



Building Tools in PHP using IMS Basic LTI



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<http://www.imsglobal.org/>
<http://www.dr-chuck.com/>





IMS: Digital Learning Standards

*Free the
content*



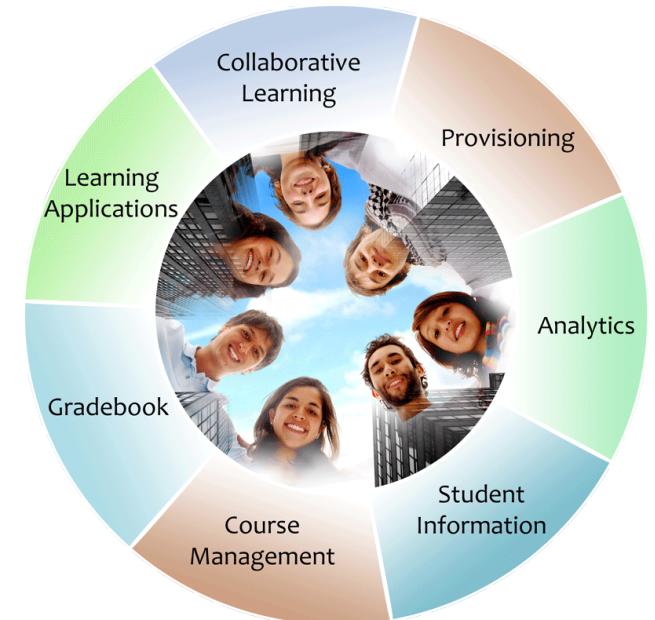
IMS Common Cartridge



IMS Learning Tools
Interoperability (LTI)

*Seamlessly
connect
to learning*

*The information
architecture for
learning*



IMS Learning Information
Services (LIS)



Desire2Learn
Innovative Learning Technology



JENZABAR®

Sakai



WORDPRESS.ORG

...
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**LEARNING
TOOL**

PHP
Java
App Engine
Wookie...



The screenshot shows the Sakai interface with the following components:

- Sakai Logo:** Located at the top left.
- Navigation Bar:** My Home, Email, Locker, Schedule, Chat, Content.
- Course Header:** Dr. Chuck's Desire2Learn Course, Welcome, Chuck Nov 26, 2009.
- Tool Tabs:** Wookie, Wisdom of Crowds.
- Wookie Chat Window:** Shows a conversation between Chuck Instructor and Matt Student.
- Wisdom of Crowds Widget:** A game interface asking for a numeric guess and name entry.
- Logout Link:** Located at the bottom right of the main content area.

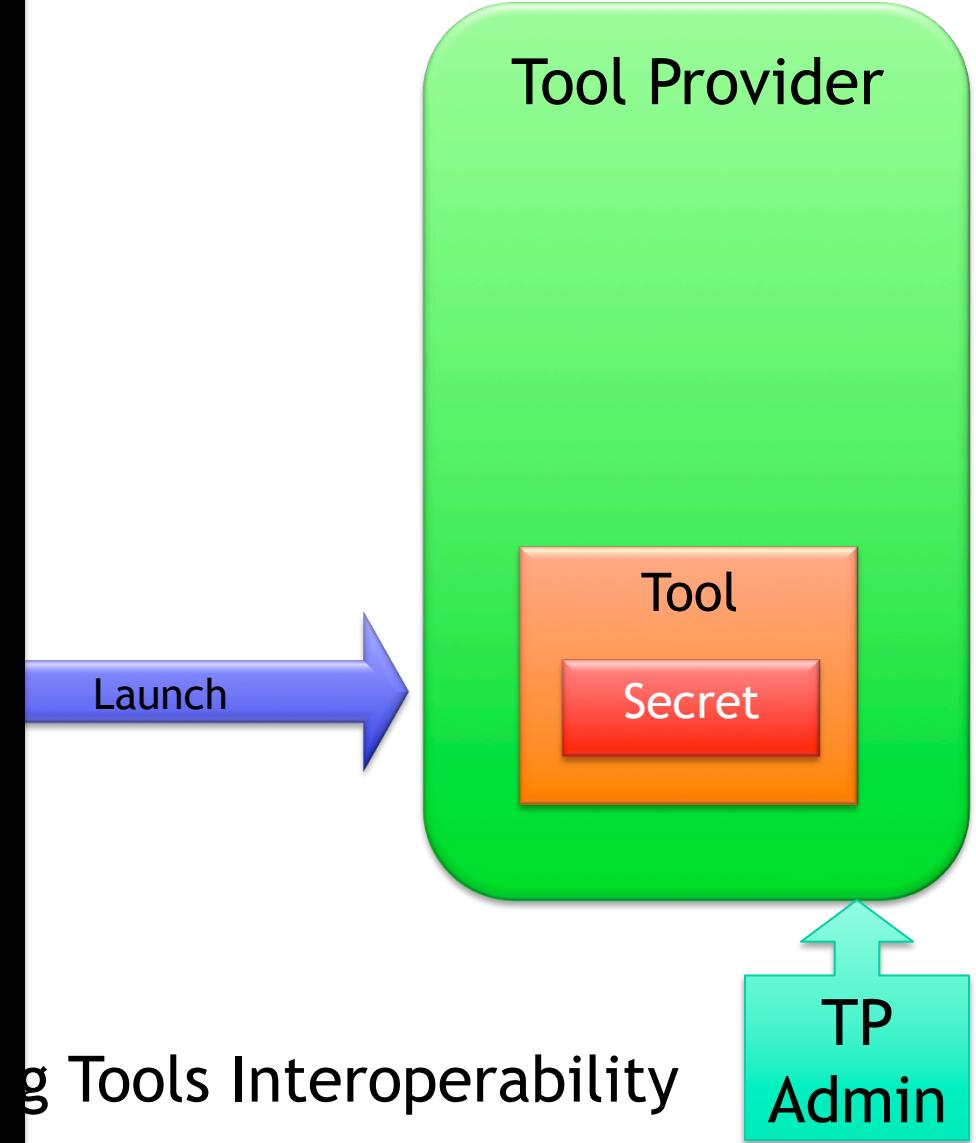
The screenshot shows the WebCT interface with the following components:

