



Recommendation on exposing IEEE LOM as Linked Data 1.0 (second version)

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Abstract

This document recommends an approach for exposing IEEE LOM [[IEEE-LOM](#)], a metadata standard for educational contents, as Linked Data. The first version of this document is available at [here](#). It is intended as a bridge for linkage of educational metadata into Linked Open Data (LOD). This recommendation aims to describe a mapping of IEEE LOM elements to RDF based on Linked Data principles [[LDSO](#)]. It also presents VoID recommendation for expressing repository data as a dataset along with a practical example.

Audience

This document is mainly addressed to the repositories and the ODS partners, especially to those directly involved in the exposing their content and collection as Linked Data. It is also of particular interest to the repository managers, as this document contains instructions to express the educational resource as RDF. The owners of digital collections of educational resources that aim at exposing the metadata of their resources openly on the Web, can be another target of this document as well.

Status of This Document

This document is an internal ODS recommendation draft.

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1. Introduction

IEEE LOM [*IEEE-LOM*], as a popular standard for describing educational contents, promotes their reusability, discoverability and interoperability. Linked Data approach, in other side, makes eLearning applications an open exposure of metadata in which searching and navigating are possible, not only in centralized metadata stores, but also across the external repositories [*OREDULD*].

This draft provides recommendations to expose IEEE LOM as Linked Data. IEEE LOM elements discussed here, are based on the final version of IEEE 1484.12.1-2002 Standard for Learning Object Metadata (LOM) [*IEEE-LOM*], which defines a structure for interoperable descriptions for learning objects. We describe how IEEE LOM elements can be expressed educational metadata as Linked Data based on Linked Data principles [*LDSO*] and complying with common Linked Data patterns [*LDPat*].

This approach covers the following steps :

- URI design recommendation of elearning objects
- RDF binding of LOM elements and their data types
- Experimental implementation of LOM elements to RDF [*RDF-PRIMER*]
- Exposing repository metadata using VoID
- Recommendations on linking to other datasets

2. Document conventions

All examples in this document are written in the Turtle format [*TURTLE*] to represent RDF with the following namespaces:

Turtle Example

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
@prefix dcterms: <http://purl.org/dc/terms/> .
@prefix xdt: <http://www.w3.org/2005/xpath-datatypes> .
@prefix cc: <http://creativecommons.org/ns#> .
@prefix vcard: <http://www.w3.org/2001/vcard-rdf/3.0#>.
@prefix lom: <http://ltsc.ieee.org/rdf/lomv1p0/lom#>.
@prefix lomvoc: <http://ltsc.ieee.org/rdf/lomv1p0/vocabulary#>.
@prefix lomterms: <http://ltsc.ieee.org/rdf/lomv1p0/terms#>.
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
```

In the appendix, there is a LOM metadata example harvested from a repository by Organic.Edunet [*OrgEdunet*]. This example is used throughout this document as a sample. Some elements have been added to the example so that covers all the LOM elements as well. The identifier of this learning resource is simplified as follows:

Example

http://www.youtube.com/v/BebNsezt6r0?version=3&f=videos&c=YouTubeHarvester&app=youtube_gdata
is simplified as:
<http://Youtube.com/v/BebNsezt6r0>

3. URI design

Using strings or number conforming to a formal identification system [*DC11*] is considered to be best practice. In IEEE LOM, identifiers are defined as "globally unique label that identifies a learning object" and are to be provided in:

- *Element 1.1: General.Identifier to provide the identifier of the resource.*
- *Element 3.1: Meta-Metadata.Identifier to provide the identifier of the metadata record.*
- *Element 7.2.1: Relation.Resource.Identifier.*

In a general case, when exposing learning object metadata, the dereferenceable URIs that deliver RDF descriptions are actually identifying metadata records and not the actual resources. In consequence, the identification in Element 3.1. is represented as the dereferenceable URI from which the RDF metadata is exposed, and there is no need to expose it again in the RDF representation. The identifier of the actual resource can then be exposed as is in the metadata record, following the guidelines described below:

Example

<Repository URI> / <meta-Metadata ID>

Note: In the case that meta-Metadata or repositories identifiers are not available, another possibilities could be using the combination of repository name space and file name as follows:

Example

<Repository name space>_<metadata file name>

In the case of the Relation element, the recommended practice is using the dereferenceable URI of the resource pointed by this one, if available, in the form of a RDF link. In summary and based on above discussion, if learning objects are considered as natural hierarchy, patterned URI can

be assigned to them [[LDPatt](#)].

Case study:

In the Organic.Edunet repository, each learning object metadata has an identity or *Primary Key*. URI of LOM conforms to the following pattern:

Example

```
<Repository URI>/resource/identifier/ metaMetadata_PrimaryKey
```

Repository URI in the above pattern is URI of the current repository (or harvester, etc). For instance, in our example, it is indicated as:

Example

```
http://data.organic-edunet.eu/resource/identifier/1454
```

If the identifiers are not available, another possibilities could be using the actual LOM file name, as follows:

Example

```
http://data.organic-edunet.eu/ont/lom/OrganicEdunet01
```

Some cases that should be discussed in learning object identifications are the following:

3.1 Identifying one copy from several with different properties

If there exist copies of a same learning object in different repositories with different properties, e.g. different access rights, it is necessary to distinguish between these different copies. This is achieved by having one metadata record for each copy of the object. In general, the same resource can be legitimately described by different metadata records in the same or in dissimilar collections, for identifying as well as describing the same resource from different perspective (e.g. for different educational usages).

3.2 Identification of versions

Learning objects may contain version metadata. This should indicate the version level and the unique identifier of the immediate parent object ("is version of"). It modifies the metadata of the parent to show that it is the parent of a new child ("has version") and provide the unique general.identifier of the child. In any case, this is achieved by relating different records.

4. Binding simple and structured IEEE LOM elements

Two types of LOM elements exist: simple and structured. Following sections explain how each type is exposed as RDF.

4.1 Simple element binding:

Simple LOM elements do not contain other LOM data elements. For RDF binding of simple element, the RDF triple of element is represented in a same place as subject, predicate and object in which object is a literal. The following example, shows *Technical.Format* of a learning object, as a simple element:

xml Example

```
<technical>
<format>
  "application/x-shockwave-flash"
</format>
</technical>
```

Which is represented in Turtle as follows:

Turtle Example

```
<http://Youtube.com/v/BebNsezt6r0> dcterms:format "application/x-shockwave-flash".
```

4.2 Structured element binding:

Regardless simple elements, an structured (or aggregate) element contains other LOM elements (either simple or structured elements). For binding of structured elements, the object is not represented in the same tag, but is pointed to another node, which means an *intermediate node* of RDF is created by this way. There exist various options of how to expose structured elements as RDF:

4.2.1 Structured element with multiplicity 1

For exposing structured elements with multiplicity 1, for instance title, one of the following options can be used:

xml Example

```
<title>
  <string language="el">Τι είναι βιολογικό.</string>
  <string language="de">Was ist biologisch.</string>
  <string language="en">What is organic.</string>
</title>
```

Option 1: using repeated properties**Turtle Example**

```
<http://Youtube.com/v/BebNsezt6r0> dcterms:title "What is organic" @en, "Τι είναι βιολογικό" @el, "Was ist biologisch" @de.
```

Option 2: using intermediate node**Turtle Example**

```
<http://Youtube.com/v/BebNsezt6r0> dcterms:title _:bnode864405440.
_:bnode864405440 rdf:value "What is organic" @en,
                    "Τι είναι βιολογικό" @el,
                    "Was ist biologisch" @de.
```

4.2.2 Structured elements with multiplicity "Many"

Keyword, as a structured element of IEEE LOM, is expressed in XML as follows:

xml Example

```
<general>
  <keyword>
    <string language="en"> certification </string>
    <string language="el"> πιστοποίηση </string>
    <string language="de"> Zertifizierung </string>
  </keyword>
  <keyword>
    <string language="en">conventional farming</string>
    <string language="el">συμβατική γεωργία</string>
    <string language="de">konventionelle Landwirtschaft</string>
  </keyword>
  <keyword>
    <string language="en">organic farming</string>
    <string language="el">βιολογική γεωργία</string>
    <string language="de">biologische Landwirtschaft</string>
  </keyword>
</general>
```

Intermediate node is recommended for representing those structured elements that have many values.

Turtle Example

