Using FERP Systems to Introduce Web Service-Based ERP Systems in Higher Education

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Abstract. Enterprise Systems like Enterprise Resource Planning (ERP) systems are an important application area in higher education and getting more and more complex. Therefore problems occur from different perspectives and increase the difficulties in teaching. Existing software products cannot be used to teach specific technical aspects, like e.g. Web Services because it is still research in progress. This contribution reports about using a Federated ERP (FERP) system as an example for a Web Service-based ERP system to introduce aspects of Service Oriented Architectures (SOA) in higher education.

Keywords: ERP Systems, Federated ERP Systems, FERP, Web Services, SOA.

1 Introduction

Enterprise Systems in form of Business Information Systems (BIS) are getting more and more important for educational environments. The technology aspects are highly complex in many areas and the resulting problems are depending on different perspectives in computer science and business economics. This interference and complexity make the teaching and learning in this field quite difficult. For this reason systems practically approved are needed to give the students the chance to get their own practical experience. Enterprise Systems have the capability for future pedagogic innovation within higher education. Their potential results from the possibilities in illustration, visualization and simulation of business and decision-making processes to students. The main goal of using enterprise system as e.g. Enterprise Resource Planning (ERP) systems in higher education is to prepare them for real work life and to give them practical experience in the application of these technologies. Another objective is focused by software developing companies like SAP® or Microsoft®, e.g the students should get in touch with their special products as early as possible, so that they already know these products if they need to work with it later or are in the position to decide about investments. Our interests belong to the area of Business Information Systems, to the variety of ERP technologies and how they could be used to teach our university students. Hereby the focus lays besides the actual standard software on new concepts resulting from up to date research, e.g. Federated ERP (FERP) systems. This contribution will show the benefit from using the FERP system to introduce Web Service-based ERP systems in higher education with the help of an exercise used within the lecture *ERP Technologies.*

2   Technical Background

Before introducing the concept of FERP systems and how they can be used for teaching in higher education it is necessary to outline the main technical concepts behind: ERP systems and Web Services.

2.1   ERP Systems

ERP systems can be defined as standard software systems that integrate operational application systems of different enterprise sectors. These sectors can be for example customer service, finance or sales, which act as different components within one ERP system (see Fig. 1). The main goal of ERP systems is to integrate the data, functions and processes of all components of an enterprise. Because of the high complexity of ERP systems the following problems occur [1]:

− The price-performance ratio is dependent to the potential benefit an ERP system is able to generate
− in the majority of cases, not all installed components/functions are needed
− a high-end computer hardware is required
− expensive customizing is necessary

Due to these problems normally only huge enterprises can apply such complex ERP system to provide business logic of all its sectors. However, small- and medium sized enterprises (SME) deploy several different smaller business application systems in parallel [2]. This parallel operation often causes problems which jointly arise from insufficient system integration. Moreover the potential of each business application system is not exploited [3].
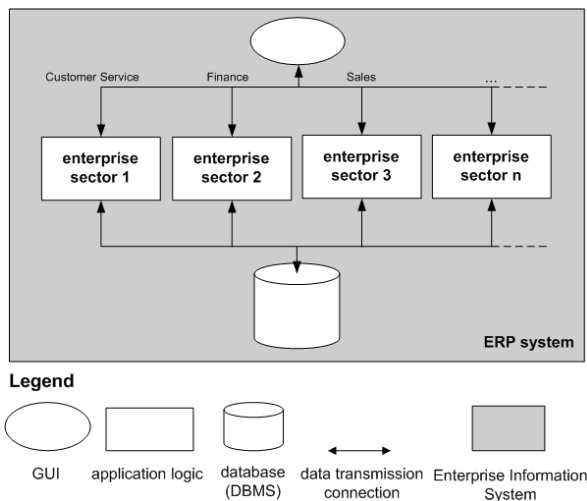

Fig. 1. Architecture of a conventional ERP system [1]

2.2   Web Services

Web Services are software systems which support interoperable interactions between machines over a network. Its interfaces are described in the Web Service Description Language (WSDL) to allow systems the interaction with the Web Service [4]. According to the paradigm of SOA, Web Services enable the development of distributed applications by offering single services which can be interconnected and reused. Furthermore, the integration of existing software is possible. Due to the allocation via a network and the access by open standards, another advantage of Web Services is the operating system and programming language independency [5].

