



Learning Registry Index Solution – RFP Guidance

SLC Project Document

January 31, 2012

Copyright © 2012 Shared Learning Collaborative, LLC (SLC). All Rights Reserved.

This document and the information contained herein is provided on an "AS IS" basis and SLC DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT THE USE OF THE INFORMATION HEREIN WILL NOT INFRINGE ANY RIGHTS OR ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Change Log

Date	Version	Name	Change Summary
01/27/2012	V1	PWenzel	Initial draft submission to SLC.
01/31/2012	V2	PWenzel	Draft for additional review.
01/31/2012	V3	PWenzel	Draft for publication.

Table of Contents

Change Log	2
Table of Contents.....	3
Table of Figures	4
1. Introduction	5
1.1. Document Structure	5
2. Overview.....	6
2.1. The Learning Registry and LRMI.....	6
2.2. The Learning Registry Index Solution.....	7
2.3. Key Use Cases of the Learning Registry Index Solution.....	7
2.3.1. Use Case A: Individual Learning Object Identifier Resolution	8
2.3.2. Use Case B: Scoped Learning Registry Index Query	9
2.3.3. Use Cases C-J: Learning Registry Announcements.....	9
3. Integration Approach.....	11
3.1. Application Categories	11
3.1.1. SLI-Compatible Applications	11
3.1.2. Content Publishing Applications.....	12
3.1.3. Instructional Improvement Systems	12
3.2. Integration with Learning Registry and Learning Registry Index Solution	12
3.2.1. The Learning Registry Index Solution Interface.....	12
3.2.2. The Learning Registry Interface	12
4. Configuration Options	13
5. Standards and Technologies.....	14
5.1. Standards and Technologies.....	14
5.2. Related and Affiliated Efforts	14
6. Constraints.....	16
6.1. Learning Registry Events	16
6.1.1. Learning Registry Bindings	16
6.1.2. Other SLC Ecosystem Assertions	16
6.2. “Authoritative” Source for Learning Objects.....	16
6.3. Learning Object Metadata	16
Glossary of Terms.....	17

Table of Figures

Figure 1: The Learning Registry	6
Figure 2: Learning Registry Index Solution in the K-12 Learning Ecosystem (SLI)	7
Figure 3: Learning Object Metadata Retrieval	8
Figure 4: Learning Resource Scoped Query	9
Figure 5: Functionality of the Learning Registry Index Solution	11

1. Introduction

This document is part of a series of documents that contain specifications for application software and system procurement where integration with SLI technologies is required. This *Draft Document* provides a draft view of a future SLC released document and is intended to be referenced in vendor RFPs. As of this writing, the SLI standards are still in development. The technical information in this document should be considered preliminary.

This document provides a description of a component of the SLI application ecosystem called the Learning Registry Index Solution, and is intended to be referenced by vendor RFPs for state- and district-operated applications such as Learning Management Systems (LMS) and Instructional Improvement Systems (IIS).

1.1. Document Structure

This document is divided into five sections:

- **Overview** – Provides a broad description of the SLI technology upon which the requirements are based, including use case summaries.
- **Integration Approach** – Describes one or more approaches for integrating with a core SLI technology.
- **Configuration Options** – Discusses areas of potential configurability.
- **Standards and Technologies** – Identifies applicable standards and technologies and specifies their applicability to the component described. This section also identifies related projects, initiatives, and organizations.
- **Constraints** – Specifies constraints and exclusions that a proposed solution must satisfy.

2. Overview

This section provides an overview of the Learning Registry Index Solution, its relationship and integration with the SLI and the SLI ecosystem of compatible and external components.

The Learning Registry Index Solution is a component of the SLI that provides data about Learning Objects to SLI-compatible applications. *Learning Objects* include both *Learning Objectives* (i.e. Learning Standards such as Common Core State Standards and K-12 education standards of individual states) and *Learning Resources* (such as learning materials and assessments available from content publishers).

