UDC 004.413.2

INTEGRATION OF G SUIT FOR EDUCATION CLOUD PLATFORM WITH LOCAL EDUCATIONAL SERVICES

MIHAIL MAKARYCHEV, ARKADY OSKIN
Polotsk State University, Belarus

This paper presents ideas for implementing a web application for testing knowledge and integrating this application with the G Suite for Education cloud platform.

Cloud technologies used in education allow you to manage information tools of learning, as well as automate regularly performed tasks of the educational process. G Suite for Education [2] is one such platform. It includes Gmail (including Inbox by Gmail), Calendar, Sync Chrome, Class, Contacts, Drive, Documents, Forms, Groups, Tables, Sites, Presentations, Talk/Hangouts, Safe and a number of additional services.

The most important service used in training is the Google Classroom [3]. With its help teachers can organize courses, invite students and other teachers, plan the training process, give out assignments, send out announcements and start discussions, and students can exchange materials, add comments to the course tape and communicate by email. The information about the jobs given is constantly updated, which allows the instructors to quickly check the tasks and put the grades. In the Classroom, you can work with Google Docs, Calendar, Gmail, Drive and Forms.

This cloud solution from Google is a universal base components. However, the requirements for software in various educational institutions may become tougher. Basic services are not enough, or their functionality has certain shortcomings. Therefore, educational institutions are forced to use third-party software, or develop their own, which will be devoid of certain shortcomings. In the second case, it is natural to develop specialized services for specific needs, implementing components of G Suite for Education, as the basis of the software platform. In addition, it is important to switch from several software products that are used separately to a single system consisting of multiple services.

After studying the products of G Suite for Education, a number of shortcomings were found in the field of testing students' knowledge. Although Google offers a Form service for this, it is not flexible enough to function, as, for example, the third-party solution is Airen [1]. Airen is free software with open source. It allows you to create tests and conduct tests on the local network, over the Internet or on single computers.

With the help of the Airen, teachers can create, save and edit tests, configure the test mode using a test profile, register the test lists in the program database and assign tests to run. During the testing, the teacher is provided with detailed information on the progress of the work, including data on the current progress of each student, up to answers to individual questions. Students can log in, view assigned tests, select tests from the assigned tests and start executing it, after execution you can view the test results.

Airen is able to work with all the most common types of questions: choosing one or several correct answers from among the suggested ones, with entering a response from the keyboard, establishing conformity, ordering and classifying. Also a question of any type can be accompanied by a script - a Pascal program, which will be performed before the question is shown to the test person. Thus, it is possible to create variational tasks, the individual content elements of which vary from the tested to the tested. Setting the test mode allows you to very flexibly manage the test parameters, the output of the result and the scale of assessments. All these parameters can be saved in the test profile, which is aligned with each test.

Studies G Suite for Education and Airen lead to the next decision. You should develop your own web application for testing knowledge, which includes all the functionality of Airen and is a service compatible with G Suite for Education. Thus, the basic components from Google are supplemented with a new multifunctional component of testing knowledge. Such a component can be especially useful when dealing with distance and distance learning students.

To develop a Web application, it is proposed to use the Java Enterprise platform [4] with the Spring Framework [5] architecture and the Apache Tomcat [6] application server.

PostgreSQL [7] will be used as the data store. This is a free cross-platform object-relational database management system. The strengths of PostgreSQL are high-performance and reliable transaction and replication mechanisms; an extensible system of built-in programming languages; inheritance; easy extensibility.

The server part is implemented using Java Servlet Technology [8]. The use of the Spring Framework greatly simplifies development with this technology. The central part of Spring is the Inversion of Control container, which provides tools for configuring and managing Java objects using reflection. The container is responsible for managing the object lifecycle: creating objects, calling initialization methods, and configuring objects by binding

them together [5]. Spring has its own MVC platform for web applications. It provides the developer with the following features:

– clear and transparent separation between layers in MVC and queries;
– interface strategy - each interface does only its part of the work;
– the interface can always be replaced by an alternative implementation;
– interfaces are closely related to the Servlet API;
– high level of abstraction for web applications.

Since passing a test is an ordered set of actions, each of which determines a certain state and, possibly, affects the further behavior of the subsystem responsible for the process of passing the test, it is reasonable to use Spring Web Flow [9]. Spring Web Flow is based on Spring MVC and allows you to implement "flows" of web applications. The flow is a sequence of steps that need to be taken to perform the business task. It consists of a set of HTTP requests that have states that operate on transaction data, reused, which can be either short-term or long-lived.

