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Declarative Agent Languages and Technologies II

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Revised Selected Papers

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Preface

The second edition of the workshop on Declarative Agent Languages and Technologies (DALT 2004) was held July 2004 in New York City, and was a great success. We saw a significant increase in both the number of submitted papers and workshop attendees from the first meeting, held July 2003 in Melbourne.

Nearly 40 research groups worldwide were motivated to contribute to this event by submitting their most recent research achievements, covering a wide variety of the topics listed in the call for papers.

More than 30 top researchers agreed to join the Program Committee, which then collectively faced the hard task of selecting the one-day event program.

The fact that research in multi-agent systems is no longer only a novel and promising research horizon at dawn is, in our opinion, the main reason behind DALT's (still short) success story. On the one hand, agent theories and applications are mature enough to model complex domains and scenarios, and to successfully address a wide range of multifaceted problems, thus creating the urge to make the best use of this expressive and versatile paradigm, and also profit from all the important results achieved so far. On the other hand, building multi-agent systems still calls for models and technologies that could ensure system predictability, accommodate flexibility, heterogeneity and openness, and enable system verification.

Declarative approaches promise to satisfy precisely these challenges posed by large-scale multi-agent systems, not least because of their strong theoretical foundation grounded in classical and recent advances in the area of computational logic. Equipped with such foundations, declarative approaches can, in principle, enable agents to reason about their interactions and their environment, hence not only establish the required tasks but also handle exceptions and unexpected situations that arise in many systems, all in a formal, verifiable way.

The workshop aimed at bringing together (1) researchers working on formal methods for agent and multi-agent systems design, (2) engineers interested in exploiting the potentials of declarative approaches for specification of agent-based systems, and (3) practitioners exploring the technology issues arising from a declarative representation of systems. The main purpose of DALT was then to foster a discussion forum to export declarative paradigms and techniques into the broader community of agent researchers and practitioners, as well as to bring in the issues from real-world, complex and possibly large-scale agent-system design from the perspective of declarative programming and technologies.

Beside the five technical sessions consisting of paper presentations, attendees enjoyed a stimulating discussion on declarative agent communication, in the form of a lively panel organized and moderated by Mike Huhns from the University of South Carolina, whom we take the opportunity to thank deeply.

This book contains selected and extended versions of the papers presented at the 2004 event.

Several active research areas such as software engineering and multi-agent prototyping, agent reasoning, BDI logics and extensions, and social aspects of multi-agent systems made their presence felt in both the 2003 and the 2004 editions, showing how declarative technologies can give an answer to problems such as engineering, specification and deployment of agent systems in the small and in the large. When compared with the previous edition (also published by Springer, as LNAI 2990) this year's edition witnessed an increasing popularity in the topic of agent verification.

This book is composed of five parts: (i) Reasoning, (ii) Modelling and Engineering, (iii) Verification, (iv) Norms and Protocols, and (v) Interaction and Communication. There follows a brief overview.

Part I – Reasoning

The first part of the book contains three papers on reasoning in multi-agent systems.

M. Birna van Riemsdijk, Mehdi Dastani, Frank Dignum, and John-Jules Ch. Meyer present *Dynamics of Declarative Goals in Agent Programming*, in which they explore interesting relations between goal dropping and goal adoption in multi-agent systems. These relations are further formalized in an agent programming framework.

In *Theories of Intentions in the Framework of Situation Calculus*, Pilar Pozos Parra and Abhaya Nayak extend the action theories used in multiagent systems to intention theories using situation calculus. The proposed intention theories can be processed using a regression-based mechanism, which decreases the computational complexity of the generally applied theorem proving.

Peep Küngas and Mihhail Matskin, in their paper *Partial Deduction for Linear Logic — The Symbolic Negotiation Perspective,* show how symbolic negotiation can be formalized as partial deduction in linear logic. Their approach is particularly interesting since they prove both the soundness and completeness of their formalization.

Part II – Modelling and Engineering

The second part of the book contains four papers on modelling and engineering aspects of multiagent systems.

In *On Modelling Declaratively Multi-agent Systems*, Andrea Bracciali, Paolo Mancarella, Kostas Stathis, and Francesca Toni present a parametric framework that is based on agents' observations and their actions. This framework is then used identify important properties of multi-agent systems, such as their success, robustness, and so on.

In *The Semantics of MALLET — An Agent Teamwork Encoding Language*, Xiaocong Fan, John Yen, Michael S. Miller, and Richard A. Volz give an operational semantics to the team-oriented agent programming language MALLET. The operational semantics is based on a transition system and can be used in

developing MALLET interpreters as well as in studying various properties of MALLET itself.

