Semantic Model Driven Architecture Based Method for Enterprise Application Development

Minghui Wu\textsuperscript{1,2}, Jing Ying\textsuperscript{1,2}, and Hui Yan\textsuperscript{2}

\textsuperscript{1}College of Computer Science, Zhejiang University, Hangzhou, P.R. China
\{minghuiwu, yingj\}@cs.zju.edu.cn
\textsuperscript{2}Dept. of Computer, Zhejiang University City College, Hangzhou, P.R. China
yanh@zucc.edu.cn

Abstract. Enterprise applications have the requirements of meeting dynamic businesses processes and adopting lasted technologies flexibly, with to solve the problems caused by the nature of heterogeneous characteristic. Service-Oriented Architecture (SOA) is becoming a leading paradigm for business process integration. This research work focuses on business process modeling, proposes a semantic model-driven development method named SMDA combined with the Ontology and Model-Driven Architecture (MDA) technologies. The architecture of SMDA is presented in three orthogonal perspectives. (1) Vertical axis is the MDA 4 layers, the focus is UML profiles in M2 (meta-model layer) for ontology modeling, and three abstract levels: CIM, PIM and PSM modeling respectively. (2) Horizontal axis is different concerns involved in the development: Process, Application, Information, Organization, and Technology. (3) Traversal Axis is referred to aspects that have influence on other models of the cross-cutting axis: Architecture, Semantics, Aspect, and Pattern. The paper also introduces the modeling and transformation process in SMDA, and describes dynamic service composition supports briefly.

Keywords: Ontology, Model-Driven Architecture, Service Oriented Architecture, Enterprise Application Modeling, UML.

1 Introduction

Nowadays, as a result of continuing evolution of technologies and the market keeps changing, enterprises have to quickly adapting their business processes to the new dynamic environments continuously if they want to stay competitive. Enterprise application system development is difficult because of the nature of heterogeneous of the cooperation processes among multiple organizations. There are following obvious problems:

1. Various implement technologies

A lot of technologies, such as Web Services, CORBA, DCOM, .Net, J2EE, etc., have been developed and are actively used as service enabling technologies. The vast diversity of implementation increases the complexity of development process of service-based systems. Each of these technologies has its own advantages and disadvantages, and different organizations may choose different technologies.
(2) Common understanding
A variety of terms are often used in cooperative enterprise processes. People involved in developing application systems do not often agree on the terms used between two different organizations. Furthermore, even in a single organization, when the same terms are used, the meanings associated with them may differ, i.e. the semantics may be different.

(3) Automated discovery and integration services
There have large numbers of business services and the number is keeping increasing quickly. How to discovery and integrate necessary functions automated is a key issues in enterprise application development.

(4) Business processes verification
Only when the process can be verified formally, the integration process can be automatically.

Due to the problems mentioned above, the development of collaborative enterprise application systems is more difficult. So, corresponding actions should be taken to tackle these problems. Consequently, new methodologies and implementation techniques should be applied. To achieve this, we present a Semantic Model-Driven Architecture (SMDA) method for enterprise application system development with support of Service-Oriented Architecture (SOA). The SMDA method combines the advantages of three main-trend technologies, supports whole lifecycle of enterprise application development.

The remainder of this paper is organized as follows. Section 2 introduces the technological spaces of SMDA and Section 3 describes the architecture of SMDA. Section 4 presents main features of SMDA modeling process and related works are reviewed in Section 5. Finally, Section 6 concludes the research.

2 Technological Spaces of SMDA

2.1 Service-Oriented Architecture

SOA systems play an important role in enabling business application integration across organizations, since most enterprises are involved in cooperation processes and are also technology dependent. SOA is defined as “a set of components which can be invoked, and whose interface descriptions can be published and discovered” in [1]. In SOA, it is advocated that developers create distributed software systems whose functionality is provided by services. A service is a software entity that encapsulates business logic and provides the functionality to others through well-defined and published interfaces [2], and it is the units of modeling, design and implementation.

SOA provides a great level of flexibility and higher level of abstraction in the following ways [3, 4]:

- Services are network-enabled components with well-defined interfaces that are implementation-independent.
- Such services are consumed by message exchange and clients that are not concerned with how these services will execute their requests.
- Services are self-contained to offer functionality as defined in interfaces.
- Services are loosely coupled, and thus more independent.
- Services can be dynamically discovered.