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We received your paper:

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,
EasyChair for ICTS 2015.

Dear Irwan Kautsar,

Congratulations! Your submission 54: Synchronizing Learning Material on Moodle and Lecture Based Supportive Tool: The REST Based Approach has been accepted
for oral presentation at International Conference on Information &
Communication Technology and Systems (ICTS 2015) which is to be held on
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Thank you very much for your cooperation.
We are looking forward to meeting you in Indonesia.

Best regards

Dr. Darlis Herumurti
General Chair of ICTS 2015

---------------------- REVIEW 1 --------------------
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----------- REVIEW -----------
The English is poor. So many grammatical errors.

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Consider to use the ICTS template.
The format of the paper is so poor.

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----------- REVIEW -----------
The presentation of the paper is not well organized.

ICTS

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Surabaya, September 16th, 2015

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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 advance 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 an 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 I.   EXAMPLE URL OF MOODLE WEB SERVICES

Function Call	URL
core_course _get_course	http://someaddress/moodle/webservice/rest/server.php? wstoken=tH1515t0k3n&wsfunction=core_course_get_c ourses&options[ids][0]=18&moodlewsrestformat=json

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.
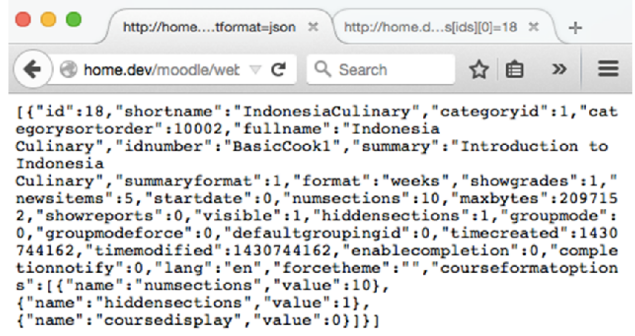
[{"id":18,"shortname":"IndonesiaCulinary","categoryid":1,"categorysortorder":10002,"fullname":"Indonesia Culinary","idnumber":"BasicCook1","summary":"Introduction to Indonesia Culinary","summaryformat":1,"format":"weeks","showgrades":1,"newsitems":5,"startdate":0,"numsections":10,"maxbytes":2097152,"showreports":0,"visible":1,"hiddensections":1,"groupmode":0,"groupmodeforce":0,"defaultgroupingid":0,"timecreated":1430744162,"timemodified":1430744162,"enablecompletion":0,"completionnotify":0,"lang":"en","forcetheme":"","courseformatoptions":[{"name":"numsections","value":10},{"name":"hiddensections","value":1},{"name":"coursedisplay","value":0}]}]

Fig. 1. Response from Moodle Web services

C. Lecturer Based Supportive Tools (LSBT)

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.

From this point, it 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.
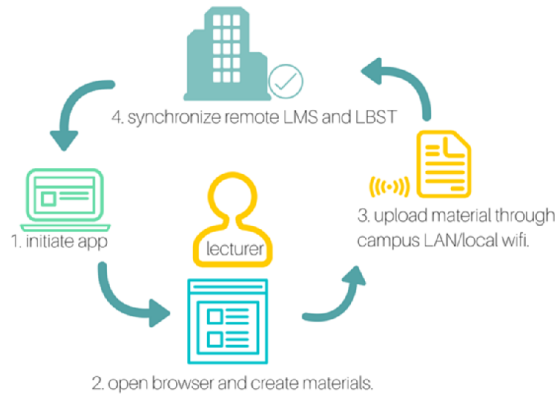
Fig. 2. Life cycle of user activity when use the LBST.

The life cycle lecturer activity on LBST, describe on following steps:

1. Lecturer need run single python script to initiate the LBST (Shown on Fig. 3).
2. Lecturer access LBST through browser apps. And create learning material.
3. Lecturer uploads learning materials.
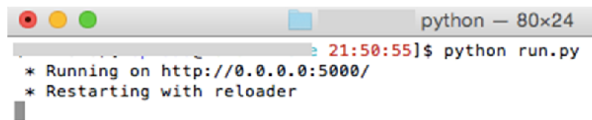4. Course uploaded on remote LMS.

Fig. 3. LBST initiation.

In order to knowing which server that learning material will be uploaded, lecturer need to do small configuration on the LBST. It is need address of remote lms and token that provided by remote LMS (shown on Fig. 4.).

Fig. 4. Setting up a Remote server on LBST.

Since the LBST can use for authoring in offline condition, it need to synchronize the learning material that has been created on LBST with learning material on Moodle LMS. It is possible to use LBST as blended learning for a lecturer when lecturer meet the condition where teach on institution with no LMS provided. However, it still need to synchronize the learning material that has been created on LBST with learning material that uploaded then modified on remote Moodle LMS. Next session we describe proposed method in order to synchronize the learning materials.

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), xml-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.

TABEL 2. REST ACTION AND MOODLE REST FUNCTION CALL

REST Action	Moodle REST Function Call
PUT	core_course_create_courses
GET	core_course_get_courses
POST	core_course_update_courses

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.

