

## Towards A Digital Rights Management Framework

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**Abstract :** One way to extract value from information products is to implement a digital rights management system. The aim of this article is to eliminate common confusions and direct future work among experts with different backgrounds. We introduce a framework to define concepts in this field. According to the framework, an entity may have legal rights in an information product in a certain jurisdiction at a certain time. The entity also has requirements how to manage its rights. Based on the legal rights and requirements, the entity has activities and its products have properties that are called rights management. The entity uses both technical and legal tools to manage its rights.

**Key words :** Digital rights management (DRM), control metadata, information products, e-books.

### 1 Introduction

One of the fastest growing and most profiting sectors of today's economy is information industry. Its success has in short time brought new opportunities to do business with digital information products. Entities have learned methods to commercialize their intangible assets to markets. Still, it is not well known how an entity could extract the most value from the information it possesses. (Sullivan, 2000)

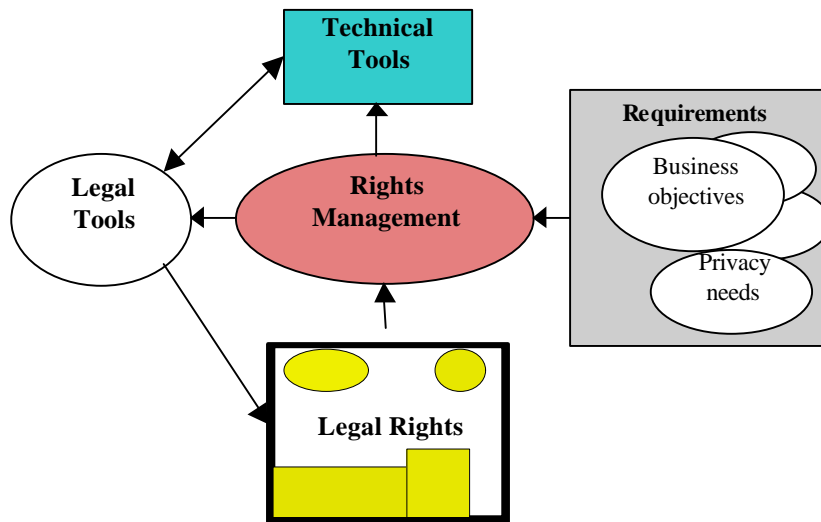
Distributing information in digital forms presents also numerous legal concerns. In general, it is very easy to reproduce digital information. The copies are as good as the originals. Especially on the Internet, it is difficult for the information providers to control what the others do with the information. The Internet enables all new business opportunities but they are vulnerable to the unauthorized use of information. Digital rights management is an essential part of implementing the selected business model.

Digital rights management is not quite a new concept. Only the name has changed. A few large companies and public entities started research in Electronic Copyright Management in the early 1980's. Later in the 1990's, especially European Union funded several notable projects such as IMPRIBATUR and COPEARMS, which tried to study the whole field from legal, technical and business perspectives. However, digital mass-markets had not yet developed and, hence, the results of these project did not lead to direct market applications. In any case, the understanding of the field increased and the last few years we have discussed of first Electronic and then Digital Rights Management. It is now clear that Digital Rights Management covers also other rights than copyright and even the management of such information assets, which lack legal definition. (Dusollier, 1999; Möschel & Bechtold, 1998)

Recently several companies and organizations have published products to manage rights in digital information. Those companies include for example Adobe, IBM, InterTrust, Liquid Audio, and Xerox ContentGuard (see the referred web pages). However, there seems to be a lack of common understanding what this area includes. All the companies have different concepts. This paper presents a framework that aims at eliminating common confusions and helping the discussion on rights management, how the products in this field could be made interoperable, and where the work should be focused on. The framework defines the concept of digital rights management, its central parts, and relations between those parts.

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**Figure 1. The DRM Framework suggested in the paper aims at defining the important areas of digital rights management and their relations.**

## 2 Definitions

An *entity*, in this context, is a person, a company, or any organization that may own rights and wishes to manage them.

