

IEEE Recommended Practice for Learning Technology—Metadata Encoding and Transmission Standard (METS) Mapping to the Conceptual Model for Resource Aggregation

IEEE Computer Society

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Learning Technology Standards Committee

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IEEE Recommended Practice for Learning Technology—Metadata Encoding and Transmission Standard (METS) Mapping to the Conceptual Model for Resource Aggregation

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IEEE Computer Society**

Approved 11 December 2013

IEEE-SA Standards Board

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Abstract: This recommended practice specifies how the elements and attributes defined in the Metadata Encoding and Transmission Standard (METS) relate to the components of the conceptual model for resource aggregation defined in IEEE Std 1484.13.1[™]-2012.

Keywords: aggregation format, conceptual model, content aggregation, digital aggregation, digital resource, IEEE 1484.13.2[™], Metadata Encoding and Transmission Standard, RAMLET, resource aggregation, resource aggregation format

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At the time this IEEE recommended practice was completed, the Resource Aggregation Models for Learning, Education, and Training (RAMLET) Working Group had the following membership:

Kerry Blinco, *Chair*
Nancy Hoebelheinrich, *Principal Investigator*
Scott Lewis, *Technical Editor*

Willem Kraan

Katrien Verbert

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

Kerry Blinco
Juan Carreon
Geoffrey Darnton
David Fuschi
Randall Groves
Nancy Hoebelheinrich

Werner Hoelzl
Noriyuki Ikeuchi
Mark Jaeger
Willem Kraan
David Massart

Daniel Rehak
Steven Smith
Thomas Starai
Gerald Stueve
Marcy Stutzman
Daidi Zhong

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Masayuki Ariyoshi
Peter Balma
Farooq Bari
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Mark Halpin
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Jim Hughes
Michael Janezic
Joseph L. Koepfinger*
Oleg Logvinov

Ron Petersen
Gary Robinson
Jon Walter Rosdahl
Adrian Stephens
Peter Sutherland
Yatin Trivedi
Phil Winston
Yu Yuan

*Member Emeritus

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Don Messina
IEEE Standards Program Manager, Document Development

Michael Kipness
IEEE Standards Program Manager, Technical Program Development

Introduction

This introduction is not part of IEEE Std 1484.13.2-2013, IEEE Recommended Practice for Learning Technology—Metadata Encoding and Transmission Standard (METS) Mapping to the Conceptual Model for Resource Aggregation.

This recommended practice specifies how the elements and attributes defined in the Metadata Encoding and Transmission Standard (METS) relate to the components of the conceptual model for resource aggregation defined in IEEE Std 1484.13.1™-2012.

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1. Overview

1.1 Scope

This Recommended Practice specifies how the elements and attributes defined in the Metadata Encoding and Transmission Standard (METS) relate to the components of the conceptual model for resource aggregation defined in IEEE Std 1484.13.1TM–2012.¹

1.2 Purpose

The mapping specified in this recommended practice may be used with the mappings of other resource aggregation formats to achieve interoperability among the formats via the conceptual model defined in IEEE 1484.13.1–2012.

¹ Information on references can be found in Clause 2.

2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

Digital Library Federation, Metadata Encoding and Transmission Standard: Primer and Reference Manual, Version 1.6, Revised, 2010.²

Digital Library Federation, METS Schema 1.7 Documentation.³

IEEE Std 1484.13.1™-2012, Standard for Learning Technology—Conceptual Model for Resource Aggregation for Learning, Education, and Training.⁴

W3C Recommendation (28 October 2004), XML Schema Part 2: Datatypes, Second Edition.⁵

W3C Recommendation, XML Linking Language (XLink) Version 1.0.⁶

W3C Team Submission (28 March 2011), Turtle—Terse RDF Triple Language.⁷

3. Definitions, acronyms, and abbreviations

3.1 Definitions

For the purposes of this document, the following terms and definitions apply. The *IEEE Standards Dictionary Online* should be consulted for terms not defined in this clause.⁸ Most definitions are taken from IEEE Std 1484.13.1-2012.

aggregation definition document: A document that lists and structures the digital resources of an aggregation.⁹ *See also:* **digital resource**; **resource aggregation**.

aggregation format: A documented method of aggregating digital resources into a complex object that can be exchanged among systems. An aggregation format may be defined by a formal specification or standard, but may also be informal. The defining characteristic is that an aggregation format specifies how to combine digital resources into a structured whole, without prescribing the kinds of digital resources, their internal structures, or their intended uses. *See also:* **digital resource**.

binding: The process that binds a model to a data structure. For example, it can refer to the binding of a conceptual model to the Web Ontology Language (OWL) ontology language.¹⁰

² Metadata Encoding and Transmission Standard: Primer and Reference Manual, Revised is available at <http://www.loc.gov/standards/mets/METSPRIMERRevised.pdf>.