```
<http://Youtube.com/v/BebNsezt6r0> lom:keyword _:node1, _:node2, _:node3.
_:node1 rdf:value "certification" @en, "πιστοποίηση" @el, "Zertifizierung" @de.
_:node2 rdf:value "conventional farming" @en, "συμβατική γεωργία" @el, "konventionelle Landwirtschaft" @de.
_:node3 rdf:value "organic farming" @en, "βιολογική γεωργία" @el, "biologische Landwirtschaft" @de.
```

4.2.3 Structured elements with multiplicity "Many" and ordered

RDF containers [[LDPatt](#)], are another options specially for those cases that order of representing elements is important:

xml Example

```
<classification>
  <keyword>
    <string language="en">Organic</string>
  </keyword>
  <keyword>
    <string language="en">Farming</string>
  </keyword>
</classification>
```

Which are expressed by RDF containers as follows:

Turtle Example

```
<http://Youtube.com/v/BebNsezt6r0> lom:classificationKeyword _:node1.
_:node1 a rdf:Seq;
rdf:_1 "Organic" @en.
rdf:_2 "Farming" @en.
```

Note: In the Organic.Edunet LD representation, for structured elements with multiplicity 1, option 1 of [section 4.2.1](#) and for structured elements with multiplicity "many" [section 4.2.2](#) is expressed.

5. Data type mapping

5.1 CharacterString

Each simple element in literal format is represented as following:

Turtle Example

```
<http://Youtube.com/v/BebNsezt6r0> dcterms:format "application/x-shockwave-flash".
```

5.2 LangString

Many elements in IEEE LOM standard are literal and translations or may have multiple literals that are related semantically. Version of a learning object, for instance, may be represented by more than one language. Here, for RDF binding of this element, `xml:lang` can be used as an attribute for the element(`lom:version`) for representing the language. This attribute consists of language code conforming to RFC1766 [RFC1766].

Turtle Example

```
<http://Youtube.com/v/BebNsezt6r0> lom:version _:node1
_:node1 rdf:value "It is not available" @en, "no está disponible" @es.
```

RDF offers several modeling options for defining collections of resources [LDPati]. Formally these are the RDF Containers (Sequence, Bag, and Alternates) and the RDF Collections (List). For this purpose and the cases that ordering are essential, RDF Sequence (`rdf:Seq`) is used.

Note: For more information about the implementation of LangString see [Section 4.2](#)

5.3 DateTime

The International Standard for representation of dates and times is ISO 8601 [ISO8601] that describes a large number of date/time formats. The LOM standard defines at least the four digits for year, two digits for month and two-digit day of month. For representing the time, the standard defines two digits of hour, two digits of minute, two digits of second and one or more digits representing a decimal fraction of a second. Times are expressed in UTC (Coordinated Universal Time), with a special UTC designator ("Z"). For example, 1994-11-05T08:15:30-05:00 corresponds to November 5, 1994, 8:15:30 am, US Eastern Standard Time and 1994-11-05T13:15:30Z corresponds to the same instant. The LOM elements that contain Data/Time values can be written in following format:

Turtle Example

```
<http://Youtube.com/v/BebNsezt6r0> lom:dateTimeValue "2011-05-17T05:53:31.00Z"
^^<http://www.w3.org/2001/XMLSchema#dateTime>.
```

Note: A date/time value can be described as a description in IEEE LOM Standard such as ("en", "circa 1300 BCE"). In this case the element is represented as LangString.

Turtle Example

```
<http://Youtube.com/v/BebNsezt6r0> lom:dateTimeValue "2011-05-17T05:53:31.00Z";
lom:dateTimeDescription "Date of publishing the learning object".
```

5.4 Duration

If an element contains duration value, the date type of the element is indicated such as follows:

Turtle Example

```
<http://Youtube.com/v/BebNsezt6r0> lom:technicalDuration "PT0.269S"
^^<http://www.w3.org/2005/xpath-datatypes#dayTimeDuration>.
```

In the above example, duration ("PT0.269S") shows that technical duration of the learning object is 269 seconds based on ISO8601, although this kind of format is not human readable.

Note: A duration value can be described as a description in IEEE LOM Standard [IEEE-LOM] such as ("en", "Fall Semester 1999"). In this case the element is also represented as LangString.

5.5 Boolean

If an element contains Boolean value (True or False), the date type of the element is indicated as follows:

Turtle Example

```
<http://Youtube.com/v/BebNsezt6r0> lom:cost false ^^<http://www.w3.org/2001/XMLSchema#boolean>.
```

5.6 VCARD

vCard as a standard for electronic business cards, is used for describing of entities in RDF binding. A resource in RDF uses vCard properties such as vCard:FN, vCard:ORG and vCard:Email. The value of entity of contribute element, In following example, in Life Cycle category is a vCard record.

xml Example

```
BEGIN:VCARD
FN:Hannes Ebner
EMAIL;TYPE=INTERNET:hebner@kth.se
ORG:http://www.kth.se
N:Ebner;Hannes
VERSION:3.0
END:VCARD
```

This item can be represented as follows:

Turtle Example

```
<http://Youtube.com/v/BebNsezt6r0> contributionEntity
  "BEGIN:VCARDFN:HannesEbnerEMAIL;TYPE=INTERNET:hebner@kth.se;ORG:http://www.kth.seN:Ebner;HannesVERSION:3.0;END:VCARD"
```

For mapping vCard to RDF, following representation is recommended:

Turtle Example

```
<http://Youtube.com/v/BebNsezt6r0> contributionEntity _:bnode1247.
  _:bnode1247 vcard:FN "HannesEbner".
  _:bnode1247 vcard:N "Ebner;Hannes".
  _:bnode1247 vcard:EMAIL _:bnode1248.
  _:bnode1247 vcard:ORG "http://www.kth.se".
  _:bnode1247 vcard:VERSION 3.0.

_:bnode1248
  rdf:value "hebner@kth.se";
  rdf:type "http://www.w3.org/2001/vcard-rdf/3.0#internet".
```

5.7 Undefined data type

Date type of IEEE LOM Elements can be expressed explicitly in RDF. xsd:dateTime, for example, is specified for datetime format and rdfs:parseType or rdf:Literal for the string data types. For those elements that are not included any specific date type in IEEE LOM , xsd:anyType is recommended [XMLSCHEMA-0].

6. Recommended use of existing vocabularies/formats

There are some vocabularies used to describe people, places, things and locations include using terms from Dublin Core [DC11], which describes metadata about published works, or Friend-of-a-Friend (FOAF) [FOAF], used to describe people and their relationship to other people, vCard for electronic business cards or GeoNames a geographical database covers all countries and over ten million geographical names. In this document, use of the URI and authoritative vocabularies that data publishers are able to publish information more quickly, is presumed. For example:

- To model simple data, are used RDF, RDFS and custom vocabularies
- To name things, are used rdfs:label and foaf:name
- To describe people, are used FOAF and vCard
- To describe Web pages and other publications, are used dc:creator and dc:description
- To describe addresses, is used vCard

Following table shows vocabulary/format mapping of some LOM elements.

LOM element	used vocabulary/format
Contribute.Entity	vCard
CharacterString	rdf:value
General.Description	dcterms:description
General.Language	dcterms:language
General.identifier.entry	dcterms:identifier
General.Title	dcterms:title
General.Coverage	dcterms:coverage
Technical.Format	dcterms:format
Right.Description	dcterms:rights

Note: All the URIs for LOM vocabulary terms shown in Appendix D.

7. IEEE LOM Element Mapping

Following Table illustrates instructions to map the LOM elements to Linked Data format. The mapping of elements with same data type, has been ignored in the Table.

LOM element kind	Mapping	Example	Details
General.Identifier	Expose Catalog as String Link Entry using dcterms:identifier	<http://Youtube.com/v/BebNsezt6r0> dcterms:identifier "http://..."	Appendix B
CharacterString Elements	<i>subject predicate object</i>	<http://Youtube.com/v/BebNsezt6r0> lom:identifierCatalog "URI"	Section 6-1
Elements with VCARD description	<i>Use separated VCARD elements</i>	<http://Youtube.com/v/BebNsezt6r0> lom:lifeCycleContribution _:bnode1247. _:bnode1247 vcard:FN "HannesEbner".	Section 6-6
Meta-Metadata Identifier Entry	<i>Repository URI/identifier/Metadata URI</i>	http://Youtube.com/v/BebNsezt6r0/ identifier/ http://agcrops.osu.edu/	Section 6-1
LangString with language tag	<i>String @ Language Tag</i>	<http://Youtube.com/v/BebNsezt6r0> dcterms:title "Agronomic crops network" @en;	Section 6-2
Date/Time or Duration	<i>Map to string/LangString</i>	"16th century France"	Date/Time may be appeared in both formats (Date/Time and String)
LangString elements with multiplicity one	<i>Map to string [@Language Code]</i>	<http://Youtube.com/v/BebNsezt6r0> dcterms:title "Agronomic crops network" @en; "Red de cultivos agronómicos" @es	Section 6-2
LangString with multiplicity many	<i>Use intermediate node or use RDF containers</i>	<http://Youtube.com/v/BebNsezt6r0> lom:keyword _:bnode864405440. _:bnode864405440 rdf:value "certification"@en,"πιστοποίηση"@el, "Zertifizierung"@de.	Section 4-2
Rights Description	<i>Link to Creative Common</i>	<http://Youtube.com/v/BebNsezt6r0> dcterms:rights <http://creativecommons.org/licenses/by-nc-nd/3.0/>	-
Contribute.Entity	<i>Use vCard or use FOAF for people</i>	<foaf:Person> <foaf:name>Hannes Ebner</foaf:name> </foaf:Person>	-
Metadata Schema	<i>Use schema URI</i>	<http://ltsc.ieee.org/xsd/lomv1.0/lom.xsd>	-
Annotation	<i>Use intermediate node for each annotated group</i>	<http://Youtube.com/v/BebNsezt6r0> lom:annotation _:bnode1, _:bnode2, _:bnode3. _:bnode1 lom:annotationEntity _:bnode4; lom:annotationDate 2012-11-08T13:13:30.0; lom:annotationDescription _:bnode5. _:bnode4 ...{is implemented as VCARD} _:bnode5 ...{is implemented as LangString}	-

7.1 Classification mapping

IEEE LOM standard represents the classification of a learning object in *classification* category in which each classification includes *purpose* and *taxonpath*. *Taxonpath* represents the structure of taxonomy. At the top level is a list of broad terms. Under each term is a list of terms that refine each of the broad terms which may be another list. Each e-learning object metadata includes several *taxonpath* and in each *taxonpath* exists several *taxon*. Hence, for mapping of classification category, following RDF mapping is recommended:

Turtle Example

