

Digital Rights Management

A White Paper for Alt-i-Lab 2004

Prepared on behalf of
DEST (Australia) and JISC-CETIS (UK)

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1 Introduction

This paper is intended to set the context for discussions and decisions about Digital Rights Management (DRM) in the community of individuals and organizations responsible for developing and implementing ICT (Information and Communication Technology) infrastructure that supports learning. It does so by taking the most common use case (creating, publishing, distributing, acquiring and using education content) from its non-digital roots into the digital age and examining the fundamental changes that have occurred and their implications for managing intellectual property rights. This brings into focus the issues that are most frequently raised by educators and administrators who are struggling with the real-world of DRM as it stands today.

It must be pointed out that DRM is a deep topic whose complexities include:

- A miasma of laws, legal precedents, patents and practices that differ from region to region [38]. These range from high profile cases concerning music sharing and open source software to education-specific legislation [35] and patents that potentially affect the technology being developed to implement DRM [4].
- Models of intellectual property rights and market mechanisms that may need complete overhauls if the goal is to enabling knowledge sharing in communities of practice [26, 32]. Traditional publishing is not the only use case that is important to the educational and research communities, even if it drives many of the questions about DRM.
- Emerging architectures, technologies and standards that are still under development, as indicated by multiple documents in the References section. Most of these are not specific to learning, but every community, including the learning community, has its own set of requirements. The lack of mature standards and of versions specific to education and learning is a cause of concern to anyone implementing DRM solutions.
- “Born Digital” content that is dynamically generated; that is a collage of other content incorporated through hyperlinks; that is data in a database; and that is streaming multimedia. These newer forms of content challenge traditional mechanisms for rights management.

This complexity can be daunting to those trying to come to grips with DRM. This paper attempts to identify some of the root causes of this complexity and some of the key issues that it engenders. It gives numerous references that readers can use to delve further into details. Of particular interest to the learning technology interoperability community are the following references:

- A white paper [10] that presents a framework for making DRM policy decisions based on an ecosystem model¹. That paper also analyzes scenarios which help point out what DRM functionality can be implemented now and what is needed in the future.
- A report prepared for the World Intellectual Property Organization [2] that covers, among other things, legal issues and emerging technologies for encryption, object identification, authentication, authorization and rights expression.

¹To be published by the Educause Center for Applied Research in the form of two research bulletins. Please contact the authors if you would like a copy of the draft.

- A report to the U.S. Library of Congress on Digital Rights Expression Languages written by Karen Coyle [4]. This is an excellent reference on a topic that is the subject of several requirements gathering and standardization efforts within the learning technology community [21, 22]. An earlier report prepared by the IEEE Learning Technology Standards Committee working group on Digital Rights Expression Languages is also available from [14].
- An interim report on a DRM study being undertaken on behalf of JISC [12]. This report contains both general perspectives and a series of illustrative use cases.

These references, as well as those at the end of this paper and those contained in the references, will allow the reader to further explore the topic of DRM at an ever increasing depths.

1.1 Acknowledgements

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2 The Non-digital Case

Educational and research communities deal extensively in intellectual property. The creation, distribution, acquisition and use of this intellectual property are all governed by intellectual property rights. These rights are created, distributed, acquired and applied together with the intellectual property², as is illustrated in the following example:

Example: Life cycle of a text book.

When a text book is written, a bundle of rights called a "copyright" is associated with the book. The precise nature of these rights - and to whom they belong - depends on laws, contracts and agreements. When the book is published, the publisher acquires the rights necessary to support a business model that depends on receiving money in exchange for copies of the book. The publisher might enter into a contract with a wholesaler, who acquires the right to distribute the book to retailers such as college bookstores. Bookstores, in turn, enter into agreements with wholesalers that allow the bookstore to acquire and sell copies of the books to students. When students buy a book from a bookstore, they also acquire a set of rights that includes the right to read and re-sell the book but not to copy the book.

It is instructive to examine the role that the physical book and the standard distribution channels from publisher to wholesaler to retailer to consumer play in rights management.

