ODRL Initiative Response to LTSC DREL Requirements

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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 January 30, 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

2 Requirement Mapping to ODRL

This section contains the DREL functional requirements for the learning, education, and training community. Each requirements 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 clearity reasons.

2.1 Attributes of the Digital Rights Expression Language

2.1.1 "The DREL shall be based on a formal grammar. [5]"

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.

2.1.2 "The DREL shall allow the specification of version or update invariant constraints. The default shall be that constraints are persistent. [3.1]"

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 elememts 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.

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. [OeBF 2.2.9 Users and roles], [4], [10], [14]”

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>
```

2.1.4 “The DREL shall support unique identifiers for learning objects. [OeBF 2.3.1 Identifiers], [3]”

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>
```

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. [OeBF 2.4.1 Object classes], [6.1]"

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 to. 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. Or if not various permissions shall be formulated, an other 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>
```

They key point made in ODRL is that it tries not to be an identification language (as well as a REL). So ODRL just use 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.

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. [OeBF 2.2.3 Extensibility]"

As ODRL is defined in XML schemas ODRL is extensible by definition. To extend the language semantics and vocabulary subschemas 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.

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. [OeBF 2.2.8 Core primitives]"

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

- One is called ODRL Expression Language XML Schema that defines the building blocks or "grammar"[1] 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 dictionary[2], including terms, such as print, sell, display etc for the language element "permission". This data dictionary can be easily extended by writing a subschema.

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**. An example is given below in which the first rights expression specifies the "play" permission for the identified asset `urn:example:asset:007`. The second rights expression is assigned to an asset with the unique ID `urn:example:asset:007-Part1` which is related to the first asset, and it specifies that the rights for the first asset should be inherited by the second asset.

The expression also indicates not to override the inherited rights (the default), hence, the complete rights for the second asset includes the "play" and "give" permissions for the asset `urn:example:asset:007`. If the second expression did indicate to override the inherited rights, then the only permissions for the second asset would be "give". For details about the attributes "default" and "override" please refer to the ODRL Specification version 1.1.

```
<rights>
     <offer>
          <asset>
               <context>
                    <uid>urn:example:asset:007</uid>
               </context>
          </asset>
          <permission>
               <play/>
          </permission>
```

[1] Linguists would call the building blockst the „syntax" of the language.
[2] Linguists would call the data dictionary the "lexis" or vocabulary of the language.

```
     </offer>
</rights>

<rights>
     <offer>
          <asset>
               <context>
                    <uid>urn:example:asset:007-Part1</uid>
               </context>
               <inherit override="false" default="false">
                    <context>
                         <uid>urn:example:asset:007</uid>
                    </context>
               </inherit>
          </asset>
          <permission>
               <give/>
          </permission>
     </offer>
</rights>
```

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

2.2.1 "The DREL shall allow the specification of constraints for the aggregation or embedding of content within learning objects, [1], [13]"

The ODRL data dictionary comprises the definition of the right "aggregation" that can be assigned to parties. The right aggregate is defined as follows:

"The act of using an asset (or parts of it) as part of a composite work or collection. "

This right can then be constraint like any other right. For example by time. In the following ODRL example the party `urn:univ:sguth` may aggregate the asset `urn:univ:lr-wuw-video-1` until the end of year 2004.

```
<?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:lr-wuw-video-1</o-dd:uid>
      </o-ex:context>
    </o-ex:asset>
    <o-ex:permission>
      <o-dd:aggregate>
          <o-ex:constraint>
               <o-dd:datetime>
                    <o-dd:end>2004-12-31T00:00:00</o-dd:end>
```

```
                </o-dd:datetime>
            </o-ex:constraint>
          <o-dd:aggregate>
      </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>
```

2.2.2 "The DREL shall allow the specification of constraints for the disaggregation of content within learning objects, [1], [13]"

The ODRL data dictionary does not comprises the definition of a right that refers to "dis-aggregation". An extension of the ODRL data dictionary would be necessary in this case. Still the language concept then allows to assign constraint to the "new" right.

The following ODRL code example shows how the ODRL data dictionary can be extended. The ODRL instance imports a fictitious XML namespace (prefix "ext") that defines the XML element "disaggregate", which can from then on be used in the ODRL instance. The ODRL license below states that the party `urn:univ:sguth` may disaggregate the asset `urn:univ:lr-wuw-package-1` with a constraint. The constraint says that it is required to make an attribution to the disaggregated asset that holds the original package ID.

