Chapter 10

A Unified Deployment and Management Model for Dynamic and Distributed Software Architectures

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ABSTRACT

Dynamic deployment of software components and services constitutes a solution for enhancing the addictiveness of distributed software systems. Such a property is necessary for the evolutionary systems that need to adapt their behaviour according to the changes in their application-level requirements or context situations. Therefore, this chapter looks for a modelling solution that can react in response to unpredictable changes in the communication and/or execution resources.

This chapter provides a generic model called Unified deployment and management Model of Dynamic and Distributed software architectures (UMoDD) based on the D&C standard proposed by the OMG. UMoDD has been designed to be suitable to dynamic deployment and management for both architecture styles: the service-oriented and component-based architecture style. The proposed model is based on a model-driven approach. It offers two levels of modelling: a generic level and a specific level to an architecture style.

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INTRODUCTION

Pervasive applications are generally composed of software entities that need to be deployed in various contexts which cannot be known in advance. For instance, a crisis management system includes software entities that need to be deployed in service-oriented or component-based architectures.

Modelling such applications needs to handle both architecture styles: the service-oriented and component-based architecture style. Several research and development works including Janssens, Joosen, and Verbaeten (2005), Janssens, Truyen, Sanen, and Joosen (2007), Keeney and Cahill (2003), Raverdy, Le, Gong, and Lea (1998), and Satoh (2005) propose such generic modelling. Most of these models are based techniques like aspect-oriented programming and reflective techniques. Such modelling still limited to the underlying technique specificities. They do not support a high level modelling that enables dealing with unpredictable changes in the architecture context. Moreover, they do not support recent deployment and management standard including WSDM (Web Services Distributed Management) for Web Services (WS) (Bullard, Murray, & Wilson, 2006) and service-oriented architecture management, or the D&C (Deployment & Configuration) standard proposed by the OMG (OMG, 2006).

In order to ensure a standard based and a high level of abstraction modelling, we should establish a generic model that unifies the two architectural styles and drops research works weaknesses. Deploying and managing distributed architectures may also take benefit from the model-driven methodologies in order to master the complexity of deploying generic and reusable addictiveness properties.

The main purpose of this paper is to provide a modelling solution for the deployment and management of distributed architecture based on the D&C standard. This solution is particularly beneficial for heterogeneous architectures that need to be dynamically adapted against unpredictable contexts changes, in order to meet non-functional requirements.

For that, we extend the D&C standard and we propose the UMoDD model (Unified deployment and management Model of Dynamic and Distributed software architectures) that provides, on the one hand, a platform-independent description. On the other hand, it provides the necessary generic description applicable for the deployment and the management of the two main software architecture styles: the Component-Based Architecture style (CBA) and the Service-Oriented Architecture style (SOA). In a more global view of the automated management and provisioning process supported by our approach, we consider also refining the generic model to obtain a specific model for each of the architecture styles: CBA and SOA. Moreover, we maintain the conformance with the notations of the most recent standards including SOARM (OASIS, 2006), SDD (OASIS, 2007) and WSDM (Bullard, Murray, & Wilson, 2006).

The paper is organized as follows. Section 2 presents an overview of a research related to the architecture deployment and its management. In order to introduce the major concepts of the D&C standard, we propose, in section 3, the basic principal of this standard. Section 4 introduces the proposed model. It stresses our approach vision and the various proposed parts. To illustrate the proposed model, section 5 describe crisis management case study. Section 6 presents our generic model called GeMoDE (Generic Model for Deployed Entity). While section 7 depicts the specific architecture style models: CBA and SOA based on a refinement process from the GeMoDE models. Section 8 presents a summary evaluation of our solution compared with some near research contributions. In Section 9 we conclude the paper and we point to future work.