A Comprehensive Architecture for Learning

Universal Learning Format
Version 1.0
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Universal Learning Format, Version 1.0

Revised: October 23, 2000

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A Comprehensive Architecture for Learning

This document introduces the Universal Learning Format, a modular set of XML-based formats developed by Saba for capturing various types of e-learning data, including online learning content, catalogs of learning resources, certification libraries, competency libraries, and learner information.

It includes the following sections:

- E-learning Marketplace
- Universal Learning Format
E-learning Marketplace

The digital revolution and the emergence of today’s knowledge economy are creating a new, global marketplace for electronic learning. By connecting an open forum of learning providers with an enormous community of potential learners, this e-learning marketplace represents a tremendous business opportunity. However, there are a variety of technical challenges which complicate the development and publication of successful e-learning products. While current web and e-learning standards help to overcome some of these challenges, the existing standards do not address the full range of business needs. To address these needs, Saba offers a set of standard XML formats for describing e-learning content. Saba’s **Universal Learning Format** embraces and extends the best of the existing and emerging web and e-learning standards to provide a comprehensive architecture for e-learning.

The Universal Learning Format is a framework for enabling the cross-industry exchange of learning content such as education catalogs, course content, competency libraries, certification tracks, and learner profiles. It includes a set of XML-based formats for creating robust, reusable XML-based documents. Using this framework, learning providers can seamlessly exchange a variety of learning content as well as make their learning content universally available for search and discovery.

The Universal Learning Format is based on the work done by standards bodies such as Instructional Management System (IMS), Advanced Distributed Learning (ADL), and the Institute of Electrical and Electronic Engineers (IEEE). It embraces and extends the existing online learning standards advanced by these organizations and is architected to take advantage of new standards as they emerge.

Background

Learning providers today have the opportunity to use the ubiquity of the web to reach the broadest possible pool of learners. However, the competition for attention and audience in this new, online world creates a variety of unique challenges. In particular, learning providers are faced with two essential challenges:

How can I leveragemy existing learning assets for maximum **reuse**?

How can I ensure the **visibility** of my learning offerings to the greatest number of interested learners?

**Reuse** is important for recouping existing investments in libraries of learning content. Content originally designed for traditional classroom use or stand-alone PCs must now be deployed across a variety of media and within a variety of environments. The challenge is compounded by the variety of competing and often incompatible systems available for managing and delivering online learning.
Visibility is important for fully exploiting the online medium. Team leaders and learners must be able to find learning content easily and accurately before they can purchase it. Even assuming appropriate learning can be found successfully, learning offerings must still compete for attention with the overwhelming amount of content and information available on the web.

Standards can help address issues of reuse and visibility by ensuring interoperability among diverse software systems and vendors. Web standards in particular focus on defining common frameworks for structuring, describing, and viewing web content. The Universal Learning Format adopts these web infrastructure standards into its e-learning framework.

General web standards alone, however, are not enough. They need to be augmented with industry-specific guidelines and follow-on standards in order to be applied effectively to vertical domains such as e-learning. As case in point, the online learning industry needs to extend general-purpose content specifications to include specific descriptions relevant to learning content, such as questionnaires and competencies. In addition, standards need to enable quick deployment in order to bring tangible benefit and real solutions to the problems they strive to solve.

Saba is addressing this dilemma with forward-looking specifications that anticipate emerging requirements for industry standards. Universal Learning Format defines the standards needed by learning providers to ensure reusability and visibility for all their learning assets, ranging from course and catalog information to competency libraries and CBT content. It incorporates and consolidates the “best of breed” among existing standards, augmenting them where appropriate to provide a complete solution today.

The Reuse Challenge

A learning provider’s library of learning material is a core asset. To maximize the return on this asset, providers need the ability to reuse and distribute this material.

The need for reuse is particularly pressing in the online world, where learning materials consist not only of traditional courseware and textbooks but also of web pages, multimedia presentations, and fully interactive multimedia CBTs. Complicating matters is the abundance of competing products and frameworks available for building and delivering these various forms of online learning.