The physical book serves several purposes. First, it is a means to both package and render content. In bibliographic terms, the content is a "work" and the physical book is an "expression" of the work [19]. As such it is rather inviolable. A book cannot be cut apart, rearranged, edited, or even conveniently annotated without impacting its integrity and quality. Second, a book is a physical token of exchange that is used to track the

² See [38] for general information on intellectual property.

transactions that generate revenue for the publisher, author, wholesaler and retailer³. From this perspective, the form of a book and ability of the book to be read are incidental: What is important is that books can be shipped, inventoried and counted⁴. The ability to track books allows the various parties to accurately report how many books have been bought or sold. Finally, books carry their own copy protection because they are relatively expensive to copy and copies are of lesser quality than the original.

The distribution channels serve to create safeguards against dishonest behavior based on relationships, law and accepted practice. A business that behaves inappropriately will be cut off from its supply of goods and ultimately subject to legal actions and penalties. Copy shops generally refuse to make copies of large portions of a book unless the customer documents permission to do so. Scholarly publications require researchers to give proper attribution and provide proper citations. Students who do not pay their bills or who engage in illegal activities may be expelled from school. All of these mechanisms help ensure that people in the distribution channels respect intellectual property rights and conform to license terms and applicable law.

3 Changes in the Nature of Content

The nature of content has changed in the digital world. Database-backed Web sites, streaming media and highly linked documents have few analogs in the print world. Digital content can be more easily disaggregated, altered and recombined. This malleability poses rights management challenges, but even before those can be addressed it is necessary to recognize two even more fundamental properties that separate digital content from non-digital content. First, whereas digital files serve to package content, they do not render it. Rendering is the function of software applications such as word processors or media players. Second, digital content can often be replicated and distributed with perfect or near perfect fidelity at little or no cost.

3.1 Enforcement of Rights through Technological Means

Since the form of content is no longer a sufficient deterrent to copying or distribution, the responsibility of enforcing rights has been assigned to rendering and editing software. Protection mechanisms are being built into software such as Adobe Acrobat™, Apple iTunes™, Windows Media Player™ and Microsoft Office™. These mechanisms make it possible for the creator of a document to assign certain rights only to persons in possession of the proper password. The traditional legal and societal means of enforcing rights are still there, but enforcement through technological means is viewed as the primary gatekeeper, see [2] for more information on existing and emerging technologies.

Technological enforcement of rights is not without inherent difficulties⁵. Users may have legal rights such as the copyright exemption granted by fair use [37] or fair dealing [36] and still be prevented from exercising these rights by the technology. It is difficult to use protection schemes to grant rights such as the right to copy 10% of a document, the right to print 3 copies (but not 4), or the right to view content for a fixed period of time. Built-in password protection is also a poor form of authorization, not allowing authorization to be based on role, circumstance, or to be granted and denied after content is distributed. Nor do content players currently contain mechanisms for mediating the exchange of rights, e.g., for

³ This view of books was first brought to my attention by Charlie Patton, now of SRI, in the mid-1990's.

⁴ Counting and inventory are instances of *tracking*.

⁵ One difficulty with protection schemes is that they can be defeated. This aspect will not be discussed in this paper.

allowing content to be viewed in exchange for a payment or only if proper attribution is given to the author.

Copy protection has become such an issue for publishers and the multimedia industry that DRM is often equated with protection mechanisms [16]. This paper views DRM as the much broader process of managing rights through digital means, but even when DRM is narrowly construed it is apparent that software applications must be aware of information, such as the role of the user and the number of times an action has been performed, that is external to the application and cannot be handled by password-based protection schemes alone.

3.2 Disaggregation and Recombination

Another property of digital content is that can be disaggregated into smaller pieces and recombined with other content from multiple sources. This is a new phenomenon that introduces questions of how rights are assigned to aggregates and how rights associated to parts relate to rights associated to the whole. The ability to disaggregate and recombine digital content is often desirable and is a fundamental tenet of the learning object program and the technical specifications and standards that support it [6, 7]. Efforts are underway to define how rights (and royalties) can be aggregated [24], but this work is still in its early stages.

4 Changes in the Nature of the Network

The nature of the underlying distribution and acquisition network is evolving in several ways that affect the management of rights.

