Digital Rights Expression Languages (DRELs)

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Executive Summary

The protection of rights over digital content is becoming increasingly visible to the general public as the rights controls associated with newer digital technologies such as DVD films and iPod music players start to make their presence felt. This is no less true in the education world where digitised research and teaching content is being handled through libraries, VLEs and Web portals. This change is throwing up new issues regarding rights protection, copyright and the need to understand the technological issues involved.

Technology, in the form of the Digital Rights Management (DRM) systems which enforce rights protection policies, has a major role to play. But how do these rights get expressed in the first place? For humans they are documented in formal statements, codified in laws and expressed in contracts and terms and conditions. However, in order for rights to be handled by computer systems they must be expressed in a formal, machine-readable manner and this is the subject of this TechWatch report: Digital Rights Expression Languages (DRELs).

The report makes a clear distinction between DRELs and the DRM systems that carry out the technical enforcement. It concentrates on providing an introduction to DRELs, the technologies involved, and their possible use in higher and further education. The report explains what DRELs are, the role they play and their generic structure as well as discussing the two most well known languages, ISO MPEG REL and ODRL, and some of the alternatives such as METSRights and XACML. Coverage is also given to the standards that are being applied to this area and the complex history and role of patents.

The report also discusses the differences between DRELs and Trust-based systems, which are exemplified by Creative Commons, and discusses the role of what are known as ‘soft’ rights which are widely used by education and, in particular, libraries. Soft rights such as ‘fair use’ (e.g. small scale copying for research purposes) are enshrined in copyright law, but are difficult to encode in rights languages due to the nature of their - deliberate on the part of lawmakers - ambiguity. Whilst for some this may throw into question the use of DRM systems in environments where such widespread use of these ambiguities is essential, the author points out a little known detail of the European Copyright Directive in which a contract may, legitimately, be used to avoid such exceptions and limitations in the case of enforcement systems using DRM and associated technologies. Whilst this is not strictly a technical issue it is one of profound importance to the context in which these technologies will be used in the educational environment.

Finally, the report concludes with some discussion of the potential future direction that DRELs may take. Many commentators believe that DRELs could hold the key to an increasingly important problem – how to ensure interoperability between different DRM systems. If all DRM systems were to recognise a single rights language then it would be possible for content owners to set a single, universally understood set of rights and permissions to a content object, safe in the knowledge that DRM systems would be able to handle it. A number of scenarios are mapped out in which differing DREL technologies play a role in future DRM systems and the future interplay with Creative Commons is also discussed. Most important though, is that H&FE should understand and make clear the requirements that it has for rights protection and the associated expression of such rights in the complex and differing scenarios of teaching, research, libraries and administration.

1. Introduction

Universities and colleges within the F&HE sector are both rights holders and rights users and often need to both grant and use their rights in ways that are not catered for by the 'blanket' approach of most commercial DRM systems e.g. fair dealing for non-commercial research, library privilege and exceptions for examinations.

Understanding Digital Rights Management is therefore becoming increasingly important within Higher and Further education and has had considerable impact on the core areas of activity: teaching, learning, administration and research. Materials, both for teaching and research, are rapidly being digitized and much information and library infrastructure is increasingly being predicated on a digital architecture and the availability and distribution of electronic materials. The subject of DRM, however, is becoming increasingly complex and difficult to map for a non-expert, and in response to this, JISC commissioned a study to make recommendations on the best approach for JISC and the UK's F&HE communities to adopt in relation to DRM (Intrallect, 2004). This report included some discussion of the role of Digital Rights Expression Languages (DRELs) within the DRM environment in HE/FE. DRELs allow asserted rights over content (most obviously copyright) to be expressed in a machine-readable format and facilitate the dissemination of this information along with more general metadata, for example, when metadata is harvested from cataloguing systems. It is generally recognised that existing descriptive metadata have an inadequate structure for handling such rights information. As part of its final recommendations the DRM report called for JISC to 'maintain a watching brief on the future development of enforcement systems, particularly to ensure that suitable DRELs are in use' (Intrallect, 2004, p. 76).

The aim of this TechWatch report is therefore, firstly, to separate out two important digital rights concepts: the expression of rights and the implementation of rights, and secondly, to investigate the expression of rights through the use of Digital Rights Expression Languages (DRELs).

2. DREL Awareness in the F&HE Environment

It is fair to say that apart from one or two exceptions, DRELs are generally not well understood. This applies to the commercial environment where DRELs are known slightly but interest in them there is limited to a very few, very simple expressions, such as 'Play once', 'Do not pass on' or 'Pass only to identified devices'. The more complex types of business rules that can be used, such as time limited loans, multiple subscriptions, permissions dependent on other rights, are simply not used. This is the case in the music industry where mobile devices, such as iPod, use DREL functionality. The iPod uses a few simple proprietary commands based on the expressions in the Fairplay DRM developed by Apple and other companies, such as Microsoft, also employ some basic expressions for their software (e.g. WMA v9 and v10). The full range of expressiveness that is present in the two best known DRELs, the ISO MPEG REL[1] and the Open Digital Rights Language (ODRL)[2] which will both be discussed later, is a closed book to all but a few experts or working groups actually involved in the development of the technologies.

Based on telephone interviews undertaken with informed personnel, from academic libraries, rights clearance organisations and information science, it is clear that within F&HE there is a similar lack of knowledge; the subject is very little known, let alone discussed. There seems to be a general anxiety about copyright and this has undoubtedly impeded any discussion of these other technologies. There is, admittedly, more knowledge of Digital Rights Management in general, but again, this is limited to a few individuals and is often consigned to the 'too difficult' or 'too alarming' pile on the desktop. By and large, the F&HE community seems to think that boundary access controls (e.g. password protected websites) are sufficient.

Although there is a general lack of knowledge of DRELs, also sometimes called Rights Expression Languages (RELs), among the F&HE community, there is one exception and that is the Learning Technologies Sub Committee – Digital Rights Expression Languages (LTSC-DREL[3]) of IEEE. Kicked off in March 2003, the LTSC-DREL initiated a work programme and initially planned to make a recommendation about the adoption of a DREL. However, during the course of its work, it came to the following conclusion:

> *'During the agreed work programme it became clear that the need for DRELs within education and training communities worldwide is still at an embryonic stage. However, while the sector has voiced its strong need for DRELs it has not, as yet, articulated unique requirements that cannot be satisfied by DRELs developed by consortia more focused on requirements for managing trusted content and services. This reflects the state-of-play within the eLearning industry where learning technologies associated with pedagogy, process, and learning activities are still largely in the R&D phase. This does not mean that such requirements may not exist, but they have not been explicitly identified in this Recommended Practice.'*
>
> LTSC-DREL, 2005, p. ii

[1] ISO REL – http://www.chiariglione.org/mpeg/standards/mpeg-21/mpeg-21.htm#_Toc23297977 (last accessed 13/06/06)
[2] ODRL – http://www.odrl.net/ (last accessed 13/06/06)
[3] LTSC-DREL - http://ltsc.ieee.org/wg4/files/DREL_Req_Analysis.doc (last accessed 13/06/06)

This suggests that before choosing any DREL, a formal requirements exercise should be undertaken to establish the precise needs of the educational community and progress towards this is outlined in later sections of the report.

Perhaps it is helpful to point out that the F&HE communities are very aware and comfortable with another kind of policy management system, namely the network access system managed by UKERNA to control the use of JANET network facilities. In the JANET Acceptable Use Policy document[4] JISC sets out the rules under which institutions gain access to JANET and the obligations that access imposes on institutions. Many of the conditions under which UKERNA monitors JANET resemble the sort of conditions that might be imposed by content owners on users of copyright-protected content. Conversely, many of the obligations imposed on institutions resemble the type of obligations that might be placed on them with respect to the use of content. While it is recognised that use of JANET is different from the use of third party content, use of both brings conditions and policy rules.

[4] JANET Acceptable Use Policy Version 8.0. Available online at: http://www.ja.net/services/publications/policy/aup.html (last accessed 13/06/06)

3. An Introduction to DRELS

This section sets out some basic facts about Digital Rights Expression Languages. It makes the very important distinction between rule setting and rule enforcement and also gives a short description of basic structure.

3.1 What Rights Languages do

Rights expression language technology was first developed in the early 1990s at the Xerox Parc Research Centre, in Palo Alto, California, by Mark Stefik, as a spin off from artificial intelligence research (Stefik, 1997; Coyle, 2004). Since that time, the technology available has become increasingly sophisticated. Today there are two major rights languages available in a reasonably mature form, along with a few others that merit mention but which are not currently major contenders.

A rights expression language is a type of high-level computer-processable language that can express human instructions for interpretation, without ambiguity and in a secure manner, by a processing device. The instructions concern what a rights owner allows a user to do with a piece of content. The primary purpose of the language is to enable an end-to-end Digital Rights Management enforcement system to control, for as long as required, the use of protected material delivered on networks or on physical media when they are accessed by users.

In practical terms this means that a rights holder can convert their human-readable licence (e.g. you can copy this to your hard disk and play it ten times) into logical language that a computer program can interpret without ambiguity. This can then be acted on by an enforcement system (i.e. DRM system) that protects the content a user wishes to access so that the rights holder can be certain that only those rights specifically requested by and granted to the user can be exercised.

A rights expression language can generate rights expressions that range from the very simple, such as the example above, to the very complex. A rights expression should be capable of being extended so that the original rights will still be respected but extra conditions can also be added. Hence, as content is passed down the value chain, channel partners of the original rights controller or other authorized interested parties are able to participate in adding value or perhaps further restricting the rights. It is only the expressiveness of the language that limits complexity or utility.

Rights expression languages are themselves written in some 'flavour' of XML[5], which can be read by human beings (with some difficulty) as well as by computers. XML, sometimes called the language of the Web, is widely used as the basis of rights expression languages as it is pervasive, hence an aid to interoperability and interworking.

3.2 What Rights Languages do not do

DRELs are not a way of expressing copyright law, they do not have anything to do with encoding copyright, nor do they have any legal force per se. However, any legal authority they may have comes from the various copyright enforcement instruments that exist today. At

[5] XML - http://www.w3.org/XML/ (last accessed 13/06/06)

the top of the hierarchy is the WIPO Copyright Treaty (1996)[6] embodying two articles that give protection to technical systems of protection (Article 11 – Technical Methods of Protection, and Article 12 – Protection of Rights Management Information). Both of these articles provide protection for a rights expression that has been generated by a DREL. As these articles must be incorporated in the legislation of all countries signing up to the treaty, rights expressions will be protected under national laws. In this way, a DREL ultimately is under the protection of the law, but is not part of the law.

