Research on Digital Copyright Infringement Based on Cloud Computing Environment

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Abstract. Since the popularity of the Internet, more and more people have chosen to look for the information and resources they need on the Internet. People’s lives have gradually been changed by the Internet. Cloud storage brings new development opportunities, and the copyright protection issues involved in cloud storage are gradually emerging. Cloud storage has changed the original pattern among traditional information owners, disseminators and users, causing conflicts among copyright owners, cloud storage servers and information acquirers, and the problem of copyright protection has become increasingly prominent. The rapid development of network file sharing platforms such as cloud storage brings unprecedented challenges to copyright protection. The application and development of cloud storage also challenges the recognition of traditional copyright system, object and content, so we must balance the contribution of cloud storage to the exchange of information resources and protect the legitimate rights and interests of copyright holders.

Keywords: Cloud computing; Cloud storage system; Digital copyright; Copyright infringement

1. Overview of Cloud Computing

Cloud Computing is a fusion development of distributed processing, network storage, virtualization, parallel processing and grid computing technologies. Using cloud computing technology, tens of millions of information can be processed in a few seconds to achieve the same powerful network service as "supercomputer". Cloud computing actually provides people with a kind of service. Its service mode is to transmit IT resources, application services and data to users through the network. At present, it has become a new business computing model. Users do not need to invest a lot of money in the development or purchase of large-scale resources and equipment to enjoy convenient services. As Cloud Computing is a fusion of distributed processing, network storage, virtualization, parallel processing, grid computing and other technologies, cloud computing technology can process tens of millions of information in a few seconds to achieve as powerful a network service as "supercomputer". Cloud computing actually provides people with a kind of service. Its service mode is to transmit IT resources, application services and data to users through the network. At present, it has become a new business computing model. Users do not need to invest a lot of money in the development or purchase of large-scale resources and equipment to enjoy convenient services. As shown in the figure [1]

Figure1 Cloud Computing Mode

Computing power has become an important strategic resource for an enterprise or even a country. Its function is not lower than other strategic materials and its cost performance is extremely high. Large enterprises at home and abroad, such as Google, Microsoft, IBM, Amazon and so on, have invested in the competition of cloud computing industry one after another, striving for a share in this emerging industry.

Cloud storage is a cloud computing system with data storage and management as its core. Cloud storage is a new concept based on the concept of cloud computing. It originates from cloud computing related technologies and gradually changes and develops through extension and development. In short, cloud storage is a new storage scheme that places storage resources on the cloud for people to access by using cloud computing technology. Users of resources can easily extract and store resources at any time and at any place through any device that can connect to the Internet and connect to the cloud system.

Therefore, cloud storage is actually a cloud computing system, but it is a cloud computing system configured with a large amount of storage space. The following figure shows a comparison of architecture models between cloud computing and cloud storage [2]:

[1] Huang Xiaoyun. Research on cloud storage service system based on HDFS [D]. Dalian Maritime University, 2010.37

[2] Li Yubo. Relying on cloud storage to build a new network application platform [J]. Computer CD software and application, 2010 (9): 20
Judging from their structural models, there are differences in storage layer and basic management layer, but they are exactly the same in access layer and application interface layer. Compared with cloud computing system architecture, cloud storage system has a storage layer besides access layer, application interface layer and basic management layer. This shows that cloud storage technology is based on the application of cloud computing, and is based on the development of cloud computing technology.

II. The Subject and Object of Copyright Protection in Cloud Storage Environment

A. Main Issues of Copyright Protection in Cloud Storage Environment

As cloud storage environment provides a kind of network technology service, it does not examine whether the collected information of numbers, documents and resources is true and reliable. Therefore, the creator of the work, i.e. the copyright owner, is difficult to automatically identify and protect in cloud storage. If documents and other resources are downloaded and tampered with by some people with bad intentions, and uploaded to the network environment again, cloud storage cannot clearly identify them. Thus, under the cloud storage environment, using pseudonyms, duplicate names, or apppellations like apppellations to confuse the true with the false, and replacing the true with the false brings certain difficulties to the identification of the subject of copyright protection.

B. The Object Problem of Copyright Protection in Cloud Storage Environment

The object of copyright protection is the work. As for the definition of works, Article 2 of the Regulations on the Implementation of Copyright Law clearly states: "Intellectual achievements that are original in the fields of literature, art and science and can be reproduced in some tangible form". It can be concluded that works must have three characteristics: originality, sensibility and replicability. It is not hard to find that the analysis of various documents and data resources of cloud storage shows that although cloud storage technology has changed the form of works, it still conforms to the three elements of the object of copyright protection.

