Representing Service-Oriented Architectural Models Using π-ADL

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Abstract. Despite the well-known advantages of applying the MDA proposal to SOA developments, there are still some gaps that need to be filled. At PIM-level, for example, there is no possibility of having an executable version of the system as it solely comprises technologically independent models. In order to solve this we propose to formalize the architectural model at this level with π-ADL, an ADL supporting the description of dynamic and evolvable architectures like SOA itself is. Since π-ADL allows the definition of executable versions of the architecture, the specification written embodies a prototype of the system at the PIM-level. We illustrate this by describing a real case study based on the SMPP standard for sending SMS messages.

Keywords: Service-Oriented Architecture, Model-Driven Architecture, PIM-level modelling, π-ADL.

1 Introduction

Service orientation has emerged as a leading technological trend due to its advantages for cross-organization integration, flexibility and scalability. As the Service-Oriented Computing (SOC) paradigm [2] is largely established as the de-facto solution for emerging information society challenges, many Software Engineering areas are taking advantage of services, ranging from the field of Software Architecture to the definition of software development processes [3].

Taking a deeper look at the methodological field we found strategies that benefit from and contribute to the SOC paradigm. The model-driven approach and the Model-Driven Architecture (MDA) proposal in particular [8], are amongst the best examples [1]. However, and despite the well-known advantages of MDA, this approach lacks in the ability to define early executable versions of the system. Taking into account the separation in abstraction levels stated by that proposal, it is not until

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the lower level (PSM) when the characteristics of a specific technology are reflected in the developed models and therefore when it is possible to get a working prototype. In this paper we study that problem applied to SOA development, focusing on a possible solution by means of using an executable Architecture Description Language (ADL) for the definition of the system architecture. This study is accomplished within a MDA-based methodological framework called MIDAS [2].

In previous work [4] we defined the architectural metamodel at the PIM level supporting all the principles of SOA. Providing the role of the architecture in MIDAS [6] and the necessity of an early executable version of the system, we have found that using an ADL is the best option for achieving that goal. We have chosen π-ADL [9] for the representation of the service architecture. π-ADL is suitable for that purpose mainly because, first, it allows the representation of the features and constraints of services reasonably and consistently and, second, it allows the representation of dynamic architectures such as SOA.

The structure of the paper is as follows: Section 2 gives an overall view of the three main concepts considered in this paper: π-ADL, MDA and SOA. Section 3 presents a case study used to illustrate the benefits of using π-ADL for describing SOA when architectural models. Finally, Section 4 discusses the main contributions of this article and some of the future works.

2 Previous Concepts

In this section we present the foundations of MDA and the MIDAS methodological framework, in which the architectural model is framed and used; SOA and the concepts involved in the definition of the architectural model; and π-ADL for the formalization of dynamic service architectures.

2.1 MDA and the MIDAS Methodological Framework

The main contribution of this article (i.e. to achieve an executable representation of the PIM-level system architecture using π-ADL) is part of a much broader research effort: the refinement of MIDAS [2], a complete development framework based on the MDA principles.

MIDAS follows an ACMDA (Architecture-Centric Model-Driven Architecture) approach [6]: it defines a method for the development of information systems based on models and guided by the architecture. The architecture is considered to be the driving aspect of the development process as it allows specifying which models, elements inside models or relationships within models should be created during the entire software development process.

With an architectural view of the system at PIM level, we ensure that there are no technology or implementation constraints in the model. Moreover, it facilitates the establishment of different PSM-level models according to the specific target platform from a unique PIM model. However, as stated in the introduction, this has as main drawback the impossibility of having a precise executable version of the system.