3   FERP Systems

To face the problems which come along with setting up and operate a conventional ERP system, there is a need of a system in which SME can fulfill its requirements. One possible solution is the usage of FERP systems. A FERP system allows a variable assignment of business application functions to software providers. The overall functionality is provided by an ensemble of standardized subsystems that all together appear as a single ERP system to the user. Different business components can be developed by different vendors [1].

In the approach the application logic of ERP systems is encapsulated in a multiplicity of Web Services, which allows the separation of local and remote functions whereby no local resources are wasted for unnecessary components. Furthermore, in FERP, single components are executable on small computers which subsides the installation and maintenance costs by decreasing the degree of local system complexity [6]. According to the usage of Web Services and following the multi-layer paradigm of modern information systems by aiming at the separation of the application logic from the presentation layer and the database layer, the vision of this approach is to allow the application of business logic components in a distributed manner.

As shown in Figure 2, the FERP reference architecture consists of several subsystems which are interconnected. The different subsystems which are specific for the Web Service functionality are described in the following section, for more details of the whole concept please see [1].

– *FERP Workflow System (FWfS)*
  The FWfS represents the central component within the FERP reference architecture and coordinates all business processes inside the FERP system. The main task of the FWfS is to organize process definitions and to control business processes. The business processes are described in an appropriate XML-based workflow language and can be implemented via a FERP workflow editor [1].

– *FERP Web Service Consumer System (FWCS)*
  The FWCS is the subsystem which provides methods to call Web Services in order to execute the business logic via the business processes. All possible types of FERP Web Services are specified by the FERP WS standard which describes the Web Service operations as well as the input and output parameters [1].
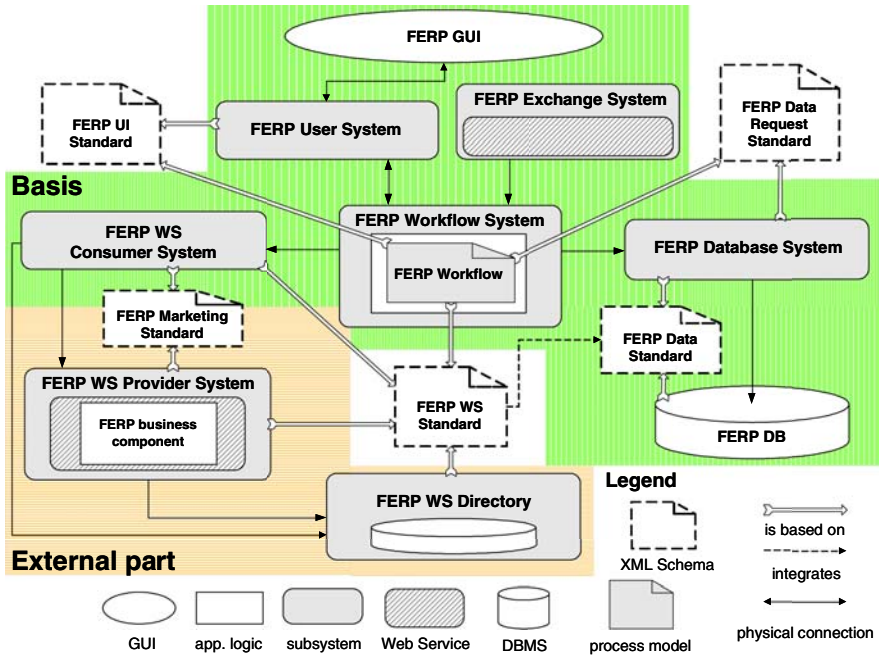
Fig. 2. Reference architecture of an FERP system with relation to necessary standards [1]

− *FERP Web Service Provider System (FWPS)*
  As another subsystem of the FERP reference architecture, the FWPS implements the functionality of Web Services according to the FERP WS standard. It offers the possibility to publish Web Services and handles incoming Web Services requests.
− *FERP WS Directory (FWD)*
  The FWD saves the Web Service descriptions in a format of a so called Web Service Secure Marketing Language (WSSML) and includes a link to the technical description of the Web Service (WSDL-File) as well as marketing-specific descriptions for helping users to make a decision about using the Web Service or not, e.g. price.

