The AgentLink III Technical Forums: Introduction to the Special Issue

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This paper introduces the Special Issue of *ACM Transactions on Autonomous and Adaptive Systems* devoted to research papers arising from the three Technical Forum Group meetings held in 2004 and 2005 that were organised and sponsored by the European FP6 Coordination Action AgentLink III.

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General Terms: Design, Documentation, Economics, Experimentation, Languages, Standardization, Theory, Verification

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1. INTRODUCTION

This special issue of *ACM Transactions on Autonomous and Adaptive Systems* is devoted to research papers arising from the AgentLink III Agent Technical Forums. AgentLink III (2004-2005) was a European Union (EU)-sponsored project to support research and development in agent-based technologies and to strengthen Europe's efforts in this domain. It was funded under the Information Society Technologies (IST) Activity Area of the Sixth Framework Programme (FP6), through the Semantic-based Knowledge Systems area (Project number: IST-FP6-002006CA).

AgentLink III could build on the success of its predecessors: the original AgentLink (1998-2001) project coordinated by Mike Wooldridge (then at Queen Mary & Westfield College, London), one of the "preparatory, accompanying and support measures" funded

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in the Long Term Research area of FP4, was instrumental in promoting agent technology in European research and development. Under the coordination of Michael Luck (then at the University of Southampton), the AgentLink II (2001-2003) FP5 "thematic network contract" was aimed at consolidating the European agent-oriented systems research community, and developed a high-quality technological roadmap describing a vision for the future and potential of agent technology. AgentLink III was an FP6 "Co-ordination Action" led by the University of Liverpool and the University of Southampton, UK, under the direction of a Management Committee comprising academic and industrial representatives from across the European agent technology community. To support this leadership, the project established in early 2004 a system of membership by which institutions active in agent research or development could apply to join the project. By the end of the project at 31 December 2005, 206 organisations from European Union member nations and associated states had become full members of AgentLink III, of which 134 were Universities, 32 were Research Institutes and 40 were private companies. A further 27 organisations were accepted as associate members, either because they were located outside Europe or because they are not yet active in agent research or development. This high level of membership indicated considerable support for the project from European organisations, both public and private.

2. AGENTLINK III OBJECTIVES

The long-term goal of AgentLink III was to put Europe at the leading edge of international competitiveness in the increasingly important area of agent technologies. To realise this aim, AgentLink III sought to achieve the following objectives:

—To gain competitive advantage for European industry by promoting and raising awareness of agent systems technology;

—to support standardisation of agent technologies and promote interoperability;

—to facilitate improvement in the quality, profile, and industrial relevance of European research in the area of agent-based computer systems, and draw in relevant prior work from related areas and disciplines;

—to support student integration into the agent community and to promote excellence in teaching in the area of agent-based systems;

—to provide a widely known, high-quality European forum in which current issues, problems, and solutions in the research, development and deployment of agent-based computer systems may be debated, discussed and resolved;

—to identify areas of critical importance in agent technology for the broader IST community, and to focus work in agent systems and deployment in these areas.

Further information about AgentLink III and its many activities is available from the AgentLink website at `http://www.agentlink.org`.[1]

3. AGENTLINK III TECHNICAL FORUMS

In order to support co-ordination and collaboration of European research efforts, AgentLink III established a series of research meetings, called the AgentLink III Technical Forums

[1] We are grateful to the University of Southampton for continuing to host this web-site following the end of the project.

(TFs). Each of these meetings comprised a number of parallel workshops, called Technical Forum Groups (TFGs), on topics suggested in response to a call for proposals issued before each Technical Forum meeting. Soliciting topics for TFGs in this way ensured that the meetings retained flexibility, and could reflect whatever was the current focus of research attention in the agents community. This feature also meant that the standard for acceptance could be quite high, with proposers needing to show evidence of research co-ordination activities before, during, and *beyond* each TF. Example outcomes of such activities included web sites and discussion forums, short and long reports of the Group meetings at the TF, surveys of activities, and co-authored survey papers of the field covered by the TFG.

Three TF events were held under AgentLink III:

—TF1: Rome, Italy, EU: 30 June – 2 July 2004.

—TF2: Ljubljana, Slovenia: 28 February – 2 March 2005.

—TF3: Budapest, Hungary: 15 – 17 September 2005.

Over a hundred participants registered to attend each of the TF meetings, which all turned out as truly global events, with attendants not just from the European Union and affiliated countries, but also from the USA, Argentina, Dubai, Japan, and Australia.

Each TF supported six to nine TFGs, with many Groups meeting for multiple days. Because AgentLink sought to build links with related research disciplines and with other research projects, special effort was invested to encourage the formation of TFGs making connections between the agents community and other research communities. For instance, there were TFGs which looked at the intersection of agent technologies and: the law; biology and bioinformatics; and economics. In addition, joint meetings were held by TFGs and two related EU-funded projects[2], *KnowledgeWeb* and *ASPIC*.