```
<?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">
             xmlns:ext="http://someInitiative.net/Vocabulary">
  <o-ex:agreement>
     <o-ex:asset>
      <o-ex:context>
           <o-dd:uid> urn:univ:lr-wuw-package-1</o-dd:uid>
      </o-ex:context>
    </o-ex:asset>
    <o-ex:permission>
      <ext:disaggregate>
        <o-ex:requirement>
          <o-dd:attribution>
            <o-ex:context>
               <o-dd:remark>
                 If the package is disaggregated a reference to
                 the original package ID has to be made in the
                 resulting asset.
               </o-dd:remark>
            </o-ex:context>
          </o-dd:attribution>
       </o-ex:requirement>
      </ext:disaggregate>
```

```
    </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>
```

2.2.3 "The DREL shall allow the specification of constraints that must be preserved and propagated under aggregation or embedding, [1], [13]"

The ODRL data dictionary comprises the definition of the right "aggregation" that can be assigned to parties (See also 2.21). This right can then be constrained like any other right. For the current requirement a constraint is needed that expresses that a right has to be preserved under aggregation. There is no constraint that is called "preserve" in the default vocabulary of ODRL 1.1. Therefore, to show a possible solution for such a use case a fictitious namespace (prefix "ext") was added to the ODRL instance.

In the following ODRL example the asset `urn:univ:lr-wuw-video-1` can be aggregated by `urn:univ:sguth` until the end of year 2004 and under aggregation the current rights have to be preserved.

```
<?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">
             xmlns:ext="http://someInitiative.net/Vocabulary">
  <o-ex:agreement>
     <o-ex:asset>
      <o-ex:context>
           <o-dd:uid> urn:univ:lr-wuw-video-1</o-dd:uid>
      </o-ex:context>
    </o-ex:asset>
    <o-ex:permission>
      <o-dd:aggregate>
          <o-ex:constraint>
               <o-dd:datetime>
                    <o-dd:end>2004-12-31T00:00:00</o-dd:end>
               </o-dd:datetime>
               <ext:preserverights/>
          </o-ex:constraint>
      <o-dd:aggregate>
    </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>
```

2.2.4 "The DREL shall allow the specification of constraints for the use of the aggregated learning objects. [1]"

In this case we suggest to issue a permission that allows aggregation and a certain usage right (here play). Both rights can be constrained. (Or each right can be constrained separately, as shown in req. 2.2.1). In the following ODRL example the asset `urn:univ:lr-wuw-video-1` can be aggregated and/or played by `urn:univ:sguth` until the end of year 2004.

```
<?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:lr-wuw-video-1</o-dd:uid>
      </o-ex:context>
    </o-ex:asset>
    <o-ex:permission>
      <o-dd:play/>
      <o-dd:aggregate/>
      <o-ex:constraint>
          <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: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>
```

2.2.5 "The DREL shall allow the specification of constraints associated with different levels of granularity in an aggregated learning object, [3]"

For the requirement 2.1.5 we already introduced how to describe a complex asset. Here again the aggregated learning object consists of the two assets: the video `urn:univ:lr-wuw-video-1` and the software `urn:univ:lr-wuw-software-1`. The license additionally shows three permissions and the party Department of IS (`urn:univ:department-IS`). The first permission "forAsset01" states that the video may be played without constraints. The second permission "forAsset02" states that the software may be executed on the machine with the cpu `urn:univ:mac-11ab33` and finally the third permission "forPackage" states that the whole package may be duplicated until the end of 2004.

```
<?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 id= »forAsset01 »>
      <asset idref= »Asset-01 »/>
      <play>
  </permission>

  <permission id= »forAsset02 »>
      <asset idref="Asset-02"/>
      <execute>
         <constraint>
           <cpu>
             <context>
               <uid> urn:univ:mac-11ab33</uid>
             </context>
           </cpu>
        </constraint>
      </execute>
  </permission>


 <permission id="forPackage">
      <asset idref="Asset-01"/>
      <asset idref="Asset-02"/>
      <duplicate>
       <constraint>
           <datetime>
             <end>2004-12-31T00:00:00</end>
           </datetime>
       </constraint>
      </duplicate>
</permission>

<party>
      <context>
        <uid>urn:univ:department-IS</uid>
      </context>
 </party>
</agreement>
</rights>
```

2.2.6 "The DREL shall allow specification of different identification schemes to uniquely identify different portions of an aggregated learning object, [3]"

This requirement has indirectly already been addressed in an earlier use case, please refer to the code example given in 2.2.5. The code example shows an aggregated learning object that

consists of the two assets: the video `urn:univ:lr-wuw-video-1` and the software `urn:univ:lr-wuw-software-1.` Both portions of the learning object have a unique local id "Asset-01" and "Asset-02" and a unique global id "`urn:univ:lr-wuw-video-1`" and "`urn:univ:lr-wuw-software-1`". Thus different identification schemes are provided, which allow a unique global identification and furthermore a local identification, e.g. for relating different permissions to different portions of the aggregated learning object (as shown in 2.2.5).

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. [3]"

In ODRL it is easy to express constraints to any kind of resource. In this case the meta data the meta data ist he resource and simply requires an id. Thus, any constraint can be assigned to the metadata. See an example below that, for example, satisfies the OAI community, as their need is to specify rights over metadata. The given meta data has the id `urn:uniA:lo-B-metadata987` and the permission states that the meta data may be harvested only if the meta data is kept with the learning object.

