

Specifications and Standards in E-Learning

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Abstract

E-learning deals with preparation, management and delivery of assets(e.g., learning content and tools) for learning using different learning technologies(Information and Communication Technologies and related technologies) and through which assets can be deployed either locally or globally. specifications and standards in E-learning enable different independent assets of learning to coexist for effective and better learning outcomes and also support properties like durability, accessibility, scalability etc. These specifications and standards allow people to work on enhancements and emphasizes on different learning aspects rather than struggling every time for the smooth preparation, management or delivery of the assets.

Many organizations like IMS, IEEE, ARIADNE, and AICC are making standards in the field of e-learning and most of the standards made by them are becoming de facto standards in e-learning. These organizations are working on different aspects within e-learning like LOM[1] for tagging learning content by IEEE, QTI for question and testing interoperability by IMS etc. SCORM from ADL initiative adopted and adapted many specifications and standards from other organization to deal with different aspects of e-learning simultaneously.

These specifications and standards are very useful to make transparent abstraction of the technology for those people who are not conversant but wants to enhance their teaching or learning. Thus, people's (as learner or learning material provider) responsibilities increase to adhere to the specifications and standards.

1. Overview

Specifications and standards have many benefits for any industry ranging from house hold tools to making of rockets. Although specification and standards are relatively new in Education industry, we hope that it will get benefited by specification and standards. At this time, many organizations around the world are making such specification and standards. In this article, we will discuss the standards and specifications and also evaluate some of the existing standards. we introduce specifications and standards in section 2. The importance of specifications and standards for e-learning has been described in third section. Although specifications and standards are relatively new in e-learning, we will describe present status of Specification and Standards in the fourth section. Fifth section will give a brief introduction to some of the standards within the learning industry such as LOM (Learning Object Metadata), SCORM etc. Before summarizing, we will discuss the future of specifications and standards in e-learning.

2. Introduction to Specification and Standards

Specifications and standards in E-learning enable different independent assets of learning to coexist for effective and better learning outcomes and also support properties like interoperability, durability, accessibility, scalability etc. Interoperability is mandatory while defining Specifications and Standards. Content metadata, content packaging, content sequencing, question and test interoperability, learner profiles, run-time interaction, etc. may be treated as interoperable objects. The data formats for these objects must be in place and widely accepted as common Standards. The acceptance of these Specifications and Standards will flourish next step of enhancements in learning technology on the basis of pedagogical, psychological aspects etc. In other words, these Specifications and Standards allow people to work on enhancements and emphasizes on learning aspects rather than struggling every time for the smooth preparation, management or delivery of the assets.

3. Need for Specifications and Standards

Learning technologies have been evolving in last 2-3 decades more rapidly and advancements in ICT gave a new dimension to it. But, as far as re-usability is concerned, we are losing the efforts of teachers and content creators because the contents which were developed in proprietary formats not only include the core data but also many innovations of placing, embedding aesthetic etc. It is not easy to recover these contents with all the information associated with the original content. Although, efforts can be put to recover or transfer the data from old formats to newer ones, we know that this recovery cannot achieve hundred percent. In case of getting satisfactory quality of recovery, problem always remain due to fast pace of the changing technology creating new formats. This makes the recovery cost ineffective.

The categorization of content on the basis of the category of different learners and learning environments that may be helpful in searching appropriate content for a learner is not transparent yet. Specifications and Standards can be helpful in the solution of above mentioned problems.

4. Status of Specification and Standards

In any industry, evolution of Standards comes parallel to the manufacture of new product. Initially, the design and other facility become proprietary to the manufacturing company but in case of non satisfaction of the user needs, industry comes up with common standards. We are in a transition period of standards in e-learning.

Some organizations like IMS, IEEE, ARIADNE, and AICC are making standards in the field of e-learning. They are also providing the reference implementation of the standards. But it is not being used in the learning purposes and common educational institutions are not able to adopt due to several reasons. Some of the reasons can be enumerated as below.

- These standards are very young.

- Organizations that are responsible for creating standards are not sure about their status of the standards because changes drastically version by version and their counterpart are not standards till yet.
- Most of the Standards are complex to a common institutional person dealing with the e-learning content and tools.

5. Existing Specifications and Standards in E-learning

There are many existing standards available in the education industry. Some of them are enumerated below:

5.1. Content Metadata (IEEE LOM 1484.12):

Content metadata deals with tagging the content such that it can be used for managing, locating and evaluating the content. Learning objects are any entity digital or non-digital, which can be used, re-used and referenced during e-learning. This standard specifies the syntax and semantics of Learning Object Metadata, defined as the attributes required to adequately describing a Learning Object.

