Rights Expression Languages

A Report for the Library of Congress

by

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Preface

Rights expression languages (RELs) are emerging in the information community that support different aspects of the digital access environment -- licensing, payments, web material, use control, access, etc. They go to different depths in the data they specify and they take different approaches vis-à-vis machine manipulation. These variations make it difficult to select the appropriate one for a particular situation or a cooperative venture. This report was commissioned to clarify the similarities and differences of various emerging RELs in order to assist users in making choices and to encourage cooperation among the developers of the languages where feasible. Karen Coyle has shown several important ways to analyze a language, such as its purpose or its machine-actionability or its data element content, that will assist the community in making decisions. She based the discussion on four leading REL initiatives (as of February 2004), following them through an analysis process.

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Executive Summary

Rights expression languages (RELs) are part of the technology of digital rights management. Both are recent technologies and still in their formative stages. The first RELs were developed in the late 1990's and none can be considered to be fully deployed at this date (2004).

This report provides an analysis of a representative sample of RELs that vary from relatively simple expressions of rights holders' preferences to highly complex components of a trusted systems environment. The four featured RELs are: CreativeCommons, METSRights, Open Digital Rights Language (ODRL), and MPEG-21, Part 5 (MPEG-21/5). The paper develops categories to aid in the analysis of the RELs. The goals and purposes of the RELs are characterized as:

- expression of copyright
- expression of contract or license agreements
- control over access and/or use

An understanding of these different purposes can be used to explain many of the differences between these and other RELs. In particular, the degree to which RELs are intended to be machine-actionable is a determinant in the kinds of rights that can be expressed in the REL. A machine-actionable REL must use very precise language and can nearly guarantee compliance with the terms of the machine-readable license. This REL cannot, however, support social or legal concepts like "fair use." On the other hand, broader and less precise RELs must rely on agreement and trust for enforcement, which means that there is a risk that some unauthorized use of the digital resource could occur.

Each of the RELs included here was developed to solve a particular set of problems. CreativeCommons functions specifically in the open access environment of the World Wide Web. METSRights is intended to accompany digital materials being provided by academic institutions and libraries. ODRL is a general-purpose language that allows, but does not require, some actionable control over resource use. It was designed as an open standard for industry and community use. MPEG-21/5 is a general language that is formally described and fully actionable within a trusted systems environment, and it is designed primarily to support applications whose resources require the greatest amount of protection from unauthorized use.

Organizations creating metadata for digital resources should not expect that any one of the languages here will be usable without some modification or development. However, any one of these may provide a suitable basis for that development. In particular the two general-purpose languages, ODRL and MPEG-21/5 have a rich vocabulary that can be reduced or expanded to create a REL for a specific purpose. Note that because the RELs included here all can be expressed as XML implementations it is entirely feasible to embed elements or entire licenses from the REL into any other XML-based metadata. This will assure compatibility with other implementations and products using that REL.

Introduction

The development of today's rights expression languages (RELs) owes much to the work of Xerox PARC scientist Mark Stefik. Stefik's work began in the early 1990's with a statement of the need for protection for digital materials in order to further online commerce and a belief that a trusted systems environment could be developed that would provide the level of security needed to allow digital commerce to flourish.[1] [2] As part of that system it would be necessary to develop a machine-readable vocabulary to express rights to the trusted system software. Stefik began work on the Digital Property Rights Language (DPRL). In 1998, version 2 of DPRL was licensed to a new company founded by Microsoft and Xerox called ContentGuard, which developed DPRL into the eXtensible Rights Markup Language (XrML). Version 1 of XrML was published in 2001, and version 2 in 2002. In 2003, XrML was used as the basis for the rights expression language for the MPEG-21 standard.

Others were also working in this arena and the concept of defining and securing rights for digital materials was the subject of much speculation in computer science. In 1997, John S. Erickson graduated from Dartmouth College with a dissertation on the automation of copyright protection[3], and went on to work on research in this area at HP Labs. Erickson's work in turn inspired other thinkers including Renato Ianella, of IPR Labs in Australia. Ianella proposed the Open Digital Rights Language (ODRL) in 2000 as an open standard rights language. ODRL is in use in various applications in Australia and Europe, primarily in academic and digital library environments but also in commercial applications such as the wireless message protocols in development by the Open Mobile Alliance.

The topic of rights expression is coming up nearly everywhere that metadata is used to describe digital resources. Organizations supporting ONIX, OAI, METS, Dublin Core, MARC and others are all casting about today for an appropriate solution within their environment. Some communities are developing data elements to meet their immediate needs, others are waiting for a clear standard solution to arise.

RELs themselves do not act on digital content, they need to be used in systems that implement the rights management that they express. This rights management technology is still at the stage of design and planning with few solid implementations to point to. What does exist today is the first iteration of what will be a series of development steps for both the systems and the languages that they implement. Consider this the first generation, with much change coming up as systems are designed and industries have more experience.

Although the main contenders for a generalized REL today appear to be MPEG-21/5 (based on XrML) and ODRL, this doesn't mean that one is limited to choosing between these two. The only prevailing wisdom is that there is not (and probably will never be) a universal REL, any more than there will be a universal metadata format. This is especially the case because a rights expression language exists in the context of a larger

system and the nature of that larger system and its requirements determine the features needed in the REL.

The main purpose of this paper is to expose the underlying goals and assumptions of a range of existing rights expression languages, and to establish a taxonomy that will allow us to evaluate RELs in relation to sets of requirements. This taxonomy may also aid in the further development of languages that serve specific or general needs.

To do the necessary analysis, four representative RELs have been chosen that cover a wide range of the functions and goals of rights expression. Not only do they vary greatly in the number of elements in the language and the degree of encoding that these elements receive, each also has its own context and it is necessary to include this context in our analysis of the REL. The four RELs are:

CreativeCommons[4] (CC)
First developed in 2002, CC provides an expression of rights for open access web resources, including HTML documents, RSS feeds, and digital audio files. The CC license is machine-readable in the sense that it is in the form of a digital document, but there is no machine-actionable control over use of the content that carries such a license — CC relies on a system of trust and prevailing copyright law to protect digital content. When a CC license has been assigned to a resource, a CC graphic displayed on the web page or embedded in the resource (in the case of digital audio files) links to the CreativeCommons web site that contains the rights expression. The CC license itself is a shortened form of more verbose licenses found on the CC web page that include full "legalese" for the small number of license statements. The CreativeCommons set of licenses are based loosely on the open licensing scheme of the Free Software Foundation, the GNU General Public License.

The CC metadata record actually has two parts: *work* and *license*. The work section uses simple Dublin Core metadata elements to describe the item to which the license pertains. Because the CC license is intended to serve any and all Internet users, the documentation for users of the CC license is extremely simple and a single web page provides a "fill in the blank" function that allows anyone to easily create a license.

METSRights[5] (METSR)
The METS community is primarily made up of academic and library-based institutions that are providing digital materials for use in education and research. Resources described in METS documents will be digital in form but may also link to analog documents or collections. Many projects using METS are dealing with materials that are primarily archival in nature, owned by a single institution but available to the greater research community. As these materials become digitized and can be distributed in multiple copies, there is an increased need to identify ownership and any contractual requirements for re-use and re-purposing of the materials. The METSRights XML schema was designed at the Stanford University Libraries by Nancy Hoebelheinrich to accompany METS data for digital resources created and/or managed in that environment. It is not designed to be machine-actionable other than

the display of the contents of the data elements included. No automated control over use is intended and the data elements do not support such control. The audience for the METSR elements is primarily information professionals who will be deciding how the resources will be used in their institutional context. There is no user documentation at this point, but the XML schema is heavily documented. An investigation is also underway to see if METSR elements can be represented as an application profile of ODRL, and if coordination with the ERMI (see below) is possible

Open Digital Rights Language[6] (ODRL)

ODRL was designed by IPR systems in Australia as an open standard for expressing machine-readable licenses for digital materials. ODRL references the work of Erickson and the UK organizations indecs[7] and Editeur[8] in its background documents. Each of these represent industry programs to formalize the commerce of digital materials. Although emanating from work at IPR systems, ODRL is now a cooperative project with more than a dozen participating organizations. ODRL consists of an expression language and a data dictionary, each of which have their specific XML schemas, plus schemas for secure encoding of ODRL statements and digital signatures. The terms included in the expression language are abstractions and take their definitions from the data dictionary.

It is intended to be machine-actionable as part of a digital rights enforcement system. In keeping with its own open license, ODRL is provided for free use by anyone who wishes to incorporate all or part of it into their own digital system. Documentation is available on the ODRL web site, including schematic views of the XML schema, and is fairly comprehensive and clear to those already familiar with XML.

MPEG-21 Part 5 (MPEG-21/5)[9]

MPEG-21 is a suite of standards relating to digital multimedia resources. There are seven primary parts to MPEG-21, including identification of digital items, content representation, delivery protocols and intellectual property management. The latter is comprised of a rights expression language and a framework for the development of a data dictionary. The entire MPEG-21 standard has been accepted as ISO 21000. Part 5 of ISO 21000/MPEG-21 is the Rights Expression Language. ISO 21000/MPEG-21 Part 6 provides a structure for a data dictionary for the REL. Although the standard does contain entries for key verbs used in the REL, a complete data dictionary has not been developed for the REL in Part 5.

The MPEG-21 REL is designed for the licensing of digital materials, especially video and audio (MPEG stands for the "Motion Picture Experts Group"). The REL was developed by the MPEG-21 standards group using XrML as its basis. ContentGuard, the company that owns and administers the XrML technology, participated in the development of the MPEG-21 REL.[10] The standard is specifically intended to be unambiguously machine-actionable and to interact with software and hardware that will enforce the license permissions. It also looks to future implementation of trusted systems technology which will allow end-to-end control over digital works from

publication through distribution channels and finally to the end user's device. Although the creators of the MPEG-21 standard represent mainly multimedia intellectual property industries, the REL standard was expressly kept broad to make it usable for a wide variety of digital products. In fact, as written the standard is highly generalized and actual implementations will need to use MPEG-21/5 as a meta-language for the creation of the specific functions that they need. For example, at this writing an extension to MPEG-21/5 for e-books is under consideration by the Open eBook Forum, an industry group developing standards for e-books. The Open eBook Forum standard consists of extensions to MPEG21/5 specific to e-books[11]. If the standard is accepted by the group, MPEG-21/5 will become the primary REL used by the trade e-book publishing industry in the United States and perhaps also in Europe.

The ISO documents for MPEG-21/5 are available to ISO members and are for sale to non-ISO members. At this time, however, only the first three parts of ISO 21000 are available on the ISO web site. As yet there is no user documentation for MPEG-21/5 or /6 and the documents themselves are extremely difficult to read, perhaps because they aspire to a high level of precision.

Some reference will be made to other rights expression languages throughout the text. These are:

Adobe Content Manager (ACM)[12]
Adobe Content Manager is one of the few fully implemented RELs in use today. It can be used only in the Adobe Reader product for protected files, and is present in e-books that are issued in the PDF format. It has a small vocabulary but covers the basics of printing, copying, lending, and text-to-speech.

Electronic Resource Management Initiative (ERMI)[13]
ERMI is a project of the Digital Library Federation, working in the area of managing licensed content in academic libraries, from collection development and acquisitions through access control. Like FDRM, it will intersect with RELs as it moves toward the encoding of licenses as part of the administrative metadata required for electronic resource management. ODRL is being considered as a possible encoding vehicle for parts of the ERMI data element set.

Federated Digital Rights Management (FDRM)[14]
FDRM is a proposal for a system design that can manage access to licensed content in an institutional setting. Although not an REL per se, it addresses a very real and important issue for libraries and educational institutions that provide licensed content for their users. It has not been developed to the point of having a defined vocabulary for access management, but if and when it does it could be part of a fulfillment system that is more relevant to institutions than the commercial access models based on individual payment systems.

