Chapter 7

A COMPARATIVE EVALUATION OF AGENT-ORIENTED METHODOLOGIES

Arnon Sturm and Onn Shehory

Abstract

Multiple agent-oriented methodologies were introduced in recent years, however no systematic evaluation of these was offered. In this work we perform a comparative evaluation of three well-known agent-oriented methodologies: Gaia, Tropos, and MaSE. To perform this evaluation we use an existing framework that focuses on four major facets of a methodology: concepts and properties, notations and modeling techniques, development process, and pragmatics. Analyzing the results of our evaluation, we recognize several facets that need further improvements within the existing agent-oriented methodologies. Our study does not attempt to state what the right methodology is. Rather, it examines existing agent-oriented methodologies.

1. Introduction

During the last decade, many methodologies for developing agent-based systems have been developed. A methodology is the set of guidelines for covering the whole lifecycle of system development both technically and managerially. A methodology, according to (Graham et al., 1997), should provide the following: a full lifecycle process; a comprehensive set of concepts and models; a full set of techniques (rules, guidelines, heuristics); a fully delineated set of deliverables; a modeling language; a set of metrics; quality assurance; coding (and other) standards; reuse advice; and guidelines for project management. The relationships between these components are shown in Figure 7.1. In that figure, we use the UML notations to depict the relationships between the components. As depicted in the figure, a methodology consists of a set of techniques, a modeling language and a lifecycle process. The set of techniques consists of metrics, quality assurance (QA) activities, a set of standards and tools. The modeling language comprises notations and a meta model. The lifecycle process consists of project management, a number of roles (e.g., an analyst or a designer), a number of procedures (e.g., how to move between
development stages), and a number of deliverables (e.g., a design document, source code). In addition, Figure 7.1 shows that the tools should be based on the meta model of the modeling technique and should represent the modeling technique's notations. The deliverables should use the modeling technique.

Figure 7.1. The components of a methodology and the relationships among them

At present, more than two dozens agent-oriented methodologies exist. The multiplicity and variety of methodologies result in the following problems: (i) industrial problem: selecting a methodology for developing an agent-based system/application becomes a non-trivial task, in particular for industrial developers which hold specific requirements and constraints; (ii) standards problem: multiple different methodologies are counter-productive for arriving at a standard. With no standard available, potential industrial adopters of agent technology refrain from using it; and (iii) research problems: excessive efforts are spent on developing agent-oriented methodologies, in times producing overlapping results. Additionally, as a result of allocating resources to multiple methodologies, no methodology is allocated sufficient research resources to enable addressing all facets and providing a full-fledged agent-based methodology.

A few evaluations of agent-oriented methodologies have been suggested. In (Yu and Cysneiros, 2002), the authors set a list of questions that a methodology should address. However, neither evaluation nor a comparison has been performed using that set. Another study (Cernuzzi and Rossi, 2002) suggests a framework for evaluating agent-oriented methodologies. That framework uses a set of evaluation criteria to examine methodologies' expressiveness, however it does not examine other properties encompassed within the methodology definition. In (Kumar, 2002), the author performs an evaluation of five agent-oriented methodologies, however, he refers only to some supported concepts such as organization design and cooperation and not to the broad set of attributes that constitute a complete methodology. In (Shehory and Sturm,