IMS GLC Learning Information Services Specification Primer

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Executive Summary

The Learning Information Services (LIS) specification is the definition of how systems manage the exchange of information that describes people, groups, memberships, courses and outcomes within the context of learning. The LIS v2.0 specification supersedes the IMS GLC Enterprise Services v1.0 specification. The LIS specification is based upon the aggregation of the Person Management, Group Management, Membership Management, Course Management, Outcomes Management and the Bulk Data Exchange Management Services specifications. The LIS v2.0 is implemented using a Web Services infrastructure. An implementation is not required to support each and every service. Neither is an implementation required to support each and every operation. Interoperability is best defined through the use of a Domain Profile. This specification includes such a profile, the Core Profiles, for Student Information System/Learning Management System (SIS/LMS) interactions. Interoperability is supported between systems that implement the same profile. The LIS documentation consists of:

- The LIS Specification – describes how the LIS is composed using its six component services;

- Information Models – these documents contain the normative description of the various service definitions, data structures and their relationships. Each of the six services has its own Information Model;

- Binding documents – each of the Information Models has an associated Web Services Description Language (WSDL) binding document;

- Best Practice & Implementation Guide – this is intended to provide vendors with an overall understanding of the IMS GLC LIS Specification, the relationship of the specification with other IMS GLC specifications, and a best practices guide derived from experiences of those using the specification. The guide also includes a several actual examples that describe how vendors can make the best use of the IMS LIS Specification;

- Core Profiles & Conformance Specification – a set of profiles of the LIS has been created for SIS/LMS interactions. The Core Profiles identify the minimal subset of the functionality that must be supported by systems developed for SIS/LMS deployment. The Core Profiles (there is a Core plus several Additions) define the set of operations and data that must be supported by the systems supporting the set of services within the LIS. Each profile contains its Conformance Specification against which compliant systems are tested;

- The Binding Files – one of the outputs of the LIS specification is the set of WSDL/XML Schema Definition (WSDL/XSD) binding files. Each service has its own set of WSDL/XSD files. It is these files that are used by code-generation tools to create the source code that handles the SOAP messages and XML data structures. Some small changes are required to the WSDL files to map the SOAP messages to the actual server-based implementation of the Web Service. Each of the services has a set of vocabulary files that contain the set of default vocabularies defined in the Information Model. The vocabulary files are instances of the IMS GLC Vocabulary Data Exchange (VDEX) specification.

Table of Contents

1   Introduction

1.1   Learning Information Service Systems

The Learning Information Services (LIS) specification is the definition of how systems manage the exchange of information that describes people, groups, memberships, courses and outcomes within the context of learning. This document is the IMS GLC Learning Information Services v2.0 Specification Primer; the specification is available in [LIS, 11a]. The LIS specification supersedes the IMS GLC Enterprise Services v1.0 specification [ES, 04]. This specification is based upon the aggregation of the Person Management, Group Management, Membership Management, Course Management, Outcomes Management and the Bulk Data Exchange Management Services specifications. The Learning Information Services Specification v2.0 can be implemented using both a Web Services infrastructure (based upon a SOAP/http transport mechanism) and the Lightweight Directory Access Protocol (LDAP).

1.2   Structure of this Document

The structure of this document is:

2.	THE LEARNING INFORMATION SERVICES SPECIFICATION	Provides an overview of the specification as a whole and explains how the six component services are orchestrated to provide the full range of services;
3.	THE HISTORIC PERSPECTIVE	Provides the historic context for this specification as it has evolved from a pure data model to this current service description;
4.	USING THE NEW VERSION	Provides an overview of the ways in which the specification can be adapted to fit specific implementation requirements;
5.	THE DOCUMENT SET	Lists and explains the set of documents produced as part of the specification.

1.3   Nomenclature

BDEMS	Bulk Data Exchange Management Service
CMS	Course Management Service
GMS	Group Management Service
IMS GLC	IMS Global Learning Consortium Inc.
LDAP	Lightweight Directory Access Protocol
LIP	Learner Information Packaging
LIS	Learning Information Services
MMS	Membership Management Service
OMS	Outcomes Management Service
PMS	Person Management Service
UML	Unified Modelling Language
URL	Uniform Resource Locator
VDEX	Vocabulary Definition Exchange
WSDL	Web Services Description Language
XSD	XML Schema Description

1.4   References

[BDEMS, 11a]   *IMS GLC Bulk Data Exchange Management Service v1.0 Information Model v1.0 Final Release*, L.Feng, W.Lee and C.Smythe, IMS Global Learning Consortium, June 2011.

