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Authors: Irwan Kautsar, Shin-Ichiro Kubota, Yasuo Musashi and Kenichi Sugitani
Title: Synchronizing Learning Material on Moodle and Lecture Based Supportive Tool: The REST Based Approach
Number: 54

The paper was submitted by Irwan Kautsar <120D9307@st.kumamoto-u.ac.jp>.

Thank you for submitting to ICTS 2015.

Best regards,
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------------------------ REVIEW 1 ------------------------
PAPER: 54
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The English is poor. So many grammatical errors.

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------------------------ REVIEW ------------------------
The presentation of the paper is not well organized.
PROCEEDINGS OF
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on Information & Communication
Technology and Systems
(ICTS)

Department of Informatics, Faculty of Information Technology
Institut Teknologi Sepuluh Nopember (ITS)
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Synchronizing Learning Material on Moodle and Lecture Based Supportive Tool: The REST Based Approach

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Abstract—A lecturer’s role are the important part for the success of any eLearning platform, include Moodle LMS. Because only lecturers that enrich learning materials. Unfortunately, Indonesia still faces the bandwidth gap that made difficulties to use Moodle as a daily basis. Moreover, it will become complex when lecturer decide to install it on a local machine. This paper presents supportive tool that not only for enrich learning materials in offline conditions with easy initiation steps, but also synchronize it on remote LMS using Moodle REST web service in order to share learning material in limited bandwidth.

Keywords—synchronization; Moodle; Supportive Tool; REST; Web Service.

I. INTRODUCTION

Based on DGHEI (Directorate General Higher Education of Indonesia), Indonesia has more than 3500 Higher Education Institution (HEI), 300.000 lecturers and 7.8 million students [1]. With those numerous numbers, the adaptation of Moodle LMS (Learning Management systems) is urgently needed. More than 600 Moodle site has been registered in Indonesia [2]. This adaptation does not become a strong point for better education environment in Indonesia, which still faces the bandwidth gap [3]. Both lecture and student need. This problem might solve simply with installing Moodle on a local machine, but the effort to install Moodle on a local machine is complex. Start with configure the Apache web server, database configuration and need practical skill to create, backup then upload manually on remote Moodle LMS. This complexity will be a burden for lecturer before they start to author learning materials in offline conditions.

With recent web development framework, it can develop supportive tool that could support lecturer author learning materials in offline condition (no need internet connection) and upload created learning material on remote LMS. Developed Lecturer Based Supportive Tool (LBST) has been proposed to solve following problems:

• Complexity while using Moodle LMS.
• The lack of internet connection when enrich learning material and synchronize it on remote Moodle LMS.

This paper presented on following format: Section I, Introduction. II. Discuss the related work, the Moodle Web services, and the LBST itself. Section III. Discuss the synchronization. IV. Implementation, V. Conclusion and future works.

II. RELATED WORK, MOODLE WEB SERVICES AND LBST

A. Related Work

Limited bandwidth are always become issues when implement LMS. The main factor for successful LMS adaptation in learning process is to enrich learning materials. While there is a bandwidth limitation, it will be limit the lecturer to enrich the learning materials. To tackle these issues, Johnson et al, propose the use of File Transfer Protocol (FTP) and Compact Disk (CD) as part of distance learning [5]. Share learning material in online using FTP and for offline using CD. This approach suitable in limited bandwidth, because using of FTP and manually distribute the CD. But, in advance, those implementations need complex handling, because of the configuration of the FTP server, and then translate from raw resources to end user pages. Also, it needs another effort to
prepare the CD. Using Johnson et al method, lecturers needs to
learn how to initiate and adapt using both media (FTP and CD).

Rafael & Andre, 2010 have an approach to enrich learning material
with distributing free learning material based on Peer to Peer (P2P)
mechanism and empowered by developing Moodle plugin [6]. This
plugin works as a mediation layer. From this mediation layer, other
University Moodle LMS could start share learning material. This
approach not specifically solve content sharing problem on limited
bandwidth, but since work through http proxy, this approaches
are suitable for enrich learning material on limited bandwidth.
The issues we found on this approach are, it need advance
configuration skill that demand lecturer to have them adapt on
what they proposed.

