

1484.12.1™

IEEE Standard for Learning Object Metadata

IEEE Computer Society

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IEEE Standard for Learning Object Metadata

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**Learning Technology Standards Committee
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IEEE Computer Society**

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Abstract: A conceptual data schema that defines the structure of metadata for a learning object is specified in this standard.

Keywords: learning object, learning object metadata (LOM), metadata, reuse

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Introduction

(This introduction is not part of IEEE Std 1484.12.1-2002, IEEE Standard for Learning Object Metadata.)

Metadata is information about an object, be it physical or digital. As the number of objects grows exponentially and our needs for learning expand equally dramatically, the lack of information or metadata about objects places a critical and fundamental constraint on our ability to discover, manage, and use objects.

This standard addresses this problem by defining a structure for interoperable descriptions of learning objects.

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IEEE Standard for Learning Object Metadata

1. Overview

1.1 Scope

This is a multi-part standard that specifies learning object metadata. This part specifies a conceptual data schema that defines the structure of a metadata instance for a learning object. For this standard, a learning object is defined as any entity—digital or non-digital—that may be used for learning, education, or training.

For this standard, a metadata instance for a learning object describes relevant characteristics of the learning object to which it applies. Such characteristics may be grouped in general, life cycle, meta-metadata, educational, technical, educational, rights, relation, annotation, and classification categories.

The conceptual data schema specified in this part permits linguistic diversity of both learning objects and the metadata instances that describe them.

This conceptual data schema specifies the data elements which compose a metadata instance for a learning object.

This part is intended to be referenced by other standards that define the implementation descriptions of the data schema so that a metadata instance for a learning object can be used by a learning technology system to manage, locate, evaluate, or exchange learning objects.

This part of this standard does not define how a learning technology system represents or uses a metadata instance for a learning object.

1.2 Purpose

The purpose of this multi-part standard is to facilitate search, evaluation, acquisition, and use of learning objects, for instance by learners or instructors or automated software processes. This multi-part standard also facilitates the sharing and exchange of learning objects, by enabling the development of catalogs and inventories while taking into account the diversity of cultural and lingual contexts in which the learning objects and their metadata are reused.

By specifying a common conceptual data schema, this part of this standard ensures that bindings of learning object metadata (LOM) have a high degree of semantic interoperability. As a result, transformations between bindings will be straightforward.

This part of this standard specifies a base schema, which may be extended as practice develops, e.g., facilitating automatic, adaptive scheduling of learning objects by software agents.

2. References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies.

IETF RFC 2048:1996, Multipurpose Internet Mail Extensions (MIME) Part Four: Registration Procedures.^{1, 2}

IETF RFC 2425: 1998, MIME Content-Type for Directory Information.^{2, 3}

IETF RFC 2426: 1998, vCard MIME Directory Profile.^{2, 3}

ISO 639-1:2002, Codes for the Representation of Names of Languages—Part 1: Alpha-2 Code.^{4, 5}

ISO 639-2:1998, Codes for the Representation of Names of Languages—Part 2: Alpha-3 Code.⁵

ISO 3166-1:1997, Codes for the Representation of Names of Countries and their Subdivisions—Part 1: Country Codes.⁶

ISO 8601:2000, Data Elements and Interchange Formats—Information Interchange—Representation of Dates and Times.⁷

ISO/IEC 646:1991, Information Technology—ISO 7-Bit Coded Character Set for Information Interchange.^{8, 9}

ISO/IEC 10646-1:2000, Information Technology—Universal Multiple-Octet Coded Character Set (UCS)—Part 1: Architecture and Basic Multilingual Plane.¹⁰

OED:1989, Oxford English Dictionary, 2nd Ed. 1989.¹¹

¹IETF RFC documents are available at <http://www.ietf.org/rfc>.

²Multipurpose Internet Mail Extensions (MIME) extends the format of Internet mail to allow non-US-ASCII textual messages, non-textual messages, multipart message bodies, and non-US-ASCII information in message headers.

³This standard defines how contact details for people and organizations can be represented. The vCard MIME Directory Profile is defined in IETF RFC 2425:1998 and IETF RFC 2426:1998.

⁴ISO publications are available from the ISO Central Secretariat, Case Postale 56, 1 rue de Varembe, CH-1211, Genève 20, Switzerland/Suisse (<http://www.iso.ch/>). ISO publications are also available in the United States from the Sales Department, American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, NY 10036, USA (<http://www.ansi.org/>).

⁵This is an international standard for the representation of languages. ISO 639-1:2002 defines two-letter language codes, e.g., “en” for English, “fr” for French, “nl” for Dutch, etc. These language codes are a basis for the IETF registry of language tags, as specified in RFC 1766:1995 [B6]. Tags for the identification of languages. ISO 639-2:1998 defines three-letter language codes, e.g. “grc” for Ancient Greek, “eng” for English.

⁶This is an international standard for the representation of country codes, e.g., “BE” for Belgium, “CA” for Canada, “FR” for France, “GB” for United Kingdom, “US” for United States, etc.

⁷This is an international standard that specifies numeric representations of date and time. The basic notation is YYYY-MM-DD where YYYY is the year in the usual Gregorian calendar, MM is the month of the year between 01 (January) and 12 (December), and DD is the day of the month between 01 and 31.

⁸ISO/IEC publications are available from the ISO Central Secretariat, Case Postale 56, 1 rue de Varembe, CH-1211, Genève 20, Switzerland/Suisse (<http://www.iso.ch/>). ISO/IEC publications are also available in the United States from Global Engineering Documents, 15 Inverness Way East, Englewood, Colorado 80112, USA (<http://global.ihs.com/>). Electronic copies are available in the United States from the American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, NY 10036, USA (<http://www.ansi.org/>).

⁹This is an international standard that defines the international 7-bit coded character set with national variants.

¹⁰This is an international standard that specifies a character set that relies on 32 bits, includes approximately 4 billion characters, of which the first 65536 are Unicode, the first 256 are ISO 8859-1, and the first 128 are ASCII.

¹¹The Oxford English Dictionary is available at <http://www.oed.com>.

3. Definitions

3.1 category: A group of related data elements.

3.2 datatype: A property of distinct values, indicating common features of those values and operations on those values.

3.3 extended data element: An element of a data structure that is defined outside a standard and is permitted within an instance of the data structure.

3.4 LangString: A datatype that represents one or more character strings. A LangString value may include multiple semantically equivalent character strings, such as translations or alternative descriptions. *See also: datatype.*

3.5 learning object: For this standard, a learning object is defined as any entity, digital or non-digital, that may be used for learning, education, or training.

3.6 learning object metadata (LOM) data element: A data element for which the name, explanation, size, ordering, value space, and datatype are defined in this standard.

3.7 smallest permitted maximum: For implementation-defined values, the smallest permitted maximum value.

NOTE—See 4.5.

3.8 value space: The set of values for a given datatype (ISO/IEC 11404:1996 [B5]).

NOTE—In LOM, a value space is typically enumerated outright, or defined by reference to another standard or specification.

