Integrating Moodle with an external tool

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About me

- Programmer/Analyst at MuchLearning
  - developed integration with the MuchLearning platform
  - developed OpenID provider plugin for Moodle
  - developed OAuth authentication for Moodle
- previously worked at Remote-Learner Canada
  - developed integration with JasperServer using MNet
  - improved OpenID authentication plugin
  - Remote-Learner has been involved with many different integrations (e.g. OK Tech Web Services, Drupal, Alfresco, Elluminate, Adobe Connect, Kaltura, . . .)

About you

- have you integrated a tool with Moodle? Which ones?
- will you be integrating a tool with Moodle? Which ones?

About this talk

- high level overview
  - examine issues and considerations
  - explore alternatives
  - examples
- very slight focus on programming (but should be relevant to others too)
- assume a basic knowledge of Moodle programming
- assume that we're doing things the "Moodle way" (but should be relevant for the other direction too)
- primarily about web-based applications
- feel free to ask questions

Why integrate with Moodle?

The M in Moodle stands for “modular” — it can be extended.

So why integrate instead of making it part of Moodle?

What does “integrating” mean?

When someone says that they want to integrate Moodle with [insert your favourite web-based application here], it could mean that they want to . . .

What does “integrating” mean?

- common look-and-feel
- share users/passwords
- single sign-on
- content embedding
- share data

What does “integrating” mean?

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- web services in Moodle 2.x
- examples
  - MuchLearning
  - IMS LTI

Many points of integration

Moodle has many types of plugins:

- activity modules
- blocks
- course format
- admin tools (as of 2.2)
- authentication
- repository (as of 2.0)
- portfolio (as of 2.0)
- local (as of 2.0)
- etc. . .

Additional considerations

customizability (how much) can the software be customized?

performance don't use up too much bandwidth/cpu/... and don't be too slow

security make sure sensitive information isn't leaked

roles the tool should know who is a teacher/student/admin

navigation adding extra items to Moodle's navigation or settings blocks, or to Moodle's breadcrumbs

My Moodle should the tool add information to the My Moodle (a.k.a. "My home") or profile page?

Additional considerations (continued)

grades e.g. Moodle needs the students' grades from the tool

push/pull e.g. will Moodle ask for information (e.g. in a cron or on demand), or will the tool send it?

calendar does the external tool schedule events that should show up in the students' calendars?

messaging should the tool use Moodle's messaging system to send messages to the student?

log how much should be logged in Moodle's log?

Global search when global search is fixed… allow Moodle users to find content in the external tool

Outline

- **common look-and-feel** → mostly theme design, block layout, etc.
- share users/passwords
- single sign-on
- content embedding
- share data
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Outline

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- **share users/passwords**
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Share users/passwords

- Moodle auth plugins (e.g. LDAP, external DB)
- allow the other app to use Moodle's user database
    - Moodle hashes passwords with salt
    - see `validate_internal_user_password` in lib/moodlelib.php

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Single sign-on (SSO)

- existing Moodle auth plugins (e.g. Shibboleth, MNet, OpenID (contrib))
- Moodle as identity provider — MNet, OpenID (contrib)
- cookie/session sharing — lots of restrictions, and more work, but more seamless
- OAuth

Single sign-out

- when user logs out of identity provider, they are logged out of all other services
- only in MNet, or cookie/session sharing

A bad sign-on protocol (don't do this)

- System A generates links of the form: `http://systemb/...?userid=x`
- System B looks at the userid parameter, and fetches the user information from System A

Why is this bad?

Another bad sign-on protocol (don't do this)

- System A generates links of the form: `http://systemb/...?username=x&password=y`
- System B looks at the username and password parameters, logs into System A as the user and fetches the user information from System A

Why is this bad?

Future considerations

- current MNet protocol is deprecated
    - probably to be replaced with something based on OAuth (2?) (plus OpenID?)
- OAuth 2 is coming out
    - not backwards compatible with OAuth 1
    - supposedly simpler
    - requires HTTPS
- new OpenID spec (OpenID Connect)
    - not backwards compatible with OpenID 2
    - based on OAuth 2

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How do we get the tool's content into Moodle

(or vice versa)

- frames
- iframe
- inject content via web services
- inject content via JavaScript

Frames v.s. iframe

- frames are ugly and deprecated
- iframes have fixed size (unless resized using JavaScript) — may have two scrollbars, or may not take up the full screen

Frames v.s. injection

- styling, scripts, links work within frames without modification
- injection looks more seamless

Injection via web services v.s. JavaScript

- web services requires Moodle to be able to log in as the user (or at least, to fetch the user's view)
- web services doesn't require client-side support
- JavaScript may be tricky due to same origin policy (may need to be proxied, or use something like JSONP)
- JavaScript may result in a pause before content is loaded

