



Question Interchange Standards and Learning Tools Interoperability

Jon Hellmann

CS6604 – Designing and Implementing Online Education Systems

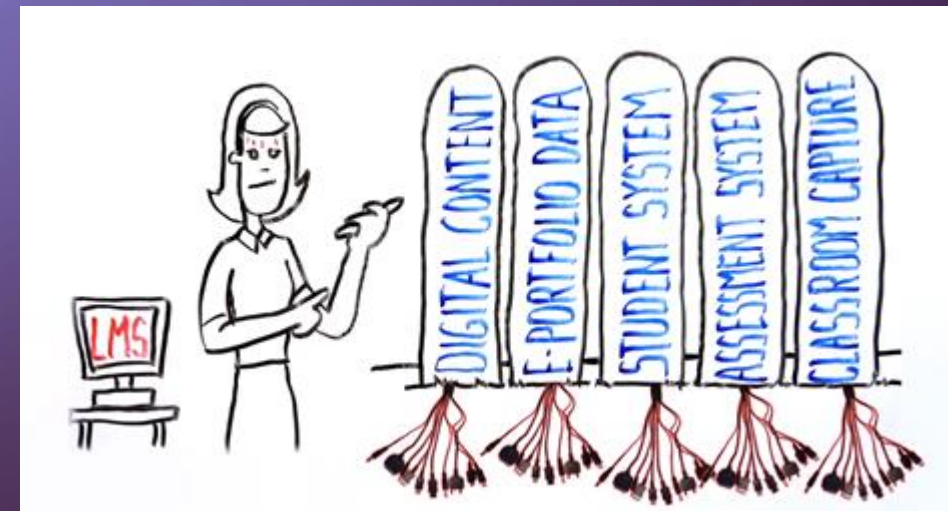
March 26, 2015 2:00PM at Randolph 110

Problem Introduction:

Course creation is generally quite hard, and involves choosing from many technologies which may not be 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

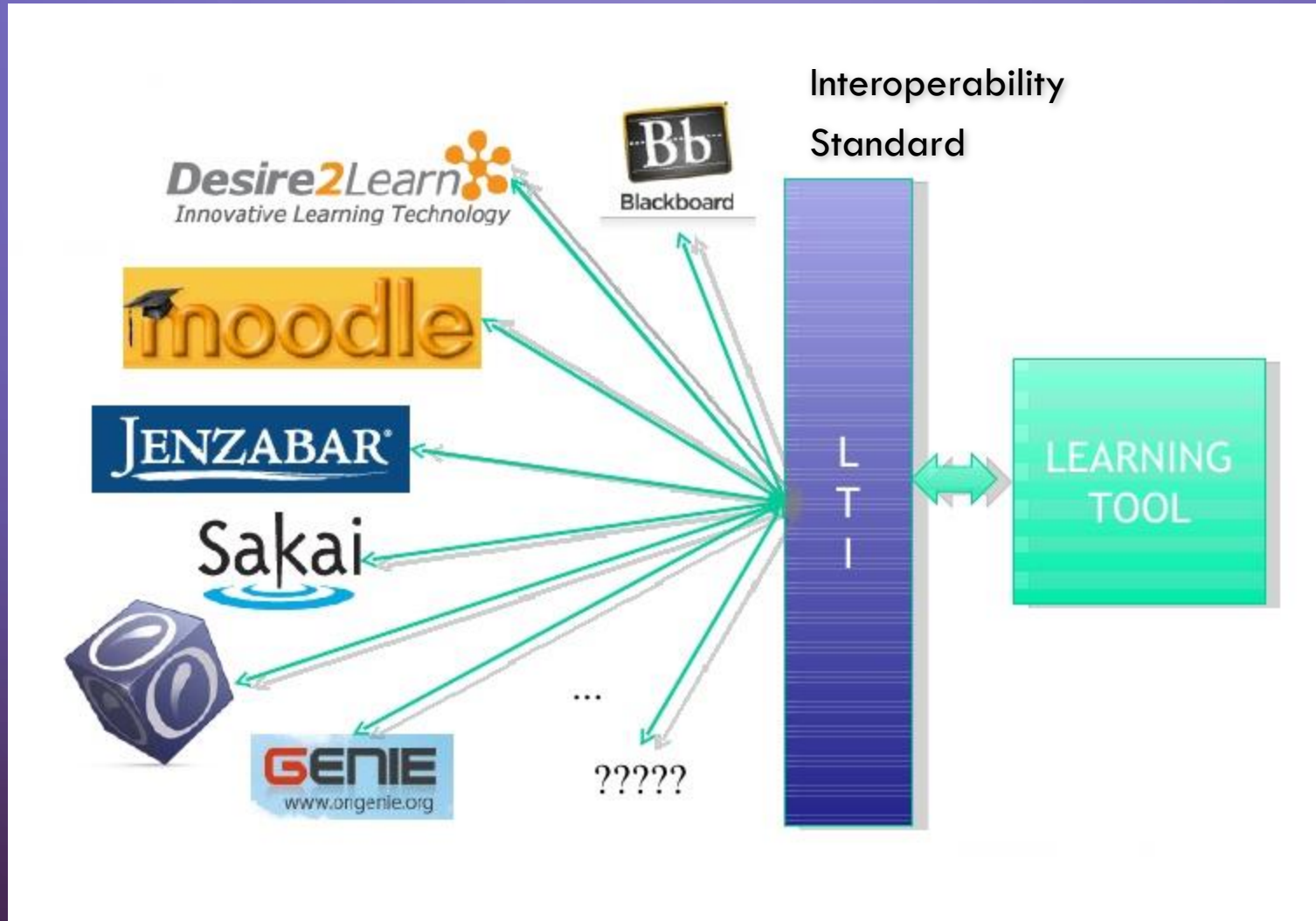


Problem Introduction:

- 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:





Focus for this presentation:

- Letting course creators use **digital content / learning applications** from **various content providers** in their courses.
- 
- 

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- Presentation Focus
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- Bringing It All Together

