

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

IEEE Computer Society

Sponsored by the  
Learning Technology Standards Committee



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

Sponsor

**Learning Technology Standards Committee  
of the  
IEEE Computer Society**

Approved 11 December 2013

**IEEE-SA Standards Board**

Copyright permissions: Definitions in scope notes are either reproduced directly from or adapted from the descriptions of the components in Metadata Encoding and Transmission Standard: Primer and Reference Manual, Revised © 2010 and METS Schema 1.7 Documentation reprinted with permission from the Digital Library Federation, Council on Library and Information Resources.

Knoodl<sup>®</sup> is a registered trademark of Revelytix, Inc. This information is given for the convenience of users of this recommended practice and does not constitute an endorsement by the IEEE of these products. Equivalent products may be used if they can be shown to lead to the same results.

W3C<sup>®</sup> 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.

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

Acknowledgments: The Resource Aggregation Models for Learning, Education, and Training (RAMLET) Working Group would like to thank the METS Editorial Board for its cooperation and support. The working group would also like to thank Revelytix, Inc., for making available the Knoodl<sup>®</sup> ontology tools that were used to aid in the development and maintenance of the ontology files.

**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<sup>™</sup>-2012.

**Keywords:** aggregation format, conceptual model, content aggregation, digital aggregation, digital resource, IEEE 1484.13.2<sup>™</sup>, Metadata Encoding and Transmission Standard, RAMLET, resource aggregation, resource aggregation format

---

The Institute of Electrical and Electronics Engineers, Inc.  
3 Park Avenue, New York, NY 10016-5997, USA

Copyright © 2013 by The Institute of Electrical and Electronics Engineers, Inc.  
All rights reserved. Published 30 December 2013. Printed in the United States of America.

IEEE is a registered trademark in the U.S. Patent & Trademark Office, owned by The Institute of Electrical and Electronics Engineers, Incorporated.

PDF: ISBN 978-0-7381-8848-5      STD98494  
Print: ISBN 978-0-7381-8849-2      STDPD98494

*IEEE prohibits discrimination, harassment, and bullying.*

For more information, visit [http://www.ieee.org/web/aboutus/what\\_is/policies/p9-26.html](http://www.ieee.org/web/aboutus/what_is/policies/p9-26.html).

*No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher.*

## **Important Notices and Disclaimers Concerning IEEE Standards Documents**

IEEE documents are made available for use subject to important notices and legal disclaimers. These notices and disclaimers, or a reference to this page, appear in all standards and may be found under the heading “Important Notice” or “Important Notices and Disclaimers Concerning IEEE Standards Documents.”

## **Notice and Disclaimer of Liability Concerning the Use of IEEE Standards Documents**

IEEE Standards documents (standards, recommended practices, and guides), both full-use and trial-use, are developed within IEEE Societies and the Standards Coordinating Committees of the IEEE Standards Association (“IEEE-SA”) Standards Board. IEEE (“the Institute”) develops its standards through a consensus development process, approved by the American National Standards Institute (“ANSI”), which brings together volunteers representing varied viewpoints and interests to achieve the final product. Volunteers are not necessarily members of the Institute and participate without compensation from IEEE. While IEEE administers the process and establishes rules to promote fairness in the consensus development process, IEEE does not independently evaluate, test, or verify the accuracy of any of the information or the soundness of any judgments contained in its standards.

IEEE does not warrant or represent the accuracy or content of the material contained in its standards, and expressly disclaims all warranties (express, implied and statutory) not included in this or any other document relating to the standard, including, but not limited to, the warranties of: merchantability; fitness for a particular purpose; non-infringement; and quality, accuracy, effectiveness, currency, or completeness of material. In addition, IEEE disclaims any and all conditions relating to: results; and workmanlike effort. IEEE standards documents are supplied “AS IS” and “WITH ALL FAULTS.”

Use of an IEEE standard is wholly voluntary. The existence of an IEEE standard does not imply that there are no other ways to produce, test, measure, purchase, market, or provide other goods and services related to the scope of the IEEE standard. Furthermore, the viewpoint expressed at the time a standard is approved and issued is subject to change brought about through developments in the state of the art and comments received from users of the standard.

