“Prediction is very difficult, especially about the future”
- Niels Bohr (1885 - 1962)

The Future of Standards

Robby Robson,
Chair, IEEE Learning Technology Standards Committee

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Outline

1. Standards and standardization
2. A perspective on standards for learning technology
3. Changes that affect our work
4. What might happen next
Standards Can ...

1. Specify the form and function of technology
2. Determine how information is exchanged
3. Require procedures to be followed
4. Define acceptable outcomes
Standards Can…

1. Specify the form and function of technology
2. Determine how information is exchanged
3. Require procedures to be followed
4. Define acceptable outcomes

Learning technology standards define technological infrastructure
Effective Standards Operate Invisibly

This ....

This is how to write a Web page ...

Screenshot from Dreamweaver™ 8 Design View
Effective Standards Operate Invisibly

And not necessarily this ....
Good standards are enablers

- Make it possible to build better products
- Provide a basis for new solutions
- Do not define what products or applications should be built

- Good standards are about being **good enough**, not being perfect!
Standards do not cure all ills

• Applying standards requires communication, agreements and understanding

• Technical standards do not solve non-technical problems

“First learn the meaning of what you say, and then speak.”
- Epictetus (55 - 135)

“The most important thing in communication is to hear what isn't being said.”
- Peter Drucker (1909 - 2005)
ISO (and hence IEEE) principles

- OPENNESS
- CONSENSUS
- BALANCE
- DUE PROCESS
- RIGHT TO APPEAL

- These apply to *accredited* standards development organizations
- These *may not* apply to other standards development organizations
Nothing is a standard until it is acknowledged and adopted by the community it serves.
Why Bother With Standards?

- Standards define and catalyze new technology
- Standards enable new solutions
- Standards solve existing problems
Why Bother With Standards?

- Standards prevent lock-in
- Standards accelerate commoditization
- Standards increase reliability
- Standards enable competition

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Why Bother With Standards?

- Standards can lower design, development and production costs
- Standards help modularize supply chains
- Standards build consumer confidence
- Standardization distributes effort
Who participates

- Researchers
- Academics
- Corporate strategists
### Who participates

<table>
<thead>
<tr>
<th>INNOVATION</th>
<th>HELP THE CONSUMER</th>
<th>BUILD MARKETS</th>
</tr>
</thead>
</table>

- Government Agencies
- Consumer Groups
- Companies looking for specific competitive advantages
Who participates

- Commercial enterprises
- Industry groups
When Does Standardization Occur?

**INOVATION**

**HELP THE CONSUMER**

**BUILD MARKETS**

Market moves from *underserved* to *overserved* *


Need arises in an influential community

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What Issues are affecting the Future of Standards?

- Patents – BIG PROBLEM
- Information and communication technology has unique characteristics
  - Semantics are important
  - Parts of standards must be openly available
  - The need for Interoperability among systems is being replaced by the need for interoperability among standards!

“Every kind of peaceful cooperation among men is primarily based on mutual trust and only secondarily on institutions such as courts of justice and police.”

Albert Einstein (1879 - 1955)
What has happened to standards in learning technology?

"Study the past if you would define the future.”
- Confucius (551 - 479 BCE)

“
To make no mistakes is not in the power of man; but from their errors and mistakes the wise and good learn wisdom for the future.”
- Plutarch (46 – 120)
Lots of organizations formed

1994: SISO, AICC, EdNA
1995: DLF
1996: IEEE LTSC, SIF, SIF EdNA
1998: CEN/ISSS WS-LT, JTC1 SC36
1999: OKI, MERLOT, ALIC
2000: EICA, CanCore, HR-XML CONSORTIUM
2001: ebXML

But few since 2001

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Goals and drivers evolved

Research Driven

- GOAL: Standardize all of learning technology
- Characterized by
  - Many activities
  - Little implementation
  - Proliferation of organizations

Consumer Driven

- GOAL: Learning content interoperability
- Characterized by
  - Government involvement
  - Focus on “learning management systems”
  - Adoption & Implementation