Yu Pan, Phan Huy Tu, Enrico Pontelli, and Tran Cao Son discuss an interesting application area for agent-based research: evolutionary biology. Their paper, *Construction of an Agent-Based Framework for Evolutionary Biology: A Progress Report* explains an agent-based system used to specify and execute phylogenetic inferences and discusses how the components of such a system can be implemented.

In *Reasoning About Agents' Interaction Protocols Inside DCaseLP*, Matteo Baldoni, Cristina Baroglio, Ivana Gungui, Alberto Martelli, Maurizio Martelli, Viviana Mascardi, Viviana Patti, and Claudio Schifanella integrate a MAS development environment with an agent programming language to help ease agent protocol development. The integration benefits from compiling AUML sequence diagrams into agent skeletons semi-automatically.

Part III – Verification

The third part of the book presents three papers on verification.

In *Model Checking Agent Dialogues* Christopher Walton defines a lightweight, yet expressive language and uses model checking to verify the correctness of this language. This paper shows that the proposed language is useful in detecting certain failures in agent dialogues, which is an important step in ensuring correct agent protocols.

L. Robert Pokorny and C.R. Ramakrishnan study how agent systems that provide services over the Web can be constructed declaratively. In *Modeling and Verification of Distributed Autonomous Agents Using Logic Programming*, they develop an approach where individual services of agents are defined using temporal logic formulas. This enables verifications of service composition of several agents that interact to carry out a service together.

In *Norm Verification and Analysis of Electronic Institutions*, Wamberto Vasconcelos proposes a formal definition of norms and shows how they apply in the context of electronic institutions. He further discusses how parts of an electronic institution can be derived when certain norm constraints are given.

Part IV – Norms and Protocols

The fourth part of the book focuses on norms and protocols, consisting of three papers. David Robertson presents *A Lightweight Coordination Calculus for Agent Social Norms*, in which he presents a declarative language for specifying social norms. The major benefit of this language is that social norms defined within it can be analyzed and deployed easily.

In *Enhancing Commitment Machines*, Michael Winikoff, Wei Liu, and James Harland study flexible interactions for agents by building on top of the commitment machine abstraction. They show that the reasoning mechanism of commitment machines can be improved when the specification of commitments and some of their operators are enhanced.

In *A Protocol for Resource Sharing in Norm-Governed Ad Hoc Networks*, Alexander Artikis, Lloyd Kamara, Jeremy Pitt, and Marek Sergot study normative relations and their application in ad hoc networks, where participating nodes may not comply with the system rules. To cope with the uncertainty in ad hoc networks, they formulate a protocol that regulates the access control of nodes in the network. This protocol is specified in event calculus and can be executed directly.

Part V – Interaction and Communication

Finally, the last part of the book contains three papers on interaction and communication in multiagent systems.

Vasu S. Alagar, Joey Paquet, and Kaiyu Wan present *Intensional Programming for Agent Communication* in which they represent the conversation contexts explicitly. They provide a calculus of contexts as well as a logic of contexts as an extension to an intensional programming language. These additions enable reasoning on contexts in agent communication languages.

In *The Logic of Communication Graphs*, Eric Pacuit and Rohit Parikh show that agents with private information can have individual communications with other agents and gather information that is private to other parties. The introduced logic is decidable and can handle a variety of cases.

In *Representational Content and the Reciprocal Interplay of Agent and Environment*, Tibor Bosse, Catholijn M. Jonker, and Jan Treur advocate the temporal-interactivist approach to denote representational content of an internal state. Using this approach, a realistic example of interactions between an agent and an environment is depicted.

DALT is now looking forward to its third meeting, which will take place July 2005 in Utrecht, The Netherlands, again as an AAMAS workshop, and will be chaired by Matteo Baldoni, Ulle Endriss, Andrea Omicini and Paolo Torroni. We expect that DALT will once again attract a large number of submissions, each reporting on new and exciting results about agents and declarative technologies, and that the meeting will feature motivating presentations and lively discussions.

As a final word, we would like to thank the authors who presented their work at the workshop and submitted improved versions of their papers, our PC members who willingly spent their valuable time on two rounds of reviewing and selection, all the additional reviewers who helped the PC members in this task, and Gregory Wheeler for his help.

March 2005

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João Leite
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Co-organizers
DALT 2004

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Workshop Organizers

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