4. Overview of the metadata structure

4.1 Basic metadata structure

Data elements describe a learning object and are grouped into categories. The LOMv1.0 base schema (see Clause 6) consists of nine such categories:

- a) The *general* category groups the general information that describes the learning object as a whole.
- b) The *lifecycle* category groups the features related to the history and current state of this learning object and those who have affected this learning object during its evolution.
- c) The *meta-metadata* category groups information about the metadata instance itself (rather than the learning object that the metadata instance describes).
- d) The *technical* category groups the technical requirements and technical characteristics of the learning object.
- e) The *educational* category groups the educational and pedagogic characteristics of the learning object.
- f) The *rights* category groups the intellectual property rights and conditions of use for the learning object.
- g) The *relation* category groups features that define the relationship between the learning object and other related learning objects.
- h) The *annotation* category provides comments on the educational use of the learning object and provides information on when and by whom the comments were created.
- i) The *classification* category describes this learning object in relation to a particular classification system.

Collectively, these categories form the LOMv1.0 base schema. The classification category may be used to provide certain types of extensions to the LOMv1.0 base schema, as any classification system can be referenced.

4.2 Data elements

Categories group data elements. The LOM data model is a hierarchy of data elements, including aggregate data elements and simple data elements (leaf nodes of the hierarchy). In the LOMv1.0 base schema, only leaf nodes have individual values defined through their associated value space and datatype. Aggregates in the LOMv1.0 base schema do not have individual values. Consequently, they have no value space or datatype. For each data element, the LOMv1.0 base schema defines the following:

- *name*: the name by which the data element is referenced;
- *explanation*: the definition of the data element;
- *size*: the number of values allowed;
- *order*: whether the order of the values is significant (only applicable for data elements with list values; see 4.3);
- *example*: an illustrative example.

For simple data elements, the LOMv1.0 base schema also defines:

- *value space*: the set of allowed values for the data element—typically in the form of a vocabulary or a reference to another standard (see 3.8);
- *datatype*: indicates whether the values are LangString (see Clause 7), DateTime (see Clause 8), Duration (see Clause 9), Vocabulary (see Clause 10), CharacterString, or Undefined.

Both the size and datatype information may include smallest permitted maximum values.

Extensions to the LOMv1.0 base schema shall retain the value space and datatype of data elements from the LOMv1.0 base schema. Extensions shall not define datatypes or value spaces for aggregate data elements in the LOMv1.0 base schema.

The numbering schema of the data elements represents an aggregation hierarchy of data elements and their components. As an example, the aggregate data element 7.2:Relation.Resource has two components: 7.2.1:Relation.Resource.Identifier and 7.2.2:Relation.Resource.Description. The former data element is in turn an aggregate, as it contains the following components: 7.2.1.1:Relation.Resource.Identifier.Catalog and 7.2.1.2:Relation.Resource.Identifier.Entry. (See 4.3 for the interpretation of aggregate data elements that have list values.)

All data elements are optional. This means that a conforming LOM instance may include values for any data element defined in Clause 6. As the LOMv1.0 base schema in Clause 6 imposes an aggregation relationship, components can, by definition, only be present in a LOM instance as a component of the aggregate element to which they belong. As an example, 7.2.1:Relation.Resource.Identifier appears by definition as a component of 7.2:Relation.Resource. In that sense, the presence of the component implies automatically the presence of the aggregate element to which the component belongs.

4.3 List values

In some instances, a data element contains a list of values, rather than a single value. Lists of values are as follows:

- *ordered*: the order of the values in the list is significant. For example, in a list of authors of a publication, the first author is often considered the more important one. As another example, in a hierarchical classification structure, the order is from more general to more specific.
- *unordered*: the order of the values in the list bears no meaning. For example, if the description of a simulation includes three short texts that describe the intended educational use in three different languages, then the order of these texts is not significant. They may appear in any order without loss of information.

If an aggregate data element contains a list of values, then each of these values shall be a tuple of component elements. For example, the LOMv1.0 base schema specifies that the data element 1.1:General.Identifier contains an unordered list of values. This means that the value of the data element 1.1:General.Identifier is an unordered list of tuples (1.1.1:General.Identifier.Catalog and 1.1.2:General.Identifier.Entry). In this case, for each individual 1.1:General.Identifier value, 1.1.1:General.Identifier.Catalog determines the catalog from which the corresponding 1.1.2:General.Identifier.Entry originates.

4.4 Vocabularies

Vocabularies are defined for some data elements. A vocabulary is a recommended list of appropriate values. Other values, not present in the list, may be used as well. However, metadata that rely on the recommended values will have the highest degree of semantic interoperability; i.e., the likelihood that such metadata will be understood by other end users or systems is highest.

The value of data elements with associated vocabularies shall be represented as a pair (source, value), as detailed in Clause 10. If the source is “LOMv1.0,” then the value space is described by this edition of this standard.

NOTE—If the source is not “LOMv1.0,” then users and implementers are encouraged to create vocabularies that do not conflict with this standard.

If a vocabulary is used that intersects with the LOMv1.0 vocabulary, then only the values not included in this standard should have a source that is not “LOMv1.0.” This will maximize semantic interoperability for the values that are included in this standard.

Example:

As an illustration, we give examples of the different cases for the data element 5.2:Educational.LearningResourceType:

- a) If the value is just contained in the vocabulary, for instance, “Questionnaire,” then this would be represented as (“LOMv1.0,” “Questionnaire”). This option is preferred if the values in the vocabulary can adequately express the intended meaning.
- b) If the user wants to assign a value that is not part of the list given for 5.2:Educational.LearningResourceType, then the user may designate the value as, for instance, (“http://www.vocabularies.org/LearningResourceType,” “MotivatingExample”). This option provides more flexibility to the indexer of learning objects, at the expense of semantic interoperability. Values defined in one community of users, or by an individual end user, will not be used consistently throughout a larger community. In example b), a URI was used to indicate the source of the vocabulary. This approach may be good practice, but using a URI is not a requirement.

The meaning associated with a vocabulary value is defined by the corresponding term in OED:1989, unless explicitly defined in the LOMv1.0 base schema.

NOTE—Future amendments to this standard may incorporate the use of registries.

4.5 Smallest permitted maximum values

In the LOMv1.0 base schema (see Clause 6), smallest permitted maximum values are defined for the following:

- *aggregate data elements*: All applications that process LOM instances shall process at least that number of entries. In other words, an application may impose a maximum on the number of entries it processes for the value of that data element, but that maximum shall not be lower than the smallest permitted maximum value.
- *data elements with datatype `CharacterString` or `LangString`*: All applications that process LOM instances shall process at least that length for the `CharacterString` value (either directly or contained in the `LangString`) of that data element. In other words, an application may impose a maximum on the number of characters it processes for the `CharacterString` value of that data element, but that maximum shall not be lower than the smallest permitted maximum value for the datatype of the data element.

NOTES:

1—The intent is for the smallest permitted maximum values to cover most cases.

2—What “processing” means in 4.5 depends on the nature of the application.

4.6 Character sets

This standard defines a conceptual structure for LOM. It does not specify bindings, encodings, and representations, which are specified in other parts of this standard. The LOMv1.0 base schema does not specify encodings for `CharacterString` (in the case of non-restricted `CharacterString` values, reference is made to the repertoire of ISO/IEC 10646-1:2000). Whatever decisions are made in documents that deal with representation, such decisions shall be taken with a view to support multiple languages.

4.7 Representation

For each data element, the specification includes the datatype (e.g., `LangString`, `DateTime`, etc.) of its values.

