

# From Business Services to Web Services: an MDA Approach

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**Abstract.** At present, enterprises need sophisticated software applications to sell and promote their products or services in order to maintain their leadership in the business world. One of the most promising trends is the Web services technology as the appropriate mechanism to implement e-business, which uses Internet to replicate services offered by an enterprise. However, despite the clear advantages of Web services, there are problems in determining the initial functionalities required by them. Currently, Web services functionalities are not obtained in a systematic manner from the organizational environment. Therefore, it is complicated to ensure that Web services fit the business user's needs. In this paper we face this problem by defining a methodological approach to generate Web services from organizational descriptions. The Model-Driven Architecture has been used in this work in order to ensure the systematic translation of modeling primitives of the organizational model into their corresponding WSDL services descriptions.

**Keywords:** business service, Web service, Model-Driven Architecture.

## 1 Introduction

Internet has become an essential tool in current enterprises' activities [1], where it has been used as a successful strategy to guarantee their competitiveness in order to maintain their leadership. In this context, e-business has been implemented as a mechanism that allows the enterprises to offer their products and services remotely, so they can expand their scope previously limited by the location. E-business approach focuses on determining the processes needed by a company to offer their services through the Web. In this context, the Web services are a key technology for an effective operation of e-business systems.

Web services are very useful in the enterprise context because they allow interoperability between software applications. The Web services can afford the evolution of processes that use the same data while merely changing the implementation. This flexibility feature allows diversity in "how" something is done.

However, not all problems involved in developing Web services have been properly solved. One of the main issues in defining Web services is the difficulty to determine what should be the expected functionality of such services. This problem arises from the following factors: 1) the current technology in Web service modeling focuses on defining its functionality without considering, in a systematic manner, the main needs of the organizational context; 2) the lack of reliable sources that allow the designers to implement a Web service reflecting the business tasks as well as the user's requirements; 3) the need of some mechanisms to establish the correspondence between the business functionalities and those which have been implemented in Web services.

We consider the most important of the current difficulties to specify the correct functionality of Web services to be the following: a) business models are not properly adapted to support service-oriented specifications and the result is the incompatibility between these models and those that implement the Web services; and b) there is a lack of methodological approaches to automatically generate services from the business's features which results in this process often needing to be accomplished manually. Therefore, we can conclude that Web services require the establishment of a good specification of the processes that are involved in the enterprise context.

In this research work, a methodological approach is proposed to generate WSDL (Web Services Description Language) descriptions, which are obtained from service-oriented business models. The source model [3] is at a high level and deploys the services offered by an enterprise to customers. It is important to point out that service-oriented approach has been developed over the *i\** Framework by adding new rules and properties to get an organizational vision of services. This is the reason why its notation uses the concept of dependency to indicate that a service helps to satisfy the goals of a user. Also the more detailed view of services is represented using an extension of *i\** primitives.

As a contribution, this work established an approach of generation of services where the business model is correctly adapted to the service technology, and the Web services are obtained in a systematic way using the MDA (Model Driven Architecture) approach [6].

## **2 Objectives of the research**

The main objective of this work is to obtain the WSDL specifications of Web services from service-oriented organizational models [3]. It is important to point out that several research works exist which discuss the creation of Web services from organizational models [4] [5] [8], however, the research work presented in this paper represents the first approach that proposes the use of the MDA standards to translate service-oriented business models into Web Service descriptions. It is also important to comment that in most of the related works [4] [5] [8] [9] we found the following issues: 1) the Web service modeling is not considered within the organizational environment; 2) some of them have not applied the MDA approach; or 3) the works have not carried out a generation of the WSDL specification.

The proposed methodological approach consists of three phases which are summarized below and depicted in Figure 1:

- a) The MDA approach imposes a restriction to transform models; it consists in achieving the transformation using models based on MOF (Meta-Object Facility) specifications [7], and using well-defined models to ensure a systematic generation when applying the transformation rules from a PIM (Platform Independent Model) source model to a PSM (Platform Specific Model) destination model. In this phase we have defined a metamodel for the business service model proposed in [3], the MOF-Ecore specifications were applied in order to create this metamodel.
- b) Once the metamodel was defined, the standard of the Object Management Group (OMG), MOFScript, is used to establish the transformation rules M2T (Model to Text), to allow the definition of transformations between a business environment and the implementation of Web services.
- c) Finally a software tool, called MOS Tool, uses the rules in MOFScript to generate the WSDL documents (PSM). First, the business service model (PIM) is created and used as a guide for designing the Web services functionalities. The service model is designed with the structure of business service metamodel (a), and then the rules (b) are applied to create the WSDL documents.