Roy et al, propose a novel method to solve this bandwidth
limitation, called the dynamic synchronizations [7]. The aim of
the proposed method is to solve the lack of learning material
from mature higher education institution that already
implemented Moodle and young HEI that recently
implemented Moodle. This approach is tested on a Moodle 1.9
and suitable for content sharing between institutions. But, this
approach is only worked on Moodle to Moodle system only
and it is mandatory to apply on same Moodle versions. This
approach will be quickly obsolete, since Moodle community
has quick release on it development.

Those three approaches have a similar goal, which is
addressing learning material sharing on limited bandwidth. But
not addressing the conditions of lecturer itself. Such as, how
lecturer could easily adapt those approaches in order to enrich
learning material in offline conditions and adapt the diversity
of the Moodle versions. None of those approaches make use
the advanced Moodle feature such as Moodle web services.

B. Moodle Web Services

Moodle provides a web services that enable third party
application access learning material with single URL instead of
regular authentication such as user and passwords [12]. For
example, if the third party application needs to get information
of some course on remote Moodle, it could use function call
that named "core_course_get_course". And combine it with
token and needed option into appropriate URL. Table 1 show
the correct URL to get Moodle course.

<table>
<thead>
<tr>
<th>Function Call</th>
<th>URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>core_course</td>
<td><a href="http://someaddress/moodle/web/service/rest/server.php">http://someaddress/moodle/web/service/rest/server.php</a>?</td>
</tr>
<tr>
<td>_get_course</td>
<td>wstoken=H151509135&amp;callfunction=core_course_get_curse&amp;courseid=0</td>
</tr>
</tbody>
</table>

If above URL is appropriate, remote server will response as
shown as on Fig. 1. The Moodle web services function call has
a similar function with CRUD (Create Read Update Delete) on
created learning materials on Moodle. These features made
possible to develop third party application and interact with
Moodle resources through it web services.

C. Lecturer Based Supportive Tools (LBST)

Web application does not burden users on specific
platform and device. This also apply on Moodle and other web
application LMS's. However, it is possible to use Moodle in
offline condition with install it on local machine. This was not
recommended for beginners. Because, user needs to configure
web server, database and Moodle administration panel.

Mostly LMS user is lecturer and student. Especially a
lecturer whom responsible to enrich learning content. This is
why, we develop supportive tool that based on what lecture
needs. Not what lecturer should adapt when they want use
Moodle in offline condition. Moreover, what lecturer need
when use LMS in offline condition is to author learning content.

For this point, is clearly needed some supportive tool
that support lecturer to author learning material in offline
conditions and upload it, whatever the version of those remote
Moodle that provided. With current technology, it is possible
built web based supportive tools that could enable lecturer
focus only on authoring learning material. No need configure
web server, database and course management, just as similar
as when they want to install Moodle on local machine.

Our current development supportive tool that named
LBST, developed with flask web framework [8]. Flask
framework has built in Web Server Gateway Interfaces
(WSGI) [9] library named werkzeug [10] and Jinja templating
[11]. This mean, that once users run the application, it
automatically run the web server and use the local database
that already provided. This will be more effective way than
Moodle that need other application as web server and effort to
configure it. So, after running the script, lecturer could directly
author learning material in offline condition and upload it on
remote LMS when lecturer already connected to campus LMS
through LAN (Local Area Network). The life cycle activity of
lecturer when using developed supportive tools, shown on Fig. 2.
III. MOODLE REST WEB SERVICE SYNCHRONIZATION

We propose to use Moodle web services for synchronization, because it standardized and cover almost Moodle release version. The web services protocol that provide by Moodle is REST (Representational State Transfer), xmi-rpc, and SOAP [12].

In this research, REST protocol was selected. REST concepts will be assuming all Moodle learning materials are resources. These concepts, consumer application like LBST, no need to deal with Moodle database relationships. These bring advantages for developer to more focus on developing supportive tools. The need of synchronization between LBST and remote Moodle is how to perform REST action: PUT, GET, POST on Moodle resource through Moodle web services. Shown on Table 2.

<table>
<thead>
<tr>
<th>REST Action</th>
<th>Moodle REST Function Call</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUT</td>
<td>core_course_create_courses</td>
</tr>
<tr>
<td>GET</td>
<td>core_course_get_courses</td>
</tr>
<tr>
<td>POST</td>
<td>core_course_update_courses</td>
</tr>
</tbody>
</table>

Moodle will give different response according what request that have been made. For example, if LBST use "core_course_create_courses", the response will be course ID that created. We propose to use these responses for synchronization.