[BDEMS, 11b]   *IMS GLC Bulk Data Exchange Management Service v1.0 WSDL Binding v1.0 Final Release*, L.Feng, W.Lee and C.Smythe, IMS Global Learning Consortium, June 2011.

[CMS, 11a]   *IMS GLC Course Management Service v1.0 Information Model v1.0 Final Release*, L.Feng, W.Lee and C.Smythe, IMS Global Learning Consortium, June 2011.

[CMS, 11b]   *IMS GLC Course Management Service v1.0 WSDL Binding v1.0 Final Release*, L.Feng, W.Lee and C.Smythe, IMS Global Learning Consortium, June 2011.

[ES, 04]   *IMS GLC Enterprise Services Specification Final Release v1.0*, C.Smythe and C.Vento, <u>IMS Global Learning Consortium</u>, June 2004.

[GMS, 11a]   *IMS GLC Group Management Service v2.0 Information Model v1.0 Final Release*, L.Feng, W.Lee and C.Smythe, <u>IMS Global Learning Consortium</u>, June 2011.

[GMS, 11b]   *IMS GLC Group Management Service v2.0 WSDL Binding v1.0 Final Release*, L.Feng, W.Lee and C.Smythe, <u>IMS Global Learning Consortium</u>, June 2011.

[GWS, 06a]   *IMS GLC General Web Services Base Profile Final Release*, C.Schroeder, J.Simon and C.Smythe, V1.0, <u>IMS Global Learning Consortium</u>, January 2006.

[GWS, 06b]   *IMS GLC General Web Services WSDL Binding Guidelines Final Release*, C.Schroeder, J.Simon and C.Smythe, V1.0, <u>IMS Global Learning Consortium</u>, January 2006.

[LIS, 11a]   *IMS GLC Learning Information Services v2.0 Specification v1.0 Final Release*, L.Feng, W.Lee and C.Smythe, <u>IMS Global Learning Consortium</u>, June 2011.

[LIS, 11b]   *IMS GLC Learning Information Services v2.0 Best Practices & Implementation Guide v1.0 Final Release*, L.Feng, W.Lee and C.Smythe, <u>IMS Global Learning Consortium</u>, June 2011.

[LIS, 11c]   *IMS GLC Learning Information Services v2.0: Core Profiles v1.0 Final Release* L.Feng, W.Lee and C.Smythe, <u>IMS Global Learning Consortium</u>, June 2011.

[MMS, 11a]   *IMS GLC Membership Management Service* v2.0 *Information Model v1.0 Final Release*, L.Feng, W.Lee and C.Smythe, <u>IMS Global Learning Consortium</u>, June 2011.

[MMS, 11b]   *IMS GLC Membership Management Service v2.0 WSDL Binding v1.0 Final Release*, L.Feng, W.Lee and C.Smythe, <u>IMS Global Learning Consortium</u>, June 2011.

[OMS, 11a]   *IMS GLC Outcomes Management Service v1.0 Information Model v1.0 Final Release*, L.Feng, W.Lee and C.Smythe, <u>IMS Global Learning Consortium</u>, June 2011.

[OMS, 11b]   *IMS GLC Outcomes Management Service v1.0 WSDL Binding v1.0 Final Release*, L.Feng, W.Lee and C.Smythe, <u>IMS Global Learning Consortium</u>, June 2011.

[PMS, 11a]   *IMS GLC Person Management Service Information Model v2.0 Final Release*, L.Feng, W.Lee and C.Smythe, <u>IMS Global Learning Consortium</u>, June 2011.

[PMS, 11b]   *IMS GLC Person Management Service v2.0 WSDL Binding v1.0 Final Release*, L.Feng, W.Lee and C.Smythe, <u>IMS Global Learning Consortium</u>, June 2011.