*Digital Rights Management (DRM)* is the set of actions, procedures, policies, product properties, and tools that an entity uses to manage its rights in digital information according to requirements. We would like to point out that the term "digital rights management" is somewhat misleading. Rights are not digital. In general, they do not have much to do with digits, but they are rather analog. The word "digital" refers supposedly to the subject matter, to information in digital form, not to rights in that information. It is also possible to think that the word "digital" refers to the fact that digital information technology is often used to manage the rights. Yet, DRM does not refer to computer-aided rights management in general. For example, an investor can have a computer-based system to manage real estates, securities, contracts, etc., but this system is not called DRM.

An *information product* consists of valuable information, which is technically delineated in a form that can be controlled and transferred between entities. It may include contents, metadata and computer programs. A *legal product* is the combination of the parts of a certain information product that are protected by legal rights in a certain jurisdiction at a certain time. Those parts that are protected by legal rights are called legal components. A legal component itself can be a legal product or an atomic subject matter.

*Metadata* is information about information. In information products, metadata is the part of the product that describes the content or the actual payload of the product. Jokela and Turpeinen classify metadata into three categories: semantic, structural, and control metadata. Semantic metadata describes the meaning of the content, structural metadata describes the format and technologies used with the content, and control metadata contains production and delivery related metadata. Control metadata assists in determining the status of the content and rights to access and use the content and thus it is the most important part of metadata in this article's context. (Jokela & Turpeinen, 2000)

## 3 Legal Rights

The basement of the framework consists of the rights to be managed. In the center are intellectual property rights (IPRs). They protect the valuable outcomes of e.g. content production and software engineering. Copyright has traditionally been the most important legal tool to protect for example texts,

pictures, computer software, and other original intangible works while patents have been used to protect more hardware related inventions. (Haarmann, 1999; Lang 2000; Merges et al, 2000)

However, in the last few years, many software companies especially in the USA have begun extensive patenting to gain a better strategic position among competitors. They are now using patents as the primary means for legally protecting their software. Moreover, U.S. Patent and Trademark Office (USPTO) has recently begun to issue Internet business method patents (see e.g. the patents and court cases referenced below). Therefore more and more inventions related to, for example, multimedia or Internet applications are within patentable subject matter. This development has also been widely criticized. It seems that sometimes patents are issued too easily without proper examination. Also it is not clear in general that patents are the best way to promote inventions and industrial development. (e.g. Aharonian, 1999; Lang, 2000; Merges, 1999; Merges et al, 2000; Samuelson, 1999a) In Europe, copyright has still kept its dominant position in contents and software industries, but also there, a lively discussion on software and Internet patents is going on (Lang, 2000). Despite the shortcomings, it seems obvious that patents are becoming increasingly important.

It should be noted that it is largely possible to extend intellectual property rights in contract terms. For instance, in a license agreement, a licensor and a licensee can agree that the licensor has rights that are not stated in the law. That kind of an agreement is normally binding and enforceable between the contracting parties. It seems that these agreed intellectual property rights are becoming quite common and significant.

In general, intellectual property rights protect the content of an information product and related computer programs. On the other hand, the metadata of an information product is usually not protected. In some cases, however, parts of metadata can be legally protected. For example, based on Article 12 of the WIPO Copyright Treaty, many countries have changed their copyright laws so that it is now illegal "to remove or alter any electronic rights management information without authority".

Not only intellectual property rights but also several other kinds of rights may be involved in information products. For example, right of privacy is a fundamental right in many legal systems and can affect the distribution of information products in many ways.

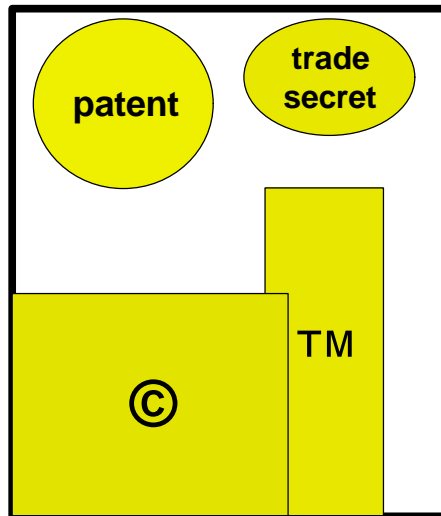
Other important intellectual property rights that should be taken into consideration in this context include trademarks. A manufacturer or a seller uses them to promote and distinguish its products from those of others. As they protect some valuable parts of an information product, especially brands, they are an essential part of digital rights management. (Garner, 1999; Lang, 2000)