IV. IMPLEMENTATION AND EXPERIMENT RESULT

To simulate the synchronization, the following steps are described:

1. User creates course on LBST. For an example, course name is The Awesome Cycling 101. Shown Fig. 5.

![Fig. 5. Lecturer create course on LBST.](image)
2. User upload the LBST on remote LMS. LBST use “core_course_create_courses” function call. The result is, on Moodle will occurs some course with title: “The Awesome Cycling 101”. Shown on Fig. 6.

3. For the sake of synchronization test from LBST to remote LMS, users need to edit course name through LBST, with name: “The Awesome Cycling 101. Update 1.0. From LBST” (Shown on Fig. 7). And from remote LMS to LBST; change course name with: “The Awesome Cycling 101. Update 2.0. From Moodle”.

4. User will select desired version on LBST. Update 1.0 or Update 2.0.

From above steps it is clearly needed some procedure in LBST to get local course ID and get remote course ID in order to map the same courses. The detail literate code on following discussions (Shown on Table 3).

<table>
<thead>
<tr>
<th>Table 3: LITERATE CODE FOR SYNCHRONIZATION SIMULATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0. Start</td>
</tr>
<tr>
<td>1. a. Set Course.local.name ← “The Awesome Cycling 101”</td>
</tr>
<tr>
<td>b. Set Course.local.ID ← “3” (Autonumber)</td>
</tr>
<tr>
<td>2. a. PUT(Course)</td>
</tr>
<tr>
<td>b. Set Course.remote.name ← “The Awesome Cycling 101”</td>
</tr>
<tr>
<td>c. GET(Course.remote.ID)</td>
</tr>
<tr>
<td>d. Set Course.local.map.ID ← Response Course ID</td>
</tr>
<tr>
<td>e. From Moodle.</td>
</tr>
<tr>
<td>3. Set Course.local.name ← “The Awesome Cycling 101</td>
</tr>
<tr>
<td>Update 1.0. From LBST”.</td>
</tr>
<tr>
<td>4. Set Course.remote.name ← “The Awesome Cycling</td>
</tr>
<tr>
<td>101 Update 2.0. From Moodle”.</td>
</tr>
<tr>
<td>5. a. If (Update 1.0) selected, then:</td>
</tr>
<tr>
<td>Set Course.remote.name ← “The Awesome Cycling</td>
</tr>
<tr>
<td>101 Update 1.0. From LBST”.</td>
</tr>
<tr>
<td>b. If (Update 2.0) selected, then:</td>
</tr>
<tr>
<td>Set Course.local.name ← “The Awesome Cycling</td>
</tr>
<tr>
<td>101 Update 2.0. From Moodle”</td>
</tr>
</tbody>
</table>

Course dashboard has been developed to provide flexibility for users to choose what desired version of created learning material that created on LBST or the remote LMS. Developed dashboard shown on Fig. 8.

Fig. 6. Created course has been uploaded to remote LMS.

Fig. 7. Update created learning materials

Course dashboard has been developed to provide flexibility for users to choose what desired version of created learning material that created on LBST or the remote LMS. Developed dashboard shown on Fig. 8.

Courses that shown on LBST dashboard are from LBST (Update 1.0) and from remote Moodle (Update 2.0). Shown on Fig. 9.
If lecturer choose step 5a in Table 3, lecturer only need select the desired version from LBST dashboards. This will change course which before it has a title: “The Awesome Cycling 101. Update 2.0. From Moodle”, will become “The Awesome Cycling 101. Update 1.0. From LBST”. Shown on Fig. 9.

Fig. 9. Different content on Moodle and LBST.

Fig. 10. Learning materials in LBST and remote Moodle become same version.

Again, in LBST dashboard also shows the selected version learning materials (shown on Fig. 11).

Fig. 11. Updated learning material that shown in LBST dashboard.

V. CONCLUSION AND FUTURE WORKS

Enrichment learning material can be done third party application. Since Moodle has provided the web service synchronization learning materials between remote Moodle and developed LBST made possible. The lecturer could use LBST as daily basis and focused on enrichment learning materials. With LBST, a lecturer are not only could adapt on just one Moodle server and single version. But also lecturer could share and enrich on other Moodle server that might be installed on different department/universities with different Moodle versions.

As future works, it need to synchronize learning material from LBST to another LMS which already support REST web services such as Chamilo, Canvas and Sakai LMS. Since developed LBST record modification time of updated materials, it will be more interesting if implement autonomous synchronization based on recent updated materials.

REFERENCES