Working theories were replaced

Working and Study Groups

- General
  - P1484.1 Architecture and Reference Model WG
  - P1484.3 Glossary WG
- Learner-Related
  - P1484.2 Learner Model WG
  - P1484.4 Task Model WG
  - P1484.13 Student Identifiers WG
  - P1484.5 User Interfaces (Study Group)
  - P1484.19 Quality System for Technology-Based Life-Long Learning (Study Group)
  - P1484.20 Competency Definitions (Study Group)
- Content-Related
  - P1484.10 CBT Interchange Language WG
  - P1484.6 Course Sequencing WG
  - P1484.17 Content Packaging WG
- Data and Metadata
  - P1484.12 Learning Objects Metadata WG
  - P1484.9 Localization (Study Group)
  - P1484.14 Semantics and Exchange Bindings WG
  - P1484.15 Data Interchange Protocols WG
  - P1484.16 HTTP Bindings WG
- Management Systems and Applications
  - P1484.11 Computer Managed Instruction WG
  - P1484.18 Platform and Media Profiles WG
  - P1484.7 Tool/Agent Communication WG
  - P1484.8 Enterprise Interfaces (Study Group)
By Accredited Standards

Search Results: 1484

   Format:PDF Copyright:2005
   » more about this product
   Add to Shopping Cart

   Format:PDF Copyright:2004
   » more about this product
   Add to Shopping Cart

   Format:PDF Copyright:2002
   » more about this product
   Add to Shopping Cart

   Format:PDF Copyright:2005
   » more about this product

   Format:PDF Copyright:2003
   » more about this product
   Add to Shopping Cart

25-01-06 The Future of Standards: International Plugfest II

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In specification consortia

IMS Global Learning Consortium, Inc.

Specifications
- Meta-Data
- Enterprise
- Content Packaging
- Question & Test

XML, Bindings and Examples
Toolkits
Requirements

Home

Specifications

Specifications are the core deliverable of IMS. Draft specification documents are listed here and will be linked for public access once approved by the IMS Technical Board. Draft specifications are in the process of final refinements and/or interoperability trials.

<table>
<thead>
<tr>
<th>Date</th>
<th>Document</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-Feb-25</td>
<td>IMS Content Packaging Specification</td>
<td>Version 0.1 Public Draft</td>
</tr>
<tr>
<td>2000-Jan-12</td>
<td>IMS Enterprise Specification</td>
<td>Version 1.01 Public Release</td>
</tr>
</tbody>
</table>

Download Specifications

You may download zip files containing pdf versions of specifications. The zip files contain the Best Practices, Information Model, and Binding documents.

Download Specifications

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Specs were released and horizons broadened.
By 2005 We Had A Portfolio

• Driven by
  – Young companies* and a few key consumer groups (Aviation, Defense, Higher Education)

• Focused on
  – Content Interoperability and Learning Delivery Systems

*including new divisions within large software vendors
## Metadata

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Search / Discovery / Cataloging / Processing</td>
<td>• Learning Object Metadata*</td>
</tr>
<tr>
<td></td>
<td>• Dublin Core Metadata (DC-ED)</td>
</tr>
</tbody>
</table>

* Part of SCORM 2004
## Learning Content Formats

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Specs &amp; Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organize &amp; Transport Learning Content &amp; “Learning Objects”</td>
<td>• IMS Content Packaging*&lt;br&gt;• AICC Course Structure Format</td>
</tr>
<tr>
<td>Store &amp; Exchange Online Quiz Questions</td>
<td>• IMS Question &amp; Test Interoperability</td>
</tr>
</tbody>
</table>

* Part of SCORM 2004
### Data Exchange

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Specs &amp; Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communicate data between content &amp; delivery platform</td>
<td>• HTTP AICC Communication Protocol</td>
</tr>
<tr>
<td></td>
<td>• IEEE Runtime Communication (JavaScript API)*</td>
</tr>
<tr>
<td>Define and Encode data to be exchanged</td>
<td>• AICC CMI Data Model (adopted by IEEE)*</td>
</tr>
<tr>
<td>Exchange Enrollment Data</td>
<td>• IMS Enterprise</td>
</tr>
</tbody>
</table>

