Research on Digital Product Confirmation Identifier and its Application Mode in Copyright Management and Transaction

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***Abstract*—In recent years, with the rapid development of digital media and big data techniques, ownership management and transactions for digital products (including digital media contents and data resources, etc.) have received increasing attention. As a core element in the process of copyright management and transaction, the confirmation identifier has played a vital role in it. In this paper, by summarizing and analyzing the existing methods of generating and applying various digital product identifiers, for the two different forms of digital products, digital media contents and data resources, we proposed a unified method for generating confirmation identifiers and the confirmation identifier constituting rules, which are suitable for their own characteristics respectively, and put forward the corresponding application model of the confirmation identifier in the digital product copyright management and transaction process, in order to give a better play to the role of the confirmation identifier. And further regulate the copyright and transaction management of digital product through the use of the confirmation identifier.**

Keywords- digital product; confirmation identifier; copyright management; copyright transaction

I. INTRODUCTION

In the open network environment, with the rapid development of digital media and big data techniques, the spread and use of digital products such as digital media contents and data resources have brought great convenience to the people's production and life. Due to the inherent characteristics of digital products such as easy replication, easy dissemination, easy access, and rapid circulation, these new media in the internet era have brought more spiritual enjoyment to people, but also introduced serious market turmoil caused by piracy and infringement. Moreover, with the explosive growth of digital products, the illegal infringement and the use of digital products are becoming more and more serious, which has jeopardized the legitimate interests of legitimate rights holders. For example, media content such as images, audios and videos can be copied, edited or even maliciously tampered with at will, and personal privacy information is sold or used without authorization, and so on. Therefore, the standardized management of digital products and the circulation of legitimate transactions have become people's earnestly hope. These problems such as the inability to blame piracy due to the unclear copyright of digital products have also attracted more and more attention from the state and related industries.

In 2017, the State Administration of Press, Publication, Radio, Film and Television emphasized in the "Thirteenth Five-Year Plan for Copyright Work" that it "should study and establish an internet copyright confirmation, authorization and transaction mechanism, strengthen copyright asset management, and improve the development of the copyright industry. Let copyright play the basic and strategic role in cultural development, and build a good and fast development pattern of the copyright industry." [1]. For the first time, the Fourth Plenary Session of the 19th Central Committee of the Party added "data" as a factor of production. In 2020, the "Opinions of the Central Committee of the Communist Party of China and the State Council on Constructing a More Perfect Market-Oriented Allocation System for Factors" was officially released and pointed out the direction of reform in the five factor areas of land, labor, capital, technology and data. A new type of production factor has become the focus of attention in all sectors of society. At the same time, data resources have also become the country's core strategic assets and social wealth. It can be seen that, whether it is digital media in the field of cultural content or data resources in the field of big data, if the ownership of these digital products cannot be determined, it will bring great inconvenience to their management, and meanwhile, they will not be able to conduct transactions. It is difficult to maximize the value of digital products. Therefore, the research on the mechanism and method for confirming the rights of digital products not only conforms to the government's decision, but also promotes the benign transaction of digital products. It is an important measure that benefits both the current and the long-term [2].

In addition to researching and relying on relevant laws and regulations, even other policies, the digital products

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confirmation also requires technically seeking corresponding methods, in which, the proposal and application of the confirmation mechanism can adapt to the digital products management and trading in an open network environment.

Copyright confirmation of digital media content represented by the field of cultural content has been proposed at an early time. Research institutions and media operators, at home and abroad, have all proposed solutions to adapt to their respective application scenarios, the most representative of which is based on copyright. The method for confirming the rights of the identified digital products achieves the purpose of marking the copyright of the content by assigning each newly created digital content a unique identifier corresponding to its copyright information. On the other hand, as an increasingly important market element and digital product, data resources, whose ownership is different from traditional property rights that can be directly controlled, whose rights have different dominant subjects in the entire life cycle of data, their ownership does not necessarily belong to a certain economic entity. Therefore, in the process of data management and transactions, the identifier generation method and application mode of data resources will be different from the media contents.