Proposed Standards



IMS LTI 2.0

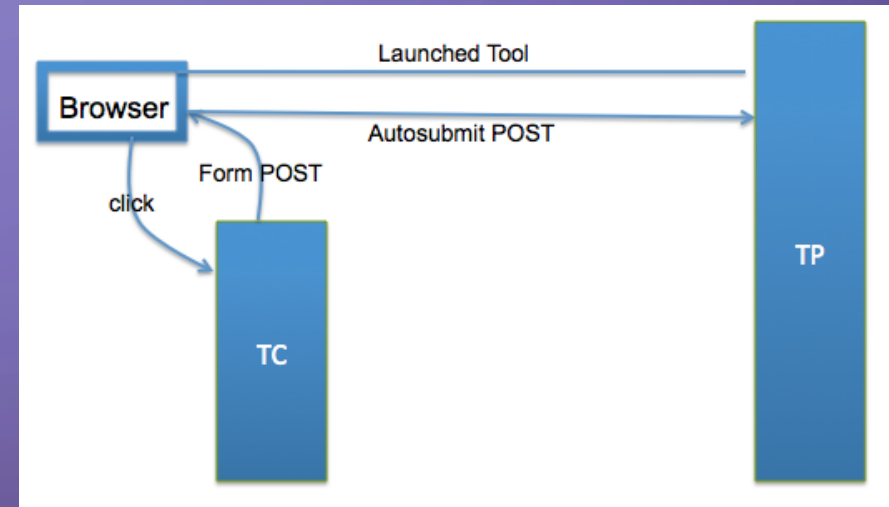
Wookie



Review of Proposed Standards:

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

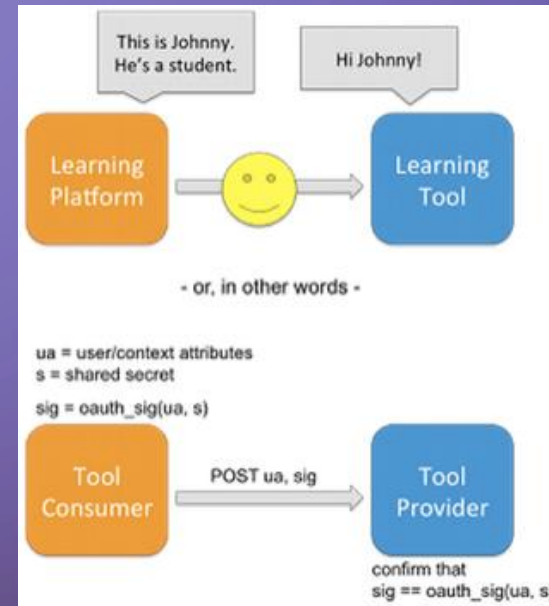
- Basic LTI (LTI 1.0)
 - Tool Consumer
 - Tool Provider
 - OAuth Protocol
 - Requires:
 - Launch URL
 - Consumer key
 - Consumer Secret
 - Does Not Have:
 - Single Sign-On
 - Pass back grades



Review of Proposed Standards:

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

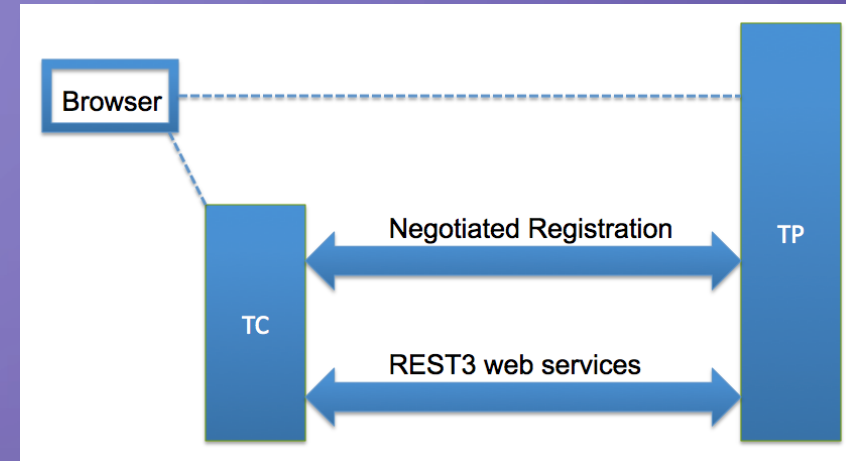
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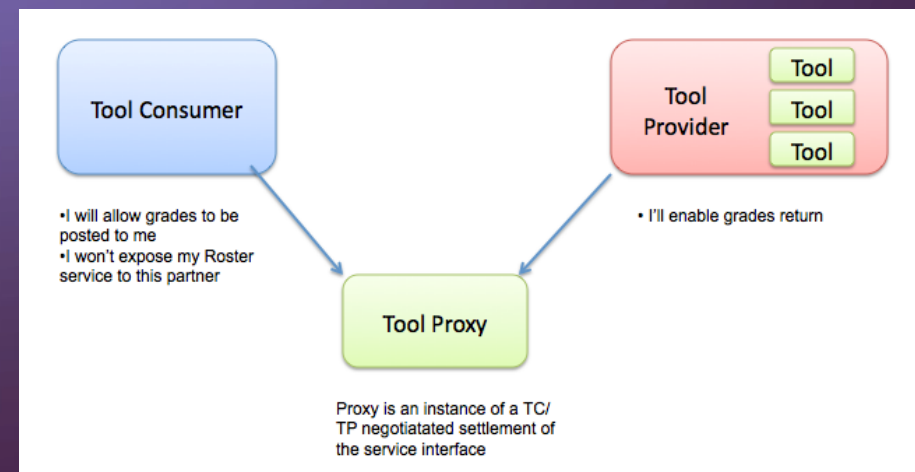
Hoyos, Wilson - Comparison of the Main Alternatives to the Integration of External Tools in Different Platforms

- 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:

