

AN E-LEARNING WEB PORTAL WITH SYSTEM INTEGRATION FACILITIES

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Abstract: The present paper focuses on means of integrating dedicated information systems based on various technologies (php / postgresql, asp / MS sql) into a global web portal, based on MS technology. The portal provides as well learning management content and e-learning facilities for various user categories.

1 INTRODUCTION

The present paper aims at describing the design of a system integration framework that is based on MS technology and integrates various information systems, based on different technologies (php / postgresql, asp / MS sql). In this respect, we describe an integrated architecture based on ILM Microsoft server, and additional interface modules, used in order to integrate the dedicated information systems into a web portal that also provides e-learning facilities, based on SharePoint Portal functionalities*. Based on the principles regarding the way in which data types are structured in organizations' databases and used by different components of integrated software systems, ILM can synchronize and optimize data access and delegate processing means to the appropriate dedicated software components.

Section 2 describes the information systems that are integrated, while section 3 focuses on the web portal and its assessment from the administrating point of view. The integration principles that we have designed and are in train of being implemented are presented in section 4.

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2 THE INFORMATION SYSTEMS

AcademicInfo is an integrated information system dedicated to managing educational information, with dedicated processing facilities for secretariats, specific access facilities for students and teachers and relevant synthesis regarding the educational process. The system models educational processes at BBU level, ensuring course selection from all faculties' curricula in study agreements, models in a flexible manner various types of educational activities at all study levels (BA, MA, PhD, continuous education, specific curricula), ensures multilingual support in processing and reporting, integrates various types of facilities, fee management, student documents and requests, on-line course evaluation.

ManageAsist system is the integrated software system for administrative management that has been developed for our university. The system can be viewed as an ERP system; within its design and implementation, we integrated systematic efficiency principles in software design: multi-layer architecture and layer autonomy (Micromax Information Services Ltd., 1999) , (Hoganson, Guimaraes, 2003), advanced object oriented design based on systematic abstraction principles (Gregory M. Bowen), design patterns (Gamma, Helm, Johnson, Vlissides, 2002), flexibility in module integration and communication, systematic workflow management, efficient database access and design (Stuparu, Andreica, Mantu, 2005), (Berry and Linoff 2000).

ManageAsist's principles and facilities are adapted for high education institutions; the system contains the following modules: Document management, Assets, Warehouse, Cashier, Finance, Accountancy, Grants, Human Resources and Acquisitions, and decision assistance facilities. The first 7 modules are already in use; their implementation has pursued systematic and efficient principles (Andreica, 2005). Each module contains management reports for the corresponding compartment. Relevant synthesis from each compartment will be integrated, together with global management tools into a decision support module.

In (Andreica., Stuparu, Ghetie 2009) we address the advantages of pursuing advanced design principles in the implementation stages of the system, and in designing a flexible framework for efficiently integrating the system's modules. We also deal with means of managing hierarchical data structures, together with efficiency issues in respect with processing them. Each module includes levels (Andreica., Stuparu, Ghetie 2009) for specific document processing, operational facilities and reporting, level that provides management assistance information for the corresponding compartment.

Research Management System. Within our university we developed and implemented a dedicated software system for managing Babes-Bolyai University's (BBU) research activities, by offering accessible and user-friendly means of collecting specific information, and automatically performing quantitative analyses, syntheses and evaluations based on the collected information. The system may be viewed as a tool for quantitative research evaluation, its more general aim being to ensure proficient management of the research activity within BBU and supporting the design of competitive strategies in the field by means of this dedicated software system.

The design and implementation principles of the Research Management software system, its architecture features and its impact in research activity management for the members of the academic & research staff, but especially for research management levels: chairs, institutes, departments, faculties, university are described in (Andreica and Agachi, 2008). The implementation of the system complied structured efficiency principles and stages (Andreica, 2005), (Andreica, 2006) in order to ensure best design and impact features.

3 WEB PORTAL ASSESSMENT

The web portal that we have implemented in order to provide e-learning and web integration facilities is based on a SharePoint solution, which has proven to be very convenient in flexible administration and integration purposes.

3.1 Assessing e-Learning Portal Functionalities

Regarding the system assessment, we developed dedicated questionnaires for administrators, students and teachers, in order to obtain a general feed-back regarding existing facilities, platform functionalities and to ensure future developments

The questionnaire has been created and interpreted using the survey functionality built-in in the platform (Share Point Portal); we underline in this respect the flexibility of the platform's tools.

We further discuss the results obtained consequent to monitoring the administrators' survey (Andreica., 2009), since administration facilities are relevant for the portal capabilities. Regarding user feed-back, preliminary results reveal that users are not fully aware of the platform functionalities and we still have to organize more trainings in this respect.

Administrators were requested to evaluate, on a 1 – 5 scale (1=very weak, 2=weak, 3=moderate, 4=good, 5=very good), the following platform characteristics: *administration functionalities* - the average weighted grade was 4.14; *communication functionalities* - the average weighted grade was 3.86; *functionalities for administering educational content* - the average weighted grade was 4; *functionalities for developing educational content* - the average weighted grade was 3.43; *functionalities for platform development* - the average weighted grade was 4.43; *platform adaptability / flexibility characteristics* - the average weighted grade was 3.57; *reporting facilities* - the average weighted grade was 4. We can notice that all characteristics are positively rated, most of them being qualified above 'good' (weighted grades ≥ 4).

