The IMS Specifications to Improve Learning: From Metadata to Caliper and Beyond

Colin Smythe (IMS Chief Architect)
csmythe@imsglobal.org
Talk Objectives

- Introduce the IMS Standards
- Give a historic context
- What to expect over the next 24 months
- Explain the benefits of using IMS
Biography

• Joined IMS in May 1999
• Responsible for the development of many IMS specifications inc. Question & Test Interoperability (QTI), Content Packaging, Accessible Portable Item Protocol (APIP), Learning Information Services (LIS), etc.
• Currently IMS Chief Architect and responsible for:
  – How the specifications fit together
  – Overseeing the technical details of the specifications
  – Supporting adoption of the specifications
The Very Early Years (1996-1999)

1999
- Metadata 1.0

2002
- IEEE LOM 1.0

2012
- Metadata XSD 1.3.2

- Data to describe a Learning Object
- A Data Model
- XML-based data exchange
- IEEE 1484.12.1
Enterprise (1999)

- SIS/LMS Data Exchange
- Data Model
- DTDs

1999
Credibility Time (2000)

• Content Packaging
  – Moving course content around

• Question & Test Interoperability
  – Support for online tests and quizzes
Because learning platforms and authoring tools are all different, there is a need for a standard interoperable format.
Content Packaging

2000
- Content Packaging 1.0

2006
- Content Packaging 1.1.4

SCORM 1.0

SCORM 2004 3rd Ed

2006
- Content Packaging 1.2

ISO 12785

2009

© 2015 IMS Global Learning Consortium, Inc. All Rights Reserved
The Problem for QTI

This time the problem is authoring an Assessment/Test or Quiz and using different online testing delivery systems.

2000 → QTI 1.0

2001 → QTI 1.1

2002 → QTI 1.2

2003 → QTI 1.2.1 → Common Cartridge 1.*
QTI (2006-2015)

2006
QTI 2.0

2012
QTI 2.1

2015
QTI 2.2

2014
APIP 1.0

CP 1.2
IMS GLC: Welcome to the IMS GLC Online Validator

Validate URI :: Direct Input :: Upload Manifest :: Upload Package

Package: Choose File  no file selected  Browse to begin validation.

Select a Profile:

- QTI v2.1 ASI (default)
- QTI v2.1 Base
- QTI v2.1 Base Metadata
- QTI v2.1 Base Results Reporting
- QTI v2.1 Usage Data
- QTIv2.2 Usage Data (Base)
- QTIv2.2 Results Report (Base)
- Dutch Examinations Profile v1.0 (DEP)
- QTI v2.2 ASI
- QTIv2.2 Usage Data (Base)

For APiP™ validation, visit http://validator.imsglobal.org/assessment

IMS Assessment Conformance and Certification

This test system is made available free-of-charge so that you can perform your own testing. To achieve IMS conformance, visit the QTI2/APiP Alliance. A primer is available on the IMS Website for more information on conformance and certification.

How to use the validator

VIA WEB UI, SOAP WEB SERVICE OR COMMAND LINE

Currently the validator can validate an imsmanifest.xml file or an entire cartridge. The validation options are: Validate by URI (provide a URI to an ims manifest file or cartridge), Direct Input (copy...
Data Models (2000-2005)

2001
- Learner Information Package 1.0

2002
- Reusable Competency Definitions 1.0

2003
- Simple Sequencing 1.0
- Learning Design 1.0

2007
- IEEE 1484.20.1
- SCORM 2004
- SCORM 2004 3rd Ed
“Simple” Sequencing

• How to provide a way to define alternative sequences through the content depending on the previous content and user activities/responses

• Implementation leads to a fundamental problem in Computer Science i.e. Halting Problem
Learning Design

• A format to allow the design of learning experiences in a pedagogic independent way
• Championed by Dutch Open University who also created the only engine i.e. CopperCore
• Has its own sequencing approach

- **2003**: Digital Repositories 1.0
- **2004**: Sharable State Persistence 1.0
- **2004**: Vocabulary Exchange 1.0
- **2005**: ePortfolio 1.0

- SCORM 2004
- SCORM 2004 3rd Ed
- Learner Information Package 1.0.1

© 2015 IMS Global Learning Consortium, Inc. All Rights Reserved
SCORM Use of IMS

2003

Simple Sequencing 1.0

2004

Sharable State Persistence 1.0

2006

Content Packaging 1.1.4

SCORM 2004 3rd Ed

- IEEE LOM
- IEEE CMI
Introduction of Services

• Data Models described what is exchanged
• Service Models also described how the data is exchanged
• Service Oriented Architecture support introduced using WSDL/SOAP