- WebCT Logo:** Top left.
- Navigation Bar:** My Places, Home, Help, Logout.
- Tool Tabs:** Build, Teach, Student View.
- Course Tools:** Course Content (selected), Manage Course, Grade Book, Grading Forms, Group Manager, Tracking, Selective Release.
- Wookie Chat Window:** Shows a message from Charles Severance (Admin) to Scott.

The screenshot shows the WebCT interface with the following components:

- WebCT Logo:** Top left.
- Navigation Bar:** My Places, Home, Help, Logout.
- Tool Tabs:** My Institution, Courses, Content Collection, System Admin, Scholar.
- Wookie Chat Window:** Shows a message from Charles Severance (Admin) to Scott.

Apache
Wookie



g Tools Interoperability



How to Write a Basic LTI Tool in PHP



Test Harness

- We provide a test LMS and test Tool.
- No membership is required

<http://www.imsglobal.org/developers/BLTI/lms.php>

<http://www.imsglobal.org/developers/BLTI/tool.php>



IMS BasicLTI PHP Consumer



This is a very simple reference implementation of the LMS side (i.e. consumer) for IMS BasicLTI.

[Toggle Resource and Launch Data](#)

[Recompute Launch Data](#)

[URL plus Secret](#)

(To set a value to 'empty' - set it to a blank)

BasicLTI Resource

Launch URL:

Key:

Secret:

Launch Data

resource_link_id:

resource_link_title:

resource_link_description:

user_id:

roles:

lis_person_name_full:

lis_person_contact_email_primary:

lis_person_sourcedid:

<http://www.imsglobal.org/developers/BLTI/lms.php>



Press to Launch [toggle debug data](#)



IMS GLOBAL LEARNING CONSORTIUM

STANDARDS THAT ENABLE THE
DEVELOPMENT AND ADOPTION OF INNOVATIVE TECHNOLOGIES
TO IMPROVE AND TRANSFORM EDUCATION WORLDWIDE



IMS BasicLTI PHP Provider

This is a very simple Basic LTI Tool. If the message is a Basic LTI Launch, it checks the signature and if the signature is OK, it establishes context. All secrets are "secret".

Context Information:

```
isInstructor() = true
getUserKey() = 12345:292832126
getUserEmail() = user@school.edu
getUserShortName() = user@school.edu
getUserName() = Jane Q. Public
getUserImage() = http://www.gravatar.com/avatar.php?gravATAR_id=447512ec60136862fa6f52382f0ffc23&size=40
getResourceKey() = 12345:120988f929-274612
getResourceTitle() = Weekly Blog
getCourseName() = SI182
getCourseKey() = 12345:456434513
getConsumerKey() = 12345
```

<http://www.imsglobal.org/developers/BLTI/tool.php>



Source Code - Download

- Simple Sample Application - Classified Ads
 - Classified Ad Software
 - Key / Secret administration
 - Basic LTI Utility Code
 - Testing harness (simple BLTI Consumer)
 - <http://www.dr-chuck.com/ims/php-simple/dist.zip>



Tool Installation and URLs

- LMS Tester
 - `install-dir/lms.php`
- Installation instructions
 - `install-dir/adlist/index.htm`
- Administration functions
 - `install-dir/adlist/admin.php`
- Launch URL
 - `install-dir/adlist/ads.php`



A Sample Tool - Classified Ads

My Home | Email | Locker | Schedule | Chat | Content | Ad List Welcome, Chuck Mar 29, 2010

 Dr. Chuck's Desire2Learn Course 

Course Home Content Discussions Dropbox Self Assessments Quizzes Classlist Grades Links Glossary Surveys Edit Course Logout

