ADL and the Sharable Content Object Reference Model (SCORM)

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Note: This presentation has explanations, definitions and references in the Notes Pages sections (like the one you are now viewing); therefore, the reader is highly encouraged to print with the Notes Pages. To do this, print the presentation as follows:

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This brief is organized as follows:

–ADL Introduction -- how it relates to SCORM

–Why and What of SCORM -- why it was developed and what it is

–SCORM parts -- the primary components of the specification

The ADL Vision

"Provide access to the highest quality education and training, tailored to individual needs, delivered cost effectively, anywhere and anytime."

- www.ADLnet.org

Note: Although ADL is a DoD initiative, it has potential for having an international impact on learning technology.

<u>The ADL Strategy</u>

- Pursue emerging network-based technologies
- Facilitate development of common standards
- Lower development costs
- Promote widespread collaboration that satisfies common needs
- Enhance performance with next-generation learning technologies
- Work with industry to influence commercial off-the-shelf (COTS) product development

What is ADL?

Advanced
- » Adaptive learning
- » Intelligent tutoring
- » Simulation
- » State-of-the-art technology

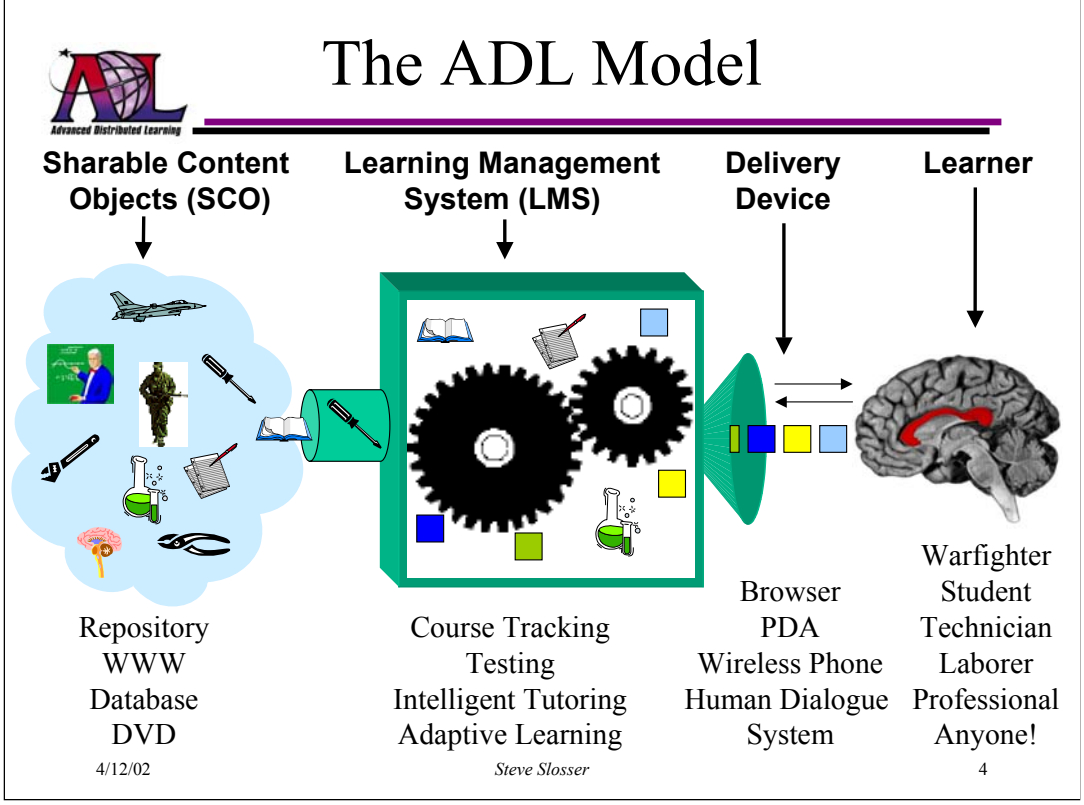
Distributed
- » Office
- » Home
- » Classroom
- » Field

Learning
- » Formal education
- » Training
- » Job performance enhancement

Advanced - applying science and the latest technology to the learning experience.
- adaptive learning
- intelligent tutoring
- intelligent agents
- reusable learning objects
- simulation
- repositories
- natural language understanding
- latest web technologies
- non-proprietary specifications

Distributed - delivered anywhere, anytime.
- office
- home
- classroom
- field
- on-the-run

Learning - the right education at the right time.
- formal education - colleges and universities
- training
- job performance enhancement - no waiting for the knowledge you need
- just-in-time information



This slide returns to the vision of the future that guides and motivates the ADL initiative. We, along with many other stakeholders, envision a future focused on the integration of cooperatively created objects -- a future that replaces today's private creation of objects intended for one-time-only use. As the slide suggests, accomplishment of this vision is keyed to the availability of courseware objects that are genuinely sharable. Such sharability does not now exist. We need capabilities that allow us to:

- Move courses from one courseware system to any other,
- Reuse content "chunks" across different courseware systems, and
- Access searchable content or media repositories created by any courseware system.

At present, we lack these enabling capabilities. We need to develop them. The technical capabilities emphasized by the ADL initiative are intended to do that -- to develop sharable courseware objects with the functional capabilities needed to fulfill our vision of the future of instruction -- a future that we are beginning to view as inevitable. The uncertainty lies in whether it will appear sooner or later.

Also, it is important to note that technology will advance and what we envision as an implementation today may not be the same as that of tomorrow. The top terms in the lists at the bottom of the slide are what we envision today as the ADL implementation. The terms that follow are possible implementations based on where we *think* technology is headed today.

ADL High-Level Requirements

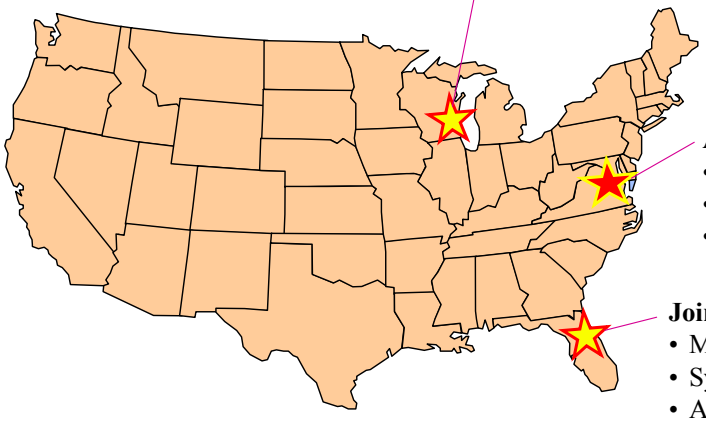
Accessibility	accessing learning content anywhere, from anywhere
Interoperability	separating courseware from operating environments and authoring tools
Durability	designed to evolve with technology
Reusability	developed once and used many times in many different ways
Adaptability	the right training at the right time
Affordability	better, faster and cheaper learning

The SCORM supports the goals of the first four requirements, and indirectly supports the last two.

<u>ADL High-Level Requirements</u> (as put by Michael Parmentier, DUSD, (P&R))

- **Accessibility** - the ability to access instructional components from one remote location and deliver them to many other locations
- **Interoperability** - the ability to use instructional components developed in one location with one set of tools or platform in another location with a different set of tools or platform
- **Durability** - the ability to operate instructional components when base technology changes without redesign or recoding
- **Reusability** - the ability to incorporated instructional components into multiple applications
- **Adaptability** - the ability to tailor instruction to individual and situational needs
- **Affordability** - the ability to increase learning effectiveness while reducing time and costs

ADL Co-Labs



Academic ADL Co-Lab
Focal point for academic collaboration & accreditation

ADL Co-Lab Hub
- Policies, Tools & Standards
- DoD-Federal Integration
- ADL Portal & Clearinghouse

Joint ADL Co-Lab
- Military Implementations
- Systems Acquisition Community
- ADL Prototype Projects
- SBIR Initiatives

What is an ADL Co-Lab? An open, collaborative environment for sharing learning technology research, development, implementation and evaluations.

