



# IMS GLC Learning Tools Interoperability Implementation Guide

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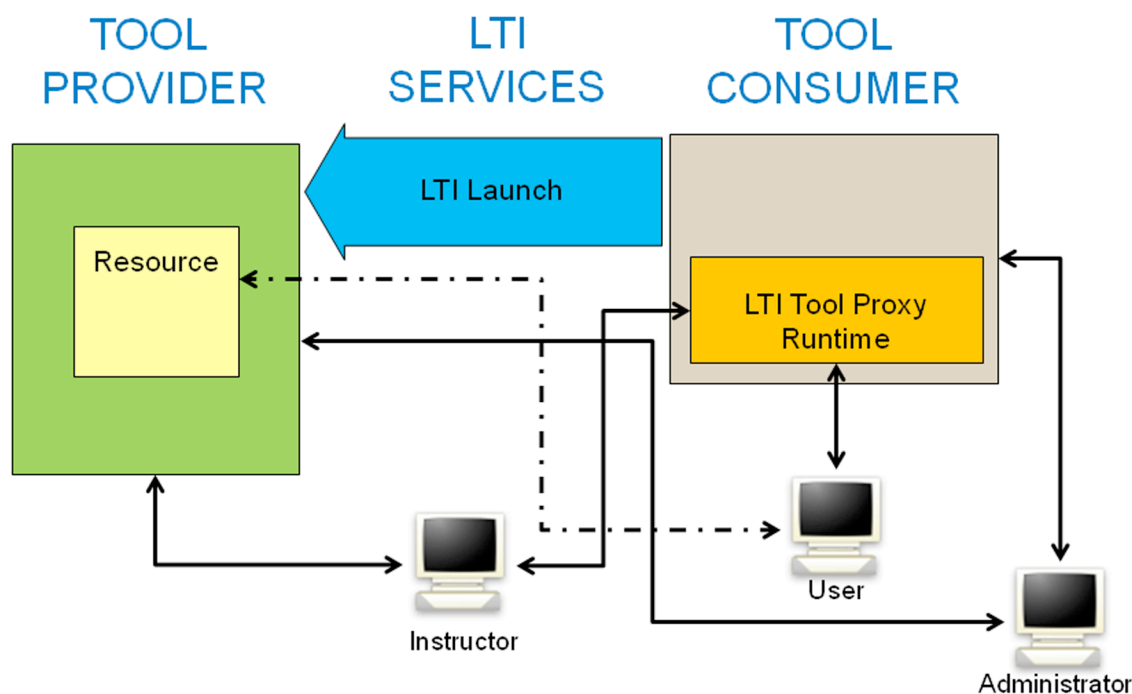
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# 1 Introduction

IMS is developing the Learning Tools Interoperability (LTI) specifications to allow remote tools and content to be integrated into a Learning Management System (LMS). This document brings a subset of those specifications together into this implementation guide that defines a profile of LTI and is the next iteration of the Basic LTI [BLTI, 10] specification that was released in spring 2010.



**Figure 1.1:** Overview of LTI.

Throughout this document, we use specific terminology to describe the two main pieces of software involved in LTI. What we traditionally think of as the "Learning Management System" (LMS) is referred to as the "Tool Consumer" (TC) as it "consumes" the tool. The external tool or content is called the "Tool Provider" (TP) as it "provides" the tool for use in the Tool Consumer. Example Tool Providers might include an externally hosted testing system or a server that contains externally hosted premium content.

This document uses the term "context" where you might expect to see "course". A context is roughly equivalent to a course, project, or other collection of resources with a common set of users and roles. The word "context" is used instead of "course" because a course is only one kind of context (another type of context would be "group").

Typically within a context (i.e. a course), users can author many LTI content items, sometimes arranging them into folders like "Week 1" or "Pre-Work". LTI links are intended to be used like any other resource within the structure of a context. In particular, there is an expectation that there will often be multiple links scattered through the content structure for the context. LTI allows the TP to differentiate amongst those links using the concept of a **resource\_link\_id**. While all of the links from within a context will share the same **context\_id**, each link within the context will be given a unique **resource\_link\_id**. This allows the TP to differentiate the content/features it shows on a resource-by-resource basis within a context by providing configuration options such as a resource picker to the instructor or administrator after the link has been launched.

This document uses the message signing approach from OAuth 1.0a protocol (<http://www.oauth.net>) to secure its message interactions between the TC and TP. OAuth signing requires a key and shared secret to sign messages. The key is transmitted with each message, as well as an OAuth-generated signature based on the key. The TP looks up the secret based on the provided key and re-computes the signature and compares the recomputed signature with the transmitted signature to verify the sender's credentials.

The TC can make choices as to how it manages credentials (keys and secrets) within its system. LTI has three patterns for the credentials: (1) the TC-wide credential for a particular TP domain which is set by the TC administrator and used for all launches to a particular TP domain, or (2) the TC-wide credential for a particular TP URL which is set by the TC administrator and used for all launches to a particular TP URL, or (3) each LTI link is protected by its own credential. The first and second patterns allow for a more seamless integration between a TC-instance and TP-instance from an instructor's perspective. The third pattern allows instructors to "mash up" LTI links.

LTI has optional support for the TP to call IMS Learning Information Services (LIS) when those services can be made available to the TP. LTI does not require LIS services, but the TC can send LIS key information to the TP using values in the LTI Launch Request.

## 1.1 Structure of this Document

The structure of this document is:

2	USE CASES FOR LTI	A listing of the use cases describing the core usage scenarios of the LTI specification;
3.	LTI LAUNCH DATA	A description of the data items that are passed as part of the POST data when an LTI launch is performed;
4.	LTI SECURITY MODEL	The definition of the security environment for LTI;
5.	REPRESENTING LTI LINKS IN A CARTRIDGE	A description of the LTI link for inclusion in an IMS Common Cartridge;
6.	USING LEARNING INFORMATION SERVICES WITH LTI	A description of how to use LTI with IMS Learning Information Services;
	APPENDIX A LTI STANDARD VOCABULARIES	A reference to the LTI specification's standard vocabularies;
	APPENDIX B IMPLEMENTATION PRACTICE	A non-normative discussion and recommendations to help guide implementations.
	APPENDIX C CUSTOM PARAMETER SUBSTITUTION	A reference to the LTI specification's custom parameter vocabularies.

## 1.2 References

This LTI v1.1 specification marks the convergence of the Basic LTI v1.0 spec with the LTI v1.0 Internal Draft documents (formerly known as full LTI). These LTI documents, some of which are referenced here, will be used to inform the continued development of the LTI work.

[BLTI, 10]	<i>IMS GLC Basic Learning Tools Interoperability v1.0</i> , IMS Global Learning Consortium, C.Severance, May 2010. <a href="http://www.imsglobal.org/lti/">http://www.imsglobal.org/lti/</a> .
[CC, 08a]	<i>IMS GLC Common Cartridge v1.0</i> , IMS Global Learning Consortium, K.Riley, October 2008. <a href="http://www.imsglobal.org/cc/">http://www.imsglobal.org/cc/</a> .
[GWS, 06]	<i>IMS GLC General Web Services WSDL Binding Guidelines v1.0</i> , C.Schroeder, J.Simon and C.Smythe, IMS Global Learning Consortium, January 2006. <a href="http://www.imsglobal.org/gws/">http://www.imsglobal.org/gws/</a> .
[LIS, 11]	<i>IMS GLC Learning Information Services v2.0</i> , L.Feng, W.Lee and C.Smythe, IMS Global Learning Consortium, June 2011. <a href="http://www.imsglobal.org/lis/">http://www.imsglobal.org/lis/</a> .
[LIS, 10 OMS]	IMS Outcomes Management Service Information Model v1.0, L. Feng and c. Smythe, IMS Global Learning Consortium, March 2010, <a href="http://www.imsglobal.org/lis/">http://www.imsglobal.org/lis/</a> .
[LTI, 10 CCI]	<i>IMS GLC Learning Tools Interoperability Common Cartridge Interaction v1.0 Internal Draft</i> , G.McFall, M.McKell, L.Neumann, IMS Global Learning Consortium, 2010.

- [LTI, 10 MSS] *IMS GLC Learning Tools Interoperability Messages v1.0 Internal Draft*, G.McFall, M.McKell, L.Neumann, IMS Global Learning Consortium, 2010.
- [LTI, 10 SEC] *IMS GLC Learning Tools Interoperability Security v1.0 Internal Draft*, G.McFall, M.McKell, L.Neumann, IMS Global Learning Consortium, 2010.
- [LTI, 10 TMT] *IMS GLC Learning Tools Interoperability Tool Management v1.0 Internal Draft*, G.McFall, M.McKell, L.Neumann, IMS Global Learning Consortium, 2010.
- [LTI, 10 VCB] *IMS GLC Learning Tools Interoperability Vocabularies v1.0 Internal Draft*, G.McFall, M.McKell, L.Neumann, IMS Global Learning Consortium, 2010.

## 2 Use Cases for LTI

This section describes common scenarios for the LTI v1.1 specification. Some of the use cases carry over from the Basic LTI v1.0 specification and others come from the LTI Tool Management [LTI, 10, TMT] documentation.

<b>Use Case Title:</b>	<b>Setting TP Domain Credentials (Basic LTI)</b>
<b>Use Case Local ID:</b>	LTIv1-TMT-14
<b>Brief Description:</b>	The TC administrator configures TP domain credentials for a particular TP. These credentials apply to LTI links authored directly in the TC system and also to LTI links imported from a Common Cartridge (see Use Case LTIv1-TMT-16).
<b>Level:</b>	Summary
<b>Actors:</b>	<ul style="list-style-type: none"> <li>• TC Administrator</li> <li>• TP Administrator</li> </ul>
<b>Basic Flow of Events:</b>	<ol style="list-style-type: none"> <li>1. <u>Generate credentials</u>. The TP Administrator creates the key and secret combination for the TC (where the TC administrator may request a particular key, often the TC domain name).</li> <li>2. <u>Exchange the credentials</u>. The TC Administrator obtains the key, secret and TP domain name from the TP administrator. The LTI standard does not prescribe any particular method for this exchange.</li> <li>3. <u>Persist the credentials in the TC</u>. The TC Administrator associates the credentials with TP's domain and persists this information using a TC-provided dialog or configuration mechanism.</li> </ol>