Administrators were also requested to evaluate the percentage of teachers who requested / were granted permissions for administering their courses / educational resources – results are displayed in figure 4: we can notice that most of the faculties (86%) did not grant for more than 50% of their teachers permissions for administering their own educational content, which reveals the fact that users are still in initial phases of platform use. Regarding the experience of our administrator respondents,

most of them - 57% didn't have the experience of using other platforms

We further discuss some of the most relevant responses in respect with the platform characteristics: *administration functionalities* and *functionalities for developing educational content* are well rated: 29% very good, 57% good, 14% moderate – see figures 1,2; *functionalities for platform development* are very well rated: 43% very good, 57% good – see figure 3

We may conclude that the adaptability and flexibility characteristics of the platform that were mainly aimed are actually implemented and we have a very good feed-back in this respect.

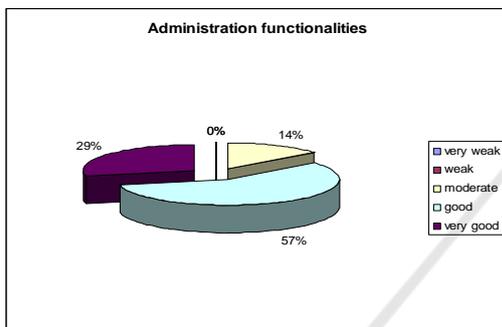


Figure 1: Administration functionalities.

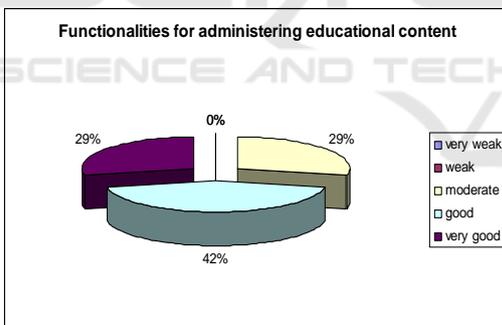


Figure 2: Administering educational content.

We also note that guided e-learning facilities are still being developed and further have to be evaluated.

We shall continue monitoring the system and completing the survey evaluations in order to ensure its most appropriate use and development; in this respect, we are confident that our prerequisites regarding adaptability specifications in system upgrades will also prove to be very useful in future developments.

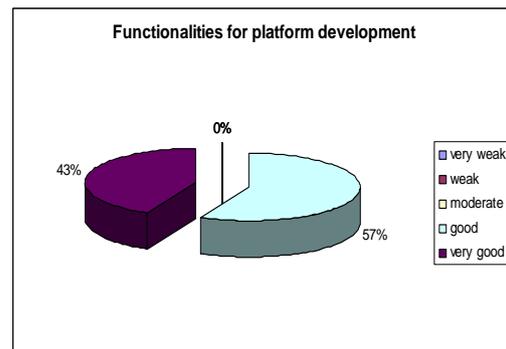


Figure 3: Functionalities for platform development.

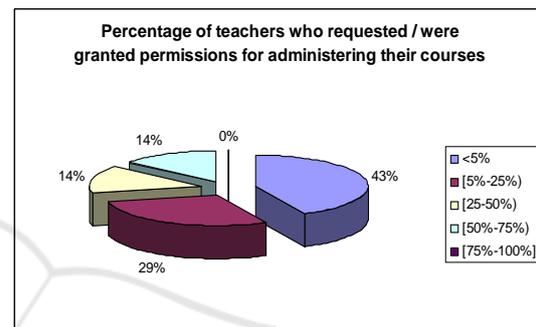


Figure 4: Percentage of teachers who administer their courses.

3.2 System Overview and Perspectives

E-learning systems (Horton, William, Horton, Katherine, 2003) may be viewed as advanced tools which assist teachers in creating a cooperative, multidisciplinary and explorative learning environment and students in accessing these learning facilities and developing learning interactions within this environment. The implementation of e-learning facilities strongly contributed to the development of the student and goal centered learning model (Allen, 2002).

E-learning implementations should pursue the same principles and stages as for other dedicated software systems (Andreica, 2005), (Andreica, 2006) - the user involvement within the stages of system requirements, verification and implementation are of utmost importance for a successful implementation. Though e-learning facilities are fairly standardized, it is important to take into account future upgrades of the implemented system

The implementation of the e-learning system within "Babes-Bolyai" University of Cluj-Napoca (Andreica, 2007), Romania systematically applied the above described principles. The flexibility

system requirements and de-centralized system administration that were pursued are expected to prove their efficiency in future developments

4 THE INTEGRATION FRAMEWORK AND PRINCIPLES

We have designed an advanced system integration framework, in order to ensure the integration of the e-learning portal (see 3) with BBU's dedicated information systems (see 2) AcademicInfo, ManageAsist, Research Management System. Integration principles are based on an integrated authentication solution, which maps facilities from the dedicated information systems into the portal, for each user category (Andreica., 2009). The authentication server associates, to each user group, the facilities that correspond to their permissions in each of the dedicated information systems AcademicInfo, ManageAsist, Research Management System, in order to make them available within the portal – see figure 5.

