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Coordination, Organizations Institutions, and Norms in Multi-Agent Systems

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Preface

This volume is the first in a planned series focussing on issues in Coordination, Organizations, Institutions and Norms (COIN) in multi-agent systems. Forthcoming events are COIN @ AAMAS 2006 and COIN @ ECIA 2006. The papers in this volume are drawn from two complementary events, ANIREM (Agents, Norms and Institutions for Regulated Multiagent Systems) and OOOP (From Organizations to Organization-Oriented Programming in MAS), that were part of the workshop program at AAMAS 2005 in Utrecht.

ANIREM: Multi-agent systems are often understood as complex entities where a multitude of agents interact, usually with some intended individual or collective purpose. Such a view usually assumes some form of structure, or set of norms or conventions that articulate or restrain interactions in order to make them more effective in attaining those goals, more certain for participants or more predictable. The engineering of effective regulatory mechanisms is a key problem for the design of open complex multi-agent systems, so that in recent years it has become a rich and challenging topic for research and development. There are many possible ways of looking at the problem of regulating multi-agent systems, and one perspective is the normative approach, based on the use of norms in artificial institutions. Lately there has been an explosion of new approaches, both theoretical and practical, exploring the use of norms as a flexible way to constrain and/or impose behavior, and these are reflected in specifications of norm languages, agent-mediated electronic institutions, contracts, protocols and policies.

OOOP: Agent organizations are an emergent area of application within multi-agent systems that pose new demands on traditional MAS models, such as the integration of organizational and individual perspectives and the dynamic adaptation of models to organizational and environmental changes, both of which are impacted by the notion of openness and heterogeneity. As systems grow to include an increasing number of agents, the view of coordination and control has to be expanded to consider both the agent-centric as well as the organization-centric views. Practical applications of agents in organizational modelling are being widely developed. All this contributes to an emerging field of research and work that could be called organization-oriented programming. However, formal theories, tools and methodologies are still very much in short supply. Even if an externally designed organizational structure is a necessary coordination device to achieve global social order there is a special tension between such imposed constraints and the agents' autonomous behavior. This leads to a focus on the trade-off between social order and agent autonomy, and on other means to achieve social order in MAS other than organizations.

ANIREM: Gabriela Lindemann, Sascha Ossowski,
Julian Padget, Javier Vázquez-Salceda
OOOP: Olivier Boissier, Virginia Dignum,
Eric Matson, Jaime Sichman

The Papers

The papers in this volume are extended, revised versions of the best papers presented at the ANIREM and the OOOP workshops at AAMAS 2005, with additionally a paper originating from an invited talk given at ANIREM. The result is a well-balanced collection of high-quality papers that really can be called representative of the field at this moment. For this volume, the papers from the two workshops have been re-grouped around the following themes:

Modelling, Analyzing and Programming Organizations: The first section contains five papers on the modelling, analysis and programming of organizations. The first paper in this section, by Sibertin-Blanc et al., proposes a basis for the design of coordination models in multi-agent systems that exploits a widely recognized sociological theory, the sociology of organized action. The paper by van den Broek et al. describes a new, formal, role-based framework for modelling and analyzing both real world and artificial organizations that considers both the dynamic properties of the organizational model and the environment. Wijngaards et al. introduce a conceptual view of realizing sustained team effectiveness, in which both the measurement of effectiveness and team management play an important role. The paper by McCallum et al. proposes a means for the formal specification, verification and analysis of agent organizations, capturing notions of role, obligation and delegation (of obligations) that furthermore allows change in the organizational structure to be modelled. The section ends with a paper by Hübner et al. describing a software implementation that aims to bridge the gap between organizational constraints and agent autonomy.

Modelling and Analyzing Institutions: The focus of the five papers in the second section is the modelling and analysis of institutions. It starts with an invited contribution from one of the pioneers of electronic institutions, Pablo Noriega, in which he surveys some of the current issues he sees in institutions research, from the perspective of three complementary case studies. The paper by Cliffe et al. describes a new approach to constructing specifications of institutional norms using answer set programming that can subsequently be used to verify properties of the institutions. Boella et al. explore the modelling of a normative system governing the production of renewable energy in the UK in which their agents map the norms into obligations represented as beliefs and goals. Rubino et al. by contrast address generic issues surrounding the engineering of normative systems and demonstrate how elements of their coordination artifacts infrastructure can capture and implement norms. The section ends with the paper by Viganò et al. in which they make the case for an event-based approach to norm specification and discuss how one institution may regulate another one.