<b>Use Case Title:</b>	<b>Setting Link Level Credentials (Basic LTI)</b>
<b>Use Case Local ID:</b>	LTIv1-TMT-15
<b>Brief Description:</b>	An instructor authors an LTI link and sets the key/password for that link.
<b>Level:</b>	Summary
<b>Actors:</b>	<ul style="list-style-type: none"> <li>• Instructor</li> <li>• Tool Provider (TP)</li> </ul>
<b>Preconditions:</b>	None
<b>Basic Flow of Events:</b>	<ol style="list-style-type: none"> <li>1. <u>Exchange Link Level Credentials</u>. The Instructor contacts the TP to obtain access to a provider tool or content. The TP provides the Instructor with (1) an LTI launch URL or XML snippet for the content or tool, (2) a key that will be used to access this content/tool, and (3) a secret associated with the key. The LTI standard does not prescribe any mechanism for this exchange.</li> <li>2. <u>Persist Link Level Credentials in the TC system</u>. The Instructor enters the three values (URL or XML snippet, Key, Secret) into an LTI authoring dialog in the TC system.</li> </ol>

<b>Use Case Title:</b>	<b>Managing Credentials for LTI Links Imported from a Cartridge</b>
<b>Use Case Local ID:</b>	LTIV1-TMT-16
<b>Brief Description:</b>	An Instructor imports a Common Cartridge containing LTI link descriptors into their context, and users use the content.
<b>Level:</b>	Summary
<b>Actors:</b>	<ul style="list-style-type: none"> <li>Instructor</li> <li>TC User (typically a Student or Instructor)</li> </ul>
<b>Preconditions:</b>	<ul style="list-style-type: none"> <li>A cartridge creator has authored a Common Cartridge that contains one or more LTI Link descriptors. These descriptors specify the launch URL(s) and other data associated with the links, but they do not contain keys or secrets.</li> <li>In accordance with Use Case LTIV1-TMT-14, the TC Administrator has set the domain credentials to particular TP(s) that are referenced in the cartridge.</li> </ul>
<b>Basic Flow of Events:</b>	<ol style="list-style-type: none"> <li><u>Import the cartridge.</u> The Instructor obtains the Common Cartridge and imports it into a learning context within the TC system.</li> <li><u>Use domain credentials during Tool Launch.</u> When a TC User launches an LTI link imported from the Common Cartridge, the TC signs the launch request using the pre-configured credentials associated with the TP address. In particular, as long as the TC-wide credentials are already installed, the Instructor does not need to take any further action to secure the launch request beyond importing a cartridge.</li> </ol>
<b>Alternative Flows:</b>	<p><b>A. Domain Credentials are not predefined</b></p> <p>If the domain credentials are not predefined within the TC system (i.e., the preconditions to this use case are not satisfied) then at Step 2 the launch requests will not be signed. In this case, the TC may (at its discretion) refuse to allow the Tool Launch to proceed. If an unsigned tool launch does occur, the TP may (at its discretion) refuse to honor the request. To correct such launch failures, it is possible to add domain or link level credentials (in accordance with Use Cases LTIV1-TMT-14 and LTIV1-TMT-15 respectively) after the cartridge has been imported.</p>

<b>Title:</b>	<b>Launching an Authored Basic LTI Link from a Context</b>
<b>Use Case Local ID:</b>	LTIV1p1-01
<b>Description:</b>	A non-Instructor user selects a Basic LTI link from a context in the TC.
<b>Actors:</b>	<ul style="list-style-type: none"> <li>TC User</li> </ul>
<b>Preconditions:</b>	An Instructor has properly authored or imported a Basic LTI Link and there are appropriate credentials in place.
<b>Basic Flow of Events:</b>	<ol style="list-style-type: none"> <li>The TC User clicks on the link in the TC UI.</li> <li>The tool or content from the TP appears in the TC UI or in another window. If JavaScript is turned off – the TC User will need to click on a "continue" button to send the POST data to the TP.</li> </ol>

<b>Title:</b>	<b>Launching Basic LTI Imported from a Cartridge (with secret)</b>
<b>Use Case Local ID:</b>	LTIV1p1-02
<b>Description:</b>	An Instructor imports a Common Cartridge containing Basic LTI link descriptors into their context and users use the content.
<b>Actors:</b>	<ul style="list-style-type: none"> <li>Cartridge Creator</li> <li>Instructor</li> <li>TC User</li> </ul>



<b>Title:</b>	<b>Launching Basic LTI Imported from a Cartridge (no secret)</b>
<b>Use Case Local ID:</b>	LTIV1p1-03
<b>Description:</b>	An Instructor imports a Common Cartridge containing Basic LTI link descriptors into their context and users use the content. Note that this scenario is optional – the TC and/or TP may decide that Basic LTI launches without secrets are treated as an error.
<b>Actors:</b>	<ul style="list-style-type: none"> <li>• Cartridge Creator</li> <li>• Instructor</li> <li>• TC User</li> </ul>
<b>Preconditions:</b>	None.
<b>Basic Flow of Events:</b>	<ol style="list-style-type: none"> <li>1. The Cartridge Creator authors a cartridge and includes one or more Basic LTI link descriptors in the cartridge. The Basic LTI link descriptors in the cartridge contain a launch URL(s) and other data but do not contain keys or secrets.</li> <li>2. The Instructor obtains the Common Cartridge and imports it into their context in the TC system.</li> <li>3. When a TC User launches the Basic LTI link from the Common Cartridge, the TC launches the Basic LTI link with no authentication or signature information.</li> </ol>

<b>Title:</b>	<b>Returning a decimal score (0.0-1.0) from the TP to the TC</b>
<b>Use Case Local ID:</b>	LTIV1p1-04
<b>Description:</b>	An instructor creates a resource link in a course and indicates that it is to receive scores from the TP and sets up any necessary routing between the LTI link and the grade book. Whether or not the TC accepts scores for a particular user/context/link is up to some combination of the TC Admin and TC Instructor.
<b>Actors:</b>	<ul style="list-style-type: none"> <li>• TC Admin</li> <li>• Instructor</li> <li>• TC User</li> </ul>
<b>Preconditions:</b>	The TC admin enables support for score routing in the TC (either universally or per TP).
<b>Basic Flow of Events:</b>	<ol style="list-style-type: none"> <li>1. The Instructor authors a link and indicates that a line item is associated with the link.</li> <li>2. The TC user launches the link and the TC includes the service endpoint for the LIS Basic Outcomes Service and the lis_result_sourcedid to allow the TP to make service calls to set, read, and delete scores.</li> <li>3. The TP system makes calls to the TC's LIS Basic Outcomes Service to set, read, and/or delete scores as needed. These service operations can be done at any time as it is a server to server trust (i.e., not just during the launch period).</li> </ol>

### 3 Basic LTI Launch Data

This section describes the data items that are passed as part of the POST data when a Basic LTI launch is performed. Very few of the fields are technically required as each Tool Provider may have different requirements. Some TPs may see the fields in the launch as information to be gathered for tracking and others may need highly detailed and precise information to perform high-stakes activities and reliably and securely return high-stakes results from those activities.

TC systems should provide as much data as possible in each launch to maximize the chance that the TP will have the data it needs to function properly. TC systems may have sandboxing features that limit the sending of certain LTI data elements only to "approved" TPs. It is outside the scope of the specification to define the nature of the TC sandboxing of LTI launches. TPs should be prepared to work with partial information – either because the TC does not have the information or the TC has been configured not to share the information with the TP.

If a profile wants to extend these fields, they should prefix all fields not described herein with "ext\_".

**lti\_message\_type=basic-lti-launch-request**

This indicates that this is a Basic LTI Launch Message. This allows a TP to accept a number of different LTI message types at the same launch URL. This parameter is required.

**lti\_version=LTI-1p0**

This indicates which version of the specification is being used for this particular message. Since launched for version 1.1 are upwards compatible with 1.0 launches, this value is not advanced for LTI 1.1. This parameter is required.

**resource\_link\_id=88391-e1919-bb3456**

This is an opaque unique identifier that the TC guarantees will be unique within the TC for every placement of the link. If the tool / activity is placed multiple times in the same context, each of those placements will be distinct. This value will also change if the item is exported from one system or context and imported into another system or context. This parameter is required.

**resource\_link\_title=My Weekly Wiki**

A title for the resource. This is the clickable text that appears in the link. This parameter is recommended.

**resource\_link\_description=...**

A plain text description of the link's destination, suitable for display alongside the link. Typically no more than several lines long. This parameter is optional.

**user\_id=0ae836b9-7fc9-4060-006f-27b2066ac545**

Uniquely identifies the user. This should not contain any identifying information for the user. Best practice is that this field should be a TC-generated long-term "primary key" to the user record – not the "logical key". This parameter is recommended

**user\_image=http://...**

This attribute specifies the URI for an image of the user who launched this request. This image is suitable for use as a "profile picture" or an avatar representing the user. It is expected to be a relatively small graphic image file using a widely supported image format (i.e. PNG, JPG, or GIF) with a square aspect ratio. This parameter is optional.

**roles=Instructor**

A comma-separated list of URN values for roles. If this list is non-empty, it should contain at least one role from the LIS System Role, LIS Institution Role, or LIS Context Role vocabularies (See Appendix A). The assumed namespace of these URNs is the LIS vocabulary of LIS Context Roles so TCs can use the handles when the intent is to refer to an LIS context role. If the TC wants to include a role from another namespace, a fully-qualified URN

should be used. Usage of roles from non-LIS vocabularies is discouraged as it may limit interoperability. This parameter is recommended.

**lis\_person\_name\_given=Jane**

**lis\_person\_name\_family=Public**

**lis\_person\_name\_full=Jane Q. Public**

**lis\_person\_contact\_email\_primary=user@school.edu**

These fields contain information about the user account that is performing this launch. The names of these data items are taken from LIS. The precise meaning of the content in these fields is defined by LIS. These parameters are recommended unless they are suppressed because of privacy settings.

**context\_id=8213060-006f-27b2066ac545**

This is an opaque identifier that uniquely identifies the context that contains the link being launched. This parameter is recommended.

**context\_type=CourseSection**

This string is a comma-separated list of URN values that identify the type of context. At a minimum, the list MUST include a URN value drawn from the LIS vocabulary (see Appendix A). The assumed namespace of these URNs is the LIS vocabulary so TCs can use the handles when the intent is to refer to an LIS context type. If the TC wants to include a context type from another namespace, a fully-qualified URN should be used. This parameter is optional.

**context\_title=Design of Personal Environments**

A title of the context – it should be about the length of a line. This parameter is recommended.

**context\_label=SI182**

A label for the context – intended to fit in a column. This parameter is recommended.

**launch\_presentation\_locale=en-US**

Language, country and variant as represented using the IETF Best Practices for Tags for Identifying Languages (BCP-47) available at <http://www.rfc-editor.org/rfc/bcp/bcp47.txt>

**launch\_presentation\_document\_target=iframe**

The value should be either 'frame', 'iframe' or 'window'. This field communicates the kind of browser window/frame where the TC has launched the tool. The tool can ignore this parameter and detect its environment through JavaScript, but this parameter gives the TP the information without requiring the use of JavaScript if the tool prefers. This parameter is recommended.

