



SCORM 2.0 White Paper Defining Content for Interoperability

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**Jill Abbott
Vince Paredes
Schools Interoperability Framework Association®
jabbott@sifinfo.org
vparedes@sifinfo.org**



Table of Contents

Abstract.....	3
Introduction	3
Problem Definition.....	3
Use Cases	5
Proposed Solution.....	6
Existing Implementations/Prototypes	9
Overarching Questions and Summary	10
Appendix A	11



Abstract

Common interoperability needs for learning, education and training exist. While specific communities of practice will need some adaptations to their own industry, an overarching definition for content interoperability is desired. This white paper outlines some of the challenges and needs for the schools environment. These things can be extrapolated to the larger learning, education and training community as well. This paper also outlines solutions for defining the specific data objects needed for commonality and context to achieve content interoperability among assessment, information about the learner, resources, competencies and grades

Introduction

Learning, education and training is complex. Adding the myriad of technologies available exacerbates the convolution of approaches. As organizations adopt, develop and adapt different technological systems, the need arises to take into account not only the interoperability of learning content but the flexibility to also pair this with organizational and administrative data about individuals.

eLearning and providing a comprehensive view of learners can be daunting. While considering content, assessment, instruction, pedagogy and planning, there is an underlying assumption that the technology can provide each of these across systems and interoperability is assumed. In addition, the pervasiveness of eLearning in schools is greatly expanding, adding to the complexity. According to NACOL, “As of September 2007, 42 states have significant supplemental online learning programs (in which students enrolled in physical schools take one or two courses online), or significant full-time programs (in which students take most or all of their courses online), or both.”¹

The need to define content within eLearning has never been greater. This definition comes in the form of describing the format of content, not the content itself.

Problem Definition

SCORM is adopted widely throughout the world. While SCORM is serving the initial goal of sharing content across systems, technologies, needs and desires for learning have changed. In addition, more data about learners are gathered now more than before and this information needs to be incorporated into SCORM 2.0.

Typical applications or systems within a school’s environment include a student information system or management information system, grade book, financial, transportation, food service, learning management system or virtual learning environment, lesson planning, curriculum planning, assessment, content, data warehouse, network account, library automation, security, human resource and many more. Providing common definitions for content becomes important so that regardless of the system that is being utilized, content can be interoperable.

¹ Watson, J. and Ryan, J. (2007). *Keeping Pace with K-12 Online Learning: A Review of state-level policy and practice*. North American Council of Online Learning. [online] <http://www.nacol.org/docs/KeepingPace07-color.pdf>.



In the schools space, several problems and challenges exist. While some of these are out of scope for SCORM 2.0, a comprehensive picture is needed to understand the complexity and how SCORM 2.0 can solve some of these.

1. Schools purchase content from a variety of different publishers. These publishers need to align content to the learning and performance standards (competencies).
2. A school may utilize a learning management system and use content from several publishers. The publishers desire to have the content used within the LMS of choice; however, do not wish to port the content to the LMS. This is content portability vs. content interoperability.
3. As a learner uses content, numerous data needs to be provided to the teacher, school and or Local Education Authority (LEA) in order to understand where the learner is in terms of understanding of learning and performance standards as well as the data are utilized in programmatic improvement and instruction.
4. Content needs to adapt based upon a learner's response and abilities.
5. Administrative data about a learner needs to be used in conjunction with learning.
6. There is a need to link learner assessment data to instruction and planning.

In Fall 2007, the SIF Association[®] and the ADL[®] hosted regional meetings to begin a requirements gathering for Core SCORM and future features and functionalities needed for interoperability. The above are a listed summary of those and the full summary from the conversation can be found in Appendix A. While this appendix covers a much broader aspect, this white paper focuses on the need to define content for interoperability including assessments, abilities, competencies and learning methods.

From an eLearning perspective in the schools space, a systemic view needs to be addressed. The SIF Association's Teaching and Learning Framework provides a context from which challenges are addressed and open interoperability specifications are built. Figure 1 provides the Teaching and Learning Framework.