ADL Co-Lab Hub – www.ADLnet.org

Joint ADL Co-Lab – www.JointADLCoLab.org

Academic ADL Co-Lab – www.WiADLCoLab.org

Joint ADL Co-Lab FY01 Prototype topics:

- Medical
- Job Performance
- Use of gaming and entertainment industry

ADL Co-Lab Functions

- Co-develop and adapt industry specifications for ADL – the SCORM
- Develop and distribute prototype, testing and implementation software
- Establish specification certification process
- Conduct outreach and tutorials
- Develop guidelines and policies for ADL implementation
- Advance ADL principles and technologies – prototypes
- Establish consensus with and collect feedback from industry, government and academia – Plugfests

Q:What are Plugfests?

A: Plugfests bring together early adopters of the SCORM specification to experiment and demonstrate interoperability of content from many sources over multiple learning management systems and from separate organizations. Plugfests are events to validate and document progress in meeting the collective requirements for reuse, adaptability, interoperability, cost-effectiveness, and global access. Representatives from learning software developers and content providers from various sectors of the U.S. government, industry, and academia, actively participate in Plugfest events which are hosted by the ADL Co-Laboratory. Plugfests provide participants with a forum for sharing their experiences in converting instructional products to comply with SCORM specifications and helps make them more robust. Proceedings of past Plugfests can be found under the Library section of the ADL Web site.

The ADL Initiative

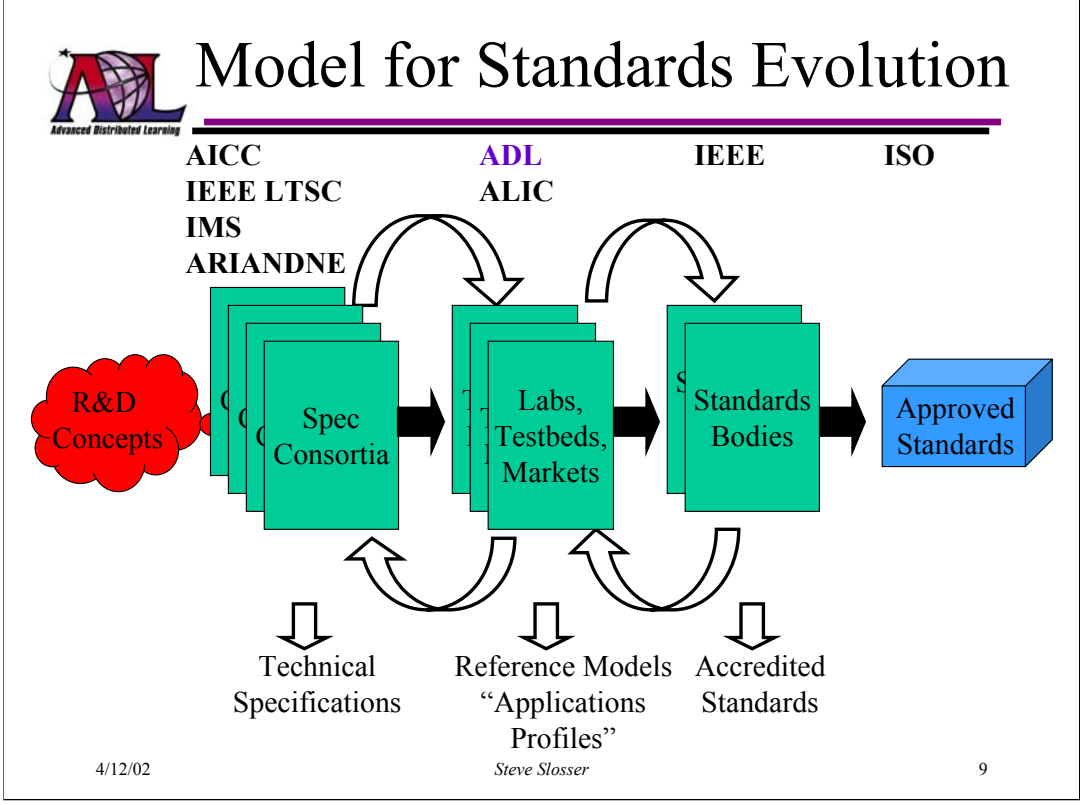
ADL is really about:

- Building consensus among users, developers and industry
- Acting as a catalyst to bring together key players
- Forging alliances in strategic technical areas
- Accelerating the pace of technology adoption for learning anytime, anywhere

ADL recognized early on that it must draw upon emerging standards under development in industry. The development of distributed learning technologies is complex and rapidly evolving.

Experts from education and training fields needed to connect with leading edge technologists in web and Internet companies to formulate solutions to vexing problems that impede large scale deployment of distributed learning systems.

ADL set out to develop a unifying model that incorporates the work of multiple organizations.



- This slide represents the current (as of January 2001) view of the technical standards process. Far from competing, the various groups of organizations each perform a needed role in the evolution of technical standards.
- ADL is primarily focused on test bed implementations, but is also very active in supporting advance and applied research. **Note that SCORM is a specification; not a standard.**
- ADL works with other groups internationally to formulate the next additions to SCORM through this process.
- The SCORM Run-Time Environment comes from the Aviation Industry CBT (Computer-Based Training) Committee (AICC) (www.AICC.org).
- The SCORM Meta-Data specification comes from the cooperative efforts of the Institute of Electrical and Electronic Engineers (IEEE) Learning Technology Standards Committee (LTSC) (LTSC.IEEE.org), IMS Global Learning Consortium (www.IMSproject.org), and the Alliance of Remote Instructional Authoring and Distribution Networks for Europe (ARIADNE) (www.ARIADNE-eu.org). SCORM Packaging Specification also comes from IMS.
- The Advanced Learning Infrastructure Consortium (ALIC) (www.ALIC.gr.jp) is the Japanese counterpart to ADL. They are taking a similar approach to attaining similar goals, including leveraging the specifications from the same organizations as ADL.
- Once specifications have been tested and there is general consensus among a user community that they are technically sound, they are submitted to standards bodies for balloting. The balloting group makes the specification a standard by a majority vote. IEEE-Standards Association (SA) (standards.IEEE.org) is one such US-based organization. The International Standards Organization (ISO) (www.ISO.org) has more of an international scope. ADL specifications are targeted for the Learning, Education and Training subcommittee of ISO known as JTC1 SC36 (JTC1SC36.org).

What is Sharable Content Object Reference Model (SCORM)?

- A means to facilitate interoperability among web-based learning products
- A set of interrelated specifications designed to meet DoD's ADL high-level requirements
- A process to bring together disparate groups and interests
- A bridge from general emerging technologies to commercial implementations

…an evolving document that collects all the "bits and pieces" in one place

Note: "Web-based" does not necessarily mean that an application must run over the Internet. "Web-based" refers to a specific "look-and-feel" and software implementation (client-server). An application can be web-based and still run entirely on a desktop PC.