³ METS Schema 1.7 Documentation is available at <http://www.loc.gov/standards/mets/docs/mets.v1-7.html>.

⁴ IEEE publications are available from The Institute of Electrical and Electronics Engineers (<http://standards.ieee.org/>).

⁵ W3C publications are available from the World Wide Web Consortium, 32 Vassar Street, Room 32-G515, Cambridge, MA 02139, USA (<http://www.w3.org/>). See: <http://www.w3.org/TR/xmlschema-2/>.

⁶ See: <http://www.w3.org/TR/2001/REC-xlink-20010627/>.

⁷ Turtle—Terse RDF Triple Language is available at <http://www.w3.org/TeamSubmission/turtle/>.

⁸ *IEEE Standards Dictionary Online* subscription is available at:

http://www.ieee.org/portal/innovate/products/standard/standards_dictionary.html.

⁹ Examples include the manifest document in IMS Content Packaging (IMS CP [B3]), the mets documents in the Metadata Encoding and Transmission Standard (METS), the Digital Item Declaration Language (DIDL) document in MPEG-21 Digital Item Declaration (DID) (ISO/IEC 21000-2:2005 [B6]).

¹⁰ See Web Ontology Language (OWL) [B7].

class: A category of items that share one or more common characteristics. Characteristics can be described informally in a scope note or formally as properties explicitly formulated in logical terms. A class cannot be defined by enumerating its instances because it is generally impossible to know all instances of a class in the world, and the future can bring new instances into being at any time. *See also:* **class instance**; **scope note**.

class instance: An instantiation of a class. A class instance has properties that meet the criteria of the intention of the class. The number of instances of a given class declared in an information system is usually less than the total number of instances in the real world. For example, although an individual is an instance of “person,” the individual may not be mentioned in all information systems describing “persons.” *See also:* **class**; **intention**; **property**.

component: Any data attribute or data element as described by the data model of an aggregation format. *See also:* **aggregation format**; **data attribute**; **data element**.

data attribute: A characteristic of a unit of data, often expressed in Extensible Markup Language (XML).

data element: A uniquely named and defined component of the data model of an aggregation format into which data items (actual values) can be placed. *See also:* **aggregation format**; **component**.

digital object: A synonym for digital resource. *See:* **digital resource**.

digital resource: Any resource that can be expressed in an electronic format, such as binary formats, Extensible Markup Language (XML), plain text, various encodings (e.g., base64), media-specific formats, and compressed archives (e.g., zip files).

NOTE—Media-specific formats include Joint Photographic Experts Group [JPEG]¹¹ and MPEG–1 Audio Layer 3 [MP3].¹²

identifier: Associates a name with a thing. Context defines how the name is interpreted. Within a given context, a name is unique.

intention: The intended meaning of a class or property. The intention consists of the common characteristics shared by all instances of the class or property. The intention need not be explicitly formulated as properties in the case of a class or as the domain and range in the case of a property. Instead, the intention can be described in a scope note that refers to a conceptualization shared by domain experts. *See also:* **class**; **class instance**; **domain**; **property**; **property instance**; **range**; **scope note**.

locator: An identifier that can be used to retrieve a digital resource or component. The digital resource or component may be either internal or external to the aggregation definition document. *See also:* **aggregation definition document**; **component**; **digital resource**; **identifier**.

mapping: An ontology of an aggregation format that relates the aggregation format’s classes and properties to the classes and properties of another ontology. *See also:* **aggregation format**.

property: A characteristic that defines a relationship of a specific kind between two classes or sets of classes. A property has exactly one domain and one range. Which classes are selected as the domain and which as the range is arbitrary. In other words, a property can be interpreted in both directions with two distinct but related interpretations. Property names are designed to be semantically meaningful and grammatically correct when read from domain to range. Inverse property names are designed to be semantically meaningful and grammatically correct when read from range to domain. Properties can also be specialized in the same manner as classes, resulting in parent/child relationships between superproperties

¹¹ See ISO/IEC 10918–1 [B4].