Although DRELs exist in the context of copyright law, they are in reality more akin to the terms found in a contract that grants permission to do certain things under certain conditions. Hence DRELs are very often considered to be a kind of encoded contract and it is here that there is often claimed to be a tension between copyright law, which always contains provisions for exceptions, and contract law, which does not.

It is also important to note that a rights expression language does not require any payment as a necessary condition. Payment may be a condition, but so may attribution or exercise of another right and so forth. A rights language can, in fact, be used in an environment where paying for content is not the norm, but providing protection to rights is.

Nor are rights languages necessarily linked to enforcement systems. This most important point is often misunderstood by those who equate rights languages with the encryption functionality found in DRM systems. A rights language could be used entirely to ensure that Party A and Party B understand the nature of the agreement between them. In addition, a rights expression can be digitally signed so that Party B knows that Party A has the authority to issue the rights expression which sets out the usage rules of the content and that the rights expression was indeed issued by Party A.

This separation of policy setting from the enforcement of policy is a critical distinction between a rights language and an enforcement mechanism (usually some kind of encryption) associated with DRM systems. This report only deals with the policy setting aspects of DRELs and does not deal with their enforcement through a DRM system.

3.3 Generic Syntactic Structure

Both the major DRELs have a similar (but not the exact same) type of structure. This basic structure enables Party A to grant Permission to Party B to use Thing C under Condition/Constraint/Requirement D. The condition/constraint/requirement must be observed in order for the permission to be exercised now or at some point in the future.

6 WIPO WCT - http://www.wipo.int/treaties/en/ip/wct/index.html (last accessed 13/06/06)

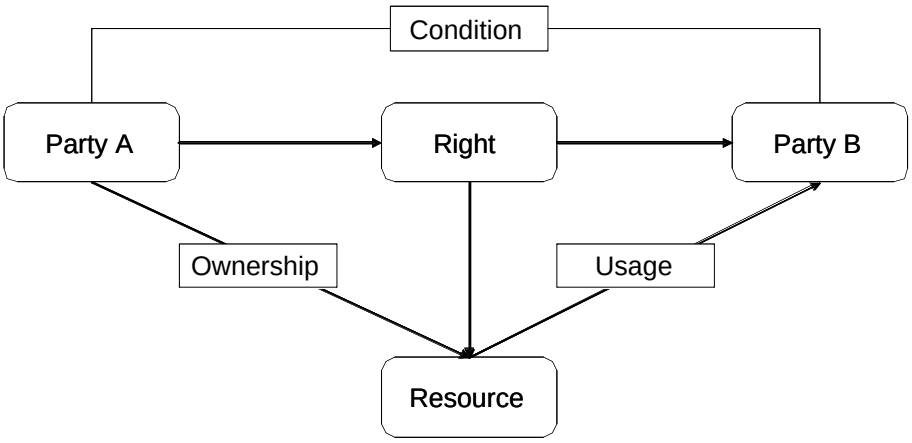

Figure 1: Generic Rights Language Structure

This very simple structure says nothing about the complexity of the conditions or the nature of the permission. Nor does it say anything about the underlying data model. But it does show how the contract analogy is more or less apt. For instance, if a rights holder wishes to grant a user the right to copy a certain piece of content, for the purpose of playing it from the hard disk of a computer, it would be possible to grant that right on certain conditions. The rights holder might wish to prevent the content being passed to any third party (i.e. that it should not be copied again) or from being changed in any way. And of course, the rights owner might wish to be paid and could make payment a condition of accessing the content. This is a simple permission that a rights expression could formulate into a machine-readable instruction.

3.4 Semantic Structure

Whilst a rights expression language can provide the structure (*syntax*[7]) for the creation of a rights expression, there is also a need for extremely precise terms that convey meaning (*semantics*) in order to create unambiguous expressions. However, it has long been recognized that natural language and computer languages are two different things. Social interaction is built on the notion that the interpretation of the nuance of language is essential. For instance, all law is framed on the basis that it cannot be so precise as to exclude legal interpretation.

Computers, on the other hand, cannot deal with imprecision. Given an ambiguous expression, computers will either fail to work or will function in an unpredictable manner. A good example of how natural language can be problematic when applied in a rights expression language is the term 'Copy'. Used extensively in copyright legislation (indeed it is the basis of the term copyright), for the purposes of a computer it is out of place. While to copy theoretically means to make an exact replica of something which is in all respects the same, human beings unconsciously know this needs interpretation. We 'know' in fact, what 'to copy' means. However, a computer does not. How can one thing be exactly the same as another thing – they would be the same thing (the same bits in the same time and place) and therefore theoretically there can be no copy. So, when using the verb 'copy' for a rights expression language that is interpreted by computers, it is essential to ensure that the imprecision in 'Copy' is effectively driven out. Furthermore, were there to be reliance on the semantics of

[7] For a formal discussion of syntax see Wulf, Shaw et al, 1981, Fundamental Structures of Computer Science, page 26

'Copy' in a court of law, it would not be possible to precisely define them, which would render the use of a rights expression containing the word 'Copy' dangerous.

For this reason, it is necessary to create a set of precise, computer readable terms (semantics) specifically for use in a rights expression language. These rights terms form the basis of a rights data dictionary. They are such words as 'Play' 'Print' and 'Adapt', verbs that describe an action which can be taken on a piece of content. Both the major DRELs described in this report have associated Data Dictionaries containing such semantics.

However, rights terms alone are insufficient. It is not enough to have a term such as 'Play' unless what is being played is clearly identified and described. DRELs therefore rely heavily on descriptive metadata in order to categorise the things that rights can be exercised over. This descriptive metadata may be drawn from many sources, but is likely to be domain-specific. Within the educational world this has long been recognised and the semantics developed for LOM[8] or Dublin Core are testament to this. In the commercial entertainment environment, the descriptive metadata employed is drawn from domain-specific metadata schemes. There are many of these, including ONIX[9] in publishing, MPEG-7[10] in the motion picture environment and MI3P[11] metadata in the sound recording environment.

A potential problem arises when content, governed by rights expressions containing domain-specific metadata, passes from one domain to another where the metadata from the original domain may not be understood.

[8] LOM home page - http://ltsc.ieee.org/wg12/ (last accessed 13/06/06)
[9] ONIX - http://www.editeur.org/ (last accessed 13/06/06)
[10] MPEG7 overview - http://www.chiariglione.org/MPEG/standards/mpeg-7/mpeg-7.htm (last accessed 20/06/06)
[11] MI3P Metadata initiative - http://www.mi3p-standard.org/ (last accessed 26/06/06)

4. State of the Art

This section of the report deals with the current state of the development of DRELs. Of the DRELs to be described three are governed by standards bodies, though only one (XACML[12]) was developed *ab initio* by a standards body.

4.1 Some high level Requirements

This section sets out some criteria by which a DREL might be evaluated. Requirements exercises have been conducted in various forums, such as LTSC (LTSC, 2003), MPEG (MPEG21, 2001) and the International Digital Publishing Forum (IDPF)[13], formerly the Open eBook Forum (OeBF, 2000), and all of them have come to similar conclusions at a high level. It should be recognised that this is a very high level list of requirements and that it is inevitable that specific criteria will always be necessary for particular use cases. Hence, if the adoption of a DREL is one of the objectives, it would seem essential that before any decisions are taken on the adoption of a specific technology, an extensive requirements exercise should be undertaken.

4.1.1 Creation Types

Various analyses in recent years identified different types of creation. For example, the INDECS[14] analysis identifies three creation types:

- Abstraction
- Expression
- Manifestation

The IFLA FRBR[15] model, on the other hand, identifies four creation 'states':

- Work
- Expression
- Manifestation
- Item

Whichever model is chosen, a DREL should be able to support any of these.

4.1.2 Content lifecycle (from usage to deletion)

A DREL should be able to manage protected content from creation to deletion. Therefore any DREL must support rights verbs that can do this. For instance it will be essential for a DREL to be able to express the concept of copying (i.e. the creation of a new resource) and the concept of complete deletion (i.e. the destruction of the resource from all parts of a computing machine's system).

4.1.3 Granularity

A DREL should be capable of a high level of granularity in order to deal with very precise permissions in rights expressions. This suggests that the DREL should be able to support many different types of metadata.

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[12] XACML home page - http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=xacml (last accessed 13/06/06)
[13] http://www.idpf.org/
[14] http://www.indecs.org/analysis.htm
[15] http://www.ifla.org/VII/s13/wgfrbr/wgfrbr.htm

4.1.4 Unambiguous Expressions

A DREL must be able to create expressions that are unambiguous. This means that it must not be possible for an expression to lead to unintended consequences. For instance, if a rights controller wishes to allow access to a certain class of user, then it must be possible for that class of user to be identified without any doubt so that the permission can be strictly applied by the DRM system. Hence unambiguous semantics are a necessity.

4.1.5 Security

One of the essentials of all DRM technology is a requirement for security. With a DREL, it must be possible to ascertain whether the expression is genuine and whether the creator of the expression had the right to issue it. One method of achieving this is to use digital signatures. However this is not the only method.

4.1.6 Extensibility

A DREL is likely to have been developed in a particular context. For instance, the underlying technologies for both the ISO REL and for ODRL were originally created with an eye to managing the rights in published textual material. Both these DRELs can now deal with many different types of content. Extensibility also means the ability to relate to the requirements of different communities with different IPR environments. Hence it is important to ascertain whether or not a DREL has a method for extension into different content types, different use cases and different communities.

4.1.7 Formal Representation and Language

First and foremost, a DREL must be written in a machine-readable language. This is essential if DRELs are to be used with a machine-processable DRM system. Secondly, a DREL should use a standard open meta-language, such as XML. Without this, interoperability would be very difficult to achieve.

4.1.8 Metadata

A DREL must be able to deal with extensive metadata schemas, such as are in use today. Without this capability, a DREL's usefulness is severely curtailed because it would not be able to integrate with external metadata systems. Secondly, it is helpful if a DREL is associated closely with a rights data dictionary. Without such an association, its core purpose – to set permissions over protected content – will have to rely on an untested, unassociated dictionary which may require extensive work to verify and integrate.

