



IEEE Trial-Use Recommended Practice for Digital Rights Expression Languages (DREs) Suitable for eLearning Technologies

IEEE Computer Society

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Abstract: This recommended practice facilitates the creation, management and delivery of digital content for eLearning by technology that implements Digital Rights Expression Languages (DREs). This recommended practice determines what, if any, extensions are needed so that these DREs can meet the identified requirements.

Keywords: Digital Rights Expression Language, DREL, MPEG-21, Open Digital Rights Access, Open eBook Forum, ODRL, Rights Expression Language, REL

The Institute of Electrical and Electronics Engineers, Inc.
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Introduction

This introduction is not part of IEEE Std 1484.4-2007, IEEE Trial-Use Recommended Practice for Digital Rights Expression Languages (DREs) Suitable for eLearning Technologies.

The Digital Rights Expression Languages Working Group (DREs WG) of the IEEE LTSC was formally established in March 2003 at the Paris quarterly meeting of the LTSC and was initially co-chaired by Juliette Adams. This followed a series of study group meetings held throughout 2002 that investigated both DREs and Digital Rights Management (DRM) in relation to the needs of learning, education, and training. With a view to constraining the problem space and minimizing stakeholder confusion, the WG developed a project proposal that focused only on DREs. The resulting Project Authorization Request (PAR) was accepted on 14 April 2003.

During the agreed work program, it became clear that the need for DREs within education and training communities worldwide is still at an embryonic stage. However, while the sector has voiced its strong need for DREs, it has not, as yet, identified unique requirements that current DREs cannot satisfy. This reflects the state-of-play within the eLearning industry where learning technologies associated with pedagogy, process, and learning activities are still largely in the research and development phase. This does not mean that such requirements may not exist, but they have not been explicitly identified in this trial use recommended practice.

The working group gathered a series of use cases that were submitted following the initial call for contributions issued on 2 June 2003. These use cases are detailed in Annex A. Most use cases were provided by stakeholders who have not yet implemented DRM systems but who are keen to make use of them. From these use cases, the WG then extracted a number of requirements, which are included in the normative section of this document (see Clause 2).

In order to align these requirements with existing rights expression languages, the WG received three language mappings, including MPEG REL, formally known as ISO/IEC 21000-5:2004; the open eBook Forum (OeBF) profile of MPEG REL; and, Open Digital Rights Language (ODRL) (see Annex A, Annex B, and Annex C). Based on these mappings and reviews thereof, the working group produced a table summarizing which requirements are met by each language mapping.

This trial-use recommended practice aims to provide a basis from which stakeholders within learning, education, and training can make informed decisions about their DREL needs.

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Participants

At the time this standard was completed, the working group had the following membership:

Magda Mourad, *Chair*
Jon Mason, *Technical Editor*

Juliette Adams (*Initial co-Chair*)
Leah Berkhoff
Stephen Downes
Rachel Ellaway
Kameshwar V. Eranki
Mike Fore
Brad Gandee
Serge Goldstein

Susanne Guth
Manuel Ham
Tim Hand
Chad Kainz
Wilbert Kraan
Sam Meredith
Kiyoshi Nakabayashi

Martha Nalebuff
Florian Pestoni
Harry Piccariello
Thomas Probert
Daniel R. Rehak
Robby Robson
Steve Sarapata
Bernd Simon

The following members of the individual balloting committee voted on this standard. Balloters may have voted for approval, disapproval, or abstention.

Satish K. Aggarwal
Kerry E. Blinco
Juan C. Carreon
Keith Chow
Tommy P. Cooper
Geoffrey Darnton
Thomas J. Dineen
Kameshwar V. Eranki
Yaacov Fenster
Geoffrey A. Frank
Ron K. Greenthaler
Randall C. Groves

Shui H. Heung
Rutger A. Heunks
Nancy Hoebelheinrich
Werner Hoelzl
Dennis Horwitz
Arshad Hussain
Peeya Iwagoshi
Robert B. Kelsey
Susan K. Land
Solomon Lee
Yeou Song Lee
William Lumpkins

G. L. Luri
David A. Massart
Richard A. McBride
Michael S. Newman
Claude Ostyn
Vikram Punj
Daniel R. Rehak
Randall M. Safier
Scott A. Valcourt
Derek T. Woo
Paul R. Work
Oren Yuen

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John Kulick
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Glenn Parsons
Ronald C. Petersen
Tom A. Prevost

Narayanan Ramachandran
Greg Ratta
Robby Robson
Anne-Marie Sahazizian
Virginia C. Sulzberger
Malcolm V. Thaden
Richard L. Townsend
Howard L. Wolfman

*Member Emeritus

Also included are the following nonvoting IEEE-SA Standards Board liaisons:

Satish K. Aggarwal, *NRC Representative*
Alan H. Cookson, *NIST Representative*

Jennie M. Steinhagen
IEEE Standards Program Manager, Document Development

Michael D. Kipness
IEEE Standards Program Manager, Technical Program Development

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IEEE Trial-Use Recommended Practice for Digital Rights Expression Languages (DRELs) Suitable for eLearning Technologies

1. Overview

1.1 Scope

This recommended practice identifies digital rights (DR) requirements for eLearning technologies. These requirements should be aligned with the most widely known standards-based specifications for Digital Rights Expression Language (DREL) that are being adopted or developed by international, regional, national, and private organizations and consortia.

1.2 Purpose

This recommended practice facilitates the creation, management, and delivery of digital content for eLearning by technology that implements DRELs. This recommended practice should determine what, if any, extensions are needed so that these DRELs can meet the identified requirements.

1.3 Special terms

For the purposes of this recommended practice, the following special terms apply:

- 1.3.1 content:** Any resource that can be regarded as “containing” information and is independent of its structure and presentation.
- 1.3.2 Digital Rights Expression Language (DREL):** A language in which expressions of permissions and conditions are specified to control the distribution or use of learning objects. The use of a DREL is one tool that is used in DRM systems. *The functional requirements of a DREL are the main focus of this document.*
- 1.3.3 Digital Rights Management (DRM):** A broad term used to describe a process or a system for managing digital rights associated with digital content. DRM covers a wide range of activities including (but not limited to) the following:
- Use of a digital rights expression language
 - Authentication of rights expressions, devices, users, and resources
 - Association of rights expressions to digital content

— Protection of digital content from being used without rights

NOTE—It is important to note that the requirements for a DRM system are out of scope for this document.¹

1.3.4 learning content: Any material useful for creating, managing, or facilitating a learning experience regardless of medium, structure, or commercial status.

1.3.5 learning object: A term that has been defined very broadly by the IEEE LTSC in IEEE Std 1484.12.1² for the purposes of creating metadata. Operationally, however, it is a term that has been widely adopted and used to distinguish digital assets that have some kind of learning objective and/or assessment associated with them. It is used in this latter sense in Clause 2.

1.3.6 rights: Expressions that describe such things as permissions and conditions that are typically associated with the use of content.

1.4 Acronyms and abbreviations

DREL	Digital Rights Expression Language
DRM	Digital Rights Management
ICT	Information and Communications Technology
LET	learning, education, and training
LO	learning object
LOX	Learning Object Exchange
LTSC	Learning Technology Standards Committee
MPEG	Motion Pictures Experts Group
ODRL	Open Digital Rights Language
OeBF	Open eBook Forum
PAR	project authorization request
REL	Rights Expression Language
RTO	Registered Training Organization
SCORM	Sharable Content Object Reference Model
WG	working group

2. Functional requirements for eLearning technologies

The functional requirements derived from the use cases specified (see Annex A) are classified into the following six groups:

- Attributes of the DREL
- Aggregation and disaggregation of learning objects
- Attribution
- Conditional use
- Tracking
- Offers

While traditional learning, education, and training (LET) environments can often be characterized by large cohorts and heterogeneous communities sharing and reviewing materials at various levels of resource granularity such activities have not been in the interests of traditional content producers. Thus, rights expressions for LET stakeholders can be seen as largely associated with the lifecycle of content (such as learning objects).

¹ Notes in text, tables, and figures are given for information only and do not contain requirements needed to implement the standard.

² IEEE Std 1484.12.1™-2002, IEEE Standard for Learning Object Metadata, is available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, Piscataway, NJ 08855-1331, USA.