Modelling Normative Designs: The third section is devoted to normative issues in organizations and institutions. Aldewereld et al. discuss a formal framework for the design of a protocol from a normative specification in highly regulated environments. By the use of landmarks they introduce an intermediate level in order to be able to connect descriptive norms with operational protocols. The paper by Garion and van der Torre proposes a software design language based on temporal deontic

logic as a means to bridge the gap between the theory of design by contract and software engineering concepts. Additionally, they discuss the relation between the normative stance toward systems implicit in the design by contract approach and the intentional or BDI stance popular in agent theory. Kollingbaum and Norman look at norms from the perspective of the agent and how a practical reasoning agent might internalize norms, have them influence its behavior and resolve conflicts between new and existing norms. This section closes with the paper by Boella and van der Torre addressing the introduction of organizations and roles in artificial social systems using a normative system. They consider the relationship between how the behavior of an organization is determined by agents playing a roles within it and, vice versa, how an organization affects the behavior of agents. These considerations are used to explore the evolution of (artificial) organizations.

Evaluation and Regulation: The fourth and last section, on evaluation and regulation, starts with a paper by Dignum et al. who present a simulation scenario that can be used to evaluate the congruence between organizational structure and task performance. The background for their purpose is the need for reorganization that can arise when environmental conditions change. The same holds for artificial organizations in the form of open multi-agent systems that operate in dynamic environments. The second paper in this chapter by Aldewereld et al. gives a formal method, based on program verification, for checking the norm compliance of knowledge-based protocols. In achieving a goal, agents can make use of predefined protocols, which should help them avoid violating any of the norms. But it should also be guaranteed that these protocols are actually norm-compliant. The section ends with a paper by Cranefield about a rule language for defining social expectations. It is based on a metric interval temporal logic with past and future modalities and a current-time binding operator. Moreover, he presents an algorithm for run-time monitoring compliance of rules in this language based on formula progression.

The workshop organizers would like to thank the AAMAS 2005 conference and Utrecht University for hosting the workshop. We are also very grateful to all the Program Committee members, the additional reviewers, the authors and the participants for their respective contributions to the process of creating two high-quality, stimulating workshops. Finally, we are pleased to acknowledge the encouragement and support from Springer, in the person of Alfred Hofmann, for helping to bring the workshop to this concrete conclusion.

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Table of Contents

I Modelling, Analyzing and Programming Organizations

A Coordination Framework Based on the Sociology of Organized Action
C. Sibertin-Blanc, F. Amblard, M. Mailliard 3

Formal Modeling and Analysis of Organizations
Egon L. van den Broek, Catholijn M. Jonker, Alexei Sharpanskykh, Jan Treur, pInar Yolum 18

Towards Sustained Team Effectiveness
Niek Wijngaards, Masja Kempen, Annika Smit, Kees Nieuwenhuis 35

Verification and Analysis of Organisational Change
Mairi McCallum, Wamberto W. Vasconcelos, Timothy J. Norman 48

$\mathcal{S}$-$\mathcal{M}$oise$^+$: A Middleware for Developing Organised Multi-agent Systems
Jomi Fred Hübner, Jaime Simão Sichman, Olivier Boissier 64

II Modelling and Analyzing Institutions

Fencing the Open Fields: Empirical Concerns on Electronic Institutions (Invited Paper)
Pablo Noriega 81

Specifying and Analysing Agent-Based Social Institutions Using Answer Set Programming
Owen Cliffe, Marina De Vos, Julian Padget 99

Modeling Control Mechanisms with Normative Multiagent Systems: The Case of the Renewables Obligation
Guido Boella, Joris Hulstijn, Yao-Hua Tan, Leendert van der Torre 114

Computational Institutions for Modelling Norm-Regulated MAS: An Approach Based on Coordination Artifacts
Rossella Rubino, Andrea Omicini, Enrico Denti 127

An Event Driven Approach to Norms in Artificial Institutions
Francesco Viganò, Nicoletta Fornara, Marco Colombetti 142

III Modelling Normative Designs

Designing Normative Behaviour Via Landmarks
Huib Aldewereld, Davide Grossi, Javier Vázquez-Salceda, Frank Dignum 157

Design by Contract Deontic Design Language for Multiagent Systems
Christophe Garion, Leendert van der Torre 170

Informed Deliberation During Norm-Governed Practical Reasoning
Martin J. Kollingbaum, Timothy J. Norman 183

Organizations in Artificial Social Systems
Guido Boella, Leendert van der Torre 198

IV Evaluation and Regulation

Exploring Congruence Between Organizational Structure and Task Performance: A Simulation Approach
Frank Dignum, Virginia Dignum, Liz Sonenberg 213

Verifying Norm Compliancy of Protocols
Huib Aldewereld, Javier Vázquez-Salceda, Frank Dignum, John-Jules Ch. Meyer 231

A Rule Language for Modelling and Monitoring Social Expectations in Multi-agent Systems
Stephen Cranefield 246

Author Index 259