4.2 Some Existing DRELs and potential DRELs

The DRELS are laid out with the best-known contenders, the ISO REL and ODRL, first. They are followed by the METS[16] initiative, which is being developed within the library community, and although not strictly a DREL, can link to a DREL with rights semantics, and by XaCML, a language for access control in the network environment (which is also not strictly a DREL). Finally come two commercial initiatives. The first, Sun Microsystems'

[16] METS Home Page - http://www.loc.gov/standards/mets/ (last accessed 13/06/06) Further information available at http://www.rlg.org/en/page.php?Page_ID=582&projGo.x=13&projGo.y=14 (last accessed 13/06/06)

DReaM[17], is being developed as an alternative to the ISO REL and ODRL. It is being built around Open Source but is currently at a very early stage. The second is Adobe's LifeCycle Policy Server[18], which may or may not be relevant in future, but is currently targeted at the enterprise environment.

4.3 ISO REL (ISO/IEC21000/5:2004)

The ISO REL is based on XrML, the creation of the American artificial intelligence scientist, Mark Stefik, who originated the language as Digital Rights Permission Language (DPRL) at Xerox Parc in the early 1990s (CoverPages, 2001). Since then, the language has been transcoded to XML and provides the baseline for an international standard (ISO/IEC21000/5), developed by the Moving Picture Expert Group (MPEG).
The patents underlying the ISO REL are owned by ContentGuard[19], which in turn is owned by Microsoft, Time Warner and Thomson.

The ISO REL has a simple and extensible data model for many of its key concepts and elements. The data model includes four basic entities. These entities come together in a 'grant'. Structurally, a grant consists of the following elements:

- The principal to whom the grant is issued
- The right that the grant specifies
- The resource to which the right in the grant applies
- The condition that must be met before the right can be exercised.

By itself, a grant is not a complete rights expression that can be transferred unambiguously from one party to another: a full rights expression is called a license. In order to fulfil the requirements of functional granularity, a typical license consists of one or more grants and an issuer, which identifies the party who issued the license. This will probably be the content owner or other party authorized by the rights owner. A simple license is illustrated below.

[17] Sun Microsystems DReaM - http://www.openmediacommons.org/collateral/DReaM-Overview.pdf (last accessed 13/06/06)
[18] Adobe LiveCycle Policy Server - http://www.adobe.com/products/server/policy/index.html (last accessed 13/06/06)
[19] ContentGuard – www.contentguard.com (last accessed 13/06/06)

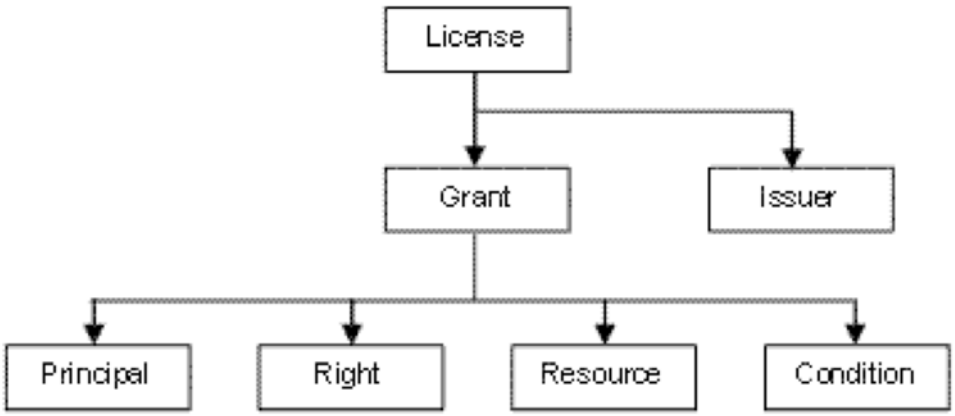

Figure 2: ISO REL Data Model

In the diagram, the issuer identifies the party who grants the license. The issuer can be authenticated by a signature, which is useful to address trust issues and to ensure license integrity. The issuer element can also contain details relating to the issuance of the license (for instance, the time it was issued or the mechanism by which it might be revoked).

The principal identifies exactly one party granted a permission who must be identified by information unique to that party. An associated authentication mechanism (which is specified by the standard) is used to prove the principal's identity. The granted right is a 'verb', such as Play or Print, that a principal may exercise against some resource under some condition. The resource is the 'object' to which a principal can be granted a permission. The specification is able to deal with digital works, services or even content on physical media. The condition specifies the terms, conditions, and obligations under which rights can be exercised. A simple condition could be a time interval during which a right can be exercised. A more complicated condition could be to require a principal to have a valid, prerequisite right. In this way, eligibility to exercise one right can depend on the eligibility to exercise other rights. Hence, rights can be concatenated.

The ISO REL is defined using the XML Schema recommendation from W3C and its element model follows the standard one that relates its elements to other classes of elements. For example, the grant element is related to its child elements: principal, right, resource, and condition.

The standard is capable both of extension (to serve the needs of specific communities which require extra elements or rights verbs) and profiling (the selection of parts of the standard which are necessary for a particular application). The process of extension and profiling is managed by JTCI/SC29/WG11 (MPEG).

Although the ISO REL does not have its own complete Rights Data Dictionary (RDD), it does contain 14 basic permission verbs which enable a very wide range of operations that may be undertaken against content, from playing or printing to deleting. Further semantics are

supplied by the Rights Data Dictionary (RDD), developed by MPEG (ISO/IEC 21000/5[20]) as a separate specification. The RDD ensures that new semantics can be supplied as required (either by the introduction of new verbs or by the specialisation of existing verbs). The RDD also ensures that semantic interpretation remains unambiguous.

4.4 Open Digital Rights Language (ODRL)

ODRL was created by an Australian scientist, Dr Renato Iannella. Originally released as Version 1.0 in November 2001, the language is now available as version 1.1. It has also been published by W3C as a Note (which recognises that the topic has been subject to formal discussion in W3C but is not the same as a standard which in W3C is called a 'Recommendation'). It provides the baseline DREL for the Open Mobile Alliance DRM[21], versions 1 and 2.

ODRL has its own underlying model, which is a bit more complex but some would argue easier to understand than that of the ISO REL. The model has three basic conceptual elements:

- Rights
- Parties
- Assets

Unlike the ISO REL it does not declare Conditions as one of the basic elements, but rather includes Conditions/Constraints/Requirements as a subset of Permission, which in turn is a subset of Rights. This gives the following information model.

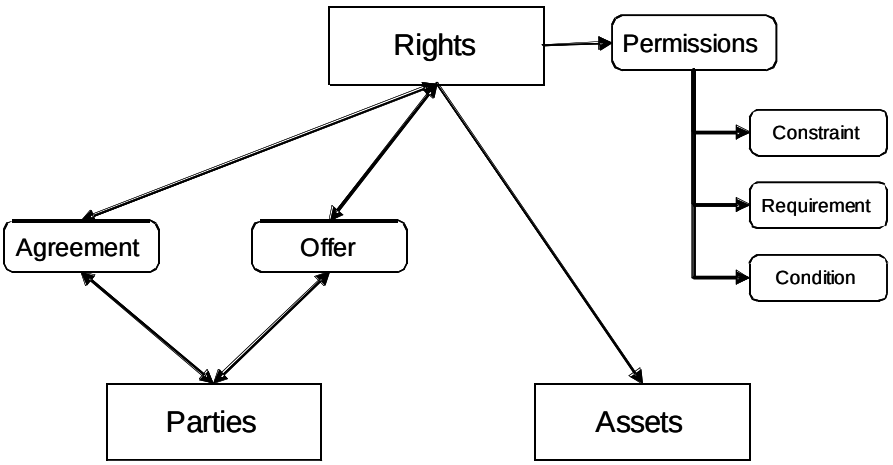

Figure 3: ODRL Information Model

The Assets element can represent any content at any appropriate level of granularity (e.g. a chapter, a music track or a whole book or music album) which can be uniquely identified. The asset can be either digital or physical.

[20] MPEG RDD - http://www.chiariglione.org/mpeg/standards/mpeg-21/mpeg-21.htm#_Toc23297978 (last accessed 13/06/06)
[21] Open Mobile Alliance Home Page - http://www.openmobilealliance.org/ (last accessed 13/06/06)

The Rights element contains Permissions which represent the actual allowed usage. The specification provides for 21 different types of Permission verbs (where the ISO REL has only 14), such as Print, Modify, Sell, Move and Delete, grouped into four categories to group similar permissions (Usage, Reusage, Transfer and Asset Management). In turn these Permissions are bounded by Constraints (limits to the Permissions), which themselves are grouped into six categories (User, Device, Bounds, Rights, Aspect and Target). Finally, Permissions are also limited by Requirements–obligations on the Parties exercising the Permissions and Conditions which are exceptions, to control Permissions such as states which must be in existence at the time of exercising the Permission.

The Parties element is used for any entity that grants or benefits from a granted permission. Such entities can include both human beings and devices.

Offers and Agreements spring from the interaction of Parties and Rights. Offers are the proposals from Rights holders (the Parties who control Rights) to users wishing to gain access to content. Agreements represent the deals which the Parties mutually agree.

Like the ISO REL, ODRL also uses a digital signature process for authentication of permissions, based on the W3C XML-SIG[22] Recommendation.

As can be seen from this very high level description, ODRL and the ISO REL are similar in intention and achieve their objectives in similar ways. However, unlike the ISO REL, ODRL supports its own linked Rights Data Dictionary. The data dictionary elements form the basis of the language and can be extended by incorporating additional elements as requirements demand.

The specification uses two XML schemas, one for the language elements and one for the data dictionary. ODRL can be extended to suit the needs of new communities by the addition of new domain-specific semantics in a new Data Dictionary Schema. This enables the deployment of the dictionary in areas that are not envisaged in the baseline specification. For instance, the OMA Rights Expression Language, developed for the mobile industry by the Open Mobile Alliance Consortium, is typical of this process.