Based on the comparative analysis of the various types of digital product identifiers that have been proposed so far, this paper proposes a unified method for generating confirmation identifier which is suitable for both the two types of digital products (digital media contents and data resources). And the constituting rules for each type of digital content are also proposed, as well as the corresponding application models, which all can provide the basic support for digital products copyright management and transactions.

The rest of this paper is organized as follows: section II summarizes and analyzes the meaning and application scope of various types of digital product identifiers that have been proposed so far. Section III introduces the confirmation identifier generation method and constituting rules for the digital media contents and data resources, respectively. Section IV introduces the specific application mode of the confirmation identifier in the copyright management and transactions. And section V summarizes the full paper.

II. Summary of Digital Product Confirmation Identifiers

Through the investigation of the relevant digital product identifiers, we can see that for different application scenarios, various identifiers with different forms have been proposed in the market, which have different generation and coding rules, and also correspond to different application scenarios. In this section, we describe some common identifiers and analyze their composition and application modes.

A. Digital Object Identifier (DOI)

DOI is a permanent symbol for digital resources, which emerges in response to the copyright protection of internet publications and was certified by the International Organization for Standardization in 2008. The DOI standard and analysis system is established by the International DOI Foundation (IDF), which is a non-profit organization of the American Associate of Publishing in 1994, and in the corporation of National Research Initiatives. In March 2007, the Institute of Science and Technology Information of China and Beijing Wanfang Data Co., Ltd., as the first RA member in China, jointly applied for and obtained DOI's Chinese registration and management rights [3] [4].

DOI is used to mark content objects in the digital environment and reveal some information about them. DOI is mainly composed of a prefix and a suffix, separated by a slash in between. The prefix starts with "10.", and the following 4 digits (which can be lengthened) are the numbers assigned by IDF registration agencies to DOI registrants. The suffix is allocated by an organization (such as a publishing house) that obtains the DOI prefix and has the right to store records, and consists of several nodes with unequal numbers of characters [3][4]. Its main purpose is to assign permanent identifiers to new digital resources and at the same time, it can locate its storage location on the network according to DOI through the resolution function of the DOI system.

B. Digital Copyright Identifier (DCI)

DCI system proposed by the Copyright Protection Center of China is a new model of digital copyright service proposed to solve copyright management and operations in the digital publishing industry [5]. During the copyright registration or contract filing of each digital work, DCI code, DCI mark and work registration certificate are issued. The DCI system has three basic functions: digital work copyright registration, copyright fee settlement certification, and rapid rights protection through monitoring and forensics.

According to the press and publishing industry standard "Unique Digital Copyright Identifier" [6], the coding structure of DCI includes five parts, which are prefixes (3 characters "DCI"), rights status identification (1 character), allocation year (4 characters), applicant code (20 characters), object identifier (indefinite-length characters), the first and second parts are separated by ":", aiming to assign a unique copyright identifier to the digital work applying for copyright registration. Using this identifier, the copyright query and verification can be implemented to achieve the purpose of confirming the authenticity of the copyright and clarifying the copyright ownership of the digital work.

C. Digital Copyright Management Identifier (DRMI)

DRMI is a research result of the National Press and Publication Administration Press and Publication Major Science and Technology Project [7]. It is intended to propose a structure and coding method suitable for the copyright identification of publications in the field of digital publishing.

DRMI is includes four parts: type identifier (1 character), digital content identification code (17 characters), copyright version number (3 characters) and check code (1 character), with no delimiter between each two neighboring parts. The main purpose of DRMI is to assign different types of digital publications (including books, audio-visual products, etc.) with identifiers that mark their content information and rights transfer information. Through analysis and identification, the content-related information and the number of rights transfers of the digital publication can be analyzed.