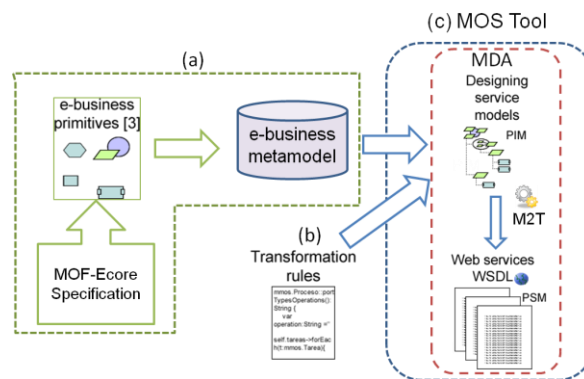


Fig. 1. Overview of the proposed approach

### 3 Scientific contributions

**A service-oriented metamodel:** One of the main contributions was the creation of an e-business metamodel (see Fig.1) which was obtained by applying the MOF-Ecore specifications [2] on the primitives of the service-oriented business model [3]. Table 1 shows the relationship among the modeling primitives, their attributes and the attributes description. It was not simple to establish the same level of correspondence between Web service and the service element of the business service model, due to the high level of abstraction in the business model. To match the Web service with the business elements, we analyzed the similar functionalities of them, and we found that a Web service corresponds to the process element; it represents correctly the Web

service while the service element represents the orchestration. The metamodel, called MOS Ecore, being based on MOF, ensures the compatibility required to be stored in MOF repositories and handled through the MOF tools. Using the model, the Web services are created inside the organizational context, and \*.mos files are generated.

**Table 1.** Description of e-business primitives.

Business Service models [3]	e-business primitives	Attributes	Attribute description
Global model, composite service model	Aggregated service	Execution order	Participation order in business model
		Description	Details of the Service's offered
	Basic service	Execution order	Participation order in orchestration
		Description	Service's details offered
Process model	Process	Transaction	Indicates if it will be deployed as a Web service
		Execution order	Participation order in orchestration
		Description	Process's details about what is done
Protocol model	Task	Transaction	Indicates if it will be deployed as an operation
		Execution order	Participation order in orchestration
		Type	Resource's type generated
		Description	Task's details about the atom activity
	Resource	Type	Resource's type to be used by a task
		Description	Resource's details about how is used by a task

**Business models to Web services transformation rules:** Another contribution is the definition of the transformation rules in MOFScript which are necessary in order to obtain the mapping from a MOS model to the WSDL description of Web. The rules take the \*.mos files as input models to generate WSDL specifications as output.

**Service modeling tool.** MOS tool was developed using NetBeans IDE 6.5 as a mechanism to validate the proposed approach. It has the following features: 1) it allows for creating and opening service models; 2) it serializes the MOS model to XML; 3) it stores the models as files with extension \*.mos and; 4) it executes Eclipse V3.3.2 to apply the transformation rules using the MOFScript plug-in. Once the WSDL document is created, it just needs to be checked in well-formed XML syntax.

The only property that needs to be changed is the address where the implementation is located.

## **4 Conclusions**

In this paper, a methodological approach is proposed to generate Web services from a business service model. We propose that by using a service-oriented model at an organizational level, it is possible to facilitate the work of defining Web services under a methodological approach such as MDA.

## **5 Ongoing an future work**

In future work, we will be dealing with the generation of complete functionality of the Web service. We are currently working on methods to use the organizational descriptions (business service models) to generate precisely the choreography and orchestration of services, using the BPEL language. Another proposal for future work is the extension of the MOS Ecore metamodel to integrate all the modeling stages proposed by the business service architecture [3].

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