In general terms, the requirements gathered for this trial-use recommended practice have all been largely framed in terms of expressing rights associated with content.

NOTE—It is recognized that as rights-enabled infrastructure becomes widely deployed over time, new requirements may emerge. An important consideration is that eLearning Technologies involve engagement of learners (and related stakeholders) with *processes* and *applications* as well as content. Rights expression may apply to any form of content not just learning objects e.g., raw assets and metadata instances.

2.1 Attributes of the Digital Rights Expression Language

The following are the attributes of the DREL:

- 2.1.1 The DREL should be based on a formal grammar.
- 2.1.2 The DREL should allow the specification of constraints that persist when a learning object is updated or new version is released.
- 2.1.3 The DREL should support the articulation of roles undertaken by users. For example, a user may be associated with the role of “instructor” for an identified learning object.
- 2.1.4 The DREL should support the use of unique identifiers when they exist for learning objects.
- 2.1.5 The DREL should support a single rights expression to apply to a class of learning objects. The DREL should therefore support class definitions and affiliations.
- 2.1.6 The DREL should be extensible and allow alternative schemas wherever sensible to meet the future needs of the learning, education, and training community.
- 2.1.7 The DREL should define a minimal core set of primitive constructs from which all other expressions can be constructed or derived. For example, instead of defining pay-per-view, rent-to-own, and other such models, the core should provide the fundamental building blocks to link constraints (e.g., payment) to actions to allow constraints to repeat according to various criteria, provide metering syntax, etc.
- 2.1.8 The DREL should support the specification of constraints that can be used as defaults.

2.2 Aggregation and disaggregation of learning objects

Learning objects may be created through aggregation into more complex learning objects. Constraints may be associated with the learning objects employed in such aggregations allowing the learning objects to be reused. Therefore

- 2.2.1 The DREL should allow the specification of constraints for the aggregation of content within learning objects.
- 2.2.2 The DREL should allow the specification of constraints for the disaggregation of content within learning objects.
- 2.2.3 The DREL should allow the specification of constraints that must be preserved and propagated under aggregation.
- 2.2.4 The DREL should allow the specification of constraints for the use of the aggregated learning objects.

- 2.2.5** The DREL should allow specification of constraints associated with different levels of granularity in an aggregated learning object.
- 2.2.6** The DREL should allow specification of different schemes to uniquely identify different portions of an aggregated learning object to which constraints apply.
- 2.2.7** The DREL should allow the specification of constraints requiring the retention of specific metadata as an integral component of a learning object regardless of source.

2.3 Attribution

Learning objects may be created from other learning objects and may require attribution. Therefore

- 2.3.1** The DREL should allow the specification of attribution constraints associated with the use associated with specific uses of learning objects.

2.4 Conditional use

The use of learning objects and other content is sometimes subject to the following conditions of use:

- 2.4.1** The DREL should allow for the specification of a set of conditions that must be fulfilled before a right (or set of rights) can be exercised.
- 2.4.2** The DREL should allow the specification of different kinds of constraints for access to learning objects for different individual users, categories of users, and circumstances as applicable.
- 2.4.3** The DREL should allow specification of constraints limiting the number of times learning objects can be used, accessed, distributed, and/or replicated.
- 2.4.4** The DREL should allow the specification of connectivity-based constraints, e.g., online or offline use of learning objects.
- 2.4.5** The DREL should allow specification of device-based constraints to restrict the use of content to a single computer or a group of computers.
- 2.4.6** The DREL should allow the specification of anonymous access to learning objects.
- 2.4.7** The DREL should allow the specification of usage rights to learning objects for educational, research, and scholarly purposes such as Fair Use. This may include declarations applying Fair Use policies.
- 2.4.8** The DREL should allow the specification of constraints associated with policies that may apply to individuals or groups. Policies may be context specific.
- 2.4.9** The DREL should allow the specification of constraints associated with multi-tiered distribution, e.g., instances where learning objects are distributed by one entity that redistributes to other entities, of learning objects.
- 2.4.10** The DREL should support the unambiguous specification of time-based constraints such as specific times, fixed intervals, sliding intervals, and metered intervals that can span across different time zones.
- 2.4.11** The DREL should support the specifications of fees according to standard terms and conditions.

- 2.4.12 The DREL should support limiting rights to portions of learning objects.
- 2.4.13 The DREL should support distribution and management of free learning objects.
- 2.4.14 The DREL should support specifying a price, including a price of “free,” for unlimited usage of a learning object.
- 2.4.15 The DREL should support the specification of payment of a fee for each use of a learning object that may be constrained by connectivity-based conditions, e.g., connection to an online service, web portal, and web service.
- 2.4.16 The DREL should support subscription-based pricing and access to learning objects.
- 2.4.17 The DREL should support time-based pricing rules for learning objects.
- 2.4.18 The DREL should support the specification of learning object usage under a site-license.
- 2.4.19 The DREL should support the specification of constraints related to the manner in which the use of a learning object is supervised, e.g., a teacher supervises taking a test.

2.5 Tracking

In some cases, usage of learning objects may need to be tracked.

- 2.5.1 The DREL should allow the specification of requirements for tracking access, usage, distribution, and purchase of content.

2.6 Offers

The ability to offer learning objects to individuals or groups of people is important within the learning, education, and training community. The offers themselves can be subject to a variety of conditions such as fees, time, membership, etc. Furthermore, offers can specify additional constraints on the use of the learning object being offered.

- 2.6.1 The DREL should allow the specification of offers. Both the offers and the use of the learning objects may be subject to constraints.

3. Issues

3.1 Requirements analysis

In the course of completing the tasks associated with the PAR an issue arose that was not resolved by the WG: “*How are digital objects that extend beyond content supported by the DREs?*” This question arises because in the learning, education, and training community there are ‘digital objects’ such as software applications that may be subject to usage control. For example, Adobe® Photoshop® has hundreds of functions such as auto-color, auto-brightness, image-size, crop, etc.³ Are these application functions to be controlled through the use of a DREL? Or are they out of scope? In fact, the scope statement within the PAR (“Digital Rights requirements for eLearning technologies”) could be read more broadly than the statement of purpose (“to facilitate the creation, management, and delivery of digital content for eLearning

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by technology that implements digital rights expression languages”). The WG made the programmatic decision to focus the scope of this document on DREL for digital content.

3.2 Practitioner feedback

The WG also received some comments and feedback after initial deadlines indicating that further rights expressions could be made that would be of benefit in library contexts. In particular, a distinction was drawn between the use of “view” and “lend,” where “view” can be seen to depend on an “obtain” action that is largely invisible when accessing digital materials via the Web. This is particularly important in situations where libraries may lend ebooks. Two further rights expressions were suggested. They are as follows:

- “The DREL should support the transfer of some rights to a user without increasing the number of usable copies of the resource. [one copy, one user]
- The DREL should support time-based rights that revert to the original rights holder at expiration. [lending]”

Annex A

(informative)

Use case requirements

Table A.1 represents a compilation of requirements, articulated as use cases, that were gathered from stakeholders following a Data Call on 2 June 2003. These use cases have been matched with (an) appropriate DREL statement(s).

Table A.1—Use case requirements

General description use case	#	Requirement name	Education/Training requirement	DREL requirement
Students and instructors engaged in eLearning activities access and process content from multiple sources. Sometimes this may mean aggregating components of a learning object with components of another learning object.	1	Multiple Sources of Aggregated Content	Documents (and environments) in education and training are often aggregated from multiple sources. Rights need to be aggregated in a sensible fashion.	1. The DREL shall allow content owners specify permissions to allow their content to be embedded/aggregated within other learning objects. 2. The DREL shall allow content owners to specify the permissions and conditions that must be preserved when content is aggregated. 3. The DREL shall support the aggregated permissions and conditions for the aggregated learning objects.
	1.1	Heterogeneous copyright constraints	Same as requirement for #1.	Rights expressions must be able to carry information from multiple sources.
	1.2	Rights roll-up rules	Aggregation of content is done under license and in cases where it is not otherwise specified the aggregation has the constraints of the aggregated element with the most restrictive rights. In other words, the restriction propagates upward into the aggregation.	Rights expressions should be able to express “rights roll-up rules.”
Researchers want to make the output of their scholarship freely available while also wanting to do so under certain conditions, primarily associated with attribution.	2	Attribution and other Creative Commons notions	In education and training, it is desirable to express Creative Commons licenses, including those addressing attribution, non-commercial use, etc.	1. Expressions of specific types of conditions and permissions are resolved through a data dictionary. A standardized extension of the dictionaries that “come with” MPEG REL and ODRL are required. 2. The DREL shall allow content owners to specify permissions to allow anyone to view scholarly output for free. 3. The DREL shall allow content owners to specify permissions to allow anyone to extract portions of their scholarly output as long as the stated attribution is made in the resulting learning object.