Spring Security [10] will be used to secure the Web application. This framework provides mechanisms for building authentication, authorization and access control systems. It is the de-facto standard for security in Spring-based applications.

The problem of integrating Google services can be solved with the help of the Spring Social framework [11]. Each service of the G Suite for Education platform provides a REST API (an application program interface that uses the REST architecture – the transmission of the view state). Spring Social interacts Spring applications with REST API providers, for example, Google Classroom. It's worth mentioning that Spring Social does not yet contain the implementation of the Google Classroom API and it needs to be developed independently, but Spring Social is an extensible framework that simplifies the process of connecting local user accounts to the service records. It has an input controller that allows authorization in a web application through the service entry and connection controller, which processes the authorization process between the web application, the service and users. Spring Social includes the implementation of the OAuth 2.0 protocol for Google services. OAuth 2.0 is an authorization protocol that allows one service (application) to grant access to user resources on another service. The protocol eliminates the need to trust the application login and password, and also allows you to issue a limited set of rights, not all at once [2].

The client part is implemented by standard HTML, CSS, JavaScript (jQuery) and executed by a web browser. It also uses JSP (JavaServer Pages), a technology that allows web developers to create content that has both static and dynamic components [12]. The JSP page contains two types of text: static source data, which can be formatted in one of the text formats HTML, SVG, WML, or XML, and JSP elements that construct dynamic content. In addition, JSP-tag libraries, as well as EL (Expression Language), can be used to introduce Java code into the static content of JSP pages.

Implementing such a web application in practice, you can have a high-performance knowledge testing system with the services included in the cloud platform G Suite for Education. The performance of the system is not limited due to the support for the clustering of PostgreSQL storage and the Apache Tomcat application server. However, one should keep in mind that the following performance limitations are documented in the Google Classroom API [13]:

– no more than 4,000,000 requests per day per client;
– no more than 50 requests per second for each client;
– no more than 5 requests per second for each user.

These restrictions do not interfere with the normal operation of a web application with a fairly large number of online users, they are rather aimed at combating various flood-attacks.

Further development of the project can go in the direction of developing client applications for mobile platforms. In Spring MVC, it is possible to create REST-controllers that send data at the request of the client, for example, in JSON-format. Due to this, mobile development does not need to re-implement business logic, but focuses on HTTP-interaction with the web application and visualization of data [5].

REFERENCES

1. Айрен. Программа тестирования знаний [Electronic resource]. – Mode of access: http://www.irenproject.ru/. – Date of access: 02.16.2018.
2. G Suite for Education [Electronic resource]. – Mode of access: https://edu.google.com/k-12-solutions/g-suite/?modal_active=none. – Date of access: 02.16.2018.

3. Google Classroom [Electronic resource]. – Mode of access: https://classroom.google.com/u/1/h. – Date of access: 02.16.2018.
4. Java EE [Electronic resource]. – Mode of access: http://www.oracle.com/technetwork/java/javaee/overview/index.htm. – Date of access: 02.16.2018.
5. Spring Framework [Electronic resource]. – Mode of access: https://spring.io/. – Date of access: 02.16.2018.
6. Apache Tomcat [Electronic resource]. – Mode of access: http://tomcat.apache.org/. – Date of access: 02.16.2018.
7. PostgreSQL [Electronic resource]. – Mode of access: https://www.postgresql.org/. – Date of access: 02.16.2018.
8. Java Servlet Technology [Electronic resource]. – Mode of access: http://www.oracle.com/technetwork/java/index-jsp-135475.html. – Date of access: 02.16.2018.
9. Spring Web Flow [Electronic resource]. – Mode of access: https://projects.spring.io/spring-webflow/. – Date of access: 02.16.2018.
10. Spring Security [Electronic resource]. – Mode of access: https://projects.spring.io/spring-security/. – Date of access: 02.16.2018.
11. Spring Social [Electronic resource]. – Mode of access: https://projects.spring.io/spring-social/. – Date of access: 02.16.2018.
12. JavaServer Pages Technology [Electronic resource]. – Mode of access: http://www.oracle.com/technetwork/java/javaee/jsp/index.html. – Date of access: 02.16.2018.
13. Usage Limits [Electronic resource]. – Mode of access: https://developers.google.com/classroom/limits. – Date of access: 02.16.2018.