```
<?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">
             xmlns:oai="http://oaiInitiative.net/Vocabulary">
<o-ex:rights>
  <o-ex:offer>
     <o-ex:asset>
        <o-ex:context>
          <o-dd:uid> urn:uniA:lo-B-metadata987 </o-dd:uid>
        </o-ex:context>
     </o-ex:asset>
     <o-ex:permission>
        <oai:harvest>
           <o-ex:constraint>
              <oai:must-keep-metadata-with-lo/>
            </o-ex:constraint>
        </oai:harvest>
     </o-ex:permission>
  </o-ex:offer>
</o-ex:rights>
```

2.3 Attribution

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

2.3.1 "The DREL shall allow the specification of attribution constraints associated with the use (aggregation, dis-aggregation, reference, etc) of learning objects [2]"

The ODRL data dictionary comprises the definition of the requirement "attribution" that can be assigned to rights. The requirement attribution is defined as follows:

"The use of the asset must always include attribution of the asset owners."

The following ODRL code example states that the asset (learning object) `ODRLMapping to LTSC Requirements` may be modified by `urn:univ:mstrembe` with the constraint that an attibution has to be made to the new asset.

```
<?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.ieee.ltsc.odrlmapping.v1</o-dd:uid>
       <o-dd:name>ODRLMapping to LTSC Requirements</o-dd:name>
    </o-ex:asset>
    <o-ex:permission>
      <o-dd:modify>
        <o-ex:requirement>
          <o-dd:attribution>
            <o-ex:context>
               <o-dd:remark>
          The LTSC Requirement mapping to ODRL has been
          originally created by S.Guth.
               </o-dd:remark>
            </o-ex:context>
          </o-dd:attribution>
       </o-ex:requirement>
     </o-dd:modify>
    </o-ex:permission>
    <o-ex:party>
        <o-ex:context>
           <o-dd:uid>urn:univ:mstrembe</o-dd:uid>
      </o-ex:context>
    </o-ex:party>
  </o-ex:agreement>
</o-ex:rights>
```

2.4 Conditional Use

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. [OeBF 2.6.1 Conditions]"

The ODRL language concept defines the "requirements" for this purpose. In the following example the right play may be performed to the resource `urn:univ:lr-wuw-video-1` by the party `urn:univ:sguth` **after** the payment of € 100,-- has been made.

```
<?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:lr-wuw-video-1</o-dd:uid>
```

```
      </o-ex:context>
    </o-ex:asset>
    <o-ex:permission>
      <o-dd:play>
        <o-ex:requirement>
          <o-dd:prepay>
            <o-dd:payment>
             <o-dd:amount currency="EUR">100.00</o-dd:amount>
            </o-dd:payment>
          </o-dd:prepay>
        </o-ex:requirement>
      </o-dd:play>
    </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>
```

2.4.2 "The DREL shall allow the specification of heterogeneous constraints for access to learning objects by different individuals, groups as applicable. [4], [10], [14]"

For the mapping of this requirement, please refer to Section 2.4.8, as this requirement can be expressed analogously.

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. [4]"

The ODRL data dictionary defines the constraint "count" for this purpose. In the following example the user `urn:univ:sguth` may perform the right play to the asset `urn:univ:lr-wuw-video-1` only five times. The count constraint can be used to analoguously narrow replication, usage, access, distribution permissions.

```
<?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:lr-wuw-video-1</o-dd:uid>
      </o-ex:context>
    </o-ex:asset>
    <o-ex:permission>
      <o-dd:play>
        <o-ex:constraint>
          <o-dd:count>5</o-dd:count>
        </o-ex:constraint>
      </o-dd:play>
    </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>
```

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. [4]"

The ODRL data dictionary comprises the definition of the constraint "software" that can be assigned to permissions. The constraint "software" is defined as follows:

"An identifiable software application that must be present. Use Context to identify the device.

In the following ODRL code example the party `urn:univ:sguth` may play the video `urn:univ:lr-wuw-video-1` only with the web service that is running on port 8085 of `http://ws.universal.org`.