4.1 Unbundling of Services and Diminution of Trust

As business has moved online, financial functions, identification, authentication, authorization, and tracking functions have been unbundled and are often provided by disparate enterprise systems or different commercial service providers. Within a university environment, for example, a student purchasing a digital course-pack online might have her identity checked against a directory service⁶; her authorization to buy the course-pack checked by the student administration system (to make sure she is enrolled in the proper class); her financial transaction handled by a national provider of online credit-card services; and the purchase tracked by e-store software used by the campus bookstore.

There is nothing revolutionary about these changes, but unbundling various transactions makes it harder to discern who is responsible for managing rights, and at what point this should occur in the overall transaction. It is also much easier to set up e-commerce than it is to set up a bricks-and-mortar wholesale or retail operation. Lowering the barrier to entry diminishes the trust that partners are willing to place in each other and increases the exposure to liability: a dishonest retailer may sell a few thousand copies of a book in a month before being found out and cut off from its supply chain, whereas a dishonest "e-tailer" may distribute an order of magnitude more copies of a digital file in an order of magnitude less time.

⁶ A directory service provides identity and demographic information.

4.2 Federations

Acquisition and distribution of learning resources is increasingly taking place in *federations* of repositories that share metadata and provide their users with access to each other's content. These federations (such as the NSDL [28], CELEBRATE [5], or coalitions of academic institutions) have membership criteria and policies and allow users to simultaneously search and acquire content from all members of a federation. Stable and relatively mature technology exists for federating searches and exchanging metadata in an interoperable fashion⁷, but the development of methods for managing rights in federations is still in its infancy. However, some valuable work is being done. Architectures like Shibboleth [17] and specifications like SAML [31] can be used to solve pieces of the rights management problem. See [33] for the approach taken by the CELEBRATE project.

4.3 Heterogeneous Sources

Within a single institution online content is acquired from a variety of sources, some internal, some external, some commercial, some non-commercial, some trusted, some anonymous. In this environment, it is essential that rights be associated to content in ways that do not always rely on a formal connection or relationship with the source of the content. It is also essential that the means of associating rights with content be standardized. The same is true in peer-to-peer networks, such as those being built by projects such as LionShare [20].

4.4 Persistence

Just as changes in the nature of content have led to a transfer of rights enforcement responsibilities to content players / editors, changes in the nature of the network will logically lead to a transfer of rights management responsibilities. A key idea in many proposed solutions is that of *persistence*, i.e. of the ability of rights to be associated with content in a way that:

- Does not depend on a relationship with or knowledge of the source of the content,
- Is maintained as content is distributed through a network, and
- Can be meaningfully interpreted and acted upon by technologies that make up a network.

Standardized rights expression languages provide part of a persistence solution. These are discussed at length in [4]. Rights expression languages can be used to express rights, conditions, constraints and other parameters relevant to rights management in a machine readable and human readable fashion. Technology is being developed that can create and interpret such expressions, but very little is in commercial products at the moment⁸. Projects like COLIS [8] and CELEBRATE [5] have demonstrated the use of rights expressions in the educational community, but the author of this paper is unaware of any demonstrator projects that have shown persistence, interpretation and enforcement of rights expressions in scenarios where content is moved outside of a trusted federation.

⁷ Including metadata standards, Open Archive Initiative protocols, Z39.50, XML versions of MARC, etc.

⁸ Microsoft Rights Management Service, part of the Windows 2003 Server, implements a version of XrML, a rights expression language that has become the basis for an international standard [18]. ODRL [29] has been implemented in technology produced by IPR systems.

4.5 Attribution and Tracking

Among the rights that need to be managed are the right to attribution and the obligation to track usage. Attribution and usage data are needed to support a variety of academic and commercial market models, including models that rely on providing metadata instead of data. Educational digital libraries such as MERLOT [25] and the ENC [13] are investing significant funds in reviewing, validating and creating quality metadata for digital learning resources. These digital libraries want to preserve the branding of their metadata so that educators recognize it as coming from an authoritative source, but at the same time they want to expose their metadata to harvesting by others so as to increase awareness and access to resources they have found to be valuable⁹. These digital libraries require a way to preserve attribution in order to preserve their value. Furthermore, as significant points of access they must also manage rights associated with content from external sources.

