ICT Project Guidance

Education Sector Interoperability Protocols

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## Description

This document outlines key protocols used in the IT sector for services that manage and exchange information to support the Education Sector.

## Synopsis

Interoperability between systems is a key objective to facilitate business continuity.  
Protocols exist for the interchange of information for educational purpose.   
  
Warning:   
As with all data interchange protocols, they are by nature implementations of lowest common denominators between systems, to be implemented only at the edge of systems, and not to be used as the basis of the design of a system’s internal elements.

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## Introduction

BOSSCARD/ RAID: Background [], Objective, Options, Scope[In/Out], Stakeholders [Users], Constraints, Assumptions, Risks, Dependencies, Decisions, Deliverables.

All IT services become obsolete. At which point the information within requires being extracted, for importing and provisioning its replacement.

The need for integration between systems also exists during normal operations, permitting the exchange to peer systems.

Issue

The effort required to integrate systems is often underestimated.

The effort and risk is larger when the integration is required to be developed from scratch.

## Resolution

Effort and delivery risk can be reduced by using a standard protocol. The choice of transport channel, associated security considerations, design of the information elements and their relationships, validation, etc. have already been investigated, defined, designed and tested. Implementation examples and even code libraries may already exists to reduce the implementation effort.

Warning:  
While delivery risk can be reduced, the use of protocols based on sector accepted, but technically obsolete approaches, or introduction of unusual complexity can introduce other risks, including limiting uptake.

# Organisations

In the education sector, standards are developed by only a few groups or organisations.

#### 1EdTech

A global consortium of education sector stakeholders.

Developers of several standards and protocols including:

* LTI

#### ACT

The company that acquired in 2016 *OpenEd*, the online repository of material that aligns to the *Common Core*.

#### ADL

A US Department of Defence (DoD) organisation that created SCORM.

#### AICC

Aviation Industry Computer-based Training Committee (AICC). Officially dissolved in 2014, but the standards they developed live on. Their standard influenced the development of SCORM.

#### IMS Global Learning Consortium

The original name for 1EdTech before it was rebranded.

Note:  
The name is still used often hence required recognition.

#### Rustici Software

The leading provider of consulting services to assist organistions to SCORM compliance, and provider of products and code libraries to assist with this task.

# Protocols & Standards

A protocol defines a set of rules used by two or more parties to interact between themselves. A standard is a formalized protocol accepted by most of the parties that implement it. Not all protocols are standards (some are proprietary). Not all standards are protocols (some govern other layers than communication).

The following list of standards are categorised as:

* **System Interoperability standards**: standards to coordinate systems in an educational context,
* **Packaging standards**: standards to package and distribute sets of resources.
* **Content Item standards**: standards to develop resources.

### Service Types

A certain number of system types are discussed in the context of education.

#### Learning Object Repositories (LOR)

While not a standard, it is an approach to developing repositories of Learning Object[ives].

#### Student Management Services (SMS)

A student management service is used by schools to organise:

* Teachers
* Learners
* Course
* Resources
* Timetables
* Progress Plans

#### School Management Services (SMS)

### Services

While not standards, some web services are used by a significant number of sector users and therefore often referenced, even if only for examples of a specific kind of service.

#### OpenEd

An online catalog of educational assessments, assignments, videos, games, lesson plans, aligned to every Common Core standard *as well as other stands*, including *Next Generation Science Standards*, *Texas Essential Knowledge and Skills*, amongst others.

While Common Core is an American standard and therefore OpenEd is an service mainly of use to American education providers, it is an example of what may be of use to other countries.

### System Interoperability Standards

#### Schools Interoperability Framework (SIF)

Access 4 Learning (A4L) manages the SIF Specifications.

There is a SIF (global) implementation specification, and locale-specific implementations, (e.g., SIF-NZ).

All implementation specifications are based on XML.

**Advantages:**

* Recognised integration framework.

**Considerations:**

* As per the name, it’s primary perspective is that of the School, and not Learner-First.
* Libraries do exist, but due the target clientele they have not been kept current (.NET Classic versus .NET Core, SOAP versus REST, etc.)

**Disadvantages:**

* The underlying architecture is SOAP based and not REST, introducing several negative issues compared to better options.
* Architecturally, it adds significant duplication of elements, increasing implementation and quality assurance costs.

#### Learning Tools Interoperability (LTI)

A technical specification stewarded by 1EdTech (previously IMS Global) that specifies a method for Learning Systems to invoke and communicate with external systems. For example, an LMS may use LTI to host course content and tools provided by web services provided by 3rd parties with information about the learner and the learning content shared, without requiring a learner to log in separately, and capable of collecting outcomes at the end of the external experience.

**Advantages:**

* It has been adopted widely.
* It permits pseudo-intensities.

