The MASIE Center presents

eLEARNING CONSORTIUM

I N D U S T R Y R E P O R T

Making Sense of Learning Specifications & Standards:

A Decision Maker's Guide to their Adoption

March 8, 2002

The MASIE Center
Learning and Technology e-Lab & ThinkTank

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Dear Learning and Training Colleagues:

The phrase “learning standards” is one of the most powerful and most misunderstood aspects of the e-Learning revolution. As organizations make significant investments in digital learning content, there is a strong desire to have greater assurances, portability, and re-usability. As organizations focus on providing learners with the “just right” content and activities, there is a strong desire to have the ability to more easily store, search, index, deploy, assemble, and revise content. All of these hopes are part of the story of “learning standards”.

To lower industry confusion about learning standards and to accelerate their adoption, The MASIE Center’s e-Learning Consortium organized and facilitated a group of learning professionals who worked together for several months to generate a collection of information and job aids.

The small group of e-Learning CONSORTIUM members formed the S3 Working Group to make **S**ense of our **S**tandards and **S**pecifications (S3). I want to thank the members of this group for their hard work and passion on this topic. Wayne Hodgins, from Autodesk, was the Visionary Leader of this group, and Connie Latson, from The MASIE Center, served as the Facilitator and Co-Leader.

We have placed this document into the Public Domain for the widest, free dissemination. Feel free to distribute to your colleagues or post on a site in its entirety. It will evolve and be updated over the months and years ahead as we develop a larger Knowledge Base in the Learning Standards field. If you have any comments, questions, or suggestions, please send them to standards@masie.com.

Yours in Learning,
Elliott Masie, The MASIE Center
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The MASIE Center

Learning and Technology e-Lab & ThinkTank

The MASIE Center is a thinktank dedicated to exploration and research on how new technologies, such as the Internet and wireless communications, can be used by people and organizations to deliver training, learning, collaboration, and better ways of working. We provide the following research-based services on issues and trends that impact the learning and technology industry:

e-Learning CONSORTIUM: The e-Learning CONSORTIUM is a collaboration of major corporations, government agencies, and e-Learning providers focused on benchmarking and the future of e-Learning. Through this CONSORTIUM, members network, learn, and share their experiences, best practices, and lessons learned. They actively participate and collaborate on dynamic benchmarking of their e-Learning activities (i.e., what and how specific e-Learning technology is being implemented within their organizations) and in targeted research (i.e., the attitudes and preferences of learners toward e-Learning).

The members of the e-Learning CONSORTIUM are a prime focus of our work in the e-Learning arena and the focus of MASIE Center staff efforts, research, and support.

e-LAB: A usability and research facility testing the behavioral aspects of new learning products and approaches from a user and buyer perspective. Strategy Retreats: We have constructed an environment for groups working on their e-Learning Strategy. You and your teammates will have an opportunity to work in the Strategy Arena to plan how e-Training Skills can be integrated into your organizational plan and strategy.

Learning Decisions Interactive Newsletter: A monthly benchmarking and resource publication focused on learning in the digital age. In addition, our free TechLearn Trends e-letter is read by over 40,000 executives every week.

Seminars: Skills for e-Trainers, e-Learning Briefings, and The Business of Learning are our signature events, focusing on the key issues of implementing and marketing learning in the Digital Age.

TechLearn 2002: In partnership with Advanstar Communications, this annual event is focused on learning in the digital age. Over 3,000 attendees from 56 countries attend the event.

Consulting: Elliott Masie and the MASIE Center staff provide targeted, extremely short-term strategic coaching to implementation groups, executive staff, and vendors on new products and services.

More information...

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Document Objectives

The "*S3 Working Group*" created a collection of information and job aids in order to help "the average person" understand the rationale, development, and implication of learning standards and to accelerate their adoption. In other words, to make Sense of Standards and Specifications (S3).

The S3 Working Group's first goal was to create a base of information which could evolve into a Knowledge Base that focuses on the practical and common functional use for each standard. Users of this Knowledge Base are expected to be e-Learning decision-makers, implementers, executive sponsors, and suppliers. The Knowledge Base clearly articulates what each of the standards are for, where they would be most useful, where to get the necessary information on any one of them, examples of how they are being used, and the tools/technology/services available to apply them.

A second goal of the S3 Working Group was to educate learning professionals about the learning standards so that they can become "*de facto*" standards (voluntarily used by a critical mass). This is vital to the success of e-Learning from the point of view of business benefits and learning effectiveness because standards address the ability to:

- Mix and match content from multiple sources
- Develop interchangeable content that can be assembled, disassembled, and re-used quickly and easily
- Ensure that buyers are not "trapped" by a particular vendor's proprietary learning technology
- Ensure that our learning technology investments are wise and risk adverse
- Increase the effectiveness of learning by enabling greater personalization and targeting of the right content to the right person at the right time
- Improve the efficiency and ROI of learning content development and management
- Increase the quantity and quality of learning content

This document is the first of two deliverables that the S3 Working Group has developed to achieve their outlined goals. To help you gain the most value from this document, the major content sections are outlined on the next page. If you are new to the topic of standards, we suggest that you read this document in a linear fashion from start to finish. If you have some familiarity with standards, we suggest that you use the Table of Contents to jump to those sections of this document that interest you.

The second deliverable, which fulfills the remaining goals of this Knowledge Base, is currently under development and is expected to be released by April 2002.

Major Content Sections

The first *seven* sections of this document (listed below) provide an overview of learning standards and serve as a "primer" for those interested in learning about standards and how to apply them in their own organization.

- *What is e-Learning and the e-Learning Industry?*
- *Understanding the Standards Concept*
- *How Standards Are Formed*
- *Learning Objects and Standards*
- *What is SCORM?*
- *Talking Standards with e-Learning Suppliers*
- *Using Standards in your Organization*

Most Learning Management System (LMS) or content vendors today claim some sort of compliance or conformance to the latest learning standards. As a result, these terms are used freely, without a real understanding of their meaning and, to add to the confusion, are often used interchangeably. "*Appendix 1: Understanding Conformance*" provides a clear and concise understanding of which term to use and why, as well as how "conformance" relates to a product's adherence to an individual specification or standard.

The term "meta-data" is used frequently throughout the e-Learning world, but what does it mean? How does its value apply to your organization? "*Appendix 2: Meta-data -- Why Implement?*" defines this term, provides examples, and explains the inherent value of meta-data, which is detailed through four main uses in today's environment.

The emergence of learning technologies has significantly altered the way in which people acquire the knowledge and skills they need to do their jobs. One learning technology concept in particular, the "*Learning Object*" (LO), has the potential to revolutionize the paradigm of learning. "*Appendix 3: Learning Objects -- Building Blocks for Learning*" explains the concept of Learning Objects, illustrates the hierarchy of a Learning Object, and describes Sharable Content Objects (SCO) and how they fit into that hierarchy.

"*Appendix 4: Standards and Specifications Groups*" identifies the various groups and organizations responsible for developing standards and provides links for further reference.

"*Appendix 5: Learning Standards Definitions*" defines key terms used throughout this document in discussing e-Learning, standards, and their implementation.

What is e-Learning and the e-Learning Industry?

A simple working definition of the term e-Learning is “learning or training that is prepared, delivered, or managed using a variety of learning technologies and that can be deployed either locally or globally." The promise of e-Learning is that it provides leadership with powerful new tools for improving capability development, speed, and performance whether their organization operates in one geography or many. Just as the rise of information technologies fundamentally changed the nature of how work gets done in organizations, the emergence of learning technologies is fundamentally changing the nature of how people learn to do that work.

The fundamental learning model hasn’t changed: Learning professionals still help others learn how to do things they couldn’t do before. In non-academic settings, this means they remain focused on providing leadership with the ability to build organizational capacity and improve performance. Learning technologies are simply a sophisticated new tool that enables each learning professional to be more productive at helping others learn.

Understanding the Standards Concept

As we have seen historically with battles over such things as railway track gauge, telephone dial tones, video tape formats, email protocols, and the platform battles between Microsoft, Apple, Sun, HP, and others, companies often start out with proprietary technology that will not work well with others. However, these technologies often do not meet the needs of end-users, and thus, the market typically drives the various leaders from business, academia, and government to work together to develop common “standards." This allows a variety of products to co-exist. This convergence of technologies is very important for the consumers of these technologies because products that adhere to standards will provide consumers with wider product choices and a better chance that the products in which they invest will avoid quick obsolescence. Likewise, common standards for things such as content meta-data, content packaging, content sequencing, question and test interoperability, learner profiles, run-time interaction, etc., are requisite for the success of the knowledge economy and for the future of learning. Fortunately, the first versions of these standards and specifications are now arriving. The question is this: How are we to integrate these standards into our plans for the future as well as into our current projects?