**launch\_presentation\_css\_url=**

This is a URL to an LMS-specific CSS URL. There are no standards that describe exactly what CSS classes, etc. should be in this CSS. The TP should send its standard CSS URL that it would apply to its local tools. The TC should include styling for HTML tags to set font, color, etc. and also include its proprietary tags used to style its internal tools.

Someday perhaps we will come up with a cross-LMS standard for CSS classes to allow a tool to look "built-in" with only one set of markup, but until that happens, the **launch\_presentation\_css\_url** allows tools a chance to adapt their look and feel across LMS systems to some degree.

**launch\_presentation\_width=320**

The width of the window or frame where the content from the tool will be displayed. The tool can ignore this

parameter and detect its environment through JavaScript, but this parameter gives the TP the information without requiring the use of JavaScript if the tool prefers. This parameter is recommended.

**launch\_presentation\_height=240**

The height of the window or frame where the content from the tool will be displayed. The tool can ignore this parameter and detect its environment through JavaScript, but this parameter gives the TP the information without requiring the use of JavaScript if the tool prefers. This parameter is recommended.

**launch\_presentation\_return\_url=http://lmsng.school.edu/portal/123/page/988/**

Fully qualified URL where the TP can redirect the user back to the TC interface. This URL can be used once the TP is finished or if the TP cannot start or has some technical difficulty. In the case of an error, the TP may add a parameter called **lti\_errormsg** that includes some detail as to the nature of the error. The **lti\_errormsg** value should make sense if displayed to the user. If the tool has displayed a message to the end user and only wants to give the TC a message to log, use the parameter **lti\_errorlog** instead of **lti\_errormsg**. If the tool is terminating normally, and wants a message displayed to the user it can include a text message as the **lti\_msg** parameter to the return URL. If the tool is terminating normally and wants to give the TC a message to log, use the parameter **lti\_log**. This data should be sent on the URL as a GET – so the TP should take care to keep the overall length of the parameters small enough to fit within the limitations of a GET request. This parameter is recommended.

**tool\_consumer\_info\_product\_family\_code=desire2learn**

In order to better assist tools in using extensions and also making their user interface fit into the TC's user interface that they are being called from, each TC is encouraged to include the this parameter. Possible example values for this field might be:

- learn
- desire2learn
- sakai
- eracer
- olat
- webct

This parameter is optional but recommended.

**tool\_consumer\_info\_version=9.2.4**

This field should have a major release number followed by a period. The format of the minor release is flexible. Possible values for this field might be:

- 9.1.7081
- 2.8-01
- 7.1
- 8

The Tool Provider should be flexible when parsing this field. This parameter is optional but recommended.

**tool\_consumer\_instance\_guid=lmsng.school.edu**

This is a unique identifier for the TC. A common practice is to use the DNS of the organization or the DNS of the TC instance. If the organization has multiple TC instances, then the best practice is to prefix the domain name with a locally unique identifier for the TC instance. In the single-tenancy case, the tool consumer data can be often be derived from the **oauth\_consumer\_key**. In a multi-tenancy case this can be used to differentiate between the multiple tenants within a single installation of a Tool Consumer. This parameter is optional but strongly recommended in systems capable of multi-tenancy.

**tool\_consumer\_instance\_name=SchoolU**

This is a user visible field – it should be about the length of a column. This parameter is recommended.

**tool\_consumer\_instance\_description=University of School (LMSng)**

This is a user visible field – it should be about the length of a line. This parameter is optional.

**tool\_consumer\_instance\_url=http://lmsng.school.edu**

This is the URL of the consumer instance. This parameter is optional.

**tool\_consumer\_instance\_contact\_email=System.Admin@school.edu**

An email contact for the TC instance. This parameter is recommended.

**custom\_keyname=value**

The creator of an LTI link can add custom key/value parameters to a launch which are to be included with the launch of the LTI link. The Common Cartridge section below describes how these parameters are represented when storing custom parameters in a Common Cartridge.

When there are **custom** name / value parameters in the launch, a POST parameter is included for each custom parameter. The parameter names are mapped to lower case and any character that is neither a number nor letter in a parameter name is replaced with an "underscore". So if a **custom** entry was as follows:

```
Review:Chapter=1.2.56
```

Would map to:

```
custom_review_chapter=1.2.56
```

Creators of LTI links would be well served to limit their parameter names to lower case and to use no punctuation other than underscores.

If these custom parameters are included in the LTI link, the TC must include them in the launch data or the TP may fail to function.

TC implementations may have the ability to make value substitutions for custom parameters as described in Appendix C. For example if a custom parameter was:

```
xstart=$CourseSection.timeFrame.begin
```

The parameter would be:

```
custom_xstart=2012-04-21T01:00:00Z
```

Note that a DateTime data type in IMS LIS represents a combined date and time in the format of ISO 8601 i.e. 'YYYY-MM-DDThh:mm:ssTZD'. The time is denoted in Coordinated Universal Time (UTC) with TZD denoting the time zone offset in hours and minutes with respect to UTC.

It is important for a TP not to depend on the TC supporting any particular parameter substitution. If a TC that did not support parameter substitution were to see the above custom parameter, it would simply send:

```
custom_xstart=$CourseSection.timeFrame.begin
```

as the parameter (i.e., send the parameter unsubstituted). It is the responsibility of the TP to deal with both kinds of launches from TCs (i.e., with and without substitution available).

In addition to these data items for the LTI launch, the next section describes additional security parameters which are to be included with the launch.

## 4 LTI Security Model

### 4.1 Basic LTI Credential Management

*This section is taken from the LTI Tool Management [LTI, 10 TMT] documentation.*

The security environment for Basic LTI launches must be set up using out-of-band interactions between the TP administrator and either the TC administrator or an Instructor who will be authoring a Basic LTI link.

As a best practice, the TP should isolate data based on the key. The TP must decide exactly how the key is used to isolate data. For example, the TP might maintain a table that maps multiple keys into a single data silo. Or, the TP might arrange to use the same key repeatedly in all cases where data are to belong to the same data silo.

There are two possible credentials associated with a particular Basic LTI launch.

1. **TC-wide instance guid and secret** associated with a particular TP. The TC-wide instance guid establishes the identity of the TC for launches to a particular TP. Once the TC-wide secret is established for a TP, all Basic LTI tool launches to the TP's domain will use this same secret. Using a TC-wide secret gives TPs the option of trusting user information and context information across multiple contexts within a particular TC instance as being maintained properly by the TC.

In order to select which TC-wide password to be used for a particular Basic LTI link, the TC examines the domain name in the launch URL for the Basic LTI link. The TC-wide password is looked up in the list of TC-wide passwords scanning the domain name of the launch URL from right to left. So for example, if the launch URL was:

```
http://launch.math.vendor.com/launch.php
```

The TC would look up the following TC-wide secret keys in order from specific to general:

`launch.math.vendor.com`, `math.vendor.com`, and then `vendor.com`. So when TPs are generating link URLs and giving them to an instructor or embedding those links in a cartridge, it is important to use consistent domain names in those launch URLs so as to be able to match a TC-wide secret for a particular TP with the appropriate launches.

2. **Link-level key and secret associated with a particular link.** This will occur when the Basic LTI link is directly authored by the instructor within the TC. This secret will often be produced when the Instructor creates or gains access to a TP content/tool and the TP content/tool provides the instructor with a key and secret associated with the TP link.

Basic LTI launches can happen from the TC with any combination of TC-wide and link-level credentials including one or the other, both, or neither being present. When both are present the launch uses the TC-wide secret to sign the request.

If there is no key/secret combination available for this launch and the TC wants to perform the launch, the TC should not sign the launch data using OAuth. The TC can decide if it wants to send unsigned requests and the TP can decide if it wants to accept unsigned requests. A TC may also choose to treat the lack of key/secret values as an error and refuse to perform the launch.

### 4.2 OAuth Message Signing for x-www-form-urlencoded Messages

*Note: This section is taken from the LTI Security [LTI, 10 SEC] documentation.*

OAuth signing is a security mechanism designed to protect POST and GET requests. This section only applies to protecting launch and other messages that are being serialized and sent using POST.

The site [www.oauth.net](http://www.oauth.net) contains the specification for OAuth 1.0 and sample source code for implementing OAuth signing. OAuth 1.0 specifies how to construct a base message string and then sign that string using a secret. The signature is then sent as part of the POST request and is validated by the Producer using OAuth.

Per the OAuth specification, the signing process produces a number of values that are to be added to the launch request including the **oauth\_consumer\_key**:

```
oauth_consumer_key=b289378-f88d-2929-ctools.umich.edu
oauth_signature_method=HMAC-SHA1
oauth_timestamp=1244834250
oauth_nonce=1244834250435893000
oauth_version=1.0
oauth_signature=Xddn2A%2BjzwjgBIVYkvigaKxCdccc%3D
oauth_callback=about:blank
```

The important values for signing a message using OAuth are the **oauth\_consumer\_key** and **oauth\_consumer\_secret**. The **oauth\_consumer\_key** is passed in the message as plain text and identifies which consumer (i.e., LMS) is sending the message allowing the producer (i.e. tool provider) to look up the appropriate secret for validation. The **oauth\_consumer\_secret** is used to sign the message.

The **oauth\_callback** is really not used in a signing-only scenario (OAuth 1.0 documentation section 6.2.3) so if your OAuth library demands it, you can set it to any value such as "about:blank". Also note that **launch\_presentation\_return\_url** serve a very different purpose as **oauth\_callback**.

Since we are using OAuth in a signing-only scenario (i.e., we are not using OAuth to transfer third-party identity), there is no need for an **oauth\_token**.

Tool Providers must support at a *minimum* the **HMAC-SHA1** signing method with OAuth data passed as POST data.

In order to support as many OAuth client libraries and approaches as possible, tool providers are encouraged to support as many OAuth signature types as possible as well as support receiving OAuth data in headers or as query parameters. Tool providers are also encouraged to support OAuth GET as well as POST.

Upon receipt of the POST, the Tool Provider will perform the OAuth validation utilizing the shared secret it must have stored locally for the relationship with the Tool Consumer in the **oauth\_consumer\_key**. The timestamp should also be validated to be within a specific time interval. This time interval can be Tool Provider defined, but should be small (on the order of a few minutes if you do not record nonces or a few hours if you do). It does rely on the time on the Tool Consumer and the Tool Provider being in sync though.

The Tool Provider should keep a record of nonces received and only allow the use of any nonce a single time. Combined with the timestamp, this means that they only have to keep track of nonces for a period of time equal to their acceptable time interval. Recommended practice would be to have a time interval of 90 minutes so that you keep a record of nonces for 90 minutes.

NOTE that this security profile requires the TC and TP to have synchronized clocks. The use of a configurable time interval can adjust for slightly-off clocks, but setting the interval too large is discouraged.