Publishing Requirements for Industry Standard Metadata (PRISM)[15]

PRISM is being used primarily by newspaper and magazine publishers to exchange information about articles and other elements (photos, charts) that can be re-used by other publications. Within the PRISM metadata are a small number of rights metadata elements. The developers of the PRISM metadata felt that it was premature to select a developed REL in 2003, and so created the few that were necessary for their specific and immediate needs. The PRISM structure can also accommodate rights metadata from other languages, such as ODRL or MPEG-21/5, and some users of PRISM may include those in the future.

extended Access Control Markup Language (XACML)[16]

XACML is a project of the e-business standards group, OASIS.[17] A technical committee has produced a first version of XACML, which provides a language for access policy enforcement. This language is intended to manage secure authorization and to connect authorized users to resources through formalized policy statements. Although not a rights expression language, XACML may resolve part of the FDRM problem set by providing a way to code access policies for machine resolution.

Goals of Rights Expression Languages

Key to understanding a rights expression language is its underlying goals and purposes. The expression of rights can be generally described in terms of three broad goals:

1. the statement of legal copyright
2. the expression of contractual language
3. the implementation of controls

Rights languages generally have a mix of goals, sometimes not explicitly stated, so part of our analysis will be to look at individual RELs and specific data elements to characterize their goals. First, it's important to define what these three categories mean for the purposes of our analysis.

Copyright law, as defined in U. S. Code Title 17, is the default agreement that exists when no other arrangement has been made between parties, and the law can still apply to any areas not articulated when an agreement does exist. A contract is a stated agreement between any two parties (whether it would stand up in court or not). In that sense, all RELs have some relationship to copyright law because it exists as a default environment variable in the intellectual property arena. Most, however, make little reference to law and do not create specific dependencies on it, for reasons that we will explore later in this report.

The difference between contract and control is harder to describe. Both contract and control may use the same or similar data elements and therefore may appear to be indistinguishable. The difference is between *agreement* (contract) and *execution* (control). Like law, the agreements in contracts should be adhered to by the parties in question, but a contract is essentially an agreement to behave in a certain manner. Control, on the other hand, is an actual implementation of the rights and limitations. Where a controlling mechanism is in place the parties are unable to violate the terms of an agreement even if they should wish to. The same language that expresses contracts may be used in control mechanisms if it is designed in such a way that it can be implemented in software or hardware.

Support for Copyright in RELs

The U. S. copyright law makes a statement about ownership of intellectual works and the rights of various parties, in particular the creators of those works and the public. Copyright law gives particular rights to the copyright owner over a limited set of actions: reproduce the work, derive other works from the work, distribute copies of the work, perform the work, and display or perform the work publicly. Copyright law does not make specific reference to using materials, such as viewing or listening. These are what are considered to be "normal use" and such use is assumed to be permitted.

Other than providing a copyright notice (i.e. "Copyright 2004, Jane Doe") there is little that a rights expression language can or should do in relation to the copyright law. Repetition of elements of the law (i.e. "You can make fair use of this document") may be considered a service to the end user, but has no effect on the actual legal status of the resource.

Rights expression languages that are intended to be machine-actionable are expressly not intended to implement copyright law. Although some early researchers hoped to use RELs to express (and enforce) legal concepts like "fair use," that has not been the case in actual implementations. The copyright law, although carefully worded, simply cannot be expressed in the kind of algorithmic language that is required by computer programs to automate functionality like printing or copying. This is especially true of the key concept of "fair use." Fair use is a deliberately vague exception to the monopoly rights of the copyright holder. It says essentially that although the copyright holder has the exclusive right to make copies of the work, members of the public can also make copies if their use is "fair." There is no *a priori* test for whether a use is fair; each such exercise of the public's right must be carefully scrutinized taking into account a number of factors. Even after such scrutiny, not everyone will agree on what is fair. Electronic systems need an unambiguous and quantitative definition that they can act on, and the copyright law does not provide that.

Rights expression languages can, however, contain within them a statement of who owns the legal rights to a digital object, and can go beyond a customary copyright statement to include useful contact information. Two of the RELs contain data elements of this nature.

METSRights
METSrights has data elements for the rights holder's name and contact information. The rights holder is not necessarily the copyright holder; it could be an agent that is handling the rights. METSR also includes a data element to define the copyright or licensing status of the digital item, including "copyrighted," "public domain," and "licensed," or "contractual" as status elements. These inform the user of the usage context but do not enforce either legal or contractual agreements.

Creative Commons
CC has optional fields to record both creator's and copyright holder's names. It doesn't include contact information as part of the license, but the license is intended to be embedded in the digital document so contact information would presumably be available there.

There is nothing in XrML or ODRL that link back to the concept of the rights holder as intended by copyright law. Both of these languages are focused on the parties to the license, which may or may not be the copyright holder. (In fact, it is likely to be a middleman, agent, or distributor.) Both refer to the issuer of the license, but have no reference to copyright.

Contract

Any rights or permissions beyond those included in copyright law are covered by contract or license. In addition, a copyright holder can extend copy and distribution rights through the mechanism of contracts and licenses. These agreements can give more or fewer rights to the users of the copyrighted material than would be covered by copyright law. Contracts are agreements between an agent and specific individuals, institutions, or groups and do not apply to the public at large. They can contain any constraints that the parties agree on.

The rights expression languages that we review here generally refer to their agreements as licenses which is indicative of their view that one party is giving specific permissions to another, rather than a general contractual agreement between parties. However, there should be no expectation that the terms used have a specific legal significance. In fact, where digital rights will be managed entirely by software, the license terms can no longer be considered of a traditional legal nature and may or may not have legal status should questions arise.

Contract language will typically have some of the following:

- named parties and their roles (can be middlemen, i.e. retailers)
- statements of access and usage that go beyond pure copyright law
- exchange of value (payments) for services or actions

In general, RELs are in the nature of contracts. They are statements about privileges granted by one party to another. The following sections describe the contractual language of some RELs.

CreativeCommons

The CreativeCommons license consists of three elements:

- require attribution
- allow modifications
- allow commercial use

The CC rights language was designed to support the re-use of material that is available on the Internet, and all of their license statements address the issue of re-use. If either "modifications" or "commercial use" are dis-allowed, this does not mean that those actions are strictly forbidden. The CC contract defines "no" in this case to mean that such use must be negotiated with the copyright holder. CC was developed in part by members of the legal community and behind the simple CC license is a fully expressed license using legal terminology. The REL acts as a simplified outline that can be quickly scanned or even searched ("find articles on this topic that allow commercial use"), but the rights language is considered only a summary of a human-readable license. The expanded explanation on the CC web pages also explains the uses and requirements that are covered by copyright law,

since these are assumed to apply to all materials on the Internet, whether or not a CC license has been assigned.

PRISM

A metadata format that uses a similar mix of rights expression and offline contract is PRISM. Where PRISM varies from other metadata carrying rights is that it assumes a prior business relationship with traditional contracts and agreements between the parties. This is possible because PRISM is used in a purely business-to-business environment where the parties of have long-standing relationships, including contracts for syndication of their materials. The rights language therefore only needs to fill in some particulars, such as a copyright notice as it should appear on the item, date and time range for the availability of the material, and a reference to the business contract that covers the transaction. PRISM is a good example of an REL that was developed for a specific situation where a more general rights language was not necessary.

METSRights

Like CC, METSR assumes the application of copyright law as a general environmental variable, and includes full contact information for the current rights holder or agent, presumably so that uses not covered by copyright law or the METSR statements can be negotiated. It does also have some stated permissions referring to access and use. These permissions include actions allowed or constrained by the offline contracts that are referred to in the area where the rights status is defined. METSR also includes some contextual elements that define categories of users that often have specific rights in an academic environment, such as "academic user" or "institutional affiliate." Although some of the METSR rights (i.e. "print") could be elements used in a control system, the intention of METSRights is that it is not machine actionable, and the permissions are not defined in a way that they could be used in a control system.

ODRL

In its introduction, the ODRL standard document states clearly that the intention of the REL is to create a fully machine-readable contract that supports digital rights enforcement and end-to-end supply chain services. This means that the ODRL language must support all of the elements of a license including identification of parties to the license, expression of all possible permissions, plus the data elements required to interact with an automated system that manages these rights through the supply chain. The high level overview of business relationships that ODRL must support is shown in Figure 1. Each box in that figure expands out to dozens of data elements in order to support a comprehensive license management system.

It is important to understand that although the ODRL REL can support a machine-actionable rights management system, it does not provide such a system nor does it make any statement about how that system should work. The goal is to provide a core set of semantics to express a variety of policies that could be enforced through a digital rights management system. Because the context for creating licenses and

managing rights can vary greatly, there is no requirement that all of the ODRL language must be used, nor are there required elements or structures. In addition, ODRL supports extension of its language through the normal XML extension mechanisms as well as through a data dictionary. The data dictionary can be augmented with new terms or can be used to re-define terms. ODRL XML documents can be extended using other schemas and examples in Version 1.1 show the inclusion of data elements from ONIX, MARC21, and the MPEG-21 schemas.

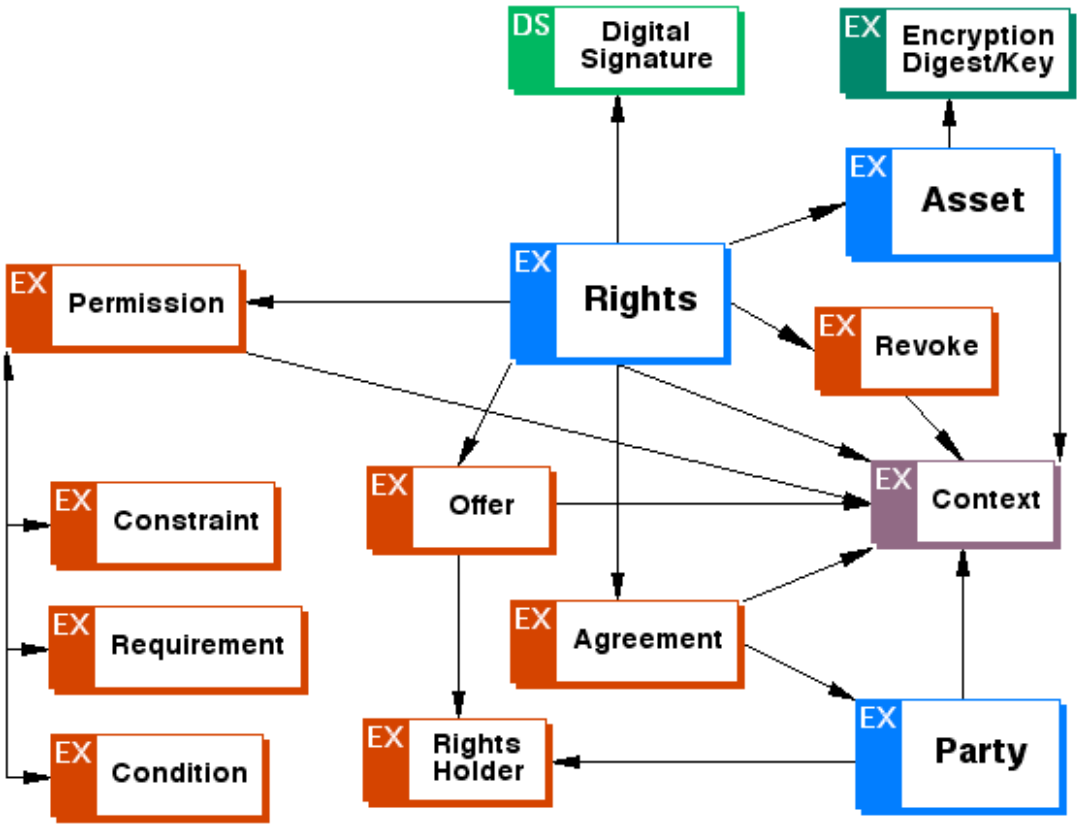

Figure 1: ODRL Rights Diagram[18]

MPEG-21/5

In many ways, MPEG-21/5 and ODRL are alike. MPEG-21/5 also describes itself as creating a machine-to-machine language for automated licensing and for managing those licenses. The overall goal of this language is to support the secure delivery of content over networks, thus realizing the potential of digital delivery of digital assets. Within this environment, the rights expression language is only one of seven architectural elements (Figure 2).