Table A.1—Requirements use cases (continued)

General description use case	#	Requirement name	Education/Training requirement	DREL requirement
IP rights are applicable to any form of digital resource—from data to single files to learning objects and clusters of objects, etc.	3	Granularity of Content	Rights associated with modular content are handled at various levels of aggregation—raw assets (such as text files, graphics, images, etc), newsfeeds, learning objects, clusters of learning objects, courses, and metadata	1. The DREL shall allow content owners to specify rights expressions that support different levels of content granularity. (NOTE—This may need to be supported by a taxonomy of content types.) 2. The DREL shall support rights expressions for aggregated objects. 3. The DREL should allow the specification of constraints that must be preserved and propagated under aggregation.
Rights associated with learning objects persist through subsequent updates, where some of these updates are not performed by the original rights holder.	3.1	Versioning of learning objects	Same as requirement as listed in #3.	Covered in #1 and #1.1
A student or teacher downloads a learning object that is protected by a single download-per-user policy to use offline on their home computer. This LO cannot be disaggregated or forwarded.	4	Single use and offline use	Offline and home use.	1. The DREL shall support rights expressions intended for an individual user or for groups of users. 2. The DREL shall support count-based conditions to restrict the number of times content can be used. 3. The DREL shall support device-based conditions to restrict the use of content to a single computer or a group of computers. 4. The DREL shall support connectivity-based conditions to ensure that content is used online or offline.
Systems designers will want a means of separating the declaration of rights from the enforcement of rights. They may wish this because they do not wish to pay for, or encumber, a system with enforcement mechanisms. Thus, “do not copy” in one context may be distinct from “do not copy” in another context, such that in the former an enforcement mechanism, such as specialized non-copy software is required, while in the latter, no such software is required.	5	Separating Declaration from Enforcement	The context of a usage cannot always be predicted. However, where it can, and enforcement of rights is a desired outcome context of usage is important. In other contexts, it may be more appropriate just to view a declaration of rights.	1. The separation appears to happen naturally since DRELs do not actually perform the enforcement. 2. Rights expression in DREL shall support consistent interpretation across applications. 3. The DREL shall be based on a formal grammar and standardized nomenclature.

Table A.1—Requirements use cases (continued)

General description use case	#	Requirement name	Education/Training requirement	DREL requirement
When purchasing content purchasers will want to be able to express choice of provider. This is expressed in the following ways: (1) they may wish to opt for one, rather than another, distributor of a given bit of content; (2) they may wish to opt for one, rather than another, payment processing agency; (3) they may wish to opt for one, rather than another, personal profile or authentication agency.	6	Choice of Providers in supply chains	When purchasing content, purchasers will want to be able to express choice of provider. This is expressed in several ways: they may wish to opt for one, rather than another, (1) distributor of a given bit of content; (2) payment processing agency; or (3) personal profile or authentication agency.	Possible need for rights policies that apply to categories of content or groups of people (see use case #6.1).
Rights policies can grant a specific set of permissions and conditions to a group of people or to a category of resources. For example, a server repository can have this policy: “university students” can view “university-owned ebooks.” When a student named Alice requests access to an ebook called Solstice, the student gets the resulting license derived from the rights policy: “Alice can view Solstice.”	6.1	Support rights policies that apply to categories of content or to groups of people	Same as requirement for #6	The DREL shall support the specification of context specific rights applying to policies. e.g., Fair Use policies may be context specific
Anonymous access to content should be the default, rather than the exception (much in the way that one normally buys a book anonymously).	7	Anonymous access	In much the same way that one normally buys books, anonymously accessing digital content should not be unnecessarily encumbered by having to submit personal information.	The DREL shall support rights expressions to specify that “anyone” can use the specified content REL should be able to allow anyone to anonymously access content.
Potential purchasers will want to be able to access and read reviews and other evaluations of learning material before making a purchase decision; this information needs to be made available at the point of sale.	8	Read reviews and evaluations	Reading reviews and other evaluations of learning material before making a purchase decision is a typical requirement of learners, educators, and trainers.	Trial usage (preview with certain conditions); relatedness to other objects (reviews, evaluations, other LOs, etc.). The ability for a rights holder to offer a free preview of the content must be supported by the DREL and this is covered in use case #4.

Table A.1—Requirements use cases (continued)

General description use case	#	Requirement name	Education/Training requirement	DREL requirement
Purchasers will want to be able to compare, side-by-side and in the same environment, content that is offered for free with content that is offered for sale; it follows therefore that the mechanisms used to market, distribute and license commercial content cannot impose an encumbrance on free materials offered through the same system (for it would then no longer be possible to offer free materials in this system, and thus, would grant a monopoly of the system to materials offered for sale).	8.1	Evaluating procurement options	Evaluating learning material prior to its procurement is a typical requirement of learners, educators, and trainers. Ideally, determining outcomes should not be “pre-determined” by constraints of whether this material is “for free” or “for purchase.”	The DREL shall allow rights holders to specify that portions or entire content be previewed by specific users also covered in use case #4.
A small producer of content would like to offer content for sale without investing in user authentication and similar mechanisms. This producer hopes and expects to have “right of access” to markets. In other words, the provisions for DRM should not explicitly or implicitly contain the means to lock out competing producers.	9	Basic content offer	Learners, educators, and trainers all produce content and sometimes may wish to offer it for sale without wanting to deal with complex mechanisms of tracking its use.	1. The DREL shall allow content owners to offer for free the permission to view a learning object. 2. The DREL shall allow content owners to offer for a fee the permissions to view and print (without additional restrictions) a learning object. 3. The DREL shall allow content owners the ability to specify tracking conditions when content is used.
A researcher offers his/her content very cheap (or for free) to the role “student,” but a little bit more expensive for the role “teacher.”	10	Matching offers with roles	Matching offers with roles already takes place in many ways - with journal subscriptions or conference registrations, for example.	1. The DREL shall allow rights holders to specify offers for free or with condition to permit the use of learning objects to groups of people with specific roles such as student, teacher, club member, journal subscriber, etc. 2. The DREL shall support the specification of rights expressions associated with activities or roles defined in a formal taxonomy.
A researcher offers his/her content to teachers that are members of a certain group (for example teachers of the same university) much cheaper, than to teachers that are not members of the group. The requirement here would be to define an attribute e.g., group, and think about reasonable values for this attribute.	10.1	Matching offers with roles	Matching offers with groups of persons/roles.	Same as requirement for use case #10.