### 4.3 Security for application/xml Messages

These services follow a "Plain Old XML" (POX) pattern and the messages are signed using OAuth body signing to insure message integrity and establish the identity of the calling system (i.e., the TP).

The body of the message is XML that follows the schema for the particular requested service operation requested, and the message is signed using the **oauth\_consumer\_key** and **oauth\_consumer\_secret** that was used to do the launch of tool for the particular user/course/resource.

The procedure for signing a body using OAuth is described on this website:

[http://oauth.googlecode.com/svn/spec/ext/body\\_hash/1.0/oauth-bodyhash.html](http://oauth.googlecode.com/svn/spec/ext/body_hash/1.0/oauth-bodyhash.html)

It is important that all messages using these services must use a content type of **application/xml**. The services will legitimately reject any other content type. In particular, the OAuth body signing specification specifically prohibits the combination of **oauth\_body\_hash** and **x-www-form-urlencoded** data in any request.

Also, these services will insist that all of the OAuth parameters be sent as part of the **Authorization** header. In particular, OAuth parameters from the request URL and POST body will not be processed.

The **oauth\_body\_hash** is computed using a SHA-1 hash of the body contents and added to the **Authorization** header. All of the OAuth parameters, HTTP method, and URL are signed like any other OAuth signed request. Other than in constructing the body hash value, the actual POST data is not involved in the computation of the **oauth\_signature**.

Most OAuth libraries can produce and verify the signatures for these messages as most libraries already support sending OAuth parameters in the **Authorization** header.

A sample signed request is shown below. The line-breaks in the **Authorization** header are there to make it easier to read the values. The **oauth\_signature** is not valid for the data below, it is just an example signature.

```
POST http://www.imsglobal.org/developers/BLTI/service_handle.php HTTP/1.0
Host: 127.0.0.1:80
Content-Length: 757
Authorization: OAuth realm="",oauth_version="1.0",
  oauth_nonce="29f90c047a44b2ece73d00a09364d49b",
  oauth_timestamp="1313350943",oauth_consumer_key="lmsng.school.edu",
  oauth_body_hash="v%2BxFnmDSHV%2Fj29ghxLwkFILrtPo%3D",
  oauth_signature_method="HMAC-SHA1",
  oauth_signature="8auRpRdPY2KRXUrOyz3HKCs92y8%3D"
Content-type: application/xml

<?xml version = "1.0" encoding = "UTF-8"?>
<imsx_POXEnvelopeRequest xmlns = "http://www.imsglobal.org/lis/oms1p0/pox">
  <imsx_POXHeader>
    <imsx_POXRequestHeaderInfo>
      <imsx_version>V1.0</imsx_version>
      <imsx_messageIdentifier>999999123</imsx_messageIdentifier>
    </imsx_POXRequestHeaderInfo>
  </imsx_POXHeader>
  <imsx_POXBody>
    <readResultRequest>
      <resultRecord>
        <sourcedGUID>
          <sourcedId>3124567</sourcedId>
        </sourcedGUID>
      </resultRecord>
    </readResultRequest>
  </imsx_POXBody>
</imsx_POXEnvelopeRequest>
```

Please consult the IMS General Web Services for details about the fields within the **ims\_POXHeader**. These definition and values for the header items are taken directly from IMS General Web Services. See "Table A1.2 Interpretation of the 'CodeMajor/severity' matrix" from IMS General Web Services WSDL Binding Guidelines [GWS, 06] for further details on header values for 'unsupported' responses.

Each service will define its own XML Schema for the **imsx\_POXBody** Request and Response content for a particular operation within a particular service.



## 5 Representing Basic LTI Links in a Cartridge

*Note: This section is taken from the LTI Common Cartridge Interaction [LTI, 10 CCI] documentation.*

Since there are no changes to these formats in LTI 1.1, we are not advancing the version of the values in this section.

A Basic LTI link is a simplified and self-contained LTI link. The Basic LTI link is defined in the resource section of an IMS Common Cartridge as follows:

```
<resource identifier="I_00010_R" type="imsbasiclti_xmlvlp0">
  <file href="I_00001_R/BasicLTI.xml"/>
</resource>
```

The **href** in the resource entry refers to a file path in the cartridge that contains an XML description of the Basic LTI link.

```
<?xml version="1.0" encoding="UTF-8"?>
<cartridge_basiclti_link xmlns="http://www.imsglobal.org/xsd/imslticc_vlp0"
  xmlns:blti = "http://www.imsglobal.org/xsd/imsbasiclti_vlp0"
  xmlns:lticm = "http://www.imsglobal.org/xsd/imslticm_vlp0"
  xmlns:lticp = "http://www.imsglobal.org/xsd/imslticp_vlp0"
  xmlns:xsi = "http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation = "http://www.imsglobal.org/xsd/imslticc_vlp0
http://www.imsglobal.org/xsd/lti/ltivlp0/imslticc_vlp0.xsd
http://www.imsglobal.org/xsd/imsbasiclti_vlp0
http://www.imsglobal.org/xsd/lti/ltivlp0/imsbasiclti_vlp0.xsd
http://www.imsglobal.org/xsd/imslticm_vlp0
http://www.imsglobal.org/xsd/lti/ltivlp0/imslticm_vlp0.xsd
http://www.imsglobal.org/xsd/imslticp_vlp0
http://www.imsglobal.org/xsd/lti/ltivlp0/imslticp_vlp0.xsd">
  <blti:title>Grade Book</blti:title>
  <blti:description>Grade Book with many column types</blti:description>
  <blti:custom>
    <lticm:property name="keyname">value</lticm:property>
  </blti:custom>
  <blti:extensions platform="my.lms.com">
    <lticm:property name="keyname">value</lticm:property>
  </blti:extensions>
  <blti:launch_url>url to the basiclti launch URL</blti:launch_url>
  <blti:secure_launch_url>secure url to the basiclti launch URL</blti:secure_launch_url>
  <blti:icon>url to an icon for this tool (optional)</blti:icon>
  <blti:secure_icon>secure url to an icon for this tool (optional)</blti:secure_icon>
  <blti:vendor>
    <lticp:code>vendor.com</lticp:code>
    <lticp:name>vendor.name</lticp:name>
    <lticp:description>This is a vendor of learning tools.</lticp:description>
    <lticp:url>http://www.vendor.com</lticp:url>
    <lticp:contact>
      <lticp:email>support@vendor.com</lticp:email>
    </lticp:contact>
  </blti:vendor>
  <cartridge_bundle identifierref="BLTI001_Bundle"/>
  <cartridge_icon identifierref="BLTI001_Icon"/>
</cartridge_basiclti_link>
```

The **launch\_url** contains the URL to which the LTI Launch is to be sent. The **secure\_launch\_url** is the URL to use if secure http is required. One of either the **launch\_url** or the **secure\_launch\_url** must be specified. It is acceptable to specify both and if both are specified, the TC decides which to use. Typically, the TC will use a **secure\_launch\_url** when embedding the Tool in a secure page and the **launch\_url** when embedding the tool in a non-secure page. So, it's important that the TP provides the same functionality whether the **launch\_url** or **secure\_launch\_url** is used.

The **icon** and **secure\_icon** are both optional and indicate a URL to be used for an icon to the tool.

Once the Basic LTI link is defined in the resources section of the cartridge manifest, it can be referenced in the organization section of the manifest as needed:

```
<item identifier="BasicLTI1" identifierref="I_00010_R">
  <title>Homework Problems</title>
</item>
```

The TC will generally display the **title** in the **item** entry in the user interface rather than **title** in the **basic\_lti\_link** entry.

The optional **custom** section can contain a set of key value pairs that were placed in the link in the system that originally authored the link. For example if the link were a section in an eTextbook, there might be a setting like:

```
<parameter key="section">1.2.7</parameter>
```

These parameters are sent back to the external tool when the tool is launched. If a Basic LTI link is imported and then exported the **custom** should be maintained across the import/export process unless the intent is to re-author the link.

The **extensions** section allows the hosting TC to add its own key/value pairs to the link. The TC may use extensions to store information that the TC or authoring environment might use across an export-import cycle. In order to allow multiple sets of extensions to be contained in the same Basic LTI descriptor, authoring environments should add the **platform** attribute and include an identifier that identifies the authoring environment.

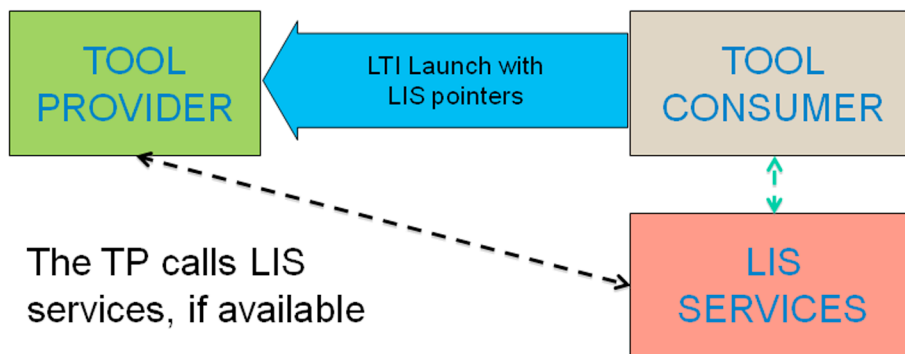
It is possible to include the icon for the link in the cartridge instead of including it as a URL using the **cartridge\_icon** entry in the descriptor. The **identifierref** attribute points to a link that includes the icon image and a dependency is added to the resource section of the Basic LTI resource entry in the manifest as shown below.

```
<resource identifier="I_00010_R" type="imsbasiclti_xmlv1p0">
  <file href="I_00001_R/BasicLTI.xml"/>
  <dependency identifierref="BLTI001_Icon"/>
</resource>

<resource identifier="BLTI001_Icon"
type="associatedcontent/imsc_xmlv1p0/learning-application-resource">
  <file href="BLTI001_Media/learning_icon.gif"/>
</resource>
```

## 6 Using Learning Information Services with LTI

This section describes how the TC provides data to the TP so as to allow the TP to call a subset of IMS Learning Information Services (LIS) [LIS, 10a]. It is not required for the TP to provide these services.



**Figure 6.1** The TP taking advantage of LIS services.

The LIS services could even be provided by a third system such as a Student Information System, or perhaps the TC system is the provider of the LIS services to be used by the TP.

In order to support grade return from the TP to the TC using the services described in this section, the following fields are defined:

### **lis\_result\_sourcedid=83873872987329873264783687634**

This field contains an identifier that indicates the LIS Result Identifier (if any) associated with this launch. This field identifies a unique row and column within the TC gradebook. This field is unique for every combination of **context\_id / resource\_link\_id / user\_id**. This value may change for a particular **context\_id / resource\_link\_id / user\_id** from one launch to the next. The TP should only retain the most recent value for this field for a particular **context\_id / resource\_link\_id / user\_id**. This field is optional.

