Preface

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Biographical notes: Rafael H. Bordini is a Lecturer in Computer Science at the University of Durham. His research interests are centred mainly on programming languages for multiagent systems, verification of multiagent systems through model checking, and applications of multiagent systems to social simulation. He received a PhD in Computer Science from the University of London (University College London) in 1999. Before moving to Durham in 2004, he was a Research Fellow at the Department of Computer Science, University of Liverpool. Previous to moving to Liverpool (in 2002), he was invited lecturer at the Federal University of Rio Grande do Sul, Brazil.

Mehdi Dastani is working in the area of multiagent systems, multiagent programming, and multiagent logics for the last ten years and has published many papers on these subjects. He has been involved in the design, development, and extensions of agent logics and agent programming languages such as BOID, 3APL and 2APL. The programming languages are based on the BDI logics and provide programming constructs to implement BDI-concepts directly. He is one of the organisers of ProMAS, Agent Contest, the chair the

EUMAS'07, BNAIC'07, LADS'07, and EASSS. He has been (senior) PC member of various international conferences and workshops such as AAMAS, JELIA, CLIMA, MATES and DALT.

Jürgen Dix is a Full Professor (Chair for Computational Intelligence and Theory) and Head of the Department of Informatics at Clausthal University of Technology since 2004. Before that he held positions at the University of Manchester, University of Maryland at College Park and University of Koblenz. Among the key achievements of his work in the past years are the foundations of logic-based heterogenous agent systems and contributions to computational logic (deductive databases). Professor Dix has led a range of successful projects and organised more than 30 international conferences and workshops. He is on the PC of most conferences and workshops in computational logic, on the steering committees of ProMAS and CLIMA, and on the Editorial Boards of six international journals. He published more than 100 papers in refereed journal and conferences

Amal El Fallah Seghrouchni is a Professor at the University Pierre and Marie Curie. She is a researcher at LIP6 laboratory (University Pierre and Marie Curie and CNRS – UMR7606) where she heads the Multiagent Systems team. Her main research topics are 'Analysis, Design and Validation of Multiagent Systems'. She published more than 100 papers in the major conferences of MAS field, co-edited five books and co-organised several international events dedicated to Multiagent Systems. She also has been invited professor and gave talks in international seminar and courses for upgraduated students about multiagent planning, coordination, interaction protocols, mobile computing, *etc.*.

This special issue of the *International Journal of Agent-Oriented Software Engineering* is edited by the steering committee of the Programming MultiAgent System (ProMAS) workshop series.[1]

One of the driving motivations behind the ProMAS workshop series (and all associated activities) is the observation that the area of autonomous agents and Multiagent Systems (MAS) has grown into a promising technology offering sensible alternatives for the design of distributed, intelligent systems that can operate in complex and dynamic environments. Several efforts have been made by researchers and practitioners (in both academia and industry), as well as by several standardisation consortia, in order to provide new languages, methods, frameworks, and tools so as to establish the necessary means for a wide use of MAS technology. Until recently, the main focus of the MAS research community has been on the development, sometimes by formal methods but often informally, of concepts (concerning both mental and social attitudes), architectures, and specific techniques (*e.g.*, for agent coordination), while approaches to the analysis and specification of MAS were often too abstract or lacking practical support. In particular, the contributions on agent techniques in the multiagent systems area of research has been quite fragmented, without any clear way of 'putting it all together', and thus completely inaccessible to practitioners. The ProMAS workshop series started in 2003, aiming at addressing this issue by encouraging technical discussions on how to make multi-agent systems a viable approach for the development of sophisticated computational systems. This aim was also shared with related workshop series such as the one on Agent-Oriented Software Engineering (AOSE).

The following is quoted from the call for papers for this special issue[2]:

> A special issue of IJAOSE will be dedicated to consolidating the combined use of AOSE methodologies and agent programming languages and platforms for agent-based software development. One typical issue is that of how the usual abstractions used in agent-oriented design (such as goals, plans, protocols, roles, norms, organisations) are mapped into specific constructs in programming languages for multiagent systems. Of no less importance is the provision for essential parts of the development process, such as debugging and testing. Any major development which has been done in accordance to well known AOSE methodologies as well as using programming languages for multi-agent systems would also be of significant interest.

Each submission was carefully reviewed by three experienced referees. Finally, five papers were selected for this special issue:

1 In 'IOM/T: interaction-oriented model by textual notation' by Doi and Honiden, a set of language functionalities are discussed which can be used to implement and test interactions between agents. Moreover, an interaction description language called IOM/T is presented which facilitates the implementation of interactions between agents. The main idea of this paper is to bridge the gap between the design and implementation of agent interactions. In particular, the authors describe how to implement a set of agents that interact with each other according to an interaction protocol specified by an AUML sequence diagram.

2 In 'An ITS [Intelligent Tutoring System] view on AOSE' by Vicari and Gluz, the authors investigate the area between the field of Agent-Oriented Software Engineering and Intelligent Tutoring Systems. They notice that ITS applications involve modelling tasks that require the modelling of complex agents (*i.e.*, humans) and therefore make the case for a strong agency approach. The paper presents core results that are formed by a conceptual framework for agents and a set of AOSE methods derived from ITS research. These methods are used to define applicability criteria, design principles and implementation guidelines for the development process. Example applications developed in the research groups of the authors are presented.

3 In 'Agent-oriented software engineering: a model-driven approach' by Fischer *et al.*, the authors propose a framework based on a model-driven approach for designing multiagent systems. The authors build on OMG's Model-Driven Architecture (MDA) and AOSE to propose a framework for building interoperable agents. They note that the various existing agent methodologies require the definition of two things:

   a a core metamodel unifying the basic agent-oriented concepts

   b its complementing framework supporting the design, development, and execution of agent systems in a model-driven manner.

   They take the Platform Independent Model (PIM) for Software Oriented Architectures (SOA) – the PIM4SOA – and the Platform Specific Model (PSM) (the BDI agent metamodel AgentMM) as examples for the application of their

framework. The authors also provide a basis for how to incorporate autonomous agents into architectures designed according to different paradigms, as, for example, SOA.

4 In the paper 'Developing organised multiagent systems using the $\mathcal{M}$OISE$^+$ model: programming issues at the system and agent levels' by Hübner *et al.*, a set of computational tools is described which supports the development and the programming of multiagent systems based on an organisational model. At the multiagent system level, a middleware is provided which ensures that all agents follow the organisational constraints. At the individual agent level, an extension of the AgentSpeak programming language is used to allow agents to perceive and act upon their organisation. The proposed approach is considered to be useful for open multiagent systems.

5 In 'West2East: exploiting WEb Service Technologies to Engineer Agent-based SofTware' by Casella and Mascardi, the authors present an approach to designing and implementing multiagent systems based on web services technology. In particular, they use current web Services technologies to allow agents to share specifications of protocols that they can then use to interact. In their approach, interactions protocols for pairs of agents are designed using AUML. They have developed a library of tools which allow users to translate the interaction protocols into a variety of formats, including WS-BPEL and WSDL documents to support protocol sharing and exchange using standard languages. Furthermore, the libraries allow the automatic generation of Prolog skeletons for agent programs that follow the interaction protocols. The paper also describes an example that shows how the final agent program can be used in existing agent platforms (including JADE, a Java-based platform) to actually deploy the final multiagent system. Finally, the tools provided by West2East also allow properties of the designed protocols to be checked, for example so that an agent can reason about whether to agree on using a particular protocol.

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Notes

1 http://www.cs.uu.nl/ProMAS/

2 http://www.cs.uu.nl/ProMAS/ProMASSpecialIssue.htm