World Wide Web (sometimes known simply as "the web") - a system of Internet servers that support specially formatted documents. (Not all Internet servers are part of the World Wide Web.) The documents are formatted in a language called HTML (HyperText Markup Language) that supports links to other documents, as well as graphics, audio and video files. One can jump from one document to another simply by clicking on hot spots. There are software applications called Web browsers that make it easy to access the World Wide Web. Browsers (or clients) and servers communicate via a protocol called Hypertext Transfer Protocol (HTTP). Documents or other resources are located on the World Wide Web by a Uniform Resource Locators (URL) which collectively make up a global address system. The World Wide Web was invented in 1990. *(Webopedia - www.Webopedia.com; History of the World Wide Web - http://ei.cs.vt.edu/~wwwbtb/book/chap1/index.html)*

Internet - a decentralized system of globally connected computers. The Internet emerged from networking research funded by the Defense Advanced Research Projects Agency (DARPA) in the late 1960's. *(Webopedia - www.Webopedia.com; A Brief History of the Internet - http://www.isoc.org/internet/history/brief.html#Origins)*

SCORM Approach

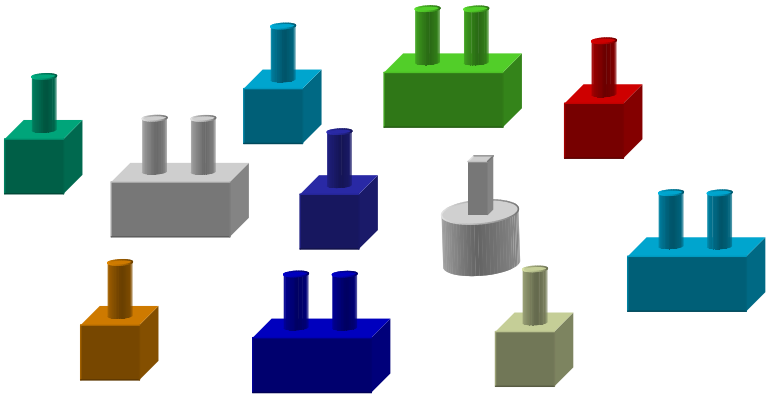
- Adopt commercial standards and practices for learning content organization, description, communication and delivery formats
- Leverage the current commercial trend towards Web-like architectures, and corresponding developments in technologies and infrastructure

A number of organizations have been working on different but highly related aspects of web-based learning technology. These work areas have coalesced into three major topics: metadata, run time environment, and course interchange. While these evolving areas have made great strides recently, they have not been "connected" to one another in a meaningful way. In some cases emerging specifications are quite general, anticipating a wide variety of implementations by various user communities (e.g., metadata), in others the specifications are rooted in earlier Computer Managed Instruction (CMI) practices and require adaptation to web-based applications.

Note that the SCORM does not specify a format for the content itself. This type of format is entirely different from the formats used to describe, organize, communicate with and deliver content.

Sharable Content Object (SCO) Model

For reuse of component pieces to be possible, they must be built to a common "object" model



The previous version of SCORM used the term "Assignable Unit" or AU to refer to a piece of learning content. Due to much confusion over the definition of an AU, this version has adopted the term "Sharable Content Object" or SCO instead. The following passage from the SCORM 1.1 gives a more comprehensive discussion of the rationale behind this change:

The term "Assignable Unit" has its roots in the AICC CMI guidelines, especially related to representing course structure. This derives from AICC practice. Within the SCORM, an AICC AU is equivalent to a SCO, but the definition of a SCO has been narrowed further than the AICC's AU definition as defined below.

AICC defines an AU to be both:

- *The smallest unit the CMI [LMS] system assigns and tracks; and*
- *A program or lesson launched by the CMI [LMS] system.*

There are three concepts embedded here: First, an AU is small and stand-alone. Second, an LMS launches an AU on the client-side. Finally, the LMS tracks users' progress through the AU, to include logging lesson completion status and performance evaluation results, when appropriate.

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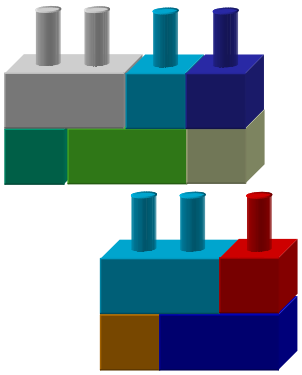
Sharable Content Object (SCO) Model

Components that share a common model can be reassembled and reused



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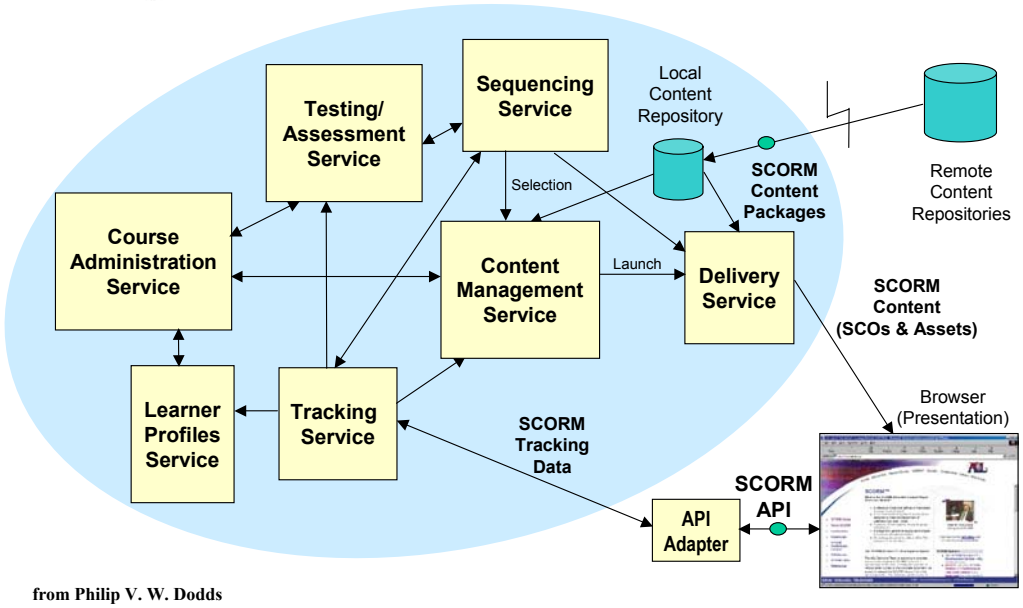
The notion of "smallness" is subjective. A more useful way to look at an AU (or SCO in the SCORM) is that it has (by definition) no separate child content components that can be tracked by an LMS at run-time. An AU/SCO could in fact be a very large executable program, or it could be an HTML file with nothing more than, say, a single letter of displayable text. Provided both examples utilize the Run-time Environment API correctly, either could be launched and tracked by an LMS.

From this release forward, ADL is defining SCORM-conformant learning content objects as "Sharable Content Objects" (SCOs). Wherever possible, this term will replace other terms that also have come to mean "content". In particular, the use of "Assignable Unit (AU)" is phased out and replaced with "Sharable Content Object (SCO)." This is in response to continuing confusion about terminology.

Learning Management System Model



from Philip V. W. Dodds

In 1998, after meeting with many leading edge vendors, ADL developed the first picture of a Learning Management System. This was the start of the Sharable Content Object Reference Model (SCORM).

Learning Management System (LMS) - a suite of functionalities designed to deliver, track, report on, and administer learning content, student progress, and student interactions. The term LMS can apply to very simple course management systems or highly complex, enterprise-wide distributed environments.

These commercially developed products are expected to include features to support intelligent tutoring and adaptive learning in the future.

Why do we need SCORM?

