Frontier and Methodologies on Digital Rights Management for Multimedia Social Networks

[1,2] Zhiyong Zhang
[1]*School of Management, Xi'an Jiaotong University, Xi' an 710049, China*
[2]*Electronics Information Engineering College, Henan University of Science and Technology, Luoyang 471003, China*
E-mail: z.zhang@ieee.org

Abstract

In recent years the emerging and versatile Multimedia Social Networks (MSN) and tools, such as YouTube, Google Video and Tudou, have further stimulated copyrighted digital multimedia contents and rights sharing among users based on social network platforms. These services and tools created more prominent Digital Rights Management (DRM) problems. Based on a brief summary of the state-of-the-art of DRM studies in recent years, new frontier issues and challenges on digital rights management of MSN are being proposed. Some of the technological and empirical methodologies were highlighted, referring to the characteristics of MSN and DRM model, empirical study on user propagation behavior, as well as DRM security risks identification, assessment and control strategies.

Keywords: *Multimedia Social Networks; Digital Rights Management; Empirical Study; Methodology*

1. Introduction

Along with the swift development of communication network technology and information technology, next generation high-speed broadband Internet and wireless mobile communication networks, such as 3G and 4G, are gradually moving from research trial to significant deployment and application. Various access modes have made it more convenient for users to use network resources, that is, users can get e-Contents and digital services anytime and anywhere. However, because digital content, such as multimedia, has advantages such as undamaged copy and easy distribution, copying digital content in batches and distributing, spreading and abusing those through various communication networks carriers have been prevalent, even though these contents are protected by the Intellectual Property Law. A series of problems on Digital Rights Management (DRM) and protection have been raised because of this and have caused serious consequences on the whole social culture and economic development.

Multimedia Social Networks (MSN) and tools that have emerged in large numbers in recent years, such as YouTube, Google Video and Tudou, have further stimulated digital multimedia content and rights sharing based on social networks platform among users. DRM is a key concern that governs good and healthy development of the digital content industry. It is also the research field where multi-subjects are crossed, such as information technology, information management, copyright law, and business model. In recent years, exploring DRM from the perspective of combined information technology and information management has become the new and effective method to solve problems on digital copyright protection.

2. Related works

The World Wide Web Consortium (W3C) DRM Workshop, which was established in 2001, has a specific definition and description of DRM, that is, "digital rights management prevents digital content from unlawful application through a series of measures, such as, digital content package, distribution, licensing, fee, etc, so as to guarantee that digital content is used and consumed conditionally under fairness, rightfulness and security licensing." From the perspective of the life cycle of DRM Ecosystem, DRM includes basic flows, such as digital

content secure encryption, pull/push distribution, licensing binding, and usage control, among others. DRM also covers copyright control links under a restricted environment, such as digital rights revocation, withdrawal, transfer, and sharing.

DRM is studied from many disciplines, such as information technology, information management, and copyright law [1]. From the technological perspective of DRM, there are two technical routes (i.e., preventive and reactive) to realize digital content security and copyright protection management [2], which is centered on digital content (rights) providers, including cryptology protection [3], digital rights usage control [4, 5], and digital watermarking technology [6]. In the past five years, controlled usage and safe spread of digital content (rights) have been highlighted, and issues concerning these have been addressed urgently. According to existing DRM distribution forms (i.e., separate delivery and super distribution [7] of digital content and its digital rights), content shares are digital rights/licensing shares, where users can access and use digital content only by acquiring corresponding digital rights. Therefore, sharing and spreading digital rights should be our main concern. Existing digital content/rights sharing has been restricted within the general authorized domain, such as digital family domain [8], [9] or personal entertainment domain, which binds distributive digital licensing and content to equipment and (or) user through redistribution and strict usage control security policy [10], [11]. This practice is to ensure that digital content is legal and authorized within the general authorized domain.

Recent studies on digital copyright protection have become increasingly abundant from the perspective of system and management, because the background of DRM study is a complete DRM ecosystem [12]. For example, interest-centered DRM value chain survivability [13] leans toward content application strategy and privacy protection in favor of the user [14], [15]. Along with developing and perfecting copyright-protected digital content value chain, open DRM system [16] and DRM SaaS (Software as a Service), which are appropriately limited, flexible, and customized, will stimulate future DRM market [17]. In addition, extensive studies have been conducted in recent years about digital content security transaction and e-commerce, users' security perception [18], [19] and protection behavior [20], users' behavior pattern [21], trust and privacy concerns [22], as well as P2P DRM security system for media sharing in mobile commerce [23].

From the perspective of information technology and information management and aiming at DRM security strategy selection theory, small world networks modeling method of digital content (rights) spread, and user security behavior's impact on DRM, among others, we carried out an empirical study, put forward DRM multilateral trust framework centered on security-utility [24] and security risk soft computing method during digital rights spread [25], and established utility analysis theory and game theory selection method of DRM composable security policy [26]. These were done so that the DRM ecosystem could reasonably select and deploy security policy with optimal utility. The current study concludes that digital content and digital rights (licensing) spread among users coincide with small world network theory. Moreover, user's security/non-security behavior becomes a key factor that influences DRM strategy implementation.