In publishing and making its standards available, IEEE is not suggesting or rendering professional or other services for, or on behalf of, any person or entity nor is IEEE undertaking to perform any duty owed by any other person or entity to another. Any person utilizing any IEEE Standards document, should rely upon his or her own independent judgment in the exercise of reasonable care in any given circumstances or, as appropriate, seek the advice of a competent professional in determining the appropriateness of a given IEEE standard.

IN NO EVENT SHALL IEEE BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO: PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE PUBLICATION, USE OF, OR RELIANCE UPON ANY STANDARD, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE AND REGARDLESS OF WHETHER SUCH DAMAGE WAS FORESEEABLE.

## **Translations**

The IEEE consensus development process involves the review of documents in English only. In the event that an IEEE standard is translated, only the English version published by IEEE should be considered the approved IEEE standard.

## **Official statements**

A statement, written or oral, that is not processed in accordance with the IEEE-SA Standards Board Operations Manual shall not be considered or inferred to be the official position of IEEE or any of its committees and shall not be considered to be, or be relied upon as, a formal position of IEEE. At lectures, symposia, seminars, or educational courses, an individual presenting information on IEEE standards shall make it clear that his or her views should be considered the personal views of that individual rather than the formal position of IEEE.

## **Comments on standards**

Comments for revision of IEEE Standards documents are welcome from any interested party, regardless of membership affiliation with IEEE. However, IEEE does not provide consulting information or advice pertaining to IEEE Standards documents. Suggestions for changes in documents should be in the form of a proposed change of text, together with appropriate supporting comments. Since IEEE standards represent a consensus of concerned interests, it is important that any responses to comments and questions also receive the concurrence of a balance of interests. For this reason, IEEE and the members of its societies and Standards Coordinating Committees are not able to provide an instant response to comments or questions except in those cases where the matter has previously been addressed. For the same reason, IEEE does not respond to interpretation requests. Any person who would like to participate in revisions to an IEEE standard is welcome to join the relevant IEEE working group.

Comments on standards should be submitted to the following address:

Secretary, IEEE-SA Standards Board  
445 Hoes Lane  
Piscataway, NJ 08854 USA

## **Laws and regulations**

Users of IEEE Standards documents should consult all applicable laws and regulations. Compliance with the provisions of any IEEE Standards document does not imply compliance to any applicable regulatory requirements. Implementers of the standard are responsible for observing or referring to the applicable regulatory requirements. IEEE does not, by the publication of its standards, intend to urge action that is not in compliance with applicable laws, and these documents may not be construed as doing so.

## **Copyrights**

IEEE draft and approved standards are copyrighted by IEEE under U.S. and international copyright laws. They are made available by IEEE and are adopted for a wide variety of both public and private uses. These include both use, by reference, in laws and regulations, and use in private self-regulation, standardization, and the promotion of engineering practices and methods. By making these documents available for use and adoption by public authorities and private users, IEEE does not waive any rights in copyright to the documents.

## **Photocopies**

Subject to payment of the appropriate fee, IEEE will grant users a limited, non-exclusive license to photocopy portions of any individual standard for company or organizational internal use or individual, non-commercial use only. To arrange for payment of licensing fees, please contact Copyright Clearance Center, Customer Service, 222 Rosewood Drive, Danvers, MA 01923 USA; +1 978 750 8400. Permission to photocopy portions of any individual standard for educational classroom use can also be obtained through the Copyright Clearance Center.

## Updating of IEEE Standards documents

Users of IEEE Standards documents should be aware that these documents may be superseded at any time by the issuance of new editions or may be amended from time to time through the issuance of amendments, corrigenda, or errata. An official IEEE document at any point in time consists of the current edition of the document together with any amendments, corrigenda, or errata then in effect.

Every IEEE standard is subjected to review at least every ten years. When a document is more than ten years old and has not undergone a revision process, it is reasonable to conclude that its contents, although still of some value, do not wholly reflect the present state of the art. Users are cautioned to check to determine that they have the latest edition of any IEEE standard.