Before SCORM, we could not…

- Move a course from one web-based Learning Management System (LMS) to another
- Reuse content across different LMS systems
- Create searchable content or media repositories across different LMS environments

These are key enabling capabilities…

The ADL SCORM is a first step toward a larger vision

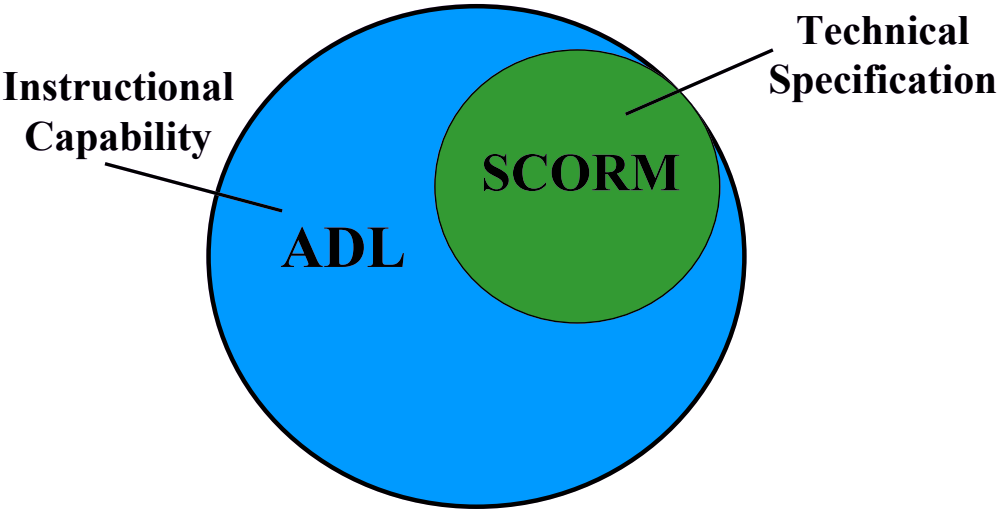
Learning Management System (LMS) - a suite of functionalities designed to deliver, track, report on, and administer learning content, student progress, and student interactions. The term LMS can apply to very simple course management systems or highly complex, enterprise-wide distributed environments.

What We Get With SCORM

- Small, reusable, sharable course content
- Discoverable and interoperable learning content repositories
- Ability to find and move entire courses
- Vendor support for COTs products that support SCORM
- Technical bedrock for development of adaptive learning systems, that can assemble content to meet the learner's needs on the fly

The ultimate goal is a learning system that can adapt to the learner. These systems would be able to intelligently assemble courseware based on the learners preferences and current needs.

How the SCORM Fits In

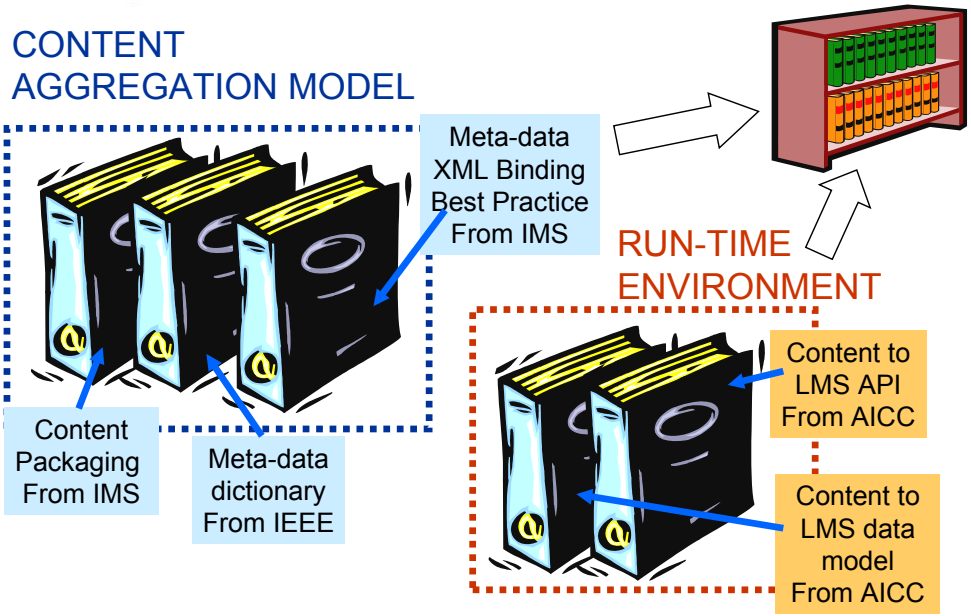


SCORM is necessary, but not sufficient.

The SCORM is an essential, enabling part of the ADL initiative. We cannot achieve ADL objectives without it. However:

- It is only part of the picture;
- It is a technical specification, for meeting technical objectives;
- The ADL goals address instructional and decision aiding capabilities – they are functional capabilities not tied to any specific technical approach. If another technical approach were capable of achieving these functional goals, we would try it.

Where we are now…SCORM 1.2



The Sharable Content Object Reference Model (SCORM) is a collection of specifications developed in a number of organizations.

SCORM can be viewed as a bookshelf containing technical specification "books" from many different sources. SCORM is organized into two sections at present: Content Aggregation Model and Run-Time Environment.

The Content Aggregation Model describes how content is described (meta-data), combined to make teaching units, courses or curricula, and how content is packaged for movement across different systems.

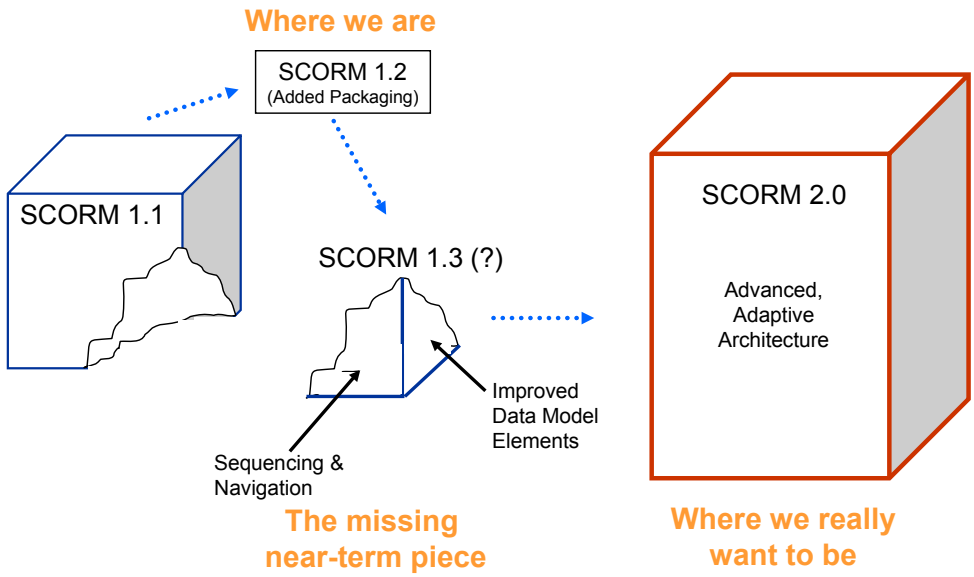
Run-Time Environment defines the technical methods for launching and tracking content between a server-side Learning Management System and a client-side learner.

SCORM 1.3, 2.0 and beyond

New volumes to be added to the shelf:

- Advanced Sequencing & Navigation (IMS & ADL)
- New Data Models (IMS & ADL)
- Repositories (content libraries)
- Simulation Objects (ADL)

The Missing SCORM piece



Emerging Issues

- Metadata Implementations
  - Does metadata need to be more community-specific?
- Repository Specifications
  - How do we connect content repositories?
- eLearning Pedagogy
  - What approaches to learning are best for the Web?
- Intelligent Content
  - How should content adapt to the learner?
- Data Model Adequacy
  - What kinds of student tracking and interactions are needed?

SCORM Primary Components

- Metadata
  - Course
  - Content
  - Raw Media
- Content Packaging
- Runtime Environment
  - Launch Mechanism
  - Application Program Interface (API)
  - Data Model

Metadata

Definition

A common description of courseware objects for purposes of being searched, found and ultimately used in unique ways.