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.
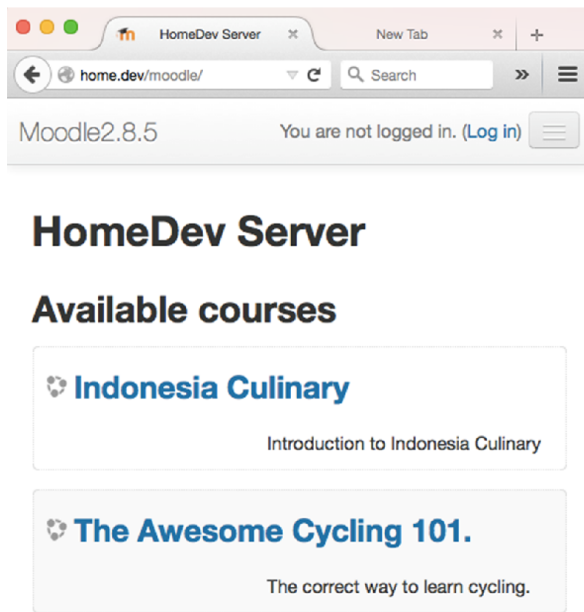

Fig. 6. Created course has been uploaded to remote LMS.

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".
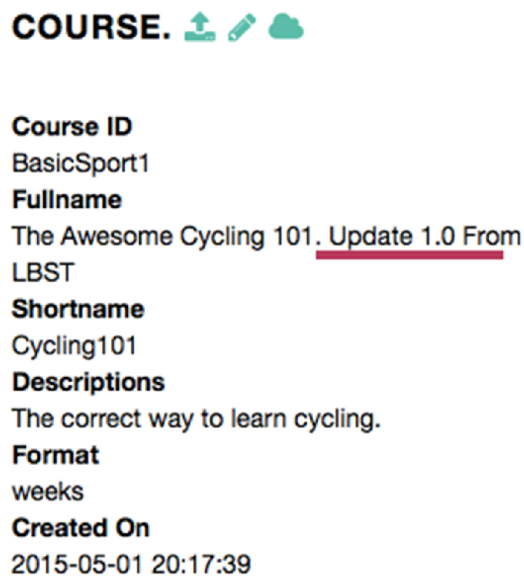

Fig. 7. Update created learning materials

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 3. LITERATE CODE FOR SYNCHRONIZATION SIMULATIONS.

0.   Start.
1.   a. Set Course.local.name ← "The Awesome Cycling 101". b. Set Course.local.ID ← "3" (Autonumber).
2.   a. PUT(Course). b. Set Course.remote.name ← "The Awesome Cycling 101". c. GET (Course.remote.ID) c Set Course.local.map.ID ← Response Course ID from Moodle.
3.   Set Course.local.name ← "The Awesome Cycling 101 Update 1.0. From LBST".
4.   Set Course.remote.name ← "The Awesome Cycling 101 Update 2.0. From Moodle".

5.   a. If (Update 1.0) selected, then:
 	
     Set Course.remote.name ← "The Awesome Cycling 101 Update 1.0. From LBST".
 	
b. If (Update 2.0) selected, then:
 	
     Set Course.local.name ← "The Awesome Cycling 101 Update2.0. From Moodle"

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.
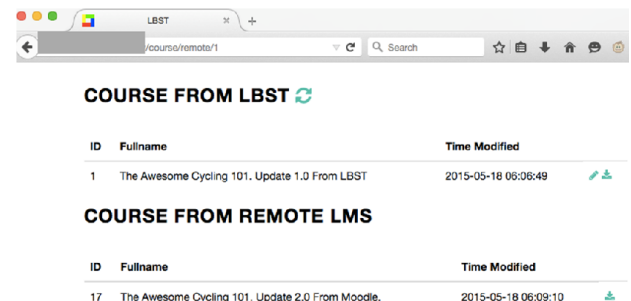

Fig. 8. Dashboard to select desired versions learning material.

Courses that shown on LBST dashboard are from LBST (Update 1.0) and from remote Moodle (Update 2.0). Shown on Fig. 9.
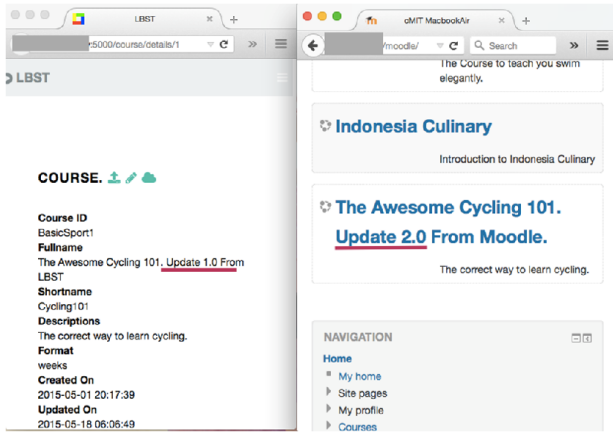
Fig. 9. Different content on Moodle and LBST.

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.
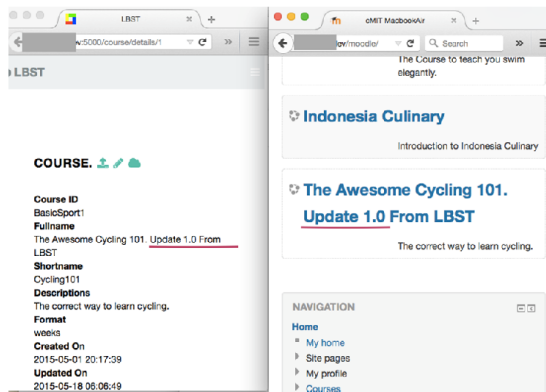

Fig. 10. Learning materials in LBST and remote Moodle become same version.

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.

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