```
<?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:lr-wuw-video-1</o-dd:uid>
      </o-ex:context>
    </o-ex:asset>
    <o-ex:permission>
     <o-dd:play>
      <o-ex:constraint>
       <o-dd:software>
        <o-ex:context>
        <o-dd:service>ws.universal.org:8085</o-dd:service>
        </o-ex:context>
       </o-dd:software>
      </o-ex:constraint>
     </o-dd:play>
    </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>
```

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 [4], [6.1]"

The ODRL data dictionary defines several device based constraints, such as cpu, network, screen, memory, printer, etc. For example, the definition of the constraint "cpu" that can be assigned to permissions is defined as follows:

"An identifiable computing system with a central processing unit (CPU). Use Context to identify the device."

In the following ODRL code example the party `urn:univ:sguth` may play the video `urn:univ:lr-wuw-video-1` only on the machine with the CPU `urn:univ:mac-11ab33`.

```
<?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:lr-wuw-video-1</o-dd:uid>
      </o-ex:context>
    </o-ex:asset>
    <o-ex:permission>
     <o-dd:play>
        <o-ex:constraint>
          <o-dd:cpu>
            <o-ex:context>
              <o-dd:uid> urn:univ:mac-11ab33</o-dd:uid>
            </o-ex:context>
          </o-dd:cpu>
       </o-ex:constraint>
     </o-dd:play>
    </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>
```

2.4.6 "The DREL shall allow the specification of anonymous access to learning objects. [4], [7]"

This requirement can be coded in ODRL by assigning rights to a mission or role-specific party. In the following example the resource `urn:univ:lr-wuw-video-1` may be played by all parties that have the role "guest".

```
<?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:lr-wuw-video-1</o-dd:uid>
      </o-ex:context>
    </o-ex:asset>
    <o-ex:permission>
     <o-dd:play/>
    </o-ex:permission>
    <o-ex:party>
        <o-ex:context>
           <o-dd:role>guest</o-dd:role>
      </o-ex:context>
    </o-ex:party>
  </o-ex:agreement>
</o-ex:rights>
```

2.4.7 "The DREL shall allow the specification of usage rights to learning objects for educational, research, and scholarly purposes [14]"

The ODRL data dictionary comprises the definition of the constraint "purpose" that can be assigned to permissons. The constraint "purpose" is defined as follows:

"Specification of a specific purpose to which the usage is constrained."

In the following ODRL code example the party `urn:univ:sguth` may play the video `urn:univ:lr-wuw-video-1` only for the purpose `urn:anta.gov.au:vocab:public-edu`, that is educational purposes.

```
<?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:lr-wuw-video-1</o-dd:uid>
      </o-ex:context>
    </o-ex:asset>
    <o-ex:permission>
     <o-dd:play>
       <o-ex:constraint>
        <o-dd:purpose>
          <o-ex:context>
          <o-dd:uid>urn:anta.gov.au:vocab:public-edu</o-dd:uid>
        </o-ex:context>
        </o-dd:purpose>
       </o-ex:constraint>
     </o-dd:play>
    </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>
```

2.4.8 "The DREL shall allow the specification of constraints associated with policies that may apply to individuals or groups, [14], [16]"

After discussing this requirement with the LTSC working group on DREL, I understood, that the following is meant by the requirement:

"A DREL shall be able to express sets of constraints that apply to individuals, and it shall be able to express sets of constraints that apply to groups."

The following ODRL example shows different requirements, respectively constraints for different users or user groups. In ODRL this requirement can be implemented by using containers. In containers that are of the "ex-or" type, the application must choose one of the alternatives in the container, i.e. the DRM system has to decide what constraint has to be taken. The first set of constraints (or requirements) should apply to company members and the second set of constraints should apply to the individual `urn:univ:sguth`. The code example states that company members may print the training note `urn:univ:lr-wuw-trainignnotes-1` for € 0.50 and the individual `urn:univ:sguth` may print for € 1.00.