Table A.1—Requirements use cases (continued)

General description use case	#	Requirement name	Education/Training requirement	DREL requirement
When granting rights to other people, it is of interest for the authors, on what “level in the educational hierarchy” the other people are—e.g., professors are above assistant professors and teaching assistants. Assistant professors are above PhD students and so on. Authors tend to grant more permissions to people that are on the same hierarchical level and we can draw some relations to knowledge management here.	10.2	Matching offers with roles (3).	Matching offers with groups of persons/roles requires identification for the role of the consumer, and a vocabulary expressing such roles.	Same as requirement for use case #10.
Expressing rights associated with a wide variety of content.	11	Accommodating diverse content types	In education and training settings, there is wide (and increasing) diversity in content types (texts, simulations, animations, video, etc.).	Not specified.
Situations such as the “booking” of content use operate most efficiently when an alert mechanism for this is triggered.	12	Alerting	There are many situations where it is desirable to provide an alert mechanism for the access to or use of content.	Not specified.
Software developers of open source educational technology need to be able to incorporate DREL techniques and code that is compatible with major open source licenses, such as the GPL, the LGPL, MIT, BSD, and Apache.	13	Open source licenses	An increasing amount of educational software is developed under a range of open source licenses. License restrictions on the DREL that are not compatible with the major open source software licenses will mean that the uptake of a DREL will be severely limited, and possibly fragmented.	An increasing amount of educational software is developed under a range of open source licenses. License restrictions on the DREL that are not compatible with the major open source software licenses will mean that the uptake of a DREL will be severely limited, and possibly fragmented.
Australian K-12 authorities wish to facilitate a streamlined approach to eLearning where constraints associated with the use of content do not interrupt its usage during each session.	14	Sector-wide- and site-licensing.	Schooling authorities wish to facilitate the acquisition of eLearning competencies and do not want to be constrained by having to clear the rights associated with content for each usage.	Rights expressions must accommodate usage at various levels of multiple use—individual, class, cohort, site, region, sector, etc.
Australian K-12 authorities do not wish to be placed in a situation where they have “to acquire and install specific software products in every management and usage environment, in order to use a learning object.”	15	Self-contained content and its usage.	Out of scope.	Out of scope.

Table A.1—Requirements use cases (continued)

General description use case	#	Requirement name	Education/Training requirement	DREL requirement
A law student expects his right of Fair Use to be respected, thereby allowing him to, for example, copy a selection from an article for use in an essay, even in cases where such use is forbidden by the vendor.	16	Fair use	Copying a selection of content (text and/or graphics) from an article for use in an essay or other educational purpose is a typical requirement of the education and training sector. Legislation exists in various jurisdictions that allows this despite individual copyright notices on materials forbidding it.	The DREL must be able to specify whether Fair Use needs explicit declaration. This will be subject to “Context.” See 6.1 for the multiple variables (of which Fair Use must be one).
Universities create a range of reports on eLearning content usage that meet with their legal requirements such as copyright. Reports may include details of usage, technical controls to limit usage, and relevant compliance information accompanying resources. Reports can also be used as feedback on effective and popular usage of content for developers and management.	17	Reports that meet legal requirements	Universities require a means for generating reports that can match their specific legal requirements with usage of eLearning content and copyright.	The DREL shall support the specification of a tracking mechanism when content is used. (Also refer to use case #9.)
University X has outsourced the development of digital material associated with output from its R&D: University X maintains copyright over the content while the developers maintain copyright on specific technological solutions they used to add interactivity to the content.	18	Separating content from technology	Universities and their staff will need mechanisms for tracking their IP on content that is subsequently utilized in novel technical ways. This presents a challenge because electronic boundaries are sometimes diffuse.	N/A. This is an implementation/process issue and not a DREL requirement.
Following on from #18, University X makes their content available to other universities free of charge as long as their logo is displayed when their content is accessed.	18.1	Persistent identification of IP	Attribution.	Same as use case #2.

Table A.1—Requirements use cases (continued)

General description use case	#	Requirement name	Education/Training requirement	DREL requirement
A lecturer uses a national e-content exchange to locate two Japanese learning objects (LOs). The lecturer finds that both are suitable but would prefer to take Lesson 1,2,4,6 from LO#1 and Lessons 3,5,7,8 from LO#2. On viewing the digital rights, the lecturer sees that this is possible and instructs the university LO repository administrator (or automated system) to do this and create a personalized LO for use by the students. The merged digital rights are still honored.	19	Merging digital rights from disparate LOs into a new LO	Lecturers will typically want to mix and match content and portions of content that might have rights attached. Disaggregating and reassembling content is a typical activity for a lecturer.	Same as use case #1.
Extending the scenario in #19, the lecturer develops supplementary material to assist the students with the Japanese LO. These are so successful that the lecturer re-submits the whole LO back into the e-content exchange as a new LO. The digital rights on the original Japanese LOs allow this (reuse right was granted). The university decides to charge on each sale of the new LO. When all three digital rights are “merged,” the final fee for the new LO is calculated. Each time it is purchased, the three rights holders are credited.	20	Merging digital rights from disparate LOs into a new LO	Aggregation of content.	Same as use case #1.
A lecturer wants to provide a seamless link from the course management system to access a specific library e-reserve article, and then add another link to a broad-ranging search across various repositories for students to search for other similar articles, with direct links to full text versions of relevant articles once discovered by student searches.	21	Integrating library permissions	Within a university, lecturers will want (and require) students to access specific (and sometimes scarce) resources that have local permissions assigned by the library. Integrating these permissions with other content usage ideally needs to be seamless.	N/A The web links to content are out of scope—these are implementation issues dealing with the management of content.

Table A.1—Requirements use cases (continued)

General description use case	#	Requirement name	Education/Training requirement	DREL requirement
A librarian wants to ensure that digital rights, copyright, and Fair Use are properly managed within a collection of resources aggregated by a lecturer for use in the course management system, and then later to preserve any lecturer-created resources within the aggregation, as well as pointers to any external copyright materials, for the future.	22	Tracking lecturer usage	Libraries will sometimes need to perform an audit on usage by lecturers of copyrighted materials for which they are the custodians.	The DREL shall support the specification of a tracking mechanism when content is used. (See use case #9)
A student wishes to gain easy access to various learning and information resources across the university, with contextual advice on searching techniques together with online help from a virtual reference desk. The virtual reference desk is able to see previous failed search attempts by the student if the student decides to share these failed searches.	23	Privacy assumed but permissions to share log of personal activity	The open environment of universities is conducive to sharing of digital information of many kinds. Personal search logs or other online activities that are tracked can be shared if appropriate permissions are in place to do so.	Not specified: —Authentication and authorization issues. The DREL can only provide elements to support the authentication of users and what authorization these users have to content. —Failed attempts to access content get logged by systems to track hackers. —May need mechanism to declare that session information can be used by a third party.
A researcher wishes to automatically gain access to data and computational services within a grid repository at another institution, where access to this repository should be anonymous, but the other institution needs to know that the researcher is authenticated at their home institution, and the anonymous access request has relevant attributes for accessing the repository according to the policies for this grid repository.	24	Maintaining anonymity while being authenticated	Maintaining anonymity while undertaking or participating in research is a common university requirement.	Out of scope. Allowing access to a search system and distributed authentication is out of scope. The DREL does not care if authentication is distributed or centralized. DREs carry information about “who” has “permissions” to “content” provided that some “conditions” are met. See related use cases #7 and #10.
An IT Director wants to provide a single login point to all staff and students for seamless access to all university systems, but only to the systems they are entitled to use according to the security and policy requirements of each system and the institution itself.	25	Authentication and access control	Single sign-on is currently pursued by universities as a service goal. However, different systems will need to apply different policies to users.	Out of scope. This is a system requirement, not a DREL requirement. NOTE—The above statement may represent a content-centric view on what the capabilities of a DREL should be. Therefore, single sign-on is out of scope, but not all access management issues are out of scope.

Table A.1—Requirements use cases (continued)

General description use case	#	Requirement name	Education/Training requirement	DREL requirement
A university wants an extension of the copyright extensions associated with face-to-face teaching to also cover web-based teaching. The U.S. TEACH legislation only does that in a very circumscribed fashion, because it requires that the presentation of material to the web-connected students be done essentially simultaneously with the presentation to the classroom students i.e., it allows you to stream a class in real time to a distant location. This ignores the reality that more and more education is delivered “just-in-time,” which is not generally class time, but any time convenient to the student.	26	Web-based teaching copyright provisions.	“Just-in-time” delivery copyright extensions.	The DREL shall support the specification of rights expressions to deal with web-based presentations.
Determining whether the downstream use of content will have a commercial aspect to it or not will also determine conditions of use.	27	Determining commercial usage.	Content is often shared freely in university settings. However, where it is used for commercial reasons, certain IP rights must be recognized.	The DREL shall allow a rights holder to specify multi-tiered distribution rights. [For example, a rights holder H allows distributor D (tier 1) to issue commercial and non-commercial licenses to allow students (tier 2) to use content under some constraints.]
An instructional designer (ID) searches a learning object Exchange (LOX) and requests a preview or evaluation copy of an object that requires a nominal payment for any use. However, the object does not currently have such rights expressed in its conditions for use, so the ID submits an offer for trialing purposes to the administrator of the LOX who then contacts the rights holder. An agreement is reached. As a further consequence, the administrator develops an “offer template” for trialing purposes for all objects held within the LOX.	28	Trial usage permission.	There are numerous intermediaries involved in education and training (tutors, instructional designers, teacher aides, teachers, etc.). In appraising the value or otherwise of content, such persons require the ability to evaluate content prior to recommending the purchase of this content.	Out of scope. The ability to assign a variety of rights to content is already covered in other requirements specified. However, the ability to modify existing rights over content is a management issue, so is out of scope.