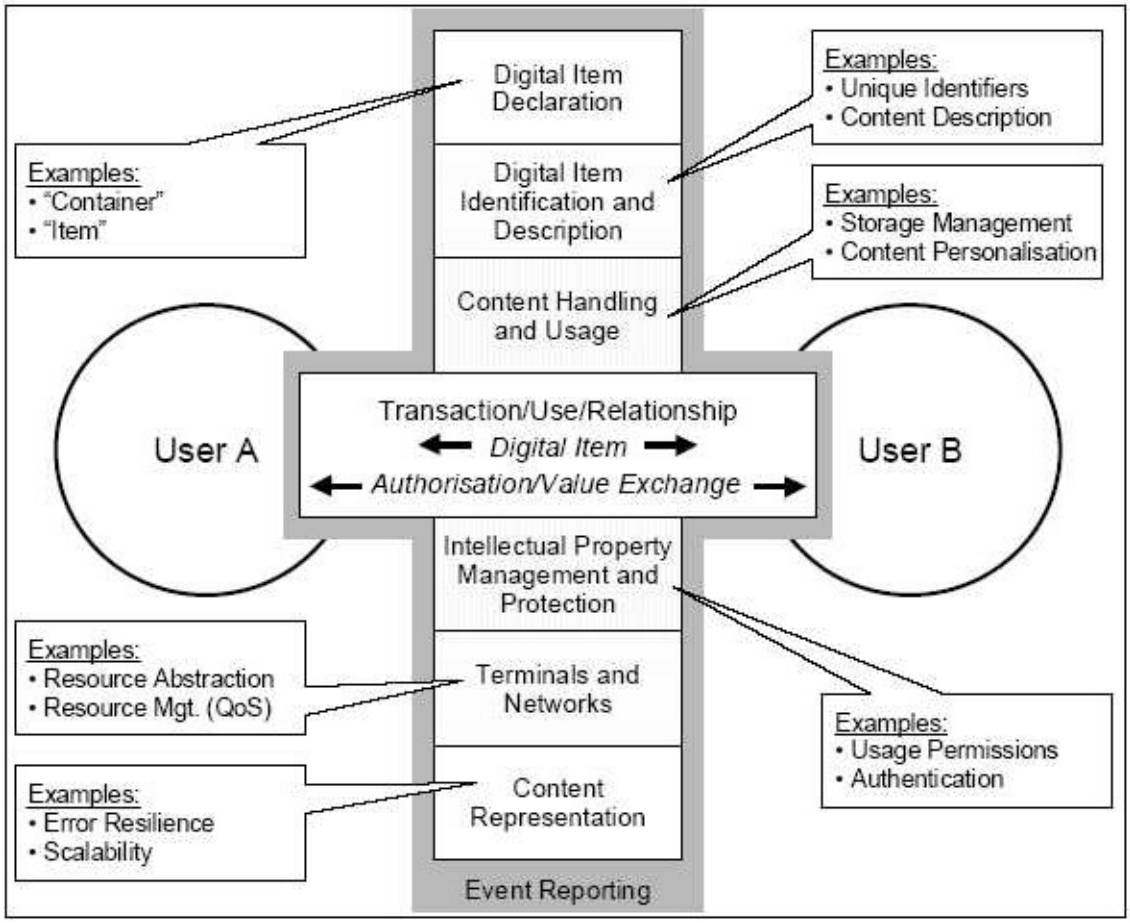

Figure 2: MPEG System Diagram[19]

MPEG-21/5 differs from ODRL in its level of abstraction. MPEG-21/5 describes an environment with one or more principals, a set of rights that are associated with a digital resource, and conditions to which those rights are subject. A principal can be a person, a network node or an end-user device. A right is described in its linguistic role as a "verb." The resource is the object of the rights and a condition describes rules under which rights can be exercised. From these basic elements, MPEG-21/5 derives extensions that implement business models. (Figure 3) The structure of its expression schema allows the transfer of rights along the full chain of electronic commerce, passing contracts to other parties much like wholesalers and retailers interact in the analog world.

Like ODRL, MPEG-21/5 does not describe or define the system that will make use of the REL. Documentation for MPEG-21/5, however, does emphasize that it assumes that the language will be used within the context of a trusted system that can operate along the entire e-commerce business chain to manage business relationships as well as end-user permissions.

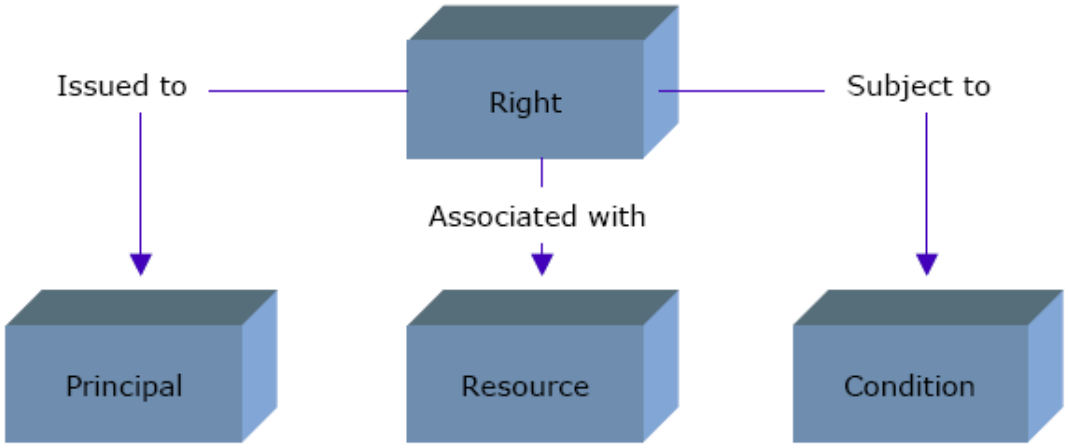

Figure 3: MPEG-21/5 Rights Language Diagram[20]

Control

Neither copyright law nor contracts assert any actual control over the behavior of users of materials. Instead, they rely on the parties to act within the stated agreement or law. Because digital materials must be mediated through software and hardware for use, it is possible to exercise *a priori* control over access to and use of the content through that technology. The nature of the control may or may not also be expressed in a human-readable user license.

Contracts and licenses. The functions of control and contract tend to have data elements in common because they both represent license terms. Control is distinctive because it is designed to be machine-enforceable, therefore it will use a highly formalized expression, generally with quantitative values since computer systems can only work with units that can be quantified. So control vocabularies will define units, such as pages or minutes, clock and calendar based constraints, and tokens of exchange, such as prices. They also need precise identifiers for each element or party. As an example, a contract will name a person and perhaps give that person's address or some other contact information. A control system has to have a unique identifier for each party, even though the identifier may not have any meaning outside of the context of the particular license. The need for control determines the kinds of functions that can be included in a license. As an example, CC has a license term for *attribution* which means that one can re-use the material if proper attribution is given to the original creator. Because this use and attribution takes place in a different document and perhaps in a different systems environment it would be very difficult for any rights management system to have control over that action. Therefore, license terms like CC's attribution will not be used in systems whose goal is control over actions.

Sales and delivery. In the languages that are designed for automated controls, many of the details of the systems are assumed to be provided by a larger context such as a computer network or a trusted system. So these languages do not specify how each party is assigned a unique identifier nor how those identifiers resolve to real-life persons (whose credit card payment may be needed for the transaction). In fact, the full context of sales and delivery is a much larger task than the expression of a set of rights or usages, and is not covered in the REL documents (nor in this paper).

Systems. There is little experience so far with systems that exercise a high level of control. E-book packages, such as those in using Adobe's ACM for PDF files and Microsoft's e-book reader formats, are protected files with some control elements, but the primary barrier to control is the general-purpose computer. A computer allows its users to exercise a number of functions such as printing and making full and partial copies. When connected to a network, a computer can easily transmit files to other points on the network. It is for this reason that the first e-books were designed for a dedicated device (such as the Rocket E-book Reader) where the capabilities of a general-purpose computer were not provided. This same technique is being used today for music files; the Apple iPod is a limited-function device that allows controls to be built in to the device itself. The general conflict between control of content and the capabilities of a computer that can perform many functions is one that will be difficult to resolve. The work taking place in an area known as "trusted systems" is an attempt to create "safe" areas within our general computing environment where such controls can be implemented. In trusted systems, certain functions available to other software will be under the control of the trusted system and not the computer user.

Access and use. There are two key points in the chain of events leading to the use of digital resources where control can be exercised, and those are the point of resource *access* and the point of resource *use*. Access controls limit who can receive or download a file. Usage controls determine what a user can do once the digital resource has been obtained. Since digital resources must be rendered in some way to make them human-perceivable, usage controls are generally built into the software and/or hardware that enables that perception. These two types of control have different environmental footprints and the languages that do attempt to assert controls tend to focus their control on one point or the other, since generally both are not necessary. This difference in focus accounts for some visible differences in data elements. Figure 4 illustrates where these two control points appear in a normal digital delivery flow.

Note that access and usage controls can work together or separately. In the typical educational environment with licenses to online materials such as indexing databases and full text journal articles, the only rights management takes place at the point of access. Once a user is authorized and the database or a resource is opened to access, no further digital controls are in place. The vast numbers of full text academic journal articles have no rights management system controlling their use once an end user obtains a copy. Electronic book systems that allow downloading of e-books to the user's computer make use of both access controls and usage controls. Patrons must be authenticated as valid members of that library's community (usually with a library card number) for access to

the database of e-books. Once downloaded, the e-book has usage controls that restrict use of that copy of the book to that borrower's computer, and that limit the use to the designated lending period. The copy of the book that resides on the user's computer no longer has access controls, however. The patron can copy the file to another user's computer or to a disk. However, the file's usage controls will not permit that other user to render the file for viewing. The digitally protected file does not need access controls because unauthorized use is prevented, so the copied file is of little interest to anyone.

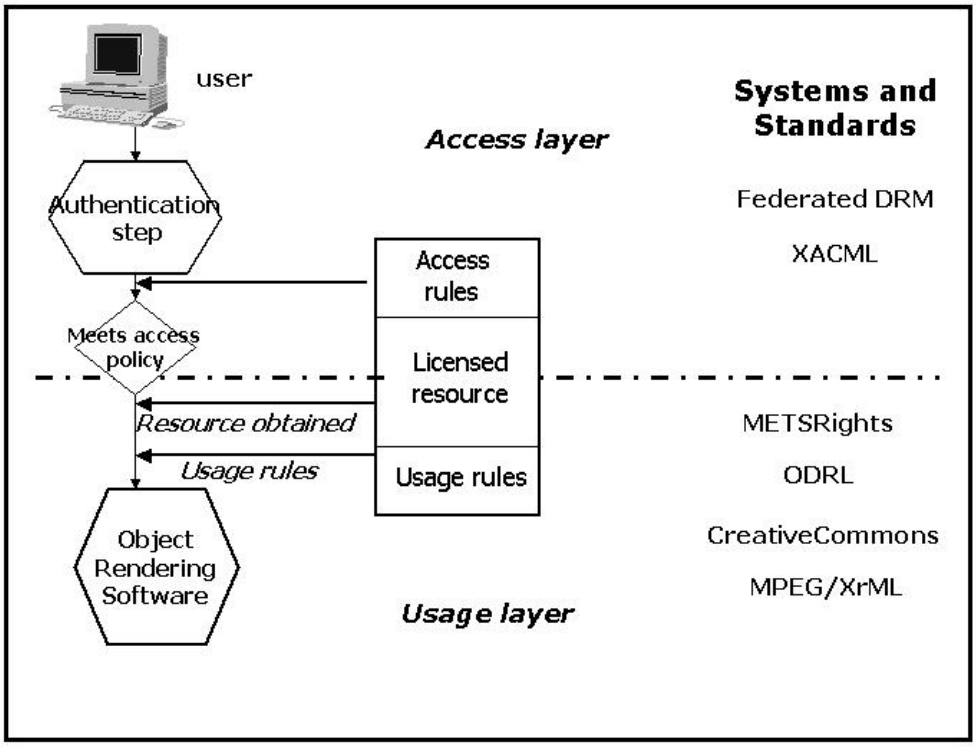

Figure 4: Access and Usage Controls

Owners of highly desirable commercial property, like popular movies and music, will normally insist on strong usage controls because their products are highly susceptible to piracy and access controls do not protect the file itself. Those resources with strong usage controls may not need access controls because usage controls solve the piracy problem. On the other hand, the educational environment has been making use of digital materials using only access controls for well over a decade and this model, although it can be abused, appears to be sufficient for the commercial viability of that market.