Title (Create New Ad)	Date	Action
Honda Shadow 600 VLX - Factory Footpegs - \$95.00	2010-03-29 13:15:24	edit delete
1983 Honda 450 - New Lower Price \$1200	2010-03-29 13:12:12	edit delete



A Sample Tool - Classified Ads

My Home Email Locker Schedule Chat Content Welcome, Chuck Mar 29, 2010

Desire2Learn Dr. Chuck's Desire2Learn Course

Course Home Content Discussions Dropbox Self Assessments Quizzes Classlist Grades Links Glossary Surveys Edit Course Logout

Content Map

[Collapse All](#) [Expand All](#)

Unit1. Learning Tools

- i. [Dr. Chuck Sample](#)
- ii. [Wisdom of Crowds](#)
- iii. [Wookie](#)
- iv. [Sakai Wiki](#)
- v. [Documentation \(DRAFT\)](#)
- vi. [Wookie Poll](#)
- vii. [Vview](#)
- viii. [Wordpress](#)
- ix. [MediaWiki](#)
- x. [Ad List](#)

Ad List

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Title (Create New Ad)	Date	Action
Honda Shadow 600 VLX - Factory Footpegs - \$95.00	2010-03-29 13:15:24	edit delete
1983 Honda 450 - New Lower Price \$1200	2010-03-29 13:12:12	edit delete



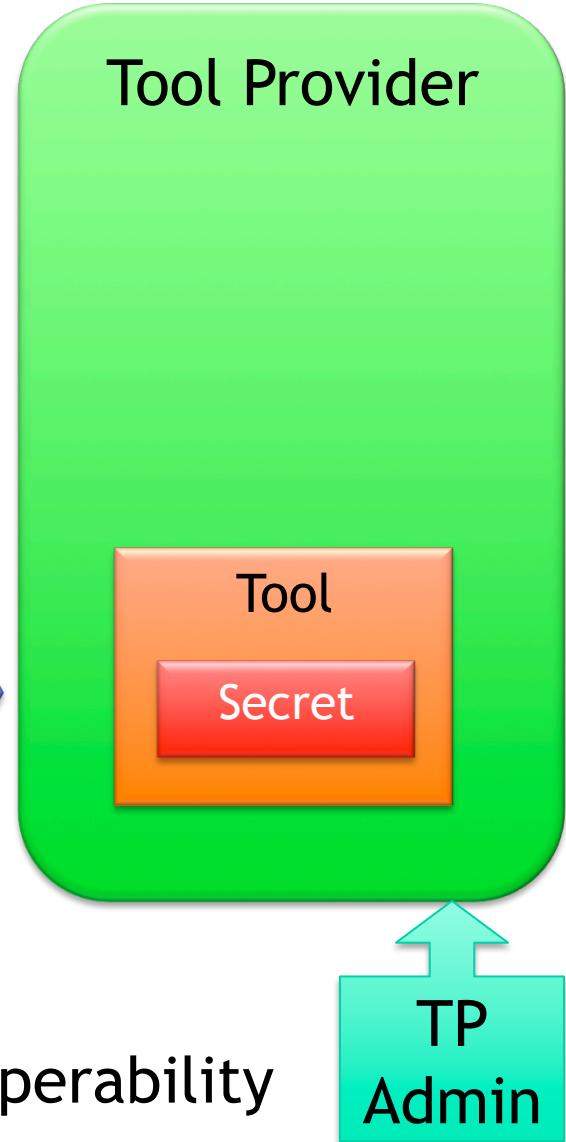
Outline

- Secret Management
- Solving Multi-Tenancy
- Handling the Basic LTI Launch and Context
- Patterns for Simple Authorization

TC
User



Launch



Basic Learning Tools Interoperability



Administration Screen

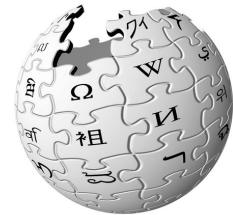
IMS Basic LTI Consumer Administration

Name	oauth_consumer_key	Secret	Action
Washtenaw College	www.wcc.edu	28sduf89dujc8fd8	edit delete
Rich Enbody	9876543	9sd8ufdvc98dfu	edit delete
Chuck	12345	secret	edit delete
Administrator	admin	secret	edit delete
The Edinburgh Uni	ed.ac.uk	9779765	edit delete
School University	lmsng.school.edu	secret	edit delete

[Add Consumer](#)



Multi-Tenancy



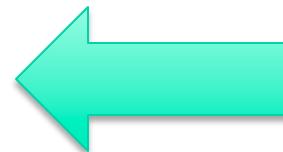
Multitenancy refers to a principle in software architecture where a single instance of the software runs on a server, serving multiple client organizations (tenants). **Multitenancy** is contrasted with a multi-instance architecture where separate software instances (or hardware systems) are set up for different client organizations. With a **multitenant** architecture, a software application is designed to virtually partition its data and configuration so that each client organization works with a customized/isolated virtual application instance.