III. Copyright Infringement in Cloud Storage Environment is More Complicated

A. Infringement of Network Neighboring Rights

As we all know, the main reason why the network can extend in all directions like spider web lies in the application of hyperlink technology. In the cloud storage environment, hyperlink technology shows more convenient features. Users can easily and quickly reach other websites with the help of hyperlinks from one website, and then obtain relevant information resources they need. This kind of link can help users directly obtain information from other websites, including some information with economic benefits. It should be pointed out that the acquisition of such information did not involve any creative work by users. In the cloud storage environment, the information in the "resource pool" is much larger than that in the traditional network. However, the link state shown by hyperlink technology among these information does not have obvious regularity, which brings difficulty to the effective control of infringement in network neighboiring rights.

B. Infringement of Copyright of Database Works

The database we usually refer to refers to a resource pool that collects literary and artistic works, scientific research achievements and other information materials. Cloud storage has been widely popularized and applied due to its large database information capacity and low management cost. However, at the same time, it also greatly increases the risk of database information being copied and transmitted. Many organizations or individuals take the relevant works from the database through the FTP file transfer function on the internet, which objectively leads to the infringement of the copyright of the database works.

[3] See the "Regulations on the Implementation of the Copyright Law of the People's Republic of China" promulgated and implemented on September 15, 2002.http://www.gov.cn/gongbao/content/2002/content_61712.htm
C. The Problem of Infringement of Network Communication Right

Once the power owner uploads the digitized works to the "cloud", the data will be quickly uploaded to a virtual server in the cloud in a short time. At the same time, because the server is shared by all users, anyone can use the server to obtain the uploaded works anytime and anywhere. In addition to downloading, the infringer can also freely use various methods to spread, exchange or reprints works with copyright, and can also use this information to make certain profits.

IV. On the Issues of Portability, Buffer and Temporary Reproduction of Works

In the cloud storage environment, works are spread on the network in digital form. At present, China has made clear legislation to protect the copyright of works in digital form. Therefore, under the existing system, authors of digital works need not worry about the copyright protection of their works. In the era of traditional copyright, works are spread by tangible carriers, and the portability of works is obvious. However, in the era of cloud storage, the spread of digital works is based on the network, without physical carriers, which makes the portability of works worthy studying. The accumulation of digital works on the virtual carrier will be involved in the environment where the network is the transmission channel. This means that the accumulation of information flow will be formed in the transmission process of digital works in the cloud storage environment. This information flow itself cannot constitute a specific work. However, when it is continuously transmitted on the virtual carrier, it accumulates time and content, which is likely to form works, for example, buffer information in websites, and some buffer information can be regarded as specific works. In the cloud storage environment, the way users use works is instant, that is, they can rent and use the works. Users only get the right to use the works, not the ownership. In short, users no longer use works based on copying behavior, they do not need to store copies of works on their own internet terminals, but browse works directly on cloud storage platform, and users do not leave any traces of works after using them. However, because the network carrier and the cloud storage carrier are not perfectly integrated at present, works in the cloud storage platform form buffer information in the network carrier, which will form copies of works in the cloud storage platform and lead to infringement problems after being illegally used by some users. Therefore, in the cloud storage environment, it is necessary to strictly control the buffering behavior. Relevant departments should analyze the specific conditions and capacity requirements for the formation of buffering information from the cloud storage technology, and effectively cut off the conditions for the formation of buffering information in the cloud storage platform. This is the critical point to establish whether the buffer information constitutes a replica, so as to avoid infringement caused by buffer information in cloud storage environment.

As more switching equipment is adopted and the two network cards of the server are fully utilized to construct the network, the network capacity and fault tolerance are greatly improved. The figure shows the aggregate bottleneck throughput versus switch failure.

| Characteristic value | Trace estimation | Critical value |
|----------------------|-----------------|----------------|
| 0.643                | 951             | 132.25         |
| 0.716                | 867             | 147.48         |
| 0.804                | 1104            | 143.86         |
| 0.328                | 886             | 176.23         |

Due to the relatively closed and centralized management of the data center network, it is drawn by different performance requirements in the actual deployment process, showing the coexistence of various network forms. In line with the premise of cointegration test. Check whether there is a long-term equilibrium relationship between relevant variables. The inspection results are shown in Table 1.

