Problem Introduction:

Course creation is generally quite hard, and involves choosing from many technologies which may not compatible with each other.

Digital content from content providers is not easily integrated into different LMS systems.

- Print → Digital Experience → Mobile Experience Transition
- LMS Adoption / Dropping
Problem Introduction:

- Digital Content
  - Many different content providers
  - Each has their own login system
  - Customizable?
- Student System
  - Student discussions / forums
- Assessment System
  - Student data analytics
    - Still possible?
- Classroom Capture
  - Seamless experience vs Context-switching?
Problem Introduction:

Interoperability Standard
Focus for this presentation:

• Letting course creators use digital content / learning applications from various content providers in their courses.
Table of Contents

• Problem Introduction
• Presentation Focus
• Table of Contents 🔄 You are currently here
• Review of Proposed Standards
• Learning Tools Interoperability
• Development and Integration Introduction
• Bringing It All Together
Proposed Standards

- Basic LTI v1.0
- IMS LTI 2.0
- Wookie
- Glue
Review of Proposed Standards:
Hoyos, Wilson - Comparison of the Main Alternatives to the Integration of External Tools in Different Platforms

- **Basic LTI (LTI 1.0)**
  - Tool Consumer
  - Tool Provider
  - OAuth Protocol
  - Requires:
    - Launch URL
    - Consumer key
    - Consumer Secret
  - Does Not Have:
    - Single Sign-On
    - Pass back grades
Review of Proposed Standards:
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Review of Proposed Standards:
Hoyos, Wilson - Comparison of the Main Alternatives to the Integration of External Tools in Different Platforms

- Full LTI (LTI 2.0)
  - Tool Consumer
  - Tool Provider
  - Requires
    - Tool Provider's public registration endpoint
    - Tool Consumer defines a key, Tool Provider defines the secret.
- Tool Proxy
  - Single sign-on user-authentication
  - Pass back outcomes (grades) from the Tool Provider to the Tool Consumer.
  - Communication after launch
  - More complex

Negotiated Registration
- Tool Proxy (Interface Contract)
Review of Proposed Standards:
Hoyos, Wilson - Comparison of the Main Alternatives to the Integration of External Tools in Different Platforms

• Full LTI (LTI 2.0)

• Tool Services:
  • Tool Settings
    • Send outcomes back to Tool Consumer with richer palette of value types
    • Allow other learning metrics to be provided

• Organizational Hierarchy
  • Structure of departments, courses, course sections
  • Enrollment lists
Review of Proposed Standards:
Hoyos, Wilson - Comparison of the Main Alternatives to the Integration of External Tools in Different Platforms

• Apache Wookie
  • Widget server architecture
  • REST based contract
    • Widget instances
    • Storage of persistent information between instances
  • Native Widgets
  • Not specifically designed for integration of learning applications.
Review of Proposed Standards:
Hoyos, Wilson - Comparison of the Main Alternatives to the Integration of External Tools in Different Platforms

- GLUE! (Group Learning Uniform Environment)
  - REST based contract
  - Three main elements
    - VLE adaptors
    - GLUElet Manager
    - Implementation Model Adaptors
  - Relies on the development of the GLUE peripheral elements by third-parties
# Review of Proposed Standards:

Hoyos, Wilson - Comparison of the Main Alternatives to the Integration of External Tools in Different Platforms

<table>
<thead>
<tr>
<th>Feature</th>
<th>LTI 1.0</th>
<th>LTI 2.0</th>
<th>Wookie</th>
<th>GLUE!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Must implement:</td>
<td>Must implement a Tool Provider, integrate with Tool Consumer</td>
<td>Must implement a Tool Provider, integrate with Tool Consumer</td>
<td>Implement adaptors for Tool Consumer, but not Tool Provider.</td>
<td>Must implement a Model Adaptor for each tool.</td>
</tr>
<tr>
<td>Amount of Communication after launch:</td>
<td>None</td>
<td>High Amount</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Outcomes passed back:</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Logging In:</td>
<td>Multiple Logins</td>
<td>Single sign-on</td>
<td>Multiple Logins</td>
<td>Multiple Logins</td>
</tr>
<tr>
<td>Community Support:</td>
<td>High Community Support</td>
<td>Low-Med Community Support</td>
<td>Low Community Support?</td>
<td>Low Community Support?</td>
</tr>
</tbody>
</table>
LTI Evolution

LTI 1.0

Example: Student reads her e-textbook within an LMS.