This standard does not define tokens for element names or vocabulary values. It is expected that such tokens will be defined in bindings of this standard.

Within the LOMv1.0 base schema, the ordering of the categories and the data elements within the categories and subcategories is informational. An instance of the LOMv1.0 base schema shall preserve the nesting of categories and subcategories, but the instance need not order the categories or the subitems within a category or subcategory. For example, category 5:Educational may appear before category 1:General, and within category General, item 1.3:General.Language may appear before item 1.2:General.Title.

5. Conformance

- A strictly conforming LOM metadata instance shall consist solely of LOM data elements.
- A conforming LOM metadata instance may contain extended data elements.
- A LOM instance that contains no value for any of the LOM data elements is a conforming instance.

In order to maximize semantic interoperability, extended data elements should not replace data elements in the LOM structure. This means that an organization should not introduce new data elements of its own that replace LOM data elements. As an example, an organization should not introduce a new data element “name” that would replace 1.2:General.Title.

NOTE—In order to maximize semantic interoperability, users of this standard are encouraged to carefully map their metadata information to the data elements of this standard. For example, the user should not map an element to describe the fonts used in the document to the data element 1.2:General.Title.

6. Base Schema

Table 1 defines the LOMv1.0 base schema structure.

(The remainder of this page is intentionally blank. Table 1 begins on the following page.)

Table 1 — LOMv1.0 base schema

Nr	Name	Explanation	Size	Order	Value space	Datatype	Example
1	General	This category groups the general information that describes this learning object as a whole.	1	unspecified	-	-	-
1.1	Identifier	A globally unique label that identifies this learning object.	smallest permitted maximum: 10 items	unspecified	-	-	-
1.1.1	Catalog	The name or designator of the identification or cataloging scheme for this entry. A namespace scheme.	1	unspecified	Repertoire of ISO/IEC 10646-1:2000	CharacterString (smallest permitted maximum: 1000 char)	"ISBN;" "ARIADNE;" "URI"
1.1.2	Entry	The value of the identifier within the identification or cataloging scheme that designates or identifies this learning object. A namespace specific string.	1	unspecified	Repertoire of ISO/IEC 10646-1:2000	CharacterString (smallest permitted maximum: 1000 char)	"2-7342-0318;" "LEAO875;" "http://www.ieee.org/documents/1234"
1.2	Title	Name given to this learning object.	1	unspecified	-	LangString (smallest permitted maximum: 1000 char)	("en;" "The life and works of Leonardo da Vinci")
1.3	Language	<p>The primary human language or languages used within this learning object to communicate to the intended user.</p> <p>NOTES</p> <p>1—An indexation or cataloging tool may provide a useful default.</p> <p>2—If the learning object had no lingual content (as in the case of a picture of the Mona Lisa, for example), then the appropriate value for this data element would be "none."</p> <p>3—This data element concerns the language of the learning object. Data element 3.4:Meta-Metadata.Language concerns the language of the metadata instance.</p>	smallest permitted maximum: 10 items	unordered	<p>LanguageID = Langcode ("-"Subcode)* with Langcode a language code as defined by the code set ISO 639:1988 and Subcode (which can occur an arbitrary number of times) a country code from the code set ISO 3166-1:1997.</p> <p>NOTES</p> <p>1—This value space is also defined by RFC1766:1995 and is harmonized with that of the xml:lang attribute.</p> <p>2—ISO 639:1988 also includes "ancient" languages, like Greek and Latin.</p> <p>The language code should be given in lower case and the country code (if any) in upper case. However, the values are case insensitive.</p> <p>"none" shall also be an acceptable value.</p>	CharacterString (smallest permitted maximum: 100 char)	<p>"en"</p> <p>"en-GB"</p> <p>"de"</p> <p>"fr-CA"</p> <p>"it"</p> <p>"grc" (ancient greek, until 1453)</p> <p>"en-US-philadelphia"</p> <p>"eng-GB-cockney"</p> <p>"map-PG-buin" (Austronesian – Papua New Guinea – buin)</p> <p>"gem-US-pennsylvania"</p>

Table 1—LOMv1.0 base schema (continued)

Nr	Name	Explanation	Size	Order	Value space	Datatype	Example
1.4	Description	A textual description of the content of this learning object. NOTE—This description need not be in language and terms appropriate for the users of the learning object being described. The description should be in language and terms appropriate for those that decide whether or not the learning object being described is appropriate and relevant for the users.	smallest permitted maximum: 10 items	unordered	-	LangString (smallest permitted maximum: 2000 char)	("en," "In this video clip, the life and works of Leonardo da Vinci are briefly presented. The focus is on his artistic production, most notably the Mona Lisa.")
1.5	Keyword	A keyword or phrase describing the topic of this learning object. This data element should not be used for characteristics that can be described by other data elements.	smallest permitted maximum: 10 items	unordered	-	LangString (smallest permitted maximum: 1000 char)	("en," "Mona Lisa")
1.6	Coverage	The time, culture, geography or region to which this learning object applies. The extent or scope of the content of the learning object. Coverage will typically include spatial location (a place name or geographic coordinates), temporal period (a period label, date, or date range) or jurisdiction (such as a named administrative entity). Recommended best practice is to select a value from a controlled vocabulary (for example, the Thesaurus of Geographic Names [TGN]) and that, where appropriate, named places or time periods be used in preference to numeric identifiers such as sets of coordinates or date ranges. NOTE — This is the definition from the Dublin Core Metadata Element Set, version 1.1 [B1]. (http://www.dublincore.org/documents/dces/)	smallest permitted maximum: 10 items	unordered	-	LangString (smallest permitted maximum: 1000 char)	("en," "16th century France") NOTE — A learning object could be about farming in 16th century France; in that case, its subject can be described with 1.5:General.Keyword=("en," "farming") and its 1.6:General.Coverage can be ("en," "16th century France").
1.7	Structure	Underlying organizational structure of this learning object.	1	unspecified	<i>atomic</i> : an object that is indivisible (in this context). <i>collection</i> : a set of objects with no specified relationship between them. <i>networked</i> : a set of objects with relationships that are unspecified. <i>hierarchical</i> : a set of objects whose relationships can be represented by a tree structure. <i>linear</i> : a set of objects that are fully ordered. (Example: A set of objects that are connected by "previous" and "next" relationships.)	Vocabulary (State)	NOTE—A learning object with Structure="atomic" will typically have 1.8:General.AggregationLevel=1. A learning object with Structure="collection", "linear", "hierarchical" or "networked" will typically have 1.8:General.AggregationLevel=2, 3, or 4.