Why should an organization care about the emergence and convergence of learning standards? The answer boils down to the organization protecting and increasing the return on its investment in the learning technologies it purchases and in the learning content and services it develops. Thousands, if not millions, of dollars will be spent on these technologies, content, and services to improve knowledge and skills. If the systems can not grow, be sustained, maintained,

and delivered to the learners, the investment will be wasted or seriously less effective on returning results.

Standards help to ensure the five "abilities" mentioned below and to protect and even nurture e-Learning investments:

1. Interoperability - can the system work with any other system?
2. Re-usability - can courseware (Learning Objects, or "chunks") be re-used?
3. Manageability - can a system track the appropriate information about the learner and the content?
4. Accessibility - can a learner access the appropriate content at the appropriate time?
5. Durability - will the technology evolve with the standards to avoid obsolescence?

How Standards Are Formed

In the learning world and long before the phrase "e-Learning" appeared, many organizations all around the world began working diligently to create specifications for learning-related technologies and needs such as meta-data, learner profiling, content sequencing, web-based courseware, and computer-managed instruction. This early work was done by such groups as ARIADNE in Europe, the Dublin Core, IEEE, the Aviation Industry's CBT Committee or AICC, and the EDUCAUSE IMS Consortium (refer to Appendix 4 for more information on these standards groups). At first, these groups focused on different areas of the standards, working simultaneously but not in coordination. The U.S. Department of Defense has taken a leadership role in bringing the work from all the disparate standards organizations together into a common and usable "Reference Model" now known as the "Sharable Content Object Reference Model," or SCORM. SCORM is a unified set of core specifications and standards for e-Learning content, technologies, and services. Today, these various specification and standards bodies are working together and collaborating on SCORM, both in its current and future forms. Even at this early stage, SCORM has proven that the existing specifications and standards are able to deliver on the promises of interoperability, re-usability, etc., and provide the foundation for how organizations will use learning technologies to build and operate in the learning environment of the future. Ongoing work in this area promises to convert even more of the potential into reality.

To understand standards, it's important to understand the following key terms that relate to the evolution of standards.

Specification:
A specification is a documented description. Some "specs" become a standard, which means they have received the stamp of accreditation after having proceeded through the four stages outlined below. In some industries, something cannot be sold until it receives a stamp of approval by the government (i.e., electrical devices are accredited by IEEE).

Standard:

- de jure Standard: De jure \De` ju"re\ [L.] By right; of right; by law; -- often opposed to "de facto." The designation/certification of a specification's status by an accredited body such as IEEE LTSC, ISO/IEC--JTC1/SC36, or CEN/ISSS (European).
- de facto Standard: de facto adj: existing in fact whether with lawful authority or not. Typically, when a critical mass or majority choose to adopt and use a specification. For example, TCP/IP, HTTP, VHS etc., are all "de facto" standards.

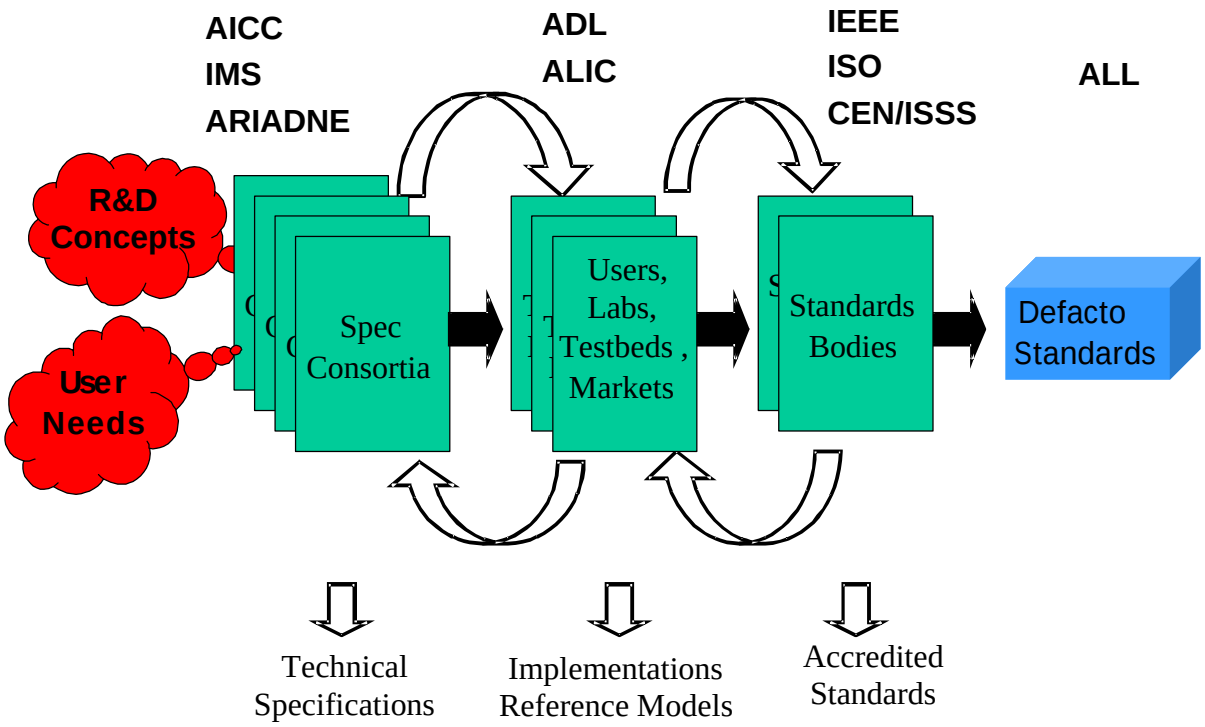
The ideal state is when a *de jure* standard is also *de facto*! (i.e., HTTP)

Specifications evolve and become standards over time and go through several phases of development before they become widely adopted or become *de facto*. While there is no absolute process in the creation of *de jure* standards, one can abstract an overall and HIGHLY ITERATIVE process model where the following four stages are typical: (see graphic below as well)

1. R&D: Research and development is conducted to identify possible solutions.
   Examples: CLEO, The Learning Federation, overall research at universities, companies, consortia, etc.
2. Specification Development: When a tentative solution appears to have merit, a detailed written specification must be documented so that it can be implemented and codified. Various consortia or collaborations, such as AICC and IMS, dedicate teams of people to focus on documenting the specifications.
   Examples: AICC, IMS, and ARIADNE *(Europe).*
3. Testing/Piloting: The specifications are put into use either in test situations or pilots to determine what works, what doesn't, what is missing, customer reactions, etc.
   Examples: ADL SCORM plug-fests or co-labs.
4. Accredited and International Standard Status: The tested and roughly complete specifications are reviewed by an accredited standards body and then made broadly/globally applicable by removing any specifics of given industries, originators, etc., and taken through an open, consensus-based process to produce a working draft which is then officially balloted.

If approved, the specification receives official certification by the accredited standards body and is made available to all through this body. *Examples: IEEE Learning Technology Standards Committee (LTSC) (http://ltsc.ieee.org); ISO/IEC JTC1/SC36 (Joint Technical Committee 1 / Sub-Committee #36) (http://jtc1sc36.org/); CEN/ISSS/LT-WS Learning Technology Work Shop (http://www.cenorm.be/isss/Workshop/LT).*

A Model for Standards Evolution



Standards Concept

Most notably perhaps, this graphic and process above shows how the different organizations and groups cited as examples here are not in any conflict or competition with each other, as is often misunderstood. Instead these various organizations have different roles and responsibilities in a very complimentary and holistic model. Each of the standards organizations has specific milestones and project schedules for their initiatives. We recommended that you visit their particular websites for details on their planned deliverables. See Appendix 4 for descriptions of each group and links to their web sites.

Learning Objects and Standards

One learning technology concept in particular, the "Learning Object," has the potential to revolutionize the paradigm for organizational learning. The concept is simple: leverage database, Internet, and other digital technologies to prepare learning content as discreet small "chunks," or "Learning Objects," that can be used alone or dynamically assembled to provide "just enough" and "just in time" learning. Learning Objects can also enable learners to select the training that is most relevant for them and perhaps even in a media format that matches their preferred learning style (auditory, visual, etc.).

