

Assumptions Document

SCORM 2.0 Project Report

LETSI Technical Roadmap Committee

February, 2009

This document explains LETSI's activities with regard to developing a successor to SCORM, called SCORM 2.0 in this document. It reflects current thinking about alternatives and priorities, both pedagogical and technical. It is our hope that this document provokes constructive comment from the Learning Education Training (LET) community during the first half of 2009 as we define the initial release of SCORM's successor. To this end all members of the LET community are invited to participate in online discussions at www.letsi.org.

This document is based on activities conducted in the second half of 2008. Inputs into this document include 100 white papers from all over the world; dozens of subsequent online discussion threads; a 3-day SCORM 2.0 Workshop in Pensacola in October; and contributions from the following LETSI teams:

- Teaching & Learning Strategies Working Group
- Business Requirements Working Group
- Policies & Procedures Working Group
- Architecture Working Group
- Orchestration Working Group (formerly called Sequencing WG)
- Strategic Communications Standing Committee
- Technical Roadmap Standing Committee

The AICC CMI and ADL SCORM Tradition

There are many approaches to technology-supported learning. The approach taken in the 1990's by ADL SCORM and the precursor AICC CMI specification share a specific set of assumptions about the learning environment:

1. **Managed instruction:** An enterprise learning management system (LMS) stores lessons, schedules students, tracks progress, keeps records, manages access, and handles billing.
2. **Evaluation:** Learner performance, and associated competencies, are measured and recorded as part of the learning experience.
3. **Multiple content sources:** Resources comes from multiple sources.
4. **Internet delivery:** All lesson materials appear in the student's browser.
5. **Interoperable content:** Content should run on any LMS

6. **Interoperable descriptions of learning activities:** Learning activities are described using standardized fields with standardized vocabularies.

Over the last few years, SCORM has become the *de facto* standard around the world to allow content developed in one learning system to be exported and used in all other systems. Many large LET initiatives have used SCORM strategically to modularize learning materials, manage contractors, avoid vendor lock-in, reduce content development and maintenance costs, and achieve long-term sustainability for their projects.

At the same time, many new technologies are finding their way into classrooms, corporate training programs, professional distance learning programs and other LET settings. These new technologies include:

- Immersive learning environments: simulations, games, virtual worlds
- Collaboration tools: wikis, chats, social networking
- Intelligent tutors and other software agents
- New forms of assessment
- Hosted learning activities of all kinds available on the Web.

Also over the last decade, Web software architecture has matured and SCORM programming is starting to feel old and cumbersome. And not only are teaching and technology changing, the market is in transition.

Assumptions about the LET Technology Market

The LETSI community has undertaken an extended discussion about the future of SCORM and of the eLearning marketplace that SCORM serves. We believe that many eLearning communities will undergo rapid technology change in the next decade and that current product lines and business models will change dramatically. The results of this change will hopefully make it possible to realize the long-promised benefits of technology on the way teachers teach and students learn.

Today's technology-supported learning environment typically involves authoring tools for creating learning assets or lessons, a learning content management system (LCMS) for managing learning assets and for more complex authoring activities, and a Learning Management System (LMS) for delivering lessons and tracking student progress. Students work in a Web browser-based environment where lessons are delivered one at a time, to an individual student, possibly with some level of individualization of the sequence of lessons or activities within the lesson.

Group learning activities such as online discussions, chat, and virtual classrooms are handled using wikis, blogs, and Web conferencing solutions that may have LET components but are not themselves specific to LET. Another emerging class of environments consists of tools that support the management of blended learning initiatives.

There are several reasons why this product line structure will rapidly change:

1. **Redundancy:** In many market segments, learning management systems overlap in functionality with existing enterprise systems for talent management, content

management, performance support, technical documentation management and so on. Integration of these systems to allow data interchange will change the landscape for LMS and LCMS systems.