2.1. The Learning Registry and LRMI

Information about Learning Resources is obtained from the Learning Registry. The Learning Registry is a joint technology effort of the US Departments of Education and Defense, supported by public, private and nonprofit members who participate in various roles as educational content publishers, indexing and search providers, and content consumers. Based on an open framework, the Learning Registry allows anyone to subscribe to, and make use of, the information flowing through it. The Learning Registry Index Solution is dependent upon the Learning Registry's functionality, and upon content publishers who must populate it with properly formatted descriptions of their available resources. This information enables SLI-compatible applications to discover content relevant to their users.

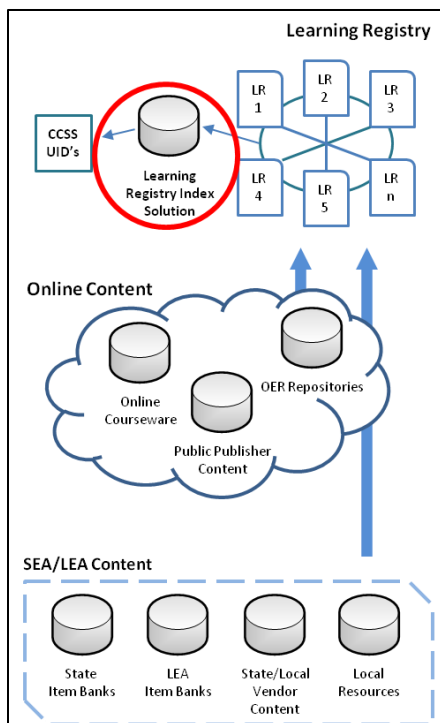


Figure 1: The Learning Registry

To facilitate discovery of content descriptions, the Learning Registry Metadata Initiative (LRMI) is in the process of creating common metadata properties that describe and distinguish Learning Resources. The current (as of this writing) published version of this set of metadata properties is available at the link shown in Table 2: Related and Affiliated Efforts. Content held in repositories, such as publisher databases, will be tagged with LRMI-defined metatags, and aligned with the Common Core State Standards (CCSS).

Content descriptions are introduced into the Learning Registry via “announcement” messages sent through a Distribution Node. Learning Registry nodes, including the SLI Learning Registry Index Solution, may record the information about Learning Resources in local data stores, for later recall. The registry will include metadata such as resource locations, LRMI-specified classification tags, and activity-related tags. The Learning Registry and its associated data flows are depicted in Figure 1.

2.2. The Learning Registry Index Solution

The SLC will build a Learning Registry Index Solution aligned with the Common Core, so that SLI-compatible applications can use it to discover aligned content meeting specific criteria. See the figure below, for a representation of the Solution and its relationship to the entire SLC ecosystem of services and applications.

