NETWORKING BETWEEN LMS MOODLE AND EXTERNAL APPLICATIONS

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Abstract: The contribution introduces the use of a prediction market as a support tool in the educational process and its networking with LMS Moodle. The prediction market FreeMarket has been running at the Faculty of Economics as the part of the financial engineering courses. The quality of the predictions estimates depends on the trade activity of the market participants. That's why it's necessary to motivate students to trade on such a market. The paper presents one of the methods to increase the activity of students. The results of the market trades form a supplement to the final students' evaluation in the relevant courses in the form of credits that are added to the total score of each student. FreeMarket points that students earn on the market are transferred to the credits according to the declared rate. The interconnection between FreeMarket and LMS Moodle is described together with the description of the process that transfers FreeMarket points to LMS Moodle gradebook. These processes update the students' assignment score automatically and periodically. In the next the interconnection between LMS Moodle and application for exam report generating is explained. Finally the technological solution of networking is described.

1   INTRODUCTION

The simulation game FreeMarket (FM) on the base of virtual prediction market is presented in this contribution. The main functionality of the system consists mainly in predicting selected events or in estimating parameters. A practical example of such a market on the Faculty of Economics of University of West Bohemia is introduced. The FM participants – traders are especially students of the university. This virtual market is a supplement to the financial engineering courses at the faculty and it has become one of the new approaches in education not only in this type of courses.

LMS Moodle is not only system for management and administration of education process, but it is also very useful tool for student testing and student evaluation (Cápay and Tomanová, 2010). LMS allows evaluating of the assignments automatically according to the tests results and manually by teacher as evaluation of tasks in file uploaded by students to LMS. LMS Moodle offers also the offline activities of students. Teachers evaluate these activities manually. The main purpose of this paper is to describe the automation of this process on the

base of interconnection of LMS Moodle and external application for student offline assignments.

The interconnection of the market with LMS Moodle and students' evaluation are described. This motivation factor is very important as support of students' activities on the market and it is used for improving the quality of predictions by increasing the market liquidity. In the next the connection between LMS Moodle and external application that generates the exam reports with all relevant information about activities of students is explained.

The problem of the networking between LMS Moodle and external application is addressed in (Sánchez and Bragós, 2007). The LMS Moodle is used for access control, register and scheduling of processes in remote experimental laboratories. Similar problem is focused in (Sancristobal,Castro, Harward, Baley, DeLong, Hardison, 2010) and (Uran, Hercog, Jezernik, 2007). These works focus on the use of LMS Moodle for access control or booking to remote application. One contribution solves the integrating of control mechanism of remote application over web into LMS Moodle. The mentioned contributions don't solve the transfer of the results from remote application to LMS Moodle and their transformation to credits for student

evaluation. This paper describes the solution of these problems.

2 PREDICTION MARKET

Prediction markets are speculative markets created for the purpose of making predictions. Assets are created whose final cash value is linked to a particular event (e.g., the winner of the Czech Parliament election will be the Civic Democratic Party) or a parameter (e.g., the close value of PX index on Friday 19/1/2012). Other names for these markets are predictive markets, information markets, decision markets, idea futures, event derivatives, or virtual markets. The current market prices can then be interpreted as predictions of the probability of the event or the expected value of a parameter. People who buy low and sell high are rewarded for improving the market prediction, while those who buy high and sell low are punished for degrading the market prediction (PM, 2011).

Many prediction markets are open to the public. Betfair is the world's biggest prediction exchange, with around $28 billion traded in 2007. Intrade is a for-profit company with a large variety of contracts not including sports. The Iowa Electronic Markets (I.E.M) is an academic market examining elections where positions are limited to $500. This market was opened in 1988 (IEM, 2011). The I.E.M. routinely outperforms the major national polls. In the last four presidential elections the I.E.M.'s election-eve predictions were off by an average of just 1.37 per cent.

Other prediction market, the Hollywood Stock Exchange, which allows people to speculate on the box-office returns, opening-weekend performance, and the Oscars, has also been prescient. Traders' predictions of the opening-weekend returns are more accurate than the movie industry's forecasts, and the Exchange has done a good job of foreseeing nominations as well. Last year, its traders correctly predicted thirty-five of the forty Oscar nominees in the top eight categories. The participants of these markets also "decided" the results of the Iraq war and the Sadam Hussain's destiny. (Surowiecki, 2003)

Why do decision markets work so well? They are extremely efficient at aggregating information and tapping into the collective wisdom of a group of traders, and groups are almost always smarter than the smartest people in them. As in financial markets, the incentive to get the better of others (whether the reward is profit or mere satisfaction) causes traders to seek out good information. The absence of hierarchy - markets don't have vice-presidents -

insures that no single person has too much influence and that diverse viewpoints don't get shut out. (Surowiecki, 2003)