LTI 1.1

Example: Student completes an assignment on a Tool Provider, and a grade is sent back to the Tool Consumer.
LTI Evolution

LTI 2.0

Example:
Student reads her e-textbook within an LMS.
- Automatic credential exchange and management

Additional Features
- Common Services
  - Tool Settings
  - Organization Hierarchy

Negotiated Registration
- Tool Proxy (Interface Contract)
LTI Data
Data provided by Tool Consumer to Tool Provider

• User’s Information
  • First name, Last Name?
  • Role: learner, professor, administrator, guest
  • Image / Avatar – for profile picture
  • Email Address

• Other Users’ Information
  • Enrollment List
  • Other students’ names, roles, images, emails, grades

• Context
  • Course, student organization, club, study group, etc.
  • Resource_link_title
  • Context_title, Context_label

• Data for LMS Administrator or Course Professor (To Incorporate a Tool Provider into an LMS):
  • Resource URL
  • Consumer Key
  • Consumer Secret

• Behind the scenes data:
  • Resource_link_id
  • User_id
  • Context_id
  • Oauth_consumer_key
  • Oauth_signature
Integration of the Tool Provider in the Tool Consumer

- Required:
  - Launch URL
  - Consumer Key
  - Consumer Secret

Ex: Moodle
LTI Launch Walkthrough

Integrated User Experience

Welcome
Local Resource
Local Resource
LTI Tool
Movie

Severance, Charles http://www.slideshare.net/csev/ims-basic-lti-overview
LTI Launch Walkthrough

User Experience

Hello: test@example.com (Instructor)

Please enter a valid, numeric guess

Enter Guess:

Enter Name (opt):

Guess  Reset Game Data

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Severance, Charles http://www.slideshare.net/csev/ims-basics-lti-overview
LTI Launch Walkthrough

Again in slow motion...

LMS (LTI Consumer)
LMS Looks up User and Course Information.
Information is signed using secret and OAuth
Form data sent to Browser

Tool (LTI Provider)

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Severance, Charles http://www.slideshare.net/csev/ims-basic-lti-overview
LTI Launch Walkthrough

Form is immediately auto-submitted using JavaScript.

```
<form action="tool">
 <input name="user_id" value="2348d8dd" />
 <input name="oauth_token"
     value="abc.edu" />
</form>
```

LMS (LTi Consumer)

Tool (LTi Provider)

Tool looks up secret and validates signature.

Tool provisions user, course, and session.

Tool sends redirect

Severance, Charles http://www.slideshare.net/csev/ims-basic-lti-overview
LTI Launch Walkthrough

Browser follows redirect...

<head>
<meta redirect
    page=“main.php”>
</head>

Tool (LTI Provider)

Tool produces first page.

LMS (LTI Consumer)

Severance, Charles http://www.slideshare.net/csev/ims-basic-lti-overview
LTI Launch Walkthrough

User Experience

Hello: test@example.com (Instructor)
Please enter a valid, numeric guess
Enter Guess: 
Enter Name (opt):

Guess  Reset Game Data

Severance, Charles http://www.slideshare.net/csev/ims-basic-lti-overview
LTI Launch Walkthrough

Basic LTI Sample Launch Data

```plaintext
lti_version=LTI-1p0
lti_message_type=basic-lti-launch-request
oauth_consumer_key=lmsng.school.edu
resource_link_id=120988f929-274612
user_id=292832126
roles=Instructor
lis_person_name_full=Charles R. Severance
lis_person_contact_email_primary = csev@umich.edu
context_id=456434513
context_title=SI301 - PHP
tool_consumer_instance_description=University of School
```

Severance, Charles http://www.slideshare.net/csev/ims-basic-lti-overview
LTI Catalog

http://developers.imsglobal.org/catalog.html

Everything here is IMS LTI Certified!