It should be noticed that an entity may have several different legal rights in one single product. Those rights can be overlapping and protecting the same parts of the product, though in principle different rights protect different valuable parts of a product. For instance, patents can protect new, non-obvious ideas related to a product, copyright protects the way ideas have been expressed, trademark protects e.g. brands, and trade secret protects business information that is kept confidential to maintain an advantage over competitors.

There is a number of international treaties that aim at harmonizing intellectual property rights in different countries. Nevertheless, details of legal rules vary from jurisdiction to jurisdiction. For example, patentable and copyrightable subject matters in the US and EU differ in a way that must be taken into account when designing interoperable rights management systems. Therefore, if a product is adequately protected in one country, say, by copyright, in another jurisdiction it might be completely out of legal protection. Thus for an entity that operates on the Internet or otherwise internationally, it is very important to understand the complex international legal situation.

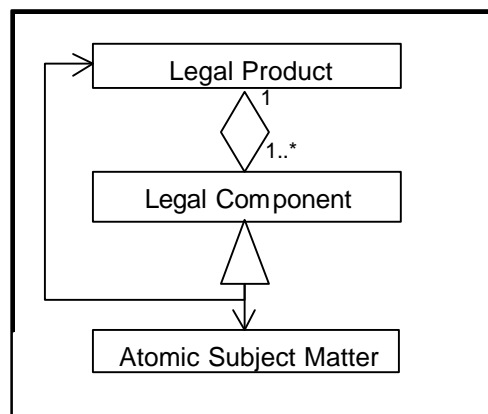
Even in one single country, intellectual property rights are nowadays typically developing in a fast pace. Therefore the situation is very dynamic. Tomorrow, the legal protection of one's products might be quite different from what it is today. An efficient digital rights management system should be able to handle the dynamics of the field in multiple dimensions: entity's own rights change in the course of time, the legal system is changing, and the differences between jurisdictions can be remarkable.

Product:



**Figure 2. Different intellectual property rights protect different valuable parts of an information product. Those rights can overlap, i.e. sometimes more than one right protects a part of a product. However, it is important to notice that in most products there are gaps, valuable parts that are not protected by any legal right.**

As defined above, a legal product is the combination of the parts of a certain information product that are protected by legal rights. Those legal rights can be different in different jurisdictions and different times. Therefore a legal product is a very dynamic concept. The parts of a product that are protected by legal rights are legal components. On the other hand, a legal component itself can be a legal product or an atomic subject matter. For instance, a multimedia product consists of many kinds of parts, like video clips, texts, and pictures. A video clip, for example, is typically another combination of several parts. Therefore, a multimedia product includes a legal product that may consist of other legal products. At the lowest level, all those legal products are combinations of atomic subject matters like a piece of text that is created by one author or a picture created by one artist.



**Figure 3. A legal product is the combination of one or more legal components that can be either legal products or atomic subject matters.**

From the DRM point of view, it is important to notice that an entity needs to manage intellectual property rights not only on a legal product level but even on atomic subject matter level. For example, a publisher of a multimedia product needs to be able to license all the components of the product and to share the revenues with all the right holders. Also, if somebody wants to reuse a legal part of a product, e.g. someone would like to copy a picture from a multimedia work to her book, it should be possible to find out who may legally grant the right for it. This leads us to think of a right clearing system, which could be incorporated – with the help of third parties -- into a well designed DRM system. For instance, in Germany there has been an online rights clearing house for some time (Clearingstelle Multimedia für Verwertungsgesellschaften von Urheber- und Leistungsschutzrechten).