[VDEX, 04]   IMS GLC Vocabulary Definition Exchange Information Model v1.0, A.Cooper, <u>IMS Global Learning Consortium</u>, February 2004. <u>http://www.imsglobal.org/vdex/</u>

2   The Learning Information Services Specification

The basic architectural model for the LIS specification is shown in Figure 2.1. In this architecture the scope of the data exchange provided by the services is shown as the dotted line. The scope of the interoperability is the data and behavioral models of the objects being exchanged.
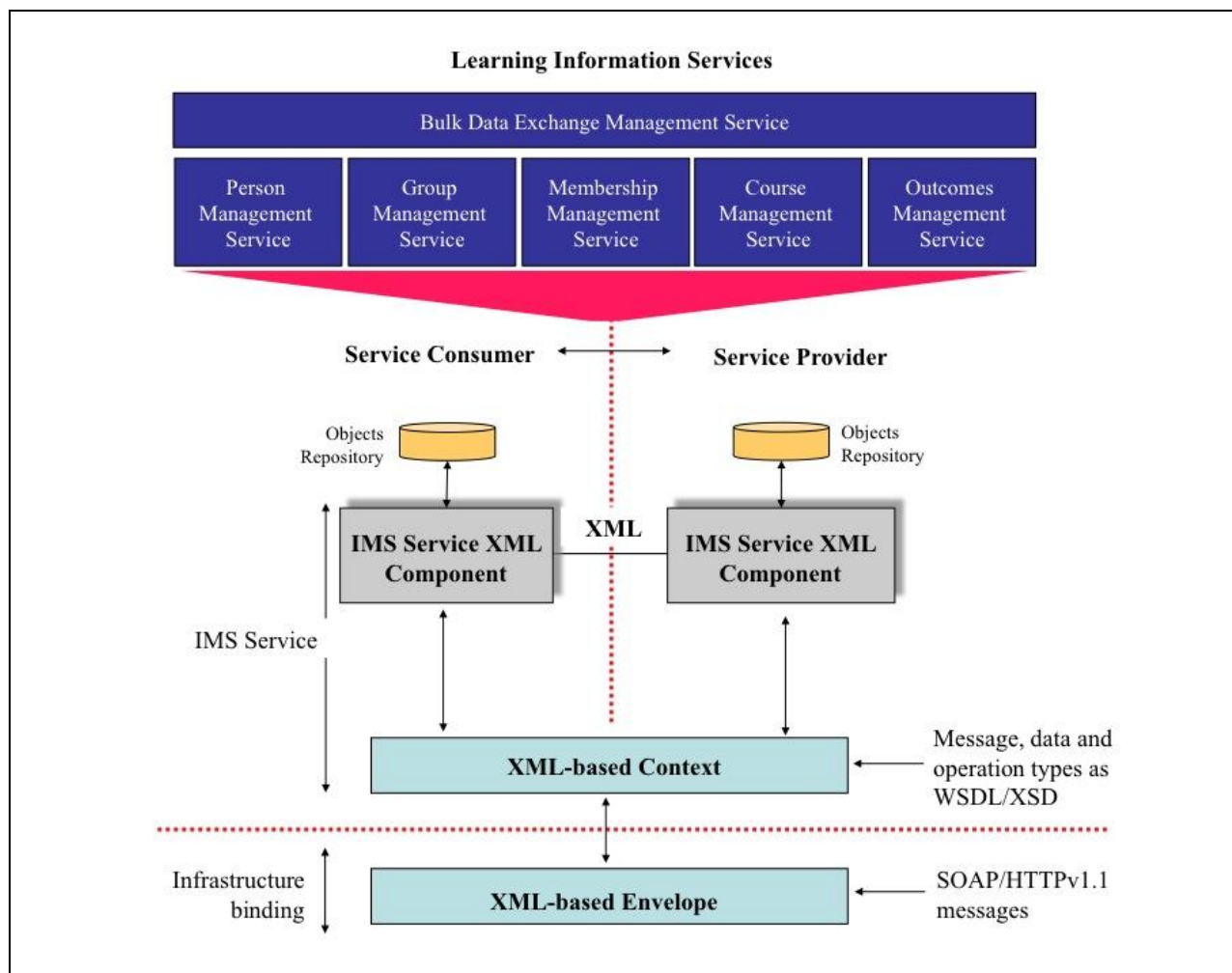

Figure 2.1 Schematic architecture of the learner information services.

