

Formal Approaches to Multi-Agent Systems: Special issue of best papers of FAMAS 2007

Over the last decade, multi-agent systems have come to form one of the key technologies for software development. The Formal Approaches to Multi-Agent Systems (FAMAS) workshop series brings together researchers from the fields of logic, theoretical computer science and multi-agent systems in order to discuss formal techniques for specifying and verifying multi-agent systems. FAMAS addresses the issues of logics for multi-agent systems, formal methods for verification, for example model checking, and formal approaches to cooperation, multi-agent planning, communication, coordination, negotiation, games, and reasoning under uncertainty in a distributed environment.

The first FAMAS workshop, FAMAS'03, was a successful satellite event of the European Conference on Theory and Practice of Software (ETAPS'03) in Warsaw. It took place on April 12th 2003, and afterwards a selection of contributed and invited papers was published in *Fundamenta Informaticae* as volume 63, issue 2,3 of 2004. The second FAMAS workshop FAMAS'06, took place on Monday 28, 2006 in conjunction with the European Conference on Artificial Intelligence (ECAI'06) at the Riva del Garda. Again, a selection of FAMAS speakers were invited to contribute an extended version of their work to a special issue of a well-known international journal, this time the *Journal of Autonomous Agents and Multiagent Systems*, as volume 19, issue 1, of 2009.

In 2007, the third FAMAS workshop, FAMAS'007, was one of the agent workshops gathered together under the umbrella of Multi-Agent Logics, Languages, and Organisations - Federated Workshops, MALLOW'007, taking place from 3 to 7 September 2007 in Durham. This current special issue of the *Logic Journal of the IGPL* gathers together the revised and updated versions of the five best FAMAS'007 contributions. A subsequent special issue of this journal will include revised and updated versions of the best work presented at the fourth edition of FAMAS, FAMAS'09, which took place in Turin, again under the MALLOW umbrella.

All research reported in this special issue is squarely related to practice, even if the formal approach is taken. Thus, the authors devote their attention to pressing practical problems such as supporting organizations and effective communication. Since the first FAMAS edition, emphasis has been shifting to correspond to the situatedness of multi-agent systems in a dynamic environment. Also, quite a few authors take on the challenge to combine different logics or to investigate the relations between different logical viewpoints, for example, temporal versus dynamic logic, in a methodologically sound manner.

Logics for teams and organizations

In "A logic for agent organizations", Virginia and Frank Dignum build a much needed bridge between organizational theory and logics for social concepts governing MAS in open environments. Thus, they formalize group capabilities, organization capabilities,

and responsibilities, and relate these to different types of organizational structures, such as hierarchies and networks. Due to a publishing glitch, this paper has already been printed in the *Logic Journal of the IGPL*, Volume 20, issue 1, 2012, pp. 283-316; but it belongs very much to this special issue.

Lorini, Herzig, Broersen and Trioquard aim to formalize the concept of power in their contribution “Grounding power on actions and mental attitudes”. They distinguish between ‘power of’, ‘power to’ and ‘power over’. In their Intentional Agency Logic, they relate the different kinds of power to agents’ attitudes, in particular beliefs and intentions, and to their abilities and opportunities.

Dynamic and temporal epistemic logics

For a long time, temporal and dynamic logic have been viewed as two competing approaches to modeling action and change in multi-agent systems. Lately, the strands have been converging. For example, Van Benthem, Gerbrandy and Pacuit have shown some precise relations between temporal and dynamic epistemics. In this special issue, Van Ditmarsch, Ruan and Van der Hoek in their paper “Model checking dynamic epistemics in branching time” have made a concrete new step in knitting together the two approaches by translating a dynamic action model into branching temporal logic with respect to the semantics of interpreted systems.

Variations on BDI systems

Dziubiński, in his paper “Complexity of the logic for multiagent systems with restricted modal context”, deals with a new way to make the teamwork logic TEAM-LOG of Dunin-Kępicz and Verbrugge much more feasible while maintaining sufficient expressivity to be useful for specifying practical multi-agent systems. It turns out that restricting the modal context of formulas, by forbidding mutual beliefs (or intentions) about beliefs (respectively intentions) of overlapping groups, including individual group members, reduces the complexity of satisfiability from EXPTIME to PSPACE.

In “A language for the execution of graded BDI agents”, Casali, Godo and Sierra apply the mobile ambient calculus, a type of process calculus, to provide an operational semantics for graded BDI-systems. Graded BDI models, here formalized as multi-context systems, allow to specify agent architectures in an environment under uncertainty, with graded mental attitudes such as degrees of belief. Extending the approach to multiple agents remains for further research.

Acknowledgments

We would like to thank all the people who helped to bring about FAMAS’007. First of all, we thank all speakers for ensuring a diverse and interesting workshop. Special thanks are due to the members of the FAMAS’007 program committee, namely Hans van Ditmarsch, Andreas Herzig, Wiebe van der Hoek, Wojtek Jamroga, Michael Luck, John-Jules Meyer, Tim Norman, David Robertson, Jeff Rosenschein, Carles Sierra and

Omn Shehory, and to the anonymous reviewers for this special issue, for their professionalism and their dedication to select papers of quality and to provide authors with useful, constructive feedback during the in-depth reviewing process.

Warszawa
Groningen

Barbara Dunin-Kępicz
Rineke Verbrugge

May 2012