```
<?xml version="1.0" encoding="UTF-8"?>
<rights>
<offer>
 <asset>
      <context>
       <uid> urn:univ:lr-wuw-trainignnotes-1</uid>
       </context>
 </asset>
 <permission>
   <print>
    <container type='ex-or'>
        <container type='and'>
           <constraint>
                 <group>
                   <context>
                       <role>CompanyMember</role>
                    </context>
                 </group>
            </constraint>
            <requirement>
                <prepay>
                    <payment>
                       <amount currency="EUR">0.50</amount>
                     </payment>
                 </prepay>
             </requirement>
        </container>
        <container type='and'>
           <constraint>
                 <individual>
                   <context>
```

```
                    <uid> urn:univ:sguth </uid>
                  </context>
                </individual>
            </constraint>
            <requirement>
                <prepay>
                    <payment>
                       <amount currency=”EUR”>1.00</amount>
                     </payment>
                </prepay>
            </requirement>
        </container>
    </container>
  </print>
 </permission>
</offer>
</rights>
```

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 who re-distributes to other entities, of learning objects. [26]”

The ODRL data dictionary includes the definition of various transfer rights. A transfer indicates a set of procedures in which the rights over the asset can be transferred. The ODRL data dictionary support the transfer rights sell, lend, give, lease. Those rights can be constraint as any other usage right. In the example below, the further distribution of the asset `urn:univ:lr-wuw-video-1` is constrained from the beginning of 1st Jan 2005.

```
<?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:lr-wuw-video-1</o-dd:uid>
      </o-ex:context>
    </o-ex:asset>
    <o-ex:permission>
     <o-dd:play>
     <o-dd:give>
        <o-ex:constraint>
          <o-dd:datetime>
             <o-dd:start>2005-01-01T00:00:00</o-dd:start>
          </o-dd:datetime>
       </o-ex:constraint>
     </o-dd:give>
    </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>
```

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. [OeBF 2.6.2 Time-based conditions], [38]"

The ODRL data dictionary comprises three different temporal constraints that can be assigned to rights. The temporal constraints are time limits within which any entity can function and are defined as follows:

1. datetime: A date and/or time-based range. Date and Time value of "datetime" must conform to [ISO8601]. Contains the following sub entities:

- start - the beginning of the range (inclusive)
- end - the end of the range (inclusive)
- fixed - an exact point in date/time

If there is no "start" and/or "end" value, then the range is open-ended. Note: "start" must always be less than or equal to "end" and one must always be present if there is no "fixed" value. "fixed" can only appear by itself.

The listing below shows the use of an asset with a "datetime" constraint. The right play may be performed to the asset `urn:univ:lr-wuw-video-1` by the party `urn:univ:sguth` from 31st Dez 2004 until 31st Dez 2004 Central European Time (+1:00).

```
<?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:lr-wuw-video-1</o-dd:uid>
      </o-ex:context>
    </o-ex:asset>
    <o-ex:permission>
     <o-dd:play>
      <o-ex:constraint>
       <o-dd:datetime>
        <o-dd:start>2004-12-31T00:00:00+01:00</o-dd:start>
        <o-dd:end>2005-12-31T00:00:00+01:00</o-dd:end>
       </o-dd:datetime>
      </o-ex:constraint>
     </o-dd:play>
    </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>
```

2. accumulated: A date and/or time-based range. The maximum period of metered usage time. Period value must conform to [ISO8601]. For example "P30H" indicates a 30 hour period.

The listing below shows the use of an asset with the "accumulated" constraint. The right play may be performed to the asset `urn:univ:lr-wuw-video-1` by the party `urn:univ:sguth` for an accumulated 30 hour period.

```
<?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:lr-wuw-video-1</o-dd:uid>
      </o-ex:context>
    </o-ex:asset>
    <o-ex:permission>
     <o-dd:play>
       <o-ex:constraint>
        <o-dd:accumulated>P30H</o-dd:accumulated>
       </o-ex:constraint>
     </o-dd:play>
    </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>
```

3. interval: Recurring period of time in which the rights can be exercised. Date and Time value must conform to [ISO8601]. For example "P7D" indicates a 7-day period.

The listing below shows the use of an asset with the "interval" constraint. The right "play" may be performed to the asset `urn:univ:lr-wuw-video-1` by the party `urn:univ:sguth` for a 7-day period.

```
<?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:lr-wuw-video-1</o-dd:uid>
      </o-ex:context>
    </o-ex:asset>
    <o-ex:permission>
     <o-dd:play>
       <o-ex:constraint>
        <o-dd:interval>P7D</o-dd:interval>
       </o-ex:constraint>
```

```
      </o-dd:play>
    </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>
```

2.4.11 The DREL shall support the specification of fees in industry standard terms. [OeBF 2.6.6 Fee-based usage], [4]

The ODRL data dictionary comprises three different payment requirements that can be assigned to rights:

1. **prepay** The amount due prior to the granting/use of the rights. Use Payment entity to specify the payment. Temporal constraints may also be used.
2. **postpay** The amount due after the use of the rights. Use Payment entity to specify the payment. Temporal constraints may also be used.
3. **peruse** The amount due for each use of the granted rights. Use Payment entity to specify the payment.

The payment element may further specify the prepay, postpay and peruse requirement with amount, currency, taxpercent and tax code. The listing below states that the video `urn:univ:lr-wuw-video-1` may be played by the party `urn:univ:sguth` after the payment of € 20.00 has been made.