4.5 XrML V1.2[23]

As noted above, the ISO REL took XrML v.2 as its baseline technology. However, an earlier version of XrML (v1.2) has been adopted by Microsoft as the rights language incorporated into its Rights Management Services (RMS) server-based system. RMS, primarily targeted at the corporate market, gives companies tight control over the permissions that apply to their business documents. RMS issues a license that must be authenticated by the server for the user to access the document. In this way a business can restrict access by user, can limit or 'time-out' user access, or even prevent the copying and pasting of specific bits of information.

That Microsoft used the earlier version of XrML, which is not schema- but rather DTD-based, is a matter of Microsoft corporate policy. This earlier version of XrML employs semantics that are different from the ISO REL and the two are not really interoperable. It is probable that development work on XrML 1.2 is only continuing inside Microsoft and is not being conducted actively by ContentGuard, which is concentrating on developing the ISO REL.

[22] W3C XML-SIG - http://www.w3.org/TR/xmldsig-core/ (last accessed 13/06/06)
[23] XrML Home Page - http://www.xrml.org/ (last accessed 13/06/06)

4.6 Metadata Encoding and Transmission Standard (METS)

The METS initiative, supported by the Digital Library Federation, attempts to provide a schema that provides a structural metadata to ensure that digital objects in library collections and archives do not dissolve into their individual, separate constituent parts[24]. The schema is used to produce XML document formats for encoding metadata necessary for both management of digital library objects within a repository and exchange of such objects between repositories (or between repositories and their users). This is important because without a schema for the transmission of such structural metadata, the page image or text files comprising the digital work are of little use, and without technical metadata regarding the digitization process, scholars may be unsure of how accurate a reflection of the original the digital version provides. Furthermore for internal management purposes, a library must have access to appropriate technical metadata in order to periodically refresh and migrate the data, ensuring the durability of valuable resources.

However, as the primary function of METS is the provision of structural metadata, it is only incidentally a Rights Expression Language. A METS document consists of seven major sections and one of those sections (Administrative Metadata) contains links to external administrative information, including rights, but does not itself provide a vocabulary and syntax for encoding administrative metadata (Beaubien, 2004). However, administrative metadata may be recorded in a METS document using vocabulary and syntax specified in an external XML standard or schema. It is therefore reasonable to assume that the METS schema could be used with one of the extensive, existing rights languages described in this report. Alternatively, it could draw on existing Rights Data Dictionaries, such as those associated with the ISO REL or ODRL, though the use of a dictionary but not a rights language itself would seem to be an odd decision, given that rights metadata is only made actionable by a rights language.

There is also another alternative, and that is METSRights, an extension schema to METS which encodes 'minimal administrative metadata about the intellectual property rights associated with a digital object or its parts' e.g. information such as copyright holder[25].

The use of METS and METSRights within the academic library system forms part of a wider debate about the requirements for intellectual property rights handling within such institutions. Libraries make use of a large body of academic and public domain materials, and commercial and non-commercial published materials for which they hold no intellectual property rights (Coyle, 2005). There is a strong reliance on national copyright law and in particular fair use. Some argue that metadata schemas in use in libraries such as MODS[26], Dublin Core and to a lesser extent METSRights do not sufficiently capture the range of descriptive information required for copyright handling (Inside CDL, 2005).

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[24] There is a brief overview of METS at the UKOLN website: http://www.ukoln.ac.uk/metadata/resources/mets/

[25] There is little documentation available on the METSRights schema, although the schema itself can be read at: http://www.loc.gov/standards/rights/METSRights.xsd

[26] For more information on MODS see: GARTNER, R. 2003. *MODS: Metadata Object Description Schema.* **JISC Technology and Standards Watch**. Report TSW-03-06, October 2003. Available online at: http://www.jisc.ac.uk/index.cfm?name=techwatch_report_0306 (last accessed 26/06/06).

4.7 eXtensible Access Control Markup Language (XACML) v2.0

This language, an approved OASIS Standard within the OASIS Access Control Technical Committee (see section 5.3 for more details), is positioned as a technology to express information system security, not specifically as a rights expression language to govern the use of content protected by intellectual property rights. Hence it is not a recognizable DREL in as much as it lacks the semantics required. However, it could be used to encode access policies, if the emphasis is on access rather than on IPR.

Like the true DRELs discussed in this report, XACML is based on XML. According to the specification, this was a natural choice due to the ease with which its syntax and semantics can be extended to accommodate the unique requirements of the application, and the widespread support that it enjoys from all the main platform and tool vendors.

XACML has a relatively complex Data Flow Model:

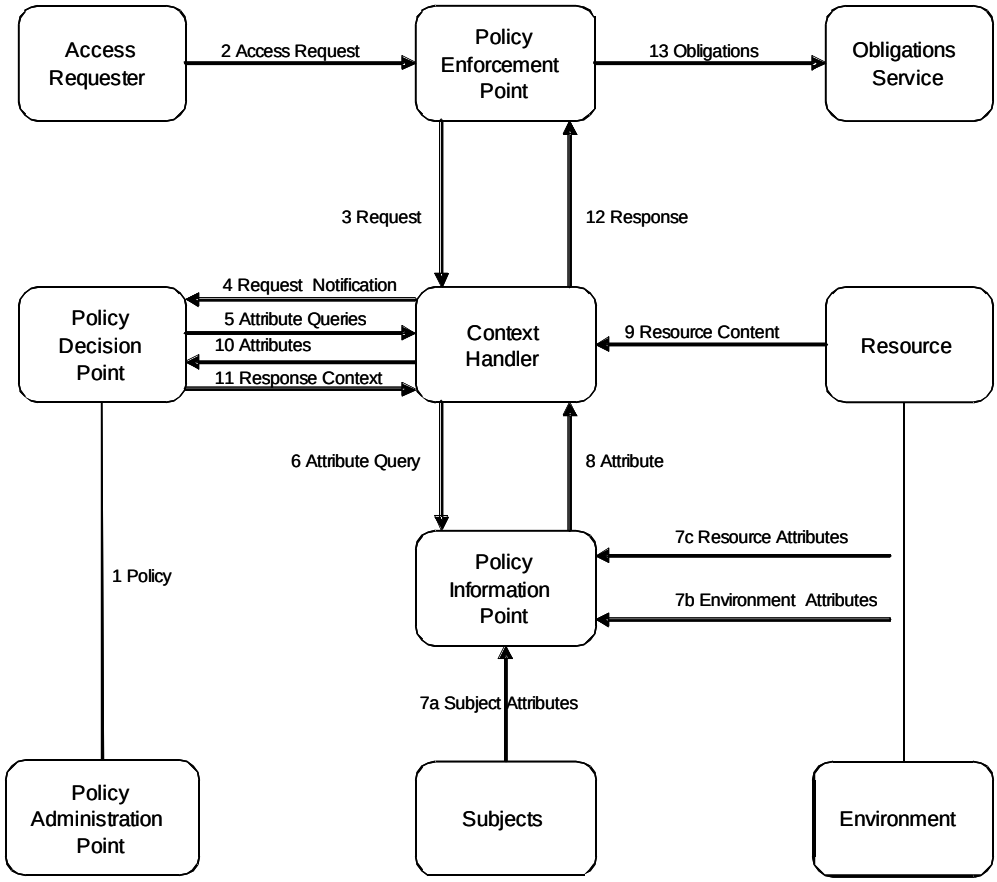

Figure 4: XACML Data Flow Model

As can be seen from the model a request for access is made (2). This is passed to the Context Handler (3), which notifies the Policy Decision Point (4) of the request. Various queries are then made by the Context Handler to establish information about the subject making the request and about the resources (which could be some data or a service) which the subject (some kind of node) wishes to access (5–9) and responses are returned. Once the information has been assembled it is passed to the Policy Decision Point (10) for a decision. This is returned (11) and a response (12) is returned to the Policy Enforcement Point in response to the original request (3). If the response is positive (i.e. the request for access is granted) it is passed to the Obligations Service which will set out the obligations the Subject must fulfil in return for access to the resource.

XACML could serve as a DREL but for the lack of rights semantics. The technology supports no rights data dictionary and its core language does not have the semantics that are appropriate for dealing with content. For instance, its core Policy Syntax element set contains no semantics that could be used specifically for controlling actions over content, such as play, print or adapt. As a result, it would be necessary either to create a rights data dictionary specific to XACML or to use one of the rights data dictionaries already in existence. However, the former course would be a significant undertaking, while the latter course may

be seen to be pointless as both existing rights data dictionaries also have their own fully functional DRELs.

4.8 Sun Microsystems Open Media Commons and DReaM-MMI (Mother May I)

Sun's Open Media Commons is an Open Source community project to develop royalty-free codecs[27] and DRM solutions. The goals of the OMC are to develop an Open Source, royalty-free solution for the distribution of digital content, focused on authenticating people and roles, not just devices; to address the application of DRM technology to a wide range of content and situations, including personal rights management, the privacy of health records and compliance management for businesses dealing with financial and accounting disclosure procedures such as Sarbanes-Oxley; and to create an open environment where creators, content owners, consumers, network operators, technology providers and consumer electronics device manufacturers can work together to address the technical problems associated with DRM (Open Media Commons website[28]).

The DReaM-MMI specification claims to outline 'a different approach to licensing and managing rights for a variety of client types that are directly or indirectly connected to content networks. The design philosophy underlying DReaM-MMI is that clients should be able to negotiate for rights through standardized protocols rather than downloading a license with an embedded expression of rights. The specification defines the message protocol, message transport and a list of profiles required to ascertain rights by a DRM client from a rights server' (Sun Microsystems, 2006).

The difference between the DReaM-MMI approach to rights and the DREL approach seems to be that in DReaM-MMI rights are stored on the network and accessible to any networked client. A client makes a request to do something and a response is given, based on the information about the rights requested held on the server. Thus, a request could be made to play and a response could be given, enabling the requester to play the identified content. As can be expected, all rights are identity based, taking advantage of the Liberty Alliance identity system. Rights can be fine grained and are available to client devices which are directly networked or networked through a proxy (for instance, a portable device which docks through a connected static device).

Apart from this very little is known so far of the DReaM MMI system, which was only made public in March 2006. However, the fact that Professor Lessig, one of the founders of Creative Commons, was a speaker at the workshop is perhaps significant. What is clear is that Sun's ambition is to develop a patent-free DRM environment. Whether this is possible, given the amount of recent patents that exist around DRM technologies (including the use of DRELs) remains to be seen.