<http://en.wikipedia.org/wiki/Multitenancy>



Basic LTI Sample Launch Data

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



Administration Screen

IMS Basic LTI Consumer Administration

Name	oauth_consumer_key	Secret	Action
Washtenaw College	www.wcc.edu	28sduf89dujc8fd8	edit delete
Rich Enbody	9876543	9sd8ufdvc98dfu	edit delete
Chuck	12345	secret	edit delete
Administrator	admin	secret	edit delete
The Edinburgh Uni	ed.ac.uk	9779765	edit delete
School University	lmsng.school.edu	secret	edit delete

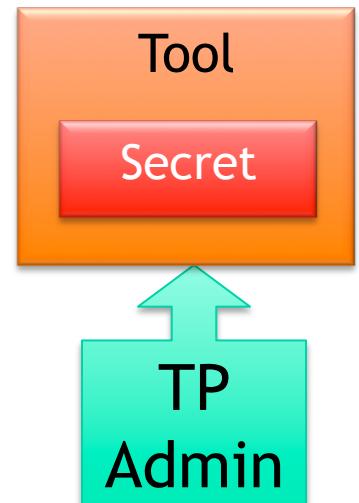
[Add Consumer](#)



Multi-Tenancy Data Model

```
create table blti_keys (
    id      MEDIUMINT NOT NULL AUTO_INCREMENT,
    oauth_consumer_key    CHAR(255) NOT NULL,
    secret          CHAR(255) NULL,
    name            CHAR(255) NULL,
    context_id      CHAR(255) NULL,
    created_at      DATETIME NOT NULL,
    updated_at      DATETIME NOT NULL,
    PRIMARY KEY (id)
);
```

context_id is used to optionally override
context_id from launches





Advertisement Data Model

My Home Email Locker Schedule Chat Content Welcome, Chuck Mar 29

Desire2Learn Dr. Chuck's Desire2Learn Course

Course Home Content Discussions Dropbox Self Assessments Quizzes Classlist Grades Links Glossary Surveys Edit Course

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- iv. [Sakai Wiki](#)
- v. [Documentation \(DRAFT\)](#)
- vi. [Wookie Poll](#)
- vii. [View](#)
- viii. [Wordpress](#)
- ix. [MediaWiki](#)
- x. [Ad List](#)

Edit Classified Ad

Title: Honda Shadow 600 VLX- Factory Footpegs - \$95.00

Description: These are the factory footpegs. I replaced the floorboards.

My Home Email Locker Schedule Chat Content Welcome, Chuck Mar 29, 2010

Desire2Learn Dr. Chuck's Desire2Learn Course

Course Home Content Discussions Dropbox Self Assessments Quizzes Classlist Grades Links Glossary Surveys Edit Course Logout

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- vi. [Wookie Poll](#)
- vii. [View](#)
- viii. [Wordpress](#)
- ix. [MediaWiki](#)
- x. [Ad List](#)

Submit Query Cancel

Title (Create New Ad)	Date	Action
Honda Shadow 600 VLX- Factory Footpegs - \$95.00	2010-03-29 13:15:24	edit delete
1983 Honda 450 - New Lower Price \$1200	2010-03-29 13:12:12	edit delete

Multi-Tenancy Data Model

```
create table ads (
    id          MEDIUMINT NOT NULL AUTO_INCREMENT,
    course_key  CHAR(255) NOT NULL,
    user_key    CHAR(255) NULL,
    user_name   CHAR(255) NULL,
    title       CHAR(255) NULL,
    description TEXT(2048) NULL,
    created_at  DATETIME NOT NULL,
    updated_at  DATETIME NOT NULL,
    PRIMARY KEY (id)
);
```

Apologies to "3NF"



Multi-Tenancy Data

```
mysql> select id, left(course_key,25),left(user_key,25),left(title,20) from ads;
+----+-----+-----+-----+
| id | left(course_key,25)          | left(user_key,25)          | left(title,20)           |
+----+-----+-----+-----+
| 6  | 12345:456434513            | 12345:292832126          | A Totally Sweet Titl   |
| 7  | 12345:456434513            | 12345:292832126          | Another Awesome Titl  |
| 8  | lmsng.school.edu:45643451  | lmsng.school.edu:29283212 | A TITLE                |
| 9  | lmsng.school.edu:7601b0ed  | lmsng.school.edu:f315ea76 | Honda 450 - 1983 - E  |
| 10 | lmsng.school.edu:7601b0ed  | lmsng.school.edu:f315ea76 | Slightly Used App En  |
| 11 | lmsng.school.edu:7601b0ed  | lmsng.school.edu:f315ea76 | Free Metal File Cabi  |
| 12 | ed.ac.uk:lti_demo           | ed.ac.uk:URN:X-WEBCT-b98f | Mountain Bike - New   |
| 13 | ed.ac.uk:lti_demo           | ed.ac.uk:URN:X-WEBCT-b98f | Two Premiere Tickets  |
| 14 | ed.ac.uk:lti_demo           | ed.ac.uk:URN:X-WEBCT-b98f | Monthly Bus Pass to  |
+----+-----+-----+-----+
```