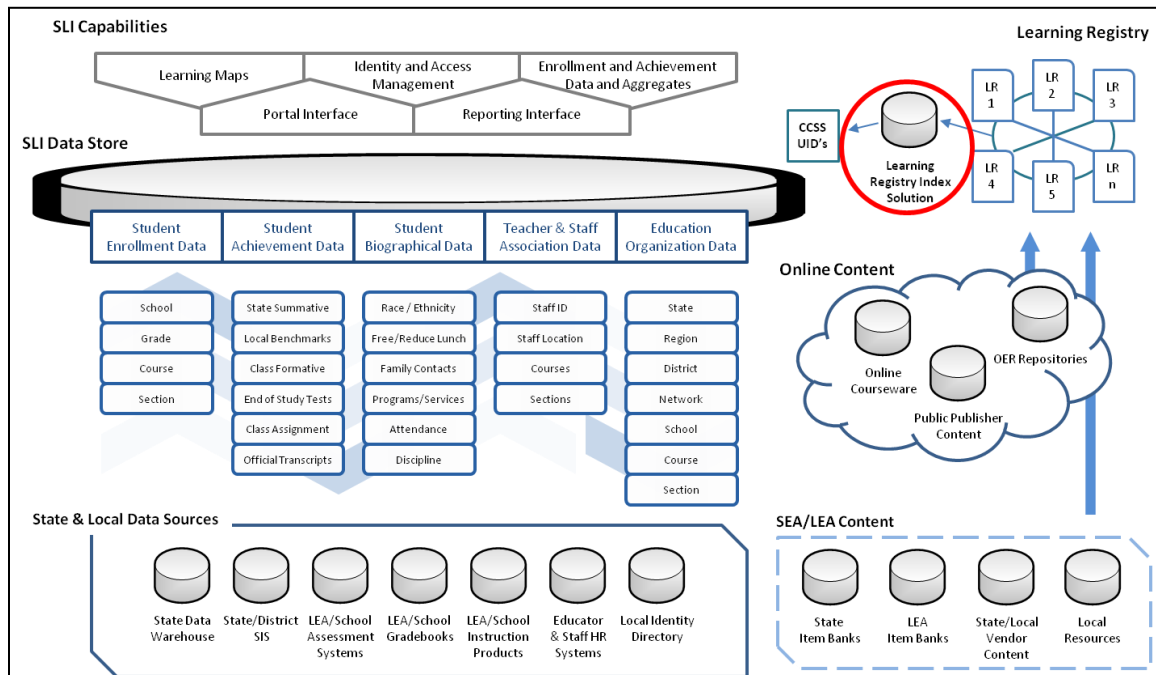


Figure 2: Learning Registry Index Solution in the K-12 Learning Ecosystem (SLI)

In addition to Learning Resources, SLI applications will require *Learning Objectives*. It is expected that the Common Core will “announce” updates to its Learning Objective standards to Learning Registry participants, in much the same way as Learning Resources are announced. Further, state organizations will “announce” relationships to the Common Core via this network. Learning Objectives are related to Learning Resources via metadata tagging, as described above.

2.3. Key Use Cases of the Learning Registry Index Solution

There are two key use cases for direct usage of the Learning Registry Index Solution by SLI Applications:

- A. Individual Learning Object Identifier Resolution
- B. Scoped Learning Registry Index Query

These use cases are described in detail, in the following sections.

In addition, it is expected that some SLI Applications, depending on their intended functionality, will contribute information to the Learning Registry network as a whole, and therefore indirectly feed useful metadata back into the Learning Registry Index Solution.

In this capacity, such applications, which would require the use of a Learning Registry Distribution Node, might be expected to:

- C. Announce usage of resources by an SLC Education Organization
- D. Announce applicability of resources for an SLC Education Organization
- E. Announce the effectiveness of resources
- F. Announce relationships between state standards and the common core
- G. Announce teacher ratings of content for an SLC Education Organization
- H. Announce updates to content
- I. Announce LRMI-based tagging of content
- J. Announce changes to the Common Core

The next sections describe the first, direct interactions with the Learning Registry Index Solution in more detail.

2.3.1. Use Case A: Individual Learning Object Identifier Resolution

SLI-compatible applications may require retrieval of information about a single Learning Objective or Learning Resource, described by its associated metadata from the Learning Registry Index. These Applications will submit the Learning Object's Identifier (a URL) to the Learning Registry Index Solution, which will return the associated Learning Object Metadata.