¹² See ISO/IEC 13818–3 [B5].

and their subproperties. Like a class, a property is characterized by an intention, which is conveyed by a scope note. *See also:* **class**; **domain**; **intention**; **range**; **scope note**; **subproperty**; **superproperty**.

property instance: An instantiation of a property that defines the domain and range of a relationship between two classes or sets of classes. For example, class X may be “containedBy” another class Y. In this example, “containedBy” is the instantiation of property. The inverse property in this example would be “contains,” i.e., class Y “contains” class X. *See also:* **class**; **property**; **range**.

range: The set of instances of a given class to which a property can be applied. For example, the range of property A might consist of those instances of class X and class Y that exhibit property A. A property can link only to instances of the classes that serve as its range. *See also:* **class**; **class instance**; **property**.

representation: A method or syntax for serializing data. For example, it can refer to the different serializations of a Web Ontology Language (OWL)¹³ ontology according to the Terse RDF Triple Language (Turtle) or Resource Description Framework/Extensible Markup Language (RDF/XML)¹⁴ syntaxes.

resource aggregation: **(A)** Digital resources of diverse types that are gathered together to form a new complex object. Information is contained in the resource aggregation for purposes of specifying the categories of and the relationships among the aggregated resources. A resource aggregation may be contained in an exchange file or not, and may be self-contained or reference resources held in other locations. A resource aggregation may be disaggregated into its component digital resources. Resource aggregations are stored and processed using system formats (internal representations) and are usually transmitted between systems using aggregation formats. *See also:* **aggregation format**; **digital resource**. **(B)** The process of aggregating digital resources so that the result can be used in one or more applications, such as transmission, storage, and delivery to users. *See also:* **digital resource**.

scope note: A textual description of the intention of a class or property. Scope notes are not formal constructs but are provided to help explain the intended meaning and application of classes and properties. *See also:* **class**; **intention**; **property**.

subproperty: A specialization of a property by inheritance from one or more superproperties. All instances of a subproperty are also instances of its immediate superproperty. The intention of a subproperty extends the intention of its immediate superproperty, i.e., its characteristics are more restrictive than that of its superproperty. *See also:* **intention**; **property instance**; **superproperty**.

superproperty: A generalization of one or more other properties, i.e., the subproperties. A superproperty subsumes all instances of its subproperties and may have additional instances that do not belong to any of its subproperties. A superproperty/subproperty relationship may also be referred to as a *parent/child relationship*. The intention of the superproperty is less restrictive than the intentions of any of its subproperties. *See also:* **intention**; **property**; **subproperty**.

3.2 Acronyms and abbreviations

Atom	Atom Syndication Format
IETF	Internet Engineering Task Force
METS	Metadata Encoding and Transmission Standard
MIME	Multipurpose Internet Mail Extensions

¹³ See OWL 2 Ontology Language Document Overview [B7].

¹⁴ See RDF/XML Syntax Specification [B8].

MPEG	Moving Pictures Experts Group
OWL	Web Ontology Language
RAMLET	Resource Aggregation Models for Learning, Education, and Training
RDF	Resource Description Framework
RFC	Request for Comments
Turtle	Terse RDF Triple Language
URI	Uniform Resource Identifier
W3C	World Wide Web Consortium ¹⁵
XML	Extensible Markup Language ¹⁶

4. Special terms

In this recommended practice, the following special term and definition applies.

core ontology: A short hand way of referencing the conceptual model referred to in this recommended practice. The core ontology does not include any recommended practice mappings.

5. Class and property prefix definitions

The class and property names in this recommended practice included prefixes that reference the documents in which the classes and properties are fully described. The prefixes used and the documents they reference are

- mets: This recommended practice.
- ramlet: IEEE Std 1484.13.1-2012™, Standard for Learning Technology—Conceptual Model for Resource Aggregation for Learning, Education, and Training.
- xlink: IEEE Std 1484.13.1-2012, Standard for Learning Technology—Conceptual Model for Resource Aggregation for Learning, Education, and Training, Annex E. (See W3C Recommendation (27 June 2001), XML Linking Language (XLink) Version 1.0.)
- xsd: W3C Recommendation, XML Schema Part 2: Datatypes, Second Edition, <http://www.w3.org/TR/2004/REC-xmlschema-2-20041028>.

6. Conformance

Conformance to this recommended practice is discussed in 6.1, 6.2, 6.3, and 6.4.