According to the discussion of the above digital product identifiers, we can find that, the existing various types of digital product identifiers have the following characteristics:

(1) Different identifiers are generated to adapt to different application requirements. The main application of DOI is the location resolution of network resources, but not marking content or copyright information. The main application of DCI is to assign a copyright identifier to each registered work. The registration system uses this identifier to retrieve and authenticate the copyright. And DRMI is to assign a copyright identifier to the publication to mark the content information and its rights transfer records. The compatibility between different identifiers is poor, whose respective characteristics cannot be considered simultaneously.

(2) All identifiers need a background management system to support their authentication of content or copyright. Whether it is DOI, DCI or DRMI, if the content or copyright of the work needs to be authenticated, the should retrieve the identifiers in the system for the purpose of authentication, but the direct and effective binding of copyright information and content itself is not technically realized.

(3) The existing identifiers cannot directly indicate the rights transfer or transaction results, which means, the corresponding rights information or transfer information cannot be directly obtained from the identifier itself.

Based on the above discussion, we proposed our own confirmation identifier generation methods in this paper. The main ideas are as follows:

(1) Aiming at the application scenarios of digital product copyright and transaction management, a unified method for generating a confirmation identifier is proposed, which can be applied to both digital media contents and data resources.

(2) Aiming at the identification of digital media content, this paper proposes a confirmation identifier constituting rule by combining the owner and the content information, and proposes a kind of application idea to directly and permanently bind this identifier to the digital product itself, which can realize the digital product copyright confirmation and infringement certification based on registration.

(3) Aiming at the confirmation of data resources, this paper proposes a confirmation identifier constituting rule by combining the data resource metadata information and rights identification information, and proposes a method for data resource transactions recording based on confirmation and trusted record. According to the rights direct marking and the transaction credible record, the data resources confirmation and infringement authentication can be realized.

(4) Aiming at the application scenarios of digital product management and transaction, this paper proposes the instruction and basic idea of the confirmation identifier, in order to maximize the use value of confirmation identifier.

III. METHODS FOR GENERATING CONFIRMATION IDENTIFIER OF DIGITAL PRODUCT

Based on the characteristics and applications of the digital media contents and data resources, we proposed the confirmation identifier generation method that is compatible with both of the two types of digital products, and also the corresponding constituting rules and usages, respectively.

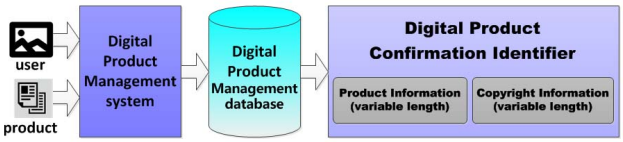

Figure 1. Digital product confirmation identifier generation method.

A. Digital Product Confirmation Identifier Generation

The process of digital product confirmation identifier generation, originates from the process of registration and unified management of the digital content and copyright. As shown in Fig. 1, in order to make the digital product's confirmation identifier plays its greatest role in copyright certification and infringement monitoring, in the digital product management platform, digital product confirmation identifier is generated as the following steps:

(1) The owner (user) of the digital product registers his/her personal information and product information in the platform according to the unified requirement of the platform.

(2) The platform forms a back-end digital product management database based on the registration information, and correspondingly records user information (including copyright information) and content information (the abstract information) of the registered digital product in the database.

(3) The digital product management platform selects product information and copyright information from the database according to specific rules to form a digital product confirmation identifier (generally in order to adapt to applications in various scenarios, in the confirmation identifier, the product information and copyright information are both variable-length ones, and a specific identifier can be used as a separation between the two sequences).

(4) The digital product management platform records the generated confirmation identifier in the database, forming an interconnected whole with the product information and user information, which is convenient for authentication.

B. Digital Media Content Confirmation Identifier Constituting Rule

Digital media content mainly includes mainstream multimedia types such as electronic documents, images, audios, and videos, etc. The main application scenarios are as follows: Firstly, for content providers and operators, they need to involve standardized management (including content management and copyright management) of digital media contents. Secondly, for content users, it is necessary to involve the dissemination and use of digital media content, or even intentional or unintentional editing processing. Therefore, the digital media content confirmation identifier generation process needs to take into account the above two aspects. One is that the digital media content's confirmation identifier can uniquely represent the media content (including its copyright information). The other is, after the digital media content has been distributed, used, edited, etc., there is also a kind of strategy, which can also recognize the corresponding confirmation identifier accurately, aiming to play the role of the confirmation identifier in the aspects of copyright certification and infringement monitoring.