Examples of Learning Objects include multimedia content, instructional content, learning objectives, instructional software and software tools, and persons, organizations, or events referenced during technology supported learning. Relevant attributes of Learning Objects to be described include type of object, author, owner, terms of distribution, and format. Where applicable, Learning Object Metadata may also include pedagogical attributes such as teaching or interaction style, grade level, mastery level, and prerequisites. It is possible for any given Learning Object to have more than one set of Learning Object Metadata. A snapshots showing some of tags of the LOM is shown below:

```
<lom xsi:schemaLocation="http://ltsc.ieee.org/xsd/LOMv1p0 lom.xsd">
  <general></general>
  <lifeCycle></lifeCycle>
  <metaMetadata></metaMetadata>
  <technical></technical>
  <educational>
    <interactivityType>
      <source> LOMv1.0</source>
      <value> active</value>
    </interactivityType>
  <learningResourceType>
    <source> LOMv1.0</source>
    <value> exercise</value>
  </learningResourceType>
  <interactivityLevel>
    <source> LOMv1.0</source>
```

```

        <value> very low</value>
    </interactivityLevel>
    <semanticDensity></semanticDensity>
    <intendedEndUserRole></intendedEndUserRole>
    <intendedEndUserRole></intendedEndUserRole>
    <context>
        <source> LOMv1.0</source>
        <value> school</value>
    </context>
    <typicalAgeRange></typicalAgeRange>
    <difficulty>
        <source> LOMv1.0</source>
        <value> very easy</value>
    </difficulty>
    <typicalLearningTime>
        <duration> P5Y4M</duration>
        <description>
            <string language="en">some description</string>
        </description>
    </typicalLearningTime>
    <description></description>
    <language>en</language>
    <language>fr</language>
    </educational>
    <rights></rights>
    <relation></relation>
    <annotation></annotation>
    <classification></classification>
</lom>

```

These standards should conform to, integrate with, or reference existing open standards and existing work in related areas. For example, core attributes of Learning Objects will be coordinated with or may simply refer to, the efforts to standardize content objects in general. But, synchronization across organizations for defining standards of common interfaces across different concerns is one of the biggest problem in defining the Standards and Specification. It seems very encouraging that this specification is used by Content Aggregation Model (CAM) of SCORM [4] (specification).

5.2. Content Packaging and Sequencing (IMS)

The IMS Content Packaging Specification provides the functionality to describe and package learning materials, such as an individual course or a collection of courses, into interoperable, distributable packages. Content Packaging addresses the description,

structure, and location of online learning materials and the definition of some particular content types.

The Content Packaging Specification is aimed primarily at content producers, learning management system vendors, computing platform vendors, and learning service providers. Learning materials described and packaged using the IMS Content Packaging XML format should be interoperable with any tool that supports the Specification. Content creators can develop and distribute material knowing that it can be delivered on any compliant system, thereby protecting their investment in rich content development.

The IMS Simple Sequencing Specification defines a method for representing the intended behavior of an authored learning experience such that any learning technology system (LTS) can sequence discrete learning activities in a consistent way. The specification defines the required behaviors and functionality that conforming systems must implement. It incorporates rules that describe the branching or flow of instruction through content according to the outcomes of a learner's interactions with content. The Specification was released to the public in March 2003.

5.3. Question and Testing Interoperability (IMS)

This specification deals with interoperability of question banks and also ensures the independent behavior of the test items. This platform- and vendor independent manner of interoperability is done by adopting the properties of XML technologies.

5.4. Content Structure (AICC)

Guidelines of AICC is for various definitions of interfaces and rules that allow CBT (Computer-Based Training) content from a variety of sources to inter operate with CMI (Computer Managed Instruction) systems.

AICC Guidelines & Recommendations (AGR's) are technical recommendations. Each AGR makes a technical recommendation in a specific area. For example, AGR-006 is the recommendation for Computer Managed Instruction. These guidelines promote the interoperability of CMI systems (on local file systems), to manage CBT lessons from different origins. It also includes the ability for a given CBT lesson to exchange data with different CMI systems. The AICC recommendation can be referred by online document given in reference [6].

5.5. SCORM

SCORM is a specification of the ADL Initiative. SCORM , borrowing from previous work of other Specifications and Standards activities done by other organization, put together a model to creating and deploying e-learning that assumed the presence of strong server-side, LMS-based learning content distribution. SCORM targets web as delivery medium. It is currently providing an Application Programming Interface (API) for communication about learner's interaction with the content object, a defined data model for representing this information, a content packaging specification that enables

interoperability of learning content, a standard set of meta-data elements that can be used to describe learning content and a set of standard sequencing rules.

SCORM 2004 is the recent version of SCORM. It introduces a complex idea called sequencing, which is a set of rules that specify the order in which a learner may experience content objects. SCORM 2004 is evolution of the underlying standards and specifications:

1. IEEE Data Model For Content Object Communications
2. IEEE ECMAScript Application Programming Interface for Content to Runtime Services Communication
3. IEEE Learning Object Metadata (LOM)
4. IEEE Extensible Markup Language (XML) Schema Binding for Learning Object metadata Data Model
5. IMS Content Packaging
6. IMS Simple Sequencing

SCORM encapsulates these specifications in three broad categories as follows:

1. Content Aggregation Model

It represents a learning strategy for designers and implementers of instruction to aggregate learning resources for the purpose of delivering a desired learning experience. There are two terms mostly used in Content Aggregation Model: Item and SCO. Example of Items in SCORM is standalone text file, media file etc. SCO are collection items which are treated as a unit for the LMSs.