Six services are defined. Instances of the data models are stored in the service consumer/provider object repositories. It is the persistence of the data in these repositories that reflects the dynamic changes in the system. The set of services are realized as SOAP messages to exchange the XML-based data objects[1].

An implementation is not required to support each and every service. Neither is an implementation required to support each and every operation. The specific requirements are defined in the corresponding profile[2]. Interoperability is supported between systems that implement the same profile. Cross-profile interoperability may occur but this is a by-product and should NOT be used as the basis for any system realization.

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[1] The LDAP bindings use a different set of message and data structures.

[2] IMS GLC has created one such profile for Student Information System/Learning Management System exchanges [LIS, 11c].

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3   The Historic Perspective

The release history for the LIS is listed in Table 3.1. The original Enterprise v1.0 data model was the second specification released by IMS GLC. It has undergone several revisions in response to feedback from the experience gained in the various implementations.

<div align="center">Table 3.1 Release history for Enterprise/LIS specifications.</div>

Version	Release Date	Description
Enterprise 1.0	November, 1999	Original data model for Enterprise systems interoperability.
Enterprise 1.0.1	January, 2000	Correction of a small number of bugs identified in version 1.
Enterprise 1.1	July, 2002	Revised data model to introduce new functionality based on commonly used extensions.
Enterprise Services v1.0	August, 2004	Introduction of services, based upon the IMS GLC General Web Services, to support the exchange of the information based upon the Enterprise v1.1 data model.

LIS v2.0 is a radical reworking of both the original services and data models. LIS has replacement services for the Person Management Service (PMS), Group Management Service (GMS) and Membership Management Service (MMS); these have some significant changes but are similar in objective. There are three new services:

- Course Management Service (CMS) – in Enterprise Services v1.0 this functionality was supported using the IMS GLC Group Management Service v1.0 [GMS, 04] specification in a variety of different ways. This created interoperability problems hence the creation of the CMS specification. The Course Management Service v1.0 is closely linked to the Group Management Service v2.0 and Membership Management Service v2.0;

- Outcomes Management Service (OMS) – in Enterprise Services v1.0 a simplified form of functionality was supported using the IMS GLC Membership Management Services v1.0 [MMS, 04]. In general, there is NO backwards compatibility between the usage of the OMSv1.0 and the ways in which MMSv1.0 has been implemented to support outcomes management. Vendors may define compatibility bridges for their own implementations but these are outside the scope of this specification.

- Bulk Data Exchange Management Service (BDEMS) – this is a bulk exchange service used to support initialization and synchronization use-cases.

The release of the Learning Information Services v2.0 creates the issue of compatibility between version 1 and version 2 implementations. Compatibility issues occur when:

a)   A version 1 service implementation initiates data exchange with a version 2 implementation;

b)   A version 2 service implementation initiates data exchange with a version 1 implementation.

The binding of the Information Model recommends that the Uniform Resource Locator (URL) for the messaging actions is dependent on the type and version number of the source specification: in such a case it is not possible for cross-interaction between implementations of version 1 and 2. However, if a common URL is used then cross-interaction becomes possible. The definition of the behavior for interactions between different versions is beyond the scope of this specification.

4   Using the New Version

4.1   Building an Interoperable Solution

The LIS consists of a set of services, each of which has a number of operations which themselves act upon the core data objects. The interoperability is between a service provider (the LIS would expect this to include the Reference Agent) and a service consumer (in LIS also termed a Sync Agent). A system that claims conformance to the LIS specification is not, in general, expected to support all of the services and service features. However, interoperability between two LIS implementations requires common service support.

The LIS specification enables interoperability in many forms i.e., it does not impose a best practice; it is the role of Profile(s) to establish a best practice for a particular community. When establishing the degree of interoperability provided by two LIS implementations the following must be considered:

- Identify which of the six services are common to both implementations;
- For each service identify the set of operations that are complementary to both implementations;
- For each operation identify the set of status codes that are commonly supported;
- For each data model in each service identify which parts of any vocabulary are commonly supported;
- For each data model identify the set of objects. In particular, inspect which optional features are common.