In principle, we should not restrict the framework to legal rights only. An entity might have for example moral rights that are not legally enforceable. An entity may also believe that it has a certain right and act according to that although it actually does not have the right. Those moral and imaginary rights should be considered also, because they have an effect on how an entity manages its rights. Having said that, it is out of the scope of this article to discuss them further.

#### **4 Requirements**

Not only legal rights have affect on what is included in rights management. An entity has also requirements on rights management based on business objectives and methods, on its role in a delivery chain, on privacy needs, and so forth. Obviously, different entities may have very different requirements. For instance, an author or any originator has quite different needs from those of an intermediary or an end-user. Furthermore, needs among intermediaries vary. Some of them need to take a lot of care of marketing as well as revenue collection and sharing while some other intermediaries are mostly concerned about their potential liabilities on rights infringement. For example publishers and Internet service providers can both be intermediaries but they often have different needs. In addition, each delivery chain is different and each entity has its own special needs. Legacy systems, for instance, may cause particular requirements. Therefore, rights management activities on organizational level should reflect the requirements of that specific entity. In this article, we will not try to define where those requirements actually come from and how they should be managed. However, in actual decision making the requirements and their function in rights management must be taken into account. Obviously, further studies on these strategic aspects of DRM in the general management of entity's intellectual assets are needed. (Sullivan, 2000)

#### **5 Rights Management**

In this paper, rights management is discussed on two levels: organization level and product level. Both the levels are closely related and they depend on each other.

First, rights management on organization level includes at least all the activities that

- *Set and refine rights management policies.* An entity should define and continuously improve definite courses of action on how to manage its rights in information products as part of its intellectual asset management strategy.
- *Make and manage agreements.* Making agreements on rights in information products, and contract management related to those agreements is a part of rights management in organization level.
- *Manage information on acquired rights.* In most cases, at least some rights in information products are acquired from other entities. It is important to know from whom those rights were received, how broad the rights are, how much and when the entity must pay for the rights, and so on. Managing this information is a part of rights management.
- *Control and enforce licenses.* In most cases, reasonable business requires that a company licenses some rights to other entities. Therefore it is essential that the company is able to control what the others do with its products and, if necessary, enforce the terms of license agreements.

- *Support marketing.* There will be lots of different business models and marketing methods involved in digital information. For that reason, rights management activities need to be flexible enough to support whatever marketing methods an entity decides to use. For instance, if an entity, for marketing purposes, wants to let other entities to use its information for free for a certain period of time or a certain number of times, and thereafter charge an increasing fee for each usage, rights management activities should be able to support that.
- *Support revenue collection and sharing.* Especially for commercial entities, it is crucial to be able to collect revenues from the users of the information. Also, those entities need to be able to account and share revenues to other entities in accordance with agreements on acquired rights.
- *Risk management.* Risks involved in digital rights management are future possible losses related to information in digital form. It is possible to manage those risks in advance in several ways.

Second, rights management in product level includes product properties that support RM activities in the organization level. Products should have appropriate properties to support rights management activities in organization level. Especially the following properties are often useful.

- Adequate information on policies, agreements, and rights so that entities can be informed about their rights and responsibilities and so that policies and agreements can be enforced.
- Properties to enforce policies and license agreements.
- Revenue collection support.

An entity does not have much influence on all the rights it has. In many cases, however, an entity can substantially affect on some of its own rights. For instance, it may apply for a patent. It may also try to influence on legislation and change the law. Therefore not only legal rights affect rights management, but also rights management can have an effect on legal rights.

## 6 Technical Tools

Rights management is performed with the help of technical tools. There can be several different kinds of technical tools. In general, they can be divided into three categories:

Rights definition languages are meant to precisely describe rights so that all the entities involved can act in accordance with them. For example, using a rights definition language, an entity could describe that it gives to another entity a non-exclusive license to complete specific operations on particular information certain times in a specified period of time if the other entity pays certain fees. Such information is adequately included in the rights description part of information product's metadata.

It is quite demanding to define a formal language that can be used to correctly express all the necessary rights in different jurisdictions. There is some interesting work going on to define such a language. Especially, eXtensible rights Markup Language (XrML) is quite a promising attempt. Another emerging example is Open Digital Rights Language (ODRL) by IPR Systems Pty Ltd.