2. Runtime Environment

It gives details of the requirement for launching content objects, establishing communication between LMSs and SCOs, and managing the tracking information that can be communicated between SCOs and LMSs.

3. Sequencing and Navigation

It is based on the IMS Simple Sequencing (SS) Specification. It also describes how learner and system initiated navigation events can be triggered and processed.

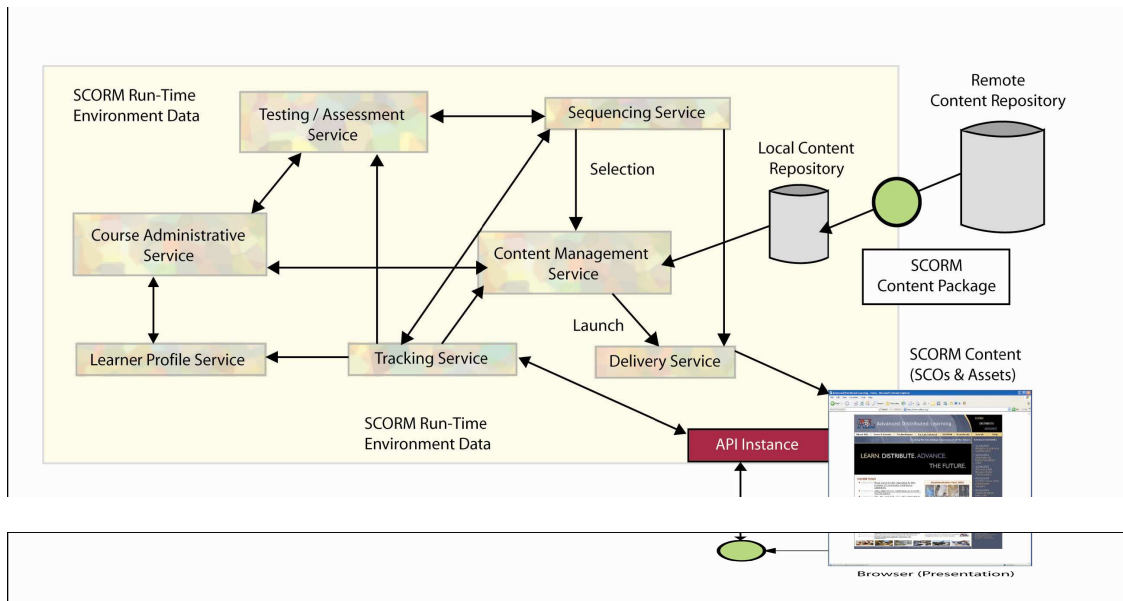


Figure 1 Highly Generalized Model Of LMS (SCORM) [3]

Figure 1 shown depicts the interaction of SCORM object and a generalized LMS. Different component of SCORM interacts with LMS for dealing different aspect of delivering the learning content. SCORM Content Package is used for populating the content in local content repository from remote Content Repository. API Instance with help of the SCORM Run-time Environment Data deals with the interaction of learner to the learning object (SCOs in case of SCORM). LMS interprets the Sequencing Service for deciding order by which different SCOs will be delivered.

5.6. Education Modelling Languages

An Educational Modelling Language (EML) [7] is a semantic notation to create units of learning to support the reuse of pedagogical entities like learning designs, learning objectives, learning activities, etc. They are used to create highly-structured course material. An EML-based course might offer features such as: reusable course material, personalized interaction for individual students, media independence, etc.

6. Summary

E-learning industry is in a transformation period with respect to the establishing standards and this will require some time to settle. Building content and tools for the learner in these standards is not without risk. After some time, all the standards, that will be de facto standards, will help the e-learning industry to make content and learner assisted tools such that it will survive for many years with all the properties of re-usability, interoperability etc.

7. References

1. <http://ltsc.ieee.org/wg12/>:WG12: Learning Object Metadata

2. Making Sense of Learning Specifications & Standards: A Decision Maker's Guide to their Adoption - 2nd Edition: MASIE Centre for Learning Consortium
3. SCORM Sharable Content Object Reference Model: SCORM 2004 2nd Edition Overview: @2004 Advanced Distributed Learning(Figure referred: Highly generalized model of a LMS)
4. SCORM Sharable Content Object Reference Model: SCORM 2004 2nd Edition Overview: @2004 Advanced Distributed Learning
5. http://www.cs.kuleuven.ac.be/~erikd/LOM/20021215/IEEE_1484_12_03_D1-2002-12-15.doc LOM EXAMPLES
6. <http://www.aicc.org/docs/AGRs/agr006v2doc.zip> Computer Managed Instruction AICC Guidelines and Recommendation
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