5 Changes in the Nature and Practice of the Law

As technology has changed, so has the nature and practice of intellectual property laws. Copyright now applies to almost anything that would be considered a digital learning resource and applies for a length of time that evermore approximates “forever.” See, for example, [1] for a history of copyright law changes in the United States. Whereas sufficiently old works pass into the “public domain” where they can be freely used by anyone for any purpose, the lengthening of the time for which a copyright applies has all but eliminated this status for digital works.

The fact that works are automatically copyrighted prevents use even when authors and other rights holders would prefer it did not. In fact, the difficulty of being granted the necessary rights has been identified as one of the major deterrents to reuse [9]. To overcome this, organizations such as the Creative Commons [11] have created a small set of standardized licenses that can be associated with content. Licenses are a mechanism for copyright holders to grant rights to others under specific conditions without relinquishing control. For example, the license associated with this paper allows anyone to copy and distribute it provided that no alterations are made and that proper attribution is given.

Another significant change in copyright is that the rights included in copyright are being defined at finer levels of granularity and are being meted out to consumers one at a time. For example, renting a video grants the renter a license only to privately view the video and not to copy it or to show it in a classroom. This unbundling of rights, together with the litigious nature of modern society, places more of an onus on people and technology to precisely express rights and to properly enforce them, an onus made heavier by legislation like the TEACH Act [35], which places specific requirements on copy protection, rights management and institutional policies.

Intellectual property law creates the need for rights management in the first place, and as legislators and their many constituents struggle with the implications of the digital age, it is expected that the shift of responsibility for rights management from societal institutions to technological solutions will be accentuated.

⁹ Digital libraries within the NSDL [28], for example, expose their metadata via OAI [30].

6 The Need for Interoperability and Standards

Looking over the changes highlighted in this paper, the major affect of the transition to the Internet and to digital technology is that services and functionality have been unbundled and responsibility for rights management has been shifted from societal institutions to technology. As services become unbundled, a higher degree of interoperability and standardization is needed. One area on which the learning community has concentrated is that of Rights Expression Languages [4], but the need for standardization applies to identification, authorization, authentication, financial exchanges, attribution, rights enforcement, and other services as well – see the attached references [2] and [10] for more information. Component and service-oriented architectures are sufficiently new that few relevant standards have reached high levels of maturity and adoption.

This paper relies on referenced works to treat standardization in further detail. In examining the references the reader should keep in mind that the services that support DRM are not specific to learning, education or training. It follows that these communities must either adopt or adapt standards to their needs. This process is taking place [3, 14, 21], but the learning community would still benefit from increased coordination with standardization efforts supported by the library community, other information and communication technology industries, multimedia industries, and publishers.

7 Policy Decisions

Finally, it is important to ask what a policy maker should do when faced with the concrete problem of implementing DRM in an educational or research setting. As is explained and illustrated in the attached reference [10], DRM ecosystem can be systematically analyzed by identifying their components, context, sources of content and supporting services. As with standards, no more will be said about that in this paper, relying instead on the reference cited.

8 Summary

DRM is a broad and deep topic. Each aspect of it - including technology, legal aspects, standardization and policy making - must be studied on its own. Nonetheless, conversations about DRM with educators and education administrators often boil down to questions about transferring classical models, usually based on publishing, to the digital world. With this as a starting place, it is important to recognize the fundamental forces and changes that are at work. Among the most important of these are the unbundling of various services and the attenuation of relationships that existed in the classical “bricks and mortar” world. This has led to more responsibility being placed on technological solutions and to a greater need for interoperability, neither of which are overly mature at this point. As stated in a quote pointed out to the author by one of the reviewers of a draft of this paper,

“Until the technical path can be settled on, people can't see or think much about the deeper issues that lie beyond that first technical step ... But in fact, the really tough issues just begin once that technical hurdle is crossed¹⁰.”

In DRM, the tough issues include finding acceptable and beneficial Intellectual Property Rights and market models. This requires experimentation, but experimentation cannot begin until the technical issues are solved. The technical

¹⁰ Phil Becker Editor, Digital ID World, The Digital ID World Newsletter - June 24, 2004 Issue.

issues, in turn, cannot be solved until those crafting the solutions have understood what has fundamentally changed and not changed so they can successfully evolve old ideas and find new ones. It is hoped that the perspectives given in this paper and the attached references will help that happen.

Note: Comments on this paper are welcomed and should be addressed to rrobson@eduworks.com

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