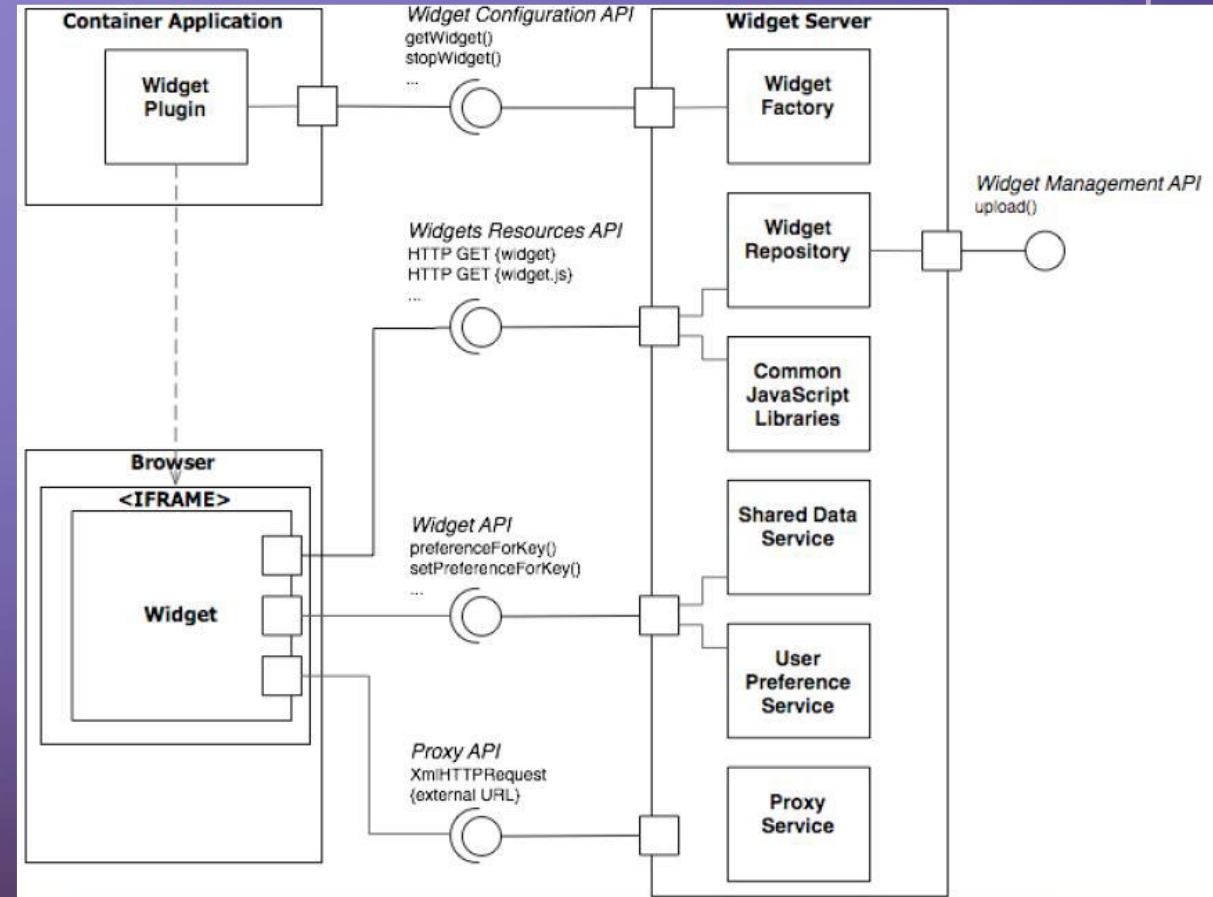
Hoyos, Wilson - Comparison of the Main Alternatives to the Integration of External Tools in Different Platforms

- 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

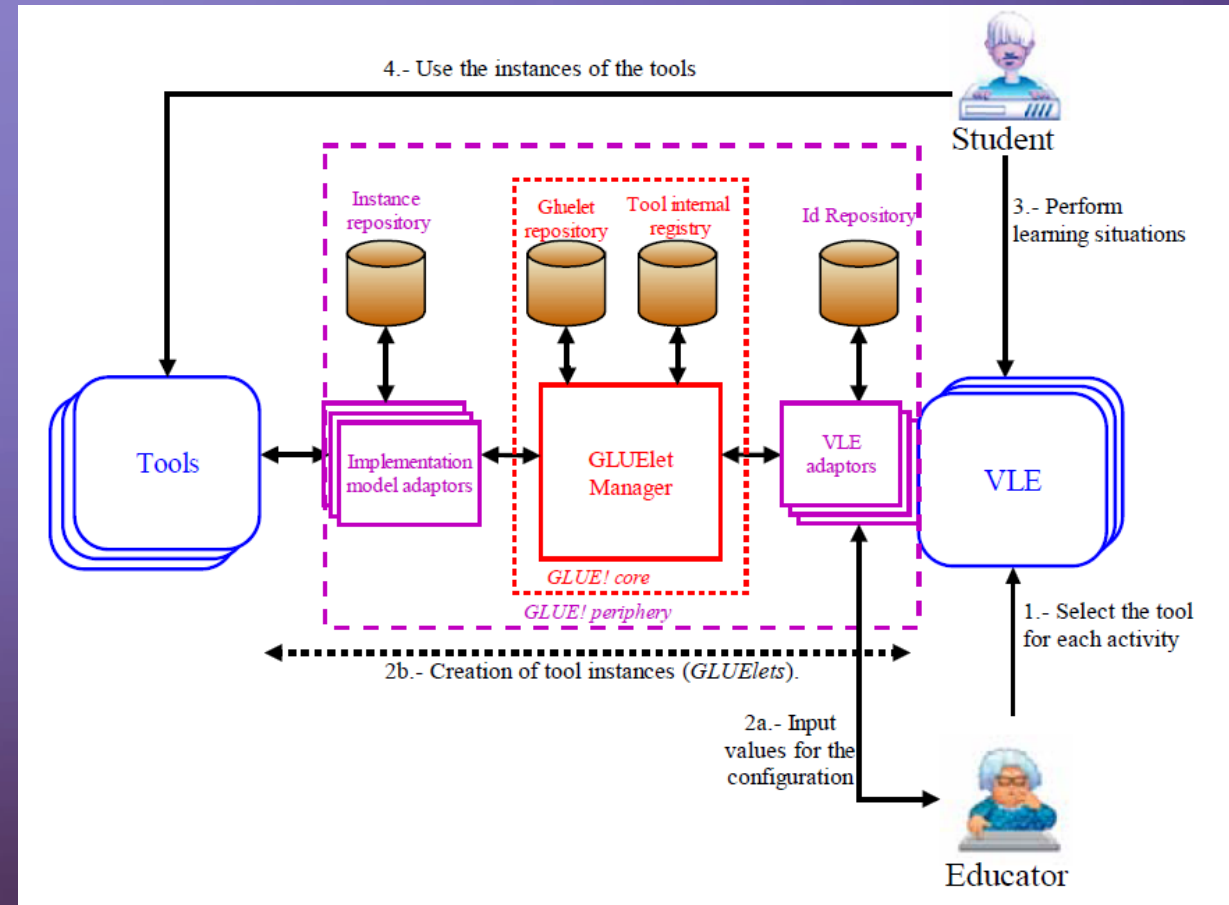
- Apache Wookie
 - Widget server architecture
 - REST based contract
 - Widget instances
 - Storage of persistent information between instances
 - Native Widgets
 - Not specifically designed for integration of learning applications.