```
<?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:lr-wuw-video-1</o-dd:uid>
      </o-ex:context>
    </o-ex:asset>
    <o-ex:permission>
        <o-dd:play>
         <o-ex:requirement>
          <o-dd:prepay>
           <o-dd:payment>
            <o-dd:amount currency="EUR">20.00</o-dd:amount>
           </o-dd:payment>
          </o-dd:prepay>
         </o-ex:requirement>
        </o-dd:play>
    </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>
```

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 5 pages") in order to support limiting rights to these certain portions. [OeBF 2.6.7 Portion-based usage], [3]"

The ODRL data dictionary includes the definition of the aspect constraint "unit" that can be assigned to rights. The constraint "unit" is defined as follows:

Specification of constraints on the whole asset or sub-parts of the asset. "Unit" contains the following attribute:

- **type** - the classification of the sub-unit part type. The values for the type attribute must be from a well known vocabulary and represented as a URI.

If constraint elements have further child elements, the child element applies to the parent constraint. In the following example the user `urn:univ:sguth` may display not the entire book, but "any 5 pages" of the book `urn:univ:lr-wuw-book-1`. The vocabulary for the unit type `NumberOfPages` has been taken from an ONIX vocabulary.

```
<?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:lr-wuw-book-1</o-dd:uid>
       </o-ex:context>
    </o-ex:asset>
    <o-ex:permission>
        <o-dd:display>
            <o-ex:constraint>
              <o-dd:unit o-ex:type="onix:NumberOfPages">
                  <o-ex:constraint>
                        <o-dd:range>
                              <o-dd:min>1</o-dd:min>
                              <o-dd:max>5</o-dd:max>
                        </o-dd:range>
                  </o-ex:constraint>
              </o-dd:unit>
          </o-ex:constraint>
        </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>
```

2.4.13 "The DREL shall support distribution and management of free learning objects. [OeBF 2.7.1 Free objects], [2]"

To express the free usage of a learning object, simply the payment requirement element is left out (first ODRL code example). To make the free use more explicit the amount of the payment requirement can be set to zero (second ODRL code example).

The listing below states that the video `urn:univ:lr-wuw-video-1` may be played by the party `urn:univ:sguth` without constraints or payment requirements.

```
<?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:lr-wuw-video-1</o-dd:uid>
      </o-ex:context>
    </o-ex:asset>
    <o-ex:permission>
        <o-dd:play/>
    </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>
```

The listing below states that the video `urn:univ:lr-wuw-video-1` may be played by the party `urn:univ:sguth` without constraints or payment requirements. The payment requirements have explicitely been set to zero.

```
<?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:lr-wuw-video-1</o-dd:uid>
      </o-ex:context>
    </o-ex:asset>
    <o-ex:permission>
        <o-dd:play>
         <o-ex:requirement>
          <o-dd:prepay>
           <o-dd:payment>
            <o-dd:amount currency="EUR">0.00</o-dd:amount>
           </o-dd:payment>
          </o-dd:prepay>
         </o-ex:requirement>
        </o-dd:play>
    </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>
```

2.4.14 "The DREL shall support specifying a price, including a price of "free", for unlimited usage of a learning object. [OeBF 2.7.2 Unlimited use for a fee], [4]"

Unlimited usage is expressed via leaving out the constraints. In the example below the video `urn:univ:lr-wuw-video-1` may be played by the party `urn:univ:sguth` without constraints (unlimited) or requirements ("for free"). For a price of "free", please refer to the second example of 2.4 13.

```
<?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:lr-wuw-video-1</o-dd:uid>
      </o-ex:context>
    </o-ex:asset>
    <o-ex:permission>
        <o-dd:play/>
    </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>
```

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, web service, etc. [OeBF 2.7.4 Pay per use], [4], [10]"

For an overview of expressing payments, please refer to Section 2.4.11. Constraints and requirements can be either assigned to one particular right (see example below) or to all granted rights in one permission. In the following example the rights "play" and "duplicate" both are constrained to the software service `http://www.universal.org/` but each right has different payment requirements. The party `urn:univ:sguth` has to pay € 1.00 for playing the video `urn:univ:lr-wuw-video-1` once and has to pay € 10.00 each time the video is duplicated.