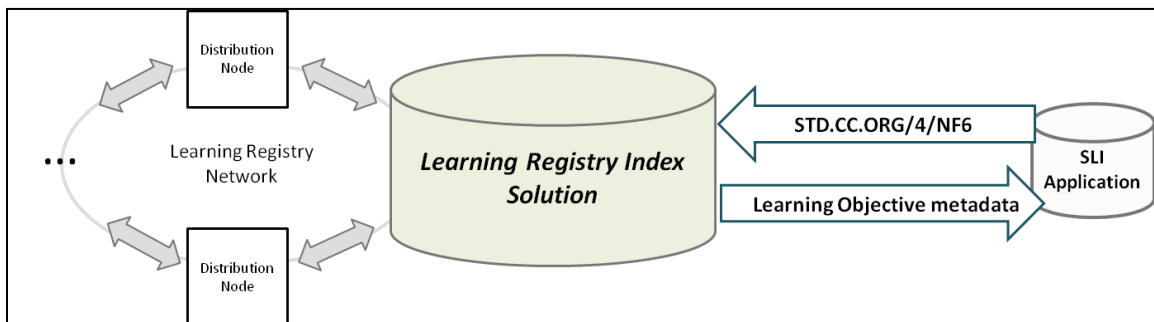


Figure 3: Learning Object Metadata Retrieval

In this use case example, an SLI application retrieves Common Core Standard NF6 for 4th grade, based on the URL identifier STD.CC.ORG/4/NF6. (Note that this example is not an actual URL, and is used for illustration only.) The Learning Registry Index Solution returns a document describing the standard, including associated RDF-tagged metadata, in a standard XML or JSON format. The SLI application could then use a URL tag embedded in the document to retrieve the normative Learning Object data from its authoritative Content Repository (see the section entitled “Authoritative” Source for Learning Objects).

2.3.2. Use Case B: Scoped Learning Registry Index Query

Scoped Learning Registry Index queries will be used to find any number of matching Learning Objects in the Learning Registry Index which fulfill a set of constraints specified by the query. In the use case example below, an SLI-compatible application performs a query containing pre-defined filter predicates, to find all Learning Resources in the Learning Registry Index that fulfill the Learning Objective used as an example above, STD.CC.ORG/4/NF6.

It is expected that events in the network of Learning Registry nodes that have been of type 'Learning Resource "123" is aligned with Learning Objective STD.CC.ORG/4/NF6' have been captured by the Learning Registry Index, which returns a list of these Learning Resource descriptions and metadata. These may be represented as RDF-tagged XML. The schema used to describe Learning Resources, as well as examples, may be found on the LRMI documentation website (see links in Section 5.2).

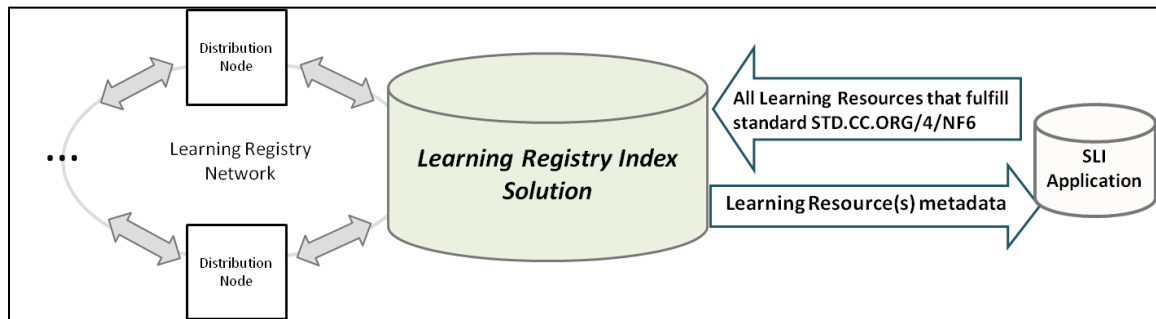


Figure 4: Learning Resource Scoped Query

Additionally, *Filter Predicates* must be supported, and will contain at a minimum:

1. Education Organization Identifiers
2. Common Core Learning Objective Identifiers

Other predicates to support queries making use of data collected by announcements to the Learning Registry, as in the remaining use cases, will be defined at a future date.

2.3.3. Use Cases C-J: Learning Registry Announcements

The remaining use cases, which involve announcements to the Learning Registry network about Learning Resources and Learning Objectives, are optional, but are included here in order to demonstrate the types of extended metadata that will be supported by the Learning Registry Index Solution. Examples are presented as English-language statements, and are for illustrative purposes only. The precise format of the metadata will be published at a later date.

C. Announce usage of resources by an SLC Education Organization

Example: "Ms. Harrison's 4th grade class has been assigned to use Resource XYZ."

D. Announce applicability of resources for an SLC Education Organization

Example: "The State has determined that Assessment XYZ may be used to fulfill Learning Objective STD.CC.ORG/4/NF6."

