This is an effort to the Ottawa Communiqué group consisting of individuals who are active participants in the IMS Global Learning Consortium, the Dublin Core Metadata Initiative, the IEEE Learning Technology Standards Committee and other similar organizations.

General Questions

1. **What is metadata?**

Metadata is commonly defined as “data about data”. More generally, metadata is information about a resource, either physical or digital. In this FAQ, metadata refers to information about resources used in the context of learning, education and training. Metadata often consists of characteristics and properties of a resource such as title and author. Metadata may include objective information such as the size of a file, classifications such as the subject or topic, and assertions such as the appropriate audience for the resource. Metadata appears in many forms. It can be presented as part of a resource, such as the title on a book, or be stored in a separate file.

2. **Why is metadata important?**

Metadata helps people organize, find, and use resources effectively. For example, metadata helps users of an educational digital library find resources in a particular subject area at a particular grade level that can be used on a particular computer. Metadata can be used to identify multi-lingual resources or to inform a user about where and how to purchase a resource. A software application might use metadata to identify which resources are identified with a particular unit of study. Without metadata, managing these tasks would be difficult or impossible.

3. **When should I use metadata?**

Metadata should be used whenever you intend to store, re-use, or exchange a resource. It is not usually necessary to use metadata for temporary resources.

4. **How is metadata expressed?**

Metadata can be expressed as records in a database, as natural language descriptions, as tags in an HTML document, as XML, or in other ways.

5. **How is metadata structured?**

Metadata is typically structured in three parts: identification of the resource to which the metadata is associated, identification of the property or characteristic being described, and the description of that property or characteristic. For example, one might record that...
the author of a book is Jane Austin. To do this, one must identify the book, say that the
name being recorded is that of the author (rather than the publisher) and record the name
itself. For example, to record that the author of the book is Jane Austin you must identify
the book, say that the name being recorded is the author (rather than the publisher or
editor), and record the name itself.

6. What is “interoperability” and how does it relate to metadata?

The Institute of Electrical and Electronic Engineers defines interoperability as “the
ability of two or more systems or components to exchange information and to use the
information that has been exchanged.” Metadata can enable interoperability of this kind,
particularly when it is in a standardized format. Metadata can also facilitate semantic
interoperability, which may be defined as the ability to properly interpret and preserve the
meaning of information when it is exchanged. Distinguishing between the property being
described and the description of the property makes it easier to understand the meaning
being conveyed.

7. Why do some people hyphenate the word metadata?

Some U.S. organizations choose to use “meta-data” or “meta data” (note space) because
the term “metadata” is a trademark registered by The Metadata Company in the United
States of America. However, the commonly used form of the word is unhyphenated.

8. Can metadata be copyrighted?

Yes, the expression of metadata is a form of intellectual property and is therefore subject
to copyright laws. It should be noted that libraries, digital libraries and other
organizations that produce metadata consider it to be valuable and may place restrictions
on its use.

9. Why do we need metadata when search engines such as Google™ seem so
effective?

Search engines are effective precisely because they use metadata such as the number of
appearances of a search term in a document and the number of links to a document to
determine what results to display and in what order to display them. This kind of
metadata does not, however, meet all the requirements of someone looking for resources
in an educational or training context. For example, search engines are not effective for
finding resources at a particular grade level, with a particular pedagogical approach, of a
particular size, associated with a particular competency, designed for a particular
community, etc. Search engines currently do not have the means to generate this type of
metadata. Furthermore, different organizations may describe the same resource in
different ways. Search engines do not have access to these different descriptions and, in
the case of educational resources that are not on the public Web, may not have access to
the resources at all.
10. Does metadata apply to all people, places and things?

In the context of this FAQ, metadata applies primarily to digital resources that can be used for learning, education and training. In general, metadata can be applied to virtually anything and in some cases the metadata is the “digital resource” itself.

11. What does it mean to “expose metadata?”

When metadata is made available for others to see it is said to be “exposed.” For example, a digital repository may expose its metadata so that an external search engine can discover and locate resources in it or so that other repositories can gather (or harvest) metadata.