The discussions and contracts enabled by the AgentLink III Technical Forum Groups were very productive in generating new research and refereed publications. This output includes a special issue of the *Knowledge Engineering Review* journal [Omicini and McBurney 2005]; a double special issue of the journal *Informatica* [Omicini et al. 2005; 2006], a special issue of the journal *Autonomous Agents and Multi-Agent Systems* on environments in multi-agent systems [Parunak and Weyns 2007], and a major research article on standard formats for the exchange of arguments between agents [Chesñevar et al. 2006]. The present special issue of *ACM Transactions on Autonomous and Adaptive Systems* adds to this impressive list.

4. SPECIAL ISSUE CONTENTS

This issue contains four papers which together cover a range of topics in contemporary agents systems research and applications. The first paper, *Awareness in Collaborative Ubiquitous Environments: the Multilayered Multi-Agent Situated System Approach* by Marco Locatelli and Giuseppe Vizzari, considers the application of research results in multi-agent systems to model, design, and engineer collaboration between distinct computational entities in ubiquitous environments. In these settings, entities need to maintain awareness of events and other dynamic information, and the authors' model deals with such awareness explicitly. The rise of ad-hoc wireless networks, the development of intelligent devices, and the widespread deployment of data sensor networks (such as public

[2]See `http://knowledgeweb.semanticweb.org/` (FP6-507482) and `http://www.argumentation.org/` (FP6-002307).

closed-circuit television cameras) make the issue of collaboration in ubiquitous computing domains an important one.

Intelligent devices are increasingly able to provide services to one another, whether freely or in return for some form of payment. How such provision should be negotiated between machines connected across distributed systems, such as those of Grid networks, is the subject of the second paper, *A Framework for Web Service Negotiation*, by Shamimabi Paurobally, Valentina Tamma, and Michael Wooldridge. These authors apply recent work in multi-agent negotiation techniques to facilitate dynamic negotiation for resources in Grid networks, and describe a web services development of the Contract Net protocol for negotiation between insurance companies and vehicle repair firms. Their paper includes an empirical evaluation showing the added value of their flexible approach in comparison today's rigid interactions.

Automated interactions between autonomous computer entities representing different commercial organisations has long been part of the vision for agent systems. For that reason, considerable research and development effort in the field has been focused on the design of standard languages and protocols for agent communications. The third paper in this collection, Stefan Poslad's *Specifying Protocols for Multi-Agent System Interaction*, presents the history of work undertaken by the Foundation for Intelligent Physical Agents (FIPA)[3] in developing public standards to support agent inter-operability, open service interaction, and heterogeneous development. He presents the main characteristics of the FIPA model of multi-agent interaction and its expected future developments, along with a comparison of the FIPA model to alternative interaction standards.

While the development of standards for agent communication and interactions is essential for commercial deployment, agent technologies will only achieve their full potential with the availability of proven agent-oriented software design and methodologies and engineering tools [Luck et al. 2005]. The final paper in this special issue, *High Variability Design for Software Agents: Extending Tropos*, written by Loris Penserini, Anna Perini, Angelo Susi and John Mylopoulos, is devoted to one such methodology, *Tropos*. The authors introduce an extension that allow explicit modelling of alternatives, thereby enhancing support for high variability design. The authors also present an implemented software development environment for Tropos, based on the Model-Driven Architecture (MDA) framework. An e-commerce case study serves to illustrate the Tropos development process.

From looking at these papers, one theme to emerge is the increasing value of research in the domain of agent technologies in realising the visions of other branches of computing. From ubiquitous and ambient computing to Grid networks through to the Semantic Web, agent theories, methodologies and practical experiences are proving to be key enablers for downstream applications. Another theme is the primary role of standards in supporting inter-operability and communication between distinct computational entities, created by teams decoupled in time and in space, and using a miscellany of software engineering tools and methods. That software agents can still communicate with one another when architected and engineered under such diverse conditions is a credit to the over-arching agent paradigm and to the inter-operability of agent-oriented methodologies. The need for such methodologies in designing autonomous and adaptive computational systems is a third theme arising from these papers. This picture reinforces the validity of the analysis

[3]Now an IEEE standards committee.

proposed [Petta and Müller 2006][4].

5. CONCLUSIONS

The papers in this volume are the culmination of considerable work from TF organisers, presenters, authors, referees, and journal editors. We wish to thank the many authors of the papers submitted for this Special Issue for their contributions, and also the referees who took care to read and comment on these papers. The Special Issue could not have happened without these different efforts. In addition, we wish to thank all those who made the AgentLink III Technical Forums such noteworthy successes, especially the AgentLink III staff: Catherine Atherton, Becky Earl, Adele Maggs, and Serena Raffin. We also thank the AgentLink III Management Committee for their efforts and their support, and the local organisers and their staff at each event: Rino Falcone at TF1, Matjaz Gams at TF2, and László Z. Varga at TF3. We also thank Cristiano Castelfranchi (TF1), who along with two of us (AO and PP), chaired the Technical Forum Committees during 2004 and 2005. Finally, we are grateful to the European Commission for the financial and other support received for the AgentLink III project (IST-FP6-002006CA).

We hope you enjoy reading this Special Issue!

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[4]See also `http://www.ofai.at/~paolo.petta/conf/at2ai4/`.