Traditional electrical interconnection data centers have gradually been unable to meet the demand, while optical interconnection technology has incomparable advantages over electrical interconnection in many aspects. Network configuration failures account for the largest proportion, followed by failures of unknown causes. With the expansion of the network scale, the interconnection between nodes becomes more and more complex, which makes the network configuration more difficult. Virtualization technology mainly refers to the formation of a virtual pool of shared resources by pooling physical resources. The system needs a process of promotion, application and upgrade. Different voices will appear in this process, which requires the construction department to obtain the support of decision makers. As shown in the figure is the equalizer architecture model.
The main challenge brought by cloud storage technology to copyright is that it has completely changed the way works are copied and disseminated. The main difference between cloud storage environment and other network copyright infringement acts is that its operation mode has certain particularity. Cloud storage uses the method of storing all information to the cloud for processing, and users do not need to download or copy it to the local server. In this case, the meaning of duplication has changed greatly, and the corresponding infringement of duplication has also changed. Based on this, this issue has become the key content to define the infringement of cloud storage rights.

V. The Issue of "Rental Right" and "Information Network Dissemination Right" of Works

In the cloud storage environment, great changes have taken place in the dissemination of works, which makes the traditional copyright system face great challenges. This challenge is most common in SaaS mode, which is most commonly used in cloud storage. In SaaS mode, service providers provide online usage services. Users can pay for any software under the cloud storage platform only by logging into the service website through a browser through an internet terminal, and do not need to download the software or other digital works to a personal computer for use as before. Therefore, there is no leasing entity for the services leased under SaaS mode. This leasing behavior is virtual and intangible. Users cannot get any actual works or services in the whole process and can only accept the right to use once. The purpose of the traditional rental right of works is to regulate the rental behavior of works with tangible materials as the carrier, which is contrary to the rental behavior under SaaS mode, thus making the traditional rental right of works encounter great challenges. In SaaS mode, the use process of works cannot be regulated through "information network communication rights", because it also does not meet the key requirements of "providing", "obtaining" and "public" in information network communication rights. According to the concept of "provision" stipulated in the "Provisions of the Supreme People's Court on Several Issues Concerning Applicable Laws in Hearing Cases of Civil Disputes Involving Infringement on Information Network Dissemination", the functions of storage, linking and information transmission provided by the platform to the third party under the cloud storage environment have not changed the application content of the third party, nor have they offered the service content to the third party voluntarily. Therefore, the network service provided under the cloud storage environment does not meet the "provision" element in the "information network dissemination right". In copyright law, "obtaining" should be understood as obtaining the ownership of the original or copy of the work. For the services provided by the platform under the cloud storage environment, users only get the right to use the relevant applications, but do not get the ownership, which does not meet the "acquisition" element of "information network dissemination right". Therefore, neither the "rental right" nor the "information network dissemination right" can stipulate the copyright issue under the cloud storage environment, let alone solve the new copyright issue under the cloud storage environment.

VI. It is difficult to define the infringement of the right of reproduction

The domestic courts adopt the "three-step method" in the judicial practice of defining the act of copying in copyright infringement, and regard whether it has the act of copying as an important premise and foundation for the establishment of copyright infringement. Therefore, it is very important to judge copyright infringement whether or not the duplication occurs, especially in cloud storage environment. In China's Copyright Law, the concept of "reproduction" is explained as the act of making one or more copies of a work by means of copying or printing. Through analysis, it is not difficult to draw a conclusion that this kind of copying behavior has three characteristics: the reproducibility of the content of the work, the repeatability of the expression ways of the work, and the non-creativity of the copying behavior of the work. This kind of copying behavior obviously does not have labor intelligence, and the "works" it copies do not meet the "originality" characteristics of copyright law, but merely reproduce the original original ideas and achievements.

In 2006, in the face of the increasingly developed network technology and the continuous emergence of network copyright disputes, the State Council issued the "Regulations on the Protection of Information Network Transmission Rights" specially aimed at network copyright. However, the information network transmission right in the regulations is based on reproduction, so it is not difficult to see how to accurately define the reproduction behavior plays a key role in determining the information network transmission right. However, in the network communication environment, the concept of replication in the current cloud storage environment is obviously different. First, there has been an obvious change in the mode of replication. The former is mainly the replication done by ISP or ICP on the computer server, but the latter is the further development and extension of the network environment. Compared with ordinary network communication, replication in cloud storage environment has obvious characteristics of concealment and remoteness, which specifically reflects that some changes have taken place in the server and the replication-transmission path of the work, that is, from the original linear transmission to the deep multi-thread transmission gradually. Second, with the increasing progress of cloud computing technology in China, replication behavior in cloud storage environment will show a more convenient,
efficient and fast electronic replication. In other words, digital works in a cloud storage environment can be copied and distributed countless times in a short time without the help of the infringer’s server. Third, the replication behavior in cloud storage environment is generally carried out in the "cloud", users do not need to download information to the local, nor do they need to use the local processor and memory to complete, so the extension of the definition of replication rights in cloud storage environment is more complex than in network environment.

