copyright service based on digital content and its copyright registration. The specific scheme of the model is as follows:

Firstly, a credible third-party copyright service agency operates and maintains a digital copyright service platform. The basic architecture of the platform is shown in Fig. 1, which mainly includes registration system, identifier tracking system and whole network monitoring system.

(1) Registration system. This system first collect and organize users' information, digital content information (including copyright information). Then extract media fingerprint information according to relevant standards and specifications. Thirdly, generate a copyright identifier for this content. Finally, register all the collected information, generated fingerprint information and assigned identifier information, forming a copyright registration database.

(2) Identifier tracking system. According to users' needs, the unique copyright identifier of the digital content generated by the system is implicitly embedded into the digital content, which then can be spread together with the digital content itself, and does not affect the use of it, also can not cause significant perceived impact. After identifier embedding, user can safely let his/her content spread freely via the internet. When copyright disputes arise, user can extract the copyright identifier to verify his/her copyright based on the copyright registration database.

(3) Whole network monitoring system. According to the media fingerprint information of digital content recorded in the copyright registration database, data collection and fingerprint comparison techniques are used to collect and analysis the network-wide data on the internet and even various mobile terminals, which are same or similar as the original digital content. In this way, we can realize the active monitoring of the copyright via the entire network content based on the extraction and comparison of media fingerprints, and infringement or suspected infringement will be proactively warned.

In addition, the platform can also provide basic services such as copyright registration information retrieval and copyright certification based on the copyright registration database.

#### B. Key core techniques of copyright service

Based on the above description of the new model of digital copyright service, in which, the key core techniques

involved mainly include digital copyright identifier embedding and extraction technique, digital media fingerprint extraction technique, network data collection technique, efficient information retrieval and comparison technique, etc.

(1) Digital copyright identifier embedding and extraction technique

Embedding a copyright identifier in a digital content needs to ensure that it cannot affect the normal distribution and use of the digital content, and the embedded identifier will not be intentionally or unintentionally removed during the dissemination and use process. Based on this, we can consider introducing the principles and methods of digital watermark technology [11] to embed the copyright identifier into digital content covertly. At the same time, when performing copyright monitoring or tracking, the copyright identifier can be completely extracted through corresponding copyright identifier extraction strategies. This technique can provide a good technical support for copyright identifier embedding and extraction in the new model of digital copyright service based on registration.

(2) Digital media fingerprint extraction technique

When registering digital content, if we upload all the digital content completely to the platform, it will cause the storage capacity of the registration database to be too large, and will also seriously affect the efficiency of content retrieval and comparison. Therefore, we can consider trying to extract the stable feature information of digital content to represent its whole content. In this way, we can store a large number of feature information of the digital contents in a small storage space, and perform efficient retrieval and comparison of the feature information. We can consider introducing the principles and methods of digital media fingerprint technology [4] to achieve the extraction of representative feature information from the digital content to form a media fingerprint. This technique can provide good technical support for media fingerprint extraction and comparison in the new model of digital copyright service based on registration.

(3) Network data collection technique

In order to realize the whole network monitoring and infringement proof in the new model of digital copyright service based on registration, it is necessary to use cross-terminal all-media efficient intelligent collection technique, through simulation of multiple IP, multiple users, multiple clients, multiple browsers, irregular random collection, to achieve efficient and concurrent collection of massive network information. At the same time, we should explore different collection strategies according to different media forms, to achieve efficient collection. It can provide technical support for the efficient comparison of the same or similar media content.

(4) Efficient information retrieval and comparison technique

The new digital copyright service model proposed in this paper will face copyright registration of massive digital contents. When providing service to the outside world, it is necessary to do the information retrieval and comparison operations frequently on unknown digital contents. Focusing

on the retrieval efficiency, it is necessary to apply content-based multimedia retrieval technology [12] to realize the efficient information retrieval by using digital content metadata, embedded copyright identifier or extracted media fingerprint. It can provide technical support for copyright inquiry verification and online infringement monitoring.

#### IV. CONCLUSION

This paper has proposed a new model of digital copyright service based on registration. The existing digital copyright management and service systems or platforms of different types and application scenarios under the current open network environment has been analyzed. Meanwhile, facing real application requirements, based on techniques such as digital copyright identification, digital media fingerprinting, copyright information registration, efficient information retrieval and comparison, the novel digital copyright service strategy in this paper, which based on such core functions including copyright information registration, feature fingerprint extraction and comparison, copyright tracking and parsing, can provides a good technical solution for hot issues such as copyright management and infringement monitoring in the current complex network environment.

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