* Part of SCORM 2004
# Learner Records

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Specs &amp; Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exchange Learner Information</td>
<td>• IMS Learner Information Package</td>
</tr>
<tr>
<td>Record status of learning objectives</td>
<td>• AICC CMI Data Model (adopted by IEEE)*</td>
</tr>
<tr>
<td></td>
<td>• Parts of IMS Simple Sequencing*</td>
</tr>
</tbody>
</table>

* Part of SCORM 2004

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### Purpose

<table>
<thead>
<tr>
<th>Telling a Management System what to deliver next</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher level organization of Learning Activities</td>
</tr>
</tbody>
</table>

### Specs & Standards

- AICC CMI specifications
- IMS Simple Sequencing*
- IMS Learning Design

* Part of SCORM 2004
## And Widespread, Increasing Adoption
(Compiled in 2004)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
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<td>56</td>
<td>29</td>
<td>23</td>
<td>43</td>
<td>23</td>
<td></td>
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<tr>
<td>AICC Support</td>
<td>41%</td>
<td>52%</td>
<td>83%</td>
<td>87%</td>
<td>65%</td>
<td>26%</td>
<td></td>
</tr>
<tr>
<td>Certified</td>
<td>*</td>
<td>*</td>
<td>7%</td>
<td>13%</td>
<td>9%</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Compliant</td>
<td>*</td>
<td>*</td>
<td>76%</td>
<td>74%</td>
<td>56%</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Support Planned</td>
<td>*</td>
<td>23%</td>
<td>*</td>
<td>4%</td>
<td>0%</td>
<td>*</td>
<td></td>
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<tr>
<td>* No AICC Exists / Planned</td>
<td>59%</td>
<td>25%</td>
<td>17%</td>
<td>9%</td>
<td>35%</td>
<td>74%</td>
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<tr>
<td>SCORM Support</td>
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<td>17%</td>
<td>83%</td>
<td>87%</td>
<td>72%</td>
<td>43%</td>
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<td>*</td>
<td>83%</td>
<td>63%</td>
<td>39%</td>
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<tr>
<td>Other</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>4%</td>
<td>9%</td>
<td>4%</td>
<td></td>
</tr>
<tr>
<td>Support Planned</td>
<td>*</td>
<td>2%</td>
<td>7%</td>
<td>13%</td>
<td>5%</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>* No SCORM Exists / Planned</td>
<td>100%</td>
<td>80%</td>
<td>10%</td>
<td>0%</td>
<td>23%</td>
<td>52%</td>
<td></td>
</tr>
<tr>
<td>IMS Metadata</td>
<td>*</td>
<td>34%</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>43%</td>
<td></td>
</tr>
<tr>
<td>IMS Metadata Planned</td>
<td>*</td>
<td>25%</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>IMS Content Packaging</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>61%</td>
<td></td>
</tr>
<tr>
<td>IMS QTI</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>22%</td>
<td></td>
</tr>
<tr>
<td>IMS (not specified)</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>9%</td>
<td></td>
</tr>
</tbody>
</table>
But the world of learning systems is changing in some significant ways ...

“Never doubt that a small group of thoughtful, committed citizens can change the world. Indeed, it is the only thing that ever has.”
- Margaret Mead (1901 - 1978)
The Topology is Changing

- Client / Server topologies replaced by massively distributed heterogeneous loosely coupled networks
The Scope is Widening

CORDRA™

Content Object Repository Discovery and Registration/Resolution Architecture (CORDRA) is an open, standards-based model for how to design and implement software systems for the purposes of discovery, sharing and reuse of learning content through the establishment of interoperable federations of learning content repositories.
Services are Ascending

Service Registry

Publish: UDDI

Find: UDDI

Service User

Describe: WSDL

Access: SOAP

Service Provider

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Contexts are Changing

- Learning Management
- Human Capital Development
- Supply Chains
- Customer Relations
- Globalization
- Workflow Learning
- Learning Content Management
- Enterprise Knowledge Management
- Learning Technology
- E-Knowledge Transformation
- Training Transformation
- Learning Architecture
The Industry is Maturing