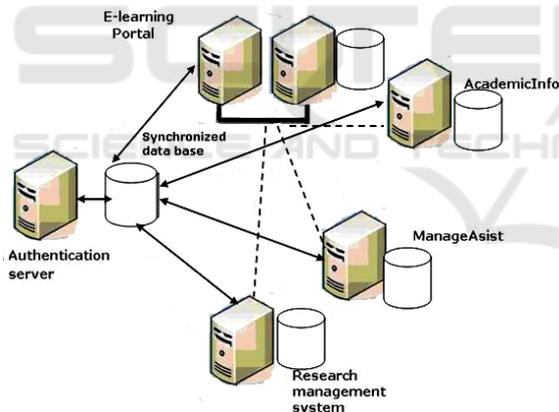


Figure 5: Framework for advanced system integration.

The MS architecture managed by an ILM type server is used in order to ensure single sign-on capabilities and uniform interface to the dedicated information systems. In this respect, we are in train of designing interface modules in order to map the portal authentication into each dedicated system.

A global synchronized database is in train of being created, the most important common information being the human resource & organization chart ones, retained in the dedicated tables:

```
User[userid, account, password, unitid]
Unit[unitid, unitname, ...]
Organization_chart[unitid, superior_id, horiz_id]
```

This common database, used by the ILM server, will also contain user and group authentication information, together with dedicated permissions in each of the information systems, in order to ensure access to corresponding permissions in AcademicInfo, ManageAsist, Research Management Systems.

The integration solution is also designed to ensure database synchronisation among AcademicInfo, ManageAsist, Research Management System and Portal databases based on matching the following data (Andreica., 2009):

- ◊portal – AcademicInfo: users (all categories), curricula, study contracts, grades, fees
- ◊portal – AcademicInfo – ManageAsist: organisation chart, units, human resources, managers, financial information
- ◊portal – AcademicInfo – Research Management System: research activities, PhD Students
- ◊portal – ManageAsist – Research Management System: organisation chart, units, human resources, grants & corresponding financial information

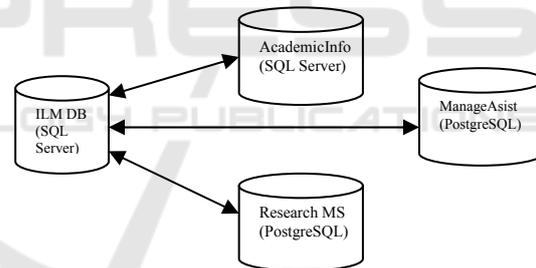


Figure 6: Synchronization scheme.

A major issue in the implementation of the global database synchronization is that the applications use 2 database management systems (PostgreSQL for ManageAsist and Research Management System and MS SQL Server for AcademicInfo), while the synchronization scheme is a multi-master one, each of the databases requiring bi-directional synchronization with the master database – see figure 6

On the other hand, this solution ensures significant autonomy functional advantages for information systems, compared to a direct Active Directory integration & mapping.

The MS SQL - PostgreSQL synchronization has been tackled in literature, see (PostgreSQL Team) for example. Although a certified multi-master

synchronization is fairly complex, in our case, the information that has to be synchronized / replicated between all databases is reduced to a few tables (see the description above for details): users, organization chart, units, people, with a fairly low modification rate, and therefore inducing a moderate network load

We are in train of implementing a synchronous database replication, in order to obtain real time synchronization. Since such a process is quite resource demanding, we also intend to explore some asynchronous mixed solutions if the run time of the global synchronizing & monitoring system tends to increase over a reasonable limit. The asynchronous solution transfers the whole database, having a larger data load, but the moment in time will be chosen in respect with the applications' low workload or even stand-by state.

In order to implement the authentication server we use MS Identity Lifecycle Management server, which has advanced integration facilities with our e-learning portal, and we are in train of configuring the necessary permission mappings from the dedicated information systems into the authentication server in order to complete the integration facilities.

The proposed integration solution may be applied in different organizations, for integrating their dedicated information systems

5 CONCLUSIONS AND FUTURE WORK

The paper focuses on information system development and implementation as tools for increasing organization competitiveness, and means of designing a system integration framework in this respect. Organizations face nowadays the phase of system integration, in order to ensure advanced management facilities at a global organization level and integrated IT facilities for various user categories. The universities' case is quite complex, since their activity covers a wide range of areas: education and learning, research, administration.

We describe an efficient integration solution by implementing a single authentication server and mapping specific facilities from the dedicated information systems, using different database management systems, into the portal, for each user category. This architecture is based on a global integrated database and a permission mapping scheme for ensuring appropriate access into the dedicated information systems. User identities that

access the portal are further redirected in authentication modules that ensure the interface between the portal and each dedicated system. We are in train of defining the necessary permission mappings in order to fulfill the implementation.

This solution has a good extensibility degree and may be applied in various organization cases.

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