4.9 Adobe LiveCycle Policy Server

Adobe has developed and marketed two DRM technologies, Adobe Content Server and Adobe LiveCycle Policy Server. Until the third quarter of 2005, Adobe was clearly interested in the market for secure delivery of entertainment content and its product, Adobe Content Server, was probably the best known technology for delivering secure eBooks. Using Adobe's own proprietary rights language, it was possible to set usage rights, such as print,

[27] A codec refers to a software technology for compressing and encoding digital content, such as music or movies

[28] http://www.openmediacommons.org/faqs.html

display and copy. There was also some facility for pass along. However, in November 2005, the company announced that it was discontinuing its Content Server technology and was to concentrate instead on the replacement LiveCycle Policy Server, specifically targeted at the enterprise market, where document security is an increasingly important issue.

Adobe's LiveCycle Policy Server is part of Adobe's Intelligent Document platform. Like the Content Server technology, LiveCycle Policy Server enables document authors to assign permissions that specify a recipient's level of access and the actions s/he can perform, such as printing, copying, adding or removing pages, forwarding, or saving to local storage. Subsequent use of a document may be tracked, including when and how often it is accessed. Adobe claims that usage rules are persistent because the policy (i.e. the usage rules) travels with the document at all times and may be updated at any time. Thus it would be possible to amend a set of usage rules governing a document without having to reissue the document once it is in circulation. To achieve this the policy is changed on the Policy Server - for instance a document from which it was originally not possible to copy could have copying rights added or an expiration date could be changed - and the policies in all existing copies of the document would be amended when they next communicate with the policy server.

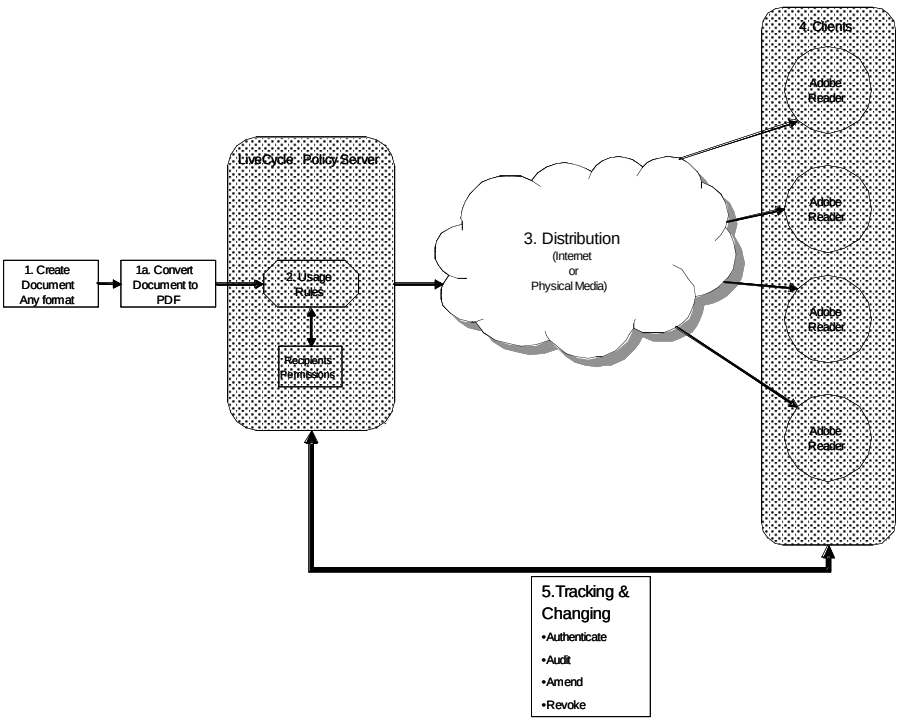

Figure 5: Adobe LiveCycle Policy Server Model

The process outlined in Adobe's website is as follows:

1. An author creates a document using a desktop application such as Microsoft Word. The document is then converted to an Adobe PDF file using Acrobat.
2. The author selects an existing security policy from Adobe LiveCycle Policy Server or creates a new one, using the LiveCycle toolset.
3. Once the policy has been set and attached to the Adobe PDF file, it can be distributed by e-mail or on a physical media or posted to a website.

4. When a user wishes to access the document, Adobe LiveCycle Policy Server authenticates the recipient against credentials stored in the organization's authentication directory (for instance, this could be achieved using Shibboleth[29]). Once authenticated, the recipient is only permitted to use the document according to the usage rules in the policy.
5. In real time, the author can check the recipient's actions and change the security policy for the document, as well as for any other documents s/he has previously published.

The DREL used in Adobe LiveCycle Policy Server appears to be closely integrated with Adobe's document handling technologies and Adobe's proprietary PDF format. It would seem to be impossible, therefore, to use it with another DRM system or document format.

[29] http://www.jisc.ac.uk/index.cfm?name=pub_shibboleth

5. DREL Standards

Standards development in the domain of digital rights management has been going on since the late 1990s, with vigorous activity since 2002. Various organizations have entered the arena and now there are several highly significant initiatives dealing with DRM in general. However, to date, only four organisations are dealing with the standardisation of DRELs.

When discussing standards it should be noted that there are different kinds, some more 'official' than others:

- Formal standards are those created under the banner of an internationally recognised organisation, such as the International Standardisation Organisation or the International Telecommunications Union.
- Consortial standards are those created under the banner of a group of companies or organisations which collaborate in order to support a particular industry or industrial sector. Sometimes these standards are subsequently ratified by formal standardisation bodies.
- Informal standards are created quickly in a more ad hoc fashion, often without a governance procedure, usually by a group of companies.

5.1 JTC1/SC29/WG11 – Moving Picture Expert Group (MPEG)

MPEG, which has been in existence for 18 years, is a working group (WG11) which operates under SC29 of the Joint Technical Committee 1 of the ISO/IEC organisation[30], a formal standards body, whose members are national standards organisations, such as the British Standards Institute. MPEG started work on a Rights Expression Language and a Rights Data Dictionary in 2001 as part of the MPEG-21 initiative. The two standards ISO/IEC 21000:5 (REL) and ISO/IEC 21000:6 (RDD) may be used independently but normatively reference each other. As noted above, the REL is based on XrML v2.0, but has been extended and refined. Currently, there are two profiles[31] in development by MPEG, the so-called Base Profile (for mobile devices) and the DAC (Digital Access and Communication) Profile for broadcasting. There will certainly be further extensions, in response to new industry requirements for the language.

Paper or electronic versions of ISO standards can be purchased from ISO or from a national standards body, such as the British Standards Institute.

The ISO REL is not yet implemented. However, it is believed that there are several commercial implementations of the REL in preparation.

5.2 Open Mobile Alliance (OMA)

The OMA[32] is a consortial standards body, constituted by various interests in the mobile communications domain. Formed in 2002, OMA started work on a rights language in 2003 as part of its DRM standardisation work. There have been two versions of the OMA REL. Both are based on ODRL and have been developed in collaboration with the ODRL creators. Version 1 was published in 2004. It is a comparatively basic piece of technology, sub-setting the much richer ODRL. Version 2 was published in 2005 and represents a richer language.

[30] http://www.chiariglione.org/mpeg/standards/mpeg-1/mpeg-1.htm
[31] Profiles are a subset of the whole standard intended for a particular application
[32] http://www.openmobilealliance.org/

The OMA REL is supported by an associated rights data dictionary, also published in a Version 1 and a Version 2.

PDF versions of the OMA standards are available for free of charge from the OMA website[33].

The OMA REL is implemented as part of OMA DRM Version 1. It is used in a wide spectrum of mobile devices which receive content from Digital Service Providers (DSPs). Such content includes ring tones, music and some basic video.

5.3 Oasis

The Oasis organisation[34] is a not-for-profit, international consortium that drives the development, convergence, and adoption of e-business standards. The consortium produces Web services standards along with standards for security, e-business, and standardization efforts in the public sector and for application-specific markets. Founded in 1993, OASIS has more than 5,000 participants representing over 600 organizations and individual members in 100 countries.

In 2001 it established a Technical Committee for Secure Access technologies to develop a core XML schema for representing authorization and entitlement policies. This is the XACML standard[35]. As noted above, this is not a true DREL, but could be used if the appropriate rights semantics were incorporated.

Oasis standards are available for free from the Oasis website.

XACML is widely implemented as a language to control secure access to services.
As noted above, Oasis established a Technical Committee for Rights Languages in 2002 but this was closed in 2005[36].

5.4 IEEE – Learning Technologies Standards Committee-DREL (LTSC DREL)

In 2003, the LTSC-DREL[37] was established to investigate DREL technology, with a view to standardising a DREL for the teaching and learning environment. As noted in the introduction to this report, the LTSC-DREL came to the conclusion that a formal requirements exercise was required and these requirements were published in August 2005. A ballot was opened within IEEE and results returned in December 2005. Of the responses received, 31 were Affirmative, 3 were Negative with comments and there were 6 Abstentions. It is understood that once the Negative comments are met, the document will be accepted. This will pave the way, at least in that part of the educational community that watches LTSC-DREL activities, for the next stage of DREL development.

5.5 International Digital Publishing Forum (IDPF)[38]

This organisation, which was originally the Open eBook Forum, is a largely US-centric standards group. In 2004, the group developed a DREL which was based on the ISO REL.

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[33] http://www.openmobilealliance.org/
[34] http://www.oasis-open.org/home/index.php
[35] http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=xacml#overview
[36] http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=rights
[37] http://ltsc.ieee.org/wg4/
[38] International Digital Publishing Forum - http://www.idpf.org/

The IDPF Rights Grammar is fundamentally the same as the ISO REL but has some extra rights verbs, such as Loan (considered unnecessary in the ISO REL).

The standard, which is available to IDPF members, has not, as far as is known, been implemented[39].

5.6 Patent Issues in Standards

In recent years there has been a rapid increase in the incorporation of patented technology into standards, and this means that royalties become payable. Standards organisations have patent policies which can usually be consulted on their websites. In the case of MPEG, the patent policy is outlined in the JTC1 Directives[40] and technology is licensed either through a Patent Pool or directly from the patent owner.