We must namespace the primary keys (user_id, context_id) with the oauth_consumer_key to isolate courses and users



Handling the Basic LTI Launch

- A utility library is provided that intercepts and processes launches

```
require_once '../ims-blti/blti.php';
require_once("db.php");
$context = new BLTI(array('table' => 'blti_keys'));
if ( $context->complete ) exit();
if ( ! $context->valid ) {
    print "Could not establish context: ".$context->message."\n";
    exit();
}
```

ads.php



Handling the Basic LTI Launch

- The "context" is either taken from the launch or restored from the PHP session - like a filter

```
require_once '../ims-blti/blti.php';
require_once("db.php");
$context = new BLTI(array('table' => 'blti_keys'));
if ( $context->complete ) exit();
if ( ! $context->valid ) {
    print "Could not establish context: ".$context->message."\n";
    exit();
}
```

ads.php



The Context

- The context contains information from the launch
 - Resource information
 - User Information
 - Course (aka context) information
 - Organizational Information
 - Launch Authentication Information



The Context - Supplied Methods

```
$context->getCourseKey() = 12345:456434513  
$context->getCourseName() = SI182  
$context->getResourceKey() = 12345:9fbe1230  
$context->getResourceTitle() = Week 1 Blog  
$context->getUserKey() = 12345:292832126  
$context->isInstructor() = true/false  
$context->getUserEmail() = jane@school.edu  
$context->getUserShortName() = jane@school.edu  
$context->getUserName() = Jane Q. Public  
$context->getUserImage() = http://www.gravatar...  
$context->getConsumerKey() = 12345
```

Simple Authorization

- With the data model, we need to know who can edit which ads in our table

```
mysql> select id, left(course_key,25),left(user_key,25),left(title,20) from ads;
+----+-----+-----+-----+
| id | left(course_key,25) | left(user_key,25) | left(title,20) |
+----+-----+-----+-----+
| 6  | 12345:456434513   | 12345:292832126 | A Totally Sweet Titl |
| 7  | 12345:456434513   | 12345:292832126 | Another Awesome Titl |
| 8  | lmsng.school.edu:45643451 | lmsng.school.edu:29283212 | A TITLE |
| 9  | lmsng.school.edu:7601b0ed | lmsng.school.edu:f315ea76 | Honda 450 - 1983 - E |
| 10 | lmsng.school.edu:7601b0ed | lmsng.school.edu:f315ea76 | Slightly Used App En |
| 11 | lmsng.school.edu:7601b0ed | lmsng.school.edu:f315ea76 | Free Metal File Cabi |
| 12 | ed.ac.uk:lti_demo     | ed.ac.uk:URN:X-WEBCT-b98f | Mountain Bike - New |
| 13 | ed.ac.uk:lti_demo     | ed.ac.uk:URN:X-WEBCT-b98f | Two Premiere Tickets |
| 14 | ed.ac.uk:lti_demo     | ed.ac.uk:URN:X-WEBCT-b98f | Monthly Bus Pass to |
+----+-----+-----+-----+
```



Instructor:

```
SELECT * FROM ads WHERE id='7' AND  
course_key='12345:456434513'
```

Student:

```
SELECT * FROM ads WHERE id='7' AND  
course_key='12345:456434513' AND  
user_key = '12345:292832126'
```

```
mysql> select id, left(course_key,25),left(user_key,25),left(title,20) from ads;
```

id	left(course_key,25)	left(user_key,25)	left(title,20)
6	12345:456434513	12345:292832126	A Totally Sweet Titl
7	12345:456434513	12345:292832126	Another Awesome Titl
8	lmsng.school.edu:45643451	lmsng.school.edu:29283212	A TITLE
9	lmsng.school.edu:7601b0ed	lmsng.school.edu:f315ea76	Honda 450 - 1983 - E
10	lmsng.school.edu:7601b0ed	lmsng.school.edu:f315ea76	Slightly Used App En
11	lmsng.school.edu:7601b0ed	lmsng.school.edu:f315ea76	Free Metal File Cabi
12	ed.ac.uk:lti_demo	ed.ac.uk:URN:X-WEBCT-b98f	Mountain Bike - New
13	ed.ac.uk:lti_demo	ed.ac.uk:URN:X-WEBCT-b98f	Two Premiere Tickets
14	ed.ac.uk:lti_demo	ed.ac.uk:URN:X-WEBCT-b98f	Monthly Bus Pass to