```

<http://Youtube.com/v/BebNsezt6r0> lom:classification _:classification1.

_:classification1 lom:classificationPurpose lomvoc:discipline;
lom:classificationDescription "This classification provides
many examples of Organic Principles and Ontologies."@en;
lom:classificationKeyword _:keyword1, _:keyword2;
lom:taxonPath _:taxonpath1, _:taxonpath2.

-----
_:taxonpath1 lom:taxonpathSource "NACE Codes of Economic Activity"@en;
lom:classificationTaxon _:taxon1.
_:taxon1 lom:taxonId "NACE Codes of Economic Activity";
lom:taxonEntry "ΔΗΜΟΣΙΑ ΔΙΟΙΚΗΣΗ ΚΑΙ ΑΜΥΝΑ, ΥΠΟΧΡΕΩΤΙΚΗ ΚΟΙΝΩΝΙΚΗ ΑΣΦΑΛΙΣΗ"@gr.

-----
_:taxonpath2 lom:taxonpathSource "Organic.Edunet Ontology"@en;
lom:classificationTaxon _:taxon1, _:taxon2.

_:taxon1 lom:taxonId "http://www.cc.uah.es/ie/ont/OE-Predicates#Explains";
lom:taxonEntry "http://www.cc.uah.es/ie/ont/OE-OAAE#OrganicPrinciple".
_:taxon2 lom:taxonId "http://www.cc.uah.es/ie/ont/OE-Predicates#ProvidesDataOn";
lom:taxonEntry "http://www.cc.uah.es/ie/ont/OE-OAAE#PlantProductionIssue".

-----
_:keyword1 rdf:value "Organic"@en.
_:keyword2 rdf:value "Farming"@en.

```

RDF containers (RDF:Seq) can be also used for describing the *Classification Keyword* as we discussed in [section 4.2.3](#).

7.2 Relation mapping

The Relation category groups features that define the relationship between the learning object and other related learning objects, if any. Same as the [classification mapping section](#), e-learning resource may include different relations and they are implemented as different intermediate nodes.

Turtle Example

```

<http://Youtube.com/v/BebNsezt6r0> lom:relation _:relation1.
-----
_:relation1 lom:relationKind dcterms:isPartOf;
            lom:identifier _:resource1, _:resource2;
            lom:relatedResourceDescription _:resourceDescription1.
-----
_:resource1 lom:identifierCatalog "URI";
            dcterms:identifier "http://smilingvines.com/OrganicvsConventional.pdf".
_:resource2 lom:identifierCatalog "URI";
            dcterms:identifier "http://smilingvines.com/OrganicFarming.pdf".
-----
_:resourceDescription1 dcterms:description "This context of this learning object is
based on a research mentioned partially in these two PDF documents."@en.

```

8. Exposing repository metadata using VoID

VoID (**V**ocabulary for **I**nterlinked **D**ata), as a bridge between the data publishers and consumers, expresses general metadata based on Dublin Core and other vocabularies such as FOAF and SKOS [[VOID](#)]. It covers different kinds of metadata (access, structural, and links between datasets) based on RDF Schema vocabulary [[RDF-SCHEMA](#)]. VoID served for describing repositories that publish their e-Learning objects as Linked Data format. Repositories compliant with Linked Data principles [[LDSO](#)] could be considered as datasets and described by VoID.

Note: In this section, when we mention a repository dataset, we point those repositories expose their e-Learning objects as Linked Data.

8.1 VoID Definition

Four areas of VoID are defined for e-learning repositories as follows:

- **General metadata:** describes general metadata such as title, description and license of a repository dataset.
- **Access metadata:** describes methods of accessing the actual RDF triples.
- **Structural metadata:** describes high-level information about the schema of a repository dataset.
- **Describing linksets:** defines different links between the repositories, if there are any.

The most important concept of VoID, is a dataset which is set of RDF triples that are published and modelled as an instance of the *void:Dataset* class.

For instance, Organic.Edunet is expressed as a VoID dataset:

Example

```
:OrganicEdunet a void:Dataset
```

Following Table declares the different void elements that describe a repository as a dataset. In this tables, following columns are defined:

Field: states a void element

Description: brief description of a void element

Vocabulary: describes the vocabulary of the field

Obligation: describes which fields are mandatory/optional or recommended

Example: an example of the field

All other void elements for describing datasets are available at [[VOID](#)].

Field	Description	Vocabulary	Obligation	Example
void:Dataset	Name of the repository dataset	void	Mandatory	:OrganicEdunet a void:Dataset
foaf:homepage	Homepage of the repository dataset including information about the dataset	foaf	Mandatory	:OrganicEdunet foaf:homepage <http://data.organic-edunet.eu>
foaf:page	Additional page of relevant information	foaf	Optional	:OrganicEdunet foaf:page <portal.organic-edunet.eu>
dcterms:title	The name of the repository dataset	Dublin Core	Mandatory	:OrganicEdunet dcterms:title "Organic Edunet"
dcterms:description	A textual description of the repository dataset	Dublin Core	Mandatory	OrganicEdunet dcterms:description "a learning portal that provides access to digital learning resources on Organic Agriculture and Agroecology"
dcterms:creator	The creator entity of the repository dataset	Dublin Core	Recommended	:OrganicEdunet dcterms:creator "European Union"
dcterms:publisher	The publisher entity of the repository dataset	Dublin Core	Recommended	:OrganicEdunet dcterms:publisher "UAH"
dcterms:contributor	The contributor entity	Dublin Core	Recommended	:OrganicEdunet dcterms:contributor "GRNET"
dcterms:created	Date of creation of the dataset	Dublin Core	Mandatory	:OrganicEdunet dcterms:created "2012-09-15"
dcterms:modified	Date on which the repository dataset was changed	Dublin Core	Optional	:OrganicEdunet dcterms:modified "2012-09-21"
foaf:person	Potential users of a repository dataset	foaf/RDF Schema	Optional	:OrganicEdunet dcterms:publisher :Miguel;a foaf:person; rdfs:label "Miguel";foaf:mbox

				<mailto:miguel@orgnaic-edunet.eu>
dcterms:subject	Category of the repository dataset	Dublin Core	Optional	:OrganicEduNet dcterms:subject "http://dbpedia.org/page/Subsistence_agriculture"
dcterms:license	Terms under which the repository dataset can be used	Dublin Core	Mandatory	:OrganicEduNet dcterms:license "http://creativecommons.org/licenses/by/"
void:technicalFeature void:technicalFeature	Format(s) of repository dataset that is available	void	Mandatory	:OrganicEduNet void:technicalFeature "http://www.w3.org/TR/REC-rdf-syntax/"
void:sparqlEndpoint	A SPARQL endpoint of the repository dataset	void	Mandatory	:OrganicEduNet void:sparqlEndpoint "portal.organic-edunet.eu/data/snorql"
void:datadump	RDF dump of the repository dataset	void	Optional	:OrganicEduNet void:datadump "data.organic-edunet.eu/rdfdump.rdf"
void:rootResource	The root resource of the repository dataset	void	Optional	:OrganicEduNet void:rootResource "portal.organic-edunet.eu"
void:exampleResource	An example entity that is representative for the entities described in a void:Dataset.	void	Recommended	:OrganicEduNet void:exampleResource "http://data.organic-edunet.eu/page/identifier/1454"
void:subset	Description of parts of repository dataset	void	Optional	:OrganicEduNet void:subset :Organic_Agriculture; void:subset :Organic_Agroecology.
void:triples	Total number of triples of repository dataset	void	Recommended	:OrganicEduNet void:triples 10000
void:classes	Total number of classes of repository dataset	void	Optional	:OrganicEduNet void:classes 10
void:properties	Total number of properties of dataset	void	Optional	:OrganicEduNet void:properties 10
void:target void:linkPredicate	void:linkPredicate	void	Optional	:DBpedia2DBLP a void:Linkset;void:target :OrganicEduNet;void:target :Dynalias; void:linkPredicate owl:sameAs.
void:DatasetDescription	A statement about the void file	void	Mandatory	:DBpedia2DBLP a void:DatasetDescription "A VoID Description of the Organic.EduNet Dataset"

8.2 Deploying VoID descriptions

For publishing VoID description alongside a dataset, a Turtle file named void.ttl is placed in the root directory of the dataset site, For example:

Example