### **lis\_outcome\_service\_url=**

This field should be no more than 1023 characters long. This value should not change from one launch to the next and in general, the TP can expect that there is a one-to-one mapping between the **lis\_outcome\_service\_url** and a particular **oauth\_consumer\_key**. This value might change if there was a significant re-configuration of the TC system or if the TC moved from one domain to another. The TP can assume that this URL generally does not change from one launch to the next but should be able to deal with cases where this value rarely changes. The service URL may support various operations / services. The TC will respond with a response of 'unimplemented' for services it does not support. This field is optional unless the TC includes a **lis\_result\_sourcedid** value in a launch in which case this field is required.

These services are based server-to-server trust and as such do not need to be called synchronously in the context of a particular user's launch and session. The TP may retain the **lis\_outcome\_service\_url** and **lis\_result\_sourcedid** from a launch and then call the service long after the user's session has ended. This allows the TP to collect grades and upload them to the TC in batches or perhaps collect grades and upload them to the TP when an instructor clicks a button within the TP.

In order to interact with LIS services provided to the TP by mechanisms outside the scope of this document, the TC may include the following additional launch parameters if the data is available to the TC for the particular launch:

**lis\_person\_sourcedid=school.edu:user**

This field contains the LIS identifier for the user account that is performing this launch. The example syntax of "school:user" is not the required format – **lis\_person\_sourcedid** is simply a globally unique identifier (i.e., a normalized string). This field is optional and its content and meaning are defined by LIS.

**lis\_course\_offering\_sourcedid=school.edu:SI182-F08**

**lis\_course\_section\_sourcedid=school.edu:SI182-001-F08**

These fields contain LIS course identifiers associated with the context of this launch. These fields are optional and their content and meaning are defined by LIS.

## 6.1 LIS Basic Outcomes Service

This service receives "Plain Old XML" (POX) messages signed using OAuth body signing. The service supports setting, retrieving and deleting LIS results associates with a particular user/resource/context combination.

The only type of grade supported by this services is a decimal numeric grade in the range from 0.0 - 1.0. Additional types of outcomes and the ability for the TP to perform more detailed outcomes operations may be added at a later date.

See section 3.3 in "IMS Outcomes Management Service Information Model" [LIS, 10 OMS] for detail on the parameters and return values for the operations described in this section.

All of these services are recommended and optional. The service endpoint must accept any well-formed request with properly formed headers that passe security checks (i.e., signature is valid) and return a well-formed "unsupported" response.

```
<?xml version="1.0" encoding="UTF-8"?>
<imsx_POXEnvelopeResponse xmlns = "http://www.imsglobal.org/lis/oms1p0/pox">
  <imsx_POXHeader>
    <imsx_POXResponseHeaderInfo>
      <imsx_version>V1.0</imsx_version>
      <imsx_messageIdentifier>4560</imsx_messageIdentifier>
      <imsx_statusInfo>
        <imsx_codeMajor>unsupported</imsx_codeMajor>
        <imsx_severity>status</imsx_severity>
        <imsx_description>readPerson is not supported</imsx_description>
        <imsx_messageRefIdentifier>999999123</imsx_messageRefIdentifier>
        <imsx_operationRefIdentifier>readPerson</imsx_operationRefIdentifier>
      </imsx_statusInfo>
    </imsx_POXResponseHeaderInfo>
  </imsx_POXHeader>
  <imsx_POXBody/>
</imsx_POXEnvelopeResponse>
```

See "Table A1.2 Interpretation of the 'CodeMajor/severity' matrix" from IMS General Web Services WSDL Binding Guidelines [GWS, 06] for further details on header values for 'unsupported' responses.

Since these services use Outh signing, in order to avoid revealing the key and secret, the best practice is for these services to be called as server-to-server web services. It is not possible to allow provide the browser with the key and secret to sign these messages without risking the loss of the key and secret. As a best practice, in production situations, these services should be accessed using secure http (i.e. https) to avoid man-in-the-middle and other security attacks.

### 6.1.1 replaceResult

The replaceResultRequest sets a numeric grade (0.0 - 1.0) for a particular result sourcedId. This service is recommended.

It is up to the TC as to whether this operation actually replaces the grade, or if the TC maintains a history of all grade values. If the TC is maintaining grade history, the TP is generally only operating on the "most recent" grade. The TP has no knowledge of the TC approach to grade history and should treat the grades as though there is only a single grade for each **lis\_result\_sourcedid**.

```
<?xml version = "1.0" encoding = "UTF-8"?>
<imsx_POXEnvelopeRequest xmlns = "http://www.imsglobal.org/lis/oms1p0/pox">
  <imsx_POXHeader>
    <imsx_POXRequestHeaderInfo>
      <imsx_version>V1.0</imsx_version>
      <imsx_messageIdentifier>999999123</imsx_messageIdentifier>
    </imsx_POXRequestHeaderInfo>
  </imsx_POXHeader>
  <imsx_POXBody>
    <replaceResultRequest>
      <resultRecord>
        <sourcedGUID>
          <sourcedId>3124567</sourcedId>
        </sourcedGUID>
        <result>
          <resultScore>
            <language>en</language>
            <textString>0.92</textString>
          </resultScore>
        </result>
      </resultRecord>
    </replaceResultRequest>
  </imsx_POXBody>
</imsx_POXEnvelopeRequest>
```

The **sourcedId** element is the value from the **lis\_result\_sourcedid** parameter for a particular **user\_id** / **resource\_link\_id** combination. The TP records these values as they are sent on launches and then can later make services calls providing the **sourcedId** as way to pick the particular cell in the TC grade book.

For this particular service, all of the values for **textString** are decimal values numeric in the range 0.0 - 1.0. Regardless of the language of the TP or TC user interface, the number format is to use a period as the decimal point. Regardless of the language of the TP or TC user interface, the **language** field in the service call is to be "en" indicating the format of the number. While the TP is required to include "en" as the **language**, the TC will likely ignore the language field in this request and always assume that the number is formatted using "en" formatting.

The **replaceResultResponse** indicates the success/failure of the operation in the header area of the response and as such the body area is empty.

The TC must check the incoming grade for validity and must fail when a grade is outside the range 0.0-1.0 or if the grade is not a valid number. The TC must respond to these **replaceResult** operations with a **imsx\_codeMajor** of "failure".

```
<?xml version="1.0" encoding="UTF-8"?>
<imsx_POXEnvelopeResponse xmlns = "http://www.imsglobal.org/lis/oms1p0/pox">
  <imsx_POXHeader>
    <imsx_POXResponseHeaderInfo>
      <imsx_version>V1.0</imsx_version>
      <imsx_messageIdentifier>4560</imsx_messageIdentifier>
      <imsx_statusInfo>
        <imsx_codeMajor>success</imsx_codeMajor>
        <imsx_severity>status</imsx_severity>
        <imsx_description>Score for 3124567 is now 0.92</imsx_description>
        <imsx_messageRefIdentifier>999999123</imsx_messageRefIdentifier>
        <imsx_operationRefIdentifier>replaceResult</imsx_operationRefIdentifier>
      </imsx_statusInfo>
    </imsx_POXResponseHeaderInfo>
  </imsx_POXHeader>
  <imsx_POXBody>
    <replaceResultResponse/>
  </imsx_POXBody>
</imsx_POXEnvelopeResponse>
```

### 6.1.2 readResult

The readResultRequest returns the current grade for a particular result **lis\_result\_sourcedid**.

It is up to the TC as to whether it maintains a history of all grade values. If the TC is maintaining grade history, the TP will see the "most recent" grade. The TP has no knowledge of the TC approach to grade history and should treat the grades as though there is only a single grade for each **lis\_result\_sourcedid**.

If the grade has not yet been set via a replaceResult operation or an existing grade has been deleted via a deleteResult operation, the TC should return a valid response with a present but empty textString element. The TC should not return 0.0 to indicate a non-existent grade and the TC should not return a failure status when a grade does not exist. It should simply return an "empty" grade.

```
<?xml version = "1.0" encoding = "UTF-8"?>
<imsx_POXEnvelopeRequest xmlns = "http://www.imsglobal.org/lis/oms1p0/pox">
  <imsx_POXHeader>
    <imsx_POXRequestHeaderInfo>
      <imsx_version>V1.0</imsx_version>
      <imsx_messageIdentifier>999999123</imsx_messageIdentifier>
    </imsx_POXRequestHeaderInfo>
  </imsx_POXHeader>
  <imsx_POXBody>
    <readResultRequest>
      <resultRecord>
        <sourcedGUID>
          <sourcedId>3124567</sourcedId>
        </sourcedGUID>
      </resultRecord>
    </readResultRequest>
  </imsx_POXBody>
</imsx_POXEnvelopeRequest>
```

The readResultResponse returns the current score in the body area of the returned message.

```
<?xml version="1.0" encoding="UTF-8"?>
<imsx_POXEnvelopeResponse xmlns = "http://www.imsglobal.org/lis/oms1p0/pox">
  <imsx_POXHeader>
    <imsx_POXResponseHeaderInfo>
      <imsx_version>V1.0</imsx_version>
      <imsx_messageIdentifier>1313355158804</imsx_messageIdentifier>
      <imsx_statusInfo>
        <imsx_codeMajor>success</imsx_codeMajor>
        <imsx_severity>status</imsx_severity>
        <imsx_description>Result read</imsx_description>
        <imsx_messageRefIdentifier>999999123</imsx_messageRefIdentifier>
        <imsx_operationRefIdentifier>readResult</imsx_operationRefIdentifier>
      </imsx_statusInfo>
    </imsx_POXResponseHeaderInfo>
  </imsx_POXHeader>
  <imsx_POXBody>
    <readResultResponse>
      <result>
        <resultScore>
          <language>en</language>
          <textString>0.91</textString>
        </resultScore>
      </result>
    </readResultResponse>
  </imsx_POXBody>
</imsx_POXEnvelopeResponse>
```

The format of the text string is a decimal value in the range 0.0 - 1.0 with a period character as the decimal point. The TC will always return "en" as the language regardless of the value for language provided by the TP in any previous replaceResult operation. The language field indicates the language to be used in the interpretation of the numeric format, not the language of the TC or TP user interface.

### 6.1.3 deleteResult

The deleteResultRequest deleted the grade for a particular result **lis\_result\_sourcedid**. This service is recommended.

It is up to the TC as to whether it maintains a history of all grade values. If the TC is maintaining grade history, it is up to the TC to define its internal meaning of the deleteResult operation. The TC may delete the most recent grade reverting to a prior grade, or it may actually completely erase the grade, or it may simply retain the previous value for a grade and mark the grade as "soft deleted". Since the TP will be expecting that its grade will have been deleted, it would be best if the TC also reflected that in its gradebook view of the "current grades".