In conclusion, DRM issues on MSN currently lack necessary theoretical study and risk control strategy. These issues are open problems that need to be challenged and solved urgently.

3. Open issue and challenge

By developing and perfecting digital content value chain, reasonable sharing and spreading digital content and rights becomes the users' primary needs. However, end users can access more high-quality digital content and service and obtain more digital experience only through reasonable and controlled digital rights sharing, thus activating a potential consumer market. Meanwhile, content providers will also obtain optimal income if users share purchased digital content and rights licensing, which are protected by copyright.

However, when digital content and rights sharing extend to extensive user social network domain (multimedia social networks) from general authorization domain (such as digital family network and personal entertainment domain), content providers will also begin to face more

random sharing and spreading of content without authorization. Hence, this will create risk issues, such as uncontrollable and abused digital copyright among others. Therefore, how to effectively perceive natural and ordinary law of user spread behavior pattern under MSN and assess security risk and control in DRM become the open problems that need to be challenged and solved urgently.

To help address the problem of DRM under MSN, we adopt a research method that combines empirical study and soft computing technology. We begin to propose a multimedia social networks digital rights management model and conduct an empirical study. The study aims to address typical problems, such as digital rights spread and transmission, to thoroughly understand digital content (rights) spread behavior among users and to address these behaviors. A soft computing technology was adopted to distinguish and quantitatively evaluate the security risk during digital rights spread, and put forward security risk control strategy to effectively guarantee the lawful rights and interests of digital content rights proprietors.

4. Technological and empirical study methodologies

(1) Multimedia social network characteristics and digital rights management model

Firstly, we need to conduct an experiment and analyze existing multimedia social network platforms and services, such as YouTube, Google Video and Tudou. An ordinary user organization model and user sharing habit under an MSN environment were summarized. A user-centered study on small world network distribution, which gathers data on characteristics and topological structure, was also conducted.

Secondly, a multi agent-role method to build multi-entity management model is adopted, including main function (logic) entity and roles, such as MSNP (MSN Provider), MCP (Multimedia Content Provider), DRP (Digital Rights Provider), MAC (Multimedia Authorized Consumer), MIC (Multimedia Illegal Consumer), and MCM (Multimedia Content Monitor), as well as their attributes and activities. This model was adopted to address multilateral entity and primary need of DRM in the digital content value chain.

Finally, there are needful studies on the network topological graph structure in a user-centered small world network domain (group) and inter-domain (inter-group), and adopted basic logic rules, such as first-order logic language characterization digital content (rights) spreads in user small world network domain and among domains.

(2) Empirical study on user spread behaviors under multimedia social networks

The above of all, we would research on key factors that affect user spread behavior under MSN, such as trust relationship, terminal security, platform usability, content product value and spread sharing environment through real observations. We further concluded attributes from representative customer groups that affect user spread behavior.

And then, we adopted specialist judging data based on the fuzzy analytic hierarchy process to assess the importance of the attributes, which are sequenced by analyzing the membership matrix model.

Finally, a set of correlation assumptions between different user group characteristics and spread behavior were proposed based on small world network characteristics and user behavior/theories of psychology. This was done according to digital content rights' basic logic rules in a small world network spread. Reach spread behavior pattern and ordinary laws of different user groups were identified through laboratory questionnaire, sample data statistical analysis, and true or pseudo proposition assumption.

(3) DRM security risk identification, assessment, and control strategies

Firstly, we investigated and put forward an identification method for key risk user node to accurately master security risk sources and potential high-risk user node during the spread of MSN. This study was done based on conclusions from empirical study about user spread behavior, in combination with several characteristics, such as reliability among user nodes and vulnerability of user terminal equipment.

Further, a risk management VaR method and soft computing technology theory were employed to assess security risk and to quantitatively analyze two kinds of high-risk user nodes in user domain and inter-domains of MSN. These methods were combined with actual demand and risk preference (i.e., risk aversion, risk neutral, or risk tolerance) of digital content (rights) provider of the DRM ecosystem.

Finally, we studied high-risk user nodes' distribution and convergence factor in MSN, uncovered substantive characteristics of high-risk user node, and then put forward a control strategy for security risk across MSN. Security risk was also controlled within given threshold values by reducing VaR remarkably to guarantee that digital content (rights) is distributed and spread controllably and safely from user domain to inter-domains.

5. Conclusions

This study raises new frontier issues and research methodology for digital rights management of MSN based on a summary of DRM studies in recent years. The study explores how to strategically control security risk, which is caused by insecure, unreliable and illegal transmission of data. Illegal transmission of data is done by mastering end user's spread behavior pattern and ordinary law in actual MSN service and platform. This research proposes safe and reasonable sharing and usage control among users by effectively controlling and reducing the security risk of digital content (rights) in MSN spread. The study will also provide a theoretical foundation on building a general model of DRM under MSN. This research also proposes ways to protect DRM rights, to ensure safe and controlled content distribution, to have a good prospective application to build an effective DRM business model, and to promote a healthy and good development for the digital content industry.

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7. References

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