Much like the early days of word processing when there was difficulty moving between products and even different versions of the same product, so today there are issues of incompatibility between learning content and course delivery systems. Web-based course authors and publishers are forced to produce different versions for different delivery systems today, and users are paying thousands of dollars per course to convert formats for the various Learning Management Systems (LMS). Above all, learning decision-makers need to make certain that their investments in acquiring or creating content are retained even when the tools change. In order to accomplish this, we must achieve agreement on global standards that facilitate assembling and re-using chunks of content from various providers across multiple platforms, from desktops to handheld devices.

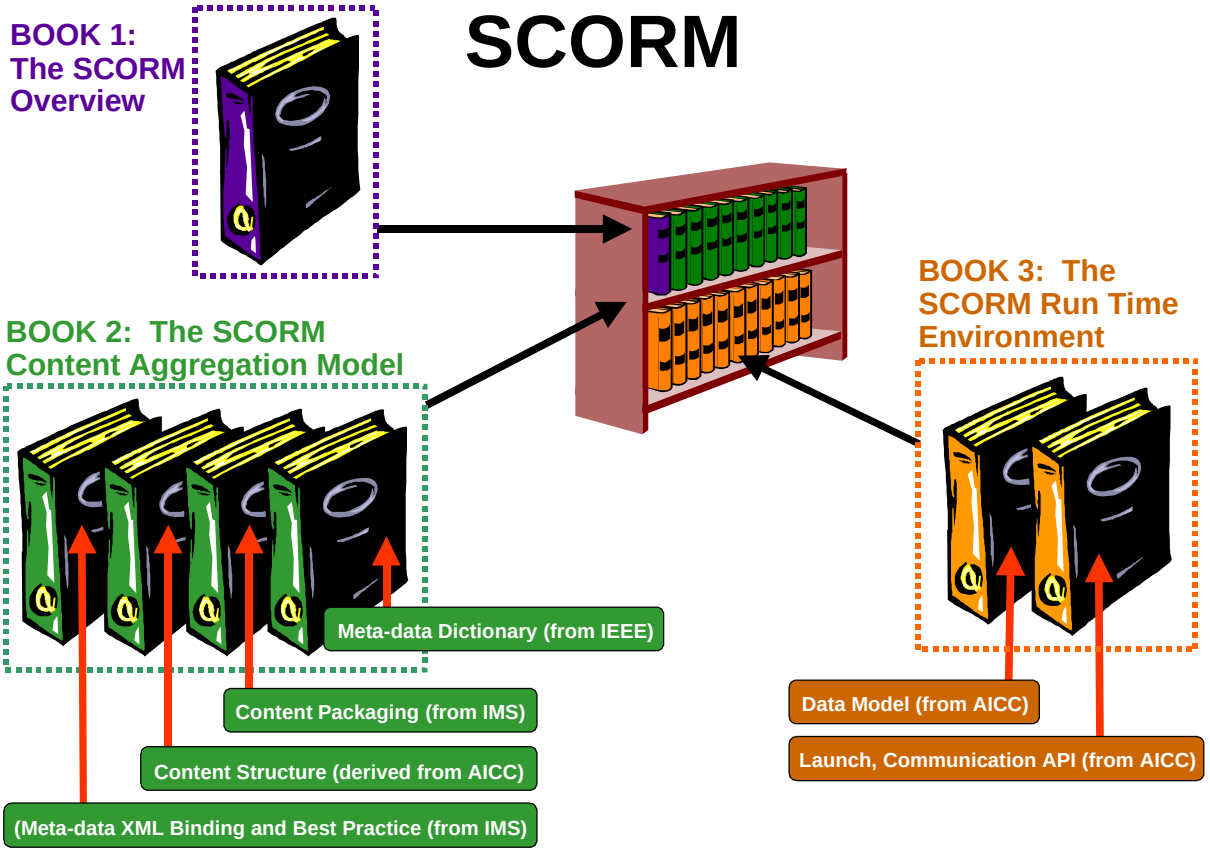
What is SCORM?

The U.S. Department of Defense and its partners initiated a project to ensure that all branches of the US military could use, exchange, manage, track, and re-use their learning technologies, content, and data no matter the source or application (Hodgins, 2000). Their current documentation is called the Sharable Content Object Reference Model, or SCORM. SCORM provides a foundational reference model upon which anyone can develop models of learning content and delivery. For example, systems should be able to "share" data about how learners access courses, their progress in the course, and their pre-test/post-test scores. Through the application of the specifications and standards from the various groups noted in Appendix 4, SCORM provides the framework and detailed implementation reference that enables content, technology, and systems using SCORM to "talk" to each other, thus ensuring interoperability, re-usability and manageability.

SCORM is NOT a standard itself, but rather a reference model that serves to test the effectiveness and real-life application of a collection of individual specifications and standards. SCORM works with standards bodies such as AICC, IMS, and IEEE to integrate their specifications into a cohesive, usable, holistic model, and defines key interrelationships between the standards. SCORM is, in essence, a *de facto* model since this group was not chartered as a

standards-approving body, but rather a model that governments around the world, as well as the learning industry as a whole, are in the process of voluntarily adopting.

The integration of these industry specifications is depicted below:



Source: ADL Technical Team

The first version of ADL's (Advanced Distributed Learning) SCORM documentation centered on web-based learning content and is intended to enable the following:

- The ability for a web-based Learning Management System (LMS) to launch content authored by tools from different vendors and to exchange data with that content
- The ability for web-based LMS products from different vendors to launch the same executable content and exchange data with that content during execution
- The ability for multiple web-based LMS products/environments to access a common repository of executable content and to launch such content

- The ability to move an entire course from one LMS to another (course interchange)

Thus, as e-Learning technology vendors move to adopt standards when designing their products, and as consumers of these technologies insist that the products they buy conform to these emerging standards, the e-Learning industry will see the proliferation of compatible, sharable web-based content among a variety of learning technologies. This will allow the industry to move towards providing learners with the chunks of learning they need and enable organizations to track the usage of these Learning Objects.

More detail will be provided in the second deliverable (due out by April 2002) on how SCORM applies to the decisions that an organization must make with regard to implementing learning technologies.

Talking Standards with e-Learning Suppliers

Quite often, e-Learning implementers know that they should be aware of standards but are not sure exactly which standards they should know about and how standards should be addressed with potential e-Learning suppliers. Conversations between an e-Learning consumer and supplier might go like this:

> Consumer: "Does your system conform to the industry standards?"
>
> Supplier: "Yes. We conform to all the latest standards."
>
> Consumer: "Oh, well... great!"

Too often, consumers don't feel that they know what questions to ask or even what answers they should expect to hear. Even if you haven't memorized each and every SCORM specification, you should still question vendors about their ability to integrate and ensure interoperability with other products. Some good questions include:

- "What level of involvement do you have with the various standards activities?"
- "Is anyone from your organization on any of the standards working groups? If so, what have they contributed?"
- "What are your plans for conforming with the accredited standards and the specifications as they emerge? Which specific standards or specifications does your product conform to (i.e., content meta-data, content packaging, etc.)?"
- "How can your company assist with our transition strategy if new standards make your existing product obsolete?"

We strongly recommend that you require vendors to spell out exactly how they will provide the functionality that you seek and require that they identify the exact specification that is associated with enabling that specific functionality. Listen closely to the supplier's answers, and look for examples of how they have incorporated emerging standards into their existing product. And, if at all possible, arrange to see a demonstration of how the vendor's technology accomplishes the functionality specified by the standard. In this way, you will be able to see their level of conformance with the specification that affects the functionality you need.

When it comes to standards, it is important to pay attention to how a vendor labels a system's level of alignment with the various standards. Three terms often used are compliance, certification, and conformance. To understand the differences between these terms and which term to use, please refer to *Appendix 1: Understanding Conformance*.

Using Standards in your Organization

It's all well and good to be aware that standards are being defined and that e-Learning vendors are beginning to conform to those standards, but what does this mean within an implementing organization? First, understanding the standards can assist in selecting a vendor that has staying power within a constantly changing marketplace. Second, setting standards within an organization can ensure sharing and interoperability even within an organization.