The TP should treat its grade as being a single item without any history and accept the fact that TCs may vary on how they alter their internal structures upon response to this request.

Regardless of how the TC decides to handle deletes internally, it should provide a view for the TP that reflects that there is no longer any grade associated with the given **lis\_result\_sourcedid**. So a readResult after a deleteResult must return an empty grade as if replaceResult had never been called.

```
<?xml version = "1.0" encoding = "UTF-8"?>
<imsx_POXEnvelopeRequest xmlns = "http://www.imsglobal.org/lis/oms1p0/pox">
  <imsx_POXHeader>
    <imsx_POXRequestHeaderInfo>
      <imsx_version>V1.0</imsx_version>
      <imsx_messageIdentifier>999999123</imsx_messageIdentifier>
    </imsx_POXRequestHeaderInfo>
  </imsx_POXHeader>
  <imsx_POXBody>
    <deleteResultRequest>
      <resultRecord>
        <sourcedGUID>
          <sourcedId>3124567</sourcedId>
        </sourcedGUID>
      </resultRecord>
    </deleteResultRequest>
  </imsx_POXBody>
</imsx_POXEnvelopeRequest>
```

The deleteResultResponse indicates the success / failure of the operation in the header area of the response and as such the body area is empty.

```
<?xml version="1.0" encoding="UTF-8"?>
<imsx_POXEnvelopeResponse xmlns = "http://www.imsglobal.org/lis/oms1p0/pox">
  <imsx_POXHeader>
    <imsx_POXResponseHeaderInfo>
      <imsx_version>V1.0</imsx_version>
      <imsx_messageIdentifier>4560</imsx_messageIdentifier>
      <imsx_statusInfo>
        <imsx_codeMajor>success</imsx_codeMajor>
        <imsx_severity>status</imsx_severity>
        <imsx_messageRefIdentifier>999999123</imsx_messageRefIdentifier>
        <imsx_operationRefIdentifier>deleteResult</imsx_operationRefIdentifier>
      </imsx_statusInfo>
    </imsx_POXResponseHeaderInfo>
  </imsx_POXHeader>
  <imsx_POXBody>
    <deleteResultResponse/>
  </imsx_POXBody>
</imsx_POXEnvelopeResponse>
```

## Appendix A – LTI Standard Vocabularies

*This Appendix is taken from the LTI Vocabularies [LTI, 10 VCB] documentation.*

The LTI standard uses URN values to identify certain entities. This section contains URN vocabularies for ContextType and Role values.

### A.1 ContextType Vocabularies

#### A.1.1 LIS vocabulary for ContextType

Handle	Full URN
CourseTemplate	urn:lti:context-type:ims/lis/CourseTemplate
CourseOffering	urn:lti:context-type:ims/lis/CourseOffering
CourseSection	urn:lti:context-type:ims/lis/CourseSection
Group	urn:lti:context-type:ims/lis/Group

### A.2 Role Vocabularies

#### A.2.1 LIS vocabulary for System Role

The following table lists URN values for system role as defined by the LIS standard.

Handle	Full URN
SysAdmin	urn:lti:sysrole:ims/lis/SysAdmin
SysSupport	urn:lti:sysrole:ims/lis/SysSupport
Creator	urn:lti:sysrole:ims/lis/Creator
AccountAdmin	urn:lti:sysrole:ims/lis/AccountAdmin
User	urn:lti:sysrole:ims/lis/User
Administrator	urn:lti:sysrole:ims/lis/Administrator
None	urn:lti:sysrole:ims/lis/None

#### A.2.2 LIS vocabulary for Institution Role

The following table lists URN values for institution roles as defined by the LIS standard

Handle	Full URN
Student	urn:lti:instrole:ims/lis/Student
Faculty	urn:lti:instrole:ims/lis/Faculty
Member	urn:lti:instrole:ims/lis/Member
Learner	urn:lti:instrole:ims/lis/Learner
Instructor	urn:lti:instrole:ims/lis/Instructor
Mentor	urn:lti:instrole:ims/lis/Mentor
Staff	urn:lti:instrole:ims/lis/Staff
Alumni	urn:lti:instrole:ims/lis/Alumni
ProspectiveStudent	urn:lti:instrole:ims/lis/ProspectiveStudent



Guest	urn:lti:instrole:ims/lis/Guest
Other	urn:lti:instrole:ims/lis/Other
Administrator	urn:lti:instrole:ims/lis/Administrator
Observer	urn:lti:instrole:ims/lis/Observer
None	urn:lti:instrole:ims/lis/None

### A.2.3 LIS vocabulary for Context Role

Roles within the LIS standard consist of a RoleType and an optional SubRoleType. The handle for the corresponding URN value contains both elements, separated by a slash.

Handle	Full URN
Learner	urn:lti:role:ims/lis/Learner
Learner/Learner	urn:lti:role:ims/lis/Learner/Learner
Learner/NonCreditLearner	urn:lti:role:ims/lis/Learner/ NonCreditLearner
Learner/GuestLearner	urn:lti:role:ims/lis/Learner/ GuestLearner
Learner/ExternalLearner	urn:lti:role:ims/lis/Learner/ ExternalLearner
Learner/Instructor	urn:lti:role:ims/lis/Learner/Instructor
Instructor	urn:lti:role:ims/lis/Instructor
Instructor/PrimaryInstructor	urn:lti:role:ims/lis/Instructor/ PrimaryInstructor
Instructor/Lecturer	urn:lti:role:ims/lis/Instructor/Lecturer
Instructor/GuestInstructor	urn:lti:role:ims/lis/Instructor/ GuestInstructor
Instructor/ExternalInstructor	urn:lti:role:ims/lis/Instructor/ ExternalInstructor
ContentDeveloper	urn:lti:role:ims/lis/ContentDeveloper
ContentDeveloper/ContentDeveloper	urn:lti:role:ims/lis/ContentDeveloper/ ContentDeveloper
ContentDeveloper/Librarian	urn:lti:role:ims/lis/ContentDeveloper/ Librarian
ContentDeveloper/ContentExpert	urn:lti:role:ims/lis/ContentDeveloper/ ContentExpert
ContentDeveloper/ExternalContentExpert	urn:lti:role:ims/lis/ContentDeveloper/ ExternalContentExpert
Member	urn:lti:role:ims/lis/Member
Member/Member	urn:lti:role:ims/lis/Member/Member
Manager	urn:lti:role:ims/lis/Manager
Manager/AreaManager	urn:lti:role:ims/lis/Manager/AreaManager
Manager/CourseCoordinator	urn:lti:role:ims/lis/Manager/CourseCoordinator
Manager/Observer	urn:lti:role:ims/lis/Manager/Observer
Manager/ExternalObserver	urn:lti:role:ims/lis/Manager/ExternalObserver
Mentor	urn:lti:role:ims/lis/Mentor

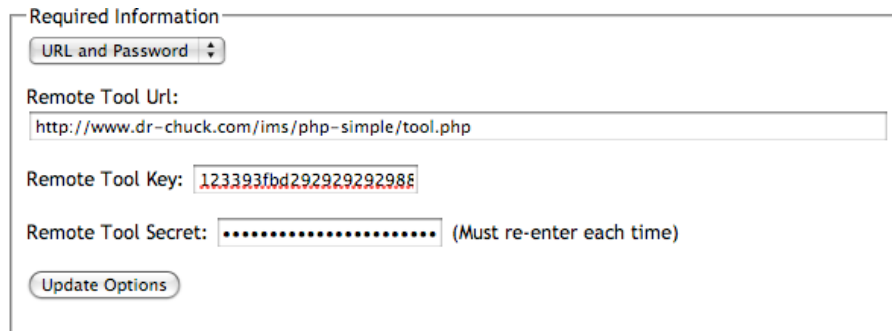
Mentor/Mentor	urn:lti:role:ims/lis/Mentor/Mentor
Mentor/Reviewer	urn:lti:role:ims/lis/Mentor/Reviewer
Mentor/Advisor	urn:lti:role:ims/lis/Mentor/Advisor
Mentor/Auditor	urn:lti:role:ims/lis/Mentor/Auditor
Mentor/Tutor	urn:lti:role:ims/lis/Mentor/Tutor
Mentor/LearningFacilitator	urn:lti:role:ims/lis/Mentor/ LearningFacilitator
Mentor/ExternalMentor	urn:lti:role:ims/lis/Mentor/ExternalMentor
Mentor/ExternalReviewer	urn:lti:role:ims/lis/Mentor/ ExternalReviewer
Mentor/ExternalAdvisor	urn:lti:role:ims/lis/Mentor/ ExternalAdvisor
Mentor/ExternalAuditor	urn:lti:role:ims/lis/Mentor/ ExternalAuditor
Mentor/ExternalTutor	urn:lti:role:ims/lis/Mentor/ExternalTutor
Mentor/ExternalLearningFacilitator	urn:lti:role:ims/lis/Mentor/ ExternalLearningFacilitator
Administrator	urn:lti:role:ims/lis/Administrator
Administrator/Administrator	urn:lti:role:ims/lis/Administrator/ Administrator
Administrator/Support	urn:lti:role:ims/lis/Administrator/ Support
Administrator/Developer	urn:lti:role:ims/lis/Administrator/Developer
Administrator/SystemAdministrator	urn:lti:role:ims/lis/Administrator/ SystemAdministrator
Administrator/ExternalSystemAdministrator	urn:lti:role:ims/lis/Administrator/ ExternalSystemAdministrator
Administrator/ExternalDeveloper	urn:lti:role:ims/lis/Administrator/ ExternalDeveloper
Administrator/ExternalSupport	urn:lti:role:ims/lis/Administrator/ ExternalSupport
TeachingAssistant	urn:lti:role:ims/lis/TeachingAssistant
TeachingAssistant/TeachingAssistant	urn:lti:role:ims/lis/TeachingAssistant/ TeachingAssistant
TeachingAssistant/TeachingAssistantSection	urn:lti:role:ims/lis/TeachingAssistant/ TeachingAssistantSection
TeachingAssistnat/ TeachingAssistantSectionAssociation	urn:lti:role:ims/lis/TeachingAssistant/ TeachingAssistantSectionAssociation
TeachingAssistant/ TeachingAssistantOffering	urn:lti:role:ims/lis/TeachingAssistant/ TeachingAssistantOffering
TeachingAssistant/ TeachingAssistantTemplate	urn:lti:role:ims/lis/TeachingAssistant/ TeachingAssistantTemplate
TeachingAssistant/TeachingAssistantGroup	urn:lti:role:ims/lis/TeachingAssistant/ TeachingAssistantGroup
TeachingAssistant/Grader	urn:lti:role:ims/lis/TeachingAssistant/ Grader

## Appendix B – Implementation Practice

This section includes *non-normative* discussion and recommendations to help guide implementations.