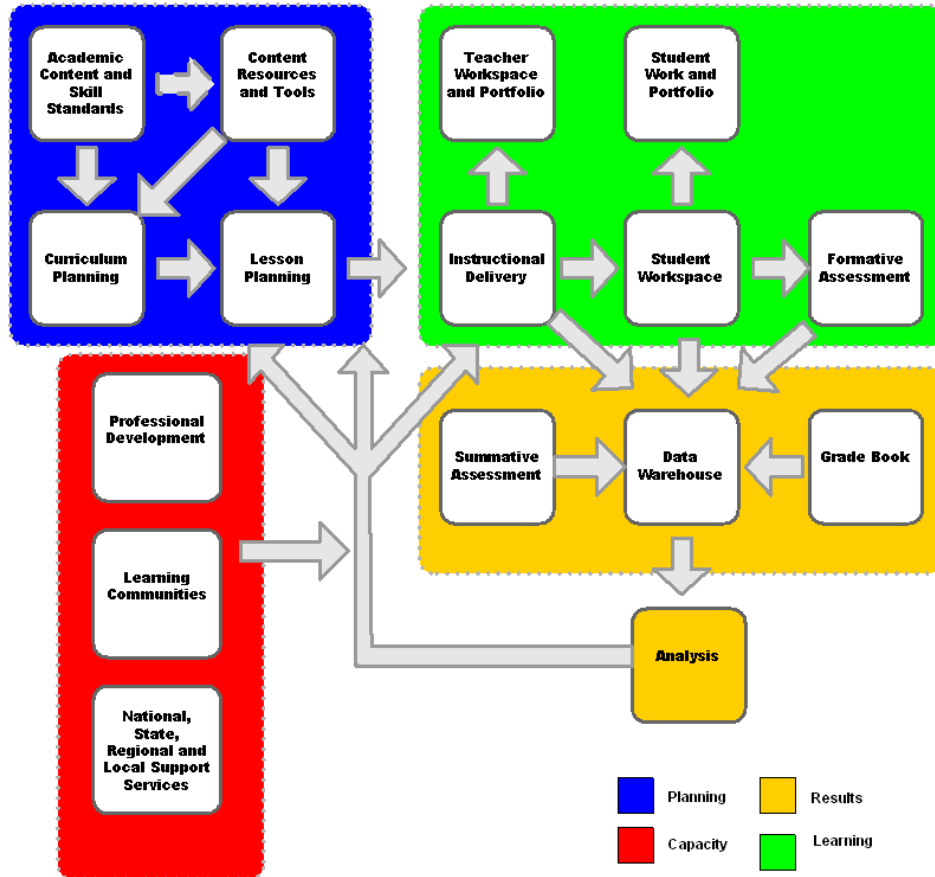


Figure 1 – SIF Association Teaching and Learning Framework[®]

The four main categorizations – planning, learning, results and capacity – are the four areas in which school system focus in learning and education. Within the four categorizations, there are applications that have been developed and play a role in the planning and definition from a technological perspective. Each of these areas need to have a definition within an open interoperable data model.

While this white paper does not address the need for sequencing and a run time environment, these are vital components that need to continue to evolve. This white paper focuses on the need for defining the pieces of learning, education and training that need to be described in a consistent manner; aligned with the six problems identified above.

Use Cases

The use cases for the described problems are numerous and too vast to get into detail within this white paper. From a general perspective, the following use cases are provided only as a few examples and from a very high-level.

1. A school would like to implement a technology-based course recovery program throughout the LEA. Learners that have failed two or more school courses will be enrolled in a virtual course program. The school has chosen a Content Provider that provides an LMS but would also like to integrate information from multiple applications within the district. This school wants to also launch the program through a state department of education portal website.
2. A school would like to implement a technology-based instructional planning and management system throughout their district. The LEA will support classroom teachers with a lesson planning system that will enable teachers to plan/schedule activities, assignments and assessments as well as manage the classroom delivery of subject matter for a course or a unit of instruction.
3. A publisher has generated digital content and desires to align the content to the states' learning and performance standards.
4. A learner takes an online assessment. The assessment is scored and returns the test score to the teacher. It is desired for the test score to be returned with item characteristics association with an assessment item, see the items related to the overall score and an item by item summary of test performance along with the content of the items.

Proposed Solution

The proposed solution for the defining of content is not the entire solution or requirements necessary for the advancement of SCORM 2.0. This white paper is outlining a proposed solution for defining content in the broad sense of the definition.

The SIF Association is a unique, non-profit collaboration composed of over 1,900 schools, districts, states, US Department and International Ministries of Education, software vendors and consultants who collectively define the rules and regulations for educational software data interoperability. The SIF Implementation Specification enables diverse applications to interact and share data efficiently, reliably, and securely regardless of the platform hosting those applications.