Table 1 — LOMv1.0 base schema (continued)

Nr	Name	Explanation	Size	Order	Value space	Datatype	Example
1.8	Aggregation Level	The functional granularity of this learning object.	1	unspecified	<p>1: the smallest level of aggregation, e.g., raw media data or fragments.</p> <p>2: a collection of level 1 learning objects, e.g., a lesson.</p> <p>3: a collection of level 2 learning objects, e.g., a course.</p> <p>4: the largest level of granularity, e.g., a set of courses that lead to a certificate.</p> <p>NOTE — Level 4 objects can contain level 3 objects, or can recursively contain other level 4 objects.</p>	Vocabulary (Enumerated)	<p>If the learning object is a digital picture of the Mona Lisa, 1.7:General.Structure=Atomic and 1.8:General.AggregationLevel=1.</p> <p>If the learning object is a lesson with the digital picture of the Mona Lisa, 1.7:General.Structure=Collection or Networked (since there are two descriptions of the same type of Structure) and 1.8:General.AggregationLevel=2.</p> <p>If the learning object is a course on the Mona Lisa, 1.7:General.Structure=Linear if the documents are intended to be viewed linearly and 1.8:General.AggregationLevel=3.</p> <p>If the learning object is a collection of lessons on the Mona Lisa from different sources, 1.7:General.Structure=Collection and 1.8:General.AggregationLevel=3.</p> <p>Lastly, if the learning object is a set of courses with a full history, description, interpretation, etc. of the Mona Lisa, 1.7:General.Structure=Linear or Hierarchical and 1.8:General.AggregationLevel=4.</p> <p>NOTE 2:--A learning object with AggregationLevel=1 will typically have 1.7:General.Structure="atomic." A learning object with AggregationLevel=2, 3 or 4 will typically have 1.7:General.Structure="collection," "linear," "hierarchical" or "networked."</p>
2	Life Cycle	This category describes the history and current state of this learning object and those entities that have affected this learning object during its evolution.	1	unspecified	-	-	-
2.1	Version	The edition of this learning object.	1	unspecified	-	LangString (smallest permitted maximum: 50 char)	("en," "1.2.alpha"), ("nl," "voorlopige versie")

Table 1 — LOMv1.0 base schema (continued)

Nr	Name	Explanation	Size	Order	Value space	Datatype	Example
2.2	Status	The completion status or condition of this learning object.	1	unspecified	draft final revised unavailable NOTE — When the status is “unavailable” it means that the learning object itself is not available.	Vocabulary (State)	-
2.3	Contribute	Those entities (i.e., people, organizations) that have contributed to the state of this learning object during its life cycle (e.g., creation, edits, publication). NOTES 1 — This data element is different from 3.3:Metadata.Contribute. 2 — Contributions should be considered in a very broad sense here, as all actions that affect the state of the learning object.	smallest permitted maximum: 30 items	ordered	-	-	-
2.3.1	Role	Kind of contribution. NOTE — Minimally, the Author(s) of the learning object should be described.	1	unspecified	author publisher unknown initiator terminator validator editor graphical designer technical implementer content provider technical validator educational validator script writer instructional designer subject matter expert NOTE — “terminator” is the entity that made the learning object unavailable.	Vocabulary (State)	-
2.3.2	Entity	The identification of and information about entities (i.e., people, organizations) contributing to this learning object. The entities shall be ordered as most relevant first.	smallest permitted maximum: 40 items	ordered	vCard, as defined by IMC vCard 3.0 (IETF RFC 2425:1998, IETF RFC 2426:1998).	CharacterString (smallest permitted maximum: 1000 char)	“BEGIN:VCARD\nFN:Joe Friday\nTEL:+1-919-555-7878\nTITLE:Area Administrator\nAssistant\nEMAIL\;TYPE=INTERNET:jfriday@host.com\nEND:VCARD\n”
2.3.3	Date	The date of the contribution.	1	unspecified	-	DateTime	“2001-08-23”

Table 1—LOMv1.0 base schema (continued)

Nr	Name	Explanation	Size	Order	Value space	Datatype	Example
3	Meta-Metadata	This category describes this metadata record itself (rather than the learning object that this record describes). This category describes how the metadata instance can be identified, who created this metadata instance, and how, when, and with what references. NOTE—This is not the information that describes the learning object itself.	1	unspecified	-	-	-
3.1	Identifier	A globally unique label that identifies this metadata record.	smallest permitted maximum: 10 items	unspecified	-	-	-
3.1.1	Catalog	The name or designator of the identification or cataloging scheme for this entry. A namespace scheme.	1	unspecified	Repertoire of ISO/IEC 10646-1:2000	CharacterString (smallest permitted maximum: 1000 char)	“ARIADNE,” “URI”
3.1.2	Entry	The value of the identifier within the identification or cataloging scheme that designates or identifies this metadata record. A namespace specific string.	1	unspecified	Repertoire of ISO/IEC 10646-1:2000	CharacterString (smallest permitted maximum: 1000 char)	“KUL532,” “http://www.ieee.org/descriptions/1234”
3.2	Contribute	Those entities (i.e., people or organizations) that have affected the state of this metadata instance during its life cycle (e.g., creation, validation). NOTE—This data element is concerned with contributions to the metadata. Data element 2.3:Lifecycle.Contribute is concerned with contributions to the learning object.	smallest permitted maximum: 10 items	ordered	-	-	-
3.2.1	Role	Kind of contribution. Exactly one instance of this data element with value “creator” should exist.	1	unspecified	creator validator	Vocabulary (State)	-
3.2.2	Entity	The identification of and information about entities (i.e., people, organizations) contributing to this metadata instance. The entities shall be ordered as most relevant first.	smallest permitted maximum: 10 items	ordered	vCard, as defined by IMC vCard 3.0 (RFC 2425, RFC 2426).	CharacterString (smallest permitted maximum: 1000 char)	“BEGIN:VCARD\nFN:Joe Friday\nTEL:+1-919-555-7878\nTITLE:Area Administrator\nAssistant\nEMAIL;\nTYPE=INTERNET:jfriday@host.com\nEND:VCARD\n”
3.2.3	Date	The date of the contribution.	1	unspecified	-	DateTime	“2001-08-23”

Table 1—LOMv1.0 base schema (continued)

Nr	Name	Explanation	Size	Order	Value space	Datatype	Example
3.3	Metadata Schema	The name and version of the authoritative specification used to create this metadata instance. NOTE:--This data element may be user selectable or system generated. If multiple values are provided, then the metadata instance shall conform to multiple metadata schemas.	smallest permitted maximum: 10 items	unordered	Repertoire of ISO/IEC 10646-1:2000	CharacterString (smallest permitted maximum: 30 char)	"LOMv1.0"
3.4	Language	Language of this metadata instance. This is the default language for all LangString values in this metadata instance. If a value for this data element is not present in a metadata instance, then there is no default language for LangString values. NOTE 1—This data element concerns the language of the metadata instance. Data element 1.3:General.Language concerns the language of the learning object.	1	unspecified	see 1.3:General.Language For this data element, "none" shall not be an acceptable value. NOTE— "none" is unacceptable, because the metadata instance is in one or more human languages. "none" is acceptable for 1.3:General.Language, as the learning object itself may be in no particular human language. For example, a picture of the Mona Lisa has "none" for 1.3:General.Language. If its description (i.e., metadata instance) is in Swedish, then 3.4:Meta-Metadata.Language has value "sv."	CharacterString (smallest permitted maximum: 100 char)	"en"
4	Technical	This category describes the technical requirements and characteristics of this learning object.	1	unspecified	-	-	-
4.1	Format	Technical datatype(s) of (all the components of) this learning object. This data element shall be used to identify the software needed to access the learning object.	smallest permitted maximum: 40 items	unordered	MIME types based on IANA registration (see RFC2048:1996) or "non-digital"	CharacterString (smallest permitted maximum: 500 char)	"video/mpeg" "application/x-toolbook" "text/html"
4.2	Size	The size of the digital learning object in bytes (octets). The size is represented as a decimal value (radix 10). Consequently, only the digits "0" through "9" should be used. The unit is bytes, not Mbytes, GB, etc. This data element shall refer to the actual size of this learning object. If the learning object is compressed, then this data element shall refer to the uncompressed size.	1	unspecified	ISO/IEC 646:1991, but only the digits "0".."9"	CharacterString (smallest permitted maximum: 30 char)	"4200"