**Metadata Standards**

12. Why do I need to represent metadata using a standard?

If you don’t use a standard way of representing metadata then it is less likely that the metadata will be correctly understood and interpreted by others. Furthermore, adopting standard practices for metadata is part of a good information management policy. Such practices will help ensure the preservation and utility of resources. A local standard may suffice for metadata that is used internally in a single organization, but it is better to use an established open standard when metadata is prepared for external use. Note that metadata in a local format can be transformed into a standard format for transmission and exchange as long as the necessary information has been captured.

13. What is IEEE Learning Object Metadata?

IEEE Learning Object Metadata (LOM) is a metadata standard published by the Institute of Electrical and Electronic Engineers, Inc. The standard has multiple parts including a “data model” formally referred to as 1484.12.1-2002 IEEE Standard for Learning Object Metadata. This part of the standard describes a set of elements, with defined semantics and a defined structure for interoperable descriptions of learning objects.

14. What is Dublin Core Metadata?

Dublin Core, more formally known as the Dublin Core Metadata Element Set and often abbreviated as “DC,” was developed by the Dublin Core Metadata Initiative and published by the International Organization for Standardization as ISO 15836-2003. Dublin Core identifies a small set of properties that are considered most useful for cross-domain search, discovery and retrieval of resources.

15. What is METS?
The Metadata Encoding Transmission Standard (METS) was developed by the Digital Library Federation and is maintained by the Library of Congress. METS is not itself a metadata standard but provides a means to exchange metadata and digital resources. It distinguishes among descriptive, administrative, and structural metadata.

16. What is MARC?

MARC stands for MAchine Readable Cataloging and is a library metadata standard developed by the Library of Congress that specifies a number of formats for cataloging and exchanging bibliographic information in electronic form.

17. There are so many metadata standards to choose from. Which one do I use?

Different standards are developed to address the different requirements of different communities and for different purpose. For example, MARC was designed for the exchange of bibliographic records. METS was designed to handle the exchange of digital resources that potentially have multiple parts and multiple layers. Dublin Core was designed to be applicable to a wide range of resources and applications. LOM was designed to capture more detailed information about a learning resource. There are many other standards not mentioned here that are relevant to educational and training settings. In general, it is best to choose the standard that most closely fits your requirements and has the widest acceptance within your community and the communities with which you may wish to exchange your metadata.

18. Who is developing metadata standards?

In a formal sense, standards are developed by accredited standards bodies such as the IEEE, ISO, CEN, and national standards bodies. However the word “standard” is often used to refer to practices and specifications that have become accepted in a community or industry. There are many organizations that develop and maintain standards relevant to learning, education, and training. A partial list appears in the references.

19. What role does metadata play in SCORM, IMS Content Packaging, OAI-PMH, MPEG, etc.?

Standards and specifications such as those listed in the question address multiple aspects of interoperability. Metadata has a role in all of these. For example, SCORM (the Sharable Content Object Reference Model) specifies a collection of specifications and standards for interoperability that includes a metadata standard as one piece. OAI-PMH (Open Archives Initiative Protocol for Metadata Harvesting) is used to expose and gather metadata from multiple collections in various formats. Packaging standards, such as IMS Content Packaging and MPEG-21 Part 2, use metadata to describe resources and how they are organized.

20. What does it mean to comply or conform to a standard?
Compliance and conformance are two terms that are often used interchangeably. Formally, conformance is a technical concept and compliance implies some kind of authoritative verification. Conformance with a standard means using the standard in the way that it was intended. Most standards include a formal conformance statement. Compliance with a standard means conforming to the standard in a way that has been formally verified. Most standards will include a formal statement of what it means to comply with the standard. Proof of compliance with the standard is often called “certification”.

21. Can my metadata be certified?

Certification typically implies that a certified authority has independently tested a product for conformance to a standard. Currently there are no known certification authorities that have processes and procedures in place to certify metadata. However, several tool sets exist to allow metadata authors to test for conformance to various standards/specifications.