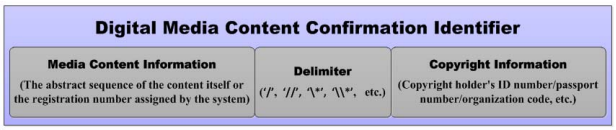

Figure 2. Digital media content confirmation identifier constituting rule.

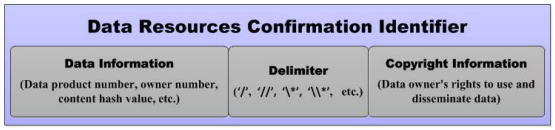

Figure 3. Data resources confirmation identifier constituting rule.

The generation of digital media content confirmation identifier needs to rely on the basic information provided in the copyright registration process, including metadata information and copyright information, in which, the media content owner's information and the content abstract information can be extracted. Combine the two as the confirmation identifier of digital media content.

The confirmation identifier constituting rule of digital media content is shown in Fig. 2, which is as follows:

(1) Media content information. Generally, it is the abstract of the media content itself (We can specify the length of the sequence to different application scenarios and ensure the uniqueness of the abstract algorithm), or it can be the registration number assigned by the system (We can set the necessary length of the number and ensure the uniqueness according to the management requirement).

(2) Delimiter. It is used to separate media content information and copyright information to facilitate machine identification or increase readability. During some specific encoding rules, the separator may not be required.

(3) Copyright information. Generally it is the ID number or passport number of the media content owner, which can uniquely identify the identity of user, or the organization code, which can uniquely identify the identity of the unit user (The copyright of digital media content generally refers to the ownership, so the unique code representing individual and organization can indicate the copyright owner).

Here, we should emphasize that, in addition to realize content and copyright authentication, the digital media content confirmation identifier also needs to be permanently bound by technical means to the media content itself, but the binding process cannot be known by users, also cannot affect the normal distribution and use of media content. The principles and methods of digital watermarking technique with imperceptibility and robustness can be used to realize the complete embedding of the confirmation identifier [8][9]. And the complete and accurate extraction can be performed to verify its authenticity if necessary. By this way, the copyright certification can be achieved at the technical level.

C. Data Resource Confirmation Identifier Constituting Rule

As a special digital product, data resources have been increasingly affected by the rapid development of big data, internet of things, artificial intelligence, etc., in recent years. At the Fifth Plenary Session of the Eighteenth Central Committee, the big data strategy has been upgraded to a national strategy. In the real network environment, the use and circulation of data resources are becoming more and more frequent. There is an urgent need for a method which can regulate data resource management and transactions to achieve data safety and credible transaction circulation.

Data resources mainly include personal data, corporate data, government data, etc. Personal data involves too much private information, so the data resources which can be used for transactions are often corporate or government data. The management and transactions of them will mainly face to the following questions: Firstly, how to standardize the data management, due to the diversity of data and other characteristics, how to describe and label data from different dimensions is an important issue. Secondly, data resources have a characteristic which can be described as "what you see is what you get". Data transaction is actually the data rights circulation process. How to describe and track the circulation of data rights is the first thing to be solved in the processes of data transactions and infringement monitoring.

The data resource confirmation identifier generation depends on some information describing the data resource and its controllable rights, including metadata information, which can uniquely represents the certain data resource, and rights information. Combine the two as the confirmation identifier of data resources.

The constituting rule of data resources confirmation identifier is shown in Fig. 3, which is as follows:

(1) Metadata information. It generally includes the content number of the data resource, the number of the data resource owner, and the hash value of the data resource content (According to different application scenarios, the length of each type of metadata information can be specified, and ensure the uniqueness of the metadata combination).

