# A SURVEY ON THE INTEGRATION OF ENTERPRISE APPLICATIONS AS A SERVICE

Hristina Daskalova, Vladislava Grigorova

*Abstract: The present paper discusses the process of multi-lateral integration of the business applications, which requires the construction of a common infra-structure, acquires the format of a service and leads to release of the individual construction of a private infra-structure by every participant in the process.*

*Keywords: Web services, BPEL, Enterprise Applications Integration.*

*ACM Classification Keywords: H.3.4 Systems and Software: Information networks*

## Introduction

The concept of Web-services application has appeared after the failure to find another successful mechanism for interaction in the enormous variety of information systems and due to business requirements as well. The modern commercial enterprises use book-keeping, financial, production, store and other information systems. The large enterprises possess multi-functional information systems and also providers, customers and partners with their specific information systems, which necessitate interaction. That is why the area of Enterprise Applications Integration (EAI) attracts the research attempts and the Web-services are expected to prove as the most efficient instrument for Web-services solution.

## Decomposition of the Business Processes

The efficient organization of the information systems interaction is preceded by evaluation of the necessary business processes realizing the business functions of a given organization. For this purpose the functional blocks of the business processes are decomposed in order to obtain a loop of business processes – from the loop of the business processes up to obtaining the separate business process, and from the independent business processes up to their comprising functions. The business function gives a certain measurable result, it is the essence, defining the process and hence this function may be identified with the service. It could be considered as a resource realizing the business function and having the following features:

- it enables a repeated use,
- it is determined by one or more technologically independent interfaces,
- it is weakly connected with other similar resources and may be requested by protocols providing the possibility for resources interaction.

In this way, from a functional view point, the business applications are decomposed to a set of interacting services. This set of interacting services, subordinate to certain common rules, interfaces and mechanisms of interaction, is the basis of the Service-Oriented Architecture (SOA).

The representative level and the level of data bases in such architecture are traditional and use the level of portals, different user's interfaces and relational data bases. The level of business logic realizes the systems and the working flows within the frames of the business processes. For this purpose, objects of different types have been introduced [Fagin, 2005]: entity objects, which derive the functions from the information at the level of business logic, realize the selection and modification of the data without details about their physical storing; activity objects which support the transactions, ensure the interactive operation of the users with the system, the access being done by an API; service objects accomplishing the service-oriented architectural principles, providing functionality and data as services for other applications. The objects from the level of the business logic guarantee the integration of the business components from a high level. The activity objects realize the customer's access to the system functional modules by standard interfaces of different types. The service objects

supply a new type of communication for the business modules on XML basis and provide the interaction of these components with the base communication services.