Access

We are familiar with access controls in the form of passwords that allow access to internal systems, such as the local area network of a company or an institution. Access controls do not determine what you can do with the digital resource once it is obtained;

that control is covered below under "usage." The main focus of access controls is on user authentication and interaction with a set of rules. These rules can be as simple as "is this a valid account?" or more complex, such as "is this account in a group that is authorized to access this file or set of files at this time?" Libraries and educational institutions are struggling with complex access rules as they try to automate a large set of licenses to diverse digital materials. This problem is addressed in the Federated Digital Rights Management (FDRM) articulated by Martin and Agnew, as well as the Electronic Resource Management Initiative (ERMI) that is in progress among members of the Digital Library Federation. ERMI is focused on the full range of data required for the acquisition of electronic materials and the management of the business aspects of licensing. Some elements of the machine-readable expression of these licenses will have potential as inputs to access control implementations. The FDRM is as much a license management system as it is a blueprint for an automated system for access control to those licensed resources. Such a system would require a number of interacting systems along with a way to address the expression of the access licenses in a machine-readable form. FDRM has developed to the point of an overall system diagram but has not yet addressed the access license language. As you can see in Figure 5, a fully functioning access control system will have many interacting subsystems. At least some of these subsystems will need to make use of license terms that are expressed in a rights language.

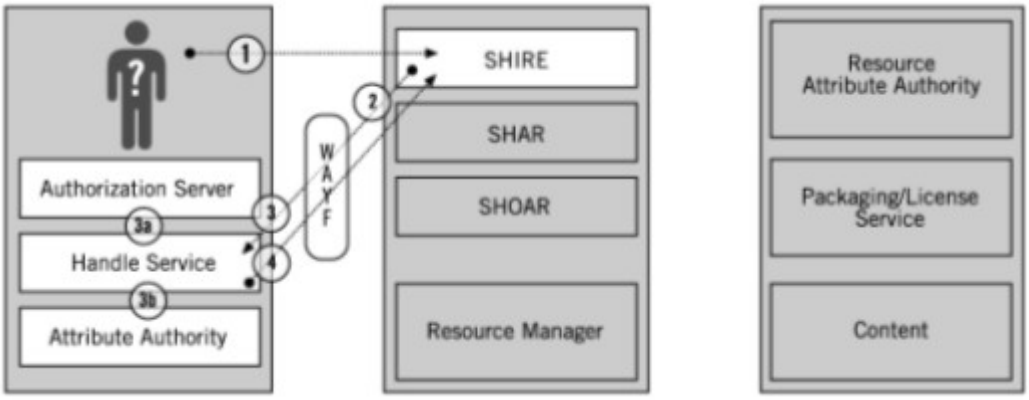

Figure 5: FDRM System Diagram[21]

A project of the standards group OASIS has produced a first version of a language for access policy enforcement called eXtended Access Control Markup Language (XACML). XACML may resolve part of the FDRM problem set by providing a way to code access policies for machine resolution.

One of the more complex technical tasks in the area of access is user authentication. This is an area where systems aimed at individual sales have an advantage: a transaction that can be authorized with a credit card is supported by an existing and highly developed system of value exchange that has its own rules for validity. Outside of the banking industry there is no wide-spread automated system for completing transactions between parties and no universal concept of "identity." Institutions like libraries and colleges have

both a diverse and highly mobile population that they need to authenticate for access to systems. Authentication can be done using local mechanisms, like a library patron database, but it is difficult to pass that authentication accurately and securely along a complex chain of digital systems such as those licensed by an institution. Although there is research being done in the area of authentication standards, this is another problem in the of managing users and digital resources that does not currently have a solution.

RELs and Access

Three of the four RELs in our main group do not address the question of access. CreativeCommons is not concerned with access because its environment is defined as pertaining to web-accessible documents. CC functions in a digital space where open access to resources is assumed. At the opposite end of the scale, both ODRL and MPEG-21/5 focus on usage controls, and access controls are outside of the scope of those languages.

METSRights has some data elements that could be used in access control, although they are not designed for automation of the access function. METSR includes data elements for categories of users that could interface with an access control system. The Federated Digital Rights Management work, mentioned above, could be just that system. FDRM could develop into a system for enforcement of access rights based on license statements like those in METSR, but most likely the access rights statements will need to be considerably more formalized than those in METSR.

Usage

Digital files are not "consumable" by human beings until they have been processed by software and are rendered in some analog way, such as on a screen or through speakers. This need for rendering provides an ideal "choke point" for controls over use. Usage controls are activated at this point where the user wishes to render the file in a human-perceivable form for reading, viewing, or listening. The MPEG-21/5 rights language is designed specifically for systems that will be imbedded in devices or software and that will exercise control over the uses of the digital file. ODRL could be used in a similar environment, although it currently has less potential connection with the device industries than MPEG-21/5. Both of these languages express their controls as being license-based. In this case the license is not a contract in the legal sense but it is a digital rendering of permissions for use. These permissions might also be expressed in a human-readable contract that has legal ramifications, but that is assumed to be outside of the REL itself.

A key aspect of usage controls relates to the fact that these controls are part of the rendering software/hardware environment. The controls only allow permitted uses of the resource to take place. For these controls to function within an automated system, every permitted usage type must be explicitly granted in order for the rendering software to securely protect the resource. This means that any rights that are not granted in the machine-readable license will not be rendered by the device. So if a license is written that allows printing but fails to include that on-screen display is permitted, the rendering

software should be designed to refuse to allow such display. This means that a fully functioning rights language designed for automated control must define every possible allowable usage. It is for this reason that the languages that are intended for automated control tend to have detailed usage terminology.

RELs and Usage Controls

Only two of the RELs in our example group are designed specifically for usage controls: ODRL and MPEG-21/5.

ODRL

ODRL states its goal as being a "…vocabulary for the expression of terms and conditions over assets."[22] ODRL does not determine the functionality of any systems using its vocabulary and states that it is suitable for trusted or untrusted systems. The control aspect of a rights language is, however, only realized when used in a secure and trusted systems environment. In this sense, ODRL is suitable to be used for usage control but its adoption does not imply that such controls are in place.

The license terminology of ODRL contains constraints that are fully compatible with enforcement systems. There are device constraints that would allow one to limit the types of hardware and software that could be used in a rendering system. The language also allows elements like resource units (pages, chapters, etc.) to be quantified for controls, as well as an expression of time units and intervals. Some of these elements are already in use in what ODRL refers to as "first generation" RELs, such as those used in the protected Adobe PDF format that supports today's e-books.

Although ODRL provides data elements and a basic structure, the content of specific data elements is not provided. For example, there is an ODRL device data element for "Printer" but no list of values that would be used to populate that data element. ODRL provides the structure and the data elements but the actual values that will fill in the rights language still need to be defined by the developers of an ODRL-based REL for a particular application.

MPEG-21/5

The MPEG-21/5 REL is a fully machine-actionable rights control language. The language is structured as a closed system with no real reference to plain language semantics, and the rights data dictionary framework in Part 6 is designed to support that closed system by providing a structure that defines all terms in the data dictionary in relation to each other. The MPEG-21/5 REL documentation is written as a set of strict rules both for structure and validation of the machine-readable license. Certain data elements, such as the "issuer" of the license, are required for the license to be valid and many database elements have requirements in their usage.[23] A valid MPEG-21/5 license is intended to be unambiguous, with the goal that different systems will implement the license with the same results even if they approach the processing of the license differently.

The environment that MPEG addresses is of a market with multiple players serving similar and competing products that must render a range of resources. MPEG-21/5 can be seen as a language serving the business of secure digital commerce, a primary goal of which is to allow the distribution of materials in digital formats while reducing the risk of piracy for those resources. The rights expression language of Part 5 needs to describe the permissions granted to a consumer of protected content while at the same time be broad enough to be used for a wide range of resource types.

To achieve the desired level of flexibility, MPEG-21 has abstracted the rights terminology in the area of allowable changes to a file, using terms like "enlarge," "diminish," and "enhance" to cover most media types in a single vocabulary. The rights terms are taken from a controlled list of verbs that all derive from the verb "do." The abstraction of these terms may make their actual function unintuitive at first. For example, there is only one verb, "play," to represent all of the possible ways that a resource can be rendered for human perception, including displaying on a screen, reading out loud through text-to-voice software, playing as sound or a video. MPEG-21/5 also includes a general term called "print" that is used for various media, not just text or pictures. The difference between "play" and "print" is that "play" refers to a transient perceivable rendering while "print" results in a fixed perceivable rendering. Each of the verbs can be further defined in a hierarchical fashion. So the verb "modify" is further subdivided into "enlarge," "reduce," and "move." Although this refinement is possible, to date MPEG-21/5 uses only a small set of verbs. However, there are no actual implementations of the standard in operation at this date (February 2004) so it can be expected that the language itself will evolve as it is used in rights enforcement products.

Like ODRL, MPEG-21/5 provides a general structure but does not define the content of the data elements. That must be provided by applications that use the language to meet specific needs. Sample licenses included in the MPEG-21/5 documentation show how MPEG-based licenses might look, but these few examples probably do not begin to fully illustrate the possibilities of the language.

Systems: the REL Environment

It is mentioned above that a REL exists within the context of a larger system. This system contains the business environment that the REL supports, the network that delivers digital content, and the software and hardware that produce and render content. Some of the differences in RELs depend on the assumptions that are made about that larger context. In a general sense, there are three system types that have an effect on the development and deployment of an REL.

No system

Although it seems like a contradiction, rights can be expressed even though there is no system that acts on it. This is the case with a copyright statement on a digital document. An example of a rights expression without technology controls is the CreativeCommons "license." The same can be said of the METSRights. These two RELs are examples of rights languages that although machine-readable they are simply textual documents. There is no digital rights management or enforcement system in their environment, only simple displays like any other digital document can receive. These languages are not intended for machine processing other than display to humans who will interpret their meaning.

Stand-alone or offline system

In this type of system, the controls are often built into proprietary software and the particular rights for the content are included in or with the content package. The content can be used offline, and there is no continuing interaction with the licensee. This is the type of system that is in place for protection in Adobe PDF files such as the books that users can download from netLibrary, and for music purchased from the Apple music store for the iPod device. The licenses attached to these digital files, once issued, cannot change, although there can be provisions for re-licensing, such as when the user needs to move content to a new device. Generally, the content package has the same rights for its entire existence, and control over use is rendered by software on the computer, or a combination of hardware and software on a format-specific device like the iPod player. Most systems using DRM today are of this variety. Both ODRL and MPEG-21/5 could be used by this type of system.

Online, interactive system

This is the most complex of systems, but it also offers the greatest number of features. An interactive system is needed to allow a full set of business relationships to take place over a piece of content, such as distribution and retailing. The transfer of the content from one party to another generally requires an interaction with a system that verifies the transaction and transfers the rights. This type of system can also accept payments along the value chain, and additional payments from the end-user for additional accesses or services. This system requires the ability of the digital package and the REL to notify the

host system when certain actions take place or thresholds are met, and to accept modifications to the rights and conditions assigned to a digital object. Although the rights language may have only a few more verbs in it, this type of system is greatly more complex than a stand-alone device or offline system. Although systems of this nature are being designed, a fully-functioning trusted system that allows ongoing interaction does not yet exist. The MPEG-21/5 REL specifically contains support for interactive systems with the data element "seekApproval." It is anticipated that actions can therefore be conditional on responses from an outside system.

Data Elements in Rights Expression Languages

RELs are made up of data elements that express the rights situation. These data elements fall into the general categories in figures 1 and 3. In general, a rights system is made up of *resources*, *agents* that interact with those resources (as users, as licensors, etc.), sets of *rights* or permissions, *constraints* on those rights, and *requirements* such as payments. Although these categories are nearly universal, different rights languages have different degrees of development of these rights based on their immediate and intended uses.

Agents

Agent is an important element of a REL because it identifies the party or parties to the contract or license that the REL expresses. Most languages use a fairly general agent data element that can represent any number of different roles in the environment of the REL.

CreativeCommons
CC uses the element "agent" which it defines as "people or things that do stuff." The agent can be defined using the Dublin Core elements "creator," "contributor," and "rights." The latter refers to the agent who holds the copyright on the resource. Because CC operates in the Web environment, there are no specific end users who would be identified; the license implicitly pertains to any users of the Web that access the resource.