Most standards organisations whose specifications contain patented technology operate under the so-called RAND (Reasonable and Non-Discriminatory) rules. This means that everyone wishing to buy a licence to implement technology based on a standard should be offered the same terms which the patent holders consider reasonable. This, of course, can be interpreted in a multitude of ways and ultimately, only negotiation or, in the last resort, legal challenge, will decide what is actually reasonable.

To facilitate licensing there are today several so-called Patent Pools, which have created licences for technology developed by standards bodies. However, not all patent owners whose technologies are incorporated in standards join patent pools.

There is one issue that must be discussed in this context. Claimed to be underlying all technology on which DRELs are based is a single patent, originally taken out by Xerox in 1994[41]. This widely drawn patent is said to cover all uses of a rights language when used in combination with an enforcement system. It would not, however, appear to cover a rights expression language itself. Hence, using the language to create expressions embodying permissions that will subsequently determine the behaviour of an enforcement system would not in theory require a licence.

This suggests that it would be quite possible to implement a DREL without having to pay patent fees, provided that it was not used as part of an enforcement system. For instance, if a rights expression language were to be employed for identifying permissions which were deployed in a trust system, no licensing would be necessary. It is only when the REL is acted on by an enforcement system that patent fees would appear to be payable and then only by the implementer or operator of the enforcement system.

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[39] See IDPF Rights and Rules Working group for further information. Available at: http://www.idpf.org/specifications/rrwgcoordinated.htm

[40] JTC1 Home Page: http://www.iso.org/iso/en/stdsdevelopment/tc/tclist/TechnicalCommitteeDetailPage.TechnicalCommitteeDetail?COMMID=1

[41] US Patent, No. 5,715,403. November 23, 1994**.** *System for controlling the distribution and use of digital works having attached usage rights where the usage rights are defined by a usage rights grammar.*

6. DRELs versus Trust Systems

It was pointed out in section 3.2 that DRELs are not, of themselves, enforcement technologies. They can be used in combination with enforcement technologies but do not themselves provide any encryption or other technical protection method to ensure that access to content is controlled. All they do is articulate the permissions that controllers or managers of rights wish to set, in a language that can be unambiguously interpreted by a processing device. In terms of the WIPO Copyright Treaty, DRELs might well be classified as Copyright Management Information (CMI) rather than as Technical Protection Measures (TPMs).

However, it is generally accepted that DRELs are of practical use only in combination with enforcement systems. Thus the permissions set using a DREL will be enforced through some kind of technical protection. In effect a DREL is the instruction to an enforcement system.

Thus it is only in combination with an enforcement system that a DREL is substantially different from a so-called Trust System. That said, they are normally seen to be very different from pure Trust Systems.

Perhaps the best known of the copyright trust systems is the Creative Commons (CC) initiative[42]. The brainchild of Professor Larry Lessig and colleagues at MIT and other institutions, the Creative Commons Initiative is driven by the Creative Commons Corporation, a Massachusetts (US) charitable corporation, and Creative Commons International, a UK not-for-profit company limited by guarantee.

Creative Commons set out to enable people to exercise selected parts of the intellectual property rights the law affords them. Fulfilling the need for ‘an easy yet reliable way to tell the world 'Some rights reserved' or even 'No rights reserved' ’ Creative Commons provides a range of licenses on its website, at no charge, to enable people to express this preference for sharing by offering a human readable licence.

The Trust System that has been established by Creative Commons has gained popularity very quickly since its inception in 2001. Today there are many national CC sites throughout the world, with licences available for 29 different copyright jurisdictions, with a further 10 under negotiation.

CC licences come in three different flavours. There is the Commons Deed, which is intended for ordinary users to read and understand. The Legal Deed is a description of the licence in legal language, which could be used in cases of dispute. The actionable version, written in XML, is intended to be machine-readable. All three 'versions' of a CC licence are compatible.

The CC system currently offers six main licences for those who wish to publish their work in the digital domain.

1. **Attribution Non-commercial No Derivatives** - this is the most restrictive of the licenses, allowing redistribution only. It allows third parties to download works and share them with others as long as they mention the owner with a link back to the owner, but no changes are allowed nor is any commercial use allowed.

[42] Creative Commons homepage – http://creativecommons.org/

2. **Attribution Non-commercial Share Alike** - This license lets others remix, tweak, and build upon a work non-commercially, as long as credit is given and new creations are licensed under identical terms. Others can download and redistribute a work just like the previous license, but they can also translate, make remixes, and produce new stories based on the work. All new work based the original will carry the same license, so any derivatives will also be non-commercial in nature.
3. **Attribution Non-commercial** - This license lets others remix, tweak, and build upon a work non-commercially, and although any new works must also acknowledge the original author and be non-commercial, it does not require third parties to license their derivative works on the same terms.
4. **Attribution No Derivatives** – this license allows for redistribution, commercial and non-commercial, as long as it is passed along unchanged and in whole, with credit to the original author.
5. **Attribution Share Alike** - This license lets others remix, tweak, and build upon an author's work, including for commercial reasons, as long as credit is given and new creations are licensed under identical terms. All new works based on the original will carry the same license, so any derivatives will also allow commercial use.
6. **Attribution** - This license lets others distribute, remix, tweak, and build upon an original work, even commercially, as long as credit is given for the original creation. This is the most accommodating of CC licenses, in terms of what others can do with works licensed under Attribution.

All CC licenses prohibit licensees from 'distributing the Work with any technological measures that control access or use of the Work in a manner inconsistent with the terms of this License Agreement.' As Creative Commons is really designed to allow transfer and dissemination of resources storing CC content in a technically protected area that prevents public access could cause the original rights holder to object. This is a particular issue within HE/FE since there is widespread and increasing use of Virtual Learning Environments in which material is password protected. This does not necessarily prohibit the use of a CC licence in the context of a DRM system but it would oblige the implementer of the DRM system to respect 'fair use' or 'fair dealing' provisions in the copyright jurisdiction where the licence is available[43].

This leads on to a discussion of the issue of 'fair use' or 'fair dealing' and DRELs. DRELS, being unambiguous languages designed to precisely control the operations of computing devices, cannot make the judgements required by the type of 'soft' legislation embodied in 'fair use' or 'fair dealing' provisions. Under Berne Article 9, exceptions are available 'in certain special cases which do not conflict with a normal exploitation of the work or other subject-matter and do not unreasonably prejudice the legitimate interests of the right holder'. Similarly, under Article 10, exceptions are possible 'for teaching, provided such utilization is compatible with fair practice'. These Berne principles are taken forward in the European Copyright Directive and in UK law. UK law also explicitly makes provision for exceptions for library use.

DREL rights expressions can clearly be created if there are very explicit exceptions to copyright. Such exceptions may refer to specific occasions or specific people or to specific

[43] For a detailed discussion of technical protection with CC licensed material, see pp. 45 – 47 of the appendices to the Common Information Environment and Creative Commons report (Intrallect) at: http://www.intrallect.com/cie-study/CIE_CC_Appendices.pdf

types of content. Hence it would be possible to create an expression that said 'this rights expression applies to you, unless you can authenticate yourself as someone who can claim an exception under copyright legislation'. This proposes some kind of authentication system, such as Shibboleth.

What DREL rights expressions are not able to do is to set permissions that say 'you must pay to make of a copy of this, unless you only copy five pages, but this rights expression cannot indicate what might constitute five pages'.

While this may seem to throw into question the use of DRM systems and associated DRELs, the reader's attention must be drawn to Article 6.4 of the European Copyright Directive, the principles of which are enforced in the UK by section 296ZE(9) of the Copyright, Designs and Patents Act (CDPA). Article 6.4 deals in principle with prohibitions on the circumvention of Technical Protection Methods (TPM) such as those used in DRM systems and makes it quite clear that the default for a TPM is that it must respect any exceptions or limitations of copyright. However, it also makes it legal for a content owner, protecting content with a TPM, to avoid having to respect copyright exceptions by taking advantage of contract law. By offering content under a contract, freely entered into with an end user, a content owner can contractually avoid the need to respect exceptions and limitations. Such a contract would specifically prevent an end user from taking advantage of exceptions and limitation allowed under copyright law in respect of access to content covered by the contract by making it illegal to circumvent the TPM that denied the exceptions.

This is a critical issue, little understood within potential user communities, for it means that DRM systems and their associated DRELs can be implemented and used, even though it is not possible for the technology to deal with the so-called 'soft exceptions' where human judgement is required. However, it should also be noted that form contracts between a consumer and a business are subject to consumer-protection legislation. Therefore, some clauses that can be shown to be 'abusive' may be struck down if they have not been properly negotiated and where they generate an imbalance between the parts[44]. TPM clauses could eventually be found to be unfair, and therefore could be struck from the contract but it should be noted that this is untested in the courts for this type of contract. JISC Collections[45], the trading company set up to leverage JISC's collective bargaining power in the negotiation of content procurement , has established the JISC Model Licence and is continually working on best practice in this area.

Further discussion of the relationship between DRELs, metadata and trust systems such as CC licences can be found in three JISC-funded studies either already undertaken or in progress. The first is the ROMEO project[46], which examined the rights issues surrounding the 'self-archiving' of research in the UK academic community under the Open Archive Initiative's Protocol for Metadata Harvesting. Study 6 of the ROMEO deliverables looked specifically at the issue of using CC licences to assert rights over scholarly material.

[44] Unfair terms European Directive (93/13/EEC). The directive has been implemented in the UK in the shape of the Unfair Terms in Consumer Contracts Regulations 1999 (UTCCR).
[45] http://www.jisc.ac.uk/index.cfm?name=coll
[46] http://www.lboro.ac.uk/departments/ls/disresearch/romeo/

The second is the TrustDR project[47], launched in 2005. This project seeks to utilise previous work sponsored by JISC to begin creating practical Digital Rights Management (DRM) systems for digital repositories of learning objects. The project's main aims are to explore the cultural, legal and technical issues that must be attended to in order to create legal agreements that can then be incorporated into a DRM system. This is consistent with the findings of the ROMEO project.

The third is the Rights and Rewards Project[48], also launched in 2005, whose aim is to contribute to the JISC Digital Repositories Programme by providing transferable models of expressing and protecting rights for teaching objects, and of motivating and rewarding academics appropriately for deposit.

