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Open Source Analytics for Blackboard Learn

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BbStats – Activity Dashboard

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It is a capital mistake to theorize before one has data.
Insensibly one begins to twist facts to suit theories,
instead of theories to suit facts.

Sherlock Holmes. Sir Arthur Conan Doyle.

Introduction

The Blackboard learning management system (LMS) facilitates online course content delivery and measurement of student progress. The student progress is tracked in a digital grade book, which provides means to mark and measure evidence of learning. The grade book feature primarily makes it a learning management system, because learning is measured and then managed. However, in addition to grades, the LMS contains scores of other data, which can be helpful to students, instructors, and administrators in making decisions.

The importance and pursuit of data is well illustrated by the story of William Fair and Earl Isaac in 1956 (Regalado, 2014). With just $800 they started a company to mark and measure data that would help lenders see a grade or score of borrowers' ability to repay a loan. With pen and paper, the borrower's income, gender, and occupation were turned into a grade, which was later used to predict future behavior. Today, Fair Isaac Corp., or FICO, generates about 10 billion credit scores annually. These scores are used in many business fields including banking and insurance to make decisions carrying much weight in the lives of individuals.

There is a gap in the functionality of the Blackboard Learn system to deliver performance indicators about the number of active courses, user activity, and course tool usage at the organizational level. This gap is the focus of the BbStats – Activity Dashboard project. Previous projects with similar focus, such as the ASTRO project supported by the Blackboard Greenhouse

Grant (Kunnen, 2009), were closed-source and did not remain usable across modern Blackboard Learn releases.

Brief History

The BbStats project was initiated in September of 2010 by Szymon Machajewski, Eric Kunnen, and Garrett Brand as an open source project under GNU General Public License v2.0. It was published to the Open Source Community for Educational Learning Objects and Tools (OSCELOT) repository and currently is the second most popular project with 4,570 downloads. As of December 2013, the Blackboard Learn LMS was used by over 20,000 organizations with more than 20 million users.

"OSCELOT is a community that creates innovative open source solutions for the challenges facing the eLearning community. We believe in openness in education, the application of OPEN standards, the power of OPEN source, OPEN community, OPEN content, and OPEN education" (OSCELOT, 2014).

In 2011, the BbStats project, among others, was awarded the Innovative Development Award for significant contributions to the Blackboard Developer Community (Henderson, 2011; IDeL, 2014). The project was recommended in the Security, Reporting, and Configuration chapter of a Blackboard administration manul as a way to understand traffic and usage of the LMS (Patterson, 2013). Currently the BbStats project is maintained by the Academic Computing and Communications Center team at the University of Illinois at Chicago. The project is under active development in collaboration with multiple higher education institutions. At the current version of 3.9.5 there were 14 software releases since 2010.

Data Sources

BbStats uses system Java libraries to collect server performance data. The Apache Tomcat container is used to execute the web-based Blackboard Learn application. Total allocated heap memory, maximum heap configured, number of CPU cores are all data useful in tuning and troubleshooting Apache Tomcat performance problems. They are also useful in designing and monitoring highly available clustered deployments of Apache Tomcat.

Another source of data for the BbStats project are the system statistics database tables in the Blackboard Learn application. The data in the tables is calculated and updated daily through a proprietary batch process. This data contains daily summary of total active users, active courses, page views, course views, and others.

The third data source is the activity accumulator database table. This table contains a record of certain web interface events, or clicks, performed by end-users. The data is appended to the table periodically throughout the day. This table can easily grow into many millions of rows. It is often set by system administrators to a 180-day deletion lifecycle.

Functionality

The BbStats project is deployed into the Blackboard Learn LMS as a building block, or a plugin. It is available to system administrators in the Sys Admin tab under Tools. The following functionality is available:

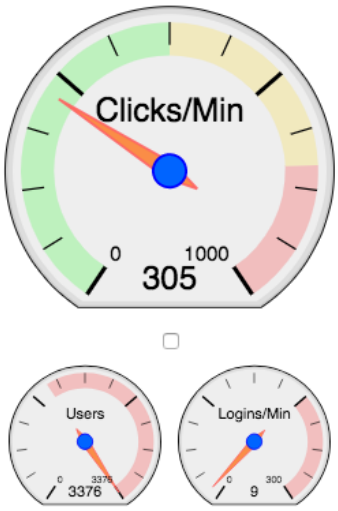
1. Active users, courses, organizations. As calculated by the internal Blackboard Learn process, active users or courses are objects accessed in the last 30 days. The graph displays historical data in perspective of time since the installation of the LMS.
2. Page views, course page views, login attempts. Page views are web resources outside of courses, such as Community System content. This data comes from the system statistics.

3. Authenticated users and activity. This graph displays hourly totals of successfully logged in users and the hourly rate of total clicks performed by them. The data comes from the activity accumulator.
4. Total user sessions. The graph displays hourly totals of user sessions, not unique users. This functionality is especially useful when misconfigured load balancing system generates multiple sessions per each logged-in user.
5. Authenticated users and guest users. An hourly total of authenticated users vs guest users helps to identify denial of service attacks and other security or performance problems.
6. Historical list of top 1000 users by activity level in last 3 days. This table shows users and the number of clicks performed in the last 3 days. The number of days is configurable by the administrator.
7. Current list of top 1000 users by activity level. This table displays currently logged in users and the number of clicks, or activity, identified.
8. Assessment attempts activity per hour. This graph displays the hourly totals of quizzes, exams, and other assessments.
9. Email generation per hour. This graph displays the number of emails sent from the LMS by students, instructors, or system administrators.
10. Clicks per minute gauge. The graphic, styled into a set of three speedometers, displays the clicks per minute rate performed in the system, the number of logged in users, and the new logins per minute rate (Figure 1).
11. Online attendance report. This table displays daily activity per online student in a specific course. This facilitates attendance reports used by K12 institutions. This

functionality is new and released at the Big Data Conference (Big Data Conference, 2014).

12. The project also includes Android and iOS mobile apps.

Figure 1.



Further, the main BbStats Dashboard provides a System Information menu with links to Background Tasks, System Logs, Task Status, Configuration, and Information. These are core Blackboard Learn system administration tools. System performance data is displayed on the dashboard including total number of logged in users. Also, a list of top twenty currently logged in users sorted by the number of performed actions is present on the dashboard view.

Future functionality planned for the project includes LMS Adoption Reports. These interfaces will report a summary of courses made available to students in specific periods of time, courses accessed by instructors, courses never accessed by instructors, courses modified but never made available to students. The interfaces will also list email addresses of instructors assigned to the various course groups to facilitate communication between instructional designers and identified faculty. Finally, the adoption reports will include the number of tools selected in the design of courses. Instructor use of such tools as the grade center, online quizzes,

discussion forums, wikis, blogs, and journals informs administrators of the adoption of the system. The reports will include break-down by categories, schools, and departments.

Summary

The BbStats project provides user interfaces in the form of graphs, tables, and figures to help system administrators access Java system library data, Blackboard system statistics, and Blackboard activity accumulator. The project is deployed as open source under the GPL v2.0 license to ensure longevity and community support. The future plans to include LMS adoption reports at the organizational level will help organizations measure and evaluate their adoption of the LMS.

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