Table 1 — LOMv1.0 base schema (continued)

Nr	Name	Explanation	Size	Order	Value space	Datatype	Example
4.3	Location	A string that is used to access this learning object. It may be a location (e.g., Universal Resource Locator), or a method that resolves to a location (e.g., Universal Resource Identifier). The first element of this list shall be the preferable location. NOTE—This is where the learning object described by this metadata instance is physically located.	smallest permitted maximum: 10 items	ordered	Repertoire of ISO/IEC 10646-1:2000	CharacterString (smallest permitted maximum: 1000 char)	"http://host/id"
4.4	Requirement	The technical capabilities necessary for using this learning object. If there are multiple requirements, then all are required, i.e., the logical connector is AND.	smallest permitted maximum: 40 items	unordered	-	-	-
4.4.1	OrComposite	Grouping of multiple requirements. The composite requirement is satisfied when one of the component requirements is satisfied, i.e., the logical connector is OR.	smallest permitted maximum: 40 items	unordered	-	-	-
4.4.1.1	Type	The technology required to use this learning object, e.g., hardware, software, network, etc.	1	unspecified	operating system browser	Vocabulary (State)	-
4.4.1.2	Name	Name of the required technology to use this learning object. NOTES 1—The value for this data element may be derived from 4.1:Technical.Format automatically, e.g., "video/mpeg" implies "multi-os." 2—This vocabulary includes most values in common use at the time that this Standard was approved.	1	unspecified	if Type= "operating system" then: pc-dos ms-windows macos unix multi-os none if Type= "browser" then: any netscape communicator ms-internet explorer opera amaya	Vocabulary (State)	-
4.4.1.3	Minimum Version	Lowest possible version of the required technology to use this learning object.	1	unspecified	Repertoire of ISO/IEC 10646-1:2000	CharacterString (smallest permitted maximum: 30 char)	"4.2"
4.4.1.4	Maximum Version	Highest possible version of the required technology to use this learning object.	1	unspecified	Repertoire of ISO/IEC 10646-1:2000	CharacterString (smallest permitted maximum: 30 char)	"6.2"
4.5	Installation Remarks	Description of how to install this learning object.	1	unspecified	-	LangString (smallest permitted maximum: 1000 char)	("en," "Unzip the zip file and launch index.html in your web browser.")

Table 1 — LOMv1.0 base schema (continued)

Nr	Name	Explanation	Size	Order	Value space	Datatype	Example
4.6	Other Platform Requirements	Information about other software and hardware requirements. NOTE—This element is intended for descriptions of requirements that cannot be expressed by data element 4.4: Technical.Requirement.	1	unspecified	-	LangString (smallest permitted maximum: 1000 char)	("en," "sound card"), ("en," "runtime X")
4.7	Duration	Time a continuous learning object takes when played at intended speed. NOTE—This data element is especially useful for sounds, movies or animations.	1	unspecified	-	Duration	"PT1H30M," "PT1M45S"
5	Educational	This category describes the key educational or pedagogic characteristics of this learning object. NOTE—This is the pedagogical information essential to those involved in achieving a quality learning experience. The audience for this meta-data includes teachers, managers, authors, and learners.	smallest permitted maximum: 100 items	unspecified	-	-	-
5.1	Interactivity Type	Predominant mode of learning supported by this learning project. "Active" learning (e.g., learning by doing) is supported by content that directly induces productive action by the learner. An active learning object prompts the learner for semantically meaningful input or for some other kind of productive action or decision, not necessarily performed within the learning object's framework. Active documents include simulations, questionnaires, and exercises. "Expositive" learning (e.g., passive learning) occurs when the learner's job mainly consists of absorbing the content exposed to him (generally through text, images or sound). An expositive learning object displays information but does not prompt the learner for any semantically meaningful input. Expositive documents include essays, video clips, all kinds of graphical material, and hypertext documents. When a learning object blends the active and expositive interactivity types, then its interactivity type is "mixed." NOTE—Activating links to navigate in hypertext documents is not considered to be a productive action.	1	unspecified	active expositive mixed	Vocabulary (State)	<i>active documents (with learner's action):</i> — simulation (manipulates, controls or enters data or parameters); — questionnaire (chooses or writes answers); — exercise (finds solution); — problem statement (writes solution). <i>expositive documents (with learner's action):</i> — hypertext document (reads, navigates); — video (views, rewinds, starts, stops); — graphical material (views); — audio material (listens, rewinds, starts, stops). <i>mixed document:</i> — hypermedia document with embedded simulation applet.

Table 1 — LOMv1.0 base schema (continued)

Nr	Name	Explanation	Size	Order	Value space	Datatype	Example
5.2	Learning Resource Type	Specific kind of learning object. The most dominant kind shall be first. NOTE—The vocabulary terms are defined as in the OED:1989 and as used by educational communities of practice.	smallest permitted maximum: 10 items	ordered	exercise simulation questionnaire diagram figure graph index slide table narrative text exam experiment problem statement self assessment lecture	Vocabulary (State)	-
5.3	Interactivity Level	The degree of interactivity characterizing this learning object. Interactivity in this context refers to the degree to which the learner can influence the aspect or behavior of the learning object. NOTE—Inherently, this scale is meaningful within the context of a community of practice.	1	unspecified	very low low medium high very high	Vocabulary (Enumerated)	NOTE—Learning objects with 5.1:Educational.Interactivity-Type="active" may have a high interactivity level (e.g., a simulation environment endowed with many controls) or a low interactivity level (e.g., a written set of instructions that solicit an activity). Learning objects with 5.1:Educational.Interactivity-Type="expositive" may have a low interactivity level (e.g., a piece of linear, narrative text produced with a standard word processor) or a medium to high interactivity level (e.g., a sophisticated hyperdocument, with many internal links and views).

Table 1 — LOMv1.0 base schema (continued)

Nr	Name	Explanation	Size	Order	Value space	Datatype	Example
5.4	Semantic Density	<p>The degree of conciseness of a learning object. The semantic density of a learning object may be estimated in terms of its size, span, or—in the case of self-timed resources such as audio or video—duration.</p> <p>The semantic density of a learning object is independent of its difficulty. It is best illustrated with examples of expositive material, although it can be used with active resources as well.</p> <p>NOTE—Inherently, this scale is meaningful within the context of a community of practice.</p>	1	unspecified	very low low medium high very high	Vocabulary (Enumerated)	<p><i>Active documents (user interface of a simulation):</i></p> <p>a) low semantic density: a screen filled up with explanatory text, a picture of a combustion engine, and a single button labeled “Click here to continue”</p> <p>b) high semantic density: screen with short text, same picture, and three buttons labeled “Change compression ratio,” “Change octane index,” “Change ignition point advance”</p> <p><i>Expositive documents:</i></p> <p>a) medium difficulty text document</p> <p>1) medium semantic density: “The class of Marsupial animals comprises a number of relatively primitive mammals. They are endowed with a short placenta, after which they give birth to a larva. The larva thereafter takes refuge in the mother’s marsupium, where it settles to finish its complete development.”</p> <p>2) high semantic density: “Marsupials are primitive mammals, with short placenta followed by the birth of larva, which thereafter takes refuge in the marsupium to finish its development.”</p> <p>b) easy video document</p> <p>1) low semantic density: The full recorded footage of a conversation between two experts on the differences between Asian and African elephants; 30 min duration.</p> <p>2) high semantic density: An expertly edited abstract of the same conversation; 5 min duration.</p> <p>c) difficult mathematical notation</p> <p>1) medium semantic density: The text representation of the theorem: For any given set φ, it is always possible to define another set ψ, which is a superset of φ.</p> <p>2) very high semantic density: The symbolic representation (formula) of the theorem ($\forall \varphi \exists \psi: \psi \supset \varphi$)</p>