Show/Hide Buttons

My Home Email Locker Schedule Chat Content Welcome, Chuck Mar 29, 2010

Desire2Learn Dr. Chuck's Desire2Learn Course

Course Home Content Discussions Dropbox Self Assessments Quizzes Classlist Grades Links Glossary Surveys Edit Course Logout

Content Map
[Collapse All](#) [Expand All](#)

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- v. [Documentation \(DRAFT\)](#)
- vi. [Wookie Poll](#)
- vii. [View](#)
- viii. [Wordpress](#)
- ix. [MediaWiki](#)
- x. [Ad List](#)

Ad List [Back to Table of Contents](#)

Title (Create New Ad)	Date	Action
Honda Shadow 600 VLX - Factory Footpegs - \$95.00	2010-03-29 13:15:24	edit delete
1983 Honda 450 - New Lower Price \$1200	2010-03-29 13:12:12	edit delete

Showing Buttons For Edit/ Delete

```
<?php
if ( $context->isInstructor() ||
    $row[ 'user_key' ] == $context->getUserKey() ) { ?>
    <a href="?action=edit&id=<row[id]?>">edit</a>
    <a href="?action=delete&id=<row[id]?>">delete</a>
<?php
} ?>
```

ads.php



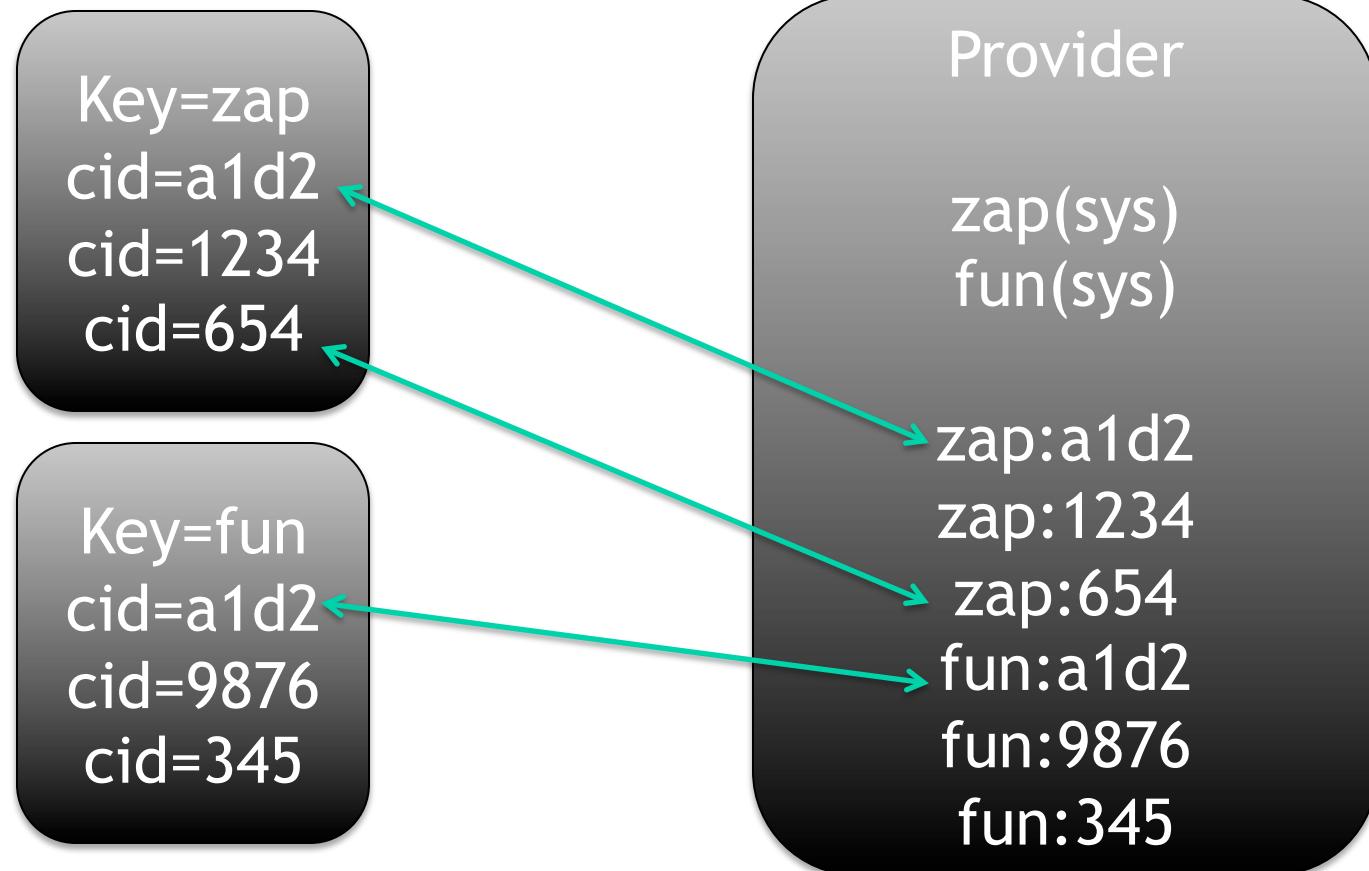
Advanced Topic: System and Course-Mapped Keys