2.1 FreeMarket – Prediction Market on University of West Bohemia

An electronic prediction market under the name of FreeMarket (FM) has been running at the Faculty of Economics, UWB in Pilsen, since November 2007 (FM, 2012). To this time 1600 users are registered and around 450 of them, participants of financial courses, are registered in each of the fall semesters 2009/2010, 2010/2011, 2011/2012. The shares are divided into 4 areas:

- Politics
- Sport
- Entertainment
- Economics

The portfolio of each of the participants was composed by an endowment of 5,000 credits (money units, points) when registering or 10,000 credits when he/she passes the final exam to become an FM broker and receives an FM broker concession number. The applicant can pass the exam together with practical training of trading in an e-learning course that is a supplement to the FM system.

The login to FM runs under the common university single sign-on system. This system ensures the creation of just one trading account for each student and this way it prevents students from creating the "black" trading. In the past this system was not used and the control mechanism detected several students that had created "black" accounts to receive more starting points from each of those accounts and then they transferred the points to their official account with the help of illegal trade.

3 NETWORKING BETWEEN FM AND LMS MOODLE

From fall semester 2009/2010 the FM system was interconnected with the LMS Moodle. The reasons for this connection are to increase student motivation and to prevent some students from "black" trade realization. The connection to LMS belongs to the incentives of FreeMarket, proposed and implemented by the author of this paper.

In the first case thanks to this connection the students could transfer their earned points to engineering courses credits in announced rate
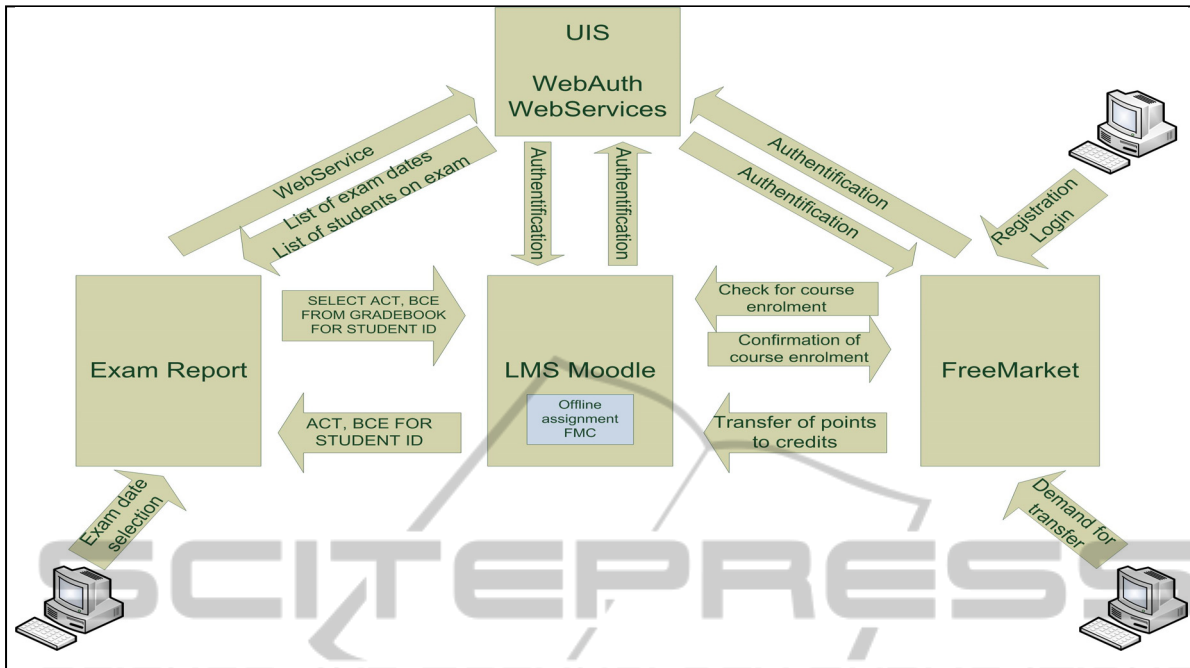
Figure 1: Interconnections between LMS Moodle and external applications. (Source: own)

(1:5000 for inclusion and 1:10000 for exam). The credits are put as evaluation of offline assignment in the course. These points help to students to reach inclusion and also were added to final result of exam as additional credit. The students can set the amount of transfer points in any time during semester. The whole process is automatic without any intervention of course teacher.

The connection to LMS Moodle with the relevant courses allows also control the number of created account. Every participant of FM has to be enrolled in selected courses in LMS Moodle and then can create only one account. The connection between FM and LMS Moodle is shown in Figure 1 together with interconnection LMS Moodle and external application for summarizing information about students for exams reports.