VII. Lack of legal awareness of copyright protection and lag of legislative mechanism

A. Lack of legal awareness of copyright protection

Intellectual property infringement is a common phenomenon in our country. There are four reasons for this phenomenon: first, the creator of the work did not have a strong sense of copyright protection after the completion of the work, and the author did not obtain evidence in time after his work was infringed, resulting in lack of evidence, and his claim could not be supported by law. Second, the various copyright protection organizations that the author has joined do not have a strong sense of responsibility and cannot well protect the author's copyright. Third, in the cloud storage environment, service providers evade laws and regulations for commercial purposes and provide works to other consumers without authorization from relevant copyright owners. Fourth, many service users are accustomed to obtaining free resources from the network and other environments and lack awareness of copyright protection.

B. Lagging of Legislative Mechanism

Law is a kind of social norm aiming at the existing social phenomena, which has a certain lag. The further the society develops, the more obvious this lag will become. At present, China's copyright protection laws are "limited to the Copyright Law, the Regulations on the Protection of Information Network Transmission Rights, the Interim Provisions on the Administration of Internet Publishing, the Administrative Protection Measures for Internet Copyright, and the Interpretation of the Supreme People's Court on Several Issues Concerning the Use of Laws in Cases Involving Computer Network Copyright Disputes". Existing laws can't solve all kinds of copyright disputes caused by copyright protection in cloud storage environment.

VIII. Supervision and Rights Protection of Copyright in Cloud Storage Environment

There are many administrative departments in our country, and their functions are also complicated. There is overlap between the intelligence of many administrative departments. This place, which should cooperate with each other and enforce the law together, has seen prevarication in some irresponsible administrative departments, which has created a regulatory gap and brought inconvenience to standardize legal protection of resources and crack down on illegal network operators. In the event of infringement of the author's works, it is even more difficult for the author to safeguard his rights. The lag of the evidence system, the complexity of the litigation procedure, the high litigation cost and the low compensation have led many infringers to submit to humiliation and give up their rights protection, resulting in the efforts of the relevant state departments to crack down on copyright infringement.

One of the important reasons for the ineffective administrative enforcement of copyright protection is the lack of specific legal provisions. The copyright legal relations discussed under the network environment mainly include three legal subjects, namely copyright owners, disseminators and the public. The disseminators mainly refer to Internet content providers and Internet service providers. However, in the "cloud", network disseminators also joined cloud storage service providers. Cloud storage service provider is the place where copyright infringement occurs in cloud storage environment, and it is also responsible for massive data of network users and the occurrence of copyright infringement results. If we only discuss from the aspect of civil infringement, compared with the legal relationship related to copyright infringement in the network environment, cloud storage service providers in the cloud storage environment are likely to become an important joint and several liability bearer to help or replace infringement. Based on this, for cloud storage service providers, once their subjective intention to provide infringement facilities for others' storage appears, they must bear indirect infringement liability from a legal point of view. Then in the actual cloud storage infringement cases, considering the uncertainty of the time and place of infringement, including the display of technical factors, cloud storage service providers are also difficult to find and avoid copyright infringement in time. Therefore, if the cloud storage service provider's duty of care and review are the same as the network environment, it is bound to bring a heavier burden and lack of fairness to the cloud storage provider's legal responsibilities. However, China's current laws in this area are still in a vague state, resulting in the absence of administrative enforcement of copyright protection in this area.

IX. Conclusions

With the advent of the cloud computing era, cloud storage has gradually entered the social life. The system, which integrates and stores various information resources on the network and provides them to the outside world, allows users to access the data stored in the cloud as long as there are networked devices without being constrained by time and place. Multi-channels of information exchange enable users to acquire more effective knowledge in a short time. On the one hand, convenient and fast information acquisition channels improve the efficiency of information use, expand users' knowledge horizons and provide strong support for the rapid development of science and technology. On the other hand, the application and development of cloud storage also pose new challenges to the traditional copyright system identification, object, content and other aspects. Therefore, it is necessary to balance the contribution of cloud storage to the exchange of information resources and the protection of the legitimate rights and interests of copyright owners.

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