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



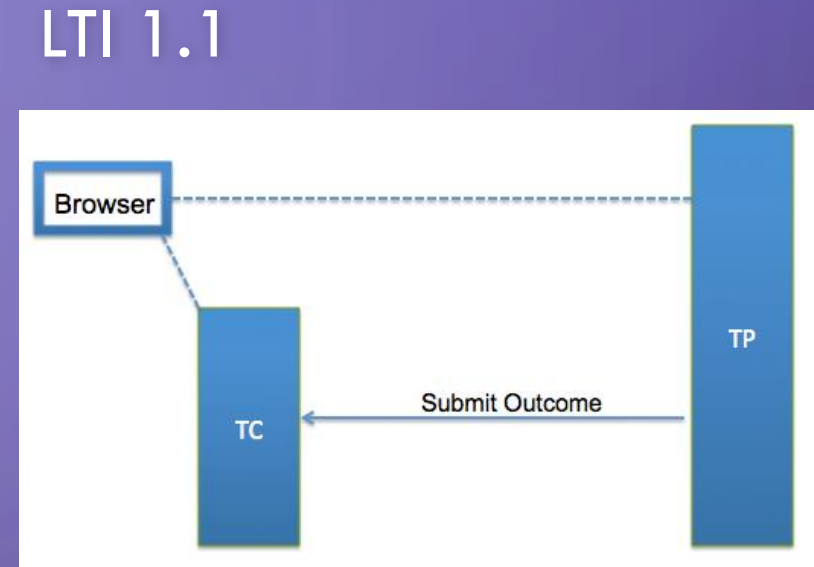
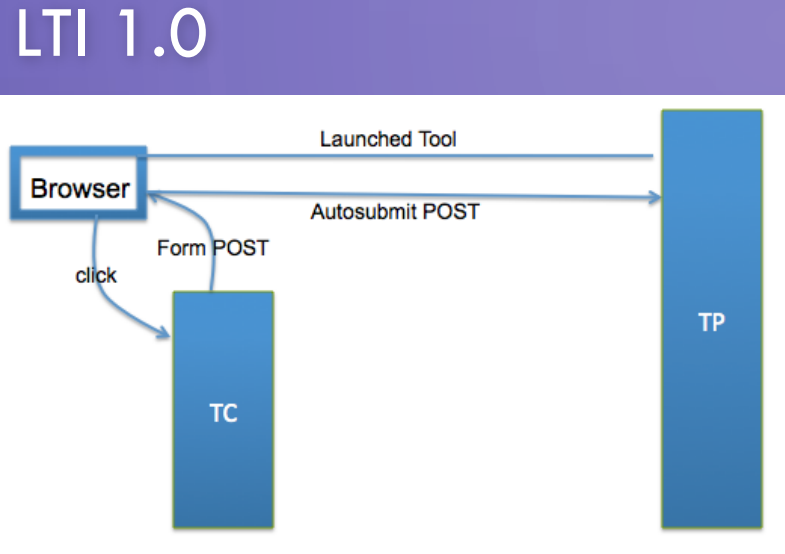
Review of Proposed Standards:

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

	LTI 1.0	LTI 2.0	Wookie	GLUE!
Must implement:	<ul style="list-style-type: none">• Must implement a Tool Provider, integrate with Tool Consumer	<ul style="list-style-type: none">• Must implement a Tool Provider, integrate with Tool Consumer	<ul style="list-style-type: none">• Implement adaptors for Tool Consumer, but not Tool Provider.	<ul style="list-style-type: none">• Must implement a Model Adaptor for each tool.
Amount of Communication after launch:	<ul style="list-style-type: none">• None	<ul style="list-style-type: none">• High Amount	<ul style="list-style-type: none">• None	<ul style="list-style-type: none">• None
Outcomes passed back:	<ul style="list-style-type: none">• No	<ul style="list-style-type: none">• Yes	<ul style="list-style-type: none">• No	<ul style="list-style-type: none">• No
Logging In:	<ul style="list-style-type: none">• Multiple Logins	<ul style="list-style-type: none">• Single sign-on	<ul style="list-style-type: none">• Multiple Logins	<ul style="list-style-type: none">• Multiple Logins
Community Support:	<ul style="list-style-type: none">• High Community Support	<ul style="list-style-type: none">• Low-Med Community Support	<ul style="list-style-type: none">• Low Community Support?	<ul style="list-style-type: none">• Low Community Support?