¹⁵ W3C® is a trademark (registered in numerous countries) of the World Wide Web Consortium; marks of W3C are registered and held by its host institutions MIT, ERCIM, Keio, and Beihang.

¹⁶ XML®—Extensible Markup Language; Language by W3C—claimed as a trademark or generic term by MIT, ERCIM, and/or Keio on behalf of the W3C.

In this recommended practice, “shall” is to be interpreted as a requirement; “shall not” is to be interpreted as a prohibition, and “should” as a recommendation.

6.1 Conforming aggregation instances

A conforming aggregation instance shall be an instance of an aggregation format that should be modeled or described in terms of the METS mapping ontology, either as a core ontology representation (mapped from a METS instance to a core ontology representation) or as a METS instance (mapped from a core ontology representation to a METS instance) following the intentions of the METS mapping ontology as expressed in Clauses 7, 8, and 9 of this recommended practice.

6.2 Conforming bindings

Conforming bindings of the METS mapping ontology

- Should conform to the requirements of Clauses 7, 8, and 9 of this recommended practice.
- If the binding technology language supports Uniform Resource Identifiers (URIs), then it shall use the same URIs as those in the Terse RDF Triple Language (Turtle) representation referenced in Annex C of this recommended practice.

If the binding technology language supports Uniform Resource Identifiers (URIs) and the binding contains extensions to the METS mapping ontology (see 6.3), then identifiers for the extensions shall be defined in a new namespace.

6.3 Conforming extensions of the METS mapping ontology

The METS mapping ontology may be extended for a conformant METS aggregation format extension that relates to interpreting externalized representations of digital aggregations by adding a new class or property and defining a new identifier in a new mapping ontology. The new identifier shall not be used to identify a concept that already exists in the METS mapping ontology. Bindings for conforming extensions shall conform to the requirements in 6.2.

NOTE—Concepts relating to interpreting externalized representations of digital aggregations should be defined as conforming extensions to the METS mapping ontology. Other concepts may be represented by other vocabularies or ontologies and combined with the METS mapping ontology using standard Semantic Web practices.

6.4 Conforming transforming implementations

A conforming transforming implementation should implement a transformation from the METS aggregation format to the core ontology and its identifiers, or from the core ontology and its identifiers to the METS aggregation format by following the intention of the METS mapping ontology as defined in classes in Clauses 7, 8, and 9 of this recommended practice.

7. METS mapping ontology—classes

This clause provides declarations of all the classes in the METS mapping ontology. The declarations use the following format:

- Class name: The name of the class in the METS mapping ontology.
- Mapped from: A RAMLET—allocated identifier representing the name (including capitalization) of the component in the METS aggregation format. This identifier is expressed as a Uniform Resource Identifier (URI), which may not resolve at the fragment level.
- Mapped to: The core ontology class to which the METS mapping ontology class maps. (See IEEE Std 1484.13.1-2012.)
- Scope note: A textual description of the class. Scope notes are either reproduced directly from or adapted from the descriptions of the METS elements and attributes in Metadata Encoding and Transmission Standard: Primer and Reference Manual, Version 1.6, Revised, 2010 and METS Schema 1.7 Documentation. For additional clarification of any of the terms in the scope notes please consult these documents.
- Data type: The data type of the METS mapping ontology class as defined in Clause 9.
- Properties: The properties of the METS mapping ontology class as defined in Clause 8. Inherited properties are not included in the entry.
- Asserted conditions: Any conditions that are asserted for the METS mapping ontology class as a result of its properties.

NOTE—Where a METS attribute has a different meaning (as described in the scope note) depending on the context provided by the element to which it is attached, a separate ontology class has been described. The notation used in the mapped-from identifier is #element_name@attribute_name.

7.1 mets:admID

Class name:	mets:admID
Mapped from:	http://www.loc.gov/standards/mets/version17/mets.xsd#ADMID
Mapped to:	ramlet:admRef
Scope note:	mets ADMID attribute contains the ID attribute values of the <digiprovMD>, <techMD>, <sourceMD> and/or <rightsMD> elements within the <amdSec> of the METS document that contains administrative metadata pertaining to the current element.
Properties:	None
Data type:	xsd:idRefs
Asserted conditions:	None