METSRights
METSR has only "rightsHolder" as an agent. This is consistent with the language's goal of clearly stating the copyright particulars and making that information available to information professionals who will make decisions about the use and re-use of the material. The language includes data elements for the contact information for the rights holder, including address, phone number, email address and fax number. Clearly the purpose of the rightsHolder element is for human-to-human contact. And because METSR is not an actionable license, there is no need to name all parties, only the rights holder who may be contacted if there are questions or intended negotiations.

ODRL
ODRL uses "party" for its general license agent. Both end users and rights holders are parties in the ODRL license, and the expression "Rights Holders" covers a broad category of roles such as creators, producers, distributors, etc. Within the ODRL license a party must be identified using a Uniform Resource Identifier (URI). A full description of the party entity is not contained within ODRL, but should be accessible through the URI or some other mechanism. Like other entities in the ODRL model, further information about the party can be specified using a Context, which is a

structure that allows the coding of a variety of pieces of information about the entity, including name, date, location, role, and general notes.

MPEG-21/5
MPEG-21/5's "Principal" is the most general since it can refer to any person, entity, or system component. So the license issuer is a principal, but so is the computer system's clipboard. In a linguistic sense, Principal can be any subject or object of a statement in the format subject-verb-object. Within the REL, Principals are identified by a name or by an encrypted key. This latter both identifies and authenticates the particular Principal. There is an element called "issuer" that is a type of Principal and that is required for an MPEG-21/5 licence to be valid.

METSR	has:	RightsHolder
CC	has:	agent
MPEG-21/5	has:	principal, issuer
ODRL	has:	party

Table 1: Agent Data Elements

Resources

Other than allowing an identifier for the resource, little is said in the RELs about the resource itself (with the exception of CC). Although not stated, the assumption is that metadata that describes the resource exists elsewhere but linked to the REL in some way, perhaps through an identifier, perhaps because the resource and/or the resource metadata is contained in the same package as the REL. In some scenarios, the REL accompanies the resource in a linked "voucher" package that is read as part of the rights management function of the rendering software.

CC differs somewhat because it functions in an environment that does not have any guarantee that resource metadata exists. The CC metadata includes a "work" section that allows for the use of Dublin Core data elements to describe the resource. This "about" section is part of the CC metadata but outside of the license portion of that metadata. The optional descriptive fields that are included in the basic CC end-user form are: title of work, description, creator's name, copyright holder's name, and year of copyright, but other Dublin Core data elements could be included in a CC license that was created in some way other than using the basic form.

Resources in MPEG-21/5 are defined expressly as digital in format. Resources in CC are also exclusively digital. Resources in METSR could be a mixture of digital and hard copy, i.e. if the METSR record represents a finding aid and the rights refers to an archive that is partially digitized. ODRL states that it does not exclude non-digital resources.

Rights

A statement of rights is the core of the rights expression language. Some languages refer to these as permissions, some call them grants, but the purpose of all of them is to express a set of allowed actions over the resource. Rights refer not only to the end-user rights, such as printing, but also the rights for other parties with business relationships related to the resource, such as the right of a retailer to make and sell copies.

The list of rights and permissions varies greatly between the RELs in this study. The most extensive lists are those in the general purpose languages, ODRL and MPEG-21/5, since these languages intend to cover a wide range of situations. While ODRL has the largest number of rights in its language, both ODRL and MPEG-21/5 are designed for expansion of their rights metadata elements as needed. METSR has rights specific to its environment and therefore does not cover the full range of rights that the general languages cover. CC has the fewest rights data elements, but these are backed up by very specific human-readable language that sets up a starting point for negotiation of use of the digital resource.

Rights Types

Rights can generally be assigned to one of these types or categories: manage, re-use, transfer, and use.

Manage covers various "housekeeping" tasks such as the installation and backup of the resource files. The rights in this category are about the resource package, not the intellectual content.

Re-use rights are ways that all or part of a resource can be modified or incorporated into other resources. In the area of digital audio files, a re-use could include whether or not a resource could be sampled. For textual materials, re-use could mean quoting a passage in another document. While we humans can easily understand these re-use restrictions, re-use rights are actually difficult to define in the context of a rights enforcement technology because they often refer to uses outside of the digital resource that is protected by the technology. As an example, the technology controls on a file can prevent that file from being changed, such as adding content copied from another file. But those controls cannot prevent portions copied from the protected file from being added to another file on the same system. For this reason, the extensions to MPEG-21/5 for the Open eBook Forum's rights language include the ability to block copying to the system's clipboard, the temporary memory area that allows the transfer of data from one document to another. Once data has been copied to the clipboard from a protected resource, all control over that copied portion is lost.

Transfer rights allow a person or agent to transfer some specific rights to another person or agent. Rights like "sell" or "lend" are transfer rights. Note that in a rights enforcement technology what is transferred is a set of rights, not the digital file itself, because the file has no value without the associated rights. Where there is no

automated enforcement mechanism, the rights language may refer to transfer of an unprotected file. In this situation there is an agreement between parties that the assigned rights will be observed and transfer of the file includes an implicit transfer of rights.

Use rights are the ones that most people think of when they think of rights languages, even though they are only a part of the rights included. These rights are the ones that affect end-users of the digital file and determine how that person will experience the content that is contained in the resource. Use rights include the rendering rights like "play," "display," or "print."

Although it is useful to look at the terms that have been defined by the RELs, one cannot assume that the terms listed mean what they would mean in natural language, nor that the absence of a term means that the function is not supported by the language. For example, ODRL has the transfer term "lend" while MPEG-21/5 does not. But lending could be achieved in MPEG-21/5 through a combination of the verb TransferControl, a time-limited constraint, and a new variable that signals that the transaction is of the "lend" variety.[24] In terms of transfer permissions for ODRL and MPEG-21/5, MPEG-21/5 has a general structure of issuers and grants that allows the transfer of licenses from one party to another. Although ODRL includes "lease" and "sell," the example in the ODRL specification that includes "sell" also includes some usage controls, which means that ODRL's "sell" may not be different from MPEG's transfer of a license. The fact is that most of the functionality of a rights management system is in the system itself, not in the REL. The REL only needs to provide a set of data elements representing basic functions (actions, limits) that can be interpreted by a system that makes use of the REL. Table 2 displays a summary of rights data elements, by type, for the four representative RELs in this study.

METSR	CC	MPEG-21/5	ODRL	Type
DELETE		delete	delete	manage
		install	install	manage
		move	move	manage
		uninstall	uninstall	manage
DUPLICATE			duplicate	manage
			backup	manage
			verify	manage
			restore	manage
			save	manage
	DerivativeWorks	adapt		re-use
		diminish		re-use
		embed		re-use
		enhance		re-use
		enlarge		re-use
MODIFY		modify	modify	re-use

METSR	CC	MPEG-21/5	ODRL	Type
		reduce		re-use
			excerpt	re-use
			annotate	re-use
			aggregate	re-use
	Distribution			transfer
			sell	transfer
			lend	transfer
			give	transfer
			lease	transfer
TRANSFER-PERMISSIONS		transferControl	transfer	transfer
COPY	Reproduction			use
DISPLAY			display	use
		execute	execute	use
		play	play	use
PRINT		print	print	use
DISCOVER				use

Table 2: Rights Data Elements

Note that MPEG-21/5 permissions are designed especially to be measurable (i.e. enlarge is a change that makes the file larger; modify changes it but not its size), while ODRL has some rights that are expressed in terms of the type of action ("excerpt") and may need to be interpreted by a human. METSR rights are qualitative instructions to creators of digital libraries who will make decisions about re-use of materials. CC communicates in natural language to users of web-based resources that are openly available on the Internet.

Constraints

Permitted actions are modified with constraints. Constraints can be based on any criteria that can logically be applied to the action, but tend to be quantitative elements in actionable RELs (time, payment, units).

Included in the table below are two data elements in the MPEG-21/5 column that are prefixed "oebx." These are extensions to the MPEG-21/5 added by the Open eBook Forum to support the management of rights for e-books. Prior to these extensions there were no device-specific constraints in MPEG-21/5. This illustrates how a rights language like MPEG-21/5 might evolve to accommodate specific applications.

The constraints below are an interesting combination of quantitative measures that can be applied to actions and aspects about the user and the use that are not quantitative in

nature. For example, METSR provides a list of users that are common to academic libraries. ODRL has the general user categories of "individual" and "group" that can be further qualified within a license. MPEG-21/5 does not include any user-specific data elements but users and user groups can be identified as Principals in the MPEG-21/5 license. These user categories must be resolved and managed by a system outside of the REL; as such, these elements are informative qualities that can be attached to the identification of a user of the system and can be used to differentiate other permissions or constraints. The user base for CC is always the general public of Internet users, and differentiation based on user is not included in that language.

With the exception of CC the languages have the ability to make basic counts of units (page, chapter), time (dates and duration), and place (territory). These constraints can be applied to rights like "print" or "display" to develop complex licenses, i.e. "user can print 2 pages every week from March 1, 2004 to September 1, 2004." These rules are also used to create licenses for the lending of materials, which is a time-constrained transfer license in the language of RELs.

METSR	CC	MPEG-21/5	ODRL	Type
ACADEMIC USER				user
GENERAL PUBLIC				user
REPOSITORY MANAGER				user
INSTITUTIONAL AFFILIATE				user
MANAGED GRP				user
			individual	user
			group	user
		oebx:clipboard		device
		oebx:textToSpeechOff		device
			cpu	device
			network	device
			screen	device
			storage	device
			memory	device
			printer	device
			software	device
			hardware	device
COUNT		quantity	count	limits
		range	range	limits
		territory	spatial	limits

METSR	CC	MPEG-21/5	ODRL	Type
TIME			datetime	temporal
			accumulated	temporal
		validityInterval duration	interval	temporal
			quality	aspect
FORMAT			format	aspect
UNIT		unit	unit	aspect
WATERMARK			watermark	aspect
	CommercialUse		purpose	target
			industry	target
RE-USE			re-context	target

Table 3: Constraint Data Elements

Requirements/Conditions

In addition to constraints, which generally limit the rights assigned to a user, there may be specific conditions that must be fulfilled before the user can exercise the rights. The most common of these is a payment, such as giving a credit card number before one can download an e-book or a music file from a web site. The usage conditions listed in the table below such as "attribution" are not ones that a rights management system can enforce. These must be assumed to be informative; they express the desire of the licensor but rely on the honesty of the user, not system controls, for compliance. Currently MPEG-21/5 does not include conditions (or constraints) of this informative nature although they could be added as extensions. The fact is, though, that the inclusion of informative elements negates the enforceability of the REL and changes the nature of the system that would be developed around the language.

MPEG-21/5 has the most detailed language for payments of all of the RELs listed in Table 4. CC is at the opposite end of the scale with no payment elements at all in the language because that type of agreement would take place "offline" in the CC environment. CC, however, has the most usage constraints, taking concepts from the licensing of open source materials where sharing with the community is a requirement of use. ODRL has a basic set of payment types that could be converted to machine-enforceable requirements. METSR has a single data element for payment which is not intended to be part of an automated system, but could conceivably be managed as a fee per use by a delivery system.

METSR	CC	MPEG-21/5	ODRL	Type
PAYMENT		feeFlat	payment	payment
			prepay	payment
			postpay	payment
		feePerUse	peruse[25]	payment
		feeMetered		payment
		feePerInterval		payment
		feePerUsePrePay		payment
		seekApproval		usage
ATTRIBUTION	attribution		attribution	usage
	notice			usage
	shareAlike			usage
			tracked	usage

Table 4: Requirements Data Elements

Business Models of Rights Expression Languages

The RELs in this paper are significantly different from each other in terms of their business models, that is in terms of how they themselves can be licensed and used. Although ContentGuard does not require a license for the use of its REL, the company holds numerous patents on digital rights management technologies[26] and states on its web site: "You may need to be licensed to use XrML in a context covered by the patents." In other words, they are basing licensing on their patents rather than on the REL technology itself. By doing so, their patents may cover more than just XrML; in particular one patent titled "System for Controlling the Distribution and Use of Digital Work Having Attached Usage Rights Where the Usage Rights are Defined by a Usage Rights Grammar" (US Patent 5,715,403) may be interpreted to cover all rights expression languages. Although ContentGuard has not yet pressed its patent with others developing and using RELs, they have stated that their position is that the patent provides that capability.[27]

ODRL is explicitly a license and patent-free technology that has been developed in the spirit of open source technology, although control over the technology is in the hands of IPR Systems. The ODRL web site states that there are no licensing requirements to use the ODRL REL. Interested companies and organizations are encouraged to become supporters of ODRL and work on its development.