E. Announce the effectiveness of resources

Example: “A State analysis determined that Resource XYZ was 90% effective in helping students fulfill Learning Objective STD.CC.ORG/4/NF6.”

F. Announce relationships between state standards and the Common Core

Example: “State A’s standard STD.STATE.ORG/E/23 is equivalent to Common Core standard STD.CC.ORG/4/NF6.”

G. Announce teacher ratings of content for an SLC Education Organization

Example: “Ms. Harrison rates Resource XYZ a 9 out of 10 for quality. (Her specific comments about it are included.)”

H. Announce updates to content

Example: “Publisher A has released a revision to Resource XYZ; the updated content can be found at a given URL.”

I. Announce LRMI-based tagging of content

Example: “Resource XYZ has been tagged with the following LRMI-based metadata (included in announcement).”

J. Announce changes to the Common Core

Example: “The Common Core has defined a new requirement, identified as STD.CC.ORG/16.”

Additional use cases involving other types of metadata are possible, and will likely be defined in the future as needed.

3. Integration Approach

Depending on the type of application being developed, there are different integration points and considerations to be taken into account. We identify three broad categories of applications, and highlight the major requirements and integration considerations of each.

3.1. Application Categories

The three main categories of applications related to the Learning Registry Index Solution are SLI-Compatible Applications, Content Publisher Applications, and Instructional Improvement Systems.

3.1.1. SLI-Compatible Applications

SLI-Compatible applications which make use of the Learning Registry Index Solution must be able to handle and process metadata-tagged documents, as well as “understand” a subset of the metadata taxonomy that is relevant to the application in question. The taxonomy may include LRMI-defined tags, and optionally SLC-defined tags. Processing metadata includes the ability to make scoped queries to resolve references to Learning Objects.

The figure below illustrates the relationship between SLI-enabled Applications and the SLI’s Learning Registry Index Solution.

