Model Driven Development of Ontology Based Multi-Agent Systems

The Scientific and Technological Research Council of Turkey (TUBITAK) Academic Research Funding Program Directorate (ARDEB) Electrical, Electronics and Informatics Research Grant Committee (EEEAG) funded research project (TUBITAK ARDEB Grant no: 108E141)

TÜBİTAK

Abstract

Software agents are considered as autonomous software components which are capable of acting on behalf of their human users in order to perform a group of defined tasks. On the other hand, systems, which are composed of several intelligent agents which cooperate with each other to solve problems that they cannot solve on their own, are called Multi-Agent System (MAS).

The information sharing problem is common both for MASs which work on the Internet in a distributed structure and the Semantic Web research area. Semantic Web evolution brought a new vision into agent research. This new generation Web aims to improve World Wide Web (WWW) such that web page contents are interpreted with ontologies. Within this context, ontology language standards have been developed and are being used intensively for knowledge modeling. The usage of ontologies for the information sharing between the agents provided new perspectives to MAS research. Development of MASs should inevitably be based on open information models (ontologies) to support capability of agents working on the Semantic Web.

At present, increasing complexities in software requirements are motivating software engineering researchers to develop new software development methodologies, techniques and approaches. Model Driven Development (MDD) is such a recent approach which aims to decrease the complexity in software development by using models of different abstraction levels and therefore focuses on models instead of code. We believe that the abstraction provided by the models and the development process that is based on models provides a powerful alternative for managing the aforementioned complexity in Semantic Web enabled MAS development. Hence, in this project, a software development process for model driven development of MASs is defined and supported with appropriate development tools.

In this project, the specialized MDD process for MASs considers the ontologies as the basic components of the MAS architecture. This enables the MASs, which are developed by visual modeling, possess the Semantic Web capabilities: Software agents gather the Web contents on behalf of their users from various sources and process this information and exchange the results with each other. In addition to all of these, with the MDD process defined in this project, an infrastructure which facilitates

the development of such systems in different agent platforms, are defined and developed.

Project includes the definition of process phases and development of the required process constructs. Both MAS metamodels and model transformations between these metamodels are defined for the MDD process. In order to obtain MAS software, model to text transformations are defined and applied to the models which conform to the MAS metamodels. Hence, codes for the agent software can be automatically generated. For all of these operations, software tools with graphical user interface are developed within this project.

Start Date: October 1, 2008

End Date: October 1, 2010

Total Budget: 144.370 TL (~$90,000)

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Related Publications:

1. Afsar, B., Kardas, G., Topaloglu, N. Y. and Dikenelli, O. (2011) "*Model driven development of JADEX belief-desire-intention agents*", Turkish Informatics Foundation Journal of Computer Science and Engineering, vol. 4, pp. 9-18 (in Turkish).

2. Kardas, G., Ekinci, E. E., Afsar, B., Dikenelli, O. and Topaloglu, N. Y. (2009) "*Modeling Tools for Platform Specific Design of Multi-agent Systems*", In proceedings of the 7th German Conference on Multi-Agent System Technologies (MATES 2009), Hamburg, Germany, September 9-11, 2009, Lecture Notes in Artificial Intelligence, vol. 5774, pp. 202-207, DOI: 10.1007/978-3-642-04143-3_20.

3. Kardas, G., Ekinci, E. E., Afsar, B., Dikenelli, O. and Topaloglu, N. Y. (2009) "*Model Driven Development of Ontology based Multi-Agent Systems*", In proceedings of the 4th Turkish National Software Engineering Symposium (UYMS 2009), October 8-10, 2009, Istanbul, Turkey, pp. 125-132 (in Turkish).