Both the ODRL principals and ContentGuard have been active in promoting their REL to standards bodies as a way to foster adoption of their technology. The MPEG-21/5 standard has been accepted not only by MPEG and ISO, but also by the Open eBook Forum. ODRL was selected as the REL for the digital rights management standard of the Open Mobile Alliance, and industry group for mobile communications such as cell phones. ContentGuard promoted XrML to the OASIS e-business standards consortium, and IPR systems has submitted ODRL to the World Wide Web Consortium (W3C) as a technical note. ODRL was also presented at the W3C Workshop on DRM held in 2001.[28]

METSRights is being developed within the academic and library community and has no restrictions on use or modification. All governance of the METS standard is done through an editorial board that is under the auspices of the Digital Library Federation, a non-profit group supported by academic institutional members. There are no license requirements for use of the METSRights REL.

CreativeCommons models its licenses on those of the open source movement, and has no license requirements for making use of the CC materials. CreativeCommons is a non-profit entity that is supported by grant funding and some logistical support of the Stanford Law School.

Conclusion

Digital resources are covered by the same copyright law that protects traditional analog materials. But digital materials are often also covered by a contract or license that outlines a specific business relationship, including access and usage rules. A rights expression language can provide a digital expression of these rules to accompany the digital resource. This machine-readable expression, however, will most likely differ from the written contract. How much it differs will depend on the sophistication of the rights expression language as well as the needs and requirements of the automated system that will process the expression. In a system designed to exert control over the end-user's interaction with the digital resource, the rights that are expressed must be couched in terms of actions that can actually be controlled by the computer system. Rights languages that intend to *express* a contract rather than *control* use can encode an expression that is a close approximation to an analog contract.

Although some work has been done to develop some highly flexible rights expressions languages, there is no "general purpose" REL that can be used for any or all digital rights expressions. The examples of rights languages that we have today each have been developed for different situations. The MPEG-21/5 language is being developed by and for the community that intends to sell movies, music, and other primarily commercial digital materials. This community wishes to create systems that strongly enforce the access and usage rights over their materials. Therefore, the MPEG-21/5 rights language must be precise and unambiguous, and it must express rights as machine-enforceable units. A very different approach is taken by the METSRights language which is intended to inform professionals in an academic setting of particular contractual arrangements over the materials described. It provides some categories of statements but includes an element for "other" so that users of the language can fill in their own values where needed. No automated control over the materials is anticipated from the rights expressed in the METSRights elements.

The intended generality of a language also has a great effect on its development. MPEG-21/5 and ODRL are intended to be used in a wide variety of situations and materials. Both of these languages attempt to be "complete" in the sense that a full statement can be coded that assumes no prior interaction between the parties. In contrast, the PRISM rights language is developed for a situation where a prior business-to-business relationship already exists and where all but a few details of the agreement between these businesses is covered by a prior contract. The PRISM language could be expanded for other situations, but the current language is used only within that particular business agreement context.

Although the work on rights languages began in the early 1990's, few of these languages have been exercised to any degree in actual systems. In fact, in the area of rights languages to control access and use, the systems that are needed to implement the rights are not as well developed as the languages themselves. Electronic commerce packages such as those used for e-books are making use of only a handful of automated control

elements compared to those that would be possible in the trusted systems that are envisioned. Sophisticated trusted systems will be needed to make possible the more complex controls that will fully implement languages like MPEG-21/5 or ODRL.

Any one of the languages covered in this report could be used as a model for rights expression by other communities, and they all have the capability of expansion of their set of data elements. Entirely different models may arise as other communities determine their own need for the digital expression of rights. This paper has attempted to provide a framework for analyzing the underlying assumptions and goals of rights languages so that potential adopters can determine their suitability. We still need more analysis of the impact of rights statements and the systems that implement them on the dissemination of works and the way that people interact with the content in digital resources, however. Further studies and more experience with protected content may result in significant changes in the rights expression landscape in the future.

---

[1] Stefik, Mark. Shifting the Possible: How Trusted Systems and Digital Property Rights Challenge Us to Rethink Digital Publishing. *Berkeley Technology Law Journal*, v. 12, n. 1, Spring, 1997.
http://www.law.berkeley.edu/journals/btlj/articles/vol12/Stefik/html/text.html

[2] Stefik, Mark and Alex Silverman. The Bit and the Pendulum: Balancing the Interests of Stakeholders in Digital Publishing. 1997.
http://www.xrml.org/reference/Pendulum97Jul29.pdf

[3] Erickson, John S. Enhanced attribution for networked copyright management. Thayer School of Engineering, Dartmouth College, 1997, 233 leaves.

[4] http://www.creativecommons.org

[5] http://www.loc.gov/standards/mets/news080503.html

[6] http://www.odrl.net

[7] http://www.indecs.org

[8] http://www.editeur.org

[9] Part 5 of the ISO standard 12000, which is the rights expression language developed by the MPEG-21 group, is not yet listed on the ISO web pages at the time of this writing.

[10] ContentGuard has frozen the development of XrML at version 2.0, and states that further development will take place within standards bodies such as ISO. The XrML web site refers to MPEG-21/5 as version 2.1 of the XrML technology.

[11] The OeBF site is http://www.openebook.org, however the specifications for the rights expression language extensions are not available on the public pages at this date.

[12] http://www.adobe.com/security/doccontrol.html

[13] http://www.diglib.org

[14] Martin, Mairead, et al. Federated Digital Rights Management: A Proposed DRM Solution for Research and Education. D-Lib Magazine, July/August 2002. http://www.dlib.org/dlib/july02/martin/07martin.html

[15] http://www.prismstandard.org

[16] http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=xacml

[17] http://www.oasis-open.org

[18] Iannella, Renato, ed. Open Digital Rights Language (ODRL). Version 1.1. August 8, 2002. http://odrl.net/1.1/ODRL-11.pdf, p. 4.

[19] The MPEG-21 Rights Expression Language: A White Paper. Rightscom Ltd. july 14, 2003. p. 7

[20] Ibid., p11

[21] Martin, op cit.

[22] Iannella, ODRL, p. 1

[23] For example: "For a given r:licensePartId value v and r:License l, l shall not contain more than one r:LicensePart having an r:licensePartId attribute with the value v.".

[24] The data element "lend" was including in versions 1 and 2 of XrML, but has not been carried over to MPEG-21/5. It isn't clear if this is because lending was not of interest to that community or if other modifications to the REL made that term unnecessary. There are great differences between version 2 of XrML and MPEG-21/5, yet ContentGuard's documentation states that MPEG-21/5 is to be considered the equivalent of version 2.1 of XrML, not a separate language.

[25] This is "per use", not "peruse," as in "read."

[26] http://www.contentguard.com/patents.asp

[27] See article at http://xml.coverpages.org/xrml.html

[28] http://www.w3.org/2000/12/drm-ws/Overview.html

Appendix A: Overview of RELs

REL Goals

1. Express ***copyright*** – CC, METSR
2. express ***license/contract*** – CC, METSR, PRISM, ODRL, MPEG-21/5; FDRM, XACML
3. support ***control*** – ODRL, MPEG-21; XACML

Types of Permissions/Grants

1. Access – XACML, FDRM
2. Use – METSR, ODRL, MPEG-21/5
3. Re-use – CC, METSR, ODRL, MPEG-21/5
4. Rights transfer – PRISM, ODRL, MPEG-21/5
5. Resource management – METSR, ODRL, MPEG-21/5

Types of Constraints

1. By user category – METSR, FDRM, XACML?
2. By device – MPEG-21/5 (with OeBF extentions), ODRL
3. By time, space, units – METSR, MPEG-21/5, ODRL
4. By transformation quality – METSR, ODRL
5. By target – CC, METSR, ODRL

Appendix B: Rights Expression Languages

Adobe Content Manager

Web site: http://www.adobe.com/products/acrobatpro/main.html
Documentation: Available with Adobe Acrobat Professional
Standards or maintenance agency: Adobe
Current implementations: Used extensively for e-books and enterprise documents.

CreativeCommons

Web site: http://www.creativecommons.org
Documentation: http://www.creativecommons.org/learn
Standards or maintenance agency: CreativeCommons, Stanford Law School Center for Internet and Society
Current implementations: Over one thousand resources listed at http://commoncontent.org

ERMI

Full name: Electronic Resource Management Initiative
Web site: http://www.library.cornell.edu/cts/elicensestudy/home.html

FDRM

Full name: Federated Digital Rights Management
Documentation: http://www.dlib.org/dlib/july02/martin/07martin.html

MPEG-21/5

Full name: Information Technology – Multimedia Framework – Part 5: Rights Expression Language. ISO/IEC FDIS 21000-5:2003(E)
Web site: http://www.chiariglione.org/mpeg/standards/mpeg-21/mpeg-21.htm
Standard: Available from ISO http://www.iso.ch/iso/en/prods-services/popstds/mpeg.html
Documentation: XrML documentation can be downloaded at: http://www.xrml.org/get_XrML.asp
Standards or maintenance agency: Motion Picture Experts Group, International Standards Organization, ContentGuard
Current implementations:
OpenIPMP: http://objectlab.com/clients/openipmp/id24.htm
Microsoft eBook Reader

METSR

Full name: METSRights
Web site: none
Standard: http://www.loc.gov/standards/rights/METSRights.xsd
Documentation: none
Standards or maintenance agency: METS Editorial Board
Current implementations: none

ODRL

Full name: Open Digital Rights Language
Web site: http://www.odrl.net
Standard: http://www.w3.org/TR/odrl/ or http://www.odrl.net/1.1/ODRL-11.pdf
Documentation:
schema: http://www.odrl.net/1.1/ODRL-EX-11-DOC/index.html
dictionary: http://www.odrl.net/1.1/ODRL-DD-11-DOC/index.html
Standards or maintenance agency: IPR Systems (Australia)
Current implementations:
OpenIPMP: http://objectlab.com/clients/openipmp/id24.htm

PRISM

Full name: Publishing Requirements for Industry Standard Metadata
Web site: http://www.prismstandard.com
Standard: http://www.prismstandard.org/Pam_1.0/PRISM_1.2h.pdf
Documentation: http://www.prismstandard.org/about/technicaloverview.asp
Standards or maintenance agency: IDEAlliance (International Digital Enterprise Alliance, http://www.idealliance.org/)
Current implementations: Press releases announce use by Time Inc., LexisNexis, Hearst Publishing, Platts/McGraw-Hill, ProQuest and others.

XACML

Full name: eXtensible Access Control Markup Language
Web site: http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=xacml
Standard:
Latest versions can be found at:
http://www.oasis-open.org/committees/documents.php?wg_abbrev=xacml
Documentation: http://www.oasis-open.org/committees/download.php/2713/Brief_Introduction_to_XACML.html
Standards or maintenance agency: OASIS eXtensible Access Control Markup Language Technical Committee
Current implementations: Sun Microsysytems and Jiffy Software have development efforts underway.

Appendix C: Library Use Case

In the course of developing the rights expression language for the Open eBook Forum (OeBF), both ODRL and MPEG-21/5 were investigated as possible languages. To evaluate their suitability, a number of use cases were devised and were coded in each language. The following was submitted to OeBF as a use case for a fictional academic library:

Foo University has a site license for itself and its sister institution, Fubar U. In this license there are these categories of users with specific rights:

1. Professors (Foo U):
   (Note that in this instance, professors are authenticated by a trustworthy mechanism that is itself outside the scope of the rights grammar. Students are authenticated by the same mechanism and are known by this mechanism to be enrolled in a given class. The system interpreting the rights grammar can rely on this.)

   Professors have:
   a. unlimited access to search and display materials on the screen
   b. page-at-a-time printing (no limit)
   c. right to make 30 downloadable digital copies of any documents for classroom use by students authenticated to be in the class (20 of these per year per professor). To restate: For each of 20 documents selectable per year, the professor may make 30 digital copies that can be downloaded and used by students enrolled in the class.

