A PRACTICAL APPLICATION OF SOA
A Collaborative Marketplace

Sophie Rousseau

ORACLE Consulting, Colombes, France

Olivier Camp, Slimane Hammoudi

GRI, ESEO, Angers, France

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Abstract: The economical context greatly impacts companies and their Information Systems (IS). Companies have new competitors or develop new business skills, delocalize whole or part of their organization. Moreover they are faced with powerful competitors, and new products, fitting customer needs, must be developed fast, sometimes in less than 3 months. These companies' ISs need to cope with such complex evolutions and have to overcome the resulting changes. Service-Oriented Architectures (SOA) are widely used by companies to gain in flexibility and Web services, by providing interoperability and loose coupling, is the fitted technical solution used to support SOA. Basic Web services are assembled into composite Web services in order to directly support business processes. The aim of this work is to present a practical and successful application of SOA towards the design of a collaborative marketplace. An implementation in the Oracle environment is achieved using the BPEL Process Manager allowing an integration of the different components involved in the design of a collaborative marketplace. In particular, this paper illustrates, through a practical example, how the SOA approach promotes interoperability, one of its main strengths, by integrating an open source ERP into a mainly ORACLE based software architecture.

1 INTRODUCTION

In today's globalised economy, hard competition sometimes requires for enterprises to collaborate with one another to respond to a specific market need. Enterprises often rely on an electronic marketplace (e-marketplace) to support their business ; An e-marketplace can span two rooms in the same building, or two continents. How individuals, firms, and organizations approach and define the e-marketplaces of the future depends on people's ability to ask the right questions now and to take advantage of the opportunities that will arise over the next few years (Leebaert, 1999).

When dealing with a collaborative business process (Chen and Hsu, 2000; Liu et al., 2009) each enterprise's e-marketplace should thus be able to collaborate with its partner's e-marketplaces. Collaborative marketplaces (Sadiq et al., 2006; Guo, 2007) have been of much interest over the last decade and ensuring interoperability between such information sys-

tems has been a major software engineering topic. The principles of the Service Oriented Architecture (SOA)(Erl, 2007) is now considered a standard to support interoperability between information systems. Thousands of enterprises have adopted Service Oriented Architecture (SOA) based on its promise to help them respond more rapidly to changing business requirements by composing new solutions from existing business services. To deliver on this promise, however, companies need to integrate solid, yet flexible, Collaborative Business Process Management (CBPM) plans into their SOA initiatives (Fiammante, 2009).

In this paper we show, through a practical example, how SOA can be used to support a collaborative e-marketplace composed of a mainly Oracle based software architecture, but also integrating an open source ERP (*www.compiere.com*). The collaborative e-marketplace relies on web services to provide interoperability between the heterogeneous systems. In section 2 we give a description of the proposed

architecture for our collaborative marketplace. The third section describes the design and implementation of the marketplace. The fourth section of this article is dedicated to the analysis of our experimentation. Finally, we conclude in section 5.

2 ARCHITECTURE

The collaborative marketplace is built according to the Service Oriented Architecture (SOA) paradigm. The World Wide Web Consortium (W3C) defines the SOA as "a set of components which can be called, whose descriptions of interfaces can be published and spotted". The SOA is an architecture designed to allow low coupling between interacting software agents or services - a service being an action to be executed by a producer for a consumer. The implementation of SOAs was facilitated by the apparition of standards like Web Services. The SOA is a very effective answer to the problems that companies meet in terms of reuse, interoperability and coupling reduction between the various systems that make up their information systems. By its standard character, an SOA contributes to improve the speed and the productivity of software developments and a component exposed as a web service can be used by other applications. Figure 1 illustrates the main architecture of our Col-
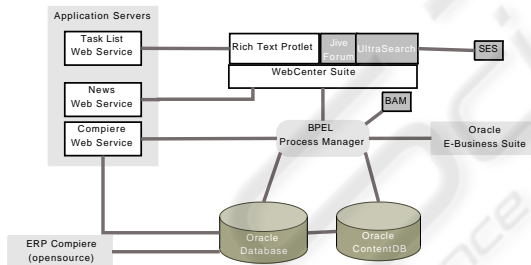