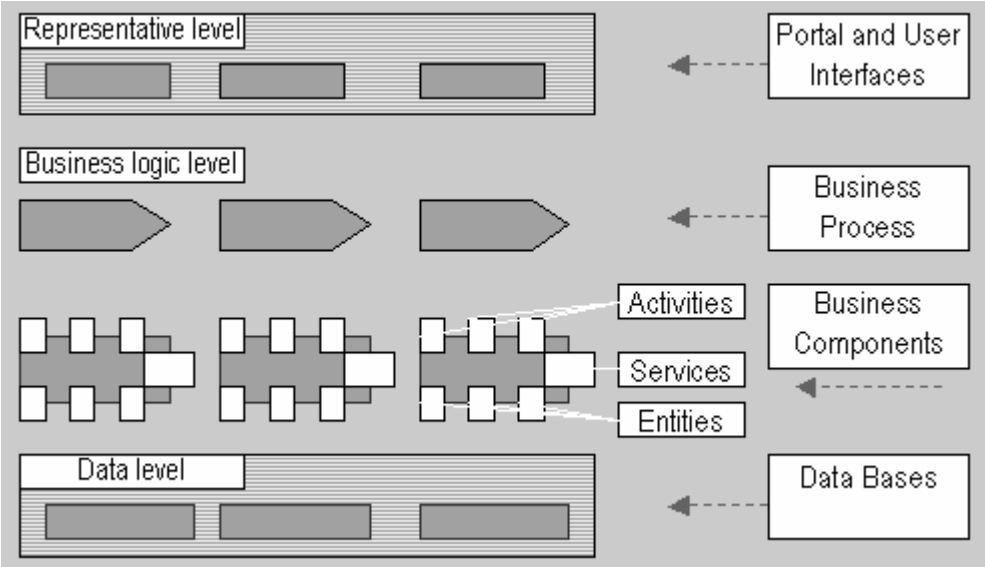


Fig. 1

## Web services and Business Process Execution Language for Web services

The Web services are based on documents exchange, on appropriately designed interface interactions and on continuous expansion of the Simple Object Access Protocol (SOAP) [Curbera, 2002] [SOAP, 2003]. The Message Exchange Patterns (MEP) of SOAP protocol suppose single-directional messages transfer, as well as a "question-answer" mode, but it does not ensure sufficient semantics for control of the interaction at an infra-structure level. Some organizations like OASIS, W3C and WS-I work for improvement of the applications controlled by the events. This is aided by the opportunity to expand SOAP protocol which is assured by its composition properties. The SOAP messages can be accompanied by appropriate electronic instructions controlling the messages acquisition and processing (for example a channel and a specific quality of the message transfer may be selected, etc). Thanks to this mechanism some specifications such as WS-Addressing, WS-Eventing, WS-Notification, WS-ReliableMessaging and WS-Security [WS-Security, 2003] together with WSDL 2.0 [WSDL, 2004] [Curbera, 2002] guarantee the realization of the functionality of modern tools at the intermediate layer, oriented towards messages.

The application of the Business Process Execution Language (BPEL) [BPEL, 2003] is a natural way to realize the service-oriented options when executing the business processes. It gives the possibility to represent an abstract model of the business process with the help of information flows connecting the system and the algorithm corresponding to this model. The algorithm may be presented as an executable Web-service with an interface depicted by WSDL language. The request for the service operation, realized with the help of BPEL causes a sequence of steps which are executed by BPEL container in compliance with the formal description of the process logic. Such steps are the synchronous and asynchronous calls of other services; in this way the process subject interacts with the external systems, combining them in one flow according to the rules of the routine and of messages conversion. BPEL enlarges the area of processes models application from the analysis up to the realization phase.

At the same time the use of such executable models implies some new questions, like:

- which aspects can be described by BPEL, and which – by WSDL and what is the difference between the process models and the traditional program models;

- in what way such elements like non-functional requirements and characteristics of the services quality could be accounted by the models;
- how to evaluate the quality of the executable process models and what tools to apply for this purpose;
- what is the role of the business flows, how the processing modeling could be synchronized with the modeling of the use cases at the design phase, etc.

The classic demonstration of BPEL possibilities can be seen in tourist services, for example in reservation of air plane tickets, accommodation booking and their payment. Certain problems appear when setting the optimizing constraints, such as total cost of the trip. This constraint depends on the price of the flight tickets and the price of the hotel rooms, which usually vary. Besides, the tickets may be sold and the hotel rooms – already booked. Only after the determination of the optimal dates and accomplishment of successful reservations, the process is paid by a credit card; otherwise there is no reservation and an error is signaled.

Local memory, branches, cycles and exclusions processing enable the automation of the process with the help of BPEL. It is also important to provide such infra-structure that guarantees integration of new services (new air lines, new hotel chains), modification of the parameters of the already used, removal of some services from the process consideration, not altering its structure. The provider of tourist services should not react independently to every alteration accomplished by the contra-agent side.

The Universal Description Discovery and Integration standard (UDDI) [UDDI, 2003] is suitable for support of the partners' self service. It is a universal method for description, discovery and integration of the Web-services in B2B systems for e-commerce.

UDDI business register is a data base for common use, in which the interested organizations register themselves (by corresponding operators' nodes) and enter information concerning their business. On the basis of UDDI standard, the description of complex business processes is possible after decomposition to their components. At that the information exchange is increased due to the easier perception of standardized information. UDDI does not provide the service, but creates the technical possibility to search for the necessary services until the technologies of the desired partners are defined, to look for compatibility interfaces, to provide standardized formats for program search of business and services.

UDDI is a manual of the available Web-services, including the types of business, names, post addresses, persons for contacts, phone and fax numbers, email addresses, URL of the Web-services offered, meta-data describing the interfaces towards existing Web-services and others. This speeds up the search for appropriate partners in Internet; assures optimal way for interaction and possibility to organize shared access to the information by a global business register.