Learning tools interoperability catalog

Ebook tools
- Bookshelf from VitalSource
- CourseSmart
- BrightView by Follett
- CourseReader
- Barnes and Noble

Eportfolio tools
- Chalk & Wire
- LiveText
- Mahara
- PebblePad
- SchoolChapters

Collaboration tools
- Blackboard Collaborate
- LTI Plugin for Vanilla 2
- Elgg
- Pizza

Use LTI tools inside these platforms: See what they support. Click for more info.
Learning Tools Interoperability Discussion
Sample Tool Consumer and Tool Provider Studio

• Sample Studio, running on Microsoft Azure Platform
  • LTI Consumer
    • http://consumer.azurewebsites.net/
  • LTI Provider
    • http://provider.azurewebsites.net/
  • Scenario: Create an account at the LTI Consumer site, enroll in a course, and try to submit a grade. Try a few of the assignments in the “Samples” course by Stuart Johnson.
LTI Components and OpenEdX

• LTI Components

Open edX supports LTI 1.1 and LTI 2.0 is in development. It is the external standard and applicable to platforms such as Canvas.

See the available apps at eduappcenter.com, an open LTI app collection:
Development and Integration

• Developing a Tool Provider with LTI:
  • Tutorial: Using LTI in OpenEdX using Ruby:
    • http://reganmian.net/blog/2015/02/20/openedx-and-lti-pedagogical-scripts-and-sso/
  • LTI Tool Provider Minimal Example:
    • https://github.com/instructure/lti_tool_provider_example
  • LTI Tool Consumer Example:
    • https://github.com/instructure/lti_tool_consumer_example
  • Example Application which uses LTI for OpenEdX:
    • https://github.com/houshuang/inquirymooc
  • Create a simple tool provider with LTI 1.0 and PHP:
    • http://developers.imsglobal.org/phpcode.html
Development and Integration

Libraries to Get You Started:

- Ruby Library to help implement IMS LTI tool consumers and providers:
  - [https://github.com/instructure/ims-lti](https://github.com/instructure/ims-lti)

- Python LTI Implementation
  - [https://github.com/mitodl/pylti](https://github.com/mitodl/pylti)

- MIT LTI Python Flask Example:
  - [https://github.com/mitodl/mit_lti_flask_sample](https://github.com/mitodl/mit_lti_flask_sample)
Development and Integration

• Connecting your Tool Provider to your Tool Consumer:
  • Adding an external learning application (Tool Provider) to an OpenEdX course:
    • http://edx-partner-course-staff.readthedocs.org/en/latest/exercises_tools/lti_component.html
  • Adding an LTI Tool Provider in Moodle
  • Adding an LTI Tool Provider to Canvas, Moodle, Blackboard, Sakai, Desire2Learn
    • http://www.edu-apps.org/tutorials.html
Bringing It All Together

Tool Consumers (OpenEdX, Moodle, Scholar), LTI, Tool Providers (OpenDSA, Snap), Project Architecture

Tool Consumer: OpenEdX

Setup:
Launch URL, consumer key, consumer secret

Launch URL (with specific parameters) is generated

Professor edits JSON File:

```
{
  "pre_text": "This problem asks …"
  "snap_instance_url": "http://…"
  "snap_instance_params": {width, height, etc.}
  "post_text": "When finished"
}
```

 ua = user/context attributes
 s = shared secret, sig = oauth_sig(ua, s)

Snap Instance
Grade

Confirm sig == oauth_sig(ua, s)

Tool Provider: Snap

Elements:
Submission buttons
Grading components
Any Questions??
References

• IMS – The basic overview on how LTI works - http://developers.imsglobal.org/tutorials.html

• Alario-Hoyos, Wilson - Comparison of the Main Alternatives to the Integration of External Tools in Different Platforms, School of Telecommunication Engineering, University of Valladolid, Institute for Educational Cybernetics, University of Bolton