Table 1—LOMv1.0 base schema (continued)

Nr	Name	Explanation	Size	Order	Value space	Datatype	Example
5.5	Intended End User Role	Principal user(s) for which this learning object was designed, most dominant first. NOTES 1— A learner works with a learning object in order to learn something. An author creates or publishes a learning object. A manager manages the delivery of this learning object, e.g., a university or college. The document for a manager is typically a curriculum. 2— In order to describe the intended end user role through the skills the user is intended to master, or the tasks he or she is intended to be able to accomplish, the category 9:Classification can be used.	smallest permitted maximum: 10 items		teacher author learner manager	Vocabulary (State)	An authoring tool that produces pedagogical material is a typical example of a learning object whose intended end user is an author.
5.6	Context	The principal environment within which the learning and use of this learning object is intended to take place. NOTE— Suggested good practice is to use one of the values of the value space and to use an additional instance of this data element for further refinement, as in (“LOMv1.0,” “higher education”) and (“http://www.ond.vlaanderen.be/onderwijs-invlaanderen/Default.htm,” “kan-didatuursonderwijs”)	smallest permitted maximum: 10 items	unordered	school higher education training other	Vocabulary (State)	
5.7	Typical Age Range	Age of the typical intended user. This data element shall refer to developmental age, if that would be different from chronological age. NOTES 1— The age of the learner is important for finding learning objects, especially for school age learners and their teachers. When applicable, the string should be formatted as minimum age-maximum age or minimum age-. [This is a compromise between adding three component elements (minimum age, maximum age, and description) and having just a free text field.] 2— Alternative schemes for what this data element tries to cover (such as various reading age or reading level schemes, IQ's or developmental age measures) should be represented through the 9:Classification category.	smallest permitted maximum: 5 items	unordered	-	LangString (smallest permitted maximum: 1000 char)	“7-9” “0-5” “15” “18-” (“en,” “suitable for children over 7”), (“en,” “adults only”)

Table 1—LOMv1.0 base schema (continued)

Nr	Name	Explanation	Size	Order	Value space	Datatype	Example
5.8	Difficulty	How hard it is to work with or through this learning object for the typical intended target audience. NOTE—The “typical target audience” can be characterized by data elements 5.6:Educational.Context and 5.7:Educational.TypicalAgeRange.	1	unspecified	very easy easy medium difficult very difficult	Vocabulary (Enumerated)	-
5.9	Typical Learning Time	Approximate or typical time it takes to work with or through this learning object for the typical intended target audience. NOTE—The “typical target audience” can be characterized by data elements 5.6:Educational.Context and 5.7:Educational.TypicalAgeRange.	1	unspecified	-	Duration	“PT1H30M,” “PT1M45S”
5.10	Description	Comments on how this learning object is to be used.	smallest permitted maximum: 10 items	unspecified	-	LangString (smallest permitted maximum: 1000 char)	(“en,” “Teacher guidelines that come with a textbook.”)
5.11	Language	The human language used by the typical intended user of this learning object.	smallest permitted maximum: 10 items	unordered	See 1.3:General.Language	CharacterString (smallest permitted maximum: 100 char)	“en” “en-GB” “de” “fr-CA” “it” NOTE—As an example, for a learning object in French, intended for English-speaking students, the value of 1.3:General.Language will be French, and the value of 5.11:Educational.Language will be English.
6	Rights	This category describes the intellectual property rights and conditions of use for this learning object. NOTE—The intent is to reuse results of ongoing work in the Intellectual Property Rights and e-commerce communities. This category currently provides the absolute minimum level of detail only.	1	unspecified	-	-	-
6.1	Cost	Whether use of this learning object requires payment.	1	unspecified	yes no	Vocabulary (State)	-
6.2	Copyright and Other Restrictions	Whether copyright or other restrictions apply to the use of this learning object.	1	unspecified	yes no	Vocabulary (State)	-

Table 1 — LOMv1.0 base schema (continued)

Nr	Name	Explanation	Size	Order	Value space	Datatype	Example
6.3	Description	Comments on the conditions of use of this learning object.	1	unspecified	-	LangString (smallest permitted maximum: 1000 char)	("en," "Use of this learning object is only permitted after a donation has been made to Amnesty International.")
7	Relation	This category defines the relationship between this learning object and other learning objects, if any. To define multiple relationships, there may be multiple instances of this category. If there is more than one target learning object, then each target shall have a new relationship instance.	smallest permitted maximum: 100 items	unordered	-	-	-
7.1	Kind	Nature of the relationship between this learning object and the target learning object, identified by 7.2:Relation.Resource.	1	unspecified	Based on Dublin Core: ispartof: is part of haspart: has part isversionof: is version of hasversion: has version isformatof: is format of hasformat: has format references: references isreferencedby: is referenced by isbasedon: is based on isbasisfor: is basis for requires: requires isrequiredby: is required by	Vocabulary (State)	-
7.2	Resource	The target learning object that this relationship references.	1	unspecified	-	-	-
7.2.1	Identifier	A globally unique label that identifies the target learning object.	smallest permitted maximum: 10 items	unspecified	-	-	-
7.2.1.1	Catalog	The name or designator of the identification or cataloging scheme for this entry. A namespace scheme.	1	unspecified	Repertoire of ISO/IEC 10646-1:2000	CharacterString (smallest permitted maximum: 1000 char)	"ISBN," "ARIADNE," "URI"
7.2.1.2	Entry	The value of the identifier within the identification or cataloging scheme that designates or identifies the target learning object. A namespace specific string.	1	unspecified	Repertoire of ISO/IEC 10646-1:2000	CharacterString (smallest permitted maximum: 1000 char)	"2-7342-0318," "LEAO875," "http://www.ieee.org/"
7.2.2	Description	Description of the target learning object.	smallest permitted maximum: 10 items	unspecified	-	LangString (smallest permitted maximum: 1000 char)	("en," "The QuickTime movie of the Mona Lisa on the web site of the Louvre museum.")