```
http://data.Organic-EduNet.eu/void.ttl
```

[Appendix C](#) declares description of organic.edunet dataset as VoID.

9. Recommendations on linking to other datasets

Linked Data as a global approach for interlinking data on the Web, allows educational material to be integrated and linkable so that make their e-learning resources more accessible, discoverable and reusable as well as unlocking educational information away from learners. DBpedia [DBpedia], as one of the most reused datasets and Linked Data version of Wikipedia, making it possible for anybody to link general information as well as extracting their relationship to other datasets. The advantages of this relationship is making one's own public information linkable and usable for others as well as being able to enrich one's own information by linking to others [INTERLINK]. Following table shows how some of IEEE LOM elements can be interlinked to other datasets as well. This recommendation table, includes all existing public datasets are available in Linked Open Data(LOD).

LOM element	description	linking to
General.Coverage	When coverage refers to a location	http://dbpedia.org/resource/{Location} DBpedia--> http://dbpedia.org/resource/{Location} GeoName--> http://sws.geonames.org/ FreeBase--> http://freebase.com/api/service/search EuroStat--> http://eurostat.linked-statistics.org/ WorldBank--> http://worldbank.270a.info/ FAO Profile --> http://www.fao.org/countryprofiles
General.Title	When Title refers to a paper/publication/book/biography	IEEE --> http://ieee.rkbexplorer.com Citeseer --> http://citeseer.rkbexplorer.com/ ACM --> http://acm.rkbexplorer.com/ Book --> http://openlibrary.org/ British National Bibliography--> http://bnb.data.bl.uk/sparql DBLP --> http://dblp.l3s.de/d2r/ or http://dblp.rkbexplorer.com ISWC, ESWC and WWW--> http://data.semanticweb.org
{General,Meta-metadata,LifeCycle,Educational}.Language	Refer to dbpedia	http://dbpedia.org/resource/{language}_Language
Technical.Format	Link to dbpedia	http://dbpedia.org/resource/{format}
Requirement.OrComposite.Type/Name	Link to dbpedia	http://dbpedia.org/resource/{Requirement.OrComposite.Type/n
Educational.LearningResourceType	Link to dbpedia	http://dbpedia.org/resource/{LearningResourceType}

Educational.IntendedEndUserRole	<i>Link to dbpedia</i>	http://dbpedia.org/resource/{IntendedEndUserRole}
Technical.Location	For videos use sameAs link	yovisto --> http://www.yovisto.com/ontology/
General.Keyword, {Category}.Description	Link the word (or vocabulary)	EUROVoc --> http://eurovoc.europa.eu News(The New York Times) --> http://data.nytimes.com/ Linked Open Vocabularies (LOV)--> http://lov.okfn.org GEMET --> http://www.eionet.europa.eu/gemet/ Government Data --> http://logd.tw.rpi.edu/ Statistical Data --> statistics.data.gov.uk Social Semantic words--> http://vocabulary.semantic-web.at Products and food --> http://aims.fao.org Cultural collection --> http://pro.europeana.eu/linked-open-data National Agriculture Library --> http://agclass.nal.usda.gov Geographic --> eionet.europa.eu or http://data.ordnancesurvey.co.uk/ Public data --> http://data.gov.uk
Classification.Taxon	Link to a taxonomy	TaxonConcept --> http://lod.taxonconcept.org/ Linked Open Ontologies --> http://lov.okfn.org
All elements	When refer to a school/company/course	Education--> http://education.data.gov.uk Companies --> http://opencorporates.com/ Open University --> data.open.ac.uk

A. Acknowledgements

We express our gratitude to the [ODS project](#) group for their support, co-operation, comments and suggestions.

B. Appendix: XML to Turtle IEEE LOM Example

xml Example

```

<?xml version="1.0" encoding="UTF-8"?>
<lom xmlns="http://ltsc.ieee.org/xsd/LOM">
  <general>
    <identifier>
      <catalog>URI </catalog>
      <entry>http://www.youtube.com/v/BebNsezt6r0?version=3&f=videos&c=YouTubeHarvester&app=youtube_gdata </entry>
    </identifier>
    <identifier>
      <catalog>youtube </catalog>
      <entry>http://www.youtube.com/watch?v=BebNsezt6r0 </entry>
    </identifier>
    <title>
      <string language="el">Τι είναι βιολογικό. </string>
      <string language="de">Was ist biologisch. </string>
      <string language="en">What is organic. </string>
    </title>
    <language>en </language>
    <description>
      <string language="de">Ein Ausbildungsvideo über die Unterschiede zwischen konventioneller und biologischer Landwirtschaft. Darüber hinaus zeigt das video das biologische Zertifizierungslabel für mehrere Produkte. </string>
      <string language="el">Ενα εκπαιδευτικό βίντεο για τις διαφορές ανάμεσα στη συμβατική και τη βιολογική γεωργία. Επιπλέον το βίντεο δείχνει τη σήμανση της βιολογικής πιστοποίησης σε διάφορα προϊόντα. </string>
      <string language="en">A learning video about the differences between conventional and organic farming. Furthermore the video shows the organic certifier's logos for several products. </string>
    </description>
    <keyword>
      <string language="en">certification </string>
      <string language="el">πιστοποίηση </string>
      <string language="de">Zertifizierung </string>
    </keyword>
    <keyword>
      <string language="en">conventional farming </string>
      <string language="el">συμβατική γεωργία </string>
      <string language="de">konventionelle Landwirtschaft </string>
    </keyword>
    <keyword>
      <string language="en">organic farming </string>
      <string language="el">βιολογική γεωργία </string>
      <string language="de">biologische Landwirtschaft </string>
    </keyword>
    <coverage>
      <string>World </string>
    </coverage>
    <structure>
      <source>LOMv1.0 </source>
      <value>atomic </value>
    </structure>
    <aggregationlevel>
      2
    </aggregationlevel>
  </general>
  <lifeCycle>
    <version>
      <string language="en"> Not available </string>
    </version>
    <status>

```