22. What is the difference between a “standard” and a “specification”?

A specification is a set of instructions that tells you how to do something. A standard is a specification that is either widely used within a community or that is formally designated as a standard by an authority such as the International Organization for Standardization (ISO) or the Institute of Electrical and Electronics Engineers, Inc. (IEEE). Specifications that achieve the status of “standard” because they represent accepted practice are sometimes called de facto standards. Standards published by official standards bodies are sometimes called de jure standards.

Creating and Using Metadata

23. Who creates Metadata?

Lots of people with varying backgrounds and expertise, create metadata! Metadata for a single resource may be created either by an individual specialist (e.g., a librarian or a learning technologist) or by many different authors. For example, technical metadata (e.g., the file size or location of a resource) may be created by the system that stores the resource; educational metadata (e.g., the type of learning resource) may be created by the teacher or trainer who developed the educational content of the resource; metadata describing copyright and intellectual property rights may be created by a legal expert and subject keywords and classifications may be added by a librarian.

24. What kinds of tools are used to create metadata?

Many software applications are used to author, assemble, annotate, store and deliver learning resources. These include authoring tools, learning content management systems,
course management systems, packaging tools, digital repositories, etc. Some of these tools are able to assign limited metadata automatically and most of these tools provide forms for recording user generated metadata.

25. I looked at a metadata standard and it doesn’t match all my needs. What do I do?
Most metadata standards include methods for modifying the standard to meet local requirements. For further information see the section on Technical Issues.

26. How do I use metadata to describe complex resources with multiple parts?
Metadata can exist at many different levels – from collections to courses to parts of courses to individual graphics and text snippets within parts of courses. You should decide which levels metadata can be usefully and effectively applied. For example, if you are creating courseware with the intent of reusing portions of it, then it makes sense to assign metadata to those portions. On the other hand, if you will only be searching for and exchanging entire course packs, then assigning metadata to individual items will be of less value.

27. How do I use metadata to describe different copies of the same resource?
From an information management perspective, it is generally not advisable to describe different copies of the ‘same’ resource with different descriptions as this may cause significant information management problems. Sometimes, however, a learning object might be used by many learners at the same time thereby requiring multiple copies and multiple descriptions. The problem of distinguishing among copies of resources, the content of resources and presentations of resources is one that is addressed in detail by the FRBR (Functional Requirements for Bibliographic Resources) conceptual model developed by the International Federation of Library Associations and Institutions (IFLA).

28. Is there a unique metadata record associated with a resource?
No, there isn’t. A resource might be used for different purposes and therefore have various associated records. For example, you might have an illustration of a painting. One set of metadata might describe the painting itself, and how it can be used in a general art history course. Someone else may use the image to illustrate a certain painting technique or brush stroke pattern, and thus would create different metadata to describe the different use of the illustration in a course on artistic techniques. Multiple people may develop many overlapping, redundant or conflicting metadata for an object. There is no “definitive” metadata.

29. What’s the difference between library cataloging and creating metadata?
What libraries refer to as cataloging can also be considered to be the process of creating metadata. Library cataloging carries with it an implication of quality control.

30. When is metadata created?

There are typical times in the lifecycle of a resource when metadata is created. For example, when a resource is created or authored, published, placed in a repository, reviewed.

31. Should metadata be revised or updated?

Metadata can be changed and updated. However doing so has consequences and implications. There are instances when updating metadata may have few adverse consequences (e.g., correcting spelling errors) and cases where the implications may be greater. For example, if the author of a resource changes their affiliation, updating the metadata will make it easier to find the author but the information about where the resource was originally produced is lost. In some cases metadata may be updated in such a way to preserve the original information while new information is added in a distinguishable manner.

For example, when an organization changes its name but still wishes to host an archive of resources under its previous name then ideally, for persistence and archival reasons, it should be possible to find all records under both names.

32. If a resource changes do I need new metadata?

If the resource is regarded as a new resource then new metadata should be created. If the resource is regarded as the same resource then the metadata may be updated or new metadata may be created. For example if a resource is saved in a different format from the original, then this may or may not be considered as a new resource. If it is not considered to be a new resource and the metadata does not describe technical format then there is no need to change the metadata. If the metadata does describe technical format then the metadata may be updated to describe the new format or entirely new metadata may be created, depending on local policies and practices.