Base Specifications

IMS Learning Resource Meta-data Specification Version 1.2
IEEE Learning Objects Metadata (LOM) Specification Draft 6.1

SCORM Adaptation

Applying the above standard to describe three categories of learning objects: content aggregations, SCOs and raw assets

Enabling Technologies

XML
XML Schema

Metadata - structured data about data. *(Webopedia - www.Webopedia.com)* An example of metadata is the kind of information you might find in the Properties dialog box (under File) in Microsoft Office products. In fact, a company called MindLever.com has developed a tool to create IMS-compliant metadata for Microsoft Office files.

Document Type Definition (DTD) – A Document Type Definition is a file (or several files to be used together) written in XML which contains a formal description of a particular type of XML document. It describes what names can be used for element types, where they may occur, and how they all fit together.

IMS Global Learning Consortium, Inc. (IMS) - an organization of companies concerned with standards for learning servers, learning content and the enterprise integration of these capabilities. (www.imsproject.org/index.html)

Institute of Electrical and Electronics Engineers, Inc. (IEEE) - an international membership organization serving today's industries with a complete portfolio of standards programs. (IEEE is a lot of other things, too; but this definition suffices for this discussion.) The IEEE Learning Technology Standards Committee (LTSC) is responsible for the Standard for Learning Object Metadata. (http://ltsc.ieee.org/)

Metadata Element Categories

General	describes the resource as a whole
Lifecycle	history and current state of the resource
Meta-metadata	information about the metadata record itself
Technical	technical requirements and characteristics
Educational	educational and pedagogic characteristics
Rights	intellectual property rights and conditions of use for the resource
Relation	relationship between the resource and others
Annotation	comments on educational use of the resource and on when and whom made them
Classification	labels the resource in a classification system

The ADL Co-Lab has developed a web-based tool (available from www.ADLnet.org) that generates XML metadata files by filing in boxes in an HTML form.

Metadata XML Example

```
<?xml version = "1.0"?>
<!DOCTYPE record SYSTEM "IMS_METADATAv1p1.dtd">
<record xmlns = "http://www.imsproject.org/metadata/">
  <metametadata>
    <metadatascheme>ADL SCORM 1.1</metadatascheme>
  </metametadata>
  <general>
  <title>
    <langstring>Navigation Lights while Run Aground</langstring>
  </title>
  <catalogentry>
    <catalogue>ADL Sample Courses Catalog</catalogue>
    <entry>
      <langstring>aground.jpg</langstring>
    </entry>
  </catalogentry>
  <language>en</language>
        •
        •
        •
```


Note that SCORM does not specify that the content itself must be in XML (although there may be advantages to doing this in the future).

Content Packaging

Definition

A description of a learning content collection's organization and its resources for the purpose of moving it between environments.

Base Specification

IMS Content Packaging Specification Version 1.1.2

SCORM Adaptation

- Extends organization section with SCORM 1.1 CSF
- Guidance for packaging assets, SCOs and content aggregations

Enabling Technology

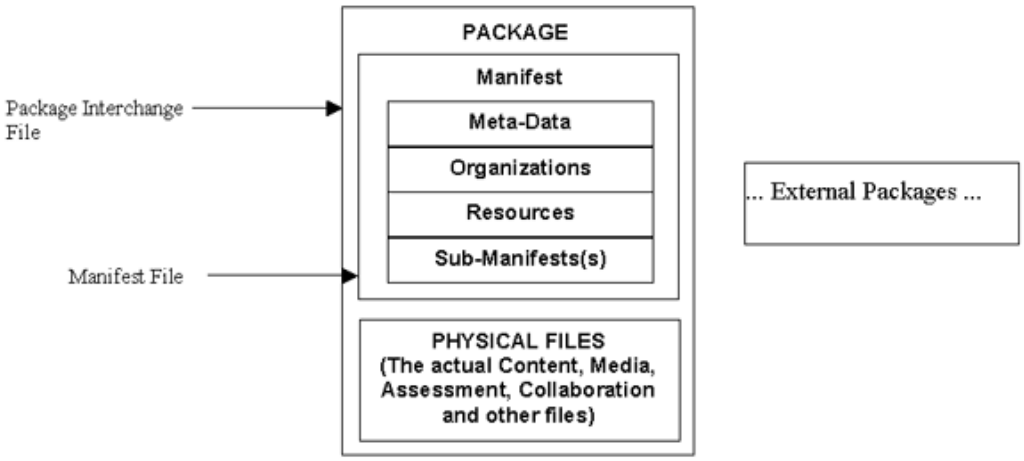
XML
XML Schema

Content Structure Format (CSF) - A representation of the hierarchical organization of the constituent elements of a course for the purpose of moving it between LMSs. This specification was incorporated into the Content Packaging specification in SCORM 1.2.

Extensible Markup Language (XML) - the universal format for structured documents and data on the Web developed by the World Wide Web Consortium (W3C). XML is a set of rules for designing text formats for data in a way that produces files that are easy to generate and read (by a computer), that are unambiguous, and that avoid common pitfalls, such as lack of extensibility, lack of support for internationalization/localization, and platform-dependency. (www.w3.org/XML/)

IMS Global Learning Consortium, Inc. (IMS) - an organization of companies concerned with standards for learning servers, learning content and the enterprise integration of these capabilities. (www.imsproject.org/index.html)

Content Packaging Conceptual Model



The IMS Content Packaging Information Model describes data structures that are used to provide interoperability of Internet based content with content creation tools, learning management systems, and run time environments.

The objective of the IMS Content Packaging Information Model is to define a standardized set of structures that can be used to exchange content. These structures provide the basis for standardized data bindings that allow software developers and implementers to create instructional materials that interoperate across authoring tools, learning management systems and run time environments that have been developed independently by various software developers. IMS describes this model using XML.

The XML binding allows for extensibility which means it is possible to define the SCORM CSF as the organization scheme in the manifest. (See the draft of version 1.1 of the specification for an example of this at www.IMSproject.org.)

Package - a standalone usable piece of content or collection of content.

Package Interchange File - a single file containing the package (in formats such as .zip, .jar and .tar). Placing the package in a single file this way is not required by the specification.

Meta-data - describes the manifest file.

Organizations - can accommodate multiple ways to organize the content inside the package.

Runtime Environment

Definition

A common approach for initiating SCOs, and the means to talk with the LMS through functions, protocol, and a defined set of data.

Base Specification

AICC CMI CMI001 Guidelines for Interoperability Version 3.4

SCORM Adaptation

Web-based implementation

Enabling Technologies

Document Object Model (DOM) JavaScript (ECMAScript)
Hypertext Transfer Protocol (HTTP)

client-server architecture - a computing environment where the user interface runs on one system, the client, and the information of interest is stored on another, the server. The actual application logic can run on either the client or the server. The Internet is one such environment where a user's interface is commonly a PC running browser software.

scripting language - a simple computing language specifically designed to interact with a computing environment and other software programs within that environment for purposes of initializing the same or orchestrating higher level tasks.

JavaScript - a cross-platform scripting language for client and server applications developed by Netscape Communications Corporation. JavaScript has become intimately tied to the World Wide Web. (http://developer.netscape.com/docs/manuals/communicator/jsref/index.htm)

ECMAScript - the European Computer Manufacturer's Association (ECMA) standard scripting language (ECMA-262) based on the JavaScript scripting language. A copy of the ECMA specification can be obtained at http://developer.netscape.com/docs/javascript/e262-pdf.pdf.

Document Object Model (DOM) – The Document Object Model is a platform- and language-neutral interface that will allow programs and scripts to dynamically access and update the content, structure and style of web documents. The document can be further processed and the results of that processing can be incorporated back into the presented page (like that fancy animation on the home page of your favorite web site).