Table 1—LOMv1.0 base schema (continued)

Nr	Name	Explanation	Size	Order	Value space	Datatype	Example
8	Annotation	This category provides comments on the educational use of this learning object, and information on when and by whom the comments were created. This category enables educators to share their assessments of learning objects, suggestions for use, etc.	smallest permitted maximum: 30 items	unordered	-	-	-
8.1	Entity	Entity (i.e., people, organization) that created this annotation.	1	unspecified	vCard, as defined by IMC vCard 3.0 (RFC 2425, RFC 2426).	CharacterString (smallest permitted maximum: 1000 char)	"BEGIN:VCARD\nFN:Joe Friday\nTEL:+1-919-555-7878\nTITLE:Area Administrator\nAssistant\nEMAIL:TYPE=INTERNET;jfriday@host.com\nEND:VCARD"
8.2	Date	Date that this annotation was created.	1	unspecified	-	DateTime	"2001-08-23"
8.3	Description	The content of this annotation.	1	unspecified	-	LangString (smallest permitted maximum: 1000 char)	("en," "I have used this video clip with my students. They really enjoy being able to zoom in on specific features of the painting. Make sure they have a broadband connection or the experience becomes too cumbersome to be educationally interesting.")
9	Classification	This category describes where this learning object falls within a particular classification system. To define multiple classifications, there may be multiple instances of this category.	smallest permitted maximum: 40 items	unordered	-	-	-
9.1	Purpose	The purpose of classifying this learning object.	1	unspecified	discipline idea prerequisite educational objective accessibility restrictions educational level skill level security level competency	Vocabulary (State)	-
9.2	Taxon Path	A taxonomic path in a specific classification system. Each succeeding level is a refinement in the definition of the preceding level. There may be different paths, in the same or different classifications, which describe the same characteristic.	smallest permitted maximum: 15 items	unordered	-	-	-

Table 1—LOMv1.0 base schema (continued)

Nr	Name	Explanation	Size	Order	Value space	Datatype	Example
9.2.1	Source	The name of the classification system. This data element may use any recognized “official” taxonomy or any user-defined taxonomy. NOTE—An indexation, cataloging or query tool may provide the top-level entries of a well-established classification, such as the Library of Congress Classification (LOC), Universal Decimal Classification (UDC), Dewey Decimal Classification (DDC), etc.	1	unspecified	Repertoire of ISO/IEC 10646-1:2000	LangString (smallest permitted maximum: 1000 char)	(“en,” “ACM”), (“en,” “MESH”), (“en,” “ARIADNE”)
9.2.2	Taxon	A particular term within a taxonomy. A taxon is a node that has a defined label or term. A taxon may also have an alphanumeric designation or identifier for standardized reference. Either or both the label and the entry may be used to designate a particular taxon. An ordered list of taxons creates a taxonomic path, i.e., “taxonomic stairway”: this is a path from a more general to more specific entry in a classification.	smallest permitted maximum: 15 items	ordered	-	-	{[“12,”(“en,” “Physics”)], [“23,”(“en,” “Acoustics”)], [“34,”(“en,” “Instruments”)], [“45,”(“en,” “Stethoscope”)]} A 2nd taxon path for the same learning object could be: {[“56,”(“en,” “Medicine”)], [“67,”(“en,” “Diagnostics”)], [“34,”(“en,” “Instruments”)], [“45,”(“en,” “Stethoscope”)]}
9.2.2.1	Id	The identifier of the taxon, such as a number or letter combination provided by the source of the taxonomy.	1	unspecified	Repertoire of ISO/IEC 10646-1:2000	CharacterString (smallest permitted maximum: 100 char)	“320” “4.3.2” “BF180”
9.2.2.2	Entry	The textual label of the taxon.	1	unspecified	-	LangString (smallest permitted maximum: 500 char)	(“en,” “Medical Sciences”)
9.3	Description	Description of the learning object relative to the stated 9.1:Classification.Purpose of this specific classification, such as discipline, idea, skill level, educational objective, etc.	1	unspecified	-	LangString (smallest permitted maximum: 2000 char)	(“en,” “A medical instrument for listening called a stethoscope.”)
9.4	Keyword	Keywords and phrases descriptive of the learning object relative to the stated 9.1:Classification.Purpose of this specific classification, such as accessibility, security level, etc., most relevant first.	smallest permitted maximum: 40 items	ordered	-	LangString (smallest permitted maximum: 1000 char)	(“en,” “diagnostic instrument”)

7. LangString

Table 2 defines the structure of a LangString item.

(The remainder of this page is intentionally blank. Table 2 is on the following page.)

Table 2—LangString

Nr	Name	Explanation	Size	Order	Value space	Datatype	Example
1	LangString	A datatype that represents one or more character strings. A LangString value may include multiple semantically equivalent character strings, such as translations or alternative descriptions.	smallest permitted maximum: 10 items	unordered	-	-	-
1.1	Language	Human language of the character string. NOTE—Indexation or cataloging tools can provide a useful default, for instance, the language of the user interface.	1	unspecified	See 1.3:General.Language If no Language is specified, then LangString.String should be interpreted as a string in 3.4:Meta-Metadata.Language. If no language is specified, and a value for 3.4:Meta-Metadata is not present in the metadata instance, then the language for the LangString value is undefined.	CharacterString (smallest permitted maximum: 100 char)	“en,” “en-GB,” “de,” “fr-CA,” “it”
1.2	String	Actual character string.	1	unspecified	Repertoire of ISO/IEC 10646-1:2000 excluding the NUL-character (UCS character U00000000)	CharacterString	“A picture of the Mona Lisa”

8. DateTime

Table 3 defines the structure of a DateTime item.

(The remainder of this page is intentionally blank. Table 3 is on the following page.)

Table 3—DateTime

Nr	Name	Explanation	Size	Order	Value space	Datatype	Example
1	DateTime	A point in time with accuracy at least as small as one second.	1	unspecified	<p>YYYY[-MM[-DD[Thh[:mm[:ss[.s[TZD]]]]]]] where:</p> <p>YYYY is the four-digit year (>=0001)</p> <p>MM is the two-digit month (01 through 12 where 01=January, etc.)</p> <p>DD is the two-digit day of month (01 through 31, depending on value of month and year)</p> <p>hh is two digits of hour (00 through 23) (am/pm NOT allowed)</p> <p>mm is two digits of minute (00 through 59)</p> <p>ss is two digits of second (00 through 59)</p> <p>s is one or more digits representing a decimal fraction of a second</p> <p>TZD is the time zone designator ("Z" for UTC or +hh:mm or -hh:mm)</p> <p>At least the four-digit year must be present. If additional parts of the DateTime are included, the character literals "-", "T", ":", and "." are part of the character lexical representation for the datetime.</p> <p>If the time portion is present, but the time zone designator is not present, the time zone is interpreted as being UTC.</p> <p>NOTES</p> <p>1—This value space is based on ISO 8601:2000. (see also http://www.w3.org/TR/NOTE-datetime-970915.html)</p> <p>2—The date portion only represents dates in the Common Era (CE). The date portion follows the Gregorian calendar for dates after October 15, 1582, and the Julian calendar for dates prior to October 15, 1582, independent of locale. Dates Before Common Era (BCE) and other cases should be represented using the "Description" data item.</p> <p>3—The square bracket meta characters ("[", "]") indicate optional elements that may appear zero or one time in the character lexical representation of the DateTime. These meta characters do not appear in the result; only the associated values described appear, e.g., "DD" is replaced by the corresponding 2 digit value for day of month.</p>	CharacterString (smallest permitted maximum: 200 char)	<p>"1999-01-11" (January 11th, 1999)</p> <p>"1997-07-16T19:20:30+01:00" (July 16th, 1997, 30 seconds past 7.20 p.m. with a time offset of 1 hour with respect to UTC)</p>
2	Description	Description of the date.	1	unspecified	-	LangString (smallest permitted maximum: 1000 char)	("en", "circa 1300 BCE")

9. Duration

Table 4 defines the structure of a Duration item.