**Considerations:**

* Technically, it leverages OAuth2, ODIC, and JSON Web tokens.

**Disadvantages:**

#### Competencies and Academic Exchange (CASE)

Stewarded by the IMS Global Learning Consortium (IMG GLC).

CASE provides a framework for provisioning and transmitting a hierarchical digital document of a program of study, curriculum, or course.

It is composed of the following elements:

* CFdocument: a digital version of the original competencies or standards document (e.g., a PDF).
* Competency Framework Item (CFItem): a statement of what a learner will know and be able to do.
* Competancy Framework Associations (CFAssociation): used to map a relationship between entire standard sets, or individual standards and courses.
* Competancy Framework Rubrics (CFRubics): instruments to delineate performance expectations around a task, product, or performance that may or may not be aligned to standards.

Advantages:

Considerations:

* Using Universally Unique IDs (UUID)s enables management of the material in a geographically distributed manner and even the use of different tools if required.
* OpenSALT[[1]](#footnote-2) is CASE development and management tool developed by the Public Consulting Group (PCG)[[2]](#footnote-3) that can be used for:
  + Creating national competency frameworks and reusablt skills definitions
  + Creating localisd versions linking to the national definitions
  + Set learning progresssions within a framework
  + Align OpenBadges and Comprehensive Learner Records (CLRs) to learning goals and standards.
  + Creating “crosswalks” between different standards and frameworks.
* While hierarchical in nature, Associations can be used.

Disadvantages:

* Hierarchical in structure, Associations are required to map more flexible graph structures.

#### Learning Object Metadata (LOM)

#### Learning Object Repository

While not a standard, it is an approach to developing repositories of Learning Object[ives].

### Content Packaging Concerns

Concerns to consider when comparing Content packaging and presentation solutions include:

* User operability
* Content Interchangability
* Operation traceability
* Compatibility across different systems.

#### AICC[[3]](#footnote-4)

A specification developed by the Aviation Industry Computer-aided Testing Consortium (AICC). While the AICC has been dissolved, their standards continue to influence. That said, largely replaced by the use of SCORM.

**Advantages:**

* Respected

**Considerations:**

* A respected legacy.

**Disadvantages:**

* Largely replaced by SCORM or other options.

**Recommendations:**

* Do not waste effort towards procuring AICC compliant systems.
* Suspect services that promote AICC compliance suspect as not evolving with the times.

#### cmi5

Computer Managed Instruction, offers more flexibility in tracking learners. It can even track sources external to a hosting LMS, including other apps and social learning.

It provides a bridge between the Learning Record Store (LRS) and the Learning Management Service (LMS).

**Advantages:**

* …

**Considerations:**

* …

**Disadvantages:**

* n/a

**Recommendations:**

* Recommended.

#### LMS Common Cartridge

**Advantages:**

* …

**Considerations:**

* …

**Disadvantages:**

* …

#### Sharable Content Object Reference Model (SCORM)[[4]](#footnote-5)

SCORM is a content packaging specification.

A SCORM package[[5]](#footnote-6) is an xml file, containing an xml-based manifest that describes the Resources within the zip file that are either:

* Assets are logical unit collections of one or more files, that are a stand-alone unit/part of a course, or for reuse in other parts of the course (e.g. for branding).
* SCOs are logical unit collections of one or more instructional parts of the course. Whereas Assets are static, SCOs interact with the providing LMS.

Tracks track important data including what portions of a particular course have a status of incomplete, complete, passed, or failed.

**Advantages:**

* The package is a zip, containing an XML based manifest file to describe the contents of the package.

**Considerations:**

* The last edition (SCORM 2004 4th Edition) was issued in March 2009.
* It was mandated by the US DoD via DoDI 1322.26 (2006) hence it widespread use in LOR and LMS services -- although DoDI 1322.26 (2013) recommended the use of xAPI (without removing the mandate of providing SCORM interoperability).

**Disadvantages:**

* While newer than AICC it is still a relatively old set of standards that much the flexibility or more recent standards.
* While an interchange formant, LORs blur this objective by persisting packages developed with the interchange format.

**Recommendations:**

* Consider systems that can dynamically produce SCORM compliant packages.
* Avoid systems that *store* SCORM packages.

#### xAPI

**Advantages:**

* Functions similarly to SCORM but can track more types of stata by using statements to increase flexibility and functionality.

**Considerations:**

* Formerly “Tin Can”.
* While it brings more flexibility in data tracking, it doesn’t ensure efficient user design or course quality. Develoeprs will need to meet these important metrics independently.
* Tracking learner activity offline and outside an LMS is considered overkill by some.