Runtime Environment: Launch Mechanism

Purpose: Defines a common means for LMSs to initiate content execution, and content to establish communications with the initiating LMS.

- The launch scheme is implemented in JavaScript which makes the API available to the SCO through the DOM object
- Only an LMS may launch content

Analogy: Driving all cars begins with you inserting a key in ignition switch and turning it clockwise. This is the "launch mechanism" for a car.

Runtime Environment: Application Program Interface (API)

Purpose: Defines a common means for content to communicate with LMSs.

- Relieves content developers from being concerned with the details of communicating with LMSs
- The *initialize* and *finish* functions are the only required parts of the API
- Currently no way for LMSs to talk to SCOs

Analogy: You need not know how engines work to drive a car -- just how to work the steering wheel, gas pedal, etc. This is the "API" for a car.

Application Programming Interface (API) - a set of routines, protocols, and tools for building software applications. A good API makes it easier to develop a program by providing all the building blocks. A programmer puts the blocks together. Most operating environments, such as MS-Windows, provide an API so that programmers can write applications consistent with the operating environment. Although APIs are designed for programmers, they are ultimately good for users because they guarantee that all programs using a common API will have similar interfaces. *(Webopedia - www.Webopedia.com)*

Note that in the context of the SCORM, the operating environment is a learning management system (LMS).

SCORM API Functions

LMSInitialize	Initialize
LMSFinish	Finish
LMSGetValue	Get a value
LMSSetValue	Set a value
LMSCommit	Send cache to LMS
LMSGetLastError	Determine error code
LMSGetErrorString	Obtain text related to error
LMSGetDiagnostic	Determine vendor-specific diagnostics

SCO to LMS Communication API

LMSInitialize initialize (SCO required)

LMSFinish finish (SCO required)

LMSGetValue get a data model value from the LMS

LMSSetValue send a data model value to the LMS

LMSCommit write cached values (previously sent) to the LMS

LMSGetLastError get the return code for the last API call

LMSGetErrorString get text description of the return code for the last API call

LMSGetDiagnostic get more vendor-specific information on the return code for the last API call

Runtime Environment: Data Model

Purpose: Establishes a defined set of information (made up of elements) about SCOs, the student and the runtime session that can be tracked by LMSs.

- All element implementation is optional for SCOs
- Some elements are mandatory for LMSs
- API allows for exchange of elements between SCOs and LMSs through "Get" and "Set" calls

Analogy: Your car has a dashboard with gauges that convey information about the state of your car. These are elements in the "data model" for a car.

All data models are optional for content executing on the client platform, or assignable units (AU). LMS's are obligated to support some mandatory elements in the LMS-to-content and Content-to-LMS data models. All Student data collection data model elements are optional for LMS's as well as content AU's. The data models are the same as those in the AICC/CMI Guidelines for Interoperability V3.4 document. See the SCORM standard for data model details.

Also, SCORM has no impact on LMS-unique and content-unique data models.

Data Model Categories

Core	basic information about the student and lesson
Suspend Data	LMS-stored SCO data from previous runs
Launch Data	information used by the SCO during launch
Comments	Free text feedback and information exchanged between the SCO and the LMS
Objectives	information on SCO objectives
Student Data	SCO customization information based on student performance
Interactions	recognized student inputs to the SCO
Student Preference	SCO options that can be selected by the student

More data models are in the works and may be included or referenced in future versions of SCORM.

Sequencing
(future capability)

Definition

A common way to specify order and delivery of SCOs that may be static or dynamic depending on user interaction and performance.

Base Specification

IMS Content Packaging Specification Version 1.1.2

SCORM Adaptation

- Incorporation is expected in soon-to-be-released SCORM 1.3
- Building an open source sequencing engine

Enabling Technologies

XML
XML Schema

The Sequencing Specification is expected to include the following components:

•Behavior model

•Sequencing Information model

•Tracking Information mode

The Sequencing Specification is designed as an extension to the IMS Content Packaging Specification.

(www.adlnet.org/library/documents/plugfest/plugfest5/Plugfest5_sequencing.ppt)

Extensible Markup Language (XML) - the universal format for structured documents and data on the Web developed by the World Wide Web Consortium (W3C). XML is a set of rules for designing text formats for data in a way that produces files that are easy to generate and read (by a computer), that are unambiguous, and that avoid common pitfalls, such as lack of extensibility, lack of support for internationalization/localization, and platform-dependency. (www.w3.org/XML/)

IMS Global Learning Consortium, Inc. (IMS) - an organization of companies concerned with standards for learning servers, learning content and the enterprise integration of these capabilities. (www.imsproject.org/index.html)

To Probe Further ...

- Visit these web sites:
  - www.ADLnet.org
  - www.AcademicCoLab.org
  - www.AICC.org
  - www.IMSproject.org
  - ltsc.IEEE.org
- "Collaborate" link on ADLNet.org
- Read the PowerPoint Notes Pages from this presentation for definitions and additional references.

The "Collaborate" link on www.ADLNet.org is a Bulletin Board system containing "discussion rooms" with different topics concerning SCORM and the ADL Initiative. At this writing, there are three discussion rooms:

•Implementing SCORM

•SCORM Content Developers Forum

•Preserving Instructional Integrity

Users can post and respond to questions on different topics under these headings. The rooms are also monitored by subject matter experts in the ADL Co-Lab. The reader is encouraged to use this resource as a first option to answer SCORM and ADL questions that can't be found elsewhere on the site.

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I would like to thank the above individuals and others at the ADL Co-Lab for a lot of the material in these slides, and for my understanding of ADL concepts and goals including the SCORM and the underlying specifications.

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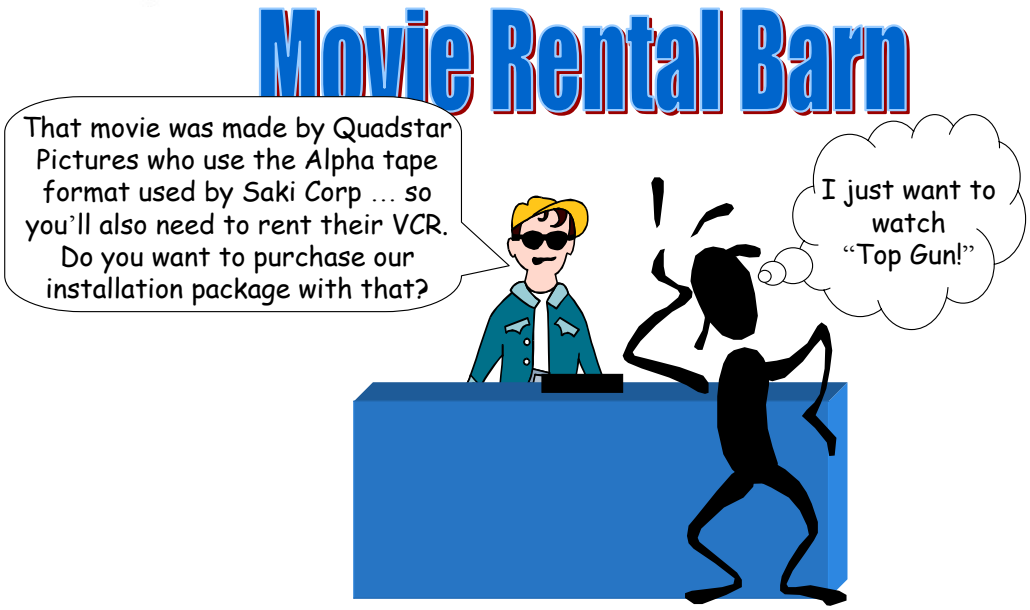
BACK-UP SLIDES