Often, a company may own one, two, or even more Learning Management Systems (LMS), several libraries of web-based, off-the-shelf content, and custom courseware authored in a variety of different tools. Figuring out how to make all of this work together and share information through a common database can be challenging. Furthermore, trying to integrate this data with an ERP system like PeopleSoft or SAP can be daunting. Consider the questions below:

- How do learning meta-data standards relate to other meta-data standards that may exist within the company? You may want to consider developing a meta-data schema specifically for your company. (For more information about meta-data, see *Appendix 2: Meta-data – Why Implement?*
- What are the minimum requirements within the organization concerning what data needs to be captured on each learner?
- Should all custom content be authored in the same tool or at least conform to a certain set of design and meta-tagging standards?
- Should the organization have a common repository for all content, and if so, what rules will govern how the system is used?

- Will any governance structures be needed to help ensure adherence to standards within an organization? Can these be monitored and implemented by the systems and infrastructures?

When implementing standards within a company, to ensure interoperability of web-based courseware and systems, be sure to gain support from senior levels of the organization. Think about whether standards need to be adhered to across the organization from the outset or whether areas within an organization should be phased into conformance as the need for interoperability increases. Sometimes it's easier to gain support for standards after some benefits can be shown, rather than trying to enforce standards on all areas all at once. Keep in mind that this is a long-term and strategic approach that will evolve and develop over a long period of time.

Appendix 1: Understanding Conformance

Which Term Should You Use – Compliance or Conformance?

Most Learning Management System (LMS) or content vendors today claim some sort of compliance or conformance to the latest learning standards. As a result, these terms are used freely, without a real understanding of their meaning, and to add to the confusion, are often used interchangeably. We recommend that conformance be the term used and that you avoid the use of the term compliance. This is both for clarity and accuracy as you will learn as you read this section entitled *Appendix 1: Understanding Conformance*.

The term compliant (an adjective) means “conforming to requirements," but the real issue is “to follow a standard," as represented by the action verb -- conformance. Beyond this initial explanation, this section seeks to provide a clear and concise understanding of conformance and how it relates to a product’s adherence to an individual specification or standard.

Conformance

Conformance is usually defined as testing to see if an implementation (i.e., product or application) meets the requirements of a standard or specification [Gray, Goldfine, Rosenthal, Carnahan; NIST/ITL, January 2000]. *What CAN be tested is conformance to a specific version of a given standard or specification.* Standards and/or specifications exist for content meta-data, content packaging, content sequencing, question and test interoperability, learner profiles, run-time interaction, etc. *It is important to realize that there is no such thing as conformance to a collection of standards or to a group such as IEEE, IMS, AICC, SCORM, or ARIADNE.*

A buyer's or supplier’s interest in conformance should be based on those requirements (content meta-data, content packaging, content sequencing, question and test interoperability, learner profiles, run-time interaction, etc.) which are relevant to their needs. *Just accepting (buyer) or claiming (suppliers) conformance is not enough. You need to focus on HOW a given standard or specification will meet your specific needs.*

For instance, you might have determined that you need to be able to improve the success of your people in getting the content that will best meet their learning needs. Since “meta-data” is the “information” on learners and content that will enable this need to be met, buyers and suppliers should focus their discussion on the degree to which tools, systems, or content that are under consideration “conform” to “meta-data” standards and specifications.

Conformance Testing

Conformance testing is a process of verifying adherence to a standard (not product quality). Conformance testing is generally affiliated with a formal conformance-testing and certification program. For example, consider the telephone. It has been certified by the FCC as indicated by an FCC sticker as adhering to certain standards for telephones. Although there is no authoritative agency established yet for learning standards, we anticipate that there will be within the next year or so.

How do agencies test for conformance? A test suite, which is a combination of test software, test procedures, and test documentation, is used to check a product for conformance. The test software, consisting of a set of test files (i.e., data, programs or scripts), checks each requirement to determine whether the results produced by the product match the expected results. The test procedures define the administrative as well as the technical process for testing a product. The test documentation describes how the testing is to be done.

Certification

Certification is the acknowledgment that testing has been completed and the criteria of the specification have been met. Certification validates a product's conformance for interoperability and re-use. A certificate-issuing body is responsible for issuing certificates for products determined to be conformant. While there could be several certifying bodies for a specification, there can be only one sponsor, or "owner," of the conformance-testing program. The sponsor establishes and maintains the program and ensures the necessary components of the program are in place.

Product Self-Test

A product self-test provides a less formal means for developers and users to assess for themselves the ability of their product to conform to the relevant standard. It allows them to identify and correct problems that may prevent the product from passing formal conformance testing as described above. These publicly available self-test suites are not affiliated with any formal conformance-testing and certification program, and you can find some at http://www.adlnet.org/.

Stuff that Works!

Conformance/certification only really matters to most people to the extent that it results in "stuff that works." In other words, "is the content consistently viewable and usable by the audience it is intended for?"

Certainly achieving certification is an ideal, but buyers must realize that not all technologies may be certified. This is especially true for e-Learning, as it is a relatively new industry and certification processes are not in place for all standards. Furthermore, standards may not always remain the same, so a certification today may not be 100% guarantee of future product viability. Take the example of the video industry. Early on, two sets of standards emerged: Betamax and VHS. Ultimately, VHS was more widely adopted and survived, while Betamax owners found their VCRs and tapes obsolete. VHS standards seemed pretty safe for a while, but then technology moved on, and now standards for DVDs are winning out over VHS technology and will soon render videotapes a thing of the past.

An "assertion of reasonableness" should be discussed between the e-Learning vendor and consumer to agree upon a satisfactory level of understanding that content may be created to be in alignment with standards, but guarantees of certification or even conformance may not be possible.

Future Proof?

How will a buyer know which standards are "safe bets"? Standards that focus on more human factors, or the "needs" of the learners, will most likely remain more constant over time, while technology and the corresponding standards, will tend to evolve over time resulting in newer versions. For example, the "need" to be able to record and view movies has remained the same, but the technology, and thus the standards used to enable that need, have evolved.

Enablers, Not Guarantees

Lastly and perhaps most importantly, keep in mind that adherence to specifications and standards does NOT guarantee or imply that the results of learning from using these products and content will be better or higher "quality." Using the video analogy, we understand that while having the VHS standard has been a critical factor in what we now know as the video industry, VHS does not have much impact on the "quality" or effectiveness of what is contained on a videotape. Similarly then, while this whole "S3" project and indeed all the work on standards and specifications will play a similarly critical role in causing the "take off" of the learning industry, they do not, in and of themselves, look after ensuring the quality or effectiveness of learning.

Perhaps standards and specifications are best characterized as “enablers” in that they make the vision of increased effectiveness of learning and of personalization possible but do not, in and of themselves, ensure it will happen. Learning must be built upon a foundation of common “de-facto” standards, AND we must continue to focus on measuring and attaining increased effectiveness of learning and the increased human performance and productivity this produces.

Appendix 2: Meta-data -- Why Implement?

What is Meta-data?

The field of e-Learning is constantly growing, as are the vast sources of e-Learning information, so it is getting more and more difficult to find and use relevant information. The purpose and usefulness of meta-data in e-Learning is that it provides the ability to richly describe and identify learning content so that we can find, assemble, and deliver the right learning content to the right person at the right time.

Simply defined, meta-data is data which describes other data, or information that describes other information, and as such, meta-data is a wonderful example of the power of simple things. Meta-data could be as objective and straightforward as the author of a book, the file size of an animation, or the location of a file in a database. It can also be as complex and subjective as the learning preferences or styles of an individual, the collective opinion of a group who has seen the same movie, or which quote is the favorite that best captures a profound idea. Content is increasingly being broken down into smaller pieces so that it can be mixed, matched, and assembled into appropriate "Learning Objects" tailored to specific needs. Without meta-data, we would drown in the chaos and inefficiency resulting from an overflowing sea of unidentified Learning Objects and content.

What should meta-data mean to you? It is the means to fully describe and identify every piece of e-Learning content so that you can efficiently find, select, retrieve, combine, use/re-use, and target it for appropriate use.

Meta-data can, and ideally needs to be, applied to all sizes and types of learning content, from the smallest piece of raw data, or "asset," all the way up to a complete course or curriculum. Using meta-data this way allows each level of content to be easily searchable and re-usable. For example, it is just as easy to find and re-use one piece of text or illustration, one page in a chapter, one chapter of a course, or an entire course. But that's not all! Apply the same concept of meta-data to people, places, and things, and the real magic begins! For people, this could include the attributes describing something as simple as their name, address, and phone number to more complex characteristics such as their learning preferences, skills, and buying habits. All these are examples of meta-data. You can start to imagine what happens when meta-data is used to filter, select, and assemble just the right bits of learning content, personalized "just right for you" and delivered on just the right device in just the right way! This is the vision of truly personalized learning and living.