Figure 1: The collaborative marketplace architecture.

laborative Marketplace Platform. On this figure, the open source Compiere ERP, together with the Oracle Database storing its data, and the Oracle ERP E-Business Suite represent two e-marketplaces that need to collaborate. The Oracle ContentDB deals with the collaborative marketplace's content management. The BPEL Process Manager (BPEL PM) represents the heart of the collaborative system and takes care of the integrations of the Oracle E-Business Suite, the Oracle Content DB and the opensource Compiere ERP. The integration of Compiere ERP is achieved through the "Web servicisation" of the ERP's main functionnalities ; access to these web services is done by specific BPEL processes. The WebCenter product is used for the front end web application exposed to

the final user. This product allows the use of portlets to design the user interface and manages the application's access to several web services such as the News service - this service already exists and just needs to be integrated in the user interface. The different services built for the platform are deployed on OC4J (Oracle Container For Java) instances of the Oracle Application Server. The project is secured by the use of JAZN files present on these OC4J instances. JAZN is the Oracle implementation of JAAS (Java Authentication and Authorization Service) which is a standard for authentication management and role based access control. Jive Forum, UltraSearch, Secure Enterprise Search (SES) and Business Activity Monitoring (BAM) are modules not implemented in the project.

3 DESIGN AND IMPLEMENTATION

The realization of the marketplace was done in 4 main steps:

- The installation of the test environment,
- The integration of the Open Source Compiere ERP with the Oracle ERP E-Business Suite,
- The authentication management,
- The creation of the user interface.

3.1 Installation of the Test Environment Platform

Figure 2 is a schematic representation of the test platform showing the interactions between the different components. The platform is composed of 5 components, each one, except for the Oracle E-Business Suite, is installed on a specific virtual machine (VM):

- An Oracle database and the Compiere ERP;
- The Oracle ContentDB;
- The Oracle SOA Suite (10g) containing BPEL PM;
- The Oracle WebCenter Suite (10g);
- The Oracle E-Business Suite (an access to this Oracle Application, running on a physical server, was provided for the realization of the marketplace).
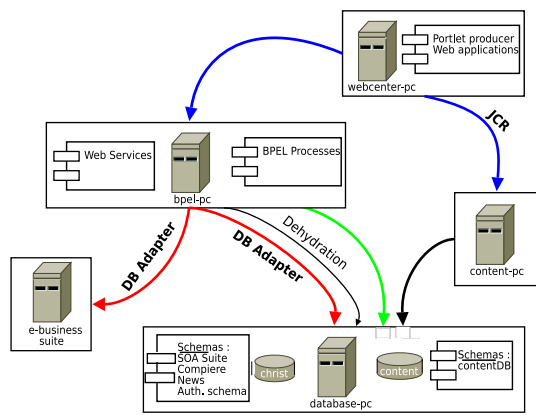
Figure 2: Test platform.

3.2 Integration of the Open Source ERP Compiere and Oracle ERP E-Business Suite

The integration of the Oracle ERP in the e-marketplace was not a difficult task. Indeed, the Oracle SOA Suite provides adapters that allow the integration of the E-Business Suite. Thus the integration of the E-Business Suite consisted in, using its interface, registering a supplier and, using BPEL PM Database adapter, detecting this registration and starting the global registration process. One important step in this process is the insertion of the E-Business Suite as a supplier in the Compiere ERP Database. The main problematic was the way to integrate this Open Source ERP since its functionalities were not exposed as web services. Looking more deeply in the product, we found some APIs that allowed the creation of web services directly in the Compiere product. This first solution was not implemented due to a lack of time. A second level of observations made us discover that the database used to store the ERP's data could be accessed directly and that the tables were easily identifiable. Oracle BPEL PM contains a database adapter that allows us to access these tables. However, for this project, we wanted the web services level to be independent from BPEL PM. Thus, we decided to develop the web services for the Compiere ERP directly on the database using the PLSQL language and developed stored procedures. The Oracle IDE, JDevelopper, allows the creation of Java web services from stored procedures and, using this functionality, we were able to expose Compiere's functionalities as Web services on an OC4J instance. The Compiere ERP was then ready to be integrated to the marketplace. Two services have been created for the needs of the marketplace:

- The registration of a supplier (creation of a record

in the database),

- The verification of the existence of a given supplier in the Compiere database.