```

    <source>LOMv1.0 </source>
    <value>final </value>
  </status>
  <contribute>
    <role>
      <source>LOMv1.0 </source>
      <value>content provider </value>
    </role>
    <entity>
      <![CDATA[BEGIN:VCARD
      FN:YouTube
      ORG:YouTube
      N:YouTube
      VERSION:3.0
      END:VCARD]]>
    </entity>
    <date>
      <dateTime>2011-05-17T05:53:31.00Z </dateTime>
    </date>
  </contribute>
</lifeCycle>
<metaMetadata>
  <identifier>
    <catalog>URI </catalog>
    <entry>http://oe.confolio.org/scam/156/entry/2365 </entry>
  </identifier>
  <contribute>
    <role>
      <source>LOMv1.0 </source>
      <value>creator </value>
    </role>
    <entity>
      <![CDATA[BEGIN:VCARD
      FN:Hannes Ebner
      EMAIL;TYPE=INTERNET:hebner@kth.se
      ORG:http://www.kth.se
      N:Ebner;Hannes
      VERSION:3.0
      END:VCARD]]>
    </entity>
    <date>
      <dateTime>2012-04-02T20:18:18.82Z </dateTime>
    </date>
  </contribute>
  <contribute>
    <role>
      <source>LREv3.0 </source>
      <value>enricher </value>
    </role>
    <entity>
      <![CDATA[BEGIN:VCARD
      FN:Hannes Ebner
      EMAIL;TYPE=INTERNET:hebner@kth.se
      ORG:http://www.kth.se
      N:Ebner;Hannes
      VERSION:3.0
      END:VCARD]]>
    </entity>
  </contribute>
  <contribute>
    <role>
      <source>LREv3.0 </source>
      <value>enricher </value>
    </role>
    <entity>
      <![CDATA[BEGIN:VCARD
      FN:Angeliki Paparadi
      N:Paparadi;Angeliki
      VERSION:3.0
      END:VCARD]]>
    </entity>
  </contribute>
  <contribute>
    <role>
      <source>LOMv1.0 </source>
      <value>validator </value>
    </role>
    <entity>
      <![CDATA[BEGIN:VCARD
      FN:Angeliki Paparadi
      EMAIL;TYPE=INTERNET:apaparadi@gmail.com
      ORG:http://www.agroknow.gr
      N:Paparadi;Angeliki
      VERSION:3.0
      END:VCARD]]>
    </entity>
  </contribute>
  <metadataSchema>LOMv1.0 </metadataSchema>
  <metadataSchema>LREv3.0 </metadataSchema>
  <language>en </language>
</metaMetadata>
<technical>
  <format>video/x-ms-wmv </format>
  <format>application/x-shockwave-flash </format>
  <format>video/3gpp </format>
  <size>0 </size>
  <location>http://www.youtube.com/v/BebNsezt6r0?version=3&f=videos&c=YouTubeHarvester&app=youtube_gdata </location>

```

```

<location>http://www.youtube.com/v/BebNsezt6r0?version=3&f=videos&c=YouTubeHarvester&app=youtube_gdata </location>
<location>rtsp://v5.cache1.c.youtube.com/
CjQLEny73wIaKwm96u3ssc3mBRMYDSANFEIQWw91VHVIZUhhcnZl3RlckgUGz2aWR1b3MM/0/0/0/video.3gp </location>
<location>rtsp://v3.cache5.c.youtube.com/
CjQLEny73wIaKwm96u3ssc3mBRMYESARFEIQWw91VHVIZUhhcnZl3RlckgUGz2aWR1b3MM/0/0/0/video.3gp </location>
<duration>
  <duration>PT0.269S </duration>
</duration>
<requirement>
  <orComposite>
    <type>
      <source>LOMv1.0 </source>
      <value>browser </value>
    </type>
    <name>
      <source>LOMFRv1.0 </source>
      <value>firefox </value>
    </name>
    <minimumVersion>1.7 </minimumVersion>
    <maximumVersion>9.0 </maximumVersion>
  </orComposite>
</requirement>

<installationRemarks>
  <string language="en">Flash Player is necessary </string>
</installationRemarks>
<otherPlatformRequirements>
  <string language="en">Multimedia </string>
</otherPlatformRequirements>

</technical>
<educational>
  <interactivityType>
    expositive
  </interactivityType >

  <interactivityLevel>
    <value>medium </value>
  </interactivityLevel >

  <semanticDensity>
    <value>medium </value>
  </semanticDensity>

  <learningResourceType>
    <source>LREv3.0 </source>
    <value>presentation </value>
  </learningResourceType>
  <learningResourceType>
    <source>LREv3.0 </source>
    <value>video </value>
  </learningResourceType>
  <intendedEndUserRole>
    <source>LOMv1.0 </source>
    <value>learner </value>
  </intendedEndUserRole>
  <intendedEndUserRole>
    <source>LOMv1.0 </source>
    <value>teacher </value>
  </intendedEndUserRole>
  <intendedEndUserRole>
    <source>LREv3.0 </source>
    <value>parent </value>
  </intendedEndUserRole>
  <context>
    <source>LREv3.0 </source>
    <value>distance education </value>
  </context>
  <context>
    <source>LREv3.0 </source>
    <value>educational administration </value>
  </context>
  <context>
    <source>LREv3.0 </source>
    <value>pre-school </value>
  </context>
  <typicalAgeRange>
    <string language="en">8-U </string>
  </typicalAgeRange>
  <difficulty>
    <value>medium </value>
  </difficulty>
  <typicalLearningTime>
    <duration>PT30M </duration>
  </typicalLearningTime >
  <description>
    <string language="en">
      This learning video should be played by a browser that supports Flash Player.
    </string>
  </description>
  <language>
    en
  </language>

</educational>
<rights>
  <cost>

```

```

    <source>LOMv1.0 </source>
    <value>no </value>
  </cost>
  <copyrightAndOtherRestrictions>
    <source>LOMv1.0 </source>
    <value>yes </value>
  </copyrightAndOtherRestrictions>
  <description>
    <string>http://creativecommons.org/licenses/by-nc-nd/3.0/ </string>
  </description>
</rights>
<relation>
  <kind>
    <source>LOMv1.0 </source>
    <value>ispartof </value>
  </kind >
  <resource>
    <identifier>
      <catalog>URI </catalog>
      <entry>http://smilingvines.com/OrganicvsConventional.pdf </entry>
    </identifier>
    <description>
      <string language="en">
        The PDF file explains the most important differences between organic and conventional farming
      </string>
    </description>
  </resource>
</relation>

<annotation>
  <entity>
    <![CDATA[BEGIN:VCARD
FN:Angeliki Paparadi
EMAIL;TYPE=INTERNET:apaparadi@gmail.com
ORG:http://www.agroknow.gr
N:Paparadi;Angeliki
VERSION:3.0
END:VCARD]]>
  </entity>
  <date>
    <dateTime>2012-05-16T00:00:00.00Z </dateTime>
  </date>
  <description>
    <string language="en">Quality certified </string>
  </description>
</annotation>
<classification>
  <purpose>
    <value>discipline </value>
  </purpose>
  <taxonPath>
    <source>
      <string language="en">Organic.Edunet Ontology </string>
    </source>
    <taxon>
      <id>http://www.cc.uah.es/ie/ont/OE-Predicates#ProvidesExamplesOf ::
http://www.cc.uah.es/ie/ont/OE-OAAE#OrganicPrinciple </id>
      <entry>
        <string>ProvidesExamplesOf :: OrganicPrinciple </string>
      </entry>
    </taxon>
  </taxonPath>
  <taxonPath>
    <source>
      <string language="en">Organic.Edunet Ontology </string>
    </source>
    <taxon>
      <id>http://www.cc.uah.es/ie/ont/OE-Predicates#CommentsOn ::
http://www.cc.uah.es/ie/ont/OE-OAAE#OrganicPrinciple </id>
      <entry>
        <string>CommentsOn :: OrganicPrinciple </string>
      </entry>
    </taxon>
  </taxonPath>
  <taxonPath>
    <source>
      <string language="en">Organic.Edunet Ontology </string>
    </source>
    <taxon>
      <id>http://www.cc.uah.es/ie/ont/OE-Predicates#ProvidesExamplesOf ::
http://www.cc.uah.es/ie/ont/OE-OAAE#OrganicConventionalAgricultureComparison </id>
      <entry>
        <string>ProvidesExamplesOf :: OrganicConventionalAgricultureComparison </string>
      </entry>
    </taxon>
  </taxonPath>
  <taxonPath>
    <source>
      <string language="en">Organic.Edunet Ontology </string>
    </source>
    <taxon>
      <id>http://www.cc.uah.es/ie/ont/OE-Predicates#ProvidesExamplesOf ::
http://www.cc.uah.es/ie/ont/OE-OAAE#OrganicStandard </id>
      <entry>
        <string>ProvidesExamplesOf :: OrganicStandard </string>
      </entry>
    </taxon>
  </taxonPath>

```

```

</taxonPath>
<description>
  <string language="en">
    This classification provides many examples of Organic Principles and Ontologies.
  </string>
</description>
<keyword>
  <string language="en">
    Organic
  </string>
</keyword>
<keyword>
  <string language="en">
    Farming
  </string>
</keyword>
</classification>
</lom>

```

This example is shown in Turtle as follows:

Turtle Example

```

@prefix db:      <http://portal.organic-edunet.eu:8080/linkeddata/resource/> .
@prefix lomvoc: <http://ltsc.ieee.org/rdf/lomvip0/vocabulary#> .
@prefix lom:    <http://ltsc.ieee.org/rdf/lomvip0/lom#> .
@prefix OrEd:  <http://data.organic-edunet.eu/resource/> .
@prefix foaf:  <http://xmlns.com/foaf/0.1/> .
@prefix vcard: <http://www.w3.org/2001/vcard-rdf/3.0#> .
@prefix dcterms: <http://purl.org/dc/terms/> .
@prefix rdfs:  <http://www.w3.org/2000/01/rdf-schema#> .
@prefix d2r:   <http://sites.wiwiw.fu-berlin.de/suhl/bizer/d2r-server/config.rdf#> .
@prefix dbpedia: <http://dbpedia.org/resource/> .
@prefix xsd:    <http://www.w3.org/2001/XMLSchema#> .
@prefix map:    <file:/home/flag/D2RQ/lom.n3#> .
@prefix owl:  <http://www.w3.org/2002/07/owl#> .
@prefix rdf:    <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix lr:     <http://organic-edunet.eu/LOM/rdf/voc#> .