- **2002**
  - Enterprise 1.1

- **2004**
  - Enterprise Services 1.0
  - Resource List 1.0

- **2004**
  - General Web Services 1.0

Sources
- Publisher Repositories
- ECMS
- Client File systems
- Server File Systems
- eLib
- Dynamic Packaging Services

Server
- Supported Content
  - Discussion Forums (with seed topics)
  - Question Test
  - Interoperability (Assessments & Question Banks)
  - Basic LTI (links to remote services)

Supported Security
- Role-restricted Content, CC Authorization (Package & Resource Level)

Supported Content
- HTML/DHTML
- Javascript
- Java Applets*
- Flash (SWF)*
- Rich Media*

* Common Cartridge provides a way for packages to identify any third party components required to execute its content
Common Cartridge Components

2008
- Common Cartridge 1.0
  - CP 1.2
  - Metadata 1.2
  - QTI 1.2.1
  - Web Links 1.0
  - Discussion Topics 1.0

2010
- Common Cartridge 1.1
  - LTI 1.0
Learning Standards Annotations

• IMS metadata to enable learning content to be annotated by links to the associated learning standards

• Use pointers to the actual learning standards themselves and allow any resource to have multiple annotations
Common Cartridge Components

2012

Common Cartridge 1.2

Curriculum Standards 1.0

2014

Common Cartridge 1.3

APIP 1.0

IWB 1.0

2015

Thin Common Cartridge

EPUB 3.0

Web Links

LTI 1.0/1.1/1.2
Learning Tools Interoperability

Tool Consumer
- Profile
- Tool Proxy Runtime
- Tool Proxy
- Secret

Tool Provider
- Tool
- Profile
- Tool
- Secret

- Settings
- Roster
- Outcomes
- Launch++
LTI & Common Cartridge

When LTI is combined with the IMS CC publishers can distribute cartridges containing active, authenticated links back to centrally hosted content.
LTI (2010-2014)

2010
LTI 1.0

2013
LTI 1.1

2014
LTI 1.2

Common Cartridge 1.1/1.2/1.3

Thin Common Cartridge
LTI (2014-2015)

2014

LTI 1.2

First IMS specification to use REST/JSON-LD based Bindings

2015

LTI 2.0

2015

LTI 2.1

Rich Outcomes
IMS Accessibility (2002-2015)

- ACCLIP - Accessibility for LIPv1.0 (2003)
- Access for All (AfA)
  - Personal Needs & Preferences (PNP)
  - Digital Resource Description (DRD)
  - AllY (Schema.Org/LRMI)
Accessibility (2000-2015)

2010
- Access For All DRD 2.0
- Access For All PNP 2.0

2012
- Access For All DRD 3.0 (PD)
- Access For All PNP 3.0 (PD)

2008
- ISO 24751/2
- ISO 24751/3
ISO Adoption of IMS

2006
- Content Packaging 1.2

2010
- Access For All DRD 2.0

2010
- Access For All PNP 2.0

ISO 12785

ISO 24751/3

ISO 24751/2
Learning Information Services

Learning Information Services v2.0

- Person Management Service v2.0
- Group Management Service v2.0
- Membership Management Service v2.0
- Course Management Service v1.0
- Outcomes Management Service v1.0

Bulk Data Exchange Management Service v1.0

IMS Global General Web Services
OneRoster

• An interoperability standard for the transfer of educational data for course rostering/gradebook reporting in K-12.
• It consists of an abstract data model for K12 educational resources, modelled using existing IMS principles (from LTI and LIS)
• It includes service definitions for data access and bindings in REST and CSV

2004

Enterprise Services 1.0

2012

Learner Information Services 1.0

2014

Course Planning & Scheduling Services 1.0 (PD)

2015

One Roster 1.0
Supporting Library Access

• Learning Object Discovery & Exchange (LODE)
  – Federated discovery and retrieval of earning objects contained in more than one collection
  – Profile a set of off-the-shelf standards inc. SQI/SRU, Open Archives Initiative-Protocol for Metadata Harvesting (OAI-PMH), etc.

• Internal Candidate Public Draft released in 2011
APIP (2010-2015)

• Accessible Portable Item Protocol
  – To provide accessible Assessments
  – Start with IMS QTI and add support for users with physical and learning disabilities
  – Core part of the USA Race To The Top Assessment (RTTA) projects
APIP 1.0 (2014)

2014

APIP 1.0

CP 1.2
Metadata 1.3.2
QTI 2.2
CSM 1.0
AfA PNP 2.0
AfA DRD 2.0

PNP APIP Ext 1.0
PNP Records 1.0
IMS Learning Analytics

• A Learning Analytics Framework
  – Part 1 – Caliper Metric Profiles and Sensor API
  – Part 2 – Repository Read Access API