With existing learning libraries limited by older, proprietary content formats, the challenge for learning providers is to choose the right formats and frameworks so learning content can be converted once and then applied to the variety of delivery media found in the networked world. In order to keep costs down when adopting new web formats or delivery mechanisms, it is important to select a framework that is extensible and can accommodate evolving requirements. To avoid vendor lock-in, the tools and utilities you select for authoring, translating, and managing learning content should be widely available and non-proprietary.
XML

The issue of reusability applies to practically all forms of web content. Recognizing problems with reuse as one of the major obstacles to the continued growth of the web, the World Wide Web Consortium (W3C) issued in February of 1998 its Recommendation for Extensible Markup Language (XML), a new web language for representing a variety of web content using a consistent structure and syntax.

Content expressed using XML can easily be reused and repurposed via standard parsers and transformation tools. Furthermore, XML has already seen widespread adoption and support within the computer industry and in a variety of servers and authoring tools. These traits make XML the ideal basis for universally reusable content.

However, while XML defines the broad parameters for structured data on the web, it says nothing about the specific format of data used in particular applications. These domain-specific applications of XML are left to the individual industries to define and standardize. In particular, the e-learning industry has just begun to define the XML-based formats used to describe the various categories of e-learning data.

Saba has adopted XML as the universal format for information exchange within our learning architecture. The Universal Learning Format adopts “best-of-breed” XML formats where they exist, and defines the direction for additional XML formats where they are needed. Saba relies on XML to ensure that its content partners will be able to achieve maximum interoperability and reuse of their XML-based content.

For more information on XML, see the W3C’s XML home page at:
http://www.w3.org/XML/

The Visibility Challenge

The ability to publish learning catalogs and content to the web does not go far enough to meet business requirements if learners cannot find a learning offering when they need it. Blindly publishing learning catalogs via traditional web pages is no longer effective. Instead, success in the e-learning marketplace hinges on ensuring that the unique strengths and benefits of a particular learning offering are successfully conveyed to the right set of potential learners.

For example, consider the advantages of searching for learning based on value-added descriptions such as target competencies, instructor qualifications, course prerequisites, and third-party ratings. Furthermore, imagine searches that automatically take into account the existing skills and learning preferences of the individual learner.

Sophisticated search techniques such as these are far more effective in helping learning providers convey to customers the unique strengths and benefits of their learning content. However, they also require far more sophisticated technology than the current generation of web search engines, focused as they are on traditional keyword matching.
RDF

Like the reuse challenge, resource visibility and discovery is an issue that affects nearly all forms of web content. To help with the problem of visibility, the W3C defined a technology called Resource Description Framework (RDF) in a February, 1999 W3C Recommendation. RDF is designed to represent metadata, descriptive data used for identification and search, about any web resource.

RDF is powerful enough to capture complex, structured metadata, allowing extremely sophisticated searches. It is also inherently distributed, taking advantage of the decentralized nature of the web to allow metadata descriptions to exist in a networked fashion.

Much like XML, RDF also requires domain-specific definitions of the relevant metadata for a particular industry. While much work has been done by standards bodies within the e-learning industry to define learning metadata, little has been done to structure this metadata as web-compatible RDF.

Saba has adopted RDF as our universal format for resource description and discovery. The Universal Learning Format employs RDF descriptions for learning content, based on existing metadata standards where possible. Saba relies on RDF and metadata querying to enable sophisticated searches by combining learning catalogs and the profiles of individual learners to ensure visibility of the most appropriate learning content for each learner. Furthermore, the Universal Learning Format builds on the distributed nature of RDF to provide a unified view of networked content, creating a truly worldwide marketplace for learning.

For more information on RDF, see the W3C’s RDF home page at:
http://www.w3.org/RDF/
Universal Learning Format

Choosing to describe your learning-based resources in any one preferred file format carries the risk of vendor lock-in and obsolescence. To minimize this risk, it is important to select a format that adheres closely to standards. However, ongoing efforts to develop learning standards are splintered and highly specialized and do not yield a comprehensive solution.

To address this problem Saba has developed the Universal Learning Format, a set of XML-based formats for capturing various types of e-learning data, including content, catalog, certification, competency, and learner profile information.

Universal Learning Format is intended for use by authors and integrators of learning-based resources to describe learning data in a format that allows universal portability, including import into Saba Learning Enterprise using the XML Bulk Import utility.