Table A.1—Requirements use cases (continued)

General description use case	#	Requirement name	Education/Training requirement	DREL requirement
A teacher logs onto an institute intranet to search for learning objects for a specific training session. There are four different types available: (1) unrestricted but requiring attribution (2) restrictions on changing or revising (3) commercially sourced and paid for, and (4) commercially available but for which payment is required (and institute protocols require a chain of approvals before this can take place).	29	Determining and responding to rights restrictions.	Educators and trainers will be typically faced by a range, if not a myriad, of choices concerning conditions of use of learning objects. In wanting to benefit from the modularity of such content, they will require systems that make it easy to assemble this content in a manner that does not impede workflow.	Out of scope. This is a content procurement and management issue, which is a system issue.
An instructional designer (ID) searches a Learning Object Exchange (LOX) for some specific LOs. Finding none that are suitable, the ID develops some and then loads them to the LOX, assigning the necessary metadata and rights information.	30	Tools for assigning rights.	Educators and trainers require systems that enable them to assign rights in simple ways. That is, they (and sometimes their students) act as publishers of content.	The ability to assign a variety of rights to content is already covered in other requirements specified. Tools are out of scope.
An instructional designer (ID) sources an LO from a national pool (repository) and wishes to re-purpose it for a context other than the one it was created for. Fortunately the LO is available for unrestricted use. The LO is downloaded, and the development team integrate it into another context. It is reloaded into the repository with the additional metadata and rights are assigned.	31	Re-purposing learning objects	Educators and trainers are trained to apply content to novel contexts. They are often wishing to modify existing content and modify it for use in a new context.	See use case #1 (roll-up rights). Also, if the content already has a rights expression granting unrestricted use (play, edit, print, copy, etc.), then the consumer of the content can do whatever he/she is legally authorized to do with the content.
Similar to #31, except that original LO is constrained by a range of usage conditions.	31.1	Re-purposing learning objects (2)	Same requirement as #31.	Already covered by other requirements specified.

Table A.1—Requirements use cases (continued)

General description use case	#	Requirement name	Education/Training requirement	DREL requirement
A teaching video is made of a surgical procedure but cannot identify the patient. There are a number of individuals involved, some of whom have rights issues, some consent—the patient; the patient's next of kin; the lead consultant surgeon; other members of the theatre staff; the specific hospital department in which the procedure took place; the hospital trust (or other global body) in which the procedure took place; and the university or faculty for whose students the video was made. For any one or more than one of these entities to establish rights would seem to place the others in positions requiring varying degrees of consent. For instance, for the hospital and university to co-own the rights to the video, consent would be required from most if not all of the individuals concerned. Some of these consents may be covered within a contract of employment. Non-contracted people, and in particular the patient, will almost certainly have no rights over the video but will have degrees of deciding control via consent of how and where the video is used (and indeed if it is made at all). Is consent therefore a prior condition in a multifactorial situation, required to allow rights to be assigned?	32	Consent	Particularly in the medical training field, restrictions to digital assets are associated with consent. Patients and their families can restrict who has access to digital assets that identify the patients. A DREL needs to have the semantics to express consent based restrictions.	Not specified.
TAFE NSW (an Australian VOCED provider) has developed a model for assessment validation with an associated website that shows the model working in practice. It is available for other registered training organizations (RTOs) for a fee. This fee is higher for public RTOs. Adaptation and contextualization are allowed to suit user needs.	33	Maximum use of a document model with an associated Web site.	Rights propagation.	Not uniquely specified.

Table A.1—Requirements use cases (continued)

General description use case	#	Requirement name	Education/Training requirement	DREL requirement
A private registered training organization (RTO) has developed interactive material for Cert II level competency Work Effectively with Others for business studies area. The material contains reusable material for developing teamwork and can be used across a variety of discipline areas. For this to happen, the materials need to be evaluated and vetted where appropriate.	34	Wide application of resources developed by private RTO but vetting of adaptations required.	Trial usage and possible re-purposing; similar to #33.	Not uniquely specified.
A developer has produced an animation on how to use a compass. He/She wants to make this widely available for educational use to assist, for example, recreational bushwalkers.	35	Maximizing educational use including ability to adapt and republish.	Rights propagation.	Not uniquely specified.
A college is developing and providing learning materials or learning objects to students in a variety of methods and situations from a variety of sources and in a variety of media and locations. It resells materials to students in some form (this could be done through a sale at the campus bookstore or perhaps by including the cost of materials in the student fees) on a cost-recovery basis only. For example, reading packages and/or course content packages may contain such things as articles from the internet or A/V resources such as videos and would be provided to the students in paper formats, on CD, or via a password protected internet site.	36	Non-commercial cost recovery	Non-commercial cost recovery of learning materials development. As technology changes and learner needs change, institutions have no choice but to adapt to the changes and to deliver these materials in a manner that is not only economically viable for both the institution and the learner, but in a manner that meets the needs of both the learner and the copyright owner.	Distribution and sales issue; medium of delivery is a condition.

Table A.1—Requirements use cases (continued)

General description use case	#	Requirement name	Education/Training requirement	DREL requirement
Content license includes the limitation on usage duration and number of users.	37	Usage duration and number of users.	Management of usage duration and number of users.	Not uniquely specified.
In requirement #37, duration may be either absolute (fixed by contract), or relative (measured from learner's actual learning start date).	38	Absolute/relative duration.	Management of usage duration and number of users—including detail concerning absolute or relative duration.	Not uniquely specified. NOTE—Ability to express an initiating event.
In requirement #38, number of users may be counted as either simultaneous users or cumulative users.	39	Simultaneous/cumulative number of users.	Management of usage by number of users.	Not uniquely defined.
The license described in #38 and #39 may be applied single content as well as a course consisting of multiple contents.	40	Compound course.	Management of usage in context of compound course.	Not uniquely defined. NOTE—Roll-up or composite rights; see use case #1
In requirements #38–#40, the multiple contents may be provided by multiple content providers, and intermediate agent (aggregator) combines and sells them to the end user.	41	Content aggregator.	Management of usage by content aggregator.	Not uniquely specified. NOTE—Roll-up or composite rights; see use case #1
The above case (#41) can be applied to multiple LOs in a single content.	42	Content consisting of multiple source LOs	Management of usage of multiple source LOs.	Not uniquely specified. NOTE—Roll-up or composite rights; see use case #1
For the SCORM content, some providers want to protect whole content, but some want to protect SCOs only, and some course structure. It depends on the provider's core-competence.	43	SCORM content protection.	Protection of SCORM content.	Not uniquely specified. NOTE—Differential roll-up
Content may be licensed with other educational service such as mentoring.	44	Educational service license	Licensing via third party service	Not specified. See use cases #36 and #37.
Usage condition violation by the end user should be notified to all the providers and intermediate agents.	45	Tracking	Notification of usage violation	N/A. Implementation of Rights Management is out of scope NOTE—Notification an implementation issue
Usage condition violation by the intermediate agents should be prevented and notified to the provider.	46	Tracking	Prevention of usage violation	N/A. Implementation of Rights Management is out of scope NOTE—Prevention an implementation issue.

Annex B

(informative)

Historical background

Annex B is included from the following document editors to provide a historical reference.

January 30, 2004
Version 1.0

IEEE LTSC Document Editors:
Manuel Ham, ContentGuard
Jon Mason, education.au limited
Thomas Probert, Lydia, Inc

B.1. Introduction

B.1.1 Purpose

The purpose of this document is to provide a distillation of the requirements articulated by stakeholders from learning, education, and training (LET) communities concerning the functionality of Digital Rights Expression Languages (DREs).