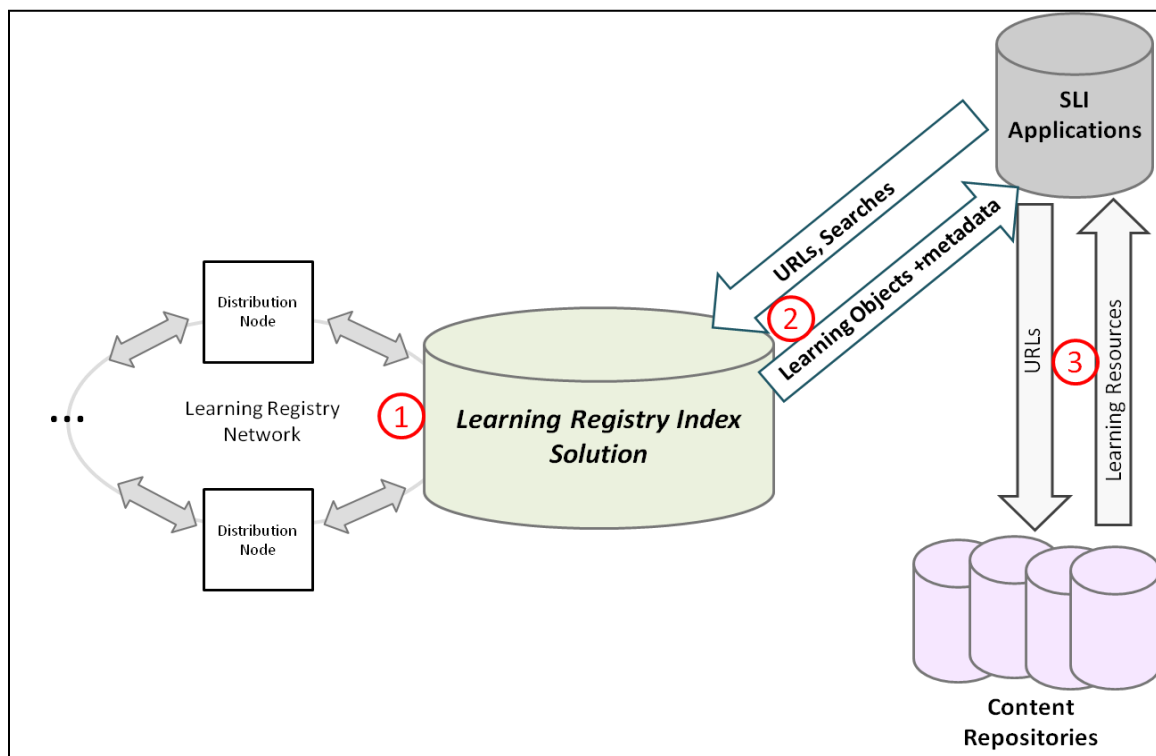


Figure 5: Functionality of the Learning Registry Index Solution

The interactions identified in the figure are described as follows:

- (1) The Learning Registry Index Solution is linked to the network of Learning Registry distribution nodes, which provide it with announcements regarding published content and Learning Objectives.
- (2) This data is then supplied to SLI-compatible applications via a web service interface that supports searches and dereferencing queries.
- (3) Applications may then retrieve Learning Resources from Content Repositories, based on URLs; but this activity is outside the scope of the Learning Registry Index Solution. How and whether applications will access the resources are dependent on the intended functionality of specific applications.

3.1.2. Content Publishing Applications

Publishers of Learning Resources (educational content) are expected to make use of applications that can create and publish object descriptions that include LRMI-based metadata tags and bindings, as well as SLC-specific bindings, into the Learning Registry network. Whether such systems include a Learning Registry Distribution Node as part of the solution, or interface with a Distribution Node in order to make “announcements”, is beyond the scope of this guidance.

3.1.3. Instructional Improvement Systems

State- and district-provided Instructional Improvement Systems should be able to interface with both the SLI data store and the Learning Registry Index Solution, as well as publish usage and feedback information (in the form of documents containing SLC-specified metadata tags) to the Learning Registry.

3.2. Integration with Learning Registry and Learning Registry Index Solution

The general system interfaces required by the above applications may be with the Learning Registry, the Learning Registry Index Solution, or both, according to the application type and functionality.

3.2.1. The Learning Registry Index Solution Interface

SLI-compatible Applications will be expected to interface with the Learning Registry Index Solution through a set of RESTful web service interactions. The precise specification of this interface will be published at a later date.

3.2.2. The Learning Registry Interface

The Learning Registry Index Solution participates in the network of Learning Registry nodes, by subscribing to Learning Resource- and Learning Objective-related announcements for later use by SLI-compatible applications, and by publishing additional metadata provided by SLI Applications. Examples of such announcements might be:

- ‘Publisher A is publishing Learning Resource “123” at <http://www.publishera.com/123>’
- ‘Learning Resource “123” is aligned with Learning Objective STD.CC.ORG/4/NF6’

- 'NY State intends to use Learning Resource "123" for Grades 2-3'

(The vocabulary used for these examples is intended to be illustrative only.)

4. Configuration Options

In order to interoperate with the Learning Registry Index Solution, applications must be parameterized to include information about how and where to connect to the Learning Registry Index Solution server(s). In addition, applications may optionally be configured to make use of the SLI's Identity Management system, to authenticate themselves and their, for purposes of access control.

Interaction with the Learning Registry Index Solution is controlled by the search vocabulary of its web service, which may require additional application configuration in order to process, but such application-specific configuration is considered to be outside the scope of this description.

Configuration of applications to interact with the network of Learning Registry nodes may also be needed, but is beyond the scope of this guidance.

5. Standards and Technologies

This section contains a nonexhaustive list of standards, technologies, and related efforts in support of understanding and developing applications that make use of the Learning Registry Index Solution.

