A UML Based Deployment and Management Modeling for Cooperative and Distributed Applications

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Abstract. Thanks to the major evolutions in the communication technologies and in order to deal with a continuous increase in systems complexity, current applications have to cooperate to achieve a common goal. Modeling such cooperatives applications should stress regular context evolutions and increasingly users requirements. Therefore, we look for a model based solution suitable to cooperative application that can react in response to several unpredictable changes. Driven by the cooperative application structure, we propose, in this paper, an UML extension named “DM profile” ensuring a high-level description for modeling the deployment and its management in distributed application. The proposed contribution is validated through a “Follow Me” case study and implemented through an Eclipse plug-in.

1 Introduction

Current distributed systems are continuously increasing in size and especially in complexity. Cooperating several software entities, to achieve a common goal, is a key to cope with such complexity. These cooperative applications have to adapt their deployed architectures due to several purposes: improving performance, evolutionary user requirements, context changes, etc.

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A successful adaptation is based on providing architecture deployment models that can be dynamically managed to meet such required purposes. This deployment and management modeling should be, in addition, suitable to the distributed and cooperative features of the application. However, modeling the architecture deployment and its management is often closely coupled to the underlying supported platform. Such a description especially targets the modeling of real deployment units such as artifacts, communication links, and computing units. This requires knowing the context and the underlying deployment platforms before starting the deployment process. For the actual systems where adaptively properties are usually unpredictable, such a deployment and its management modeling remains inappropriate. User requests and the application context are continuously evolving. In addition, the availability of deployment structures such as deployment platform and communication flows are not always guaranteed.

The challenge is to design high-level deployment and management solution that can easily handles diverse deployment infrastructures. This modeling should provide not only platform-independent models, but also a modeling abstraction that handles various architecture deployment approaches applicable for the service-oriented and the component-based architectures. This deployment and management modeling should ensure a best effort adaptation while taking advantage of all available resources whatever their architecture development approach or their underlying platform are. Moreover, such modeling should take advantage of the structured organization of the cooperative application.

Basing on the UML standard language, several works propose extensions to handle software architecture deployment such as [9], [12], [8], and [22]. These works follows a structural management reconfiguration on behalf of a deployment management modeling. Other works focus on a high-level modeling that describes the deployment management such as [10], [13], and [17].

The contribution made by this paper merges both: the modeling power of the UML language specification and a high-level modeling. It proposes an UML profile extension providing an abstract model that describes the deployment and its management of distributed software architectures while taking into consideration cooperative architectures specificities. This modeling ensures a best effort solution for the management of an architecture deployment to meet their adaptiveness requirements.

The rest of this paper is organized as follows: Section 2 discusses the related work. In section 3, we present our UML extension profile. Then, in Section 4, we illustrate our extension by a case study Follow Me. Section 5 presents the realization of our profile as a plug-in for eclipse. Finally, section 6 concludes this paper and presents future work directions.

2 Related Work

Many works dynamically manage their software architecture in response to the context evolution requirement. Various management techniques are used. We