2. **Service Orientation:** Changes in the Web are changing the topology for all technology-supported learning applications. For example, it is no longer valid to assume that an organization will buy or develop learning materials, store them locally in an LCMS, and deliver them through an LMS to a student's PC. Instead, publishers are developing Web-hosted learning activities that students can access directly, the LMS is becoming another "Software as a Service" offering, the role of user-generated content is growing, and learning is taking place on mobile devices.
3. **Emerging Technologies and Modularity:** Today's enterprise learning systems tend to be monolithic and offer a large set of similar functionality. As innovators explore the use of new technologies (online collaboration, social networking, intelligent agents, simulation, games, virtual worlds, etc.), new functionality must be integrated with existing systems. New eLearning initiatives will not need all the functionality offered by existing systems and are likely to demand specialized functionality they do not provide. This will lead to mixing and matching smaller systems to build their solutions.
4. **Private sector innovation:** The private sector has taken a more active role in delivering innovation in e-learning. These innovations addressed the integration of e-learning with larger scoped blended learning activities, synchronous and asynchronous activities, as well as blending innovation with emerging best practices to support them. A new solution must recognize the role of the industry as an embedded feature of an emerging standard.

The learning technology landscape will look very different a decade from now. Key to enabling this level of innovation is the interoperability of specific classes of data across systems, new and old.

Data: People, Resources, Competencies and Activities

The traditional AICC CMI/ADL SCORM approach integrates information about people, resources, competencies, and learning activities in an idiosyncratic way to enable self-paced individual learning using "sharable content objects". The design assumptions behind this approach derive from the 1992 world of AICC CMI characterized by:

1. Pre-Web technology designed for Local Area Networks
2. Primacy of data formats over services
3. Primacy of a single, controlling learning management application

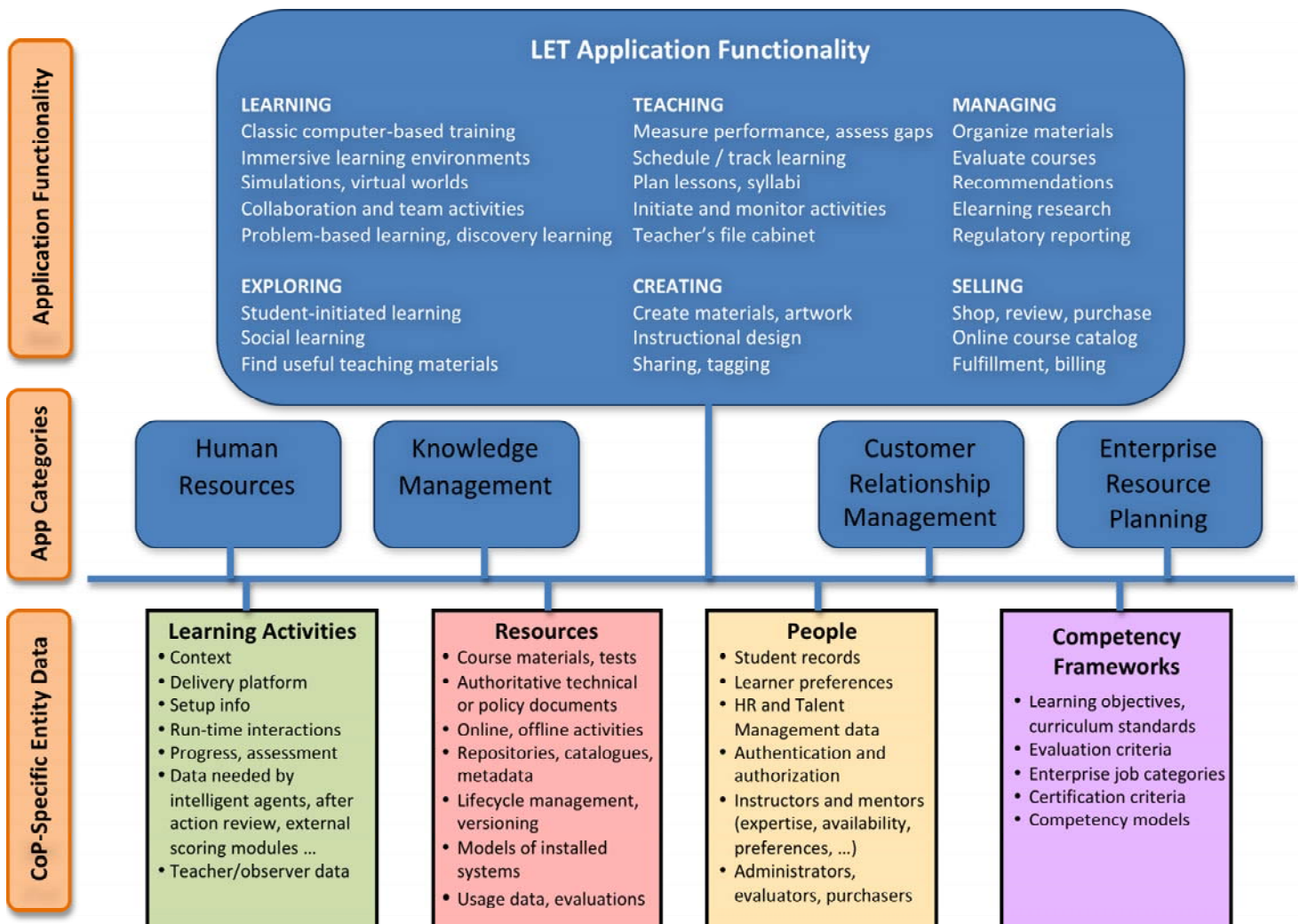
A challenge for SCORM 2.0 is to adapt the successful aspects of this approach to a changed technology context characterized by:

1. Service-oriented approach
2. Need to integrate with multiple applications

3. Significant differences in technical choices across communities of practice

The proposed LETSI approach is to partition the SCORM 2.0 problem space into the four related but distinct service domains of **people**, **competencies**, **resources** and **learning activities**, as illustrated below. This approach will:

1. Emphasize the integration points between domains, which is a tractable problem
2. Mask the internal complexity within domains from uninterested parties
3. Facilitate the integration of existing service frameworks
4. Facilitate the integration of vendor applications
5. Facilitate technology choices at the community of practice level
6. Encourage experimentation within domains without breaking the whole



Learning, Education, Training (LET) Use Case Assumptions

In designing SCORM 2.0 primary consideration will be to the LET use cases that it needs to support. These include:

1. Blended learning and ILT integration
2. Knowledge management and formal learning integration
3. Learner data collection
4. Collaborative learning and assessment
5. Adaptive instruction
6. Adaptive assessment
7. Integration with simulations/games
8. Structural changes without requiring repackaging
9. Technical Requirements derived from LET Use Case Assumptions

SCORM 2.0 support for the desired LET cases entails the following technical requirements:

1. Offline and occasionally connected learning: The learner takes content offline and when a connection is available, performance data is synchronized with system
2. "Out of browser" experiences: Some learning taking place outside of the Web browser, but is integrated with browser-based instruction
3. Data persistence/mining: Enabling and controlling access to data that has been collected.
4. Read-Write-LMS: Allow an LMS to accept inputs about learner performance/status from other sources and to export information about learner performance/status to other systems or resources
5. Business systems integration
6. Alternate devices/formats
7. Roles and rights functionality: Authorization, authentication, rights management
8. Content lifecycle surveillance
9. Assessment interoperability
10. Backward compatibility with SCORM 2004

Architecture Assumptions

1. **Deployment/Delivery Environments:** It is assumed that LET experiences are advancing beyond current methods of development, deployment and distribution. These LET experiences will include capabilities such as simulations, games, mobile learning, virtual classrooms, virtual coaches, and traditional online browser-based and blended solutions. Development, deployment and distribution of these (and other) LET experiences, and the interoperable content upon which they rely, must be supported within any proposed architecture or framework.

2. **Communication Protocols/Models:** In order to support a variety of deployment and delivery environments, it is assumed that the SCORM 2.0 communication model will investigate and include alternative approaches (e.g., SOA, WOA, SaaS) as well as support the current IEEE ECMAScript API communication protocol.
3. **Impending modularization of the traditional Authoring/LCMS/LMS environment:** The LMS/LCMS market in general is moving future development efforts toward a more modularized and flexible integration strategy. It is assumed that SCORM 2.0 will support these modularized “system of systems” approaches and adaptable architectures being implemented by various market segments. In generalized terms the functions are a) Author/Aggregate; b) Store, Manage and Maintain; c) Access/Deliver.
4. **Wealth of existing standardized frameworks and service architectures to potentially serve as base of new SCORM functionality:** A breadth of existing research, development, and standards/specification development is being done in the LET community. It is assumed that SCORM 2.0 will do due diligence and perform the appropriate level of investigation needed to identify, utilize and adapt the appropriate set of existing, mature services, protocols, data models, standards and specifications to meet SCORM 2.0 requirements.
5. **Majority of existing tool and LMS providers will be able to work with service based approaches:** It is assumed that services for communication will NOT create a significant technical barrier for LMS and other system providers.
6. **Learner, content, LMS, and other tools are not necessarily in the same domains or from the same providers:** It is assumed that as various tools move toward service based approaches consumers may opt to mix and match a variety of tools from multiple providers to build an environment that will work best for them.
7. **Dynamic Provisioning of Content and Services:** It is assumed that the architecture needs to support dynamic provisioning, late binding, or at-runtime content or service delivery.
8. **Synchronous / Asynchronous activities are supported:** It is assumed that the architecture will support activities where a few participants are interacting in either a Synchronous or Asynchronous manner, and the environment can support the required persistency connectivity and scheduling to support such activities.
9. **Security:** This draft notes the need to define assumptions about support for security.
10. **Localization:** This draft notes the need to define assumptions about support for localization.
11. **Accessibility:** The draft notes the need to define assumptions about support for accessibility. It is assumed that accessibility encompasses all disabilities that affect access to the Web, including visual, auditory, physical, speech, cognitive, and neurological disabilities. Of equal importance is that web accessibility also benefits