The formats comprising Universal Learning Format are based on and can be mapped (using style sheets) to and from IMS, ADL, IEEE LTSC, Dublin Core, and other specifications. Saba strongly believes in the value of open standards and is committed to maintaining compliance with all industry standards.

The table below lists and describes the component formats of Universal Learning Format:

<table>
<thead>
<tr>
<th>Format</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catalog Format</td>
<td>Use to import online course content</td>
</tr>
<tr>
<td>Learning Content Format</td>
<td>Use to import competency library definitions</td>
</tr>
<tr>
<td>Competency Format</td>
<td>Use to import certification library definitions</td>
</tr>
<tr>
<td>Certification Format</td>
<td>Use to import catalog entries to populate the Learning Catalog</td>
</tr>
<tr>
<td>Profile Format</td>
<td>Use to import learner profile data</td>
</tr>
<tr>
<td></td>
<td>Saba provides two Profile formats, one for importing profile data</td>
</tr>
<tr>
<td></td>
<td>for internal employees and another for importing profile data for</td>
</tr>
<tr>
<td></td>
<td>clients.</td>
</tr>
</tbody>
</table>
The following diagram illustrates the architecture of Universal Learning Format:

![Universal Learning Format Diagram]

**Figure 1:** *Universal Learning Format*
Catalog Format

Catalog Format represents all information necessary to exchange catalogs of learning resources, focusing in particular on the data needed to locate and discover learning resources. It represents all catalog information as XML/RDF metadata, and incorporates several existing metadata standards, including:

- **IMS Learning Objects Metadata (LOM)** — A set of metadata elements for describing learning resources. IMS is a standards body focused on Internet-based learning technology. Its metadata specification is a subset of compatible work by the IEEE Learning Technology Standards Committee.

- **Dublin Core** — A set of metadata elements defined by a body of experts in library and bibliographic science. Dublin Core defines a set of 14 attributes, such as **title** and **author**, which are broadly applicable to practically any document on the web.

- **vCard** — A set of metadata elements defined by the Internet Engineering Task Force (IETF) as a standard for representing information about people and organizations such as that which is profiled on a common business card.

Catalog Format also addresses business needs not met by IMS metadata alone. It specifies the full set of data needed for online learning catalogs by defining price and ordering information, schedules and locations, and provided competencies.

By incorporating existing standards, Catalog Format ensures broad compatibility with both LOM data and the variety of RDF and Dublin Core tools for working with web metadata. By addressing critical unspecified areas, it captures all the information needed to create an effective model for publishing catalogs of learning resources. As a result, by employing Catalog Format, a learning provider can create a single course catalog that accomplishes all of the following:

- Establishes relationships with competency libraries for performance tracking
- Enables searches on critical metadata such as copyrights, authorship, keywords, and technical requirements
- Enables ordering of products using a variety of delivery modes and currencies
- Ensures compatibility with standard web search engines

For more information on Catalog Format, see “Catalog Format Specification”.
Learning Content Format

Learning Content Format (LCF) is an interchange format for online learning content. Several standards related to online content and courses are currently in the process of being defined, including IMS Packaging Format, IMS Question & Test, and ADL Course Structure Format. LCF adopts these standards and consolidates their best features into a stable and comprehensive format for describing online learning content.

LCF defines the structure and contents of online educational courses and content. It unifies all the information required for defining online learning, including:

- Flexible table of contents definitions
- Local and remote references to content resources
- Course structure and objectives
- Assessments for a variety of purposes, including tests, evaluations, and surveys

With LCF, a learning provider can structure learning resources as reusable chunks, then flexibly recombine them to create new and modified courses.

For more information on Learning Content Format, see “Learning Content Format Specification”.

Competency Format

Competency Format is an interchange format for competency-related information. A competency is a skill, knowledge, or behavior that can be measured, calculated, acquired, specified, or tested. In order to maximize human performance, organizations need to effectively track and manage competencies held or required by people throughout the extended enterprise. Successfully modeling an organization’s competencies typically requires the ability to reuse and refine existing competency models.

Competency Format defines the structure of competency categories, levels, profiles, and behaviors. It can represent competency models across a variety of roles and industries, and allows competencies to be associated with other resources, such as learning offerings described in Catalog Format. By using Competency Format, a learning provider can create a web-based competency library that can be easily referenced and reused by a variety of online training.