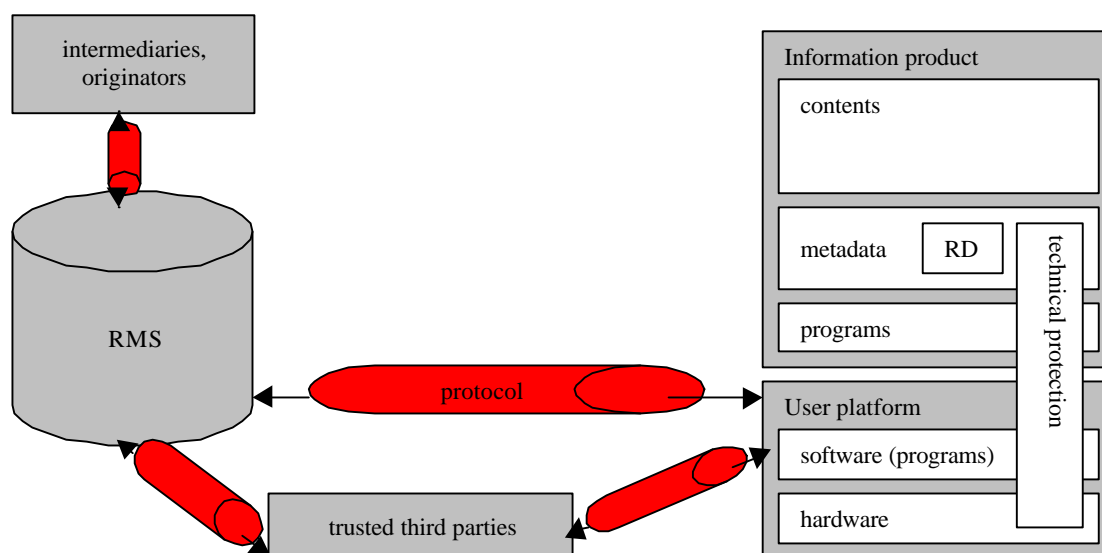
In addition to rights definition language, entities need a common understanding how to transfer data from one entity to another. One of the most important requirements on the DRM technical tools is that they are interoperable enough in a network environment. Therefore at least a defined set of communication protocols is required.

Technical protection systems are mostly in product level and meant to assist on product level rights management. They include software tools for authentication, access control, integrity, watermarking, and so on. In most cases, encryption is an essential part of these tools. Many technical protection systems need hardware support. For instance, it is not possible to make a perfect copy protection system without hardware support. However, the best solution, a globally tamperproof hardware, is not easy to develop and standardize.

Technical tools to protect certain information products gain special legal protection based on Articles 11 and 12 of the WIPO Copyright Treaty. According to those articles many countries have provided legal protection against the circumvention of technological measures that are used to protect copyright

as well as against those who remove or alter rights management information without authority. Yet, there are unsolved questions concerning the legal status of technical protection systems (Samuelson, 1999b).

Rights management systems in organization level are used to support activities in organization level. A trivial example would be an information management system to manage information on acquired rights and license agreements.



**Figure 4. Technical tools in digital rights management. An information product consists of contents, metadata and possibly computer programs. An entity accesses the information product using a user platform, which includes hardware and software (i.e. computer programs and data). The technical tools include e.g. the rights description part (RD) of metadata; technical protection tools consisting of metadata, software, and hardware; and the rights management systems (RMS) of intermediaries and originators. The technical tools communicate with each other using a communication protocol.**

## 7 Legal Tools

Legal tools, in this paper, are the set of tools that a legal system provides to protect one's legal rights. They include, for instance, law enforcement, litigation, arbitration, and execution of court's rulings. Technical tools may be needed e.g. for production of evidence. For example, a technical tool can produce log files that can be used in a court but that are worthless as evidence unless the technical tool is designed correctly. Legal tools may heavily depend on technical tools and, therefore, legal tools need to be considered when designing technical tools. On the other hand, it is at least theoretically possible that technical tools could be e.g. authorized using legal tools and, hence, a technical tool might depend on a legal tool. For instance in some jurisdictions court might be able to authorize an entity to perform certain acts using technical tools and without such ruling the technical tool would be useless. Otherwise legal tools are out of the scope of this paper.