people without disabilities, and this form of accessibility will be supported by the architecture by adopting existing international Accessibility standards.

SCORM 2.0 Orchestration Assumptions

“Orchestration” is the term adopted by the LETSI community to replace the term “sequencing” used in SCORM 2004. Orchestration refers to the way in which LET activities and resources are selected and combined for the purpose of use. Because orchestration is critical to the success of SCORM 2.0, the following assumptions are given in some detail.

1. SCORM 2.0 will retain support for a modular approach to associating LET activities with the resources (e.g. content) that enable those activities. As in SCORM 2004, the association between an activity and a resource will be an ephemeral “late binding”.
2. SCORM 2.0 will retain support for an entity that manages the delivery of LET activities and associated resources. In this context, “managing” refers to managing LET sessions, orchestrating the launch of LET activities with associated resources, and retrieving, routing and persisting relevant data. However, SCORM 2.0 will enable a more flexible approach to management than the LMS-centric approach taken in existing versions of SCORM. There will not necessarily be a single managing entity. An entity fulfilling a management role might also be managed by another entity, allowing entities to form management hierarchies.
3. SCORM 2.0 will retain support for the “CMI data model” (IEEE 1484.11.1-2004) as the basic information used to manage a LET activity and measure learner performance. Because SCORM 2.0 anticipates support for LET activity and resource types beyond those addressed by the IEEE standard, LETSI may recommend updates to the IEEE standard and may also recommend the adoption of additional data models.
4. Resource aggregation refers to a digital aggregate of resources for LET applications. A resource aggregation may contain one or more orchestrations. A resource aggregation is typically used to support the interchange of digital resources between systems. “Content packaging” is a form of resource aggregation.
5. SCORM 2.0 must anticipate that orchestration will take place in a variety of technical and pedagogical contexts. Orchestration may be statically specified or dynamically generated, may involve multiple types of LET activities and resources, and may rely on a variety of hardware platforms.
6. SCORM 2.0 anticipates support of the ISO/IEC standardized version of IMS Content Packaging as a resource aggregation format. SCORM 2.0 anticipates a requirement to allow communities of practices to adopt alternate resource aggregation formats. The Resource Aggregation Model for Learning, Education, and Training (RAMLET) under development by the IEEE Learning Technologies Standards Committee SCORM may be a technology that LETSI can use to support this goal in a principled way.
7. SCORM 2.0 efforts will focus on two parallel approaches to orchestration: the first approach (“declarative”) anticipates using a simple XML pseudo-script that may be

included in a resource aggregation. The second approach (“delegated”) anticipates that orchestration is delegated to and handled internally by entities providing specialized orchestration services. SCORM 2.0 anticipates that these two approaches may be combined within a single orchestrated learning experience.

8. Orchestration may require typed LET activities and resources, so that particular forms of orchestration can specify and will only apply to certain combinations of LET activities and resources types. The combination of orchestration services with typing opens the opportunity for creating specialized orchestration templates.
9. Entities will be able to share data with each other, both synchronously (e.g. by runtime messaging) and asynchronously (e.g. by using a shared management service to persist commonly understood data).
10. Managed entities and orchestration services will have access to a wider range of primitives allowing them to interrogate their managing service for details of e.g. user role, competency, or the state of other entities.
11. The requirement for backwards compatibility with SCORM 2004 and IMS Simple Sequencing should be addressed at an appropriate time but should not be allowed to constrain the development of a new architecture.