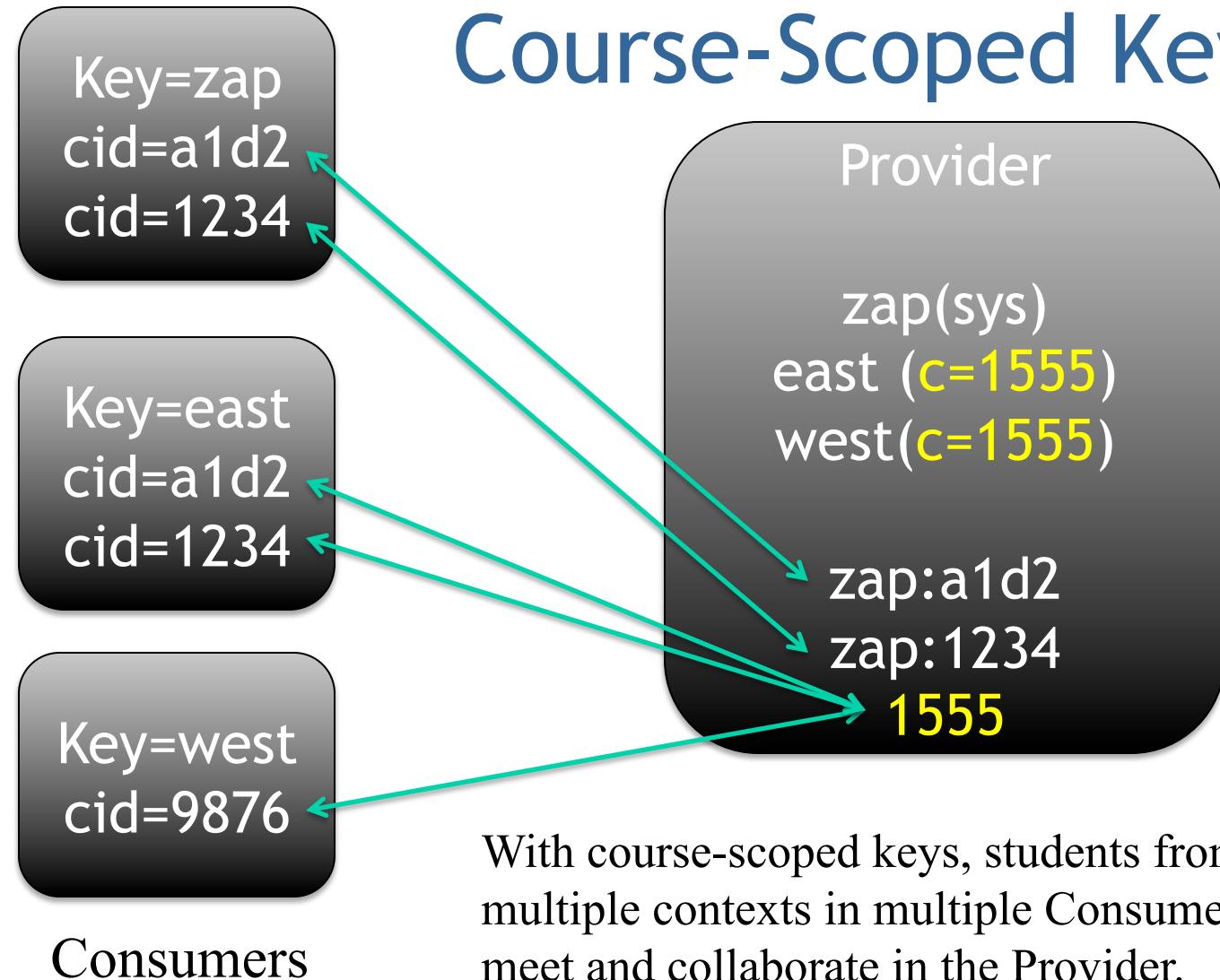
Use cases

- System-scoped key - The Consumer sends us a context_id for each course which allows many different courses to use our tool independently - this is a typical approach
- Course-mapped key - in this case, you ignore the consumer-provided context_id and specify the context_id inside of your (Provider) system

System-Spaced



Course-Scooped Keys



With course-scoped keys, students from multiple contexts in multiple Consumers can meet and collaborate in the Provider.