Using this approach, the tourist operator, who keeps business relations with the air lines and hotel chains, gives them the right to autonomously publish their services and to control them in his partners' register-catalogue. The client of these services is the reservation process. When operating the requests, the process is connected to the catalogue in order to find the accessible services, after that it operates in conformance with the business logic. Using the options of the catalogue, that classifies the services and their providers, the process may be improved, avoiding consideration of services not connected with the request considered. Thus the number of flights and hotels combinations to be processed, could be diminished.

The catalogue provides also one and the same interface for the services. It must contain a description of the meta-data associated with the services, including the specification of their interfaces described by WSDL. Every booking service may be referred to a given group. During the reservation process only the services corresponding to this type, will be discovered and considered. Different autonomous business applications are combined in this example of tourist services. Inside the companies the services are also integrated in order to realize the functions needed for external interactions. The direct interaction with the partners and customers is prepared by the integration of the internal business processes of the enterprises.

## Conclusion

Some integration service providers already possess a built-in logic for events control in their own infra-structure, accessible through Internet. The optimal solution of the problem for multi-lateral integration will require the construction of a common infra-structure. The users themselves could control the logic of interaction with the partners using BPEL realization. One of the best fulfilled realizations of BPEL is known as the product Oracle BPEL Process Manager. It has got a strategic position in the service-oriented investigations of the company and is presented within the composition of Oracle Application Server 10g (tools for processes execution) and JDeveloper (tools for processes design). In this way BPEL is the linking element among the variety of Oracle Applications products [Oracle, 2004].

In its essence the integration process of an infinite number of terminals acquires the format of a service, supplied on a request, and this releases the participants in the process from the necessity to develop their own infra-structure. A still more intensive advance of the companies specializing in the area of integration technologies is expected in the future.

## Acknowledgement

This work is carried out under EU Project INFRAWEBS - IST FP62003/IST/2.3.2.3 Research Project No. 511723.

## Bibliography

[BPEL, 2003] Business Process Execution Language for Web Services Version 1.1 http://www-106.ibm.com/developerworks/library/ws-bpel/

[BPML, 2002] BPML working draft March 25, 2002. http://www.bpmi.org/, http://xml.coverpages.org/bpml.html

[Curbera, 2002] F. Curbera, M. Duftler, R. Khalaf, W. Nagy, N. Mukhi, and S. Weerawarana. Unraveling the web services web: An introduction to SOAP, WSDL, UDDI. IEEE Internet Computing, 6(2):86-93, March-April 2002.

[Fagin, 2005] D. Fagin. Architectures and tools for applications integration. Open systems. # 02/2005. (In Russian).

[Oracle, 2004] Oracle BPEL Process Manager. http://www.oracle.com/technology/products/ias/bpel/index.html

[Shapiro, 2005] R. Shapiro. A Comparison of XPDL, BPML and BPEL4WS. http://xml.coverpages.org/Shapiro-XPDL.pdf

[SOAP, 2003] SOAP Version 1.2 Part 1: Messaging Framework. http://www.w3.org/TR/2003/REC-soap12-part1-20030624/

[UDDI, 2003] UDDI Version 3.0. http://uddi.org/pubs/uddi-v3.00-published-20020719.htm

[WSDL, 2004] Web Services Description Language (WSDL) Version 2.0 Part 1: Core Language. http://www.w3.org/TR/2004/WD-wsdl20-20040326/ Author information

[WSFL, 2003] Web Services Flow Language. http://www-3.ibm.com/software/solutions/Webservices/pdf/WSFL.pdf http://xml.coverpages.org/wsfl.html, http://www.ebpml.org/wsfl.htm

[WS-Security, 2003] Web Services Security (WS-Security). http://www-106.ibm.com/developerworks/Webservices/library/ws-secure/

[WS-Transaction, 2003] Web Services Transaction (WS-Transaction). http://www-106.ibm.com/developerworks/Webservices/library/ws-transpec/

## Authors' Information

Hristina Daskalova – Institute of Information Technologies; BAS, Acad. G. Bontchev St., block 2, Sofia-1113, Bulgaria; e-mail: daskalovahg@abv.bg

Vladislava Grigorova – Institute of Information Technologies; BAS, Acad. G. Bontchev St., block 2, Sofia-1113, Bulgaria; e-mail: v.grigorova@abv.bg