3.1 A Practical Example of Credits Calculations

In the relevant LMS Moodle courses two artificial offline assignments were created

- FreeMarket credits FMC
- Bonus credits to exam BCE

The following formulas calculate the Aggregation Course Total (ACT) of all the course assignments credits and Bonus credits to exam (BCE). It uses one of the useful features of LMS

Moodle consisting in defining calculation for the gradebook by means of a math formula. The formula follows the pattern of formulas/functions in popular spreadsheet programs. The process of evaluating the whole course with respect to the values of all the course assignments (AS-n) and FMC is proposed and implemented in LMS Moodle.

$$ACT=sum([[AS1]];….;[[AS\text{-}n]]; [[FMC]]) /200*100 \tag{1}$$

$$BCE=max([[FMC]]\text{-}max(180\text{-} max(180\text{-}sum ([[AS1]];…;[[AS\text{-}n]]);0);0) *5000/10000 \tag{2}$$

180 credits out of 200 credits is the minimum amount of credits for students to become eligible for the course. 5000 is the transfer rate for the bonus inclusion credits and 10000 is the transfer rate for the bonus exam credits. The ACT and BCE are parts of the final course report of each student and serve as basic documentation for the final course exam.

They are processed automatically by another application (*exam_report*, ER) activating by teacher that selects demanded exam term. This application first of all connects to university information system (STAG) and generates the list of students on demanded exam term. Then ER connects to gradebook of relevant courses in LMS Moodle (see Figure 1) and it reads ACT and BCE values for every student on generated exam list. According to these values the ER determines information about

students' inclusions and calculates bonus points for exam.

3.2 Technological Solution of Applications Networking

The transfer of credits from FM participants' accounts to gradebook of LMS Moodle is realized in two steps.

In first steps student determines the amount of points (money) that has to be transferred to LMS Moodle. He/she fills the web form with the number of credits and by this way activates the process that controls student's money account and rounds the points with respect to ratio 1:5000. Then this process saves the points to database table *fm_users* with all information about participants and adds it to the total amount of all previous transferred student points. Finally it sets up the flag for transfer to 1.

The second step is processed by php script *points2moodle* that is activated in cron process one time per day. The script selects all users' profiles with transfer flag equal to 1 and then transfers total amount all transferred points to student gradebook of relevant course as a value of offline assignment FMC. (see section 3.1).

Described transfer is processed with help of SQL commands *Select*, *Insert* and *Update*. First of all the *Select* command selects assignment id for relevant course id and assignment name 'FMC' in Moodle table *grade_items*. Next *Select* command finds the gradebook of given user from the table *grade_grades* according to the user id and assignment id. Then the new record is inserted to the table *grade_grades* if it is processed for the first time and the gradebook record doesn't exist for the user and assignment or the existing record is updated by new FMC value. In both described cases the new record is inserted to the table *grade_grades_history* that archives information about grade changes.

Finally the script *regrade* is activated to recalculate ACT value (see section 3.1) for course and every student. The script selects the values of all assignments for user id and course id from the table *grade_grades* and *grade_items*. Some of assignments are calculated items (ACT, BCE). In case of these items the process has to evaluate the item value according to the calculation prescription that is saved in the table *grade_items*. At the end the values of all assignments are summarized according to the final grade ACT calculation prescription and the ACT value is set in the table *grade_grades*. This value is important for next generation of exam report in such it shows the student course inclusion.

The exam report generation is implemented as connection to the university information system via web service and as a connection to LMS Moodle table *grade_items* and *grade_grades*. The *exam_report* script determines the list of exam dates via web service from university IS. Teacher can select demanded exam term and the process requests the list of students enrolled on exam again via web service from IS. Then the script connects to LMS Moodle database and it finds out ACT and BCE assignment id for every student on list from *grade_items* table and the ACT and BCE values are determined from *grade_grades* table. The final output of whole process is a table of all students on exam term with collected information and empty fields for exam results. This table is generated in HTML code and it is published on web page or it is generated as CSV file for importing to spreadsheet application.

4 CONCLUSIONS

LMS Moodle offers several types of assignments. One of them is offline assignment that is evaluated and the credits are set manually by teacher. The contribution shows the possibility of the networking between external application, where students process their assignments, and LMS Moodle. The functional transfer of credits from external application to gradebook of LMS Moodle is described as well as the networking between reporting application that utilizes information from LMS Moodle, is presented. This online interconnection between applications and every day possibility to watch results in LMS Moodle supports students' activities.

The interconnection and networking are realized with straight access to LMS Moodle database tables. The transfer of credits can be realized with import utilities that are implemented in LMS Moodle. But in such case it is needed to load Moodle libraries to external host and application. Another solution is development of universal web service server as the part of LMS Moodle (Al-Ajlan and Zedan, 2008), (Casany, Alier, Conde, 2009). The external application code for credits transferring would be simpler than current solution.

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