How does meta-data work in the e-Learning world today? Four main uses of meta-data point to its inherent value to individuals and organizations: Categorization, Taxonomies, Re-Use and Dynamic Assemblies. Each one enables reduced cost and significant timesaving as well as human performance improvement.

Categorization

One of the first and most common uses of meta-data comes when it is used to add value by organizing information into categories. A good example are the Yahoo search categories which make looking for information on the web (i.e., autos, entertainment, health, etc.) so much easier and faster. Finding information faster obviously saves time, money, and frustration. It also significantly improves productivity and job performance. However, doing this across different systems, organizations, countries, and disciplines can only be achieved when a common meta-data standard is adopted and implemented.

Taxonomies

While it is useful to organize content into categories, it is even more powerful to structure and organize meta-data categories into ordered groups of relationships known as taxonomies. Most of us learned about taxonomies in biology class when we studied the classification of plants and animals into a hierarchical structure of families, kingdoms, genus, and species. As in biology, there are enormous benefits from having such a structure or taxonomy for meta-data. It can not only organize the content but also capture the relationships between categories. In this way meta-data taxonomies allow different systems and structures to be recognized, translated, and understood.

Imagine that you are trying to explain the structure of the school system in your country to someone from a far away country who knows nothing about your system of education. You would likely refer to the hierarchical system of classes or grade levels or years (a taxonomy), and then use this taxonomy to compare, contrast, and “map” to their country’s system. Can you start to see the power and value of taxonomies in understanding and translating different categorical systems? The same is true with learning content. If all of the attributes (meta-data) about learning content are recorded in a common structure or taxonomy, both the meta-data AND the learning content can be integrated into universally searchable and virtually centralized catalogs and databases which span multiple systems, audiences, and countries.

Re-Use

As content and meta-data become more structured and their granular size decreases, the re-usability of the content and the meta-data begins to increase exponentially. It is not hard to see how this ability to create once and re-use multiple times can provide some of the highest multipliers and return on investment (ROI) imaginable. Once again, meta-data plays a pivotal role.

A current impediment to sharing or re-using information across organizational boundaries is the high cost, time, and difficulty of reformatting, re-categorizing, editing out the irrelevant examples (to the new audience), and integrating it all to match organization-specific circumstances, disciplines, and proprietary information. For example, an in-house course in business ethics might contain 80% non-proprietary content that could be sold and re-used by other organizations which combine it with their 20% proprietary or unique information on business ethics.

Dynamic Assemblies

Let's put this all together; literally! Information can only be re-used to the degree it can be flexibly and, best of all, dynamically assembled into "just the right stuff" for just the right person, in the right media format, in the right language, delivered to the right location, on the right device, at the right time. Let's look at an example of how an Electronic Document Management System (EDMS) or Learning Content Management System (LCMS) could pick and choose just the right content and assemble it for a civil engineer in a remote field location in England who needs to learn how to survey – by applying rules to meta-data. It would select "just the right" bits of data for this field engineer who's using a wireless device, choose examples which are in metric units, match similar characteristics of that location and job, choose the content types which are ideal for small onscreen viewing only (animations, etc., rather than print), and then assemble all this into one or more "just right" Learning Objects and deliver them via satellite cellular connections to her wireless device. As the civil engineer uses these Learning Objects, meta-data in the form of learner usage data is created and sent back to the repository in the EDMS or LCMS for future analysis.

In summary, the four main uses of meta-data described above help to explain that while the ultimate goal of personalized, profoundly effective, and scalable learning is not immediately upon us, it is within our grasp if we embrace standards-based meta-data.

References

http://workflow.ecc-astdinstitute.org/index.cfm?sc=help&screen_name=cert_view

http://www.internettime.com/itimegroup/astd_web/capture.htm

http://www-cscl95.indiana.edu/cscl95/wiburg.html

http://www.imsproject.org/feature/kb/knowledgebits.html

http://www.learningcircuits.org/dec2000/dec2000_ttools.html

http://www.universitybusiness.com/0101/cover_building.html

http://www.w3.org/TandS/#Metdata

http://ifla.inist.fr/II/metadata.htm

http://www.dlib.org/dlib/July95/07weibel.html#refer

Appendix 3: Learning Objects -- Building Blocks for Learning

The Learning Object (LO)

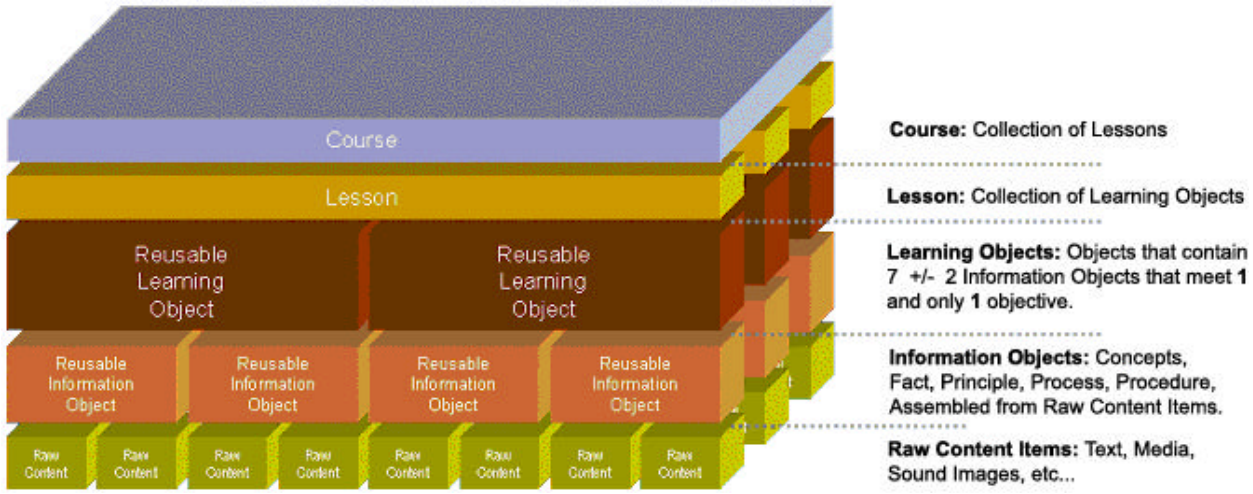
The emergence of learning technologies has significantly altered the way in which people acquire the knowledge and skills they need to do their jobs. One learning technology concept in particular, the "Learning Object" (LO), has the potential to revolutionize the paradigm of learning. A Learning Object is a self-standing, discrete piece of instructional content that meets a learning objective.

In the old paradigm, learning was organized into lessons and courses that met specific learning objectives. In the new paradigm, learning content is broken down into these much smaller, self-contained pieces of instructional content (Learning Objects) that can be used alone or can be dynamically assembled with other Learning Objects to meet the "just enough" and "just-in-time" requirements of a learner.

Part of a Conceptual Content Model

Defining and understanding Learning Objects has been a challenge because they need to be viewed within the context of an overall conceptual model that is based on a hierarchy of granular content objects. The analogy of Lego blocks is often used with the individual Lego pieces representing the smallest piece of "raw content" objects (shown in green in the graphic on the next page). These blocks or objects can be snapped together and pulled apart as needed, which enables almost infinite flexibility to create logical assemblies of individual content objects to meet the learning needs of individuals.

Let's look at a real-world implementation example. Autodesk has defined their strategy to re-use Learning Objects. The Autodesk model represents a five-level hierarchy depicting the aggregation of learning content from the lowest level raw media assets (shown in green in the graphic on the next page) up to the course level (shown in blue). The end result is a database of re-usable learning and information objects that can be used for all forms of learning, including e-Learning, traditional Instructor-Led Training, or Blended Learning solutions.



autodesk CONTENT MODEL

SCO and SCORM

A Sharable Content Object (SCO) represents the lowest level of granularity of learning resources that can be tracked by a Learning Management System (LMS). A Sharable Content Object (SCO) is a particular implementation of a Learning Object which follows the SCO Reference Model (SCORM). Thus, a SCO is a LO that also:

- Contains one or more assets (electronic representations of media, text, images, sound, web pages, assessment objects, or other pieces of data that can be delivered to a Web client.)
- Can locate an LMS API adapter
- Contains the following minimum API calls: (LMSInitialize("") and LMSFinish("")
- Can *not* launch other objects

(The complete SCO specification can be found in the latest version of the SCORM specification documents (http://www.adlnet.org.)