The SIF Association defines data comprehensively and in four groups, as defined by Victoria Bernhardt². *Demographic* data provides data about a school and learner. This data includes gender, race, enrollment, attendance, etc. *Perceptions* data provide data about what the stakeholders think about learning. *School Process* data focuses on data relating to the processes involved in education including instruction, programmatic improvement, instructional strategies and classroom practices. Finally, *Student Learning* data provides information about the learner's results including assessments and observations. Cross sections of these data are necessary in order to gain a complete understanding of the school setting. Within the SIF Data Model, objects are defined for each of these four types of data.

SIF defines both the data model and infrastructure/architecture for transport in the SIF Implementation Specification. This XML specification provides an enterprise solution for interoperability within organizations³. Figure 2 outlines the conceptual model.

² Bernhardt, V.L. (1998). Data analysis for comprehensive schoolwide improvement. Larchmont, NY: Eye on Education.

³ Adapted from Hohpe, G. and Woolf, B. (2004). Enterprise integration patterns: Designing, building and deploying messaging solutions. New Jersey: Addison-Wesley.



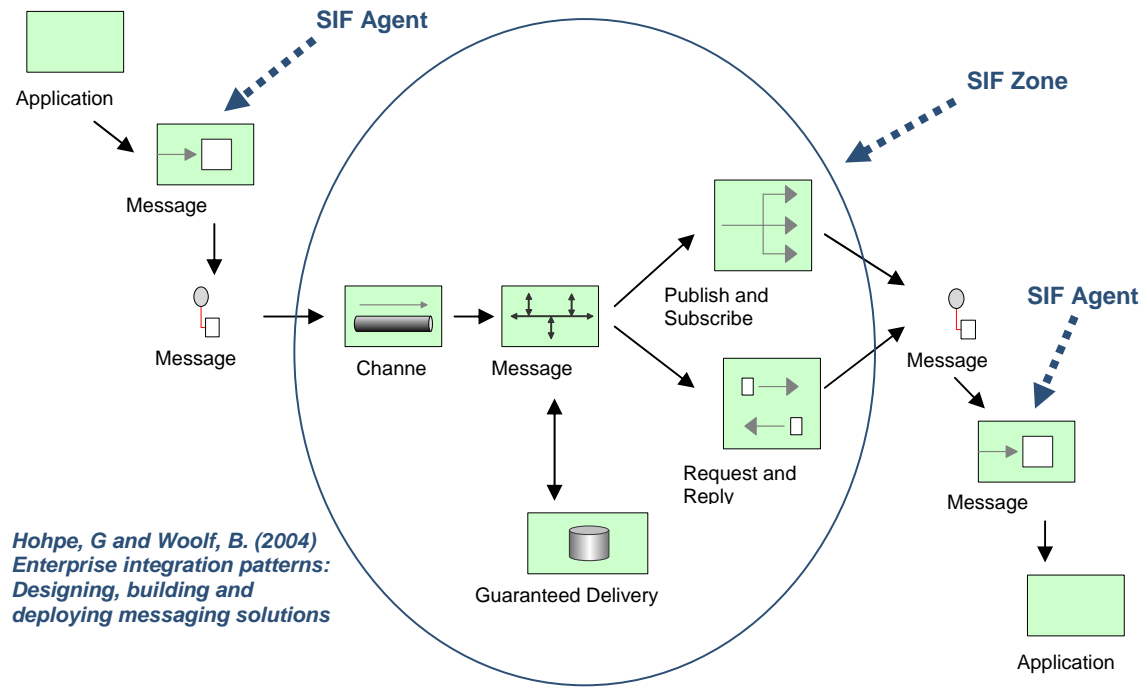


Figure 2 – SIF Enterprise Conceptual Model

It is proposed to leverage the existing work of the SIF Association and SIF Specification to further define content in SCORM 2.0 (note that content is broadly defined to include curriculum, lessons, assessments, learning resources, etc.). The overarching concept is to have a comprehensive system for education content interoperability, outlined below in Figure 3.