```
<?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:lr-wuw-video-1</o-dd:uid>
      </o-ex:context>
    </o-ex:asset>
    <o-ex:permission>

     <o-dd:play>
      <o-ex:requirement>
        <o-dd:peruse>
          <o-dd:payment>
           <o-dd:amount currency="EUR">1.00</o-dd:amount>
           </o-dd:payment>
        </o-dd:peruse>
      </o-ex:requirement>
     </o-dd:play>

     <o-dd:duplicate>
      <o-ex:requirement>
        <o-dd:peruse>
          <o-dd:payment>
           <o-dd:amount currency="EUR">10.00</o-dd:amount>
           </o-dd:payment>
        </o-dd:peruse>
      </o-ex:requirement>
     </o-dd:duplicate>

     <o-ex:constraint>
       <o-dd:software>
        <o-ex:context>
        <o-dd:service>http://www.universal.org/</o-dd:service>
        </o-ex:context>
       </o-dd:software>
     </o-ex:constraint>

    </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>
```

2.4.16 "The DREL shall support subscription-based pricing and access to learning objects. [OeBF 2.7.5 Subscription], [10]"

This requirement is supported by ODRL via assigning rights to a specific role, e.g., students, subscribers, teachers, etc. The ODRL expression below grants the right to "play" the video `urn:univ:lr-wuw-video-1` within the fixed subscription interval of e.g., 31st Dec. 2004 and 31st Dec. 2005 to the role "subscriber".

```
<?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:lr-wuw-video-1</o-dd:uid>
      </o-ex:context>
    </o-ex:asset>
    <o-ex:permission>
     <o-dd:play>
      <o-ex:constraint>
       <o-dd:datetime>
        <o-dd:start>2004-12-31T00:00:00+01:00</o-dd:start>
        <o-dd:end>2005-12-31T00:00:00+01:00</o-dd:end>
       </o-dd:datetime>
      </o-ex:constraint>
     </o-dd:play>
    </o-ex:permission>
    <o-ex:party>
        <o-ex:context>
           <o-dd:role>subscriber</o-dd:role>
        </o-ex:context>
    </o-ex:party>
  </o-ex:agreement>
</o-ex:rights>
```

2.4.17 "The DREL shall support time-based pricing rules for learning objects. [OeBF 2.7.6 Time-based pricing], [4], [27], [38]"

This requirement is provided by joining temporal constraints and payment requirements within containers. To express a payment requirement, for example, that is dependent from the current local time the following ODRL expression would be used. Here, to play the video `urn:univ:lr-wuw-video-1` costs a student € 0.50 in the morning (from 0.00 hours to 12:00 hours) and € 0.90 in the afternoon (from 12:00 hours to 24:00 hours).

```
<rights>
  <agreement>
    <asset>
      <context>
       <uid>urn:univ:lr-wuw-video-1</uid>
      </context>
    </asset>
    <permission>
     <play>
      <requirement>
         <container type="ex-or">
            <container type="and">
               <peruse>
                  <payment>
                      <amount currency="EUR">0.50</amount>
                  </payment>
               </peruse>
```

```
              <datetime>
                 <start>00:00:00<start>
                 <end>12:00:00</end>
              </datetime>
           </container>
           <container type="and">
              <peruse>
                 <payment>
                   <amount currency="EUR">0.90</amount>
                 </payment>
              </peruse>
              <datetime>
                  <start>12:00:00<start>
                  <end>24:00:00</end>
              </datetime>
            </container>
         </container>
       </requirement>
     </play>
   </permission>
   <party>
       <context>
         <role>student</role>
        </context>
  </agreement>
</rights>
```

2.4.18 "The DREL shall support the specification of learning object usage under a site-license. [OeBF 2.7.8 Site licensing], [14]"

Implementing such a requirement in ODRL depends on how a "site" is identified in the system that processes the ODRL expression. A site could be identified by a certain subnetwork, which can be identified via a range of IP addresses. Another way to identify a "site" is to identify a certain group of people. The ODRL code below shows the implementation of both cases. The first example shows an ODRL instance that restricts the right play to the group of people with the ID `urn:wu-wien:is` which could be the "site" of the department of information systems at Vienna University. In the second example the right play is restricted via the network constraint to a site. The "site" is identified by all computers that have an IP address beginning with 137.208.224.

Identifying a site via the group constraint:

```
<rights>
  <agreement>
    <asset>
      <context>
       <uid>urn:univ:lr-wuw-video-1</uid>
      </context>
    </asset>
    <permission>
     <play>
      <constraint>
```

```
        <group>
          <context>
            <uid>urn:wu-wien.ac.at:is</uid>
          </context>
        </group>
      </constraint>
    </play>
   </permission>
  </agreement>
</rights>
```

Identifying a site via the network constraint:

```
<rights>
  <agreement>
    <asset>
      <context>
       <uid>urn:univ:lr-wuw-video-1</uid>
      </context>
    </asset>
    <permission>
     <play>
      <constraint>
        <network>
          <context>
            <uid>137.208.224.XXX</uid>
          </context>
        </network>
      </constraint>
    </play>
   </permission>
  </agreement>
</rights>
```

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."

To implement this requirement, we recommend to reuse a vocabulary that clearly states what "supervises" means, respectively defines different forms of supervision, e.g. the LOM vocabulary. The respective right can then be constrained by the "purpose constraint". See the corresponding ODRL offer code example below, where the right play to the resource `urn:univ:lr-wuw-video-1` is restricted to the purpose "examination".

