Digital Rights Management in Digital Libraries: An Introduction to Technology, Effects and the Available Open Source Tools

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Abstract

The purpose of this article is to summarize the development and application of Digital Rights Management (DRM) in the digital library scenario. The authors identify the effects of DRM on the trinity of digital libraries – the creators, the content and the consumers. And, introduce the Open source projects on DRM. The article summarizes the technology process and effects of DRM in digital libraries within a legal frame work.

Keywords: Copyright, Digital Rights Management, Digital Library, Open Source Software

1.   Introduction

With the rapid development of the Internet and computer technology, digital content, including digital images, video and music can be distributed instantaneously. However, digital content in the digital world differs from objects in real world. The main difference is the dissemination - it can be easily copied, altered, and distributed to a large number of recipients seamlessly. This almost certainly causes copyright infringement and revenue losses to content owners.

Content owners were in want of a technology that can control the use of their content. Further, they were in need of a protocol of hardware and software services and technologies that can govern the authorized use of digital content and manage any consequences of use throughout the life-cycle of the content (ALA 2003). These aspects gave birth to the concept called Digital Rights Management (DRM).

In 2003, the Congressional Internet Caucus Program on Digital Rights Management, American Library Association states that "Digital Rights Management" is a term used for technologies that control how digital content is used.

Technologists and information scientists consider DRM as a tool which address the issues pertaining to –

1.   Digital Rights Enforcement (DRE) environment
2.   Digital Rights, and
3.   Standardization for interoperability

Many public interest organizations, however, fear that DRM technologies will be used by copyright owners to erode capabilities that had previously been permitted to the public by copyright law under the "fair use" doctrine (or its cousins, such as first sale or limited term) (IITAC 2007).

DRM technologies can be used for more nefarious purposes such as infringing on privacy, personal profiling, price discrimination based on personally-identifiable information and stymieing the development of open source software.

For libraries, DRM technologies can additionally impact first-sale, preservation activities, and institute pay-per-use pricing (ALA, 2003).

2. DRM and Legal Background

The legal context for DRM is copyright law. The United States of America (USA) copyright and the European Union (EU) Countries have their DRM system derived from World Intellectual Property Organization (WIPO) Copyright Treaty of 1996 (WCT). Most of the EU countries have private copying provisions in their copyright laws, which allow consumers to create copies of legitimately obtained content for their own use or that of family members (Rosenblatt, 2006).

3. DRM Technology

Digital Rights Management refers to the technologies and processes that are applied to describe the digital content and to identify the user. Further it refers to the application and enforcement of usage rules in a secure manner. The

primary purpose of DRM is to control access, use and distribution; and thereby protect the interests of copyright holders in the online environment.

DRM systems are also referred to as Electronic Rights Management Systems (ERMS), Rights Management Information Systems (RMIS) and Copyright Management Systems (CMS).

The impetus for DRM is found increases in telecommunications bandwidth and the concomitant increases in digital file transfer and copying over the internet. Abetting the affects of bandwidth are advances in compression algorithms which improve transmission times and facilitate the storage of high-fidelity content. Duplication of content has thus become easy, cheap, and perfect.

Efforts are made by Martin, Mairead, et.al., in their proposed project on Federated Digital Rights Management (FDRM). The project entitled to develop a "federated" mechanism, which refers to the shared administration of access controls between the origin site and the resource provider. The origin site is responsible for providing attributes about the user to the resource provider. FDRM applies and extends the Federated Access Control Mechanisms (FACM) of Shibboleth, a project of the 'Internet2Middleware Initiative' which was designed to develop architectures, policy structures, practical technologies, and an open source implementation to support inter-institutional sharing of web resources subject to access controls. The goals of the FDRM project are to support local and inter-institutional sharing of resources in a discretionary, secure and private manner, and to maintain a balance between the rights of the end-user and those of the owner (Martin, Mairead 2002).

4. Current Scenario

The domain of DRM is currently lacking a generic architecture that supports interoperability and reuse of specific DRM technologies. This architectural lack is a serious drawback in light of the rapid evolution of a complex domain like DRM. It is unlikely that a single DRM technology or standard will be able to support the diversity of devices, users, platforms, and media; or the wide variety of system requirements concerning security, flexibility, and efficiency (Michiels, 2005).