Education Content Interoperability

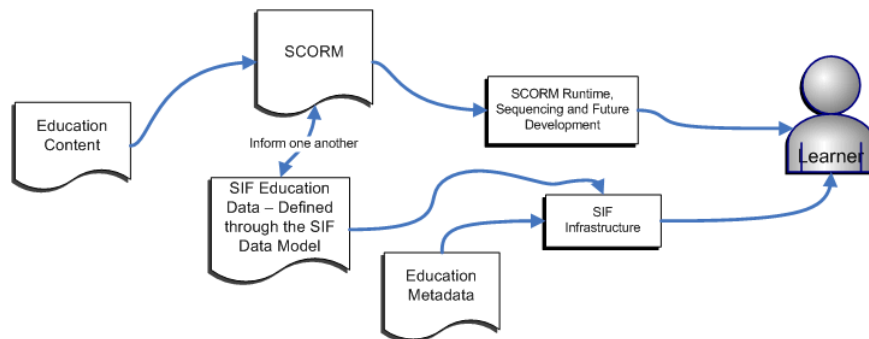


Figure 3 – Education Content Interoperability

Currently the SIF Implementation Specification defines the following for learning, education and training⁴:

Assessment

- Assessment
- AssessmentAdministration
- AssessmentForm
- AssessmentItem
- AssessmentPackage
- AssessmentRegistration
- AssessmentSubTest
- ItemCharacteristics
- StudentResponseSet
- StudentScoreSet

Grade Book

- GradingAssignment
- GradingAssignmentScore
- GradingCategory
- MarkInfo
- MarkValueInfo
- OfficialStudentPeriodAttendance
- SectionMarkInfo
- StudentPeriodAttendance
- StudentSectionMarks

Instructional Services

- Activity
- Assignment
- CurriculumStructure
- LearningResource
- LearningResourcePackage
- LearningStandardDocument
- LearningStandardItem (Competencies)
- Lesson

SIF Metadata

- TimeElement
- LifeCycle
- RightsElement
- EducationFilter
- StudentLEARelationship

Special Programs

- StudentParticipation
- StudentPlacement
- TestAccommodation

⁴ The full SIF Implementation Specification, describing both the full data model and transport, can be found at <http://specification.sifinfo.org/Implementation/2.2/>



Student Information System/Management Information System

- StudentPersonal
- StudentSchoolEnrollment
- StudentSectionEnrollment

The objects listed above are only a portion of the full data model. These are some of the most pertinent ones for this conversation that can be leveraged.

Existing Implementations/Prototypes

Existing Implementations

All SIF implementations are not fully known. From the information that the SIF Association has, there are SIF Implementations in all 50 states in the United States of America, the United Kingdom, Australia, and Canada and planning in several other countries. In addition, in the United States of America, there are six statewide implementations with an additional 11 in process.

During the past two years, the UK has conducted two proofs of concept. The first focused on passing data from the school to the local authority to the ministry of education⁵. The second passed a learner's assessment information to the scoring vendor and then to the MIS⁶.

Prototypes

Launched in summer 2008, the SIF Association and the ADL are completing a pilot that leverages each specification. Schools today have numerous applications. SIF has provided interoperability for data movement in both administrative and teaching and learning applications. SIF does not define interoperability within an application. SCORM has defined interoperability within an application. As schools use more learning environment applications, there is a need to have interoperability within an application and between applications. In using SCORM and SIF together, a comprehensive solution for interoperability can be provided for administrative data and teaching and learning data. A pilot is necessary to begin identifying specifics from each specification/reference model in providing documentation of best practices and implementation as well as needs that are not met by either. The goals of the pilot are to:

1. Pass content from a publisher to a learning platform.
2. Pass run time data, regardless the state, from one application to another in real-time.
3. Use and define objects from SIF and SCORM that can be utilized together.

This pilot work is to be completed in Spring 2009.

⁵ Final report - http://www.sifinfo.org.uk/upload/news/C21EZ7_SIFPOCFINALREPORTv1%200.pdf

⁶ Final report currently being written. Summary - http://uk.sifinfo.org/news_details.asp?news_id=86



The second prototype, on the teaching and learning side within the SIF Association, is passing learner grades within an LMS to an official grade book. This pilot work is to be completed in Spring 2009.

Overarching Questions and Summary

As the evolution of SCORM 2.0 is underway, this requirements gathering phase from the large community of learning, education and training proves vital in better meeting the interoperability challenges, needs and solutions. A leveraging of existing work, advancement of new work and comprehensive, thoughtful decisions in creating a comprehensive solution remains key to interoperability for a variety of applications. As the white paper suggested topics and issues are vast, and this white paper only address a portion of abilities, assessment and evaluation, competencies and learning methods, a true systemic solution is necessary. Given this, some overarching questions remain.

