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Preface

These are the post-proceedings of the International Workshop on Programming Multi-Agent Systems (ProMAS 2007), the fifth of a series of workshops that is attracting increasing attention from researchers and practitioners in multi-agent systems.

Multi-agent systems (MAS) constitute a promising software development paradigm for complex and distributed applications. The aim of the ProMAS workshop series is to promote and contribute to the establishment of MAS as a mainstream approach to the development of industrial-strength software. In particular, ProMAS aims to address the technologies that are required for implementing multi-agent systems designs or specifications effectively. We promote the discussion and exchange of ideas on principles, concepts, requirements, techniques, and tools that are essential for programming approaches and technologies specifically devised for MAS.

The idea of organizing the first workshop of the series was first discussed during the Dagstuhl seminar "Programming Multi-Agent Systems Based on Logic", where the focus was on *logic-based approaches*. It was felt that the scope should be broadened beyond logic-based approaches, thus giving the current scope and aims of ProMAS.

After four very successful editions of the ProMAS workshop series, which took place at AAMAS 2003 (Melbourne, Australia), AAMAS 2004 (New York, USA), AAMAS 2005 (Utrecht, The Netherlands), and AAMAS 2006 (Hakodate, Japan), the fifth edition took place on May 14 in Honolulu, Hawai'i, in conjunction with AAMAS 2007, the main international conference on autonomous agents and MAS. ProMAS 2007 received 17 submissions. These were reviewed by members of the Program Committee, and 11 papers were accepted.

At the workshop, in addition to the papers being presented, Jörg Müller gave an invited talk on business applications of agent technologies. Subsequently, Jörg was invited to prepare an invited paper for the post-proceedings. The resulting paper (written with Bernhard Bauer and Stephan Roser) examines the trade-offs involved in selecting an architecture for business process modelling and enactment.

The proceedings also contain an invited paper by Ralph Rönnquist describing a new agent platform, GORITE, which we hope will be of interest to the ProMAS community. GORITE ("GOal oRIented TEams") is a Java-based framework that provides facilities for implementing agent teams and goals. The aim of GORITE is to offer the team programming view and concepts dressed up in a standard Java solution, and thereby make the benefits of the paradigm accessible to a wider audience.

All but one of the 11 regular papers in these proceedings fall into one of three themes. The first paper by Keiser et al. is the exception. It looks at adding accounting features to the JIAC agent platform, motivated by the maxim that

"objects do it for free, agents do it for money." The three themes that the remaining papers fall into are "Environment and Interaction", "Agent Programming Languages", and "Analysis of MAS".

Environment and Interaction

The paper by Aldewereld et al. develops a method for deriving interaction protocols from norms using landmarks. Their procedure can be used to systematically derive concrete protocols that can be used by agents in norm-governed electronic institutions, and ensure that the norms of the institution will be fulfilled.

The paper by Santos et al. presents a way of interoperating Bayesian network knowledge amongst agents using an ontology-based approach.

The paper by Ricci et al. builds on their A&A (Agents and Artifacts) principles which argue that *artifacts* play a critical role in activities. The paper presents the CARTAGO platform and shows how it can be integrated with existing MAS programming frameworks, using the *Jason* platform as an example.

Agent Programming Languages

The paper by Dastani and Meyer presents the agent-oriented programming language 2APL ("A Practical Agent Programming Language"), a successor to the well-known 3APL language. The syntax and semantics of 2APL are presented.

The paper by Dennis et al. presents an intermediate language for BDI-style programming languages. The intermediate language aims to be a low-level "lingua franca" for existing high-level languages, ultimately enabling a generic model checker to be developed. The semantics of the language are presented, focussing on plan processing and intentions.

The paper by Novák and Dix proposes a mechanism for modularity which works by extending the syntax of the language using the concept of a mental state transformer. Formal semantics and a concrete syntax are presented.

The paper by Hindriks also tackles the issue of modularity in agent programming languages. Hindriks' solution, developed in the context of the GOAL language, views modules as policy-based intentions which can be activated when their context condition is true. Modules also allow the agent to "focus" its attention, thus reducing the inherent non-determinism in GOAL and similar languages.

Analysis of MAS

The paper by Mermet et al. proposes the use of goal decomposition trees (GDTs) to model agent behavior, and shows how properties of GDTs can be proven.

The paper by Vigueras and Botía proposes the use of causality graphs to visualize the behavior of a multi-agent system. They argue that causality graphs make the behavior of an MAS easier to follow than simple sequence diagrams, and give an algorithm for building causality graphs.

The paper by Furbach et al. shows how a multi-agent system can be modelled using a combination of UML state-charts and hybrid automata. The proposed modelling notation is suitable for real-time systems with continuous variables. By exploiting existing model checkers for hybrid automata these systems can be model checked.

Agent Contest 2007

The proceedings also contain papers relating to Agent Contest 2007 (http://cig.in.tu-clausthal.de/AgentContest2007/). While the first two editions of this contest were organized within the Computational Logic in Multi-Agent Systems workshop series (CLIMA 2005 and CLIMA 2006), the organizers (Mehdi Dastani, Jürgen Dix and Peter Novák) felt that ProMAS is an ideal environment for such a contest. For this edition the actual contest took place in April/May with the results announced at ProMAS 2007. The winner of the ProMAS 2007 Agent Contest was the JIAC IV team from the DAI-Labor, Technische Universität Berlin, Germany. The second team was the microJIAC team, from the same institute, followed by the Jason team. These proceedings contain a detailed report about the contest by the contest organizers, as well as five papers describing the MAS that were accepted for Agent Contest 2007.

One of the driving motivations behind the ProMAS workshop series (and all associated activities) was the observation that the area of autonomous agents and MAS has grown into a promising technology offering sensible alternatives for the design of distributed, intelligent systems. However, the success of MAS development can only be guaranteed if we can bridge the gap from analysis and design to effective implementation. This, in turn, requires the development of fully fledged and general purpose programming technology so that the concepts and techniques of MAS can be easily and directly implemented. Only by advancing our understanding of the key issues in the development of large-scale MAS will we see a paradigm shift, with MAS techniques becoming, as the AAMAS community predicted, the predominant approach to the development of complex distributed systems that are able to operate in dynamic and unpredictable environments. We hope that the work described in this volume takes us a step closer to this goal.

Finally, we would like to thank all the authors, the invited speaker, the author of the second invited paper, the Program Committee members, and additional reviewers for their outstanding contribution to the success of ProMAS 2007. We are particularly grateful to the AAMAS 2007 organizers for their technical support and for hosting ProMAS 2007.

November 2007

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