Field Guide to Learning Management Systems

A 2005 Learning Circuits survey on LMSs asked respondents to identify the biggest challenges to implementing an LMS. Here’s what they had to say:

- Content integration, 42.7%
- Customization, 41.1%
- Employee buy-in, 32.3%
- Integration with legacy systems, 22.6%
- IT buy-in, 17.7%
- Management buy-in, 23.4%
- Standards, 16.1%
- System maintenance and administration, 29.8%
- System performance, 25%
- Supplier management, 18.5%
- Supplier selection, 16.9%

Popular LMS Providers

- Cornerstone OnDemand
  - www.cornerstoneondemand.com
- Convarsys
  - www.convarsys.com
- GeoLearning
  - www.geolearning.com
- IBM
  - www.ibm.com
- Lotus software
- Intellinex
  - www.intellinex.com
- Oracle (e-Learning/PeopleSoft)
  - http://learning.oracle.com
- Pathlore Software
  - www.pathlore.com
- Plateau Systems
  - www.plateau.com
- PLATEAU
- Saba Software/ThingWorx
  - www.saba.com
- SAP
  - www.sap.com/solutions/education-training
- SumTotal Systems
  - www.sumtotalsystems.com
- TEDS
  - www.teds.com/about/purposing.html
- WBT Systems
  - www.wbstystems.com

According to a 2005 Learning Circuits survey on LMSs, direct purchase is still the most popular pricing model.

- Hosted: 11.9%
- Bought: 66.7%
- Built: 14.8%

Source for this slide: ASTD’s Field Guide to Learning Management Systems, Learning Circuits, August 2005

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AND THIS IS TRANSFORMING THE WORLD OF STANDARDS
“It is an error to imagine that evolution signifies a constant tendency to increased perfection. That process undoubtedly involves a constant remodeling of the organism in adaptation to new conditions; but it depends on the nature of those conditions whether the directions of the modifications effected shall be upward or downward.”

- Thomas H. Huxley (1825 - 1895)
### Business Environment: In the 1980’s, applications of computers to learning was a research area.

<table>
<thead>
<tr>
<th>Type of System</th>
<th>Some Top Issues</th>
<th>Enabling Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monolithic (e.g. Plato)</td>
<td>• Programmed Learning</td>
<td>• Standardized language</td>
</tr>
<tr>
<td></td>
<td>• Data reporting</td>
<td>• Standard reports</td>
</tr>
</tbody>
</table>

Monolithic (e.g. Plato)"
### Raising NEW ISSUES and requiring DIFFERENT STANDARDS ENABLERS

<table>
<thead>
<tr>
<th>Type of System</th>
<th>Some Top Issues</th>
<th>Enabling Standards</th>
</tr>
</thead>
</table>
| 1980 Monolithic (e.g. Plato) | • Programmed Learning  
• Data reporting | • Standardized language  
• Standard reports |
| 1995 Client / Server (e.g. institutional LMS) | • Data exchange  
• Separating content & platform | • Communication Protocols  
• Data models |

Business Environment: *In the 1990’s, research projects and startup companies were spawned by new opportunities presented by the Internet*
### Raising NEW ISSUES and requiring DIFFERENT STANDARDS ENABLERS

<table>
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<tr>
<th>Type of System</th>
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<td></td>
<td>• Data reporting</td>
<td>• Standard reports</td>
</tr>
<tr>
<td>1980</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Client / Server (e.g. institutional LMS)</td>
<td>• Data exchange</td>
<td>• Communication Protocols</td>
</tr>
<tr>
<td></td>
<td>• Separating content &amp; platform</td>
<td>• Data models</td>
</tr>
<tr>
<td>1995</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distributed Homogeneous (e.g. Enterprise clusters)</td>
<td>• Information Management</td>
<td>• Identifiers / Metadata / Registries</td>
</tr>
<tr>
<td></td>
<td>• Data Exchange</td>
<td>• Service definitions / data models</td>
</tr>
<tr>
<td>2005</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Business Environment:** *Between 2000 and 2005, learning technology became commoditized. Consumers looked to standards to reduce costs and risk.*
### Raising NEW ISSUES and requiring DIFFERENT STANDARDS ENABLERS