1. How does SCORM 2.0 provide a systemic solution to interoperability while leveraging existing work and moving forward technological advancements?
2. How will SCORM 2.0 ensure greater interoperability and alignment to the reference model through conformance?
3. How can SCORM 2.0 provide flexibility for different communities of practices yet provide interoperability between the various applications?
4. How can the SIF and SCORM standards inform each other and be expanded in order to achieve content interoperability in schools?



Appendix A



ADL/SIFA Fall 2007 Regional Meetings Summary Information

Background

Upon announcing a more formal partnership for ADL and SIFA to work together, the organizations decided to host regional meetings. The purpose of these meetings was to inform the community about the partnership, gather information about the requirements for Core SCORM for Schools and answer any questions moving forward.

There were five such meetings held in Birmingham, UK; New York, NY; Washington, DC; Chicago, IL and Seattle, WA. In addition, feedback was sent via email and other conversations.

Summary of Information Gathered

- The profiling of SCORM is very important and the UK will no doubt create or embrace a particular profile.
- At author-time and runtime I think SCORM is sufficient (given the right tools are available). There is an argument for a presentation and styling book but if we are just talking about creating effective learning resources then yes it is sufficient. If you think of how SCORM can be used in school such as:
 - Self-paced learning modules - suitable for revision and for kids that may not be able to attend school (hard to reach kids, teenage pregnancies, etc);
 - Small engaging activities that can be used inside or outside the classroom;
 - Other examples (CPD for staff)
- The data handling after the SCO has run has been outside of the scope of SCORM but needs addressing by SIFA.
- Search and discoverability is something that needs sorting
- Movement of SCORM resources from authoring tools and repositories to an LMS/VLE I believe would greatly enhance the usability of systems.
- For schools there has to be a mixed approach so that instructional resources (SCORM content for example) are used where suitable along with collaborative tools and other approaches.
- SCORM is not ubiquitous
- It's difficult to know what LMS will adopt what specification/standard



- Interpreting the information is difficult
- Need to look at reporting from SCORM and the use of SIF
 - Including scoring and grading
- Sequencing is not there yet – need to be able to sequence an entire course for a student
 - Not enough depth and flexibility with curriculum design
 - need more dynamic options within sequencing other than branching
 - increasing customization wanted for individual students – how are we going to get there
 - Need to look at UI
 - What's standard to enable?
 - Is there a core set of rules?
 - Where does curriculum fall into this?
 - How do we then integrate the objects?
 - Need to develop a reader to read the rules
 - Have to keep in mind the content vs. the context of the content
- Assessment portability is an issue
 - Some use QTI, but different systems do this in different ways even if compliant
- Issues with backward compatibility
- With the LMS assessment and results and the SCORM content with interoperability, it's too easy to lose the data with the pre-test to prescribe learning
- No easy tool to help develop
- Rights management is going to become a huge issue
- Need to address metadata
 - Not comprehensive enough
 - Too many “controlled” vocabularies – need one
 - Need to make an extensible schema
- Extensions of SCORM that we need to look at for Core SCORM for Schools:
 - Giving assessment feedback
 - Scores against a learning standard
- Content objects need to be shared across modules
- Search and discovery
 - Need to look at access level
 - Authentication based
 - DRM
- How are we going to organize content that is independent of a LMS and how will teachers use this?
- Possibly look at standardized navigation
 - Student presented material – shouldn't have to learn how to navigate
- Have to focus on controlled vocabularies
- Have to look at manifests – confusing when move from one LMS to another
- Link objects to appropriate learning and performance standards
- Data pollution will become worse
- Flexibility in pedagogy and instruction desired
 - Objects and programming
 - Legacy data is an issue
 - Reporting of data – output
 - Need vendor side to assist when importing data



- Frameworks with SIF and SCORM – have to come to agreement on structure
- How do we capture the best practices from school to school?
- Need to develop business and use cases – how are we going to do this?
- What does content interoperability mean?
- Focus on: objective, rationale, solution and cost
- In the proposed content packaging for Core SCORM, need to look at this. Many use IMS CP.
- Need to maintain a global look
- Technology brings the ability to individualize and customize teaching so there is a comprehensive interaction between curriculum, student performance, assessment, etc. SIF and SCORM have pieces to put together and bring the technology and tools to adapt to those situations.

