



Software Architecture for In-House Development of a Student Web Portal for Higher Education Institution in Kazakhstan

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Abstract

The students' portal is a student management information system developed in-house for higher education institution in Kazakhstan. It represents a major part among university information systems. This paper reviews the common features of the general portal structure. The architecture of the new students' portal framework is presented (Boranbayev, *Nonlinear Anal.* 71:1633–1637, 2009). It consists of a web application developed for the university, dedicated for students and staff members of the department of Student Affairs. It was developed in the last 6 years with such technologies like IBM WebSphere, Java EJB, JavaScript, HTML, and Oracle Database. The university's system designers and application development team constantly work on enhancing and improving it. The software architecture of the developed portal is shared among various web applications at the university (Boranbayev and Boranbayev, *Development and optimization of information systems for health insurance billing. Seventh International Conference on Information Technology: New Generations (ITNG 2010)*, Las Vegas, Nevada, USA, 2010, pp. 1282–1284). This architecture and experience may be used by various development teams developing local applications for universities, either in-house or with the help of suppliers and vendors.

In addition, the paper discusses how the students' portal components were developed. The research contributes towards the higher education field worldwide by providing a solution that could be followed for building university portals with various components.

Keywords

Software framework · Web application · Portals · Computer architecture · Information system · Software development

100.1 Introduction

The “Student Portal” was built to create a single information space for university students [1, 2]. The Department of Student Affairs and the Student community of the University are the key stakeholders of the system.

The student portal implements the following functions: creation/publication of news; creating/confirming the publication of events; creation/confirmation of clubs; recording in clubs; search and display of the student in the phone book; an entry to a psychologist; record on psychological trainings; online payment for services; application for room reservation.

100.2 Description and Technologies Used

The student portal consists of an information part and interactive services. The information part is a multi-level set of web pages designed to store and display content. Interactive services—a set of modules and databases, designed to implement the functionality for the needs of the student community. The student portal is integrated with other information systems of the University. It was developed on the IBM WebSphere Portal platform, interactive services are developed in the Java programming language. The system is built using the Java technology stack, EJB3.0, JPA, Javascript, HTML, Oracle Database 11 g. The technical characteristics of the hardware platform are presented in Table 100.1.

Operating systems—on the servers of the Student Portal, “Red Hat Enterprise Linux Server release 6.5 (Santiago)” is used. Web server—the Student Portal server uses a load

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balancer. As the portal is active, it distributes the load to three web application servers (nodes). On the nodes are installed WebSphere portal 7. Caching—to cache data received from the database and LDAP uses the service Dynamic cache service.

Database—the system uses Oracle Database 11 g. The main components of development of the applied software application are:

jQuery—library for creating interfaces.

ExtJS 4—library for creating interfaces.

EJB 3.0—the framework for building the business logic of an application.

JPA—the Java EE API specification, provides the ability to store Java objects in a convenient way in a database.

Oracle 11 g—data storage and management.

The entry point is a proxy http/https web server. It is responsible for handling requests, transferring static content, and load balancing between nodes. The system uses three separate Oracle, DB2, and LDAP servers. The Oracle database contains a database of installed applications. On the DB2 server, there is a database responsible for the health of the portal. On the LDAP server is a database with data about the users of the university.

The student portal provides communication with the following systems:

1. Identity Management System in the part of authorization and obtaining personal information of the student [3].
2. Billing subsystem in terms of obtaining information on names, codes of paid services, the cost of these services and the transfer of information about paid services.
3. Registrar's office in obtaining information about students (data on the student, a sign of social vulnerability, the form of training, the transfer of information on booking rooms).
4. Subsystem for accounting services in terms of obtaining data for invoicing in the personal account on the Student Portal.
5. HMS (Housing management system) in terms of obtaining information about residence in the dormitory.

Design, implementation and enhancement of an online student portal is an ongoing process. It has become vital for the Department of Student Affairs, Students and the IT department to team up and make use of the system.

The overall IT Ecosystem at our University encompasses both commercial and in-house built systems. The decision rationale that we use for choosing between our commercial, or custom, solutions has largely been driven by two underlying factors—the commercial vendor technology support landscape existing in Kazakhstan as well as the overall University budgeting process. As a result, we have invested significant time, effort and resources towards the development of custom, in-house software solutions to meet many of the operational needs of the University's core administrative functions including admissions, resource management and student services [4]. By designing these systems from the ground up, we have been able to tailor system functionality to specific university's business process requirements and have been able to seamlessly integrate these separate systems with each other to create very effective end-user experiences [5]. These custom solutions have been able to provide most of the core functionality required by our university in our early existence while also proving to be easily supportable and extensible.

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