To be re-usable, a SCO by itself should be independent of learning context so that it may be re-used in different learning experiences to fulfill different learning objectives. A SCO can be described with SCO meta-data to allow for search and discovery within online repositories, thereby enhancing opportunities for re-use. In addition, SCOs can be aggregated to form a higher-level unit of instruction that fulfills higher-level learning objectives.

For additional information and examples of Learning Objects, see:

Re-usable Learning Objects, by Peder Jacobsen, e-Learning Magazine
http://www.elearningmag.com/elearning/article/articleDetail.jsp?id=5043

Learning Objects Tutorial, by Robbie Robson, Eduworks
http://www.eduworks.com/LOTT/tutorial/index.html

A Primer on Learning Objects, by Warren Longmire, Learning Circuits
http://www.learningcircuits.org/mar2000/primer.html

Learning Object Pioneers, by Tom Barron, Learning Circuits
http://www.learningcircuits.org/mar2000/barron.html

Objects of Interest, by Clive Shepherd, Fastrack Consulting, Ltd.
http://www.fastrak-consulting.co.uk/tactix/features/objects/objects.htm

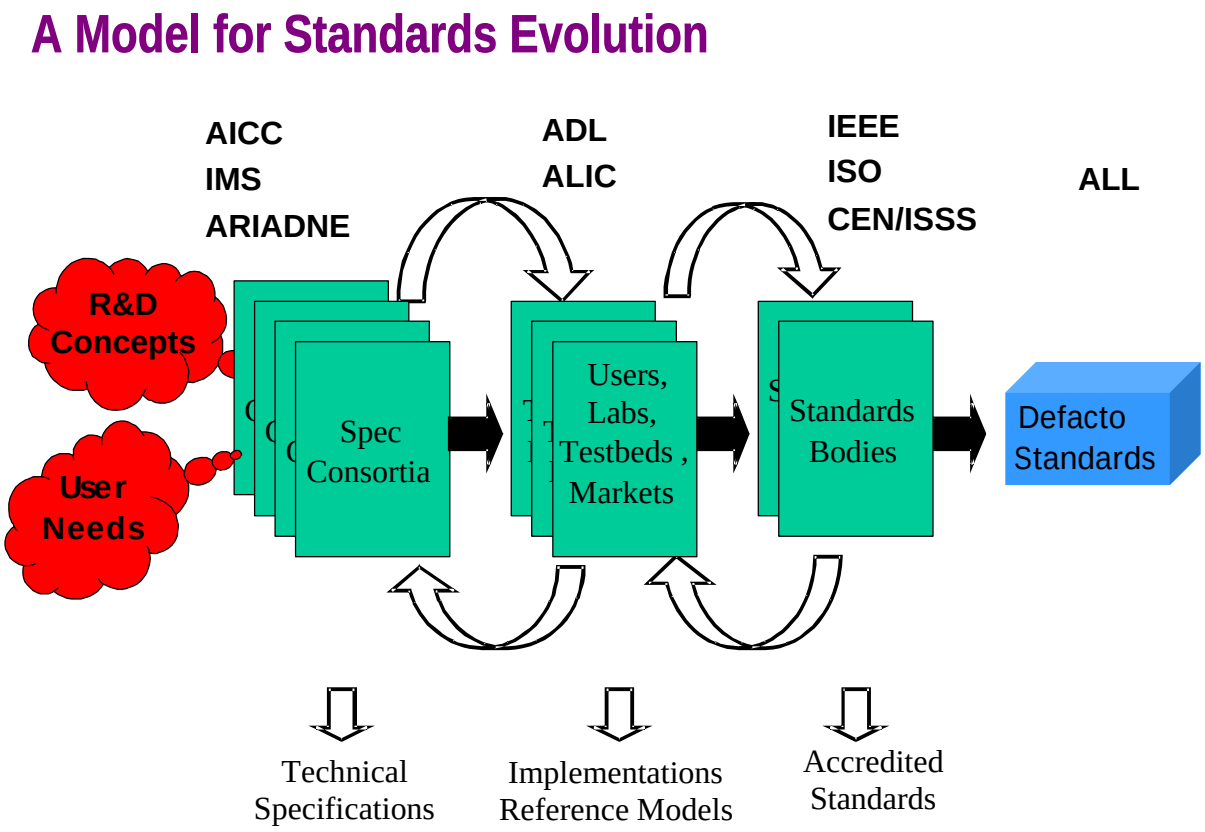
The Objects of Learning, Academic ADL Co-Lab
http://adlcolab.uwsa.edu/lo/index.htm

The Instructional Use of Learning Objects (online version), by David Wiley
http://reusability.org/read/

Appendix 4: Standards and Specifications Groups

Purpose

This appendix cites the primary groups and organizations responsible for developing standards along with their URL links for further reference.



Standards Concept

Specifications evolve and become standards over time, going through several phases of development before they become widely adopted, or become *de facto*. The visual above describes the process by which standards evolve and become *de facto* standards -- acknowledged and used by many working groups. While there is no absolute process in the creation of *de jure* standards, one can abstract an overall and HIGHLY ITERATIVE process model where the following four stages are typical:

1. R&D -- Research and development is conducted to identify possible solutions. *Examples: CLEO, The Learning Federation, overall research at universities, companies, consortia, etc.*
2. Specification Development -- When a tentative solution appears to have merit, potential use, and value, a process of documenting a detailed written specification, which can be implemented and codified, is required. This is typically done by a working group and often by various consortia or collaborations.
   Examples: AICC, IMS, and ARIADNE (Europe)
3. Testing/Piloting – The specification are put into use either in test situations or pilots to determine what works, what doesn't, what is missing, customer reactions, etc.
   Examples: ADL SCORM plug fests or co-labs.
4. "De jure" standard status -- The tested and roughly complete specifications are taken to an accredited standards body where they are reviewed, made broadly/globally applicable by removing any specifics of given industries, originators, etc., and taken through an open, consensus-based process to produce a working draft which is then officially balloted. If approved, the specification receives official certification by the accredited standards body and is made available to all through this body.
   Examples: IEEE Learning Technology Standards Committee (LTSC) (http://ltsc.ieee.org/); ISO/IEC JTC1/SC36 (Joint Technical Committee 1 / Sub-Committee #36 (http://jtc1sc36.org/; CEN/ISSS/LT-WS Learning Technology Work Shop (http://www.cenorm.be/isss/Workshop/LT)

Standards and Specifications Groups

ADL Initiative: (Advanced Distributed Learning)

An initiative by the U.S. Department of Defense and its partners in industry, academia, and the private and federal sectors to achieve interoperability across computer and Internet-based learning courseware through the development of a common technical framework, which contains content in the form of re-usable learning objects. This group is responsible for authoring the SCORM document. (http://www.adlnet.org)

From the ADL Web site: The purpose of the ADL initiative is to ensure access to high-quality education and training materials that can be tailored to individual learner needs and made available whenever and wherever they are required. This initiative is designed to accelerate large-scale development of dynamic and cost-effective learning software and to stimulate an efficient market for these products to meet the education and training needs of the military and the nation's workforce of

the future. It will do this through the development of a common technical framework for computer and net-based learning that will foster the creation of re-usable learning content as "instructional objects."

AICC (Aviation Industry Computer-Based Training Committee):
An international association of technology-based training professionals that develops training guidelines for the aviation industry. AICC is developing standards for interoperability of computer-based and computer-managed training products across multiple industries. (http://www.aicc.org)

From the AICC Web site: The AICC's mission is to provide and promote information, guidelines and standards that result in the cost-effective implementation of CBT and WBT.