7.2 mets:agent

Class name:	mets:agent
Mapped from:	http://www.loc.gov/standards/mets/version17/mets.xsd#agent
Mapped to:	ramlet:party
Scope note:	Allows for various parties and their roles with respect to the METS document to be recorded.
Properties:	ramlet:includes someValueFrom mets:role ramlet:includes allValuesFrom mets:agentType, mets:ID, mets:name, mets:note, mets:otherRole, mets:otherType, mets:role
Data type:	None
Asserted conditions:	Being a member of this class implies that an individual has some value of the property ramlet:includes that is a member of mets:role. Being a member of this class implies that an individual has only values of the property ramlet:includes that either: — are members of mets:agentType — or are members of mets:ID — or are members of mets:name — or are members of mets:note — or are members of mets:otherRole — or are members of mets:otherType — or are members of mets:role

7.3 mets:agentType

Class name:	mets:agentType
Mapped from:	http://www.loc.gov/standards/mets/version17/mets.xsd#agent@TYPE
Mapped to:	ramlet:partyType
Scope note:	An optional attribute to specify the nature of the agent acting with respect to the METS object. It can take one of three values: INDIVIDUAL: a single, human agent ORGANIZATION: a collective entity OTHER: some other form of agent (e.g., a software agent).
Properties:	xsd:token someValueFrom oneOf dataRange INDIVIDUAL, ORGANIZATION, OTHER
Data type:	xsd:token

Asserted conditions: Being a member of this class implies that an individual has some value of the property `xsd:token` that belongs to the enumerated data range:

- INDIVIDUAL
- ORGANIZATION
- OTHER

7.4 `mets:altRecordID`

Class name: `mets:altRecordID`

Mapped from: `http://www.loc.gov/standards/mets/version17/mets.xsd#altRecordID`

Mapped to: `ramlet:alternateID`

Scope note: Allows for documentation of alternative ID values for the METS document in addition to the primary ID stored in the `OBJID` attribute in the root METS element.

Properties: `ramlet:includes` allValuesFrom `mets:ID`, `mets:altRecordIDType`

Data type: None

Asserted conditions: Being a member of this class implies that an individual has only values of the property `ramlet:includes` that either:

- are members of `mets:ID`
- or are members of `mets:altRecordIDType`

7.5 `mets:altRecordIDType`

Class name: `mets:altRecordIDType`

Mapped from: `http://www.loc.gov/standards/mets/version17/mets.xsd#altRecordID@TYPE`

Mapped to: `ramlet:identifierType`

Scope note: An optional string describing the type of identifier (e.g., OCLC #, LCCN, etc.).

Properties: None

Data type: `xsd:string`

Asserted conditions: None

7.6 `mets:amdSec`

Class name: `mets:amdSec`

Mapped from:	http://www.loc.gov/standards/mets/version17/mets.xsd#amdSec
Mapped to:	ramlet:administrativeDescriptorObject
Scope note:	This section records all of the administrative metadata for all items in the METS object (including structural map divs, data files, descriptive metadata sections and administrative metadata sections themselves), and is divided into four subsections: techMD (technical metadata), rightsMD (intellectual property rights metadata), sourceMD (analog/digital source metadata), and digiprovMD (digital provenance metadata). Each of these subsections follows the mdSecType model, so that they can either include metadata within the METS hub document (mdWrap) or reference it via an identifier/locator (mdRef). Multiple techMD, rightsMD, sourceMD and digiprovMD elements are allowed so that administrative metadata can be recorded for each separate item within the METS object.
Properties:	ramlet:includes allValuesFrom mets:digiProvMd, mets:ID, mets:rightsMD, mets:sourceMd, mets:techMd
Data type:	None
Asserted conditions:	Being a member of this class implies that an individual has only values of the property ramlet:includes that either: — are members of mets:digiProvMd — or are members of mets:ID — or are members of mets:rightsMd — or are members of mets:sourceMd — or are members of mets:techMd

7.7 mets:area

Class name:	mets:area
Mapped from:	http://www.loc.gov/standards/mets/version17/mets.xsd#area
Mapped to:	ramlet:anchor
Scope note:	File Area. The area element provides for more sophisticated linking between a div element and content files representing that div, be they text, image, audio, or video files. An area element can link a div to a point within a file, to a one-dimension segment of a file (e.g., text screen, image line, audio/video clip), or a two-dimensional section of a file (e.g., subsection of an image, or a subsection of the video display of a video file. See the areaType documentation for more details.
Properties:	ramlet:includes someValueFrom mets:fileID ramlet:includes allValuesFrom mets:admID, mets:begin, mets:beType, mets:contentIDs, mets:coords, mets:end, mets:extent, mets:extType, mets:fileID, mets:ID, mets:shape
Data type:	None