Persistence of data is a key feature for any system for which conformance to this specification is claimed. A service provider must persist the data it is required to support (note that the specification makes no imposition on how the data is stored – it is only concerned with interoperability). This persistence enables conformance testing. A service consumer is only required to persist the data if it also acts to forward the data to another LIS-compliant system or if it also acts as a service provider i.e., permitting another system to read from it.

There is no interoperability between an Enterprise Service v1.0 and LIS v2.0. This is because the data models have been subject to significant changes, the services themselves have been refactored and new services added in LIS.

4.2   Profiles & Profiling

The Core Profiles identify the minimal subset of the functionality that must be supported by systems developed for deployment for Student Information System/Learning Management System (SIS/LMS) interaction. These Profiles (there is a Core plus several Additions) define the set of operations and data models that must be supported by the systems supporting the set of services within the LIS. A system can support greater functionality but there is no guarantee of interoperability for those extra features. Interoperability is only guaranteed for the functionality described in the Core Profiles.

If the Core Profile, either alone or in combination with one or more of the Addition Profiles, is inadequate then a new profile can be created and registered with IMS GLC.

5   The Document Set

Apart from this Primer, the LIS documentation set consists of:

- The LIS Specification – describes how the LIS is composed using its six component services [LIS, 11a].

- Information Models – these documents contain the normative description of the various service definitions, data structures and their relationships. Each of the six services has its own Information Model [PMS, 11a], [GMS, 11a], [MMS, 11a], [CMS, 11a], [OMS, 11a] and [BDEMS, 11a].

- Binding documents – each of the Information models has an associated WSDL binding document;

- Best Practice & Implementation Guide – this is intended to provide vendors with an overall understanding of the IMS GLC LIS Specification, the relationship of the specification with other IMS GLC specifications, and a best practices guide derived from experiences of those using the specification[3]. The guide also includes several actual examples that describe how vendors can make the best use of the LIS Specification;

- Core Profiles & Conformance Specification – a set of profiles of the LIS has been created for SIS/LMS exchange [LIS, 11c]. The Core Profiles identify the minimal subset of the functionality that must be supported for SIS/LMS exchanges. These Profiles (the Core and several Additions) define the set of operations and data models that must be supported by the systems supporting the set of services within the LIS. This Core Profiles includes the Conformance Specification against which compliant systems are tested;

- The Binding Files – this is the set of WSDL and XSD files that realize the binding. Each of the services has a set of vocabulary files that contain the set of default vocabularies defined in the Information Model. The vocabulary files conform to the IMS GLC Vocabulary Definition Exchange (VDEX) specification [VDEX, 04].

The documentation set of the IMS GLC Learning Information Services Specification is daunting. However, a few simple guidelines make it considerably easier for even a newcomer to work through the documents. The recommended approach to reviewing the documentation set is:

a)   The *LIS Best Practices & Implementation Guide* is an excellent way to understand the why, what and how of a specification. The set of examples described in the guide is an excellent way to understand what is being created by the specification. The guide should always be read before attempting to work through either the Information Models or the WSDL/LDAP Bindings;

b)   The *LIS Specification* [LIS, 11a] describes the overall structure of the specification in terms of its component services. It provides the context for the details given in each of the Information Model and Binding documents;

c)   Once the set of examples has been digested, it is time to work through the Information Models. These models provide the formal definition of all of the service operations, data structures and their behaviors and relationships;

d)   Finally, work through the WSDL Binding documents. Often, only the implementation/engineering team needs to understand the details of these documents. Each binding document is the definitive statement of how interoperability is achieved using WSDL. The WSDL Bindings are formally realized as the WSDL/XSD files (these files can be used to generate the corresponding SOAP messages);

e)   The *LIS Core Profiles* [LIS, 11c] should be used as the basis for providing the core service capability for SIS/LMS exchanges. This profile identifies the minimal set of service operations that are required to create a 'useful' learning information service (the profile identified less than 5% of the full set of service operations as necessary).

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[3] We recommend that new users of the IMS GLC LIS Specification start with the *IMS GLC LIS Best Practices & Implementation Guide*. The examples in this document show how we intend the specification to be used, whereas the Information Model and WSDL Binding documents contain the formal description of the services, data structures, their syntax and semantics.

About This Document

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Revision History

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