[47] http://www.uhi.ac.uk/lis/projects/trustdr/
[48] http://rightsandrewards.lboro.ac.uk/index.php?section=1

7. Domain-specific requirements

Most of this report concerns a fairly generalised view of DRELs but naturally, each domain will have its own particular requirements. Both the major rights languages presented in this report – ODRL and the ISO REL – have processes by which they can be extended to meet the requirements of specific domains. An example of such a domain is GeoDRM[49]. Principal data providers in the geospatial community are leading the development of GeoDRM requirements, driven partly by the need to control or track who has access to its data and how it is used. The lack of a Geospatial Digital Rights Management (GeoDRM) capability is a major barrier to broader adoption of Web-based geospatial technologies and geospatial data exploitation. The JISC-funded GRADE project[50] has developed a compendium of use cases that highlight the complexity of the rights issues involved in this domain.

The mission of the OGC's GeoDRM Working Group[51] is to co-ordinate and mature the development and validation of work being done on digital rights management explicitly for the geospatial community. As part of this work, GeoDRM has developed a Reference Model which has not yet been released for public scrutiny. However, it is understood to contain a section on the information viewpoint which defines what an electronic licence should contain. The reference model is apparently technology neutral but the Working Group developing the Reference Model envisions the rights language for GeoDRM being implemented using a DREL already in existence – such as ODRL or the ISO REL. Other communities will most likely follow the same pattern as GeoDRM and adopt a pre-existing DREL to meet their baseline requirements.

[49] GeoDRM Home Page - http://www.opengeospatial.org/groups/?iid=129
[50] http://www.edina.ac.uk/projects/grade
[51] http://www.opengeospatial.org/groups/?iid=129

8. Automated Systems

The development of networks as a primary method for the delivery of content is proceeding rapidly, not only through the Internet but also through mobile and satellite networks. Commercial content is routinely made available by record companies, publishers and increasingly by broadcasters and their telecommunications service partners. Apple recently announced its billionth music download and 2006 is seeing the exponential growth in IPTV (Internet Protocol Television) (Friedman, 2005). While DRM protection systems for this content are still not interoperable, most consumers do not yet seem to mind. As long as they can gain access to desirable content on a mobile device or via a PC, the fact that they cannot play an iTunes song on a Microsoft player seems to matter little.

However, this is starting to change and there will come a time, sooner rather than later, when the demand for interoperable content becomes pressing. In March, the French National Assembly prepared legislation to force DRM providers to reveal the technologies behind their systems and although this legislation is unlikely to be copied by other countries and, in fact, is now being watered down following threats from Apple to withdraw from the French market (Frost and Schuck, 2006), the fact that French politicians are considering such legislation should be taken seriously. In addition, the music industry (including major record labels) is now starting to press for interoperability (Geer, 2006) so before long, the need to enable consumers to enjoy content from different service providers without recourse to many different technologies will become imperative. This will become a major issue for DRM developers and service providers.

There would appear to be two solutions to this. Either the current situation of multiple DRM systems will converge on a single DRM, or multiple DRM systems will be enabled to provide 'interworking', that is, consumers will not face the problems they currently experience due to 'walled garden' DRM solutions. As the former possibility – a single DRM – is most unlikely, given the competitive environment for technology, the latter solution is more likely. Several technically different DRM systems will continue to dominate the digital environment, but crosswalks will be developed so that consumers – and possibly content owners – are not inconvenienced by having to manually choose between different systems.

Automation of this process, including the packaging and delivery of content, will be the key. Service Oriented Architectures (SOAs) supporting Web Services will play a significant role in the development of automated content delivery whereby consumers gain access to different encoded content without the current burden of manual software installation (Kwok and Chi, 2006; Serrao, 2005). Instead, installation will be done for them by Web Services, which will either provide the service remotely or will install, without fuss, the appropriate player software. A useful analogy to this is the supermarket environment. Most countries have several dominant retailers, all selling similar goods. Most supermarkets have their own cheaper brands, only available from them, as well as major brands which are available from all supermarkets. Consumers select the supermarket of their choice, but expect to be able to use products from one in combination with products from another. Crucially, they also expect to be able to use the same currency and payment systems in all supermarkets. Hence, consumers make their choice on the brand of the supermarket but expect to be able to mix and match major brands at home.

In the digital space, DRELs will be an important constituent of such interworking. In some respects they are similar to pricing and currency conventions, ensuring that all content owners and consumers are able to gain access to the same goods but through different channels.

In such automated systems, DRELs will not necessarily appear on the client side and consumers/users will hardly be aware of them. Instead, users will make requests for the content and usage permissions they want and server-side services will deliver content, reformatting and transcoding it as necessary for the specific consumer application, which has been signalled to the server-side through an initial information 'handshake'. A rights expression attached to content will thus be mediated by a Web Service and the user's client will be sent content with the permissions appropriate to the request.

9. DRELS – Into the Future

Many believe that DRELs could hold one of the keys to interoperability or interworking between different DRM systems in the future. For instance, if all DRM systems were to understand a single DREL used to set permissions over content then it would be possible for content owners to attach a single, universally understood permission to content in the knowledge that all DRM systems would understand what to do. This would not overcome the problem of different codecs (some DRM systems, such as Real and Microsoft integrate their codec technology with their DRM) but it would lessen the burden on content owners and make accessing content much easier for content users.

Some observations on possible developments to DRELs in the medium- and long-term future are set out as scenarios in the following two sections.

9.1 Medium-term (four to five years)

This medium-term forecast is predicated on a digital environment that is edging towards interoperability but has not yet arrived. Devices remain tied to codecs and DRM islands continue to be in existence. However, consumer appetite for content continues to grow, particularly with respect to peer-to-peer modalities, in which consumers can send protected content to each other.

In the education environment, resources are increasingly being made available beyond the confines of the library. Distance learning is an important constituent of all F&HE offerings. However, barrier access control remains the primary means of controlling content flows, with single sign-on being mediated through processes such as Shibboleth. This means that students gain access to collections and not to individual documents.

Two DRELs – probably the ISO REL and ODRL and its various flavours – remain in existence but there are as yet no translation services to connect the two. This is both a technical issue (it would be necessary to map the languages on a one to one semantic basis) and a Trust issue. Content owners are not certain that permissions issued in one language can be exactly replicated in the other via translation. Hence DRM systems must understand both languages. Some do not.

Both DRELs have been dramatically extended, so that they can be used by many different communities. While this means that DRELs and complex licence creation are now recognised as part of the mainstream of DRM, it has caused a new set of problems. Many domain extensions have required new rights semantics to fulfil specific requirements. Initially these new domain semantics are only understood in the communities for which they have been developed which leads to further problems of interoperability. For instance, content managed by the DREL extension for GeoDRM is not readily interpretable in a notional BioDRM environment.

The existence of two non-interoperable DRELs with a growing number of domain extensions means that those wishing to create rights expressions will have to choose one or the other, or they will have to ensure that all content they release can be associated with permissions written in both languages. While this is not a significant problem for organisations where commercial imperatives demand that content is made available through as many channels as possible (in particular across the divide of the fixed and mobile networks), it imposes a burden on non-commercial organisations which use a DREL for internal purposes but which

also have to ingest content from external DRM systems which may be governed by either DREL.

The good news is that there is significant progress in metadata crosswalks. Descriptive metadata schemas are being mapped to each other for the purposes of interoperability and there are increasing numbers of such Web-based services. Organisations such as Open Archives Initiative[52] and Los Alamos have made much progress in this area. Some of the progress is based on ontologies, which are made available for enquiry through Web Services. Descriptive metadata schemes from the publishing, music and audio-visual domains now have crosswalks to each other. Rights semantics, which have increased in number and complexity, have to be the next step.

While there are still no translation services for DRELs, the processes for signalling which DREL is being used have progressed. Devices are now aware, when receiving content protected by an enforceable rights expression, of the nature of the expression and what schema to consult to interpret it. In addition, Registration Authorities for rights data dictionaries now operate so that unknown semantics in a rights expression can be checked remotely using a Web Service.

9.2 Long-term (eight to ten years)

DRELs have become part of the landscape of DRM which is now a globally accepted process used for the secure delivery of valuable content to network capable devices, whether online or offline. Consumers are completely unaware of the technology, which is largely dealt with on the server side.

However, DRM protected content is not the only network modality. There is another type of content exchange, mediated by open trust systems, such as Creative Commons. This has led to the development of a bi-polar system which enables content exchange between both those who do not put monetary value at the top of their list of priorities and those for whom content in exchange for money is the sole commercial objective.

At the barrier of the two systems a porous membrane has developed. This enables content to migrate from the trust environment to the enforcement environment, depending on the requirements and intentions of the content owners. Both systems have their appropriate uses and exist side by side. The binding of these two worlds is the metadata applied by content owners and others to express (a) the nature of the content and (b) the means by which the content can be licensed. Creative Commons licences, or something like them, are mirrored, if required, by DREL permissions. For instance, content such as a PhD thesis can be developed in an academic setting and mediated by trust exchange, using trust licences. However, once the PhD is published, the author and publisher wish to make it available to third parties beyond the confines of the known trust system in return for payment. They repackage the content and attach to it a DREL licence, which mirrors the intention of the original CC licence, but makes payment an enforceable condition (diagram 6).

[52] Open Archives Initiative - http://www.openarchives.org/

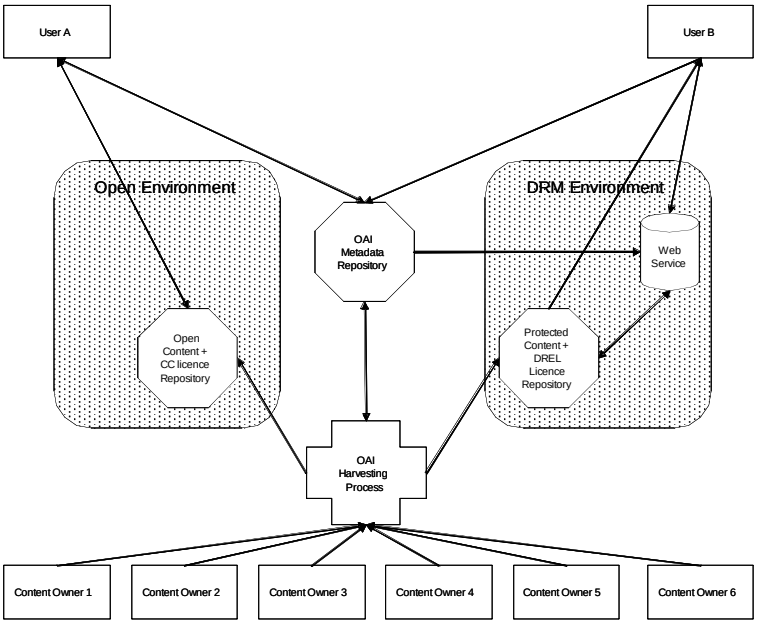

Figure 6: Automated Content Delivery Future with Open and DRM Environments

In the diagram above, content has been fed into repositories by Content Owners 1–6. Some of the content is governed by Trust Licences, some is governed by a DREL enforced by a DRM system. The OAI metadata record not only describes the content but also carries information about the type of licence under which the content is available.

