

A Semiotic Perspective for Multiagent Systems Development (Extended Abstract)

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ABSTRACT

Based on a semiotic perspective, this paper proposes a first step towards combining the advantages from both AOSE methods and AI inspired agent organization (AO) models in order to propose a MAS project development cycle using an organization centered approach.

Categories and Subject Descriptors

I.2.11 [Distributed Artificial Intelligence]: Multiagent systems

General Terms

Design, Experimentation, Standardization

Keywords

Software engineering (multi-agent oriented), Social and organizational structure, Semiotic

1. INTRODUCTION

In order to structure the development and to manage the complexity associated with multiagent systems, several development methods have been proposed in the AOSE field during the last decade, such as Tropos [1] and Gaia [8]. Additionally, the AI tradition in MAS has proposed different agent organization (AO) models, as AGR [3] and MOISE+ [4].

While a great part of methods adopts an individual agent centered MAS approach, focusing on the agent's behavior, agent organization models consider the notion of *group* or *agent organization* as a leading concept, called by some authors as an organization centered approach [5]. Considering that AO models are not currently incorporated into AOSE based MAS development methods, someone who adopts an organization centered approach to build a MAS does not have tool support for using both AOSE methods and AO models together. Nevertheless, using only AOSE methods or AO models separately may cause some project drawbacks. On the one hand, MAS

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methods that offer a structured development cycle, such as Tropos, may not adopt an explicit agent organization model. On the other hand, most AO models do not provide a structured MAS development cycle in terms of phases, tasks and work products.

Situational Method Engineering [2] seems to be a promising approach to be considered for MAS development. Roughly speaking, tailoring a situational method consists on reusing portions of existing methods according to a specific project situation. In this context, we claim that a semiotic perspective [7] can be helpful for configuring MAS situational methods using both AOSE methods and AO models.

This paper proposes a first step towards combining the advantages from both AOSE methods and AI inspired AO models, namely a structured project development cycle using an organization centered approach. In order to develop such a cycle, we propose a MAS Semiotic Taxonomy that can provide a set of categories that glues together both AOSE typical aspects and AO models characteristics, allowing a better identification of different MAS development aspects related to these two approaches.

2. MAS SEMIOTIC TAXONOMY

Semiotics deals with the syntactic (structure), semantics (meaning) and pragmatics (usage) aspects of signs. Ronald Stamper [7] proposed to treat information as signs: he has extended the traditional division of Semiotics – syntactic, semantic and pragmatic – by including three new signs aspects called *social* (social dimensions), *empirics* (statistics properties) and *physical* (hardware properties).

In the same line, we claim that a semiotic perspective offers a different frame of reference for analyzing MAS development aspects. The MAS Semiotic Taxonomy aims to classify several aspects involved on AOSE project development. Using such taxonomy someone that has a MAS project to be developed can search for a good choice among the existing development approaches, such as MAS development methods and AO models.

Such a semiotic perspective allows to take into account both the MAS development aspects linked to human information related functions (such as MAS team skill and culture, MAS development usages and meanings) and the MAS information technology aspects (like notation, language and development platform). As shown in figure 1, the MAS Semiotic Taxonomy involves the

following levels: Social Level, Pragmatic Level, Semantic Level, Syntactic Level and Empirical Level.

The **Social Level** aims to identify the set of social norms related to the MAS development projects, involving the following categories: *Utilization Degree, Success Degree, Reuse Degree, Validation Degree, User Participation Degree, Iteration Type and Development Type*.

The **Pragmatic Level** allows distinguishing MAS development aspects based on their usage and intention. It is composed of the following categories: *Agent Discipline Category, Group Discipline Category, Analysis Style Category, MAS Approach Category, Fragment Source Category, MAS Nature Category and Agent Architecture Category*.

The **Semantic Level** allows distinguishing MAS development aspects based on their meaning, i. e., method fragment specific meaning into a software and process engineering meta-model as SPEM 2.0 (*Software & System Process Engineering Meta-Model Specification*) [6]. Therefore, this level is mainly composed of method engineering typical aspects: *Fragment Content Category and Fragment Process Category*.

The **Syntactic Level** allows distinguishing MAS development aspects according to their structure and format. In order to do so, this level takes into account categories related to the notation and the language used in order to structure and to express them: *Fragment Notation Category, Language Paradigm Category and Fragment Language Category*.

Finally, the **Empirical Level** allows distinguishing MAS development aspects according to their development standards and patterns, involving the following categories: *Code Generation Category and Development Platform Category*.

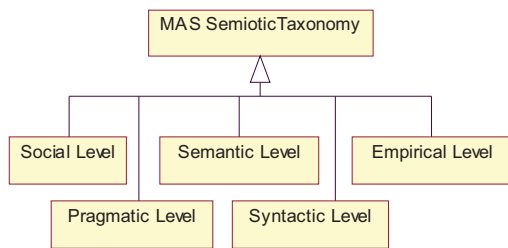


Figure 1: Five levels of MAS Semiotic Taxonomy

Using such a semiotic perspective, this taxonomy puts together concepts originated from three main sources: (i) MAS specific development aspects originated from AOSE and AO, (ii) Situational Method Engineering related concepts, mainly those proposed by Harmsen [2] and (iii) method content and method process notions provided by SPEM 2.0. The Semiotic Taxonomy can be used in two ways. First, it helps identifying MAS development aspects supported by each MAS development approach as a whole. For instance, in a pragmatic perspective, Tropos can be used to develop agent centered MAS.

Second, this taxonomy helps on classifying method fragments (method building blocks) captured from several MAS development approaches. For instance, in a pragmatic perspective, the taxonomy could be used to support the search for “portions” of MAS development approaches to build organization centered MAS or to model system requirements in terms of use cases.

3. CONCLUSIONS

The MAS Semiotic Taxonomy offers a broad collection of categories for classifying and identifying MAS development aspects from a whole method, as well as those MAS development aspects from a specific method portion. This set of categories provides a clear way of stating main characteristics of each method fragment through social, pragmatic, semantic, syntactic and empirical perspectives.

Such a semiotic perspective could facilitate putting together MAS development approaches from both AOSE and AO fields in order to take advantages from all of them to build MAS. Moreover, it offers a collection of criteria for choosing method portions among the existing MAS development approaches and AO models in order to reuse them in different project contexts.

We claim that such taxonomy can also be helpful for configuring MAS situational methods for a specific MAS project. Such an approach constitutes a structured way of reusing portions of existing AOSE methods and AO models in order to build customized MAS methods on demand.

4. ACKNOWLEDGMENTS

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