B.1.2 Background

In developing a work plan to accomplish its aims, the LTSC DREL WG established a Requirements Analysis Subcommittee tasked with evaluating the DREL use cases and producing the functional requirements for DREs relevant to practitioners of eLearning technology.

The Requirements Analysis Subcommittee reviewed “use cases and requirements” captured in two Calls for Data dated 2-Jun-2003 and 3-Jun-2003 contained in the attachments as the “IEEE LTSC Requirements Spreadsheet” (the Spreadsheet).

The requirements proposed by the Open eBook Forum and the MPEG REL provide a useful perspective and validation of the basic capabilities for a DREL. Only the requirements from OeBF and MPEG REL that were specific to learning, education, and training are included in this document.

The functional requirements that are documented in the paragraphs that follow are broadly representative of the current needs of learning, education, and training. However, it is recognized that as rights-enabled infrastructure becomes widely deployed over time, new requirements may emerge. An important consideration is that eLearning technologies involve engagement of learners (and related stakeholders) with *processes* and *applications* as well as *content*. However, most requirements have hitherto been framed in terms of expressing rights associated with content.

Initially, five “use cases” were selected from the Spreadsheet as representative of the educational community. These were analyzed to establish an analysis process for the subcommittees’ interpretation of the intent of the remaining Use cases.

The DREL functional requirements analysis process focused on the need to specify *permissions* and *conditions* over *digital content* and reduced emphasis on *enforcement* or *implementation* mechanisms.

Associated with each requirement are references that comprise a concordance between the Spreadsheet and the listed requirement. This concordance is used to provide a crosswalk (see Table B.1) between the requirements identified by the subcommittee and the data represented in the use cases.

Table B.1—Crosswalk

Req.#	Spreadsheet use case numbers																		
	1	2	3	3.1	4	5	6.1	7	9	10	12	13	14	16	17	22	26	27	38
2.1.1						x													
2.1.2				x															
2.1.3					x					x			x						
2.1.4			x																
2.1.5							x												
2.1.6																			
2.1.7																			
2.1.8																			
2.2.1	x											x							
2.2.2	x											x							
2.2.3	x											x							
2.2.4	x																		
2.2.5			x																
2.2.6			x																
2.2.7			x																
2.3.1		x																	
2.4.1																			
2.4.2					x					x			x						
2.4.3					x														
2.4.4					x														
2.4.5					x		x												
2.4.6					x			x											

Table B.1—Crosswalk (*continued*)

Req. #	Spreadsheet use case numbers																		
	1	2	3	3.1	4	5	6.1	7	9	10	12	13	14	16	17	22	26	27	38
2.4.7													x						
2.4.8													x	x					
2.4.9																	x		
2.4.10																			x
2.4.11					x														
2.4.12			x																
2.4.13		x																	
2.4.14				x															
2.4.15				x					x										
2.4.16									x										
2.4.17				x													x	x	
2.4.18												x							
2.4.19																			
2.5.1								x		x				x	x				
2.6.1								x											

B.1.3 Definition of terms

Normative terminology is, of course, a key component of any language. However, this document is not a normative reference. The following terms are “defined” only with a view to help in overall readability of this annex.

content: Any resource that can be regarded as “containing” information and is independent of its structure and presentation.

Digital Rights Management: A broad term used to describe a process or a system for managing digital rights associated with digital content. DRM covers a wide range of activities including (but not limited to) the following:

- The use of a digital rights expression language
- The authentication of rights expressions, devices, users, and resources
- The association of rights expressions to digital content
- The protection of digital content from being used without rights

NOTE—It is important to note that the requirements for a DRM system are out of scope for this document.

Digital Rights Expression Language: A language in which expressions of permissions and conditions are specified to control the distribution or use of learning objects. The use of a DREL is one tool that is used in DRM systems. *The functional requirements of a DREL are the main focus of this document.*

learning content: Any material useful for creating, managing, or facilitating a learning experience regardless of medium, structure, or commercial status.

learning object: A term has been defined very broadly by the IEEE LTSC in the LOM standard for the purposes of creating metadata. Operationally, however, it is a term that has been widely adopted and used to distinguish digital assets that have some kind of learning objective and/or assessment associated with them. It is used in this latter sense below.

rights: Expressions that describe such things as permissions and conditions that are typically associated with the use of content.

B.1.4 References

IEEE Std 1484.12.1-2002, IEEE Standard for Learning Object Metadata
— http://shop.ieee.org/ieeestore/Product.aspx?product_no=SH95001

OeBF Rights and Rules Coordinated Requirements
— <http://www.idpf.org/specifications/rwgcoordinated.htm>

MPEG REL Requirements
— http://www.chiariglione.org/mpeg/working_documents/mpeg-21/requirements/RDD&REL_requirements.zip

IEEE LTSC DREL Analysis of Use Cases and Development of Functional Requirements
— <http://ltsc.ieee.org/wg4/materials.html>

IEEE LTSC DREL Requirements Spreadsheet
— <http://ltsc.ieee.org/wg4/materials.html>

B.2. Learning, education, and training requirements

This subclause contains the DREL functional requirements for the learning, education, and training community.

B.2.1 Attributes of the Digital Rights Expression Language

B.2.1.1 The DREL shall be based on a formal grammar.

B.2.1.2 The DREL shall allow the specification of version or update invariant constraints. The default shall be that constraints are persistent.

B.2.1.3 The DREL shall support the articulation of roles undertaken by users. Example: User may be associated with the role of “instructor” for an identified learning object.

B.2.1.4 The DREL shall support unique identifiers for learning objects.

B.2.1.5 The DREL shall support a single rights expression to apply to a class of learning objects. The DREL shall therefore support class definitions and affiliations.

- B.2.1.6** The DREL shall be extensible and allow alternative schemas wherever sensible to meet the future needs of the learning, education, and training community.
- B.2.1.7** The DREL shall define a minimal core set of primitive constructs from which all other expressions can be constructed or derived. For example, instead of defining pay-per-view, rent-to-own, and other such models, the core shall provide the fundamental building blocks to link constraints (e.g., payment) to actions, to allow constraints to repeat according to various criteria, provide metering syntax, etc.
- B.2.1.8** The DREL shall support the specification of constraints that can be used as defaults.

B.2.2 Aggregation and disaggregation of learning objects

Learning objects may be created through aggregation into more complex learning objects. Constraints may be associated with the learning objects employed in such aggregations allowing them to be reused. Therefore

- B.2.2.1** The DREL shall allow the specification of constraints for the aggregation or embedding of content within learning objects.
- B.2.2.2** The DREL shall allow the specification of constraints for the disaggregation of content within learning objects.
- B.2.2.3** The DREL shall allow the specification of constraints that must be preserved and propagated under aggregation or embedding.
- B.2.2.4** The DREL shall allow the specification of constraints for the use of the aggregated learning objects.
- B.2.2.5** The DREL shall allow specification of constraints associated with different levels of granularity in an aggregated learning object.
- B.2.2.6** The DREL shall allow specification of different identification schemes to uniquely identify different portions of an aggregated learning object.
- B.2.2.7** The DREL shall allow the specification of constraints requiring the retention of specific metadata as an integral component of a learning object.

B.2.3 Attribution

Learning objects may be created from other learning objects and may require attribution. Therefore

- B.2.3.1** The DREL shall allow the specification of attribution constraints associated with the use (aggregation, disaggregation, reference, etc) of learning objects.

B.2.4 Conditional use

- B.2.4.1** The DREL shall allow for the specification of a set of conditions that must be fulfilled before a right (or set of rights) can be exercised.
- B.2.4.2** The DREL shall allow the specification of heterogeneous constraints for access to learning objects by different individuals, groups as applicable.
- B.2.4.3** The DREL shall allow specification of constraints limiting the number of times learning objects can be used, accessed, distributed, and/or replicated.