**Disadvantages:**

### Item Development Standards

Standards exist for the development of education resources – which can in turn be packaged, and made available in services, and shared using interoperability standards.

#### Question and Test Interoperability (QTI) Specification

Stewarded by the IMS Global Learning Consortium (IMG GLC).

Defines a standard format for the representation of assessment content and results.

**Advantages:**

* A recognised standard.
* The latest version 2.2.2 has made efforts to address current W3C standards including: HTML5, SSML, PLS, CSS, ARIA, MathML.

**Considerations:**

* XML based.
* While a standard, it is losing currency due to it being relatively immaterial to more current approaches to assessment (dynamic).

**Disadvantages:**

* There has been little development of late: the latest version 2.2.2 was finalised in 2017.
* Implemented by some Commercial products, although some are removing support for it, with little uptake by open-source systems, including the most popular learning management systems.

#### Open Badge[[6]](#footnote-7)

Stewarded by the IMS Global Learning Consortium (IMG GLC).

Open Badges format to develop untamperable Badges proving competency, which can then be embedded within emails, webpages, digital resumes, LinkedIn, etc.  
  
Exactly as cameras regularly embed into their pictures metadata about where the photo was taken, lighting, using lens, iso and other conditions, Badges are pictures within which metadata is embedded to record the issuer, name, skills achieved, evidence, issue, duration, etc.

A listing of the types of metadata that can be expected to be embedded within the picture includes: Description, Name, Criteria, Recipient, Issued, Expiration, Evidence, Verification, Digital Signature.

Advantages:

* Very easy to work with, deploy, display.

Considerations:

* While images can be posted anywhere, 3rd party Open Badge repositories can be used to manage and display multiple badges in a more formal manner.

Disadvantages:

* None analysed.

Appendices

Appendix A - Document Information

### Images

[Figure 1: TODO Image 2](#_Toc144995112)

### Tables

[Table 1: TODO Table 3](#_Toc145048484)

[Table 2: TODO Table 2 3](#_Toc145048485)

### References

**There are no sources in the current document.**

### Review Distribution

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### Audience

The document is technical in nature, but parts are expected to be read and/or validated by a non-technical audience.

### Structure

Where possible, the document structure is guided by either ISO-\* standards or best practice.

### Diagrams

Diagrams are developed for a wide audience. Unless specifically for a technical audience, where the use of industry standard diagram types (ArchiMate, UML, C4), is appropriate, diagrams are developed as simple “box & line” monochrome diagrams.

### Terms

Refer to the project’s Glossary.

##### AAIC

: Aviation Industry Computer-based Training Committee. See SCORM.

##### DoD

: Department of Defence, the source of DoDI.

##### DoDI

: Department of Defence Instructions. Relevant, as it is by DoDI 1322.26 (2006) that SCORM was mandated, and DoDI 1322.26 (2013) that xAPI was advised.

##### IT

: acronym for Information, using Technology to automate and facilitate its management.

##### ICT

: acronym for Information & Communication Technology, the domain of defining Information elements and using technology to automate their communication between entities. IT is a subset of ICT.

##### LMS

: Learning Management System.

##### LTI

: Learning Tools Interoperability (v1.3).   
Specifies a method for Learning Systems to invoke and communicate with external systems. For example, an LMS may use LTI to host course content and tools provided by web services provided by 3rd parties with information about the learner and the learning content shared, without requiring a learner to log in separately, and capable of collecting outcomes at the end of the external experience.

##### Moodle

: a free and open-source PHP based LMS to facilitate online teaching and learning management in K-12, higher education and the workplace.

##### Next Generation Science Standards (NGSS)

: a multi-state effort in the United States to create new education standards that are *"rich in content and practice, arranged in a coherent manner across disciplines and grades to provide all students an internationally benchmarked science education.".* Developed after the *Common Core* standard.

##### SCORM

: Shareable Content Object Reference Model.

##### Texas Essential Knowledge and Skills

: one of several standards being followed to develop education resources within *OpenEd*.

1. [openSALT (google.com)](https://sites.google.com/view/opensalt/home) [↑](#footnote-ref-2)
2. [Education - PCG | Public Consulting Group](https://www.publicconsultinggroup.com/education/) [↑](#footnote-ref-3)
3. [What is AICC? Overview, benefits, and modern alternatives (docebo.com)](https://www.docebo.com/glossary/aicc/) [↑](#footnote-ref-4)
4. [SCORM.com HomePage: What is SCORM and How it Works](https://scorm.com/) [↑](#footnote-ref-5)
5. [The SCORM content packaging specification: SCORM.com](https://scorm.com/scorm-explained/technical-scorm/content-packaging/) [↑](#footnote-ref-6)
6. [Home | IMS Open Badges](https://openbadges.org/) [↑](#footnote-ref-7)