(The remainder of this page is intentionally blank. Table 4 is on the following page.)

Table 4—Duration

Nr	Name	Explanation	Size	Order	Value space	Datatype	Example
1	Duration	An interval in time with accuracy at least as small as one second.	1	unspecified	<p>P[yY][mM][dD][T[hH][nM][s[.s]S]] where:</p> <p>y is the number of years (integer, > 0, not restricted)</p> <p>m is the number of months (integer, > 0, not restricted, e.g., > 12 is acceptable)</p> <p>d is the number of days (integer, > 0, not restricted, e.g., > 31 is acceptable)</p> <p>h is the number of hours (integer, > 0, not restricted, e.g., > 23 is acceptable)</p> <p>n is the number of minutes (integer, > 0, not restricted, e.g., > 59 is acceptable)</p> <p>s is the number of seconds or fraction of seconds (integer, > 0, not restricted, e.g., > 59 is acceptable)</p> <p>The character literal designators “P”, “Y”, “M”, “D”, “T”, “H”, “M”, “S” must appear if the corresponding nonzero value is present.</p> <p>If the value of years, months, days, hours, minutes or seconds is zero, the value and corresponding designation (e.g., “M”) may be omitted, but at least one designator and value must always be present. The designator “P” is always present. The designator “T” shall be omitted if all of the time (hours/minutes/seconds) are zero. Negative durations are not supported.</p> <p>NOTES</p> <p>1—This value space is based on ISO 8601:2000. (see also http://www.w3.org/TR/xmlschema-2/#duration)</p> <p>2—The value is designated in the Gregorian calendar.</p> <p>3—The ordering of durations may be indeterminate (e.g., 1 month may be 28, 29, 30, or 31 days).</p> <p>4—For durations that apply only while the learning object is in use, but not when its use is suspended, it is recommended that only hours and smaller units of duration be used. Examples: PT43H, PT5M35S. For durations that express a time span, regardless of whether the learning object is actually used continuously during that time, days and larger units of duration may be used. Examples: P1Y6M, P20D.</p> <p>5—The square bracket meta characters (“[”, “]”) indicate optional elements that may appear zero or one time in the character lexical representation of the Duration. These meta characters do not appear in the result; only the associated values described appear, e.g., “dD” is replaced by the corresponding value for the number of days in the duration and is followed by the character literal designator “D.”</p>	CharacterString (smallest permitted maximum: 200 char)	“PT1H30M” (1 h and 30 min)
2	Description	Description of the duration.	1	unspecified	-	LangString (smallest permitted maximum: 1000 char)	(“en,” “Fall Semester 1999”)

10. Vocabulary

Table 5 defines the structure of a Vocabulary item.

(The remainder of this page is intentionally blank. Table 5 is on the following page.)

Table 5— Vocabulary

Nr	Name	Explanation	Size	Order	Value space	Datatype	Example
1	Source	“LOMv1.0,” or an indication of the source of the value, for instance through a URI (see also 4.4).	1	unspecified	-	CharacterString (smallest permitted maximum: 1000 char)	“LOMv1.0” “http://www.vocabularies.org/OSList”
2	Value	The actual value. If the source is “LOMv1.0,” then the value shall come from the list defined in the LOMv1.0 Base Schema for the data element. In ISO 11404:1996 [B5] terminology, when there is implied ordering in the value list, then the values are “enumerated;” when there is no implied ordering, then they are “state.”	1	unspecified	-	CharacterString (smallest permitted maximum: 1000 char)	“MacOS”

Annex A

(informative)

Bibliography

[B1] Dublin Core Metadata Initiative^{12, 13}

[B2] IETF RFC 2045:1996, Multipurpose Internet Mail Extensions (MIME) Part One: Format of Internet Message Bodies.¹⁴

[B3] IETF RFC 2046:1996, Multipurpose Internet Mail Extensions (MIME) Part Two: Media Types.¹⁵

[B4] IETF RFC 2047:1996, Multipurpose Internet Mail Extensions (MIME) Part Three: Message Header Extensions for Non-ASCII Text.¹⁵

[B5] ISO/IEC 11404:1996, Information Technology—Programming Languages, their Environments and System Software Interfaces—Language-Independent Datatypes

[B6] RFC 1766:1995, Tags for the Identification of Languages^{15, 16}

¹²The Dublin Core is a metadata element set intended to facilitate discovery of electronic resources.

¹³Information on the Dublin Core Metadata Initiative can be obtained at <http://dublincore.org/>.

¹⁴Multipurpose Internet Mail Extensions (MIME) extends the format of Internet mail to allow non-US-ASCII textual messages, non-textual messages, multipart message bodies, and non-US-ASCII information in message headers.

¹⁵Information on RFC documents can be obtained at <http://ietf.org/rfc>.

¹⁶This internet standard defines a language tag, referring to ISO 639-1:1988 for the language, and to ISO 3166-1:1997 for the country code.

Annex B

(informative)

Mapping to unqualified Dublin Core

The Dublin Core defines 15 data elements. These data elements map directly to data elements defined in this standard, as illustrated in the Table B.1.

Table B.1—Mapping to unqualified Dublin Core Metadata Element Set

Dublin Core data element	LOM data element
DC.Identifier	1.1.2:General.Identifier.Entry
DC.Title	1.2:General.Title
DC.Language	1.3:General.Language
DC.Description	1.4:General.Description
DC.Subject	1.5:General.Keyword or 9:Classification with 9.1:Classification.Purpose equals “Discipline” or “Idea.”
DC.Coverage	1.6:General.Coverage
DC.Type	5.2:Educational.LearningResourceType
DC.Date	2.3.3:LifeCycle.Contribute.Date when 2.3.1:LifeCycle.Contribute.Role has a value of “Publisher.”
DC.Creator	2.3.2:LifeCycle.Contribute.Entity when 2.3.1:LifeCycle.Contribute.Role has a value of “Author.”
DC.OtherContributor	2.3.2:LifeCycle.Contribute.Entity with the type of contribution specified in 2.3.1:LifeCycle.Contribute.Role.
DC.Publisher	2.3.2:LifeCycle.Contribute.Entity when 2.3.1:LifeCycle.Contribute.Role has a value of “Publisher.”
DC.Format	4.1:Technical.Format
DC.Rights	6.3:Rights.Description
DC.Relation	7.2.2:Relation.Resource.Description
DC.Source	7.2:Relation.Resource when the value of 7.1:Relation.Kind is “IsBasedOn.”
<p>NOTES</p> <p>1—The Dublin Core Metadata Initiative is also developing data element qualifiers to further refine the semantics of the Dublin Core data elements.^a A further refinement of the mapping in Table B.1 can be based on these qualifiers.</p> <p>2—The LOM working group is committed to working with the Dublin Core Metadata Initiative (DCMI) to develop interoperable metadata, as outlined in the Memorandum of Understanding between the IEEE LTSC LOM WG and the DCMI.^b</p>	
^a http://dublincore.org/documents/dcmes-qualifiers/	
^b http://standards.ieee.org/announcements/metaarch.html	