- B.2.4.4** The DREL shall allow the specification of connectivity-based constraints, e.g., connection to an online service, web portal, web service, etc. associated with the use of learning objects.
- B.2.4.5** The DREL shall allow specification of device-based constraints, e.g., associated with the capabilities of specific reading systems or other applications, associated with the use of learning objects.
- B.2.4.6** The DREL shall allow the specification of anonymous access to learning objects.
- B.2.4.7** The DREL shall allow the specification of usage rights to learning objects for educational, research, and scholarly purposes.
- B.2.4.8** The DREL shall allow the specification of constraints associated with policies that may apply to individuals or groups.
- B.2.4.9** The DREL shall allow the specification of constraints associated with multi-tiered distribution, i.e., instances where learning objects are distributed by one entity that redistributes to other entities, of learning objects.
- B.2.4.10** The DREL shall support the unambiguous specification of time-based constraints such as specific times, fixed intervals, sliding intervals and metered intervals that can span across different time zones.
- B.2.4.11** The DREL shall support the specification of fees in industry standard terms.
- B.2.4.12** The DREL shall support the specification of information about portions of learning objects, including both identified portions and generic portions (such as “any five pages”) in order to support limiting rights to these certain portions.
- B.2.4.13** The DREL shall support distribution and management of free learning objects.
- B.2.4.14** The DREL shall support specifying a price, including a price of *free*, for unlimited usage of a learning object.
- B.2.4.15** The DREL shall support the specification of payment of a fee for each use of a learning object that may be constrained by connectivity-based conditions, e.g., connection to an online service, web portal, and web service.
- B.2.4.16** The DREL shall support subscription-based pricing and access to learning objects.
- B.2.4.17** The DREL shall support time-based pricing rules for learning objects.
- B.2.4.18** The DREL shall support the specification of learning object usage under a site-license.
- B.2.4.19** The DREL shall support the specification of constraints related to the manner in which the use of a learning object is supervised, e.g., a teacher supervises taking a test.

B.2.5 Tracking

- B.2.5.1** The DREL shall allow the specification of requirements for tracking access, usage, distribution, and purchase of content.

B.2.6 Offers

The ability to offer learning objects to individuals or groups of people is important within learning, education, and training community. The offers themselves can be subject to a variety of conditions such as fees, time, membership, etc. Furthermore, offers can specify additional constraints on the use of learning object being offered.

B.2.6.1 The DREL shall allow the specification of offers. Both the offers and the use of the learning objects may be subject to constraints.

B.3. Issues

Table B.2 is a list of issues that came up during the development of the functional requirements.

Table B.2—Issues

#	Issue	Description	Resolution
1	How are digital objects that extend beyond content supported by the DREs?	In the LET community, there are digital objects such as software applications whose use might need to be controlled. For example, Adobe Photoshop has hundreds of functions like auto-color, auto-brightness, image-size, crop, etc. Are these application functions to be controlled through the use of a DREL? Or are they out of scope?	

Annex C

(informative)

Mapping requirements to ODRL

Editor: Susanne Guth
Email: susanne.guth@wu-wien.ac.at
Date: 25 June 2004
Version 1.0

C.1. Introduction

This document outlines the response from the Open Digital Rights Language (ODRL) Initiative to the Digital Rights Expression Language (DREL) Requirements Version 1.0 (dated 30 January 2004) of the Learning Technology Standards Committee (LTSC). The submission is based on extensive research, development, and implementation experience with digital rights management systems by the supporters of the ODRL Initiative. The ODRL Initiative is confident the resultant submission meets and exceeds the expectations of the LTSC DREL working group and is committed to working with the LTSC in future development of the DREL specification.

This response refers to the following documents:

LTSC DREL Requirements Version 1.0
<http://ltsc.ieee.org/wg4/index.html>

LTSC DREL Use Case/Requirements Spreadsheet - Draft 4, 4 Dec 03
http://ltsc.ieee.org/wg4/files/DREL_Requirements_draft41.pdf

Open Digital Rights Language (ODRL) Version 1.1
<http://odrl.net/1.1/ODRL-11.pdf>

ODRL Rights Expression Language (REL) XML Schema
<http://odrl.net/1.1/ODRL-EX-11.xsd>

ODRL Rights Data Dictionary (RDD) XML Schema
<http://odrl.net/1.1/ODRL-DD-11.xsd>

C.2. Requirement mapping to ODRL

This annex contains the DREL functional requirements for the learning, education, and training community. Each requirement is mapped to the REL ODRL with a use case and ODRL code examples showing the ODRL implementation of the requirement. Please note that the XML code examples sometime omit the XML namespace prefixes due to clarity reasons.

C.2.1 Attributes of the Digital Rights Expression Language

This subclause contains the DREL functional requirements for the learning, education, and training community. Each requirement is mapped to the REL ODRL with a use case and ODRL code examples

showing the ODRL implementation of the requirement. Please note that the XML code examples sometime omit the XML namespace prefixes due to clarity reasons.

C.2.1.1 “The DREL shall be based on a formal grammar.”

The current ODRL specification version 1.1 formally specifies the ODRL language basics (grammar) and the ODRL core vocabulary or data dictionary (please also refer to 2.1.7).

Furthermore, the ODRL initiative is engaged in defining a “formal semantics” for ODRL which is different from a formal grammar. A formal semantics would represent rights expressions independent from a certain syntax, i.e., right expression language. A formal semantics is the basis for the formulation of state machines for ODRL rights expressions. State machines allow for an unambiguous interpretation of ODRL instances. Some work on this subject has already been published:

Riccardo Pucella and Vicky Weissman, A Formal Foundation for ODRL, Workshop on Issues in the Theory of Security (WITS'04), Barcelona, 2004.

Another publication with this subject was presented at the ODRL Workshop in Vienna:

M. Holzer, S. Katzenbeisser, C. Schallhart, Towards a formal semantics for ODRL, ODRL Workshop, Vienna, April 2004.

The specification of a formal semantics is planned to be part of ODRL version 2.

C.2.1.2 “The DREL shall allow the specification of version or update invariant constraints. The default shall be that constraints are persistent.”

The context element in ODRL allows for the specification of versions. The context element can be assigned to each ODRL element, such as assets, parties, permissions, constraints, etc.

The following ODRL example shows an offer for the asset “ODRL Specification,” more exactly for version 1.1 of the ODRL specification. The offer states that this version of the specification may be printed until the end of 2004. However, for special purposes, also versions for permission and/or constraint elements can be expressed. In the offer below, the permission and the constraint are related to the version number 0.7, which could represent special semantics of the permission “play” and the constraint “datetime.”

```
<?xml version="1.0" encoding="UTF-8"?>
<o-ex:rights xmlns:o-ex="http://odrl.net/1.1/ODRL-EX"
             xmlns:o-dd="http://odrl.net/1.1/ODRL-DD">
  <o-ex:offer>
    <o-ex:asset>
      <o-ex:context>
        <o-dd:name>ODRL Specification</o-dd:name>
        <o-dd:version>1.1</o-dd:version>
      </o-ex:context>
    </o-ex:asset type="work">
    <o-ex:permission>
      <o-ex:context>
        <o-dd:version>urn:univ:v0.7</o-dd:version>
      </o-ex:context>
    <o-dd:print/>
      <o-ex:constraint>
        <o-ex:context>
```

```
<o-dd:version>urn:univ:v0.7</o-dd:version>
  </o-ex:context>
    <o-dd:datetime>
      <o-dd:end>2004-12-31T00:00:00</o-dd:end>
    </o-dd:datetime>
  </o-ex:constraint>
</o-ex:permission>
</o-ex:offer>
</o-ex:rights>
```

Also via the *type* attribute of the ODRL element “asset” it can be further specified whether the asset is of the type “work,” “expression,” “manifestation” or “item. For details on the type attribute please refer to the ODRL specification version 1.1.

C.2.1.3 “The DREL shall support the articulation of roles undertaken by users. Example: User may be associated with the role of “instructor” for an identified learning object.”

The context element in ODRL allows for the specification of roles. The context element can be assigned to each ODRL element, such as assets, parties, permissions, constraints, etc.

The following ODRL example shows a license that allows all students to display the asset “ODRL Specification.”

```
<?xml version="1.0" encoding="UTF-8"?>
<o-ex:rights xmlns:o-ex="http://odrl.net/1.1/ODRL-EX"
  xmlns:o-dd="http://odrl.net/1.1/ODRL-DD">
  <o-ex:agreement>
    <o-ex:asset>
      <o-ex:context>
        <o-dd:name>ODRL Specification</o-dd:name>
      </o-ex:context>
    </o-ex:asset>
    <o-ex:permission>
      <o-dd:display/>
    </o-ex:permission>
    <o-ex:party>
      <o-ex:context>
        <o-dd:role>Student</o-dd:role>
      </o-ex:context>
    </o-ex:party>
  </o-ex:agreement>
</o-ex:rights>
```

C.2.1.4 “The DREL shall support unique identifiers for learning objects.”