## 8 Electronic Books

Next, we shall introduce an example where the developed framework is applied on an information product. Currently, there are lots of efforts to develop electronic books, e-books. The first examples of

them are already commercially available. In a few years we will plausibly see a rapidly growing market in this area.

E-books as information products include not only the contents but also metadata, i.e. information about the contents, and computer programs that are parceled up. It is possible that some parts of an information product are distributed separately to the end-user. For example, parts of metadata like a key to decrypt the contents may be delivered by a trusted third party while an intermediary distributes the rest of the product. Yet all those parts form a logical whole and they can be called a product.

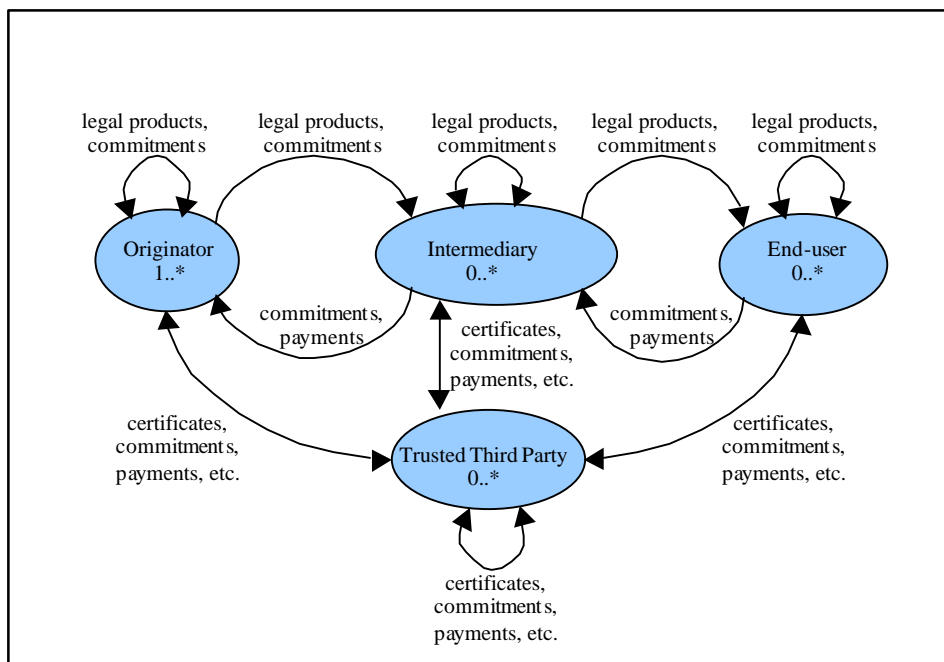
E-books enable a vast amount of new business possibilities. There are few ways to sell a traditional printed book. In general, it conforms a single transaction to sell a book: a seller gives a book to a customer and the customer gives payment to the seller. However, in addition to the traditional single-transaction mechanism, there is an unlimited number of other ways to sell an e-book. For example, an e-book can be given for free for awhile and charged later if the customer wants to keep it. Or a customer can be charged based on the usage: he or she will pay per read page, for instance. This will not only enable better price discrimination but also creates a valuable continuous relationship between an e-book provider and a user. (Shapiro & Varian, 1999)

These new business models, however, rise up questions that are both legal and technical. An e-book publisher should be able to control and enforce its intellectual property rights to get payments. An e-book is a legal product; i.e. it may include several legal components. Therefore the publisher should also be able to take care of the rights in components and share the revenues accordingly. (Stefik, 1997)

E-books will be distributed through networks that may be wireless. There can be a number of different kinds of intermediaries between authors, publishers, sellers, and customers. For instance, network operators and service providers will have an important role. It is essential to have secure mechanisms to perform the business transactions. The technology will be based on cryptographic methods and trusted third parties. Therefore there will be a number of important actors involved in these transactions. All of them need to be able to communicate with each other using well-defined protocols and languages.