5.1. Standards and Technologies

The following standards and technologies are applicable to this specification:

Standard / Technology	Applicability
HTML5 (http://dev.w3.org/html5/html4-differences/)	Supports schema.org – based mark-up with MicroData.
MicroData (http://www.w3.org/TR/microdata/ also http://dev.w3.org/html5/md/)	This mechanism allows machine-readable data to be embedded in HTML documents in an easy-to-write manner, with an unambiguous parsing model. This is the selected representation standard for LRMI terms.
RDF (http://www.w3.org/RDF/)	RDF is a standard model for data interchange on the Web. This is a competing representation standard for schema.org terms. Initial versions of LRMI will be published in RDF as well as MicroData.

Table 1: Standards and Technologies

5.2. Related and Affiliated Efforts

These organizations and efforts are also relevant to implementation of the Learning Registry Index Solution:

Initiative / Project / Organization	Applicability
Common Core Standards (http://www.corestandards.org/)	Organization responsible for defining Common Core competency-related terms.
Dublin Core (http://dublincore.org/)	Prior work on standard terms and metadata vocabularies, used for tagging certain resource elements.
Learning Registry (http://www.learningregistry.org/)	Defines the protocol used by Learning Registry distribution nodes.

Initiative / Project / Organization	Applicability
Learning Resource Metadata Initiative (http://www.lrmi.net/ and http://wiki.creativecommons.org/LRMI) LRMI Draft Specification (http://wiki.creativecommons.org/LRMI/Properties)	Organization developing content metatag definitions.
schema.org (http://www.schema.org/)	Base structure for LRMI terms.

Table 2: Related and Affiliated Efforts

See also the companion SLC paper entitled “Learning Resource Metadata Initiative (LRMI) – RFP Guidance” for further details about the relationship of the Solution described here, with the LRMI.

6. Constraints

An SLI-compatible application designed to make use of the Learning Registry Index Solution must adhere to certain standards for metadata markup and processing.

6.1. Learning Registry Events

Events in the network of Learning Registry nodes will be assertions, such as ‘New York intends to use Learning Resource “www.publisherA.com/123” for grades 2-3’. There will be two types of assertions:

1. Learning Registry bindings
2. Other SLC ecosystem assertions

6.1.1. Learning Registry Bindings

These are the specifications developed by the LRMI initiative, and bindings for a set of assertions regarding Learning Resources.

6.1.2. Other SLC Ecosystem Assertions

There are a number of events that will be of interest to the SLC ecosystem that do not currently have Learning Registry bindings. Other SLC ecosystem assertions are a defined set of events that the Learning Registry Index Solution will “listen” for, and be able to provide to applications in addition to the standard Learning Registry bindings.

These events and the vocabulary for these events will be defined in a document to follow.

6.2. “Authoritative” Source for Learning Objects

In the case of both Learning Objectives and Learning Resources, Learning Object Identifiers (LOIs) are assumed to be in the form of a URL that points to the “authoritative” source within a Content Repository. Learning Object Metadata returned by the Learning Registry Index Solution will vary by Learning Object type, and, in general, will be assumed to be non-authoritative.

6.3. Learning Object Metadata

In the first release of the Learning Registry Index Solution, supported Learning Objective metadata will be provided in a well-defined format; and for Learning Resources, it is represented by the LRMI/Learning Registry mappings. In both cases, the metadata will be provided in consistent, well-specified formats, including XML and JSON.

Glossary of Terms

Term	Definition
Learning Object Identifier	A URL that uniquely refers to a Learning Object.
Learning Object Metadata	Information which describes a Learning Object, such as its unique identifier, type, authoritative source, usage information, etc.
Learning Objectives	Learning Standards, such as Common Core State Standards and K-12 education standards of individual states.
Learning Objects	Items of educational significance, including both Learning Objectives and Learning Resources.
Learning Registry Distribution Node	A member of the Learning Registry network which publishes information to peer nodes of the Learning Registry.
Learning Registry Index Solution	A component of the SLI that provides data related to Learning Objects, to SLI-compatible applications.
Learning Resources	Educational content and materials, such as texts, assessments, applications and other media, available from content publishers and distributors.

Table 3: Glossary of Terms