ALIC (Advanced Learning Infrastructure Consortium) (Japan):
From the ALIC Web site: Our objective is to establish an active society by reasonably and effectively providing a learning environment, which enables anyone to learn anytime, anywhere, according to the goals, pace, interests and understanding of individuals and groups. Also, we attempt to foster experts who will be the origin of global competitiveness. (http://www.alic.gr.jp/eng/index.htm)

ARIADNE (Alliance of Remote Instructional Authoring and Distribution Networks for Europe):
From the ARIADNE Web site: ARIADNE is a research and technology development project pertaining to the "Telematics for Education and Training" R&D program sponsored by the European Union. The project focuses on the development of tools and methodologies for producing, managing, and re-using computer-based pedagogical elements and telematics-supported training curricula. Validation of the project's concepts is currently taking place in various academic and corporate sites across Europe. (http://ariadne.unil.ch)

CEN/ISSS (European Committee for Standardization/Information Society Standardization System):
From the CEN/ISSS Web site: The mission of CEN/ISSS is to provide market players with a comprehensive and integrated range of standardization-oriented services and products, in order to contribute to the success of the Information Society in Europe. (http://www.cenorm.be/isss)

EdNA (Education Network Australia):
From the EdNA Web site: EdNA Online is a service that aims to support and promote the benefits of the Internet for learning, education, and training in Australia. It is organised around Australian curriculum, its tools

are free to Australian educators, and it is funded by the bodies responsible for education provision in Australia - all Australian governments. (http://www.edna.edu.au/EdNA)

DCMI (Dublin Core Meta-data Initiative):

From the DCMI Web site: The Dublin Core Meta-data Initiative is an open forum engaged in the development of interoperable meta-data standards that support a broad range of purposes and business models. DCMI is dedicated to promoting the widespread adoption of these standards and developing specialized meta-data vocabularies for describing resources that enable more intelligent information discovery systems. DCMI's activities include consensus-driven working groups, global workshops, conferences, standards liaison, and educational efforts to promote widespread acceptance of meta-data standards and practices.

GEM (Gateway to Educational Materials):

From the GEM Web site: The Gateway to Educational Materials^{SM} is a Consortium effort to provide educators with quick and easy access to thousands of educational resources found on various federal, state, university, non-profit, and commercial Internet sites. GEM is sponsored by the U.S. Department of Education and is a special project of the ERIC Clearinghouse on Information & Technology. Teachers, parents, administrators can search or browse The Gateway and find thousands of high quality educational materials, including lesson plans, activities, and projects from over 414 GEM Consortium member sites. (http://thegateway.org)

IEEE (Institute of Electrical and Electronics Engineers):

The IEEE's Learning Technology Standards Committee is working to develop technical standards, recommended practices, and guides for computer implementations of education and training systems.

From the IEEE Web site: The mission of IEEE LTSC working groups is to develop technical Standards, Recommended Practices, and Guides for software components, tools, technologies, and design methods that facilitate the development, deployment, maintenance, and interoperation of computer implementations of education and training components and systems. (http://ltsc.ieee.org)

IMS Global Learning Consortium (Instructional Management System):

IMS is a global consortium with members from educational, commercial, and government organizations dedicated to defining and distributing open architecture interoperability specifications for e-Learning products.

From the IMS Web site: IMS Global Learning Consortium, Inc. (IMS) is developing and promoting open specifications for facilitating online

distributed learning activities such as locating and using educational content, tracking learner progress, reporting learner performance, and exchanging student records between administrative systems.

IMS has two key goals:
1. Defining the technical specifications for interoperability of applications and services in distributed learning, and
2. Supporting the incorporation of the IMS specifications into products and services worldwide. IMS endeavors to promote the widespread adoption of specifications that will allow distributed learning environments and content from multiple authors to work together (in technical parlance, "interoperate"). (http://www.imsproject.org)

ISO (International Organization for Standardization):
From the ISO Web site: The ISO is a worldwide federation of national standards bodies from some 140 countries, one from each country. ISO is a non-governmental organization established in 1947. The mission of ISO is to promote the development of standardization and related activities in the world with a view to facilitating the international exchange of goods and services, and to developing cooperation in the spheres of intellectual, scientific, technological and economic activity. ISO's work results in international agreements which are published as International Standards. (http://www.iso.org)

PROMETEUS (PROmoting Multimedia access to Education and Training in the EUropean Society):
From the PROMETEUS Web site: PROMETEUS is an open initiative launched in March 1999 under the sponsorship of the European Commission with the aim of building a Common Approach to the Production and Provision of e-Learning Technologies and Content in Europe. PROMETEUS is an expert opinion-making forum where actors from a wide range of professional, cultural, and linguistic backgrounds, come together to build critical mass in the field of educational technology and applications. The complementary expertise of the PROMETEUS Signatories is brought together in the aim to bridging the gap between research and actual use of learning technologies, content, and services. (http://www.prometeus.org.uk)

Appendix 5: Learning Standards Definitions

Purpose

This appendix serves as a preliminary guide to understanding some of the key terms found when engaging in discussions of e-Learning, standards, and implementation. Additional resource links are also provided for your reference.

Definitions

Accessibility:
The ability to locate and access instructional materials without regard for either geographic location or physical disabilities.

API (application program interface):
Operating system services made available to programs that run under the operating system.

Asset:
Learning content in its most basic form is composed of assets that are electronic representations of media, text, images, sound, web pages, assessment objects, or other pieces of data that can be delivered to a Web client. An asset can be described with meta-data to allow for search and discovery within online repositories, thereby enhancing opportunities for re-use.

Certification:
The acknowledgment that testing has been completed and the criteria of a standard or specification has been met. Certification validates a product's conformance for interoperability and re-use. There may also be varying levels of certification for each standard. Certification is to be legally obtained through an approved certifying body authorized to issue the certification.

Compliance or Compliant:
Many Learning Management System (LMS) or content vendors today claim "compliance" or say they are "compliant" to a specific learning standard. As a result, these terms are used freely without a real understanding of their meaning, and often used interchangeably. We recommend that conformance be the term used and to avoid the use of compliance or compliant. This is both for clarity and because compliant is an adjective which means "conforming to requirements," so the real issue is the action of the verb conformance, which is most simply "to follow a standard." For more information about conformance, see *Appendix 1: Understanding Conformance*.

Conformance:

Successful testing of an implementation (i.e., product or application) to meet the requirements of a standard or specification. Conformance only applies to and can be tested for a given specification. Therefore, it is not conformance to SCORM (for example), but rather conformance to a specific version of a standard or specification, such as content meta-data, content packaging, etc. We recommend that conformance be the term used and to avoid the use of compliance or compliant. A buyer's or supplier's interest in conformance should be based on those specifications relevant to their needs and purpose. For more information about conformance, see *Appendix 1: Understanding Conformance.*

Note on Conformance from the ADL:

It is important to note that testing and demonstration activity in no way implies certification of any participant's products by ADL or any other involved company or organization. Results of conformance testing can not be used to indicate any kind of endorsement or product certification by ADL or any other participating company or organization. Currently, there are no certificate-issuing organizations responsible for certifying products determined to be conformant to SCORM. For more information on ADL certification, go to http://www.adlnet.org.

Content Structure:

Defines a mechanism that can be used by the content developer with the means to author/aggregate collections of learning resources into a cohesive unit of instruction (i.e., course, chapter, module, etc.), apply structure, associate learning taxonomies, and associate specific behaviors that can be uniformly reproduced across LMS environments. The content structure can be considered the map used to sequence/navigate through the learning resources defined in the content package. The content structure contains not only the structure of the learning resources, but also all behaviors to be applied to the learning experience. Content Structure does not define LMS functionality.

Data Model:

A conceptual representation of the data structures that are required by a database. The data structures include the data objects, the associations between data objects, and the rules which govern operations on the objects. As the name implies, the data model focuses on what data is required and how it should be organized rather than what operations will be performed on the data. To use a common analogy, the data model is equivalent to an architect's building plans. The data model is a standard set of data elements used to define the information being communicated, such as the status of the learning resource. In its simplest form, the data model defines elements that both the LMS and learning content are

expected to “know” about. The LMS must maintain the state of required data elements across sessions, and the learning content must utilize only these predefined data elements if re-use across multiple systems is to occur. Structured data is at the heart of the modular content paradigm upon which things like Learning Objects are based upon.

De jure standard:

[de jure: by right; of right; by law -- often opposed to "de facto"].
The designation/certification of a specification's status by an accredited body such as IEEE LTSC, ISO/IEC--JTC1/SC36, or CEN/ISSS (European). For more information, see *How Standards Are Formed* in this document.

De facto standard:

[de facto: existing in fact whether with lawful authority or not].
Typically, when a critical mass or majority choose to adopt and use a specification. For example, TCP/IP, HTTP, VHS etc. are all "de facto" standards. The ideal state is when a "de jure" standard is also "de facto"! (i.e., HTTP). For more information, see *How Standards Are Formed* in this document.