### B.1 Authoring Links with Link-Level Credentials

If the TC chooses to support link-level credentials, they are supporting the ability for the Instructor to author LTI links inside of the TC. The minimal authoring screen is very simple.



The screenshot shows a web form titled "Required Information". At the top is a dropdown menu with "URL and Password" selected. Below this are three input fields: "Remote Tool Url:" containing "http://www.dr-chuck.com/ims/php-simple/tool.php", "Remote Tool Key:" containing "123393fbd29292929298f", and "Remote Tool Secret:" containing a series of dots followed by the text "(Must re-enter each time)". At the bottom of the form is a button labeled "Update Options".

**Figure B.2** Authoring screen for LTI links inside of the TC.

Another possible authoring interface might be to allow the pasting of the XML **basic\_lti\_link** descriptor into an input field.

```
<?xml version="1.0" encoding="UTF-8"?>
<basic_lti_link xmlns="http://www.imsglobal.org/xsd/imsbasiclti_v1p0"
  xmlns:lticm="http://www.imsglobal.org/xsd/imslticm_v1p0"
  xmlns:lticp="http://www.imsglobal.org/xsd/imslticp_v1p0"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.imsglobal.org/xsd/imsbasiclti_v1p0
    http://www.imsglobal.org/xsd/lti/ltiv1p0/imsbasiclti_v1p0.xsd
    http://www.imsglobal.org/xsd/imslticm_v1p0
    http://www.imsglobal.org/xsd/lti/ltiv1p0/imslticm_v1p0.xsd
    http://www.imsglobal.org/xsd/imslticp_v1p0
    http://www.imsglobal.org/xsd/lti/ltiv1p0/imslticp_v1p0.xsd">
  <title>Grade Book</title>
  <description>Grade Book with many column types</description>
  <custom>
    <lticm:property name="keyname">value</lticm:property>
  </custom>
  <extensions platform="my.lms.com">
    <lticm:property name="keyname">value</lticm:property>
  </extensions>
  <launch_url>url to the basiclti launch URL</launch_url>
  <secure_launch_url>secure url to the basiclti launch URL</secure_launch_url>
  <icon>url to an icon for this tool (optional)</icon>
  <secure_icon>secure url to an icon for this tool (optional)</secure_icon>
  <vendor>
    <lticp:code>vendor.com</lticp:code>
    <lticp:name>vendor.name</lticp:name>
    <lticp:description>This is a vendor of learning tools.</lticp:description>
    <lticp:url>http://www.vendor.com/</lticp:url>
    <lticp:contact>
      <lticp:email>support@vendor.com</lticp:email>
    </lticp:contact>
  </vendor>
</basic_lti_link>
```

**Figure B.3** Sample pasting of an LTI link in XML.

As a best practice, TC systems should support both the URL/Key/Secret and XML/Key/Secret of authoring an LTI link. The user interface for these options and how and where these options are shown to the user is up to the TC.

The TC might add other features like frame height, "open in new window" or add a title field to the link entry.

Display Information

Set Button Text:

Set Tool Title:  (Above the tool)

Update Options

Optional Launch Information

iFrame Height:

Debug Launch: ☐

When Debug Launch is selected, the tool pauses before launching and displays launch data.

Update Options

**Figure B.4** Sample interface for including various options inside the TC.

These screens will be available in the TC where the Instructor is creating the course organization and adding a new link. A typical approach is to make creating an LTI launch just one more type of TC link in the course structure.

## B.2 Security Policy / SandBoxing Launch Requests

TC systems will likely implement a number of security policy related features that can be controlled by both the TC administrator and the Instructor. These are some considerations:

- TC systems will likely limit the transmission of identifying information for users such as name and E-Mail to a trusted set of TPs.
- TC Administrators may want to allow only certain approved/trusted Instructors to be allowed to author their own LTI links.
- The TC system may want the ability of an Instructor to further reduce/sandbox the data items transmitted to a TP.

It is out of the scope of this document to specify how the TC system controls which instructors can author LTI links or which URLs can be launched using LTI or which data is shared with particular TPs.

## B.3 Roles

Some of the commonly used roles from LIS include **Learner**, **Instructor**, **Administrator**, **TeachingAssistant**, **ContentDeveloper**, and **Mentor**. Multiple roles can be included, separated by commas. TC systems should include as many roles as appropriate for the user (i.e., more roles are better). TC systems should be aware that simple TPs will key off the presence or absence of the **Instructor** role and group users into those with the **Instructor** role (read-write-configure) and those without the **Instructor** role (read).

## B.4 Non-Context LTI Launches

While the typical use of an LTI link is in a context, it is also possible to use LTI to launch a link that is not part of a context. One example of a non-context launch might be a menu item that is part of the portal or part of a global menu in the TC.

Supporting non-context launches is optional for both the TP and TC.

If an LTI launch is coming from a non-context placement, the context information is simply omitted and the launch will contain the user and organization information but no context information.

## B.5 LTI Sample Launch

The LTI launch protocol is a POST to the launch URL with the LTI parameters described above, properly signed using OAuth signing.

The most common launch approach will be for the TC to emit a form to the browser and then include code to automatically submit the form to the launch URL. The TP will assume that it is in a browser, process the input parameters, setting session information if necessary and optionally redirecting.

Here is a sample of an HTML form using a password of "secret" and **oauth\_consumer\_key** of "12345".

```
<div id="ltiLaunchFormSubmitArea">
<form action="http://dr-chuck.com/ims/php-simple/tool.php"
  name="ltiLaunchForm" id="ltiLaunchForm" method="post"
  encType="application/x-www-form-urlencoded">
<input type="hidden" name="oauth_version" value="1.0"/>
<input type="hidden" name="oauth_nonce" value="c8350c0e47782d16d2fa48b2090c1d8f"/>
<input type="hidden" name="oauth_timestamp" value="1251600739"/>
<input type="hidden" name="oauth_consumer_key" value="12345"/>
<input type="hidden" name="resource_link_id" value="120988f929-274612"/>
<input type="hidden" name="user_id" value="292832126"/>
<input type="hidden" name="roles" value="Instructor"/>
<input type="hidden" name="lis_person_name_full" value="Jane Q. Public"/>
<input type="hidden" name="lis_person_contact_email_primary" value="user@school.edu"/>
<input type="hidden" name="lis_person_sourced_id" value="school.edu:user"/>
<input type="hidden" name="context_id" value="456434513"/>
<input type="hidden" name="context_title" value="Design of Personal Environments"/>
```

```

<input type="hidden" name="context_label" value="SI182"/>
<input type="hidden" name="lti_version" value="LTI-1p0"/>
<input type="hidden" name="lti_message_type" value="basic-lti-launch-request"/>
<input type="hidden" name="tool_consumer_instance_guid" value="lmsng.school.edu"/>
<input type="hidden" name="tool_consumer_instance_description"
  value="University of School (LMSng)"/>
<input type="submit" name="basiclti_submit" value="Launch Endpoint with BasicLTI Data"/>
<input type="hidden" name="oauth_signature_method" value="HMAC-SHA1"/>
<input type="hidden" name="oauth_callback" value="about:blank"/>
<input type="hidden" name="oauth_signature" value="TPFPK4u3NwmtLt0nDMP1G1zG30U="/>
</form>
</div>
<script language="javascript">
  document.getElementById("ltiLaunchFormSubmitArea").style.display = "none";
  nei = document.createElement('input');
  nei.setAttribute('type', 'hidden');
  nei.setAttribute('name', 'basiclti_submit');
  nei.setAttribute('value', 'Press to continue to external tool.');
```

This form is designed to work even if JavaScript is turned off in the browser – the user simply presses the submit button. If JavaScript is on, the button is quickly hidden and the form is automatically submitted.

The JavaScript must add a hidden field to the form when it is auto-submitting the form because the submit value was included in the OAuth base string and signature computation.

The following is the base string prior to the OAuth signature computation:

```

POST&http%3A%2F%2Fdr-chuck.com%2Ffims%2Fphp-
simple%2Ftool.php&basiclti_submit%3DLaunch%2520Endpoint%2520with%2520BasicLTI%2520Data%26context_
id%3D456434513%26context_label%3DSI182%26context_title%3DDesign%2520of%2520Personal%2520Environme
nts%26lis_person_contact_email_primary%3Duser%2540school.edu%26lis_person_name_full%3DJane%2520Q.
%2520Public%26lis_person_sourced_id%3Dschool.edu%253Auser%26lti_message_type%3Dbasic-lti-launch-
request%26lti_version%3DLTI-
1p0%26oauth_consumer_key%3D12345%26oauth_nonce%3Dc8350c0e47782d16d2fa48b2090c1d8f%26oauth_signatu
re_method%3DHMAC-
SHA1%26oauth_timestamp%3D1251600739%26oauth_version%3D1.0%26resource_link_id%3D120988f929-
274612%26roles%3DInstructor%26tool_consumer_instance_description%3DUniversity%2520of%2520School%2
520%2528LMSng%2529%26tool_consumer_instance_guid%3Dlmsng.school.edu%26user_id%3D292832126
```

In the above string, all line wrapping needs to be removed. Notice that all of the POST values, including the submit button, are included in the base string (i.e., the string signed by OAuth).

## B.6 Conformance

Conformance for LTI is granted through the IMS CC-LTI Alliance and consists of certification testing for TC and TP implementations. For additional information about conformance, visit the CC-LTI Alliance here:

<http://www.imsglobal.org/cc/alliance.html>.

## B.7 Administrator / Instructor User Interfaces / Custom Parameters

While the user interface is completely up to the TC, there are several user interface patterns that have evolved to be quite effective in practice. There are two primary use case patterns described below.

### B.7.1 Instructor Creates New Tools

In the case that the TC decides to allow the instructor to place tools without administrator action by getting a URL, key, and secret from a TP and plugging them into a course structure, it is a good practice to allow the instructor to enter custom parameters without requiring administrator assistance. Some TPs will need custom parameters to function properly. Also if the instructor is using a TC to produce an IMS Common Cartridge with LTI links in the cartridge, often setting custom parameters for a tool placement is an essential part of authoring a cartridge.

### **B.7.2 Admin Creates New Tools, Instructor Only Places Tools**

Another common case is to only allow the administrator to create new tools (i.e., key/secret/url) and then let the instructor place those pre-configured tools in their courses. In this use case, instructors never handle url/key/secret values. Even in this use case it is important to allow the instructor to be able to set or augment custom parameters for each placement. These parameters may be necessary for the TP to function and/or may be necessary if the instructor is building a course in the TC to be exported into an IMS Common Cartridge. It is not necessary to always give the instructor the option to configure custom parameters, but it should be possible for the administrator to make a choice to reveal a user interface to set custom parameters.