Following are the DRM architecture widely used and accepted as the standards at present situation. This extracts are the high-level usage scenarios according to content consumers, producers and publishers.

5. Fingerprinting

Fingerprinting technologies can be used to identify content by the process depicted in the diagram below. Fingerprinting or "content-based identification technologies" function by extracting the characteristics of a file and storing them in a database. When the technology is presented with an unknown file, the characteristics of that file are calculated and matched against those stored in the database, in an attempt to find a match. If a match is found, the system will return the appropriate metadata from the fingerprint database.
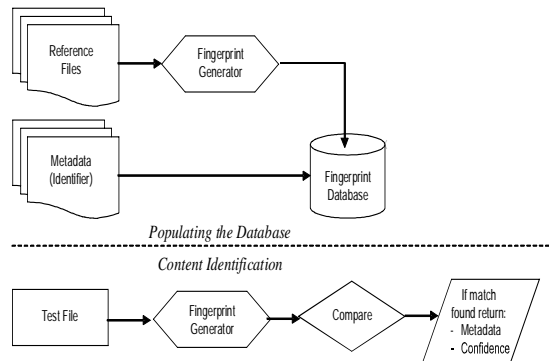
Populating the Database

Content Identification

Source: WIPO, Standing Committee on Copyright and Related Rights, 10th Session, Geneva November, 3 to 5, 2003 document no. SCCR10/2

Fingerprints are highly effective with certain content types, but less equipped to aid the unique identification and greatly depends on the "detail" they provide. Hence fingerprints are suitable for audio, video and audio-visual content as well as photographs but less for computer graphics and text.

6. Watermarking

Watermarking is also often cited when discussing copyright protection technologies. A watermark is "embedded information." This information (often a file or IP identifier) can be extracted by special software. This "watermarking detector" when applied to content that is suspected to be pirated, check if the content bears the watermark and thereby prove or disprove the suspicion. Typically, all files that are to be distributed are watermarked before they are allowed into the content chain. A functional flow diagram of this is shown in the diagram below.
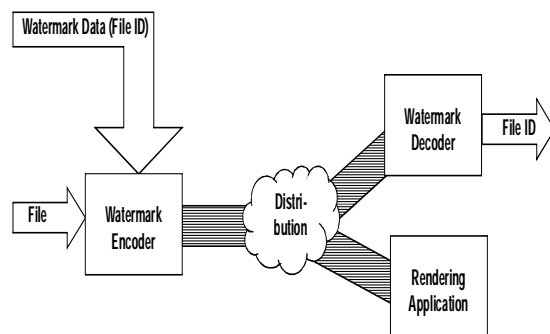
Source: WIPO, Standing Committee on Copyright and Related Rights, 10th Session, Geneva November, 3 to 5, 2003 document no. SCCR10/2

Similar to fingerprinting, watermarks cannot be used with all content types. Small graphic elements such as logos or text are not able to carry watermarks because of a general limitation on the amount of data that can be embedded into the content. All watermark systems known today are susceptible to being removed without substantially affecting the quality of the content itself–which may lead to the situation that, when a watermarking system has been broken, the originally governed content may become uncontrollable.

7. Digital Signature

Digital Signatures akin to hand written signatures can be used to regulate the access to digital content. It is important to see that information associated with content (e.g., IDs and rights expressions) can be trusted. Such functionality can be achieved when the party adding the metadata

a) digitally signs the metadata, and

b) is known to be authorized to add the metadata.

A digital signature provides information about the origin of a piece of information and knowledge about whether the information has been altered or not.

However, although this kind of architecture solves the rights management problems, a customized image viewer is not convenient for users. Later several commercial DRM

solutions has been developed and suggested by InterTrust, Alpha-Tec, Digimarc and LTU. But, the requirements of digital libraries vary enormously and differ from those of industry. Building a DRM system for digital libraries based on existing commercial solutions without any modification is impractical (Bechtold 2003).