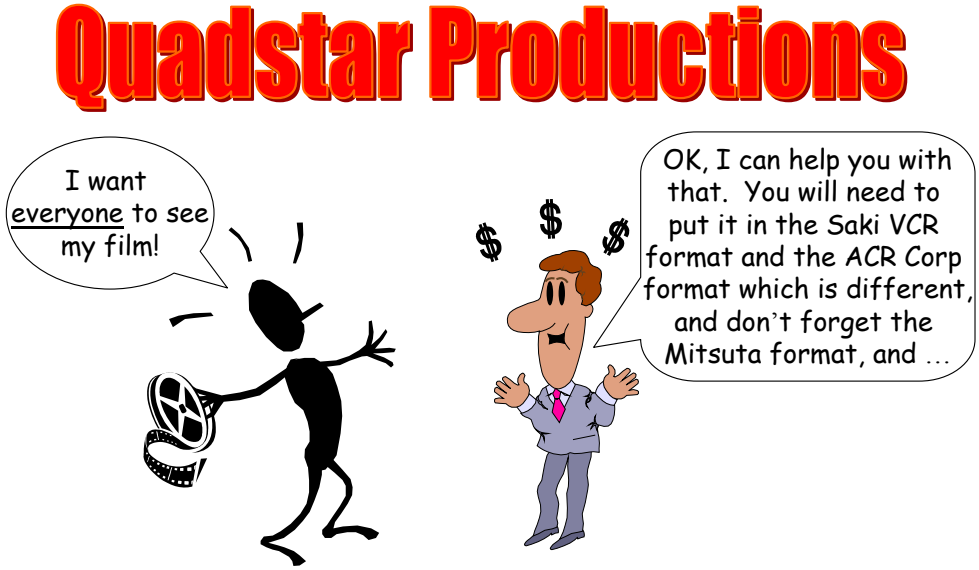
Standards are Good for Users



Today, we can get just about any movie made, and be confident that it will play on a VHS VCR that you choose and buy from a couple dozen manufacturers. Imagine a world where every VCR manufacturer used a different video tape format. Movie producers would have to be aware of all of these formats and decide which ones they want to support. They would probably initially only support a limited number of formats; thus, providing consumers with limited choice in either movies or VCR brands. The producers may eventually support multiple brands, but at added expense that would most likely be passed on to the consumer.

A similar situation exists today with the satellite television distribution market. One must buy a receiver and dish antenna for the specific service to which they wish to subscribe. If you want to change to a different provider service, then you have to buy that provider's receiver and antenna. Wouldn't it be nice if there was a common standard for receiving and decoding satellite television signals so that changing service providers was as simple as aiming your antenna at a different satellite?

Standards are Good for Content Developers



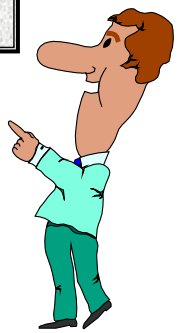
Movie producers want to be able to get their product to as wide an audience as possible. After the initial showing of a movie in the theaters, the next logical step is to put it in VHS video tape format for sale and rental. (There are other video tape formats used in foreign markets, but lets assume only the US market is available for the sake of the argument.) Adoption of a single video format means that a producer can assume an entire "infrastructure" to record, mass produce, distribute, market and eventually play a movie in the home of a consumer. The single format spawns niche markets specializing in certain aspects of the bigger video tape market. There were no local video stores 30 years ago!

The same argument could be made for the Internet which has been around since the early 1970's. Wide spread use of the Internet is largely attributed to the establishment of the World Wide Web which defines standards for formatting, transmitting and locating documents on the Internet. These standards are now maintained and evolved by the World Wide Web Consortium. Now many businesses exist whose sole purpose is to build web sites. There are even software tools available for someone to build their own web site. No one company controls access to the Web, what gets put on there, or how web sites are designed and developed. Competition in these areas gives consumers and information providers choices, and keeps costs down.

Standards are Good for Prospective System Developers

VCR Project Issues

- Saki dominates the market
- Saki tape format is proprietary
- Saki format is de facto standard
- Saki tools are industry standard



Open industry standards make it easy for innovative companies and individuals to enter the market; thus, we currently have many choices among VCR's, tapes and movie rental services. Proprietary standards can come into being through wide-spread adoption and market forces. These standards are known as "de facto" standards. If the company that defines the standard chooses not to make it open to all, then that company can monopolize a certain market. A company or individual who wishes to enter this market must compete in many areas to counter the clout the monopoly has. If a competing product does emerge, consumers are often reluctant to switch because of the investment they might have in the de facto standard products (VCR, tapes and movies in this example).

Perhaps the most obvious example of this situation today is in the personal computer software industry as evidenced by the guilty verdict against Microsoft Corp. in the recent Justice Department antitrust case. The court findings resulted from allegations that Microsoft attempted to use its market monopoly through its Windows software - used in more than 80% of all personal computers - to try to dominate the Internet browser market. This is but one example of how the company has been accused of monopolizing the entire PC software industry through their market clout. Microsoft sells not only the Windows operating system software, but also applications and content for most all popular PC uses. Competing operating systems must also address these areas since this software will most likely not run in their environment. *(reference CNN - www.CNN.com)*

Standards Make Things Work

- Railroad tracks
- Lightbulbs
- Power outlets
- Beer bottle caps
- Phone lines
- The Internet

Standards for interchangeable parts and data…

from Philip V. W. Dodds

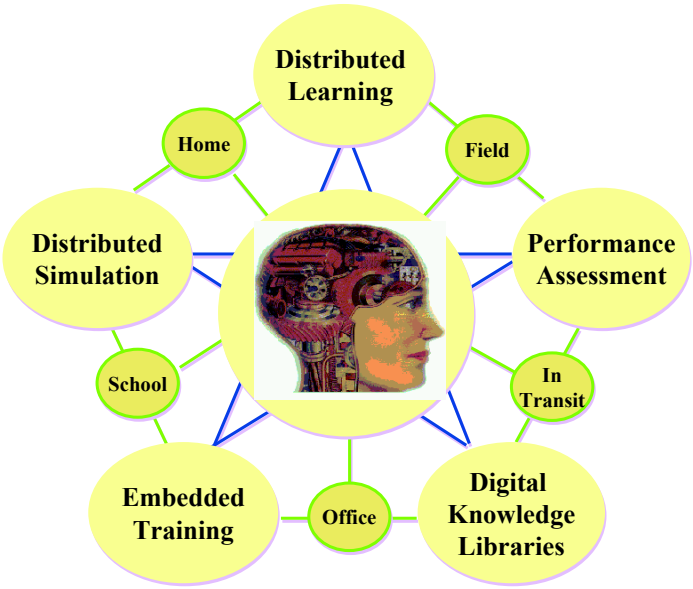
…we take them for granted

Standards Changed History

Harpers Ferry Arsenal made high quality, rifled muskets and engaged in what we now call research and development. The location of the arsenal eventually attracted other industrial development. Perhaps the most significant from a technological point of view was the Hall Rifle Works. Created by John R. Hall, this plant used the **concept of interchangeable parts** to produce breech-loading rifles. This industrial development spurred more commercial and retail development.

from Philip V. W. Dodds

The ADL Promise



Content Structure Format (CSF)

Definition

A representation of the hierarchical organization of the constituent elements of a course for the purpose of moving it between LMSs.