LTI Evolution

Architecture



Example:

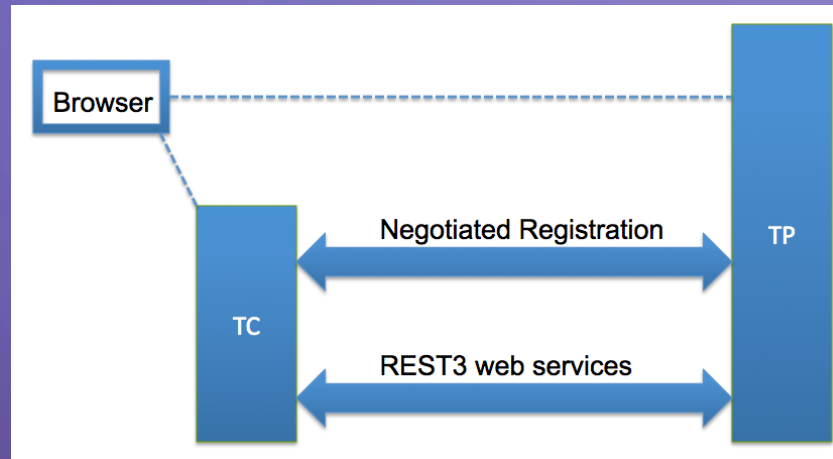
Student reads her e-textbook within an LMS.

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

LTI Evolution

LTI 2.0

Architecture



Example:

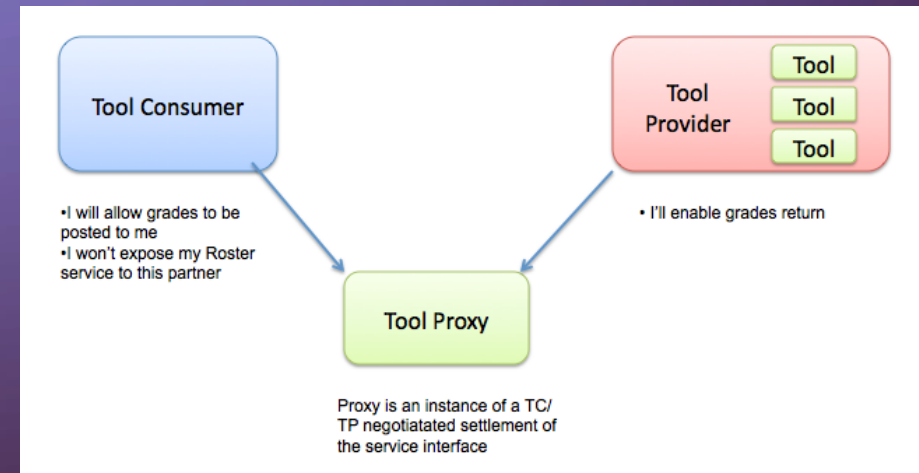
Student reads her e-textbook within an LMS.

- Automatic credential exchange and management
- Common Services
 - Tool Settings
 - Organization Hierarchy

Additional Features

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
- Oath_consumer_key
- Oauth_signature

Integration of the Tool Provider in the Tool Consumer

Ex: Moodle

- Required:

- Launch URL
- Consumer Key
- Consumer Secret

Activity Name* You must supply a value here.

Activity Description*

Font family | Font size | Paragraph | [Rich Text Editor Icons]

Path: p

Display activity name when launched

Display activity description when launched

External tool type ? Automatic, based on Launch URL + ×

Launch URL ?

Secure Launch URL* ?

Launch Container ? New window

Consumer Key* ?

Shared Secret* ? Unmask

Custom parameters* ?

Icon URL* ?

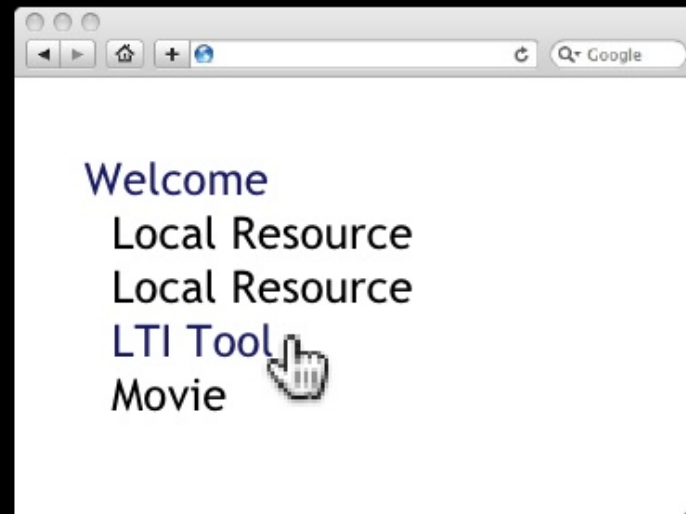
Secure Icon URL* ?

Privacy

- ? Share launcher's name with the tool
- ? Share launcher's email with the tool
- ? Accept grades from the tool
- ? Allow the tool to access this course's roster

LTI Launch Walkthrough

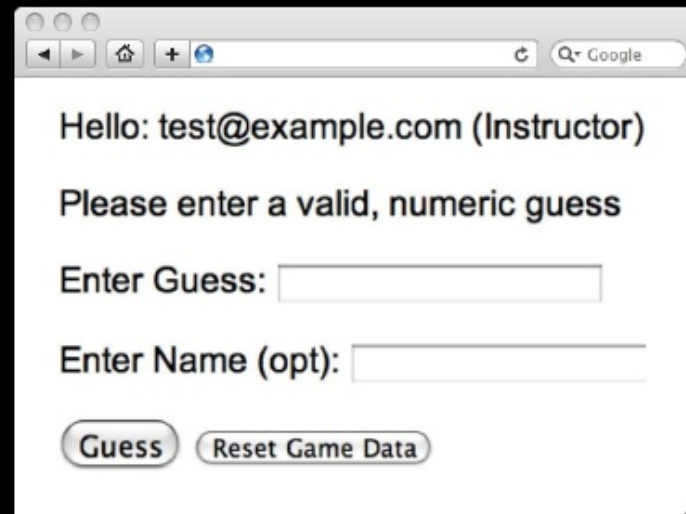
Integrated User Experience



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LTI Launch Walkthrough

User Experience



Hello: test@example.com (Instructor)

Please enter a valid, numeric guess

Enter Guess:

Enter Name (opt):



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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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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.