(2) Delimiter. It is used to separate metadata information and controllable rights information to facilitate machine identification or increase readability. During some specific encoding rules, the separator may not be required.

(3) Rights information. It generally refers to the rights' types of data resources that can be transferred when the actual controller uses or trades the data resource (including copy rights, merger rights, modification rights, etc. [10]). Through a specific coding method, we can mark the rights of the data resource owned by the data resource controller (Since the circulation of data resources is a change in rights, it is different from digital media content, the identification of data resources must have a description of specific rights information in order to track its related rights).

Different from the permanent binding of the digital media content confirmation identifier, the data resource confirmation identifier needs to be associated with the metadata information in the registration platform for correlation records. When the right(s) of a data resource is transferred, a new confirmation identifier will be assigned to the transferred data resource, and all the confirmation identifiers are associated together to form a process chain of data resource transactions, which facilitates data traceability, determination of infringement, etc.

IV. Application Mode of CONFIRMATION IDENTIFIER in Copyright Management and Transactions

In this section, we put forward the use methods and basic ideas of digital product confirmation identifier in copyright management and transaction application scenarios, including copyright registration, copyright search and retrieval, and copyright transaction tracking, etc.

A. Copyright registration

As mentioned above, the generation process of the digital product confirmation identifier is completed during the registration process, and the generated identifier is treated as part of the digital product metadata information, which is also recorded in the platform, aiming to realize content retrieval, rights analysis, and other specific applications based on the identifier in practical applications. The identifier can be used as a unique representative of digital product to some extent. For example, the confirmation identifier can be combined with the DOI mentioned in Section II to realize content analysis and positioning.

B. Copyright search and retrieval

Copyright search and retrieval based on the confirmation identifier is a very common application in the copyright service model based on registration. The user can retrieve the content based on the confirmation identifier, and can also retrieve the confirmation identifier based on the content metadata, including content duplication, etc. Meanwhile, for the digital media content confirmation identifier, the corresponding copyright information can be retrieved based on the confirmation identifier retrieval, and the copyright of the media content can be authenticated based on the analysis of the confirmation identifier, which has been bound to the content itself. For the data resource confirmation identifier, the right information of the data resource can be confirmed based on the analysis of the confirmation identifier itself.

C. Copyright transaction tracking

In the digital product transaction process, different types of digital products have different roles in the confirmation identifiers. For the transaction circulation of digital media content, the confirmation identifier marks the ownership of the media, and the transaction circulation is the right to use or other rights. Without the change of ownership, its own confirmation identifier is unchanged. We can use this identifier to confirm the rights and verify the copyright of digital media in any link of copyright transactions. In contrast, for the transaction circulation of data resources, the confirmation identifiers mark the right information of the data resources before and after any transaction circulation. The data resource after each transaction circulation needs to be assigned a new confirmation identifier, which makes that, a series of confirmation identifiers will be generated during the transaction flow of data resources, which can exactly constitute the record of the transaction circulation chain of data resources. Additionally, combined with the registration platform, the data resources transaction process retrieval, data tracing, infringement positioning can be realized.

V. Conclusion

This paper analyzes and summarizes the characteristics of digital products (including digital media contents and data resources) and their applications in copyright management and transactions. Based on existing digital identifiers such as DOI, DCI, and DRMI, a unified confirmation identifier generation method has been proposed, which is compatible with the two types of digital products. And also, according to the different characteristics of them, this paper also proposes their own configuration rules respectively, aiming to provide a kind of basic idea for the generation and use of the confirmation identifier. What is more, this paper also briefly discusses the application of the confirmation identifier in different links such as registration, copyright retrieval, transaction tracking, and provides a basic digital product copyright management and transactions model based on identifier, for the industry users. In actual production applications, it is also necessary to combine specific application environments and scenarios to adaptively refine or adjust the generation method and rules of the confirmation identifier proposed in this paper, aiming to play a greater role in the process of copyright management and transactions.

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