<table>
<thead>
<tr>
<th>Type of System</th>
<th>Some Top Issues</th>
<th>Enabling Standards</th>
</tr>
</thead>
</table>
| Distributed Heterogeneous (“Advanced Distributed Learning”) | • De-centralized learning management  
• Integrating diverse systems and contexts  
• Intellectual property | • Competency standards  
• Content interchange formats  
• Workflow  
• Rights / Access control  
• Context management |

Business Environment: *It appears that learning technology will continue to mature as an industry, expand to include even more interactive environments and become more deeply integrated into enterprise technology.*
In general ...

- Learning technology is less distinguishable from other enterprise infrastructure.
- Learning applications are far more diverse.
- The problem is no longer managing learning.
- The problem is letting learning take place and managing everything around it.
SO ...

WHAT WILL HAPPEN?
“Information is Not data

Too often the words information and data are used interchangeably which leads to confusion. Data is unstructured, lacks context and may not be relevant to the recipient. When data is correctly organized, filtered and presented with context it can become information because it then has ‘value’ to the recipient.”

- Wikipedia on “information”
Work is being done ...

- DC & LOM are being fit into an abstract framework amenable to RDF and subsequent mapping (not cross-walking)
- AMG is being approached by industry and academic projects
- Repositories are being federated
- Query languages are being developed
Content Standards will become Copernican (None will be the center of the universe)

E-Content E-Business E-Knowledge E-Learners

Tech Pubs & Documentation
Content Packaging
Learning Content
Open Office
“Office” Documents
MPEG-21 Digital Item Descriptio n Language
Metadata Encoding & Transmission Standard
Digital Libraries
Help Screens (EPSS)
Multimedia Content
S1000D: Tech Pubs / Common Source Data Base

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Work is being done …

- S1000D – SCORM integration
- HLA – SCORM integration
- Use of MPEG-21 Part II as a universal format (e.g. Los Alamos National Labs)
- Use of Open Document Format as an underlying content model
- Development of a reference model to aid translation among formats (IEEE LTSC project)
We will borrow a LOT from enterprise services

“When I took office, only high energy physicists had ever heard of what is called the Worldwide Web.... Now even my cat has its own page.”
- Bill Clinton (1946 - )
Work is being done...

- Services frameworks have been proposed
- SCORM related services are being created by technology companies
- Data models and APIs are being modularized
- Persistent unique identifiers are being proposed
COMPETENCY MANAGEMENT will rise to the fore

- Relationships Among Competencies
- Competencies
- Definitions of Competencies & Objectives
- Evidence of Competency
- Learning Experiences
- People
- Learner Information

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Work is being done ...

- Models are being developed
- The HR community is getting involved
- Existing standards are being applied
- But it is hard to mix technology, learning theory and business drivers!

“Science is facts; just as houses are made of stones, so is science made of facts; but a pile of stones is not a house and a collection of facts is not necessarily science.”
- Henri Poincare (1854 - 1912)
“Digital Rights Management” is a way to route intellectual property. It does for information and knowledge what switches and TCP/IP do for data.

“It is dangerous to be right in matters on which the established authorities are wrong.”
- Voltaire (1694 - 1778)
Work is being done ... 

- Lots of standards exist
- The problem is how to apply them
- And what to do about them!
So ...

WHAT CAN WE DO TO ENSURE A BRIGHT FUTURE?
Some “simple” things ...

• Ground standards in practice and science
• Go with the ICT flow
• Divide and conquer problems
  – Across organization
  – Across borders
  – Across domains
• Pay attention to other standards arenas

“We must all hang together or assuredly we shall all hang separately.
- Benjamin Franklin (1706 - 1790)
AND ABOVE ALL ....

PARTICIPATE

"The world is run by those who show up."
- Anonymous
QUESTIONS?

robb@computer.org