<http://data.organic-edunet.eu/resource/resource/2909>
  a lom:LearningObject ;
  lom:OtherPlatformRequirements
    "Multimedia"@en ;
  lom:aggregationLevel
    lomvoc:AggregationLevel-2 ;
  lom:annotation db:Annotation-2909-14023 ;
  lom:classification db:Classification-2401 ;
  lom:lifeCycleContribution db:Contribute-2909-12723 ;
  lom:copyrightAndOtherRestrictions
    "yes" ;
  lom:cost "no" ;
  lom:coverage db:Coverage-2909-0 ;
  lom:description db:Description-2909-0 ;
  lom:educational db:Educational-2909-11632 ;
  lom:identifier db:Identifier-14075 , db:Identifier-14076 ;
  lom:keyword db:Keyword-2909-2 , db:Keyword-2909-1 , db:Keyword-2909-0 ;
  lom:lifeCycleStatus lomvoc:Status-final ;
  lom:technicalLocation <http://www.nationalfruitcollection.org.uk/> , <rtsp://v3.cache5c.youtube.com/CjQLENY73wIaKwm96u3ssc3mBRMYESARFEIQWw91VHVIZUhhcnZl3RlckgUgZ2aWR1b3MM/0/0/video.3gp> ,
    <rtsp://v5.cache1c.youtube.com/CjQLENY73wIaKwm96u3ssc3mBRMYDSANFEIQWw91VHVIZUhhcnZl3RlckgUgZ2aWR1b3MM/0/0/video.3gp> ,
    <http://www.youtube.com/v/BebNsezt6r0?version=3> ;
  lom:metaMetadataContribution
    db:metaMetadataContribute-2909-9050 , db:metaMetadataContribute-2909-9051 ,
    db:metaMetadataContribute-2909-9048 , db:metaMetadataContribute-2909-9049 ;
  lom:metaMetadataLanguage
    "en" ;
  lom:metaMetadataSchema
    "LOMv1.0" , "LREv3.0" ;
  lom:metaMetadataIdentifier
    db:MetaMetadataIdentifier-2909 ;
  lom:relation db:Relation-11556 ;
  lom:technicalRequirements db:requirement-2909-0 ;
  lom:structure lomvoc:Structure-atomic ;
  lom:technicalDuration "PT0.269S" ;
  lom:technicalInstallationRemarks "Flash Player is necessary"@en ;
  lom:technicalSize "0" ;
  dcterms:format "text/html" , "video/x-ms-wmv" , "video/3gpp" , "application/x-shockwave-flash" ;
  dcterms:language "en" ;
  dcterms:rights "The resource or at least part of it can be openly accessed,
    but specific copyright conditions may apply for its use/re-use. It is advisable
    to consult any specific copyright clauses included at the resource location,
    since Intute holds no responsibility for any violation of stated restrictions
    in accessing/using the resource."@en , "http://creativecommons.org/licenses/by-nc-nd/3.0/"@unspecified ;
  dcterms:title "Was ist biologisch."@de , "Τι είναι βιολογικό."@el , "What is organic."@en .
----- Identifier -----
db:Identifier-14075 lom:identifierCatalog "URI" ;
dcterms:identifier <http://www.youtube.com/v/> .
db:Identifier-14076 lom:identifierCatalog "youtube" ;
dcterms:identifier <http://www.youtube.com/watch?v=BebNsezt6r0> .

----- Metadata Identifier -----
db:MetaMetadataIdentifier-2909 lom:identifierCatalog "URI" ;

```

dcterms:identifier "http://oe.confolio.org/scam/156/entry/2365" .

----- Metadata Contribute -----

```

db:metaMetadataContribute-2909-9048 lom:dateTimeValue
  "2012-04-02T20:18:18.82Z" ;
  lom:contributionEntity db:metaMetadataContribution-9048 ;
  lom:metaMetadataContributionRole lomvoc:Role-creator .
db:metaMetadataContribution-9048 vcard:EMAIL "hebner@kth.se" ;
  vcard:FN "Confolio Administrator" , "Hannes Ebner" ;
  vcard:N "Confolio Administrator" , "Hannes Ebner" ;
  vcard:ORG "http://www.kth.se" ;
  vcard:VERSION "3.0" .
db:metaMetadataContribute-2909-9049 lom:dateTimeValue
  "0000-00-00 00:00:00" ;
  lom:contributionEntity db:metaMetadataContribution-9049 ;
  lom:metaMetadataContributionRole lomvoc:Role-enricher .
db:metaMetadataContribution-9049 vcard:EMAIL "lynda.gibbins@nottingham.ac.uk" , "hebner@kth.se" ;
  vcard:FN "Lynda Gibbins" , "Hannes Ebner" ;
  vcard:N "Lynda Gibbins" , "Hannes Ebner" ;
  vcard:ORG "http://www.kth.se" , "http://www.intute.ac.uk" ;
  vcard:VERSION "3.0" .
db:metaMetadataContribute-2909-9050 lom:dateTimeValue
  "0000-00-00 00:00:00" ;
  lom:contributionEntity db:metaMetadataContribution-9050 ;
  lom:metaMetadataContributionRole lomvoc:Role-enricher .
db:metaMetadataContribution-9050 vcard:EMAIL "lynda.gibbins@nottingham.ac.uk" ;
  vcard:FN "Angeliki Paparadi" , "Lynda Gibbins" ;
  vcard:N "Angeliki Paparadi" , "Lynda Gibbins" ;
  vcard:ORG "Intute / University of Nottingham (Intute)" ;
  vcard:VERSION "3.0" .
db:metaMetadataContribute-2909-9051 lom:dateTimeValue
  "0000-00-00 00:00:00" ;
  lom:contributionEntity db:metaMetadataContribution-9051 ;
  lom:metaMetadataContributionRole lomvoc:Role-validator .
db:metaMetadataContribution-9051 vcard:EMAIL "apaparadi@gmail.com" ;
  vcard:FN "Angeliki Paparadi" , "Confolio Administrator" ;
  vcard:N "Angeliki Paparadi" , "Confolio Administrator" ;
  vcard:ORG "http://www.kth.se" , "http://www.agroknow.gr" ;
  vcard:VERSION "3.0" .

```

----- Coverage -----

```

db:Coverage-2909-0
  dcterms:coverage dbpedia:World , dbpedia:UnitedKingdom .
----- requirement -----
db:requirement-2909-0 lom:isCompositeOf db:SingleTechnicalRequirement_sample_1_1 .
db:SingleTechnicalRequirement_sample_1_1
  lom:orCompositeMaximumVersion
    "9.0" ;
  lom:orCompositeMinimumVersion
    "1.7" ;
  lom:orCompositeName lomvoc:OperatingSystemTechnology-firefox ;
  lom:orCompositeType lomvoc:RequirementType-browser .

```

----- relation -----

```

db:Relation-11556 lom:identifier db:relation_identifier_sample_1_1 ;
  lom:relatedResourceDescription db:relatedDescription-1 ;
  lom:relationKind dcterms:ispartof .
db:relation_identifier_sample_1_1 lom:identifierCatalog "URI" ;
  dcterms:identifier "http://smilingvines.com/OrganicvsConventional.pdf" .

```

```

db:relatedDescription-1
  dcterms:description "The PDF file explains the most important
  differences between organic and conventional farming"@en .
----- Description -----

```

```

db:Description-2909-0 dcterms:description "Ένα εκπαιδευτικό βίντεο για τις διαφορές ανάμεσα
στη συμβατική και τη βιολογική γεωργία. Επιπλέον το βίντεο δείχνει τη σήμανση
της βιολογικής πιστοποίησης σε διάφορα προϊόντα."@el , "Ein Ausbildungsvideo über die Unterschiede zwischen
konventioneller und biologischer Landwirtschaft. Darüber hinaus zeigt das video
das biologische Zertifizierungslabel für mehrere Produkte."@de , "A learning video about the differences between
conventional and organic farming. Furthermore the video shows the organic
certifier's logos for several products."@en .

```

----- Keyword -----