In order to determine whether a given document is the current edition and whether it has been amended through the issuance of amendments, corrigenda, or errata, visit the IEEE-SA Website at <http://ieeexplore.ieee.org/xpl/standards.jsp> or contact IEEE at the address listed previously. For more information about the IEEE-SA or IEEE's standards development process, visit the IEEE-SA Website at <http://standards.ieee.org>.

## Errata

Errata, if any, for all IEEE standards can be accessed on the IEEE-SA Website at the following URL: <http://standards.ieee.org/findstds/errata/index.html>. Users are encouraged to check this URL for errata periodically.

## Patents

Attention is called to the possibility that implementation of this standard may require use of subject matter covered by patent rights. By publication of this standard, no position is taken by the IEEE with respect to the existence or validity of any patent rights in connection therewith. If a patent holder or patent applicant has filed a statement of assurance via an Accepted Letter of Assurance, then the statement is listed on the IEEE-SA Website at <http://standards.ieee.org/about/sasb/patcom/patents.html>. Letters of Assurance may indicate whether the Submitter is willing or unwilling to grant licenses under patent rights without compensation or under reasonable rates, with reasonable terms and conditions that are demonstrably free of any unfair discrimination to applicants desiring to obtain such licenses.

Essential Patent Claims may exist for which a Letter of Assurance has not been received. The IEEE is not responsible for identifying Essential Patent Claims for which a license may be required, for conducting inquiries into the legal validity or scope of Patents Claims, or determining whether any licensing terms or conditions provided in connection with submission of a Letter of Assurance, if any, or in any licensing agreements are reasonable or non-discriminatory. Users of this standard are expressly advised that determination of the validity of any patent rights, and the risk of infringement of such rights, is entirely their own responsibility. Further information may be obtained from the IEEE Standards Association.

## Participants

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

When the IEEE-SA Standards Board approved this recommended practice on 11 December 2013, it had the following membership:

**John Kulick**, *Chair*  
**David J. Law**, *Vice Chair*  
**Richard H. Hulett**, *Past Chair*  
**Konstantinos Karachalios**, *Secretary*

Masayuki Ariyoshi  
Peter Balma  
Farooq Bari  
Ted Burse  
Wael William Diab  
Stephen Dukes  
Jean-Philippe Faure  
Alexander Gelman

Mark Halpin  
Gary Hoffman  
Paul Houzé  
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

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

Richard DeBlasio, *DOE Representative*  
Michael Janezic, *NIST Representative*

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.

## Contents

1. Overview .....	1
1.1 Scope .....	1
1.2 Purpose .....	1
2. Normative references.....	2
3. Definitions, acronyms, and abbreviations .....	2
Definitions .....	2
3.1 Acronyms and abbreviations .....	4
4. Special terms .....	5
5. Class and property prefix definitions.....	5
6. Conformance .....	5
6.1 Conforming aggregation instances .....	6
6.2 Conforming bindings.....	6
6.3 Conforming extensions of the METS mapping ontology .....	6
6.4 Conforming transforming implementations.....	6
7. METS mapping ontology—classes .....	7
7.1 mets:admID .....	7
7.2 mets:agent.....	8
7.3 mets:agentType.....	8
7.4 mets:altRecordID.....	9
7.5 mets:altRecordIDType.....	9
7.6 mets:amdSec.....	9
7.7 mets:area.....	10
7.8 mets:begin.....	11
7.9 mets:behavior.....	11
7.10 mets:behaviorSec.....	12
7.11 mets:beType.....	13
7.12 mets:binData.....	14
7.13 mets:bType.....	14
7.14 mets:checksum.....	15
7.15 mets:checksumType.....	15
7.16 mets:contentIDs.....	16
7.17 mets:coords.....	16
7.18 mets:created.....	16
7.19 mets:createDate.....	17
7.20 mets:digiProvMd.....	17
7.21 mets:dmdID.....	18
7.22 mets:dmdSec.....	18
7.23 mets:div.....	19
7.24 mets:divType.....	20
7.25 mets:end.....	20
7.26 mets:extent.....	20
7.27 mets:extType.....	21
7.28 mets:fContent.....	21
7.29 mets:file.....	22
7.30 mets:fileGrp.....	23