3.2.1 Supplier Registration Process

The registration process is split in two steps:

Phase 1: registration on the E-Business Suite - first level of validation and creation of user accounts.

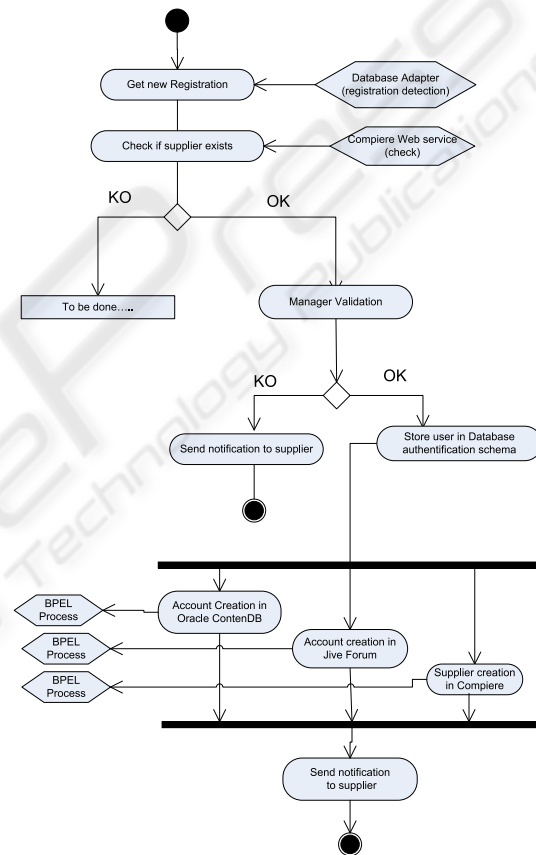**Phase 2:** update of the needed user files and final validation of the registration.

Figure 3: Registration process.

Phase 1: Figure 3 illustrates the pre-registration process. This first part of the process contains the following steps:

- An instance of the process is created when a supplier registers through the E-Business Suite registration interface. The database adapter used to detect this registration receives all the supplier data.

- The Compiere service is called to check whether the supplier is already registered.

  – If not, the supplier registration needs to be validated.

* When the registration is accepted, a record is created in the authentication base, a private space is created for the supplier in Oracle Content DB, an account is added for the Jive Forum and the supplier is recorded in the Compiere database.
* A notification is sent to the supplier. Then, he can access his space.

Phase 2: The second phase validates - or not - in a final way the supplier registration. This phase uses the Oracle Content DB functionalities. Figure 4 represents the process of this phase. This second process
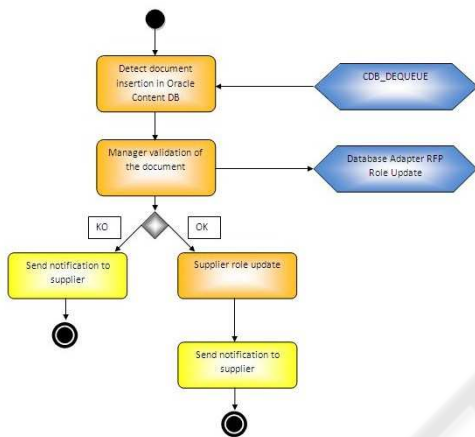

Figure 4: Validation of the registration.

is launched when a new document is uploaded by the supplier. This document is then validated to allow the update of the supplier with his final roles and access rights on the marketplace.