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Sharing data

- direct database connection
- web services
- screen scraping

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Web services in Moodle 2.x

- configured under Site administration > Plugins > Web services
- plugins/core define functions that can be called
- defines “services” (groups of functions)
- users are given permissions to call services
- web services can be called using different protocols (e.g. XML-RPC, SOAP)
- users have extra authentication methods for web services
    - token: user is identified by a unique token
        - can limit what service can be called, source IP address

Web services in Moodle 2.x (continued)

How to write web services in Moodle 2.x

- see `http://docs.moodle.org/dev/Adding_a_web_service_to_a_plugin`

How to call Moodle web services

- see `admin/webservice/testclient.php` and `webservice/{$protocol}/locallib.php`: `webservice_{$protocol}_test_client` class

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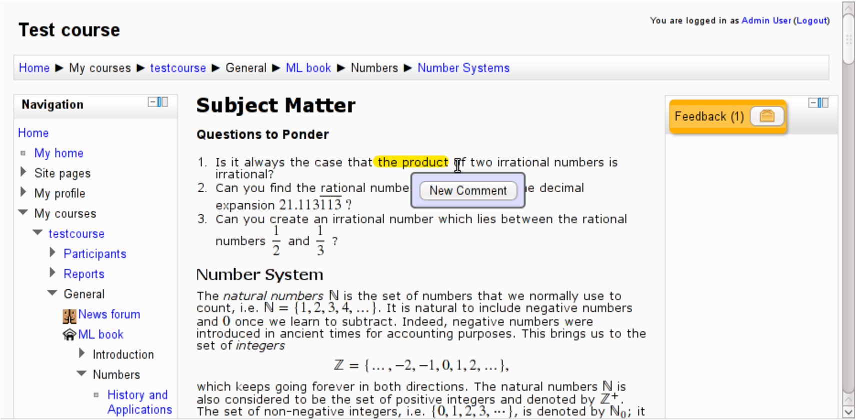
MuchLearning integration

- use OpenID for single sign-on
- REST web services called using OAuth (MDL-30599)
- inject content using JavaScript
  - caches links to stylesheets, JavaScript
  - content is fetched every time
- fetch table of contents (if applicable) using web services, and added to navigation block
  - caches table of contents
- push grades to Moodle gradebook using web services
- module settings gets list of available activities (via JavaScript)

MuchLearning integration



Test course

You are logged in as Admin User (Logout)

Home ▶ My courses ▶ testcourse ▶ General ▶ ML book ▶ Numbers ▶ Number Systems

Navigation

- Home
- My home
- Site pages
- My profile
- My courses
  - testcourse
    - Participants
    - Reports
    - General
      - News forum
      - ML book
        - Introduction
        - Numbers
          - History and Applications

Subject Matter

Questions to Ponder

1. Is it always the case that the product of two irrational numbers is irrational?
2. Can you find the rational numbe[New Comment]e decimal expansion $21.113\overline{113}$?
3. Can you create an irrational number which lies between the rational numbers $\frac{1}{2}$ and $\frac{1}{3}$?

Number System

The *natural numbers* $\mathbb{N}$ is the set of numbers that we normally use to count, i.e. $\mathbb{N} = \{1, 2, 3, 4, \dots\}$. It is natural to include negative numbers and 0 once we learn to subtract. Indeed, negative numbers were introduced in ancient times for accounting purposes. This brings us to the set of *integers*

$$\mathbb{Z} = \{\dots, -2, -1, 0, 1, 2, \dots\},$$

which keeps going forever in both directions. The natural numbers $\mathbb{N}$ is also considered to be the set of positive integers and denoted by $\mathbb{Z}^+$. The set of non-negative integers, i.e. $\{0, 1, 2, 3, \cdots\}$, is denoted by $\mathbb{N}_0$; it

Figure: MuchLearning in Moodle

IMS LTI (Learning Tools Integration)

- standard for embedding a learning tool into an LMS
- supported by Moodle (as of 2.2), Sakai, Blackboard, Desire2Learn, . . .
- Moodle can also be used as a learning tool (contrib plugin)
- web services via OAuth
- identity sent as part of OAuth request
- content embedded via frame/iframe/separate window
- push grades to Moodle gradebook using web services
- fixed set of common roles (but can support custom roles)

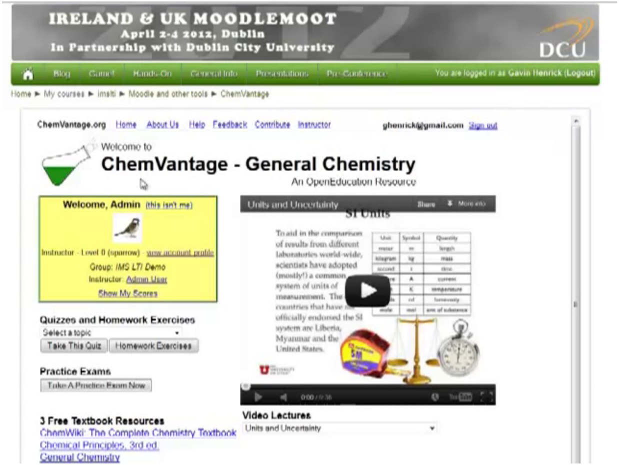
IMS LTI (continued)