33. Can I create metadata in languages other than English?

Yes, but a distinction should be made between a standardized name of characteristic or property (e.g., “title” or “author”) and the description of the characteristic or property (e.g., “Die Unendliche Geschichte” or “Michael Ende”). Your organization can use and display the names of characteristics in any language. Some metadata standards require that the names of characteristics be expressed in English when exchanging metadata records. Most allow the descriptions to be expressed in any language.
34. What is a metadata record (or instance)?

When exposing and exchanging metadata it must be expressed in a way that people or computers can read. These expressions are called metadata records. If a particular standard is used to create a metadata record then that record is called an instance of that standard.

35. When a standard refers to a metadata implementation, what does that mean?

The IEEE defines an implementation as:

(1) The process of translating a design into hardware components, software components, or both. See also: coding.[610.12]; (2) The result of the process in (1) [610.12] (From IEEE Std 610.12-1990 Software Engineering Terminology (1990)).

A metadata implementation refers to when a software system stores, expresses and transmits metadata, and/or processes and uses metadata.

36. What is a metadata element?

A metadata element is an agreed term or label that describes one of the properties or characteristics (e.g., the title of a resource) of an information model. A metadata element typically provides a means for associating values with this label. For example, the metadata element *Title* provides a placeholder for containing information about the title of a resource.

37. What is a vocabulary?

A vocabulary, in relation to this FAQ, is list of terms that are used to describe a particular characteristic of a resource. Many different types of vocabularies are used with metadata standards to describe educational resources. Here are some examples:

- **Simple vocabularies and value lists** are simple lists of words or “values”. Some value lists may be developed *ad hoc* by particular communities, others are widely used international standards e.g., ISO 639.1988 is a standard for describing the names of languages in two letters (“ar” = Arabic, “en” = English, “fr” = French).
- **Classifications and taxonomies** help describe relationships between resources by arranging them into broad classes, divisions and subdivisions based on common characteristics.
- **Thesauri** are vocabularies that are formally arranged so that complex relationship between words (e.g., “broader terms” and “narrower terms”) may be made explicit. Monolingual thesauri are composed of words from a single language and multilingual thesauri are composed of words from multiple languages.
- **Controlled or restricted vocabularies** are vocabularies that are recommended for use by metadata standards. Limiting the number of words that are used to describe a characteristic of a resource helps to reduce confusion about the description.

38. What is the relationship between metadata and vocabularies?
Metadata standards typically use vocabularies (sometimes “controlled vocabularies”) to define the range of possible values for a particular characteristic. When describing a learning resource, one has to say what aspect is being described and then give the description. For example, suppose you want to assert that a particular interactive applet is appropriate for students at the university level. To communicate this, you must first say that you are going to make a statement about two aspects of the applet (its audience and its educational level) and then say what these are (students and university). Had the resource been different, you might have described the same aspects but with different words (teacher for audience, K-12 for educational level).

39. Can I make up my own vocabulary?

Yes, if necessary. Although metadata standards may include controlled vocabularies (see question 38 above) you may add a term to an existing vocabulary or even make up your own vocabulary if necessary. For example, a standard may recommend that you use the controlled vocabulary “school, higher education, training, other” to describe the educational context that a resource may be used in. If you wished to indicate that a resource could also be used for “community learning” you could add this term to the vocabulary; however, you must indicate that this term comes from a vocabulary source other than the standard. Although most metadata standards allow you to add your own vocabularies you should be aware that you will not necessarily be able to share metadata using your customized vocabularies with other users who may only be able to accept standard metadata using controlled vocabularies. Furthermore, using a custom vocabulary may compromise conformance with the standard. So, although making up your own vocabulary may be useful for your own users, it may also have a negative impact on interoperability. For this reason, if the controlled vocabularies that accompany a standard do not meet your needs you should first look for other existing published vocabularies before creating your own. You should further note that augmenting or using alternative vocabularies will affect whether your implementation is considered strictly conformant or conformant. For more information see the section 2.5.1 Meta-data Instance Conformance in IMS Meta-data Best Practice Guide for IEEE 1484.12.1-2002 Standard for Learning Object Metadata.