8.   Other Works on DRM Technology:

To prevent the abuse of digital content, most digital libraries and museums adopt digital watermarking techniques to guard the digital contents. Though useful, watermark-based protection systems are still not robust enough to resist a variety of attacks. In 2004, Pramod et.al proposed that DRM should be adopted as a layered framework, whereby various services are offered to users of the digital content at each layer. Bogdan et.al., proposed a security architecture that enables DRM of home networks. The concept of "authorized domain" is used to authenticate compliant devices, instead of relying on expensive public key cryptographic operations. Nicolakis et.al., developed a DRM system called MediaRights that protects digital images (Hsiao, 2005).

9.   DRM and the 3C of Digital Libraries:

Managing access to online information is a broad problem, which occurs in a wide range of different applications. Managers of online information wish to implement policies about who can access the information and greatly demands the awareness among users about the terms and conditions under which these implications are posses. Considering the reasons for implementing policies for access, it has observed that digital library managers often need to restrict access to parts of their collections for various reasons, including restrictions imposed by donors, concerns about privacy or obscenity, licensing arrangements, and other agreements with copyright owners. With regard to electronic resources, the publishers and other copyright owners wish to manage access is because they require payment for use of materials, but there are other reasons, such as preventing the spread of unapproved derivatives. "Polices" framed by the managers / administrators of digital library plays a central concept of any Digital Right Management System.

The users are the core groups who are abide by the policies and operations framed in an access management system. In this article, the "users" are termed as "Consumers". "Digital materials" is the collection on which the policies and users perform certain operations for want of Information hence it is termed as "Content". The "Content owners" or authors of the digital materials are the other streams, who want to control the use of their content and wish to govern the authorized use of digital content they are referred as "Creators".

The Creators, Content and Consumers are the trinity of any digital library management system. Any policy framed by the managers / administrators should not affect their surveillance function, privacy and freedom of expression. This issue is based on the available technology which we are adopting in DRM

system. Based on the literature and the personal experience, the authors have explained implication of DRM technology on the trinity of digital library.

10. DRM and Creator

With the DRM technology –

♦ The creators can have an exclusive control over their content and there need of a regulatory technology to control the access and use of general public is achieved.

♦ The creators have enough opportunities to promote their work, establish relationships with users and earn income by tapping into the niche markets

♦ The creator will enjoy not only the authority of distribution or copying, but also the laws, contracts and licenses.

♦ The technology helps the creators to manage copyright material and the terms and conditions on which it is made available to users. The DRM system helps to manage creative material and protect content from copyright infringement.

♦ The technology is designed to produce a more predictable and secure environment for transmission of copyrighted materials.

11. DRM and Content:

♦ With the available international standards the DRM technology provides option to manage and protect the interest of the copyright holders, by providing adequate identification and description tools pertaining to content availability (i.e., metadata).

♦ The technology supports the association of the content with various applications–including anti-piracy services.

♦ In the analog world such association between content and its metadata can be achieved by printing an identifier onto the data carrier containing the content (e.g., by printing a bar code onto a CD cover or an ISBN onto one page in a book). This approach fails in the digital world, however, because there are no physical carriers to carry the identifiers. Hence a technology is needed that allows obtaining the metadata from looking at the content itself.

♦ Restriction on accessibility and usage, the rate of effective use or share of information will diminish. This will enhance the digital divide in the scholarly communication. This amount to the increase in the rate of repetitive and unupdated content in the knowledge base.

12. DRM and Consumers

♦ The technology imposes the restriction at the cost of the consumers' rights: to privacy, to freedom of expression, to fair use rights, and the promotion of science and the useful art.

♦ Copyright law gives copyright owners the right to prohibit others from making some uses of their work, such as copying, distributing or making a derivative work, where as the DRM is highly inflexible to the end user to make fair use of the works.

♦ Free use of copyright material is called 'fair dealing' in India and some other countries and 'fair use' under the United States law and Indian Copyright Act, 1957, provides for 'fair dealing' under, Sec.52 (a) and Sec.52 (b). Thus, it can be seen that use of DRM may prevent the users from using copyrighted material for 'fair use', which is expressly permitted under law. DRM

which provides digital locks to digital content severely restrict fair use practices. Unless the right holder gives permission to use the work, it is not possible to subject such works for fair use.