7.31	mets:fileID	24
7.32	mets:fileSec	24
7.33	mets:file_seq	24
7.34	mets:fLocat	25
7.35	mets:fPtr	25
7.36	mets:groupID	26
7.37	mets:ID	26
7.38	mets:interfaceDef	27
7.39	mets:label	28
7.40	mets:lastModDate	28
7.41	mets:locType	28
7.42	mets:mdRef	29
7.43	mets:mdType	30
7.44	mets:mdWrap	31
7.45	mets:mechanism	32
7.46	mets:mets	33
7.47	mets:metsHdr	33
7.48	mets:metsType	34
7.49	mets:mimeType	34
7.50	mets:mPtr	35
7.51	mets:name	36
7.52	mets:note	36
7.53	mets:objID	36
7.54	mets:order	37
7.55	mets:orderLabel	37
7.56	mets:otherLocType	37
7.57	mets:otherMdType	38
7.58	mets:otherRole	38
7.59	mets:otherType	38
7.60	mets:ownerID	39
7.61	mets:par	39
7.62	mets:profile	40
7.63	mets:recordStatus	40
7.64	mets:rightsMd	40
7.65	mets:role	41
7.66	mets:seq	42
7.67	mets:shape	42
7.68	mets:size	43
7.69	mets:smLink	43
7.70	mets:sourceMd	44
7.71	mets:status	45
7.72	mets:stream	45
7.73	mets:streamType	45
7.74	mets:structID	46
7.75	mets:structLink	46
7.76	mets:structMap	47
7.77	mets:structMapType	47
7.78	mets:techMd	48
7.79	mets:transformAlgorithm	48
7.80	mets:transformBehavior	49
7.81	mets:transformFile	49
7.82	mets:transformKey	50
7.83	mets:transformOrder	50
7.84	mets:transformType	51
7.85	mets:use	51
7.86	mets:versDate	51

7.87 mets:xmlData.....	52
7.88 mets:xptr.....	52
8. METS mapping ontology—object properties.....	52
8.1 ramlet:includes.....	53
8.2 ramlet:references.....	53
8.3 xlink:actuate.....	53
8.4 xlink:arcRole.....	53
8.5 xlink:from.....	53
8.6 xlink:href.....	53
8.7 xlink:show.....	54
8.8 xlink:title.....	54
8.9 xlink:to.....	54
8.10 xlink:type.....	54
9. METS mapping ontology—data types.....	54
9.1 xsd:anyURI.....	55
9.2 xsd:base64Binary.....	55
9.3 xsd:dateTime.....	55
9.4 xsd:ID.....	55
9.5 xsd:idRef.....	55
9.6 xsd:idRefs.....	55
9.7 xsd:integer.....	55
9.8 xsd:long.....	56
9.9 xsd:positiveInteger.....	56
9.10 xsd:string.....	56
9.11 xsd:token.....	56
Annex A (informative) Bibliography.....	57
Annex B (informative) Conceptual overview.....	58
Annex C (informative) The binding of the core and METS mapping ontologies.....	59
Annex D (normative) Internet availability and use of the Turtle representation of the conceptual model and METS mapping.....	60
Annex E (informative) Internet availability and use of the RDF/XML representations of the conceptual model and METS mapping.....	61

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

*IMPORTANT NOTICE: IEEE Standards documents are not intended to ensure safety, security, health, or environmental protection, or ensure against interference with or from other devices or networks. Implementers of IEEE Standards documents are responsible for determining and complying with all appropriate safety, security, environmental, health, and interference protection practices and all applicable laws and regulations.*

*This IEEE document is made available for use subject to important notices and legal disclaimers. These notices and disclaimers appear in all publications containing this document and may be found under the heading “Important Notice” or “Important Notices and Disclaimers Concerning IEEE Documents.” They can also be obtained on request from IEEE or viewed at <http://standards.ieee.org/IPR/disclaimers.html>.*

## 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 1484.13.1<sup>TM</sup>–2012.<sup>1</sup>

### 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.

---

<sup>1</sup> Information on references can be found in Clause 2.