```

db:Keyword-2909-0
  rdf:value "πιστοποίηση" @el , "certification" @en , "Zertifizierung" @de .
db:Keyword-2909-1
  rdf:value "συμβατική γεωργία" @el , "conventional farming" @en ,
  "konventionelle Landwirtschaft" @de .
db:Keyword-2909-2
  rdf:value "βιολογική γεωργία" @el , "organic farming" @en , "biologische Landwirtschaft" @de .

```

----- Contribute -----

```

db:Contribute-2909-12723 lom:dateTimeValue "2011-05-17T05:53:31.00Z" ;
  lom:contributionEntity db:lifecycleContribution-12723 ;
  lom:dateTimeValue lomvoc:Role-contentprovider .
db:lifecycleContribution-12723 vcard:FN "YouTube" ;
  vcard:N "YouTube" ;
  vcard:ORG "YouTube" ;
  vcard:VERSION "3.0" .

```

----- Educational -----

```

db:Educational-2909-11632 lom:educationalContext lomvoc:Context-pre-school ,
  lomvoc:Context-educationaladministration , lomvoc:Context-distanceeducation ;
  lom:educationalDifficulty lomvoc:Difficulty-medium ;
  lom:educationDescription db:EduDescription-3000 ;
  lom:educationalLanguage "en" ;
  lom:educationalIntendedUserRole lomvoc:IntendedEndUserRole-parent ,

```

```

lomvoc:IntendedEndUserRole-learner , lomvoc:IntendedEndUserRole-teacher ;
lom:educationalInteractivityLevel lomvoc:InteractivityLevel-medium ;
lom:educationalTypicalAgeRange db:Age-8953 ;
lom:educationalTypicalLearningTime "PT30M" ;
dcterms:type lomvoc:LearningResourceType-video , lomvoc:LearningResourceType-presentation .

db:EduDescription-3000 dcterms:description "This learning video should
be played by a browser that supports Flash Player."@en .
db:Age-8953
  rdf:value "8-U"@en .
----- Annotation -----
db:Annotation-2909-14023 lom:dateTimeValue "2012-05-16T00:00:00.00Z" ;
lom:annotationDescription "Quality certified"@en ;
lom:annotationEntity db:Annotation-14023.
db:Annotation-14023
  vcard:EMAIL "apaparadi@gmail.com" ;
  vcard:FN "Angeliki Paparadi" ;
  vcard:N "Angeliki Paparadi" ;
  vcard:ORG "http://www.agroknow.gr" ;
  vcard:VERSION "3.0" .
----- Classification -----
db:Classification-2401 lom:classificationDescription db:ClassificationDescription-1 ;
lom:classificationKeyword db:ClassificationKeyword-1 ,
db:ClassificationKeyword-2 ;
lom:classificationPurpose lomvoc:Purpose-discipline ;
lom:taxonPath db:TaxonPath-2401-7669 ,
db:TaxonPath-2401-7670 ,
db:TaxonPath-2401-7671 ,
db:TaxonPath-2401-7672 .
db:ClassificationDescription-1 dcterms:description "This classification
provides many examples of Organic Principles and Ontologies."@en .
db:ClassificationKeyword-1 rdf:value "Organic"@en .
db:ClassificationKeyword-2 rdf:value "Farming"@en .

db:TaxonPath-2401-7669 lom:classificationTaxon db:Taxon-2401 ;
lom:taxonpathSource "Organic.Edunet Ontology"@en .
db:Taxon-2401 lom:taxonEntry "ProvidesExamplesOf :: OrganicPrinciple" ;
lom:taxonId "http://www.cc.uah.es/ie/ont/OE-Predicates#ProvidesExamplesOf ::
http://www.cc.uah.es/ie/ont/OE-OAAE#OrganicPrinciple" .

db:TaxonPath-2401-7670 lom:classificationTaxon db:Taxon-2402 ;
lom:taxonpathSource "Organic.Edunet Ontology"@en .
db:Taxon-2402 lom:taxonEntry "CommentsOn :: OrganicPrinciple" ;
lom:taxonId "http://www.cc.uah.es/ie/ont/OE-Predicates#CommentsOn ::
http://www.cc.uah.es/ie/ont/OE-OAAE#OrganicPrinciple" .
db:TaxonPath-2401-7671 lom:classificationTaxon db:Taxon-2403 ;
lom:taxonpathSource "Organic.Edunet Ontology"@en .
db:Taxon-2403 lom:taxonEntry "ProvidesExamplesOf :: OrganicConventionalAgricultureComparison" ;
lom:taxonId "http://www.cc.uah.es/ie/ont/OE-Predicates#ProvidesExamplesOf ::
http://www.cc.uah.es/ie/ont/OE-OAAE#OrganicConventionalAgricultureComparison" .
db:TaxonPath-2401-7672 lom:classificationTaxon db:Taxon-2404 ;
lom:taxonpathSource "Organic.Edunet Ontology"@en .
db:Taxon-2404 lom:taxonEntry "ProvidesExamplesOf :: OrganicStandard" ;
lom:taxonId "http://www.cc.uah.es/ie/ont/OE-Predicates#ProvidesExamplesOf ::
http://www.cc.uah.es/ie/ont/OE-OAAE#OrganicStandard" .

```

C. Appendix: Organic Edunet Void

Turtle Example

```

@prefix void: <http://rdfs.org/ns/void#> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix owl: <http://www.w3.org/2002/07/owl#> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
@prefix dcterms: <http://purl.org/dc/terms/> .
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
@prefix ww: <http://vocab.org/waiver/terms/norms> .
@prefix sd: <http://www.w3.org/ns/sparql-service-description#> .

<a void:DatasetDescription;
dcterms:title "A Void Description of the Organic.Edunet Dataset";
dcterms:creator <http://www.uah.es/msicilia>;
foaf:primaryTopic :OrganicEdunet.

:OrganicEdunet a void:Dataset;
foaf:homepage <portal.organic-edunet.eu/data> ;
foaf:page <portal.organic-edunet.eu> ;
dcterms:title "Organic Edunet";
dcterms:description "The metadata of collection of learning objects exposed through the Organic.Edunet portal";
dcterms:source <portal.organic-edunet.eu>;
dcterms:feature :TurtleFormat;
dcterms:feature :RDFXMLFormat;
dcterms:creator "http://www.uah.es/http://www.cc.uah.es/msicilia/";
dcterms:publisher :UAH;
dcterms:contributor "GRNET";
dcterms:created "2012-09-01";
dcterms:modified "2012-09-21";
dcterms:subject "http://dbpedia.org/page/Subsistence_agriculture";
dcterms:license "http://creativecommons.org/licenses/by-nc/3.0/";
void:sparqlEndpoint "portal.organic-edunet.eu/data/snorql";
void:datadump "portal.organic-edunet.eu/data/rdfdump.rdf";
void:exampleResource "portal.organic-edunet.eu/data/identfier110";
void:triples 10000;

```



```

:OrganicEdunet2Dynalias a void:Linkset;
  void:target :OrganicEdunet;
  void:target :Dynalias;
  void:linkPredicate owl:sameAs;
  .

:Miguel a foaf:person;
  rdfs:label "Miguel-Angel Sicilia";
  foaf:mbox <mailto:miguel@orgnaic-edunet.eu>.

:RDFXMLFormat a void:TechnicalFeature;
  rdfs:label "RDF/XML" ;
  rdfs:comment "Available as Linked Data in RDF/XML format";
  dcterms:format "application/rdf+xml".

:TurtleFormat a void:TechnicalFeature;
  rdfs:label "Turtle" ;
  rdfs:comment "Available as Linked Data in Turtle format";
  dcterms:format "application/Turtle".