• Caliper vs. Tin Can/xAPI
  – Caliper has Metric Profiles
  – Caliper is Open Standard
  – Caliper has Code APIs available
  – Caliper is integrated with other IMS standards
The Metric Profiles
Caliper 1.0 (2015)

Supported code bases:
- JavaScript
- Java
- PHP
- Python
- C#
- Ruby
EDUPUB

- Joint activity between IDPF and IMS
- IDPF responsible for electronic book EPUB specification
- Initial motivation for IMS was how to support quizzes and formative testing inside of EPUB3
EDUPUB in the IMS Context

- Student Information System (SIS)
- Learning Management System (LMS)
- Assessment System
- Analytics System
- ePub Reader
- eBook

- Enrollments
- Outcomes
- Gradebooks
- Timetables
- Assessment Outcomes Scores Tracking
- Outcomes Gradebook Tracking Scores
- Tracking Scores Outcomes …

3rd Party Tools/Apps
IMS & EDUPUB 2015

LT (TP/TC) 1.0

LTI Rich Outcomes

EDUPUB 1.0
IMS & EDUPUB Long Term

- LT (TP/TC) 1.0
- LTI Rich Outcomes
- Caliper 1.0
- QTI 2.2

EDUPUB 1.*
Community “App Store” Architecture (CASA)

• An Open Source Community Initiative for open sharing of ‘apps’ via trusted distributed ‘app’ stores
• To develop and support code libraries and APIs to reduce the time and effort required to enable interoperable educational resources in seamless, agile and information-rich enterprises
IMS-GLC INITIATIVE
CASA – COMMUNITY APP STORE ARCHITECTURE DIAGRAM

University C CASA Engine
University B CASA Engine
University A CASA ENGINE

CASA ENGINE CONFIGURATION MANAGER
UI & App

Possible CASA tool CONSUMERS
- LMS Environment: Moodle, Sakai, Canvas, D2L, etc...
- Research Portal site
- Mobile Dashboard

LEGEND
Exchange of Apps using CASA standards
Using IMS Standard CASA Community App Store Architecture
Item that we propose to build a reference implementation of

LTI Tool Provider
CASA Component

IMS Global CASA Engine
Provider CASA Engine

Learning Game Supplier
Publisher

Exchange Apps CASA standard
Published Apps via CASA
Published Apps via USE protocol
IMS CASA standard Interchange
IMS CASA standard Interchange
CASA f(x) – to Filter, Trusted Peer Engines, Preferences, Published App Profiles
Competency Based Education (CBE)

- Designing a CBE-aware ecosystem that leverages the technical groundwork of IMS LTI Standards
- Includes demonstration of the exchange of an Electronic Transcript (eT) to support evidence of competencies
- First deliverables in November 2015
Digital Credentials

• Started in early 2015
• Digital Badges (based upon Mozilla Open Badges)
• Support deeper integration and exchange within extant systems, while exploring new models of badge system design, storage, usage, and evaluation in the institutional context
2015 and Beyond

• There is an extensive legacy to be supported
• New versions to be released in response to our Member needs
• New specifications to address outstanding or new pain-points of our Members
• Create when required, adopt/profile/integrate whenever possible
Active Work-1

- Common Cartridge 2.0
- APIP 1.1
- Open Video 1.0
- Access For All DRD 3.0
- Access For All PNP 3.0
- Privacy & Security 1.0
Active Work-2

- LTI Services
- aQTI
- Caliper 1.1
- One Roster 1.1 LIS 2.1
- LTI Service APIs
- aQTI APIs
- LTI Service APIs
- Enterprise Service APIs
aQTI

• 3rd Generation QTI
• Full end-to-end Test/Item delivery
  – Authoring-to-Delivery-Results Reporting
  – Transformationless
  – Services-based
  – Full accessibility-aware/support
• Initial solution delivered in mid-2017
QTI Specification Mosaic

- IMS
  - QTI XML
  - Content Packaging
    - Common Cartridge v2.0
  - Access for All DRD
  - Access for All PNP
  - Curriculum Standards Metadata
  - Learning Tools Interoperability v2.*
  - Caliper v1.*
  - APIP v1.*
  - REST/JSON-based services

- Non IMS
  - HTML5/CSS3
  - Web Components
  - WCAG 2.0
  - WAI ARIA
  - SSML & PLS
  - IEEE LOM
  - CSS
  - Schema.Org/LRMI
  - SMIL
  - SVG
Summary

• Nearly 20 years of developing, advocating and supporting interoperability standards for learning
• An extensive set of standards with global adoption to enable best practice learning in the education and corporate markets
• The success of IMS is heavily dependent on the Members’ involvement in the IMS activities and not just paying the membership fee
Questions & Comments