For more information on Competency Format, see “Competency Format Specification”.
Certification Format

Certification Format is an interchange format for certification-related information. A certification is a group of learning offerings that a learner must complete in order to gain a certification or be qualified in a particular technology, educational area, or field. Organizations need to track learner certifications for a variety of reasons, ranging from standard business procedures to customer and legal requirements. The ability to define and reuse standard certification models is critical to ensuring this compliance. Certification Format addresses the need for a standard way to exchange certification-related information.

Certification Format defines the structure of certification paths. A certification path represents the set of educational offerings and competencies needed to achieve a given certification. By using Certification Format, a learning provider can create a web-based certification library that easily integrates with other online formats, including catalogs and competencies.

For more information on Certification Format, see “Certification Format Specification”.

Profile Format

Profile Format is an XML-based representation for describing learner profile information. Learner profiles comprise a variety of data about learners, including personal and job information, learning history, goals and plans, and held competencies and certifications. Profile Format captures this information in an XML-based format using RDF to define metadata for describing learners. Profile Format incorporates several existing metadata standards, including the Dublin Core and vCard, which ensures compatibility with existing person/profile descriptions.

By employing Profile Format to describe the learners in a system, learning providers can extend their learning management architecture to support all of the following:

- Searches of critical learner metadata such as name, title, role, learning results, and held competencies and certifications
- Tracking the learning history of individual learners
- Assignment of competencies (with proficiency levels) and certifications to learners
- Assignment of learning goals to learners and tracking of progress towards fulfillment of those goals
- Creation of distributed profiles, where portions of a learner's profile are provided by different sources
- Compatibility with standard web search engines

For more information on Profile Format, see “Profile Format Specification”.
Integration of Universal Learning Formats

The formats defined by Universal Learning Format integrate to provide a full range of capabilities for associating learning offerings with competencies and certifications, updating learner profiles, and querying all types of e-learning data.

Specifically, the interdependencies between the XML formats include:

- **Catalog Format** provides a metadata representation for “cataloging” information described in Learning Content Format, Competency Format, and Certification Format documents. Catalog entries in a Catalog Format document can refer to a learning resource, that is, a Learning Content Format document, a competency library, that is, a Competency Format document, or a certification path, that is, a Certification Format document. Thus, Catalog Format provides a consistent way of describing common metadata about all types of learning resources.

- You can embed properties from the Competency RDF schema within a Catalog Format document in order to define the competencies provided by a particular learning offering. This enables users to search for all courses providing a specific competency.

- **Profile Format** provides a metadata representation for associating information described in Catalog Format, Competency Format, and Certification Format documents with a learner profile. You can associate completed and planned learning with a learner profile by referencing a Catalog Format document. You can associate held certifications with a learner profile by referencing a Certification Format document. You can associate held competencies with a learner profile by referencing a Competency Format document.

- Learning Content Format, Competency Format, and Certification Format all support a `metadataRef` attribute that references a catalog entry in a Catalog Format document. This provides a mechanism for associating a learning offering, competency, or certification with metadata for that object.

- Additionally, Certification Format can reference learning offerings (defined in a Catalog Format document), competencies (defined in a Competency Format document), or other certifications as options for completing a step along the path to achieve the certification.
The following diagram represents the network of interdependencies among the XML formats defined by the Universal Learning Format:

![Diagram of interdependencies among Universal Learning Format documents]

**Figure 1-1: Interdependencies Among Universal Learning Format Documents**

**Developer Kits**

To enable learning providers to rapidly transform existing learning content, Saba offers a set of Learning Content Developer Kits. These toolkits provide a set of tools and utilities to help learning providers migrate their existing learning assets to Saba’s XML-based formats. By performing this one-time migration, learning providers can be confident that their learning libraries are structured for maximum reuse and visibility.

**Conclusion**

The Universal Learning Format fills the gap left by emerging and incomplete industry standards. Learning content based on the formats defined in the Universal Learning Format is easy to author and compliant with existing standards. It is reusable across a broad range of e-learning tools and systems, and it is readily visible to the right set of learners.

In sum, the Universal Learning Format enables learning providers to fully participate in and benefit from the emerging e-learning marketplace. As the business world embraces this open, flexible, and ultimately more efficient networked marketplace for learning, Saba’s content partners will be well-positioned to fuel their success and growth.