4   FERP Systems in Higher Education

FERP is a theoretical approach which shows how problems of conventional ERP systems could be solved by using new technologies like Web Services. Furthermore there is the prototype *FERP X ONE* as open source software available as basis for a Web Service-based ERP System. Thus, we used it in our lectures to teach the students in aspects of these new technologies, e.g. ERP Technologies and Electronic Business.

The objective of the lecture ERP Technologies is to teach the main theoretical and technical aspects in this application area, e.g. the implementation of Web Services. Therefore we invented exercises which deepen and clarify the problems step by step to increase the understanding and the interaction with these technologies. After the
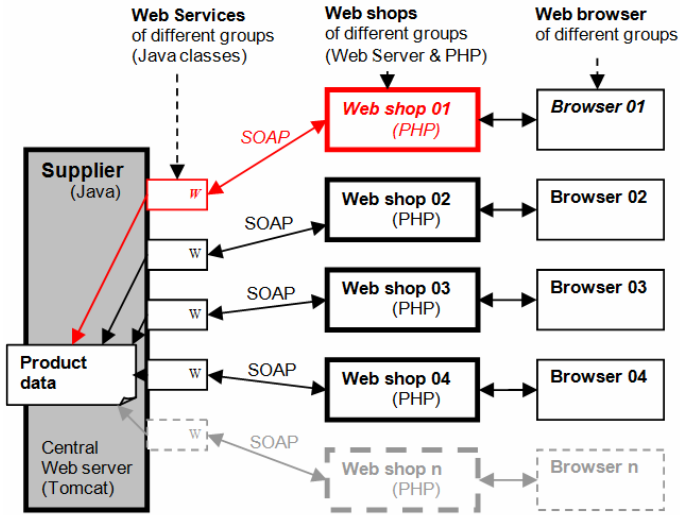
Fig. 3. Scenario of a Web Service exercise

introduction of the theoretical aspects of SOA and a detailed overview about the FERP Architecture, we give the students a practical exercise to learn more about the implementation. One scenario given in these exercises is shown in Figure 3.

The main task of the students in this exercise was to develop a Web Service for request and display the time of delivery of products. Therefore each student was already an owner of a web shop (implemented with PHP before) and partly prepared Java components were given as basis. The goal was to extend the functionality of the both systems in that way, that it allows a communication between the supplier (left side) and the web shop (middle) using the Simple Object Access Protocol (SOAP). All Web Services are managed by one central server and each student has to develop his program logic locally first and transfer it later to this server. In the next step they to extend the operation from getDeliveryTime to the parameter distance and weight to show as a result how the proposed delivery time is depending on the distance of the shop from the customer and from the weight of the product.

At the end of the exercise the students were able to implement a Web Service communicating with a web shop and an ERP system (FERP) via Web Service and to change different parameters. They used the Eclipse Platform[1], Tomcat Web Server[2], JAVA and PHP and learned why WSDL is needed.

5 Summary

FERP represents an approach for a Web Service-based ERP system which does not exist in practice, but where actual research in computer science and economics is

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[1] www.eclipse.org
[2] www.tomcat.apache.org

directed to. Due to this fact, FERP offers a very good chance to let students participate in ongoing research activities by teaching them in concepts beyond the state of the art. Our contribution shows only one small example how this approach could be used for explanation and training in the area of Web Services-based systems. The main advantage of this approach is that students can work with an environment which considers newest technologies and is already approved. Thus, it is possible to teach them about the whole architecture as well as only in some specific parts like the implementing a Web Service as it is shown in our case.

The application area of this Enterprise System and its potential is much wider, e.g. in the area of Electronic Business etc. Actually we are working in an extension to include Semantic Web Services. The FERP prototype is open source software and consequently offers the potential for future scenarios in other lectures. Therefore the inclusion of FERP in higher education could be seen as collaborative work which is done in the future by more then only one university. In future work we are interested to build up a network of universities and research institutes to share our experience, software and cases. Within this, it is possible to extend and improve the technical environment as well as to benefit from each other in teaching actual cases.

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