Communication between entities includes e-books, but also commitment notifications, payments, certificates, and so on. The term commitment refers to something that an entity agrees to accomplish in the future. A written contract and an oral agreement are possible ways to manifest commitments. (Garner, 1999; Kontio et al, 1998) Yet, it is also possible to send another entity a message expressing a commitment, either a conditional commitment, like an offer, or an unconditional commitment like an acceptance notification or a promise. For example, an e-book distributor can send an end-user a message telling that the end-user is allowed to use the e-book on the condition that the end-user pays a certain price and accepts certain other terms. This message does not constitute an agreement because it does not bind the end-user until the end-user accepts the conditions stated in the message. It is rather an offer. However, if the offer binds the distributor, it expresses distributor's commitments. The distributor is committed to grant the end-user a license to use the e-book on certain conditions. The end-user in turn can send the distributor a message telling that the end-user accepts the terms and will pay the price. This message represents the commitments of the end-user. After the end-user has accepted the distributor's offer, there exists an agreement between the end-user and the distributor even though it is not manifested in a one contract but in two or even in several commitment notifications.





**Figure 5. A sample legal process of e-book transactions.**

In figure 5, originators have created, invented, collected, or otherwise brought about contents in legally significant ways. Intermediaries, including agents, publishers, service providers, operators, retailers, etc., add new components, new value and new rights into the legal products and forward the combinations further. End-users of e-books get licenses to use e-books. They send payments to intermediaries that share them with other parties. Transactions are secured using cryptographic methods and trusted third parties. The term commitment in the figure refers to commitment notifications that entities send to each other. The notations 0..\* and 1..\* refer to cardinalities. In general, there should be one or more originators and any number of intermediaries, end-users, and trusted third parties. If there are no intermediaries, originators transact directly with end-users. In the undesired situation that there are no end-users, the process of course is reduced to meaningless. If the parties trust in each other enough, there do not need to be any trusted third parties. A loop arrow going from an actor to the same actor means that if there are more than one actor of that kind they can communicate with each other.

## 9 Conclusions and Future Work

All the areas mentioned in this paper are important to digital rights management. However, to make the electronic commerce of information products work, we do not need to solve the problems in all those fields. It is important to understand where the requirements on rights management come from and how they affect on rights management. Yet, it is not essential at the moment to solve all the problems in requirements elicitation, definition and so forth. Alike, legal tools may have their limitations and difficulties, but let us leave them for now.

The central area to build a working electronic commerce for information products is the combination of legal rights, rights management, and technical tools. Legal rights and the corresponding liabilities need to be fully understood in order to build rights management on top of them. As mentioned earlier, there are also a number of problems related to those rights. They can seriously harm the industry.

The main focus of the further work should be on rights management and especially on technical tools to support it. The article describes a framework to define the area of digital rights management.

Although this area is crucial to electronic commerce, today, only a few points are well-known. Linkages between DRM and entity's general intellectual asset management and intellectual property strategy should be studied in more detail. In general, the framework should be elaborated further and it should be made more concrete to make it useful. For example, going through sample cases that show its shortcomings and faults can refine the framework.

Interoperability. As previously mentioned, it is very important to ensure the adequate interoperability of the DRM systems. Therefore, one of the key components related to digital rights management is rights definition language. XrML seems to be the most promising language for the purpose. However, it is necessary to study what the limits of current XrML are. Also, a common set of communications protocols needs to be defined.

Intermediary liability and trusted third parties. A framework for online intermediary liability should be created. Among other things, it should include the definition of legally clear and unclear content; the clarification of different intermediary, stakeholder, and third party roles; requirements on trusted transactions and study their implications; and requirements on rights management system from the intermediary liability point of view. A model on the roles of trusted third parties with respect to rights management and the delivery chain of information products should also be created.

Prototype tools. The feasibility of the framework should be studied and the related problems should be shown by testing the existing products and possibly creating sample prototypes of new technical tools.

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Open eBook Forum Working Groups, <http://www.openebook.org/>

XrML - eXtensible rights Markup Language, <http://www.xrml.org/>