:UAH rdfs:label "University of Alcala";
  foaf:homepage "http://www.uah.es".

```

D. Appendix: URIs for LOM vocabulary terms

The main idea for definition of LOM vocabulary terms comes up on [[IEEDCAM](#)] and the URIs are suggestion links based on [xsd vocabulary](#).

LOM element 1.7 Structure

Value	URI
atomic	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Structure-atomic
collection	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Structure-collection
networked	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Structure-networked
hierarchical	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Structure-hierarchical
linear	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Structure-linear

LOM element 1.8 Aggregation Level

Value	URI
1	http://ltsc.ieee.org/rdf/lomv1.0/vocab#AggregationLevel-1
2	http://ltsc.ieee.org/rdf/lomv1.0/vocab#AggregationLevel-2
3	http://ltsc.ieee.org/rdf/lomv1.0/vocab#AggregationLevel-3
4	http://ltsc.ieee.org/rdf/lomv1.0/vocab#AggregationLevel-4

LOM element 2.2 Status

Value	URI
draft	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Status-draft
final	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Status-final
revised	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Status-revised
unavailable	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Status-unavailable

LOM element 2.3.1 Role and 3.2.1 Role

Value	URI
author	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Role-author
publisher	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Role-publisher
unknown	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Role-unknown
initiator	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Role-initiator
terminator	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Role-terminator
validator	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Role-validator
editor	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Role-editor
graphical designer	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Role-graphicalDesigner
technical implementer	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Role-technicalImplementer
content provider	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Role-contentProvider
technical validator	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Role-technicalValidator
educational validator	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Role-educationalValidator
script writer	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Role-scriptWriter

instructional designer	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Role-instructionalDesigner
subject matter expert	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Role-subjectMatterExpert

LOM element 3.3 Metadata Scheme

Value	URI
LOMv1.0	http://ltsc.ieee.org/rdf/lomv1.0/vocab#MetadataScheme-LOMv1.0

LOM element 4.4.1.1 Type

Value	URI
operating system	http://ltsc.ieee.org/rdf/lomv1.0/vocab#RequirementType-operatingSystem
browser	http://ltsc.ieee.org/rdf/lomv1.0/vocab#RequirementType-browser

LOM element 4.4.1.2 Name

Operating System Technology

Value	URI
pc-dos	http://ltsc.ieee.org/rdf/lomv1.0/vocab#OperatingSystemTechnology-pc-dos
ms-windows	http://ltsc.ieee.org/rdf/lomv1.0/vocab#OperatingSystemTechnology-ms-windows
macos	http://ltsc.ieee.org/rdf/lomv1.0/vocab#OperatingSystemTechnology-macos
unix	http://ltsc.ieee.org/rdf/lomv1.0/vocab#OperatingSystemTechnology-unix
multi-os	http://ltsc.ieee.org/rdf/lomv1.0/vocab#OperatingSystemTechnology-multi-os
none	http://ltsc.ieee.org/rdf/lomv1.0/vocab#OperatingSystemTechnology-none

Browser Technology

Value	URI
any	http://ltsc.ieee.org/rdf/lomv1.0/vocab#BrowserTechnology-any
netscape communicator	http://ltsc.ieee.org/rdf/lomv1.0/vocab#BrowserTechnology-netscapeCommunicator
ms-internet explorer	http://ltsc.ieee.org/rdf/lomv1.0/vocab#BrowserTechnology-ms-internetExplorer
opera	http://ltsc.ieee.org/rdf/lomv1.0/vocab#BrowserTechnology-opera
amaya	http://ltsc.ieee.org/rdf/lomv1.0/vocab#BrowserTechnology-amaya

LOM element 5.1 Interactivity Type

Value	URI
active	http://ltsc.ieee.org/rdf/lomv1.0/vocab#InteractivityType-active
expositive	http://ltsc.ieee.org/rdf/lomv1.0/vocab#InteractivityType-expositive
mixed	http://ltsc.ieee.org/rdf/lomv1.0/vocab#InteractivityType-mixed

LOM element 5.2 Learning Resource Type

Value	URI
exercise	http://ltsc.ieee.org/rdf/lomv1.0/vocab#LearningResourceType-exercise
simulation	http://ltsc.ieee.org/rdf/lomv1.0/vocab#LearningResourceType-simulation
questionnaire	http://ltsc.ieee.org/rdf/lomv1.0/vocab#LearningResourceType-questionnaire
diagram	http://ltsc.ieee.org/rdf/lomv1.0/vocab#LearningResourceType-diagram
figure	http://ltsc.ieee.org/rdf/lomv1.0/vocab#LearningResourceType-figure
graph	http://ltsc.ieee.org/rdf/lomv1.0/vocab#LearningResourceType-graph
index	http://ltsc.ieee.org/rdf/lomv1.0/vocab#LearningResourceType-index
slide	http://ltsc.ieee.org/rdf/lomv1.0/vocab#LearningResourceType-slide
table	http://ltsc.ieee.org/rdf/lomv1.0/vocab#LearningResourceType-table
narrative text	http://ltsc.ieee.org/rdf/lomv1.0/vocab#LearningResourceType-narrativeText
exam	http://ltsc.ieee.org/rdf/lomv1.0/vocab#LearningResourceType-exam
experiment	http://ltsc.ieee.org/rdf/lomv1.0/vocab#LearningResourceType-experiment
problem statement	http://ltsc.ieee.org/rdf/lomv1.0/vocab#LearningResourceType-problemStatement
self assessment	http://ltsc.ieee.org/rdf/lomv1.0/vocab#LearningResourceType-selfAssessment
lecture	http://ltsc.ieee.org/rdf/lomv1.0/vocab#LearningResourceType-lecture

LOM element 5.3 Interactivity Level

Value	URI
very low	http://ltsc.ieee.org/rdf/lomv1.0/vocab#InteractivityLevel-veryLow
low	http://ltsc.ieee.org/rdf/lomv1.0/vocab#InteractivityLevel-low
medium	http://ltsc.ieee.org/rdf/lomv1.0/vocab#InteractivityLevel-medium
high	http://ltsc.ieee.org/rdf/lomv1.0/vocab#InteractivityLevel-high
very high	http://ltsc.ieee.org/rdf/lomv1.0/vocab#InteractivityLevel-veryHigh

LOM element 5.4 Semantic Density

Value	URI
very low	http://ltsc.ieee.org/rdf/lomv1.0/vocab#SemanticDensity-veryLow
low	http://ltsc.ieee.org/rdf/lomv1.0/vocab#SemanticDensity-low
medium	http://ltsc.ieee.org/rdf/lomv1.0/vocab#SemanticDensity-medium
high	http://ltsc.ieee.org/rdf/lomv1.0/vocab#SemanticDensity-high
very high	http://ltsc.ieee.org/rdf/lomv1.0/vocab#SemanticDensity-veryHigh

LOM element 5.5 Intended End User Role

Value	URI
teacher	http://ltsc.ieee.org/rdf/lomv1.0/vocab#IntendedEndUserRole-teacher
author	http://ltsc.ieee.org/rdf/lomv1.0/vocab#IntendedEndUserRole-author
learner	http://ltsc.ieee.org/rdf/lomv1.0/vocab#IntendedEndUserRole-learner
manager	http://ltsc.ieee.org/rdf/lomv1.0/vocab#IntendedEndUserRole-manager

LOM element 5.6 Context

Value	URI
school	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Context-school
higher education	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Context-higherEducation
training	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Context-training
other	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Context-other

LOM element 5.8 Difficulty

Value	URI
very easy	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Difficulty-veryEasy
easy	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Difficulty-easy
medium	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Difficulty-medium
difficult	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Difficulty-difficult
very difficult	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Difficulty-veryDifficult

LOM element 7.1 Kind

Value	URI
ispartof	http://purl.org/dc/terms/isPartOf
haspart	http://purl.org/dc/terms/hasPart
isversionof	http://purl.org/dc/terms/isVersionOf
hasversion	http://purl.org/dc/terms/hasVersion
isformatof	http://purl.org/dc/terms/isFormatOf
hasformat	http://purl.org/dc/terms/hasFormat
references	http://purl.org/dc/terms/references
isreferencedby	http://purl.org/dc/terms/isReferencedBy
isbasedon	http://purl.org/dc/terms/source
isbasisfor	http://ltsc.ieee.org/rdf/lomv1p0/terms#isBasisFor
requires	http://purl.org/dc/terms/requires
isrequiredby	http://purl.org/dc/terms/isRequiredBy

LOM element 9.1 Purpose

Value	URI
discipline	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Purpose-discipline
idea	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Purpose-idea
prerequisite	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Purpose-prerequisite
educationalObjective	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Purpose-educationalObjective
accessibility restrictions	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Purpose-accessibilityRestrictions
educationalLevel	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Purpose-educationalLevel
skillLevel	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Purpose-skillLevel
securityLevel	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Purpose-securityLevel
competency	http://ltsc.ieee.org/rdf/lomv1.0/vocab#Purpose-competency

Copyright and Other Restrictions

Value	URI
Yes	http://ltsc.ieee.org/rdf/LOM/rights#yes
No	http://ltsc.ieee.org/rdf/LOM/rights#No

E. References

Dated references below are to the latest known or appropriate edition of the referenced work. The referenced works may be subject to revision, and conformer implementations may follow, and are encouraged to investigate the appropriateness of following, some or all more recent editions or replacements of the works cited. It is in each case implementation-defined which editions are supported.

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