Data Model Changes

```
create table blti_keys (
    id      MEDIUMINT NOT NULL AUTO_INCREMENT,
    oauth_consumer_key    CHAR(255) NOT NULL,
    secret            CHAR(255) NULL,
    name              CHAR(255) NULL,
    context_id        CHAR(255) NULL, ←
    created_at        DATETIME NOT NULL,
    updated_at        DATETIME NOT NULL,
    PRIMARY KEY (id)
);
```

`context_id` is used to optionally override `context_id` from launches



Course-Spaced Keys

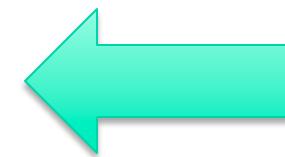
- In the sample application, each key has a `context_id` field - if it is null, the key is a system-scoped key.

```
mysql> select id,oauth_consumer_key,secret,context_id from blti_keys;
+----+-----+-----+-----+
| id | oauth_consumer_key | secret | context_id |
+----+-----+-----+-----+
| 4  | 12345             | secret | NULL      |
| 5  | bob.smith.lcc.edu | secret | 999999    |
+----+-----+-----+-----+
```



Basic LTI Sample Launch Data

lti_version=LTI-1p0
lti_message_type=basic-lti-launch-request
oauth_consumer_key=bob.smith.lcc.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=4598634513
context_title=SI301 - PHP
tool_consumer_instance_description=University of School





Configuration using resource_link_id



Use Case: Picking a Video

- If our Tool Provider is video archive and the purpose of each "placement" in a course is to play a particular video using BLTI to gain access to the video
- Problem: How to place BLTI resource links several places in the course map but refer to different videos in each placement?

Goal State

Week 1

Video snippet ←

Discussion board

Week 2

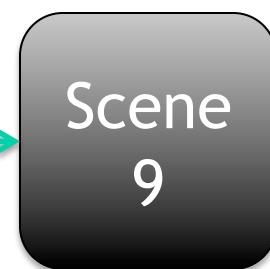
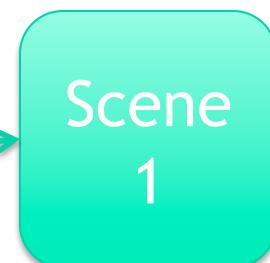
Video snippet ←

Wiki

Week 3

Video Snippet ←

Midterm Exam





Basic LTI Sample Launch Data

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





Understanding resource_link_id

Key=987 cid=a1b2

Week 1

[Video snippet](#) rlid=9c45

Discussion board

Week 2

[Video snippet](#) rlid=23b5

Wiki

Week 3

[Video Snippet](#) rlid=1725

Midterm Exam

The resource_link_id is unique for each placement of Basic LTI in a course. When each of the resources is launched you get key, cid, and rlid. Resource_link_id is required on all launches.



Using resource_link_id

Key=987 cid=a1b2

Week 1

Video snippet rlid=9c45

Discussion board

You need a table in your application which maps from a **consumer_key:resource_link_id** (i.e. 987:9c45) to some local resource identified within your application. Until the Instructor selects a resource within your tool, it is "unconfigured"



Understanding resource_link_id

Key=987 cid=a1b2

Week 1

Video snippet rlid=9c45

Discussion board

Not
Config

Pick
Video

Scene
1

Scene
1

Learner

Instructor

Learner

Instructor

Not configured

987:9c45 = matrix_scene_01



Primary Key for resource_link_id

- While the **resource_link_id** is a "GUID" and should be unique across consumers, it is safer to treat the tuple (oauth_consumer_key, context_id, resource_link_id) as the primary key for a resource



Redirect and Multiple Instances

- Once you have stored or retrieved the mapping between the LMS **resource_link_id** and your own internal resource id, you should redirect the browser to a URL that includes your internal resource id as a parameter or in the path
- You should not depend on session for either the **resource_link_id** or your own internal resource id to deal with the cases of multiple launches embedded in a single page, or launches running simultaneously in multiple browser windows at the same time.



Custom Field .vs. Resource Link

- In a Common Cartridge, Basic LTI Resource Links have a custom field which *could* be used for this purpose ... But ...
- The custom fields UI varies from LMS to LMS and may not even be available to the Instructor
- Using **resource_link_id** keeps the configuration UX in the Provider and keeps from needing per-LMS documentation
- A good practice is to use **custom_fields** in cartridges and if no custom field is present fall back to **resource_link_id** provisioning



Advanced Topics

- Adding Basic LTI To and Existing Application



Source Code - Download

- Simple Sample Application - Classified Ads
 - <http://www.dr-chuck.com/ims/php-simple/dist.zip>
 - Classified Ad Software (adlist/ads.php)
 - Key / Secret administration (adlist/admin.php)
 - Basic LTI Utility Code (ims-blti/blti.php)
 - Testing harness (simple BLTI Consumer) (lms.php)
 - Uses MySQL (adlist/setup.sql and adlist/db.php)



IMS Alliance Membership

- Attend IMS Quarterly Meetings
- Attend related Working Group Meetings
- Technical support for implementers of IMS Specifications
- Certification Program

<http://www.imsglobal.org/cc/jointhealliance.cfm>



Questions

*Seamlessly
connect
to learning*

- IMS - www.imsglobal.org
- cseverance@imsglobal.org



IMS Learning Tools
Interoperability (LTI)