User A searches for content, making a request to an OAI metadata repository. The repository directs User A to a content repository where licences are governed by a Trust System, which is not enforced by any technical protection measures. User A then requests the content which is delivered with the Trust Licence.

User B also searches for content, making a request to an OAI metadata repository. The repository directs User B to a content repository where licences are governed by a DREL permission which is enforced by a DRM system. A negotiation is carried out by a Web Service, which holds the DREL licences that govern the desired content. User B buys the rights and only the rights she requires which are then packaged with the content by the Web Service, effectively sub-setting the DREL licence. User B receives only those portions of the licence which are necessary for the required usage and these portions are then acted on by the client DRM engine.

If at any point one of the Content Owners wishes to change the nature of the licence governing a piece of content, this can be achieved by amending the DREL specified in the metadata maintained at the content owner's site.

10. The Value of DRELs for F&HE

The development of the online and offline DRM environment has been comparatively slow. However, with the advent of user-friendly commercial services in the last twelve months, first in music and now in audio-visual, the process has speeded up considerably. As reported earlier, Apple has announced its one billionth music download from iTunes and other, Windows Media-based services, are also experiencing major growth (Geer, 2006). In addition 2006 seems as though it will see an explosion of growth in the delivery of audiovisual material. While DVD sales continue strongly, the profit from sales may have peaked (Netherby, 2005) and it is expected that an alternative online mechanism and business model for secure content delivery will soon start to take their place. This process will probably see its first peak with the Beijing Olympics in 2008 when the world will demand online access to this global sporting event.

Supporting these commercial services are technologies for online and offline delivery which are becoming increasingly mature. The concept of the 'home domain' enabling users to share their downloaded content across different devices is now firmly entrenched and accepted. Legitimate peer to peer, enabled by secure delivery technologies, is also expected to find more traction on networks.

As the offers from these services become more sophisticated (way beyond the mere offer of 'play this') rights language functionality will be essential. DRELs will be used to mediate complex relationships with consumers, ensuring that they are guaranteed that permissions are genuine and that the licensors have the rights to grant them. They will also, obviously, be used to ensure that content is only accessed and enjoyed in accordance with rights owners' wishes.

This will be the experience of anyone who downloads and uses securely delivered commercial content. Just as the use and convenience of online shopping for physical goods and services (Amazon, Opodo, Misco etc.) has become second nature to a generation of people in the developed world, so the experience of acquiring and enjoying securely delivered content will become common. The behind-the-scenes technologies will lose their 'demon' status and the competition they engender between service providers to reduce prices will eventually win out. Consumers will use rights languages without being aware of the technology that has so recently been developed.

The general significance of this for the F&HE is that students and staff will become increasingly familiar with the delivery of secure entertainment content managed by usage rules. The rules, set using a rights language, will enable them to gain far more value and utility from the content. They will be able to move it around between devices, send it to friends, buy it for limited periods and even incorporate it into their own content packs. For instance, there is great interest in users being able to create personal play lists, whereby they will be able to recombine music from different sources into their own compilations. This can easily be enabled by rights language functionality and device manufacturers are extremely interested.

However, while DRELs enforced by DRM systems seem set to become very widespread in the commercial content environment, both for online and mobile applications, the future of DRELs for F&HE must be carefully considered. These are expensive systems to establish and will need comparatively expensive maintenance. Therefore it will be essential to scope

requirements carefully to identify those environments and applications for which DRELs and enforcing DRM systems might be necessary. Clearly, within institutions where there is proximity and trust, they are unlikely to be employed. Between institutions, where there is no requirement for payment, the trust process can also be invoked. However, where a consortium is established (such as the Coleg Project[53]) with payment for content exchange one of the objectives, a DRM system, driven by a DREL, could be appropriate, if only to manage the commercial process. Other applications would include the management of third party content, such as commercial journal articles. In this case, the institutions will be governed by their contract with the supplying third party and ensuring that the articles are disseminated on a controlled basis would be facilitated by a DREL, and enforced by a DRM.

Other specialised applications could involve sensitive content, such as medical imaging, where access must be strictly controlled for reasons of data and patient protection. There are likely to be other, perhaps national security related content areas, where controlling access with a DREL might be deemed essential.

It is possible to create a kind of paradigm of content creation and control as shown in the diagram below.

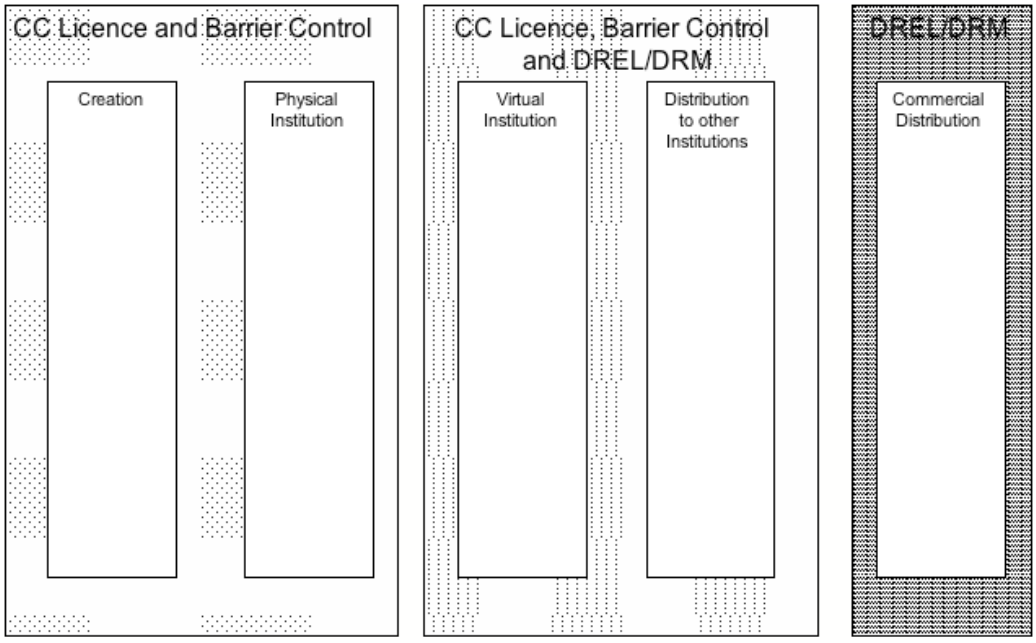

Figure 7: Academic Licensing Paradigm

In the diagram above, the progression is from left to right. In the box on the left assets are created and distributed within the physical confines of the institution. This would include the library. These assets may only require the application of a CC licence and perhaps barrier access control (e.g. a password-protected website). In the middle box, assets are made available to remote students who are part of the virtual institution. These students may access a protected website where they will encounter documents licensed under CC. Alternatively they may be faced with a DRM system, with a DREL licence. The assets may also be shared or sold to other institutions. Depending on the relationship to the other institution, these

[53] www.coleg.org.uk

documents may either be licensed under CC or they might be controlled by a DRM and a DREL. In the box on the right, all assets are protected by a DRM as they are in a commercial environment where payment is required. Documents may move from one environment to the other depending on the requirements of usage. As they move they will be governed by different modalities.

Conclusion

It is not entirely clear which direction DRELs will travel in coming years. In terms of technology, the choice is between a language which has been developed within a formal international standards process (ISO REL) and one which has been developed in an environment more akin to the open source development context (ODRL), and future adoption may hinge on how the patent situation affects these two languages. At present, the choice is between the two and it seems likely that staff within tertiary education will be faced with content that has rights expressed in different languages. A solution to this may involve further progress in what are called metadata 'cross-walks' (the mapping of metadata for interoperability). Related to this is the issue of problems that may arise when content governed by RELs contains domain-specific metadata and passes from one domain to another. It is important that efforts continue to allow metadata from different domains to be interoperable.

Whilst the technology is important it can be argued that a more critical issue is the context in which such languages will be used. It is argued that further consideration needs to be given to identifying which areas of education will actually require enforcement of content rights, and further work is required to ascertain the precise requirements. An important issue, which this report argues is little understood within education, is the fact that technical protection methods (TPM) such as those used by DRM systems can legitimately be used to secure rights over content without building in the expression of the 'soft rights' that copyright law provides for (and education makes much use of). The principle for this was established in the EU Copyright Directive, which allows a content owner, using a TPM, to *contractly* avoid respecting such copyright-based expressions and rights; this is enforced in the UK by section 296ZE(9) of the Copyright, Designs and Patents Act (CDPA). This has significant implications for the education community and how it negotiates its contracts with content suppliers and these issues are handled by JISC through JISC Collections.

For H&FE there is a careful balance to be struck between the use of enforcement technologies and reliance on trust (e.g. through Creative Commons). It is likely that there will be a wide range of usage scenarios not only within institutions (where trust is high) but also between institutions that require different approaches to rights protection and usage. DRELs will play a part in this and it will be important for management and staff to remain aware of technical developments in these and associated DRM systems. However, the choice of DREL is not necessarily the main issue currently facing the education community: wider social and legal issues (e.g. negotiation of contracts with content suppliers; inter-institutional trust systems) are arguably more immediately pressing and certainly worthy of consideration.

About the author

Chris Barlas has been working on DRM for more than 12 years. In the mid-1990s he managed the EC backed Imprimatur project and was also closely involved in the <indecs> project. Since founding Rightscom in 2000, he has been active in technology analysis in the rights management domain for many commercial and non-commercial clients. A strong supporter of standards, Chris has been active in the Open eBook Forum, MPEG and other international standardisation initiatives. Chris's email address is: chris.barlas@rightscom.com.

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