Durability:

The ability to withstand technology changes without redesign, reconfiguration, or recoding.

e-Learning:

Learning or training that is prepared, delivered, or managed using a variety of learning technologies, and that can be deployed either locally or globally.

Extensibility:

As technology and requirements evolve, the e-Learning framework must allow for additional components to be integrated easily using some form of open and component-based software architecture. Example: Extending the use of the same content from a PC to a Personal Digital Assistant (PDA).

Globalization:

The tailoring of content to include clear, grammatically correct text that eliminates slang and generational idioms; omits references to cultural-specific content; facilitates the same content across cultural and linguistic boundaries; is tailored to be correctly interpreted in local geographies; and uses simple business language. Also, it can refer to making content very culture-specific for more than one target audience.

Granularity:
Refers to the level of divisibility and accessibility of learning content within a system.

Interoperability:
The ability to take instructional components developed in one location with one set of tools or platform and use them in another location with a different set of tools or platform. An effective e-Learning framework must allow content and other data to be exchanged and shared effectively by separate tools, software, and systems connected via the Internet. The network and web protocols or technologies allow content structures to be exposed in a manner that allows content packages, in whole or part, to be re-used in other contexts. Note: there are multiple levels of interoperability.

Learning Object (LO):
A re-usable, media-independent chunk of information used as a modular building block for e-Learning content. Learning objects are most effective when organized by a meta-data classification system and stored in a data repository such as an LCMS.

LCMS (Learning Content Management System):
A software application that enables authors to register, store, assemble, manage, and publish learning content for delivery via web, print, or CD.

LMS (Learning Management System):
Software that automates the administration of training events. The LMS registers users, tracks courses in a catalog, records data from learners; and provides reports to management. An LMS is typically designed to handle courses by multiple publishers and providers. A learner's development plan and job-related training can be stored and personalized to the individual.

Manageability:
The ability for a system, such as a Learning Management System (LMS), to track the appropriate information about the learner and learning content.

MASIE Center e-Learning CONSORTIUM:
A collaboration of major corporations, government agencies, and e-Learning providers focused on the future of e-Learning.

Meta-data:
The information which describes other information and allows it to be stored, indexed, searched, and retrieved from a database or repository. The purpose and usefulness of meta-data in e-Learning is that it provides the ability to richly describe and identify learning content so that we can find, assemble, and deliver the right learning content to the right person at

the right time. For more information, see *Appendix 2: Meta-data – Why Implement?*

Meta-data tag:
An attribute that describes a Learning Object. Examples include author, publisher name, keywords, version, language, learning objectives, etc.

Modularity:
Arranging learning content in a way to permit its recombination for use within other learning contexts.

Reference Model:
The selected standard used to guide development, delivery, and implementation of e-Learning. The ADL's SCORM document is an example (http://www.adlnet.org). For more information about SCORM, see *What Is SCORM?* in this document.

Re-usability:
The flexibility to incorporate instructional components in multiple applications and contexts.

Run Time Environment:
Launching, communicating with, and tracking content in a web-based environment. This communication takes place between a Learning Management System (LMS) and learning content (through a browser or a Virtual Classroom tool, etc.).

S3 Working Group
The MASIE Center e-Learning CONSORTIUM organized and facilitated a group of e-Learning professionals who worked together to generate a collection of information and job-aids to help "the average person" understand the rationale, development, and implication of learning standards and to accelerate their adoption. This small group of e-Learning CONSORTIUM members formed the "S3 Working Group" to help make Sense of our Standards and Specifications (S3). They created this document and all of the S3 project deliverables. Please consult the Table of Contents for the names of these contributors.

Scalability:
The degree to which a computer application or component can be expanded in size, volume, or number of users served.

Schema:
Standard meta-data structure; a structured framework or plan.

SCO (Sharable Content Object):

Sharable Content Object [from SCORM, version 1.2]. A SCO represents the lowest level of granularity of learning resources that can be tracked by a Learning Management System (LMS). A collection of one or more assets that include a specific launchable asset that utilizes the SCORM Run-Time Environment to communicate with an LMS. To be re-usable, a SCO by itself should be independent of learning context. For example, a SCO could be re-used in different learning experiences to fulfill different learning objectives. In addition, one or more SCOs can be aggregated to form a higher-level unit of instruction or training that fulfills higher level learning objectives. SCOs are intended to be subjectively small units, such that potential re-use across multiple learning objectives is feasible. A SCO can be described with SCO meta-data to allow for search and discovery within online repositories, thereby enhancing opportunities for re-use. For more information about SCO's, see *SCO and SCORM* in this document.

SCORM (Sharable Content Object Reference Model):

A standards reference model that incorporates defined standards (such as IEEE and AICC), that can be applied to course content, Virtual Classroom technologies, LMS', and LCMS tools to manage the creation, publishing, and delivery of re-usable Learning Objects. As a result of the U.S. Department of Defense's Advanced Distributed Learning (ADL) initiative, courseware elements following SCORM standards can be easily merged with other elements that conform to the standard to produce a highly modular and interoperable repository of training content. For more information about SCORM, see *What Is SCORM?* in this document.

Specification:

A documented description. Some "specs" become a standard, which means they have received the stamp of accreditation after having proceeded through the four stages outlined in *How Standards are Formed* in this document. In some industries, something cannot be sold until it receives a stamp of approval by the government (i.e., electrical devices are accredited by IEEE).

Standard:

There are two types of standards:

- de jure Standards: De jure \De` ju"re\ [L.] By right; of right; by law; -- often opposed to "de facto." The designation/certification of a specification's status by an accredited body such as IEEE LTSC, ISO/IEC--JTC1/SC36, or CEN/ISSS (European).
- de facto Standards: de facto adj: Existing in fact whether with lawful authority or not. Typically, when a critical mass or majority choose to

adopt and use a specification. For example, TCP/IP, HTTP, VHS etc. are all "de facto" standards.

The ideal state is when a *de jure* standard is also *de facto*! (i.e., HTTP).

Specifications evolve and become standards over time and go through several phases of development before they become widely adopted or become *de facto*. While there is no absolute process in the creation of *de jure* standards, one can abstract an overall and HIGHLY ITERATIVE process model where the following four stages are typical.

1. R&D -- Research and development is conducted to identify possible solutions.
   Examples: CLEO, The Learning Federation, overall research at universities, companies, consortia, etc.
2. Specification Development -- When a tentative solution appears to have merit, a detailed written specification must be documented so that it can be implemented and codified. Various consortia or collaborations, such as AICC and IMS, dedicate teams of people to focus on documenting the specifications.
   Examples: AICC, IMS, and ARIADNE (Europe).
3. Testing/Piloting -- The specifications are put into use either in test situations or pilots to determine what works, what doesn't, what is missing, customer reactions, etc.
   Examples: ADL SCORM plug-fests or co-labs.
4. Accredited and International Standard Status -- The tested and roughly complete specifications are reviewed by an accredited standards body, and then made broadly/globally applicable by removing any specifics of given industries, originators, etc., and taken through an open, consensus-based process to produce a working draft which is then officially balloted. If approved, the specification receives official certification by the accredited standards body and is made available to all through this body.
   Examples: IEEE Learning Technology Standards Committee (LTSC) (http://ltsc.ieee.org/); ISO/IEC JTC1/SC36 (Joint Technical Committee 1 / Sub-Committee #36) (http://jtc1sc36.org/); CEN/ISSS/LT-WS Learning Technology Work Shop (http://www.cenorm.be/isss/Workshop/LT).

Taxonomy:

Hierarchical levels which can be ascribed to learning content. Note: multiple classification schemes, or taxonomic hierarchies, may be adopted to describe one piece of learning content.

Virtual Classroom:
An online learning space where students and instructors interact in real time.

XML (Extensible Markup Language):
Coding language that allows the separation of style from content. XML enables designers to create their own markup commands, and still allow interoperability of data between applications.

Additional Resources

See additional terms and definitions in the following resources:

http://www.cisco.com/warp/public/10/wwtraining/elearning/pdf/elearn_glossary.pdf

http://www.internettime.com/itimegroup/eglossary.htm

http://www.learningcircuits.org/glossary.html

http://elearners.com/services/faq/glossary.htm

Bibliography

American Society for Training & Development (2001), E-Learning Glossary http://www.learningcircuits.org/glossary.html

Advanced Distributed Learning Initiative (2001), Sharable Content Object Reference Model, Version 1.2

Rosenberg, Marc J. (2001) e-Learning, New York: McGraw Hill.