The context element in ODRL allows for the specification of unique identifiers. The URI format is used for all identifiers. The context element can be assigned to each ODRL element, such as assets, parties, permissions, constraints, etc.

The following ODRL instance shows an offer for the Video on Project Management with the unique identifier **urn:univ:lr-wuw-video-1**. The video may be played without any constraints.

```
<?xml version="1.0" encoding="UTF-8"?>
<o-ex:rights xmlns:o-ex="http://odrl.net/1.1/ODRL-EX"
  xmlns:o-dd="http://odrl.net/1.1/ODRL-DD">
  <o-ex:offer>
    <o-ex:asset>
      <o-ex:context>
```

```
<o-dd:name> Video on Project Management</o-dd:name>
<o-dd:uid> urn:univ:lr-wuw-video-1</o-dd:uid>
</o-ex:context>
</o-ex:asset>
<o-ex:permission>
  <o-dd:play/>
</o-ex:permission>
</o-ex:offer>
</o-ex:rights>
```

C.2.1.5 “The DREL shall support a single rights expression to apply to a class of learning objects. The DREL shall therefore support class definitions and affiliations.”

Depending on the actual use case and implementation, this requirement can be supported differently.

1. Defining one asset type via the attribute “role” where permissions can be assigned. The following ODRL example shows a license that allows the student urn:univ:sguth to display all assets of the type “PowerPoint Presentations.”

```
<?xml version="1.0" encoding="UTF-8"?>
<o-ex:rights xmlns:o-ex="http://odrl.net/1.1/ODRL-EX"
  xmlns:o-dd="http://odrl.net/1.1/ODRL-DD">
  <o-ex:agreement>
    <o-ex:asset>
      <o-ex:context>
        <o-dd:role>Powerpoint Presentations</o-dd:role>
      </o-ex:context>
    </o-ex:asset>
    <o-ex:permission>
      <o-dd:display/>
    </o-ex:permission>
    <o-ex:party>
      <o-ex:context>
        <o-dd:uid>urn:univ:sguth</o-dd:uid>
        <o-dd:name>Susanne Guth</o-dd:name>
        <o-dd:role>Student</o-dd:role>
      </o-ex:context>
    </o-ex:party>
  </o-ex:agreement>
</o-ex:rights>
```

2. Defining multiple assets with an ID. In the following ODRL agreement, the permission “play” refers to all listed asset and is assigned to the party urn:univ:sguth. If no further references are given, the permissions refer to all listed assets, i.e., to urn:univ:lr-wuw-video-1 and urn:univ:lr-wuw-software-1. (Please also refer to the code example in 2.2.5.)

```
<?xml version="1.0" encoding="UTF-8"?>
<rights>
  <agreement>
    <asset id="Asset-01">
      <context>
        <uid>urn:univ:lr-wuw-video-1</uid>
      </context>
    </asset>
    <asset id="Asset-02">
      <context>
        <uid>urn:univ:lr-wuw-software-1</uid>
      </context>
    </asset>
```

```
<permission>
  <play>
</permission>
<party>
  <context>
    <uid>urn:univ:sguth</uid>
  </context>
</party>
</agreement>
</rights>
```

3. If various permissions shall not be formulated, another alternative is to bundle the learning objects within assets. In the following ODRL agreement, the permission play refers to the videos 1 to 5 and is assigned to the party urn:univ:sguth.

```
<?xml version="1.0" encoding="UTF-8"?>
<rights>
  <agreement>
    <asset>
      <context>
        <uid>urn:univ:lr-wuw-video-1</uid>
        <uid>urn:univ:lr-wuw-video-2</uid>
        <uid>urn:univ:lr-wuw-video-3</uid>
        <uid>urn:univ:lr-wuw-video-4</uid>
        <uid>urn:univ:lr-wuw-video-5</uid>
      </context>
    </asset>
    <permission>
      <play>
    </permission>
    <party>
      <context>
        <uid>urn:univ:sguth</uid>
      </context>
    </party>
  </agreement>
</rights>
```

4. Depending on the DRM system, a bundle of learning objects should have unique ID as well. In that case, the bundle is referenced in a rights expression as a single asset. In the following ODRL agreement, the permission display refers to the bundle urn:univ:group-of-assets-2222B and is assigned to the party urn:univ:sguth.

```
<?xml version="1.0" encoding="UTF-8"?>
<o-ex:rights xmlns:o-ex="http://odrl.net/1.1/ODRL-EX"
             xmlns:o-dd="http://odrl.net/1.1/ODRL-DD">
  <o-ex:agreement>
    <o-ex:asset >
      <o-ex:context>
        <o-dd:uid>urn:univ:group-of-assets-2222B</o-dd:uid>
      </o-ex:context>
    </o-ex:asset>
    <o-ex:permission>
      <o-dd:display/>
    </o-ex:permission>
    <o-ex:party>
      <o-ex:context>
        <o-dd:uid>urn:univ:sguth</o-dd:uid>
      </o-ex:context>
    </o-ex:party>
  </o-ex:agreement>
</o-ex:rights>
```

```
    </o-ex:context>  
  </o-ex:party>  
  </o-ex:agreement>  
</o-ex:rights>
```

They key point made in ODRL is that it tries not to be an identification language (as well as a REL). So ODRL just uses the “power” of the UDI (e.g., with an URI) to identify (a single object or group of objects). For referencing packaged learning objects, the SCORM specification (<http://www.adlnet.org/>) could be (re-) used in ODRL rights expressions.

C.2.1.6 “The DREL shall be extensible and allow alternative schemas wherever sensible to meet the future needs of the learning, education, and training community.”

As ODRL is defined in XML schemas ODRL is extensible by definition. To extend the language semantics and vocabulary sub-schemas of ODRL have to be defined, respectively other XML namespaces can be imported into ODRL instances. ODRL itself already reuses the XML Signature specification of the W3C to specify digital signature information within ODRL instances, i.e., electronic contract or tickets. Alternative schemas that could be used to e.g., further specify the assets and the learning objects are the Dublin Core or LTSC LOM standard, respectively the vCard standard.

C.2.1.7 “The DREL shall define a minimal core set of primitive constructs from which all other expressions can be constructed or derived. For example, instead of defining pay-per-view, rent-to-own, and other such models, the core shall provide the fundamental building blocks to link constraints (e.g., payment) to actions, to allow constraints to repeat according to various criteria, provide metering syntax, etc.”

ODRL is designed just like that. The ODRL language is defined in two XML schemas.

- One is called ODRL Expression Language XML Schema, which defines the building blocks or “grammar”⁴ of ODRL, containing assets, parties, permissions, constraints, etc. and their relations.
- The second one is called ODRL Data Dictionary XML Schema, which defines the ODRL data dictionary⁵, including terms, such as print, sell, display etc for the language element “permission.” This data dictionary can be easily extended by writing a subschema.

C.2.1.8 “The DREL shall support the specification of constraints that can be used as defaults.”

ODRL does not differentiate “who” is writing constraints at what time into the ODRL rights expression. Whether constraints have been entered by default, or by the authors they have the same syntax and place in the rights expression. Having a default constraint seem to depend on whether the software is entering a constraint by default if the authors/rightsholders did not do so. Default constraints could be implemented via rights expression templates that are offered to the customers.

To understand this requirement completely there has been a discussion with the LTSC working group. The author of the document understands the requirement as follows: “A collection of learning resources shall receive certain rights, which can be overridden, extended or restricted by additional rights expressions that are assigned to individual resources within the collection.” For this purpose, ODRL offers the concept of “inheriting” rights. **Please note that this is not an official clarification of the LTSC requirement 2.1.8.**

⁴ Linguists would call the building blocks the “syntax” of the language.

⁵ Linguists would call the data dictionary the “lexis” or vocabulary of the language.