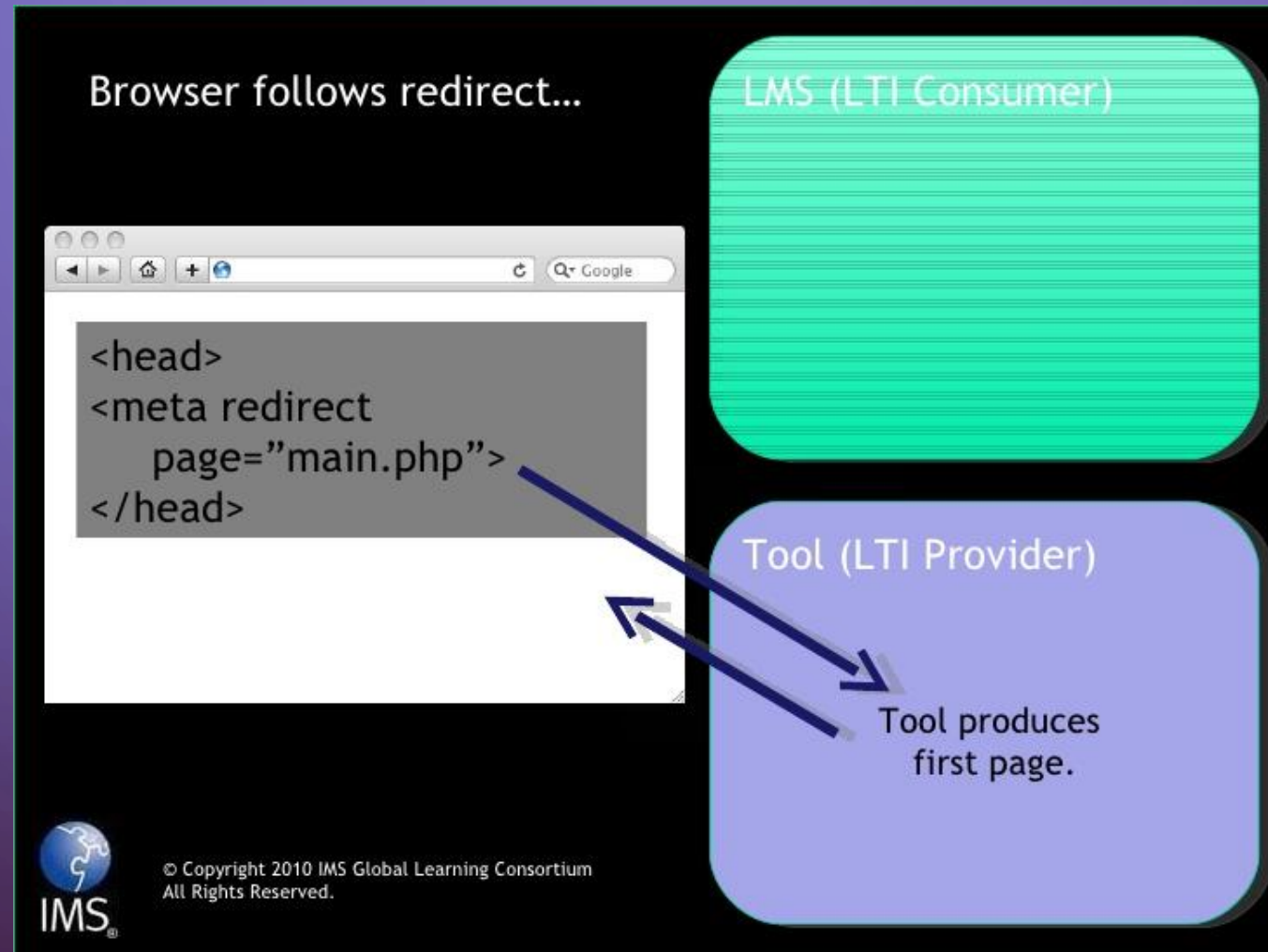
Tool provisions user, course, and session.

Tool sends redirect



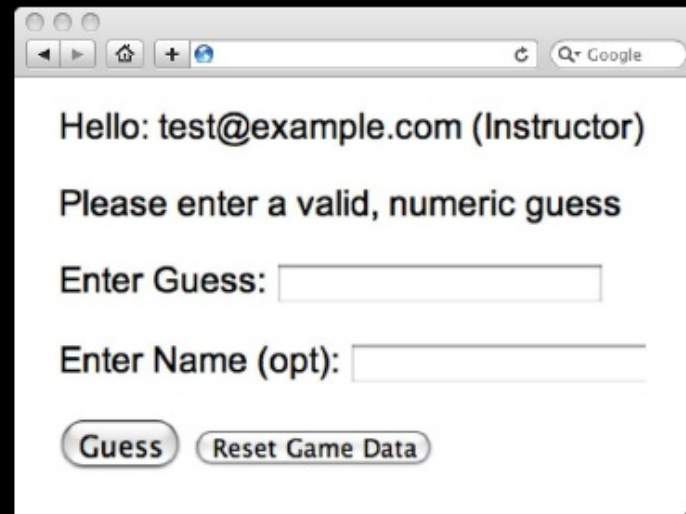
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LTI Launch Walkthrough



LTI Launch Walkthrough

User Experience



Hello: test@example.com (Instructor)

Please enter a valid, numeric guess


Enter Guess:

Enter Name (opt):



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LTI Launch Walkthrough



Basic LTI Sample Launch Data

```
lti_version=LTI-1p0
lti_message_type=basic-lti-launch-request
oauth_consumer_key=lmsg.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
```

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LTI Catalog

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

Everything here is IMS LTI Certified!

learning tools interoperability® catalog

Use LTI tools inside these platforms- [See what they support](#)

click icon for more info



Blackboard



brightspace
vital



canvas
BY INSTRUCTORS



GlobalScholar

ebook tools



vitalsource

Bookshelf® from VitalSource®

Integrated online, downloadable and mobile access for your e-textbooks



CourseSmart

CourseSmart

Find and access eTextbooks and digital course materials



BryteWave by Follett

Digital textbooks - Read, note, study and share all in one place.