- Moodle sends launch data to tool, such as
  - link information
  - user information (incl. roles)
  - information about Moodle site
  - information about Moodle context
  - presentation information (e.g. extra stylesheets, locale)
  - return URL
  - callback information for grade push
- sent as POST data (either using JavaScript or pushing a button)

IMS LTI (continued)

- fairly basic protocol
  - embedding
  - user login
  - role setting
  - grade sync
  - some (non-standardized) support for common look-and-feel
- for tool providers: fast way to support multiple LMSs
- may be "good enough" to start, and may be able to add more integration on top

IMS LTI (continued)



IRELAND & UK MOODLEMOOT
April 2-4 2012, Dublin
In Partnership with Dublin City University

You are logged in as Gavin Henrick (Logout)

Home ► My courses ► imslti ► Moodle and other tools ► ChemVantage

ghenrick@gmail.com Sign out

Welcome to
ChemVantage - General Chemistry
An OpenEducation Resource

Welcome, Admin (this isn't me)

Instructor - Level 0 (sparrow) - view account profile

Group: *IMS LTI Demo*

Instructor: Admin User

Show My Scores

Quizzes and Homework Exercises

Select a topic

Practice Exams

3 Free Textbook Resources
ChemWiki: The Complete Chemistry Textbook
Chemical Principles, 3rd ed.
General Chemistry

To aid in the comparison of results from different laboratories world-wide, scientists have adopted (mostly!) a common system of units of measurement. The countries that have not officially endorsed the SI system are Liberia, Myanmar and the United States.

Unit	Symbol	Quantity
meter	m	length
kilogram	kg	mass
second	s	time
[illegible]	A	current
[illegible]	K	temperature
[illegible]	cd	luminosity
mole	mol	amt of substance

Video Lectures

Units and Uncertainty

Figure: LTI in Moodle (`http://www.somerandomthoughts.com/blog/2012/04/11/ireland-and-uk-moodlemoot-2012-ims-lti-demo/`)

Conclusion

- “integrating” can mean many different things
- we compared different options for integration
- we took a quick look at web services in Moodle 2
- we looked at two examples of integrations

Extra slides

A more secure protocol (similar to MNet)

- System B checks if user is logged in
- if not, redirects to System A, to a URL of the form: `http://systema/...?token=longrandomtoken`
- System A ensures that the user is logged in
- System A redirects to system B, to a URL of the form: `http://systemb/...?token=longrandomtoken&key=longrandomkey`
- System B (securely) asks System A who is associated with [longrandomtoken] and [longrandomkey]
- System A expires [longrandomtoken] and [longrandomkey]

Another more secure protocol (similar to OpenID)

- System B checks if user is logged in
- if not, redirects to System A, to a URL of the form: `http://systema/...?token=longrandomtoken`
- System A ensures that the user is logged in
- System A redirects to system B, to a URL of the form: `http://systemb/...?token=longrandomtoken&userinfo=userinfo&signature=signature`
- System B makes sure that the user is associated with [longrandomtoken] and checks the signature

How to write web services in Moodle 2.x

1. create the following files within your plugin:
   1. `.../db/services.php`
   2. `.../db/access.php` (if needed)
   3. `.../externallib.php`
2. bump the plugin version number
3. go to Site administration > Notifications

services.php

```
$functions = array(
  ’[functionname]’ => array(
    ’classpath’   => ’[path/to/plugins/externallib.php]’,
    ’classname’   => ’[class that defines function]’,
    ’methodname’  => ’[class method to be called]’,
    ’description’ => ’[plain-language description]’,
    ’capabilities’=> ’[capability required to call]’,
    ’type’        => ’write’, /* or ’read’ */
  ),
);
```

services.php (continued)

```
$services = array (
  ’[plain-language name]’ => array(
    ’functions’ => array(
      ’[functionname]’
    ),
    ’enabled’ => 1,
    ’restrictedusers’ => 1,
    ’shortname’ => ’[short name]’
  ),
);
```

externallib.php

```
<?php

defined(’MOODLE_INTERNAL’) || die();

require_once("$CFG->libdir/externallib.php");

class [class from services.php]  extends external_api {
    ...
}
```

externallib.php

in the class, for each web service function:

1. `public static function [functionname]_parameters`
   - defines what type of parameters the function takes
   - return an `external_function_parameters` object (see `lib/externallib.php`)
     - construct with array of `external_description` objects, keyed by parameter name
2. `public static function [functionname]`
   - implements the actual function
   - remember to check permissions
   - call `self:validate_context($context)`
3. `public static function [functionname]_returns`
   - defines what the type of data the function returns
   - return an `external_description` object or `null`