Assumptions about LETSI Deliverables

LETSI considered several options for the kinds of deliverables it could produce to support the creation of SCORM 2.0. These included:

1. Requirements: Collect & compile requirements and then pass them to standards development organizations to implement.
2. Specifications: New technical specifications & supporting documentation.
3. Reference Model(s): Create reference models as done in ADL SCORM by integrating and profiling existing standards
4. Software (community source): Use a community source development effort to create software deliverables that satisfy the LETSI requirements.
5. Specifications/Software (sponsored development): Create specifications and sample software using an in-house team instead of open-source volunteers.

Considering these options, LETSI reached the following conclusions:

1. Since inception LETSI has taken the position that it will not develop specifications.
2. The traditional development process, where specifications are finalized by Standards Development Organizations (SDO), then implemented independently by systems developers, and then tested by users moving learning materials between those systems, is no longer effective. Ambiguities and inconsistencies are sometimes not identified for years after the specification is finalized. Meanwhile new technical developments can't find their way into the interoperability models, once the specification is released.

3. **LETSI will focus on gathering requirements, determining which requirements are broadly shared across LET communities and are of high priority, and developing community source software solutions to support timely and consistent adoption of appropriate technical specifications.**

Assumptions about LETSI Software Development

1. LETSI will follow a community source approach.
2. LETSI will follow an agile software development process focused on small, modular pieces.
3. As practicable, LETSI will support international standards in the software it develops and will maintain active liaisons with the IEEE Learning Technology Standards Committee and ISO/IEC JTC1 SC36.
4. As practicable, LETSI will leverage and integrate existing technologies rather than reinventing comparable capabilities.

Assumptions about LETSI Continuity with ADL Activities

LETSI will consider and as practicable support the following activities that ADL performed in developing SCORM:

- Coordinate across all LET markets with organizations developing specifications
- Provide documentation for implementers
- Manage releases
- Provide sample software
- Host events for implementers to assess interoperability (ADL Plugfests)
- Promote the adoption of standards by implementers and policy makers
- Enable conformance testing
- Maintain a conceptual framework and roadmap

Assumptions about LETSI Governance

The LETSI governance model defines roles for both organizations and individuals.

Managing Sponsors: Major contributors to LETSI elect a Board of Directors that determines LETSI's bylaws, procedures, fees, standing committees, officer nominations, and so on. The current minimum fee is \$10,000/year.

Advocate Sponsors: Sponsors not interested in LETSI's governance can nevertheless participate fully in the technical activities and management of the Working Groups. The current fee is \$3000/year, or \$1000 for non-profit organizations.

Liaison: Sister organizations that are not in a position to sponsor LETSI can establish formal liaison and document sharing relationships.

Individual Members: Individuals can lead and vote in Working Groups, run for office, and vote for LETSI's officers. Membership costs only \$100/year.

Participants: LETSI is determined to be an open and transparent organization. The website and wiki are public. If you sign up at the wiki, which is free, you will be able to add your voice to the discussions.

Assumptions about the LETSI Process

The LETSI process will:

1. Maintain an open forum and a transparent process that includes educators, technologists and policy makers from all LET communities of practice.
2. Assure to the best of our ability that LET interoperability standards endorsed by LETSI have no issues about intellectual property ownership and are unencumbered, royalty-free, and freely customizable by communities of practice.
3. Follow a modular architectural approach so that community-specific specializations and innovations can be integrated easily and, if successful, migrated across communities.
4. Support communities of practice in establishing appropriate conformance regimes regionally or in vertical markets.
5. Support a community effort to develop a library of royalty-free software tools and components which will allow quicker, less expensive, and more consistent adoption. In a rapidly evolving eLearning environment, an interactive approach with shorter release cycles is necessary.
6. Assure through compatibility and migration strategies that adopters' investments in earlier versions of SCORM are protected.

Next Steps

Feedback on the ideas, assumptions and proposals in this document are solicited from all interested parties. Please email to scorm2@letsj.org or participate in the ongoing discussions at www.letsj.org.

LETSI is very interested in having meetings (in person or virtual) with interested groups who would like to discuss this document and its implications. Again, please contact scorm2@letsj.org.