Base Standard

AICC/CMI Guidelines for Interoperability V3.4

SCORM Adaptation

- XML implementation
- Extended for web-based content

Enabling Technology

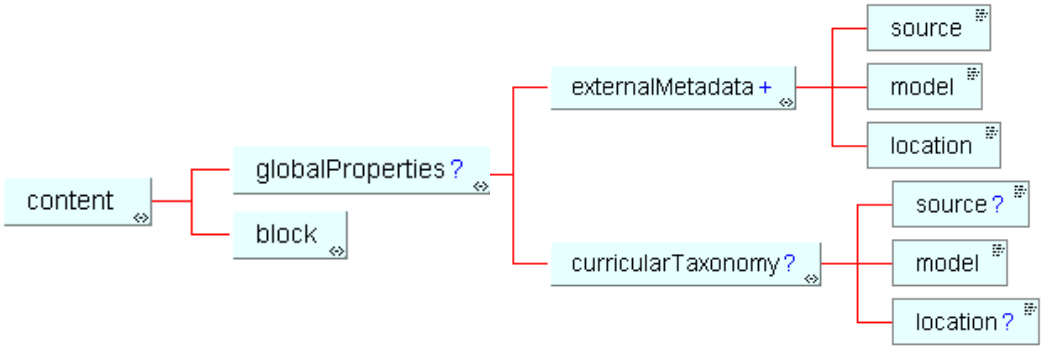
XML

Analogy for the Content Structure Format (CSF) - Imagine a book with all of the chapters ripped out and separated. (To make a better analogy, also imagine there are no page or chapter numbers.) The table of contents would tell you how to reassemble the book so that the chapters are in the order intended by the author. The table of contents is essentially the "CSF" for a book.

Extensible Markup Language (XML) - the universal format for structured documents and data on the Web developed by the World Wide Web Consortium (W3C). XML is a set of rules for designing text formats for data in a way that produces files that are easy to generate and read (by a computer), that are unambiguous, and that avoid common pitfalls, such as lack of extensibility, lack of support for internationalization/localization, and platform-dependency. (www.w3.org/XML/)

Aviation Industry CBT (Computer-Based Training) Committee (AICC) - an international association of technology-based training professionals. The AICC develops guidelines for aviation industry in the development, delivery, and evaluation of CBT and related training technologies. (www.aicc.org)

Top-level CSF Structure



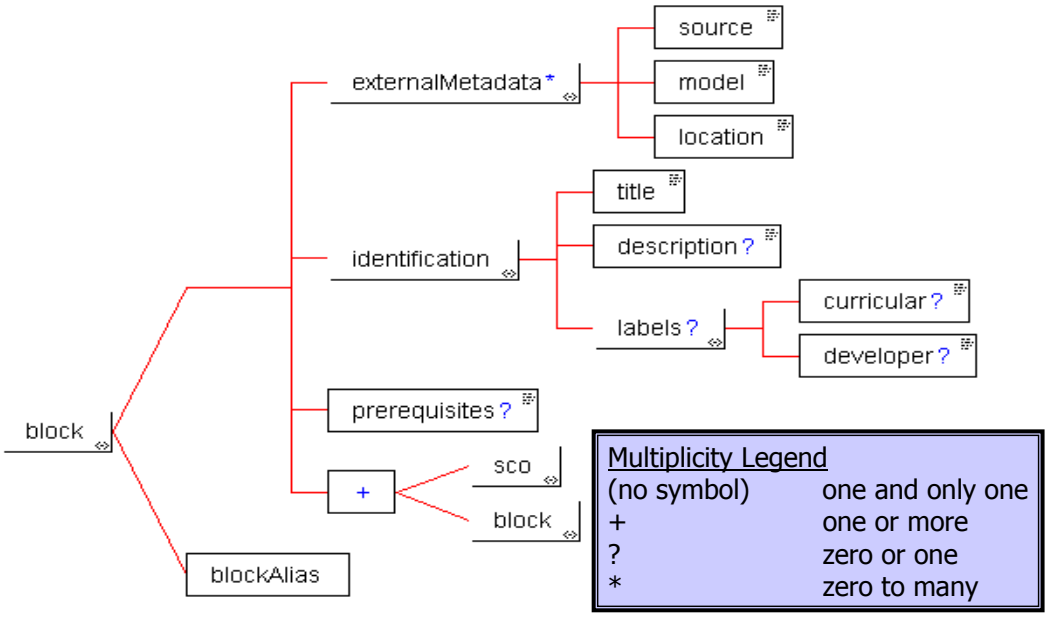
Multiplicity Legend	
(no symbol)	one and only one
+	one or more
?	zero or one
*	zero to many

This and the next two slides are graphical representations of the XML file that describes a CSF.

externalMetadata - describes the whole course or piece of content.

curricularTaxonomy - structure and naming convention used for the content based on the user community, because one group's "lesson" might be another's "module".

CSF Block Structure

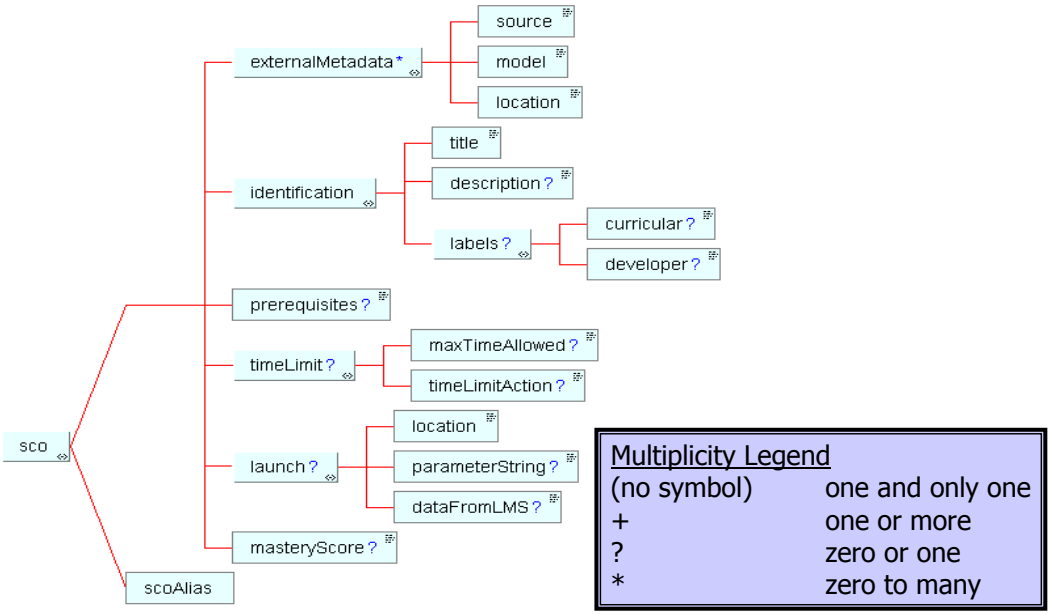


- Multiple Sharable Content Objects (SCOs) or blocks can be contained in a block (in any combination).
- A SCO is the smallest unit of learning content addressed/launched by an LMS.

<u>blockAlias</u> - pointer to a previously defined block. Used instead of a block definition.

Prerequisites are expressed algorithmically.

CSF SCO Structure

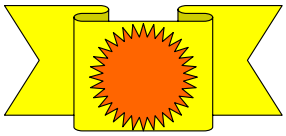


dataFromLMS - initialization data from the LMS.

masteryScore - passing grade for the SCO.

SCORM Accreditation and Certification

- ADL Initiative is establishing process for certifying content, courses and LMSs as "SCORM compliant"
- Other organizations may become testing labs if they wish; ADL will train and accredit them.



Means to test products and learning content for conformance to SCORM referenced specifications is necessary to be sure products will in fact interoperate.

ADL created conformance test software to assure accessibility, interoperability, adaptability, reusability, and durability.

An accreditation process is being established to establish testing facilities around the world. This process is open to all.

(Modeled after ISO QMS/EMS RAB process)

Note that SCORM conformance test software is currently available for download from www.ADLnet.org. This software allows one to do self-test of SCORM courses, content and LMSs.