2. Students (both Foo and Fubar U) and Professors (Fubar U):
   (Note that in this instance, professors and students of both Foo and Fubar are identified only by IP addresses)

   Students in both universities and professors of Fubar have: a. unlimited access to search and display materials on the screen b. page-at-a-time printing (no limit)

3. Librarians (Foo U)
   (Note: Librarians at Foo U. are authenticated by a mechanism similar to the one used by students and professors in the first instance.)

   Librarians have:
   a. unlimited access to search and display materials on the screen
   b. page-at-a-time printing (no limit) c. right to make up to 5 downloadable digital copies of articles from any journal title for interlibrary loan to Fubar U. (That is, out of any one journal title, 5 article copies are made, whether of the same article or 5 different ones). Fubar U. librarian may grant rights to use these 5 copies, to students and professors of Fubar U. These usage rights are as follows:

c. copying
    i. Maximum 1 other digital copy (to move it form one machine to another)
    ii. Maximum the equivalent of 2 print copies (you know, the dog ate it)
    iii. Time limit = end of semester c4. No lending, no giving away, no selling
d. can make up to 3 downloadable digital copies of any document or document portion to be placed on reserve for a single semester (Foo U)
e.

In summary, Foo U is the main licensee, but the site license includes on-campus access for students and faculty at Fubar U and allows standard journal article copying for ILL from Foo to Fubar U.

Both ODRL and MPEG-21/5 were able to create a language "solution" to this use case, and they are appended here. An attempt to code this case in METSRights revealed that language cannot associate particular rights with individual constraints, so that there is no way to link COPY with the constraint COUNT. However, a possible coding of this use case in METSRights is also included here.

ODRL response to "Library/Site License" Use Case.

```
<agreement>
  <-- Agreement between the Content Provider (as the rightsholder)
      and the University of Foo -->
  <party>
     <context>
        <uid> urn:content-provider </uid>
     </context>
     <rightsholder/>
  </party>
  <party>
    <context>
      <uid> urn:universities:uFOO </uid>
    </context>
  </party>
  <asset>
    <!-- Agreement covers All the Content Provider materials -->
    <context>
      <uid> urn:content-provider:documents:ALL </uid>
    </context>
  </asset>
  <permission>
    <!-- What everyone can do -->
    <display/>
    <oebf:search/>
    <print/>
    <!-- But they must be in this IP address range -->
    <constraint>
      <network>
         <context>
           <oebf:ip-from> 111.8.1.1 </oebf:ip-from>
           <oebf:ip-to> 111.8.250.250 </oebf:ip-to>
         </context>
      </network >
    </constraint>
  </permission>
  <permission>
    <!-- What FooU Profs can do -->
    <display/>
    <oebf:search/>
    <print/>
    <!-- But they must be in this group -->
    <constraint>
      <group>
         <context>
           <uid> ldap://dir.edu/ou=Profs;ou=FooU;c=US </uid>
         </context>
      </group >
    </constraint>
    <!-- They can also choose 20 documents per year
         and make 30 copies (excerpt) of each to
         be used by students -->
    <excerpt>
       <constraint id="eachDocument">
          <unit type="oebf:single-document">
```

```
          <constraint>
             <count> 20 </count>
             <interval> P1Y </interval>
          </constaint>
        </unit>
      </constraint>
      <constraint idref="eachDocument"
                  type="http://odrl.net/1.1/#forEachMember">
        <count> 30 </count>
      </constraint>
      <constraint>
        <group>
          <context>
            <uid> ldap://dir.edu/ou=Students;ou=FooU;c=US </uid>
          </context>
        </group>
      </constraint>
  <excerpt>
</permission>
<permission>
  <!-- What FooU Librarians can do -->
  <display/>
  <oebf:search/>
  <print/>
  <!-- But they must be in this group -->
  <constraint>
    <group>
      <context>
        <uid> ldap://dir.edu/ou=Librarians;ou=FooU;c=US </uid>
      </context>
    </group >
  </constraint>
  <!-- They can also loan 5 copies of articles from any
       journal to FuBar U -->
  <lend>
     <constraint id="eachJournal">
        <unit type="oebf:journal"/>
     </constraint>
     <constraint idref="eachJournal"
                 type="http://odrl.net/1.1/#forEachMember">
        <unit type="oebf:article">
          <constraint>
             <count> 5 </count>
          </constraint>
        </unit>
     </constraint>
     <constraint>
       <group>
         <context>
           <uid> ldap://dir.edu/ou=FuBarU;c=US </uid>
         </context>
       </group>
     </constraint>
     <constraint>
       <!-- FuBar U are limited to the below: -->
       <transferPerm downstream="equal">
          <display>
             <constraint>
```

```
                  <interval> P3M </interval>
               </constraint>
            </display>
            <print>
               <constraint>
                  <count> 2 </count>
               </constraint>
            </print>
            <excerpt>
               <constraint>
                  <count> 1 </count>
               </constraint>
            </excerpt>
         </transferPerm>
      </constraint>
    </lend>
    <!-- They can also put 3 copies of any document
         onto reserve (ie loan) for a semester -->
    <lend>
       <constraint id="eachDocument">
          <unit type="oebf:single-document"/>
       </constraint>
       <constraint idref="eachDocument"
                   type="http://odrl.net/1.1/#forEachMember">
          <count> 3 </count>
          <interval> P3M </interval>
       </constraint>
    <lend>
  </permission>
</agreement>
==========================
```