COURSELOAD

CourseLoad

Delivers course materials through any web-enabled device



nook

Barnes and Noble

Use Nook Study to read your ebooks and texts

eportfolio tools



C&W

Chalk & Wire

ePortfolio authoring, assessment system, and data analysis tools for students, faculty and professional staff in higher education and K-12



success

LiveText

Building cultures of assessment through learner-centered feedback, field experience and data analytics for continuous improvement and student



mahara

Mahara

Open source eportfolios where you can collect, reflect on and share your achievements success.



PebblePad

Users create records of learning, achievement, and aspiration



SchoolChapters

Portfolio solutions for web, mobile, and print delivered in the cloud.

collaboration tools



Blackboard collaborate

Blackboard Collaborate

Create virtual classrooms, offices and meeting spaces



Learning Objects

Learning Objects

Social software for learning



Vanilla FORUMS

LTI Plugin for Vanilla 2

Provides forum capability via a LTI connection



elgg

Elgg

Create your own fully-featured social networks and applications



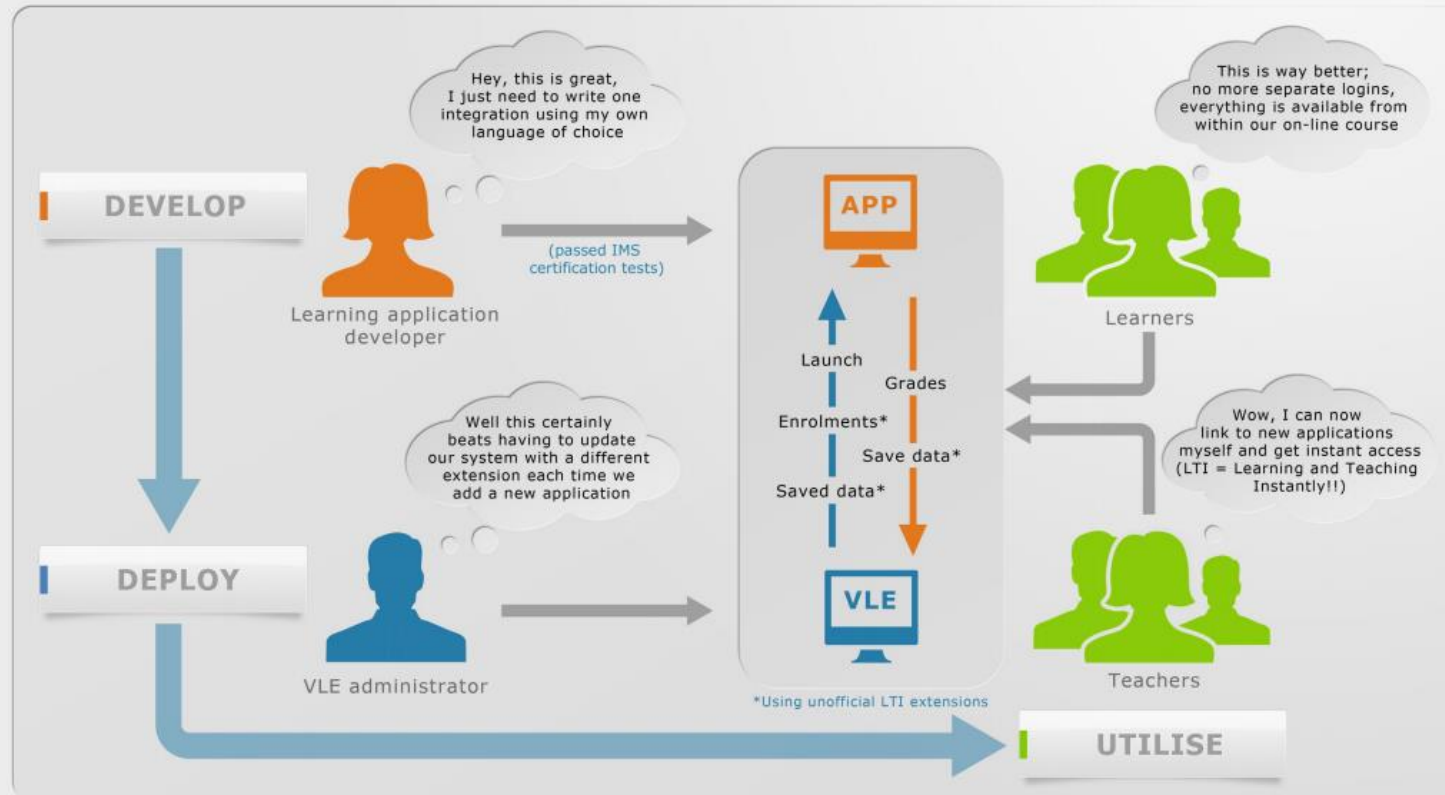
Piazza

Piazza

Helping students and instructors ask for and provide course help online

Learning Tools Interoperability Discussion

The IMS **LTI** specification provides significant benefits for all parties involved in **developing**, **deploying** and **utilising** learning applications. It provides a standard mechanism for **launching** external tools which is supported by all major **virtual learning environments** (VLEs) as well as other educational systems. **LTI 1.1** adds the ability to pass **grades** back to the **VLE** and the IMS is continuing to develop the specification further. In the meantime some unofficial extensions have been widely adopted to give tools access to an **enrolment list** and a simple **data store**.