♦ Right to privacy has different dimensions. One aspect of privacy that would be directly affected by DRM is informational privacy. The administrative process of DRM demands the user personal information for authentication or registration, this has made the user to think of security of the personal information he/she submitted.

♦ DRM initiatives may be viewed as a series of concentric levels of control, each penetrating more deeply into the user's home electronic and computing environment. At the first level, DRM systems impose direct restrictions on what individuals can do in the privacy of their own homes with copies of works they have paid for. At the next level of control, DRM systems report back to the copyright owner on the activities of individual users.

♦ Commentary, criticism, parody, and other authorized uses may be of significant value in stimulating public debate and fostering an informed populace, but with the DRM, the value and growth of these works will have great impact.

13. DRM and Open Source Movement:

Although the OSS movement objects the principles of DRM by supporting the 'Right to Read' battle, the Open source community has contributed the tools for DRM. The requirement of such tools has discussed in the OS community for a quite a while

and centers around the need for independent applications for accessing content (unprotected as well as DRM governed content) (Becker 2003).

The Open Digital Rights Language (ODRL) initiative in an international effort which aims to develop and promote the open standard for rights expressions. ODRL is intended to provide flexible and interoperable mechanisms to support transparent and innovative use of digital content in publishing, distributing and consuming of digital media across all sectors and communities. The ODRL Initiative governance is managed by the ODRL International Advisory Board. (http://odrl.net/)

Following are the products available in the Open Source market for the DRM activities -

♦ **OpenIPMP** is an open source DRM for MPEG-4 and MPEG-2 adhers to ISO/MPEG IPMP open standards. (http://sourceforge.net/projects/openipmp)

♦ **Open SDRM** is an open source digital object rights management solution is another product of ODRL initiative based open-source components and on open standards. (http://sourceforge.net/projects/opensdrm/)

The project which works on the phenomena of open-source license and a community-source license (akin to the way Java is licensed) is Open Media Commons. Project started at Sun Microsystems Laboratories to develop an open, end-to-end content-protection solution consistent with the interoperability and DRM tools. The products are–

♦ **DRM InterOPERAblity Framework**, an interoperable DRM architecture implementing standardized interfaces and processes for the interoperability of DRM systems. The DRM

InterOPERAbility Framework is independent of specific hardware and operating systems and is not restricted to specific media formats. It enables user based license provision as opposed to the situation today where licenses are assigned to devices. (https://drm-opera.dev.java.net//)

♦ **Project DReaM** is an initiative to develop an open Digital Rights Management (DRM) solution for multiple domains (media, documents, enterprise, personal, etc.). This open source project develops an end-to-end Reference Implementation for the DReaM Specifications in order to enable a quick-start for DRM solutions. (https://dream.dev.java.net/)

Other OS initiatives –

♦ **Open media platform and open DRM systems** are the two software(s) which go a long way towards solving hurdles faced by the three key elements of the digital environment community - consumers, digital-media companies and consumer-electronics vendors. These hurdles include a current lack of device interoperability; media rights culture clashes among the key stakeholders; and the dearth of an easy to use secure, pervasive content solution (Foley, 2003. available at http://www.extremetech .com/article2/0,3973,822282,00.asp)

♦ **The PachyDRM Digital Rights Management solution** is an open and suitable for any media on any device on any network. A working, cross platform code base is also immediately available to the community. The source is open and free for development (client & server), with a minimal royalty for a commercial distribution license. (http://www.pachydrm.org/)

The major drawback of openness would be that not only the honest programmers would gain access to the specifications but also those who are eager to provide application that one written in order to circumvent any DRM system.

Conclusion

The challenge for the society is to balance between internet threat and the DRM policy, and to perform. The delivery and consumption of digital content depends on satisfaction of both copyright holders and end-users. Each has different concerns, ranging from piracy to privacy. Copyright policy can ignore neither (Owens). So far copyright law was able to maintain some sort of balance between copyright holders and users, with the advent of DRM this balance may be tilted in favour of copyright owners. DRM may adversely affect fair use practices, free speech of users and privacy. As Timothy (2006), rightly says 'recognizing and accommodating the rights of parties on both sides of the fair use equation, such an implementation might well be the first system of "digital rights management" truly worthy of the name'

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