3.3 Authentication Management

JAZN, the Oracle implementation of JAAS (Java Authentication Authorisation Service) is used for authentication management. JAAS allows services to authenticate users and to grant them with access control permissions. Users should authenticate before having access to the application's pages. Access to the page is given if the user correctly authenticates and only if his role gives him the sufficient permission.

Access to the application is based on five roles:

USER: all the users identified by the application.

SUPPLIER: the suppliers that register on the application. They get this role at the end of the first phase. It allows access to the private supplier space.

BUYER: the simple buyers of the company.

MANAGER: the managers of the company.

RFP: the users that have access to the marketplace. All the managers and buyers have this role. The suppliers get this role at the end of the second phase.

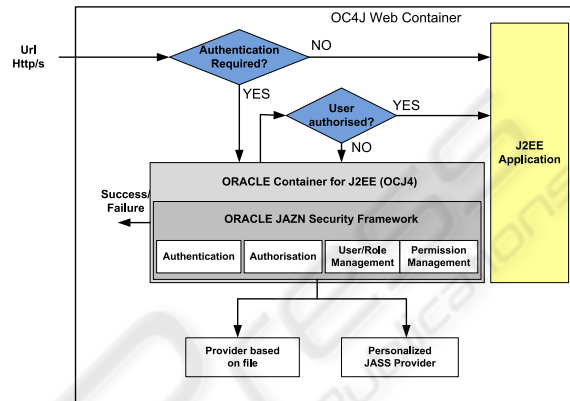Figure 5 presents the user authentication procedure for the application's pages.

Figure 5: Authentication architecture.

3.4 Creation of the User Interface

The application is divided in 2 main pages:

* The buyer space (for buyers or managers): from this page, the user can view the tasks he has to do an action on. The "Show tasks" button on this page lets the buyer or manager see the details of his tasks. This gives him access to the task application available with BPEL PM. This application allows him to accept or reject the registrations of suppliers.

* The supplier space: from this page, the supplier can consult his file directory and access the ContentDB interface to add documents.

figure 6 is a screenshot of the manager space for user *jstein*.

Figure 6: Manager space.

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4 EXPERIMENTAL FEEDBACK

This project is a typical SOA project because of its constraints both in terms of software and hardware. The software constraints were explicitly expressed: for example, the integration of the open source Compiere ERP and of the Oracle ERP E-Business Suite. The reason for this choice was to illustrate the integration of heterogeneous legacy applications in the information system. The hardware constraint was implied by what was available to implement the marketplace.

The second aspect that appeared difficult was the establishment of the project planning. The hardware constraints - the dates of delivery of the computers and virtual machines - forced us to reorganize the activities and to modify the priorities on the project. To do this, three priority levels were defined:

- Level 1 - high priority: the modules that had to be implemented.

- Level 2 - medium priority: the modules that seemed required at first but that were not needed for the marketplace to be operational.

- Level 3 - low priority: modules that were not required but that could be interesting to be integrated.

5 CONCLUSIONS

With the rapid development of Internet technology nowadays, B2B e-commerce and collaborative e-marketplace become quickly growing preoccupations. Enterprises that solely rely on their own business information system, are unable to meet the rapidly changing business needs, resulting from corporate merger acquisitions and hard competition. Enterprises must be able to quickly adapt to constantly changing market needs by providing efficient solutions for information systems integration. This allows for suppliers and partners to collaborate through the network with greater efficiency. In order to ensure flexible operations, companies tend to build their IT systems in accordance with the SOA paradigm and take advantage of the Web and Semantic Web technologies. SOA, including the protocols and standards, thus defines a new distributed scheme on the Web. The goal of SOA is to provide a common technology layer, which is independent from languages and platforms. The applications of different platforms need this technology layer to connect and integrate with each other. SOA seems to be the right technical infrastructure to design future collaborative marketplace. In this paper we have discussed, on a practical example, how SOA can be used to support a collaborative e-marketplace composed of a mainly Oracle based software architecture, but also integrating an open source ERP. Our architecture and approach is of course not specific to Oracle systems and ERPs, but can easily be adapted to other very different environments and software systems.

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