Creating Environments for **Learning**
using **Tightly Integrated** Components
A JISC-funded project

www.celtic-project.org



Project partners: The University of Edinburgh, University of Stirling, Queen Margaret University, IMS Global Learning Consortium, Blackboard, Learning Objects and Pebble Learning

Published January 2012

Sample Tool Consumer and Tool Provider Studio

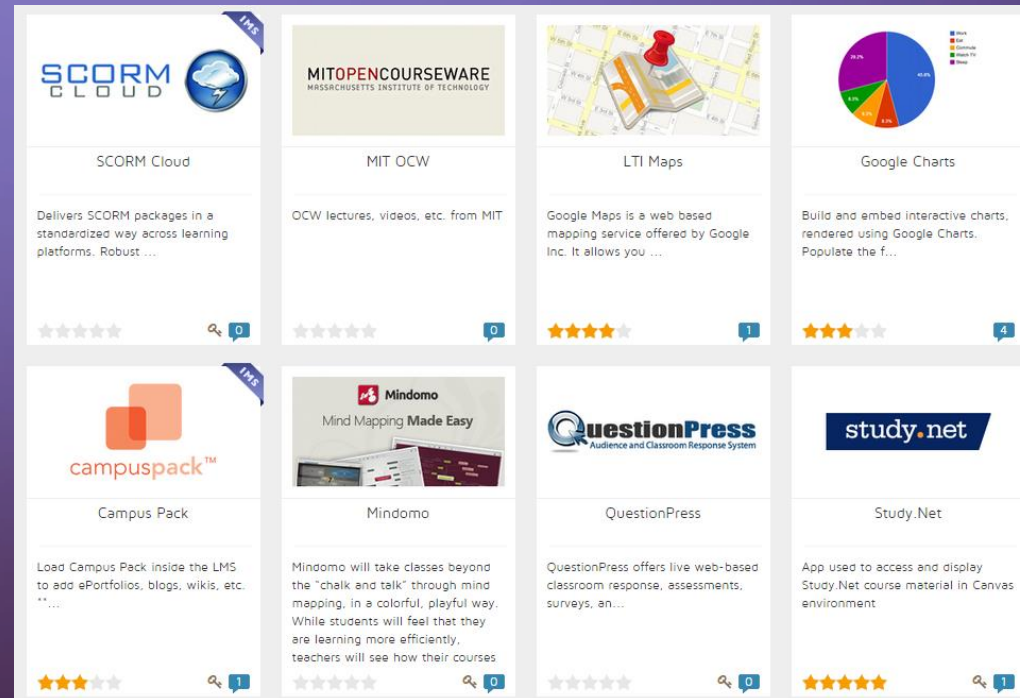
- Sample Studio, running on Microsoft Azure Platform
 - LTI Consumer
 - <http://consumer.azurewebsites.net/>
 - LTI Provider
 - <http://provider.azurewebsites.net/>
 - Scenario: Create an account at the LTI Consumer site, enroll in a course, and try to submit a grade. Try a few of the assignments in 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>

- Python LTI Implementation

- https://github.com/mitodl/py_lti

- MIT LTI Python Flask Example:

- 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
 - <http://www.somerandomthoughts.com/blog/2011/11/28/moodle-2-supports-connecting-to-ims-lti-tools/>
 - Adding an LTI Tool Provider to Canvas, Moodle, Blackboard, Sakai, Desire2Learn
 - <http://www.edu-apps.org/tutorials.html>

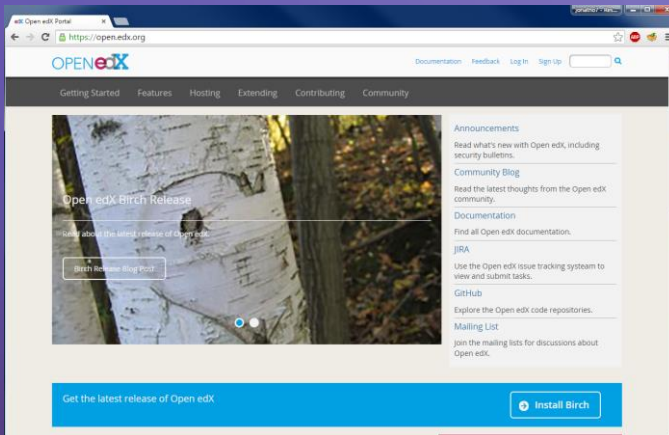
Bringing It All Together

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

Professor edits JSON File:

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

Tool Consumer: OpenEdX



ua=user/context attributes



s=shared secret, sig=oauth_sig(ua, s)

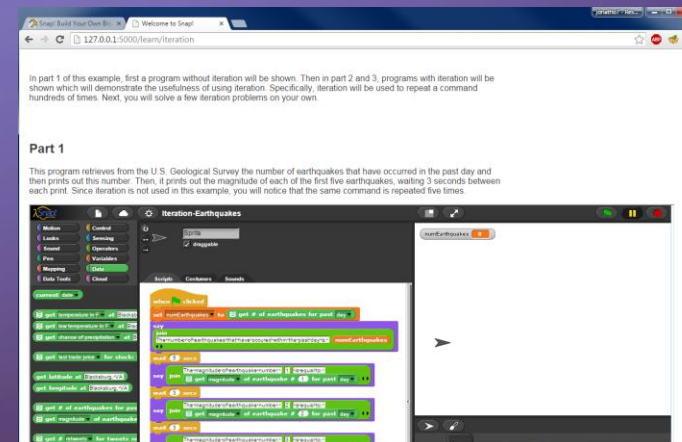


Confirm sig == oauth_sig(ua,s)

Snap Instance

Grade

launch URL (with specific parameters) is generated



Tool Provider:
Snap

Setup:

Launch URL,

consumer key,

consumer secret

Elements:

Submission buttons

Grading components

The background is a dark purple gradient. In the center, the text "Any Questions??" is written in a white, sans-serif font. The corners of the image are decorated with white, stylized circuit board traces and nodes, resembling a network or data flow diagram.

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
- Severance, Charles – IMS Basic Learning Tools Interoperability, <http://www.slideshare.net/csev/ims-basic-lti-overview>