40. Can I use my own community’s metadata along with standards?

Yes. It is important to note, however, that you should not duplicate existing elements and vocabularies in your metadata instances if you wish to expose and exchange your metadata instances with others. You should develop a crosswalk (see 48. below) from your metadata set to the standard to ascertain the elements and vocabularies in common and those that are unique to your particular implementation. The resulting metadata instances will contain your local unique elements and vocabularies and those from the standard that are shared. When exposing and exchanging your metadata instances, the standard’s elements and vocabularies in common should have precedence over your local implementation of these elements and vocabularies.
41. Do I need to use all the elements in the metadata standard I have chosen?

In short, the answer is no but often a community of practice will define a minimum mandatory set (e.g., in SCORM). Generally, standards will indicate if an element is mandatory or otherwise. To conform in these cases requires that these mandatory elements are implemented and appear in your metadata instances. Other optional elements do not need to appear in your instances. Note that for many standards, all elements are optional. In these cases, you may pick and choose any, one or all elements. Note that having an element in your implementation does not require that a value or entry be present for the element. If, however, you are a tool builder then conformance with a standard would require that all elements are accommodated.

42. How do I choose which metadata elements to use?

There are two approaches that can help you choose which metadata elements to use:

1. Identify the resources that you want to describe, then decide what kind of information about these resources you need to record. Select a metadata standard and choose the elements from the standard that can be used to record this information.

2. Alternatively, you may choose to begin with a metadata standard and look at each elements in the standard deciding which will be useful to you depending on the type of resources you are describing and the information you need to record.

When choosing metadata elements it is very important to distinguish between elements that are of critical importance to you and those that are “just nice to have”, otherwise you may end up with too many elements. It is also important to consider your end users, the people who will be using your resources and your metadata, and choose elements that will be useful to them.

43. Can I mix metadata elements from different standards?

Yes. Some communities of practice create “hybrid” application profiles (see question 44 below), drawing on elements from different standards.

44. What is an “application profile”?

Metadata standards – and related schemas, vocabularies and taxonomies – are designed to provide users with a means of sharing basic information especially relevant to a particular knowledge domain. At times, however, not all requirements of a community of practice may be met by a standard requiring that the community extend or modify it. Thus the term Application Profile has emerged as a means of describing this practical reality. Your application (how you apply the standard to your requirements) may therefore include ‘local’ elements or even include elements sourced from multiple metadata standards.

45. How is metadata associated with an object?
There are several ways to associate metadata with a resource. The metadata might be directly embedded in the resource (in much the same way as the title and author of a book are embedded in the book). Alternatively, the metadata might be detached from the resource as a separate item. In such cases it will often contain a reference or pointer to the resource. Typically the resource would be assigned an identifier (such as a URL, DOI, or ISBN) and the metadata instance would include the resource identifier. Alternatively, the metadata instance might be assigned an identifier, and the resource would embed within it the identifier of the metadata instance. Another option is to create an “association” object that contains both the identifier of the content resource and the identifiers of the metadata instances. These are not necessarily mutually exclusive methods because metadata also exists in searchable indexes or repositories that are quite separate from the resources being referred to.

46. Must metadata be part of the object it describes, e.g., as “properties” of a Word Document or within <meta> tags of an HTML document?

In general, metadata is associated with a resource but need not be part of it. For example, an educational digital library may consist only of metadata records that point to resources. The resources exist external to the digital library and the metadata exists external to the resources. However, sometimes metadata exists as an integral part of a resource.

Metadata should exist wherever applications or users that need it can find it. Sometimes, it is most useful to embed metadata within the resource itself. One common method is to embed metadata tags within the HTML markup of an electronically accessible resource. There are some advantages to this approach, not the least of which is that there is a presumption that the metadata is reflective of the version of the resource it describes. It also makes it convenient for consuming applications to retrieve the metadata implicitly. Another advantage is that when the resource is updated, the metadata is – at least presumably – updated as well. There is a downside, though: access to the metadata requires access to the resource itself. If the resource is proprietary and is not intended for free and open access, the metadata describing it is then not available for discovery. Also, metadata can describe resource, events or methods that are not represented by or instantiated in digital format.