## Appendix C – Custom Parameter Substitution

Support for substitutable custom parameters is optional and the TP should anticipate that these parameters may come from the TC in their unsubstituted form.

*Note: This Appendix is taken from the LTI Vocabularies [LTI, 10 VCB] documentation.*

### C.1 LTI User variables

Message Variable Name	Corresponding LTI value
\$User.id	LaunchMixin.user id (This is the local identifier for the user within the TC.)

### C.2 LIS Person variables

Message Variable Name	XPath for value from LIS Database
\$Person.sourcedId	personRecord/sourcedid
\$Person.name.full	personRecord/person/formname[/formnameType/instanceValue/text="Full"] /formattedName/text
\$Person.name.family	personRecord/person/name/partName[instanceName/text="Family"]/instanceValue/text
\$Person.name.given	personRecord/person/name/partName[instanceName/text="Given"]/instanceValue/text
\$Person.name.middle	personRecord/person/name/partName[instanceName/text="Middle"]/instanceValue/text
\$Person.name.prefix	personRecord/person/name/partName[instanceName/text="Prefix"]/instanceValue/text
\$Person.name.suffix	personRecord/person/name/partName[instanceName/text="Suffix"]/instanceValue/text
\$Person.address.street1	personRecord/person/address/[addressType/instanceValue/text="Preferred"]addressPart /nameValuePair[/instanceName/text="NonFieldedStreetAddress1"]/instanceValue /text <sup>1</sup>
\$Person.address.street2	personRecord/person/address/[addressType/instanceValue/text="Preferred"] addressPart /nameValuePair[instanceName/text="NonFieldedStreetAddress2"] /instanceValue/text
\$Person.address.street3	personRecord/person/address/[addressType/instanceValue/text="Preferred"]addressPart /nameValuePair[/instanceName/text="NonFieldedStreetAddress3"] /instanceValue/text
\$Person.address.street4	personRecord/person/address/[addressType/instanceValue/text="Preferred"]addressPart /nameValuePair[/instanceName/text="NonFieldedStreetAddress3"] /instanceValue/
\$Person.address.locality	personRecord/person/address/[addressType/instanceValue/text="Preferred"]addressPart /nameValuePair[/instanceName/text="Locality"]/instanceValue/text
\$Person.address.statepr	personRecord/person/address/[addressType/instanceValue/text="Preferred "]addressPart /nameValuePair[/instanceName/text="Statepr"]/instanceValue/text
\$Person.address.country	personRecord/person/address/[addressType/instanceValue/text="Preferred"]addressPart /nameValuePair[/instanceName/text="Country"]/instanceValue/text
\$Person.address.postcode	personRecord/person/address/[addressType/instanceValue/text="Preferred"]addressPart /nameValuePair[/instanceName/text="Postcode"]/instanceValue/text
\$Person.address.timezone	personRecord/person/address/[addressType/instanceValue/text="Preferred"]addressPart /nameValuePair[/instanceName/text="Timezone"]/instanceValue/text
\$Person.phone.mobile	personRecord/person/contactinfo[contactinfoType/instanceValue/text="Mobile"]

<sup>1</sup> The “Preferred” instanceName is not part of the default LIS vocabulary. We are proposing to add this term in the LTI Profile of LIS so that we can support a single address instead of dealing with multiple address types as prescribed by the full LIS standard.



	/contactInfoValue/text
\$Person.phone.primary	personRecord/person/contactinfo [contactinfoType/instanceValue/text="Telephone Primary"]/contactinfoValue /text
\$Person.phone.home	personRecord/person/contactinfo [contactinfoType/instanceValue/text="Telephone Home"]/contactinfoValue /text
\$Person.phone.work	personRecord/person/contactinfo [contactinfoType/instanceValue/text="Telephone Work"]/contactinfoValue /text
\$Person.email.primary	personRecord/person/contactinfo [contactinfoType/instanceValue/text="Email Primary"] /contactinfoValue /text
\$Person.email.personal	person/contactinfo[contactinfoType/instanceValue/text="Email_Personal"] /contactinfoValue /text
\$Person.webaddress	personRecord/person/contactinfo[contactinfoType/instanceValue/text="Web-Address"] /contactinfoValue/text
\$Person.sms	personRecord/person/contactinfo[contactinfoType/instanceValue/text="SMS"] /contactinfoValue/text

### C.3 LIS Course Template Variables

Message Variable Name	XPath for value from LIS Database
\$CourseTemplate.sourcedId	courseTemplateRecord/sourcedId
\$CourseTemplate.label	courseTemplateRecord/courseTemplate/label/textString
\$CourseTemplate.title	courseTemplateRecord/courseTemplate/title/textString
\$CourseTemplate.shortDescription	courseTemplateRecord/courseTemplate/catalogDescription/shortDescription
\$CourseTemplate.longDescription	courseTemplateRecord/courseTemplate/catalogDescription/longDescription
\$CourseTemplate.courseNumber	courseTemplateRecord/courseTemplate/courseNumber/textString
\$CourseTemplate.credits	courseTemplateRecord/courseTemplate/defaultCredits/textString

### C.4 LIS Course Offering Variables

Message Variable Name	XPath for value from LIS Database
\$CourseOffering.sourcedId	courseOfferingRecord/sourcedId
\$CourseOffering.label	courseOfferingRecord/courseOffering/label
\$CourseOffering.title	courseOfferingRecord/courseOffering/title
\$CourseOffering.shortDescription	courseOfferingRecord/courseOffering/catalogDescription/shortDescription
\$CourseOffering.longDescription	courseOfferingRecord/courseOffering/catalogDescription/longDescription
\$CourseOffering.courseNumber	courseOfferingRecord/courseOffering/courseNumber/textString
\$CourseOffering.credits	courseOfferingRecord/courseOffering/defaultCredits/textString
\$CourseOffering.academicSession	courseOfferingRecord/courseOffering/defaultCredits/textString

## C.5 LIS Course Section Variables

Message Variable Name	XPath for value from LIS Database
\$CourseSection.sourcedId	courseSection/sourcedId
\$CourseSection.label	courseSectionRecord/courseSection/label
\$CourseSection.title	courseSectionRecord/courseSection/title
\$CourseSection.shortDescription	courseSectionRecord/courseSection/catalogDescription/shortDescription
\$CourseSection.longDescription	courseSectionRecord/courseSection/catalogDescription/longDescription
\$CourseSection.courseNumber	courseSectionRecord/courseSection/courseNumber/textString
\$CourseSection.credits	courseSectionRecord/courseSection/defaultCredits/textString
\$CourseSection.maxNumberOfStudents	courseSectionRecord/courseSection/maxNumberOfStudents
\$CourseSection.numberofStudents	courseSectionRecord/courseSection/numberOfStudents
\$CourseSection.dept	courseSectionRecord/courseSection/org[type/textString="Dept"] /orgName/textString
\$CourseSection.timeFrame.begin	courseSectionRecord/courseSection/timeFrame/begin
\$CourseSection.timeFrame.end	courseSectionRecord/courseSection/timeFrame/end
\$CourseSection.enrollControl.accept	courseSectionRecord/courseSection/enrollControl/enrollAccept
\$CourseSection.enrollControl.allowed	courseSectionRecord/courseSection/enrollControl/enrollAllowed
\$CourseSection.dataSource	courseSectionRecord/courseSection/dataSource
\$CourseSection.sourceSectionId	createCourseSectionFromCourseSectionRequest/sourcedId

## C.6 LIS Group Variables

Message Variable Name	XPath for value from LIS Database
\$Group.sourcedId	groupRecord/sourcedId
\$Group.grouptype.scheme	groupRecord/group/groupType/scheme/textString
\$Group.grouptype.typevalue	groupRecord/group/groupType/typevalue/textString
\$Group.grouptype.level	groupRecord/group/groupType/typevalue/level/textString
\$Group.email	groupRecord/group/email
\$Group.url	groupRecord/group/url
\$Group.timeFrame.begin	groupRecord/group/timeframe/begin
\$Group.timeFrame.end	groupRecord/group/timeframe/end
\$Group.enrollControl.accept	groupRecord/group/enrollControl/enrollAccept
\$Group.enrollControl.allowed	groupRecord/group/enrollControl/enrollAllowed
\$Group.shortDescription	groupRecord/group/description/shortDescription
\$Group.longDescription	groupRecord/group/description/longDescription
\$Group.parentId	groupRecord/group/relationship[relation="Parent"]/sourcedId

## C.7 LIS Membership Variables

Message Variable Name	XPath for value from LIS Database
\$Membership.sourcedId	membershipRecord/sourcedId
\$Membership.collectionSourcedId	membershipRecord/membership/collectionSourcedId
\$Membership.personSourcedId	membershipRecord/membership/member/personSourcedId
\$Membership.status	membershipRecord/membership/member/role/status
\$Membership.role	membershipRecord/membership/member/role/roleType
\$Membership.createdTimestamp	membershipRecord/membership/member/role/dataTime
\$Membership.dataSource	membershipRecord/membership/member/role/dataSource

## C.8 LIS LineItem Variables

\$LineItem.sourcedId	lineItemRecord/sourcedId
\$LineItem.type	lineItemRecord/lineItem/lineItemType
\$LineItem.type.displayName	lineItemTypeRecord/lineItemType/displayName
\$LineItem.resultValue.max	resultValueRecord/resultValue/valueRange/max <i>where</i> resultValueRecord.sourcedId = lineItemRecord/lineItem/resultValueSourcedId
\$LineItem.resultValue.list	resultValueRecord/resultValue/valueList/orderValue <i>where</i> resultValueRecord.sourcedId = lineItemRecord/lineItem/resultValueSourcedId
\$LineItem.dataSource	lineItemRecord/lineItem/dataSource

## C.9 LIS Result Variables

\$Result.sourcedGUID	resultRecord/sourcedId
\$Result.createdTimestamp	resultRecord/result/date
\$Result.status	resultRecord/result/statusofResult
\$Result.resultScore	resultRecord/result/resultScore/textString
\$Result.dataSource	resultRecord/result/dataSource

## About This Document

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## Revision History

Version No.	Release Date	Comments
Base Document v1.0	27 July 2009	The first formal release of the Base Document. This document is released for review by the IMS GLC LTI Project Group.
Internal Draft Final v1.0	30 October 2009	The first formal release of the Internal Draft document. This document is released for interoperability implementation by the IMS GLC Members and Affiliates.
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Final v1.0	17 May 2010	The first formal release of the Final specification. This document is released for public adoption.
Public Draft v1.1	13 October 2011	This version of LTI includes updates and clarifications and the addition of an outcomes service.

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