```
<rights>
  <offer>
    <asset>
      <context>
       <uid>urn:univ:lr-wuw-video-1</uid>
      </context>
    </asset>
    <permission>
     <play>
      <constraint>
```

```
        <purpose>
          <context>
            <uid>uri:lom.org/vocab/supervision/examination</uid>
          </context>
        </purpose>
      </constraint>
    </play>
   </permission>
  </offer>
</rights>
```

2.5 Tracking

"The DREL shall allow the specification of requirements for tracking access, usage, distribution and purchase of content, [9], [12], [17], [22]"

The ODRL data dictionary comprises the definition of the requirement "tracked" that can be assigned to permissions. The requirement "tracked" is defined as follows:

"The User will be tracked for their use of the asset. The user must be aware of privacy policy of the service provider."

In the example below the video `urn:univ:lr-wuw-video-1` may be played by the party `urn:univ:sguth` whereby the usage right play is tracked. Please note that additional tracking details could be specified (e.g. where or how often the asset is tracked).

```
<?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:lr-wuw-video-1</o-dd:uid>
       </o-ex:context>
    </o-ex:asset>
    <o-dd:play>
      <o-ex:requirement>
        <o-dd:tracked>
          <o-ex:context>
            <o-dd:remark>
            The frequence of usages is tracked by the service provider.
            </o-dd:remark>
          </o-ex:context>
        </o-dd:tracked>
      </o-ex:requirement>
    </o-dd:play>
    <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>
```

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.

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. [9]"

The ODRL language concept allows for the formulation of offers and agreements. The document mostly includes agreements and, for example, Section 2.1.2 shows a fully qualified offer. Both, agreement and offer may be specified by e.g., asset, permission, parties, etc. Permission may be constrained in general, thus the use of learning objects can be constraint in offers. If the offer itself shall be constraint, ODRL allows to specify a date in the context element of the offer. In the example below, the offer with the id `urn:uni:offer:1111` expires 31st Dec, 2005 and the play permission to the asset `urn:univ:lr-wuw-video-1` expires 31st Dec, 2006. Note that with ODRL several parties can be identified. The offer below specifies the rightsholder `urn:univ:gneumann` (distinguished from the consumer by the `rightsholder` element) of the asset `urn:univ:lr-wuw-video-1.`

```
<?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:context>
       <o-dd:uid> urn:uni:offer:1111 </o-dd:uid>
       <o-dd:date>
           <o-dd:end>2005-12-31T00:00:00+01:00</o-dd:end>
       </o-dd:date>
    </o-ex:context>
    <o-ex:asset>
      <o-ex:context>
         <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:constraint>
          <o-dd:datetime>
             <o-dd:end>2006-12-31T00:00:00+01:00</o-dd:end>
          </o-dd:datetime>
       </o-ex:constraint>
    </o-ex:permission>
    <o-ex:party>
        <o-ex:rightsholder/>
        <o-ex:context>
         <o-dd:uid> urn:univ:gneumann </o-dd:uid>
        </o-ex:context>
    </o-ex:party>
  </o-ex:offer>
</o-ex:rights>
```

Alternatively, an offer can be treated as a "thing" having a unique ID to which ODRL rights expressions can be expressed. Assuming, additional constraints shall be expressed for the offer above with the UID <urn:uni:offer:1111>, then the following expression can be formulated, that restricts the offer to the country Austria.:

```
<?xml version="1.0" encoding="UTF-8"?>
  <o-ex:offer>
    <o-ex:asset>
      <o-ex:context>
         <o-dd:uid> urn:uni:offer:1111 </o-dd:uid>
      </o-ex:context>
    </o-ex:asset>
    <o-ex:constraint>
       <o-dd:spatial>
           <o-ex:context>
              <o-dd:uid> urn:countries:austria </o-dd:uid>
         </o-ex:context>
       </o-dd:spatial>
    </o-ex:constraint>
  </o-ex:offer>
</o-ex:rights>
```