ContentGuard (MPEG-21/5) response to "Library/Site License" Use Case.

```
<?xml version="1.0" encoding="UTF-8"?>
<!--
Copyright (C) 2003 ContentGuard Holdings, Inc.  All rights reserved.  "ContentGuard"
is a registered trademark, and "XrML" and "eXtensible rights Markup Language" are
trademarks of ContentGuard Holdings, Inc.  All other trademarks are properties of
their respective owners.

CONTENTGUARD MAKES NO REPRESENTATIONS OR WARRANTIES ABOUT THE SUITABILITY OF THIS
FILE, EITHER EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES
OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE,OR NON-INFRINGEMENT.
CONTENTGUARD SHALL NOT BE LIABLE FOR ANY DAMAGES SUFFERED AS A RESULT OF USING,
MODIFYING OR DISTRIBUTING THIS FILE OR ITS DERIVATIVES.
-->
<licenseGroup xmlns="http://www.xrml.org/schema/2002/05/xrml2core"
xmlns:sx="http://www.xrml.org/schema/2002/05/xrml2sx"
xmlns:mx="urn:mpeg:mpeg21:2002:01-REL-NS" xmlns:oebx="urn:oebf:oebx:2003:02"
xmlns:dsig="http://www.w3.org/2000/09/xmldsig#"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="urn:oebf:oebx:2003:02 oebx.xsd">
   <license licenseId="RR08/1">
      <grantGroup>
         <forAll varName="professorAtFooU">
            <everyone>
               <sx:propertyUri definition="oebx:Professor"/>
               <trustedIssuer>
                  <keyHolder licensePartId="FooU">
                     <info>
                        <dsig:KeyValue>
                           <dsig:RSAKeyValue>

   <dsig:Modulus>n5gzmvv4/3x1Pr6F6LdSM7QTH0n9IxgMasaZ3OrnXUNdH6mARFvfvBwa2iwGNjBK463b0
14yFkP3sbHEoermxA==</dsig:Modulus>
                              <dsig:Exponent>AQABAA==</dsig:Exponent>
                           </dsig:RSAKeyValue>
                        </dsig:KeyValue>
                     </info>
                  </keyHolder>
               </trustedIssuer>
            </everyone>
         </forAll>
         <forAll varName="anyLibraryDocument"/>
         <principal varRef="professorAtFooU"/>
         <grant>
            <oebx:search/>
            <digitalResource varRef="anyLibraryDocument"/>
         </grant>
         <grant>
            <oebx:displayOnScreen/>
            <digitalResource varRef="anyLibraryDocument"/>
         </grant>
         <grant>
            <mx:print/>
            <digitalResource varRef="anyLibraryDocument"/>
            <oebx:portion>
```

```
               <oebx:unit>oebx:Page</oebx:unit>
               <oebx:quantity>1</oebx:quantity>
            </oebx:portion>
         </grant>
         <grant>
            <mx:adapt/>
            <digitalResource varRef="anyLibraryDocument"/>
            <sx:seekApproval>
               <serviceReference>
                  <sx:uddi>
                     <sx:serviceKey>
                        <sx:uuid>00011234-1234-1234-1234-123456789abc</sx:uuid>
                     </sx:serviceKey>
                  </sx:uddi>
                  <serviceParameters>
                     <datum>
                        <digitalResource varRef="anyLibraryDocument"/>
                     </datum>
                     <datum>
                        <principal varRef="professorAtFooU"/>
                     </datum>
                     <datum>

   <oebx:maxDocCountPerPrincipalPerPeriod>20</oebx:maxDocCountPerPrincipalPerPeriod>
                     </datum>
                     <datum>
                        <oebx:recurrancePeriod>
                           <oebx:period>
                              <oebx:unit>oebx:Year</oebx:unit>
                              <oebx:unitCount>1</oebx:unitCount>
                           </oebx:period>
                        </oebx:recurrancePeriod>
                     </datum>
                     <datum>

   <oebx:maxCopyCountPerDocPerPrincipalPerPeriod>30</oebx:maxCopyCountPerDocPerPrincip
alPerPeriod>
                     </datum>
                  </serviceParameters>
               </serviceReference>
            </sx:seekApproval>
         </grant>
         <grant>
            <forAll varName="studentAtFooU"/>
            <issue/>
            <grant>
               <principal varRef="studentAtFooU"/>
               <oebx:use/>
               <digitalResource varRef="anyLibraryDocument"/>
            </grant>
            <sx:seekApproval>
               <serviceReference>
                  <sx:uddi>
                     <sx:serviceKey>
                        <sx:uuid>00021234-1234-1234-1234-123456789abc</sx:uuid>
                     </sx:serviceKey>
                  </sx:uddi>
                  <serviceParameters>
```

```
                  <datum>
                     <principal varRef="studentAtFooU"/>
                  </datum>
                  <datum>
                     <principal varRef="professorAtFooU"/>
                  </datum>
                  <datum>
                     <digitalResource varRef="anyLibraryDocument"/>
                  </datum>
               </serviceParameters>
            </serviceReference>
         </sx:seekApproval>
      </grant>
   </grantGroup>
   <grantGroup>
      <forAll varName="peopleAtFooUandFuBarU"/>
      <forAll varName="anyLibraryDocument"/>
      <principal varRef="peopleAtFooUandFuBarU"/>
      <sx:territory>
         <sx:domain>
            <sx:uri>foou.edu</sx:uri>
         </sx:domain>
         <sx:domain>
            <sx:uri>fubaru.edu</sx:uri>
         </sx:domain>
      </sx:territory>
      <grant>
         <oebx:search/>
         <digitalResource varRef="anyLibraryDocument"/>
      </grant>
      <grant>
         <oebx:displayOnScreen/>
         <digitalResource varRef="anyLibraryDocument"/>
      </grant>
      <grant>
         <mx:print/>
         <digitalResource varRef="anyLibraryDocument"/>
         <oebx:portion>
            <oebx:unit>oebx:Page</oebx:unit>
            <oebx:quantity>1</oebx:quantity>
         </oebx:portion>
      </grant>
   </grantGroup>
   <grantGroup>
      <forAll varName="librarianAtFooU">
         <everyone>
            <sx:propertyUri definition="oebx:Librarian"/>
            <trustedIssuer>
               <keyHolder licensePartId="FooU"/>
            </trustedIssuer>
         </everyone>
      </forAll>
      <principal varRef="librarianAtFooU"/>
      <grant>
         <forAll varName="anyLibraryDocument"/>
         <oebx:search/>
         <digitalResource varRef="anyLibraryDocument"/>
      </grant>
```

```
         <grant>
            <forAll varName="anyLibraryDocument"/>
            <oebx:displayOnScreen/>
            <digitalResource varRef="anyLibraryDocument"/>
         </grant>
         <grant>
            <forAll varName="anyLibraryDocument"/>
            <mx:print/>
            <digitalResource varRef="anyLibraryDocument"/>
            <oebx:portion>
               <oebx:unit>oebx:Page</oebx:unit>
               <oebx:quantity>1</oebx:quantity>
            </oebx:portion>
         </grant>
         <grant>
            <forAll varName="journal"/>
            <forAll varName="article"/>
            <forAll varName="libraryAtFubarU">
               <everyone>
                  <sx:dnsName>library.fubarU.edu</sx:dnsName>
                  <trustedIssuer>
                     <keyHolder licensePartId="FubarU">
                        <info>
                           <dsig:KeyValue>
                              <dsig:RSAKeyValue>

   <dsig:Modulus>n5gzmvv4/3x1Pr6F6LdSM7QTH0n9IxgMasaZ3OrnXUNdH6mARFvfvBwa2iwGNjBK463b0
14yFkP3sbHEoermxA==</dsig:Modulus>
                                 <dsig:Exponent>AQABAA==</dsig:Exponent>
                              </dsig:RSAKeyValue>
                           </dsig:KeyValue>
                        </info>
                     </keyHolder>
                  </trustedIssuer>
               </everyone>
            </forAll>
            <oebx:interLibraryLoan/>
            <mx:diReference varRef="article"/>
            <allConditions>
               <sx:seekApproval>
                  <serviceReference>
                     <sx:uddi>
                        <sx:serviceKey>
                           <sx:uuid>11111234-1234-1234-1234-123456789ASD</sx:uuid>
                        </sx:serviceKey>
                     </sx:uddi>
                     <serviceParameters>
                        <datum>
                           <digitalResource varRef="journal"/>
                        </datum>
                        <datum>
                           <oebx:maxDocCountPerPrincipalPerPeriod>
                           5
                           </oebx:maxDocCountPerPrincipalPerPeriod>
                        </datum>
                        <datum>
                           <mx:destination>
                              <principal varRef="libraryAtFubarU"/>
```

```
                  </mx:destination>
               </datum>
            </serviceParameters>
         </serviceReference>
      </sx:seekApproval>
      <mx:diPartOf>
         <mx:diReference varRef="article"/>
         <mx:diReference varRef="journal"/>
      </mx:diPartOf>
   </allConditions>
</grant>
<grant>
   <issue/>
   <grantGroup>
      <forAll varName="librarianAtFubarU">
         <everyone>
            <sx:propertyUri definition="oebx:Librarian"/>
            <trustedIssuer>
               <keyHolder licensePartIdRef="FubarU"/>
            </trustedIssuer>
         </everyone>
      </forAll>
      <forAll varName="article"/>
      <forAll varName="libraryAtFooU">
         <everyone>
            <sx:dnsName>library.foou.edu</sx:dnsName>
            <trustedIssuer>
               <keyHolder licensePartIdRef="FooU"/>
            </trustedIssuer>
         </everyone>
      </forAll>
      <principal varRef="librarianAtFubarU"/>
      <sx:seekApproval>
         <serviceReference>
            <sx:uddi>
               <sx:serviceKey>
                  <sx:uuid>22221234-1234-1234-1234-123456789gHH</sx:uuid>
               </sx:serviceKey>
            </sx:uddi>
            <serviceParameters>
               <datum>
                  <mx:diReference varRef="article"/>
               </datum>
               <datum>
                  <mx:source>
                     <principal varRef="libraryAtFooU"/>
                  </mx:source>
               </datum>
            </serviceParameters>
         </serviceReference>
      </sx:seekApproval>
      <grant>
         <issue/>
         <grantGroup>
            <forAll varName="studentAtFubarU">
               <everyone>
                  <sx:propertyUri definition="oebx:Student"/>
                  <trustedIssuer>
```

```
                        <keyHolder licensePartIdRef="FubarU"/>
                     </trustedIssuer>
                  </everyone>
               </forAll>
               <principal varRef="studentAtFubarU"/>
               <oebx:validityPeriod>
                  <oebx:period>
                     <oebx:unit>oebx:Semester</oebx:unit>
                     <oebx:unitCount>1</oebx:unitCount>
                  </oebx:period>
               </oebx:validityPeriod>
               <grant>
                  <!-- Or mx:transfer-->
                  <mx:adapt/>
                  <mx:diReference varRef="article"/>
                  <sx:exerciseLimit>
                     <serviceReference>
                        <sx:uddi>
                           <sx:serviceKey>
                              <sx:uuid>33331234-1234-1234-1234-
123456789uuI</sx:uuid>
                           </sx:serviceKey>
                        </sx:uddi>
                        <serviceParameters>
                           <datum>
                              <principal varRef="studentAtFubarU"/>
                           </datum>
                           <datum>
                              <mx:diReference varRef="article"/>
                           </datum>
                           <datum>
                              <oebx:maxCount>1</oebx:maxCount>
                           </datum>
                        </serviceParameters>
                     </serviceReference>
                  </sx:exerciseLimit>
               </grant>
               <grant>
                  <mx:print/>
                  <mx:diReference varRef="article"/>
                  <sx:exerciseLimit>
                     <serviceReference>
                        <sx:uddi>
                           <sx:serviceKey>
                              <sx:uuid>44431234-1234-1234-1234-
123456789YYY</sx:uuid>
                           </sx:serviceKey>
                        </sx:uddi>
                        <serviceParameters>
                           <datum>
                              <principal varRef="studentAtFubarU"/>
                           </datum>
                           <datum>
                              <mx:diReference varRef="article"/>
                           </datum>
                           <datum>
                              <oebx:maxCount>2</oebx:maxCount>
                           </datum>
```

```
                        </serviceParameters>
                     </serviceReference>
                  </sx:exerciseLimit>
               </grant>
            </grantGroup>
         </grant>
         <grant>
            <issue/>
            <grantGroup>
               <forAll varName="professorAtFubarU">
                  <everyone>
                     <sx:propertyUri definition="oebx:Professor"/>
                     <trustedIssuer>
                        <keyHolder licensePartIdRef="FubarU"/>
                     </trustedIssuer>
                  </everyone>
               </forAll>
               <principal varRef="professorAtFubarU"/>
               <oebx:validityPeriod>
                  <oebx:period>
                     <oebx:unit>oebx:Semester</oebx:unit>
                     <oebx:unitCount>1</oebx:unitCount>
                  </oebx:period>
               </oebx:validityPeriod>
               <grant>
                  <!-- Or mx:transfer-->
                  <mx:adapt/>
                  <mx:diReference varRef="article"/>
                  <sx:exerciseLimit>
                     <serviceReference>
                        <sx:uddi>
                           <sx:serviceKey>
                              <sx:uuid>33331234-1234-1234-1234-
123456789uuI</sx:uuid>
                           </sx:serviceKey>
                        </sx:uddi>
                        <serviceParameters>
                           <datum>
                              <principal varRef="professorAtFubarU"/>
                           </datum>
                           <datum>
                              <mx:diReference varRef="article"/>
                           </datum>
                           <datum>
                              <oebx:maxCount>1</oebx:maxCount>
                           </datum>
                        </serviceParameters>
                     </serviceReference>
                  </sx:exerciseLimit>
               </grant>
               <grant>
                  <mx:print/>
                  <mx:diReference varRef="article"/>
                  <sx:exerciseLimit>
                     <serviceReference>
                        <sx:uddi>
                           <sx:serviceKey>
```

```
                                    <sx:uuid>44431234-1234-1234-1234-
123456789YYY</sx:uuid>
                                 </sx:serviceKey>
                              </sx:uddi>
                              <serviceParameters>
                                 <datum>
                                    <principal varRef="professorAtFubarU"/>
                                 </datum>
                                 <datum>
                                    <mx:diReference varRef="article"/>
                                 </datum>
                                 <datum>
                                    <oebx:maxCount>2</oebx:maxCount>
                                 </datum>
                              </serviceParameters>
                           </serviceReference>
                        </sx:exerciseLimit>
                     </grant>
                  </grantGroup>
               </grant>
               <!--Assuming that we only need to worry about monitoring the three
copies per semester not the actual usage (at the circulation desk) -->
               <grant>
                  <mx:adapt/>
                  <digitalResource varRef="anyLibraryDocument"/>
                  <sx:seekApproval>
                     <serviceReference>
                        <sx:uddi>
                           <sx:serviceKey>
                              <sx:uuid>77711234-1234-1234-1234-123456789KET</sx:uuid>
                           </sx:serviceKey>
                        </sx:uddi>
                        <serviceParameters>
                           <datum>
                              <digitalResource varRef="anyLibraryDocument"/>
                           </datum>
                           <datum>
      <oebx:maxDocCountPerPrincipalPerPeriod>3</oebx:maxDocCountPerPrincipalPerPeriod>
                           </datum>
                           <datum>
                              <oebx:recurrancePeriod>
                                 <oebx:period>
                                    <oebx:unit>oebx:Semester</oebx:unit>
                                    <oebx:unitCount>1</oebx:unitCount>
                                 </oebx:period>
                           </oebx:recurrancePeriod>
                           </datum>
                        </serviceParameters>
                     </serviceReference>
                  </sx:seekApproval>
               </grant>
            </grantGroup>
         </grant>
      </grantGroup>
   </license>
</licenseGroup>
```

METSRights Coding of "Library/Site License" Use Case.

```
<?xml version="1.0" encoding="UTF-8"?>
<RightsDeclarationMD xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:noNamespaceSchemaLocation="http://www.loc.gov/standards/rights/\METSRights.xsd"
RIGHTSDECID="DBService" RIGHTSCATEGORY="LICENSED">
   <RightsDeclaration>Foo University has a site license for itself and Fubar U for
these materials.</RightsDeclaration>
   <RightsHolder RIGHTSHOLDERID="fooUlib">
      <RightsHolderName>Foo University Library</RightsHolderName>
      <RightsHolderComments>Contact Mary Smith for any questions about the library's
license with DBService, Inc.  and the terms of the Foo U contract.
</RightsHolderComments>
      <RightsHolderContact>
         <RightsHolderContactEmail>msmith@fooUlib.edu</RightsHolderContactEmail>
      </RightsHolderContact>
   </RightsHolder>
   <Context CONTEXTCLASS="OTHER" OTHERCONTEXTTYPE="FACULTY">
      <UserName USERTYPE="GROUP">Foo U Faculty</UserName>
      <Permissions DISCOVER="true" DISPLAY="true" COPY="false" DUPLICATE="true"
MODIFY="false" DELETE="false" PRINT="true" OTHER="false"/>
      <Constraints CONSTRAINTTYPE="COUNT">
         <ConstraintDescription>Professors may make 30 downloadable digital copies of
any documents for classroom use</ConstraintDescription>
      </Constraints>
   </Context>
   <Context CONTEXTCLASS="ACADEMIC USER">
      <UserName USERTYPE="GROUP">Foo U Students</UserName>
      <UserName USERTYPE="GROUP">Foobar U Students</UserName>
      <Permissions COPY="false" DELETE="false" DISCOVER="true" DISPLAY="true"
DUPLICATE="true" MODIFY="false" OTHER="false" PRINT="true"/>
      <Constraints CONSTRAINTTYPE="UNIT">
         <ConstraintDescription>Printing is one page at a time</ConstraintDescription>
      </Constraints>
   </Context>
   <Context CONTEXTCLASS="OTHER" OTHERCONTEXTTYPE="LIBRARYSTAFF">
      <Permissions COPY="true" DISCOVER="true" DISPLAY="true" DUPLICATE="true"
MODIFY="false" OTHER="false" PRINT="true"/>
      <Constraints CONSTRAINTTYPE="COUNT">
         <ConstraintDescription> 1 digital copy to move from one repository to
another.</ConstraintDescription>
      </Constraints>
      <Constraints CONSTRAINTTYPE="TIME">
         <ConstraintDescription>Each semester</ConstraintDescription>
      </Constraints>
      <Constraints CONSTRAINTTYPE="COUNT">
         <ConstraintDescription>Maximum 2 copies for archival
purposes</ConstraintDescription>
      </Constraints>
      <Constraints CONSTRAINTTYPE="UNIT">
         <ConstraintDescription>Printing is one page at a time</ConstraintDescription>
      </Constraints>
   </Context>
</RightsDeclarationMD>
```