Metadata can also be encapsulated in tightly coupled files. One advantage of this method is that the metadata can describe or assert information relating to a collection of individual resources as opposed to only that metadata relating to the individual pieces that comprise a complex learning resource.

Finally, metadata can exist as records that are completely distinct from a resource and that may even be maintained by third parties. For example metadata contained within catalog records that describe resources stored elsewhere. Clearly, an advantage of this method is that it enables resource discovery without requiring direct access to the
resource itself. Also, external metadata is the only option for describing resources that are not intrinsically digital in nature. Disadvantages to maintaining separate repositories for metadata relate to assuring that version changes in the resources are reflected in the metadata, and maintaining accurate object identification and retrieval information.

A more complete discussion of the issues relating to metadata placement and association may be found in the following article: *Metadata Principles and Practicalities*

47. **What is a metadata schema?**

A metadata schema is a model, including an element set and vocabularies, used to present metadata instances, facilitate binding, etc. In the context of learning resources a metadata schema is “for encoding descriptive, administrative, and structural metadata regarding objects within a digital library, expressed using the XML schema language of the World Wide Web Consortium.” (source: METS)

48. **What is a “cross-walk”?**

In the context of metadata and metadata standards a cross-walk is a mechanism for mapping elements from two or more schemas. Typically, it is represented in a table format indicating relationships and equivalencies between elements. Cross-walks therefore enable systems to share resources described using different metadata schema and help promote interoperability.

49. **Where is metadata stored?**

Metadata is stored wherever, whenever, and however an application that requires it consumes it. Metadata may be stored in SQL databases, in flat files, in spreadsheets, in raw xml files, and encapsulated in packages designed for distribution, discovery and retrieval.

Metadata that your application needs to function properly should be stored in the format that serves your application. It is when you want to share your metadata that metadata standards come into play.

Today, the standard carrier for interoperable sharing of information between disparate applications is some form of XML. At the point you want to make your stored metadata available to applications in a standard way, you will need to consider how those applications might query your application and how you will need to package your metadata in a way that those applications will be able to understand. A number of open and extensible XML standards for interoperable data are available including the service definition standards SOAP/UDDI, WSDL, and EbXML. What standards you use for sharing of data will depend on what others in your community of practice have adopted.
References/resources

Papers

http://www.dlib.org/dlib/april02/weibel/04weibel.html


Organizations developing, adopting & promoting metadata standards

ADL – Advanced Distributed Learning initiative, developers of SCORM
http://www.adlnet.org

ALIC – Advanced Learning Infrastructure Consortium
http://www.alic.gr.jp/eng/

CETIS – Centre for Educational Technology Interoperability Standards (UK)
http://metadata.cetis.ac.uk/

CEN – European Committee for Standardization

DLF – Digital Library Federation, developers of METS
http://www.diglib.org/

ECC (E-learning Competency Centre
http://www.ecc.org.sg/

EdNA – Education Network Australia
http://www.edna.edu.au/

European SchoolNet
http://www.educat.hu-berlin.de/~kluck/datahandbook.htm
GEM – The Gateway to Educational Materials
http://www.geminfo.org/index.html

Learning and Teaching Scotland
http://www.ltscotland.org.uk/about/guidelines/ords.asp

MEG – The Metadata for Education Group (UK)
http://www.ukoln.ac.uk/metadata/education/

MedBiquitous – Enabling medical education
http://www.medbiq.org/

SC36 – Standardization of IT for Learning, Education, and Training
http://jtc1sc36.org/

\(^i\) See question 37 for a definition of a record.
\(^ii\) HTML (HyperText Markup Language) is the language used to encode Web pages. See …
\(^iii\) XML stands for eXtensible Markup Language. See ….  
\(^iv\) Even when expressed in one of these ways, e.g., in XML, its syntax can also take various forms: for example the date a resource is published could be expressed in the for \texttt{yyyy-mm-dd} or \texttt{yyyy-mm-dd}.