

# Lecture Notes in Artificial Intelligence

1788

Subseries of Lecture Notes in Computer Science

Edited by J. G. Carbonell and J. Siekmann

Lecture Notes in Computer Science

Edited by G. Goos, J. Hartmanis, and J. van Leeuwen

**Springer**

*Berlin*

*Heidelberg*

*New York*

*Barcelona*

*Hong Kong*

*London*

*Milan*

*Paris*

*Singapore*

*Tokyo*

Alexandros Moukas   Carles Sierra  
Fredrik Ygge (Eds.)

# Agent Mediated Electronic Commerce II

Towards Next-Generation Agent-Based  
Electronic Commerce Systems



Springer

## Series Editors

Jaime G. Carbonell, Carnegie Mellon University, Pittsburgh, PA, USA  
Jörg Siekmann, University of Saarland, Saarbrücken, Germany

## Volume Editors

Alexandros Moukas  
MIT Media Laboratory and Frictionless Commerce Inc.  
20 Ames Street  
Cambridge, MA 02142, USA  
E-mail: moux@media.mit.edu

Carles Sierra  
IIIA-Institut d'Investigació en Intel·ligència  
CSIC-Spanish Scientific Research Council  
Campus UAB  
08193 Bellaterra, Catalonia Spain  
E-mail: sierra@iiia.csic.es

Fredrik Ygge  
EnerSearch AB and Uppsala University  
Chalmers Science Park  
412 88 Gothenburg, Sweden  
E-mail: ygge@enersearch.se

Cataloging-in-Publication Data applied for

Die Deutsche Bibliothek - CIP-Einheitsaufnahme

Agent mediated electronic commerce 2 : Towards next generation agent based electronic commerce systems / Alexandros Moukas ... (ed.). - Berlin ; Heidelberg ; New York ; Barcelona ; Hong Kong ; London ; Milan ; Paris ; Singapore ; Tokyo : Springer, 2000

(Lecture notes in computer science ; 1788 : Lecture notes in artificial intelligence)

ISBN 3-540-67773-9

CR Subject Classification (1998): I.2.11, K.4.4, C.2, H.3.4-5, H.4.3, H.5.3, I.2, J.1, K.5

ISBN 3-540-67773-9 Springer-Verlag Berlin Heidelberg New York

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer-Verlag. Violations are liable for prosecution under the German Copyright Law.

Springer-Verlag Berlin Heidelberg New York  
a member of BertelsmannSpringer Science+Business Media GmbH  
© Springer-Verlag Berlin Heidelberg 2000  
Printed in Germany

Typesetting: Camera-ready by author, data conversion by Christian Grosche, Hamburg  
Printed on acid-free paper SPIN 10720026 06/3142 5 4 3 2 1 0

## Preface

The Internet is spawning many new markets and electronic commerce is changing many market conventions. Not only are old commercial practices being adapted to the new conditions of immediacy brought forth by the global networks, but new products and services, as well as new practices, are beginning to appear. There is already ample evidence that agent-based technologies will be crucial for these developments. However many theoretical, technological, sociological, and legal aspects will need to be addressed before such opportunities become a significant reality.

In addition to streamlining traditional transactions, agents enable new types of transactions. For example, the elusive one-to-one marketing becomes more of a reality when consumer agents capture and share (or sell) consumer demographics. Prices and other transaction dimensions need no longer to be fixed; selling agents can dynamically tailor merchant offerings to each consumer. Economies of scale become feasible in new markets when agents negotiate on special arbitration contracts. Dynamic business relationships will give rise to more competitively agile organizations. It is these new opportunities combined with substantial reduction in transaction costs that will revolutionize electronic commerce.

The first generation of agent-mediated electronic commerce systems are already creating new markets and beginning to reduce search and transaction costs in a variety of business practices. However, we still have a long way to go before software agents transform how businesses conduct business. This change will occur as technology matures to better manage ambiguous content, personalized preferences, complex goals, changing environments, and disconnected parties, but more importantly, as standards are adopted to succinctly and universally define goods and services, consumer and merchant profiles, value added services, secure payment mechanisms, inter-business electronic forms, etc.

During this next generation of agent-mediated electronic commerce systems, agents will streamline business-to-business transactions, reducing transaction costs at every stage of the supply chain. At some critical threshold, new types of transactions will emerge in the form of dynamic relationships among previously unknown parties. Agents will strategically form and reform coalitions to bid on contracts and leverage economies of scale - in essence, creating dynamic business partnerships that exist only as long as necessary. It is in this third generation of agent-mediated electronic commerce where virtual and non-virtual companies will be at their most agile and marketplaces will approach perfect efficiency. This book sets the scene for the assessment of the challenges that agent-based electronic commerce faces as well as the opportunities it creates. By focusing on agent mediated interactions we

brought together specialists from different disciplines who are contributing theoretical, methodological, and application perspectives in the narrowly focused topic that nevertheless involves wide ranging concerns such as: agent architectures, institutionalization, economic-theoretic, modeling, legal frameworks, and policy guidelines.

The workshop on whose proceedings this book is based was held during the Sixteenth International Joint Conference on Artificial Intelligence in Stockholm, Sweden in July 1999. The six papers that were presented during the workshop were augmented with six additional manuscripts that were invited to contribute to this book in order to provide a more complete picture of the practical, theoretical, institutional, and legal issues of agents in electronic commerce.

The papers covered a wide range of topics: Greenwald and Kephart's *Shopbots and Pricebots* contribution focuses on agents that collect information about pricing and specifications information for products and services on the Web. The authors include findings on the tradeoffs between profitability and computational complexity of the pricebots algorithms. Dellarocas and Klein's paper on *Civil Agent Societies* introduces a framework and the infrastructure support tools that can assist in the design of open marketplaces that will provide quality of service guarantees to their members. Conan et al. in *Privacy Protection and Internet Agents* discuss privacy issues in a variety of agent mediation scenarios in electronic commerce, from agents that represent the users, to agents that represent the sellers, to agents that are acting as third party middlemen. Ygge presents an overview in his paper *Energy Resellers - An Endangered Species?* describing important issues related to implementing electronic power trade. An overview paper called *Modeling Supply Chain Formation in Multi-agent Systems* describing the importance of supply chain formation and its most major promises and difficulties is authored by Walsh and Wellman. Yoon et al. in their *Jangler: A Novel Agent-Based Electronic Marketplace* paper discuss the design and implementation of a marketplace that provides brokering, negotiation, and reputation capabilities, while addressing ontological and computational complexity issues. Collins et al. introduce a bid evaluation framework that supports the assessment of multiple criteria in a multi-agent automated contracted environment. Boutilier et al. in *Resource Allocation Using Sequential Auctions* discuss a model for agent bidding in a resource allocation environment where the agents are coming up with policies that govern their bidding behavior. Dailianas et al. in *Profit-Driven Matching in E-Marketplaces: Trading Composable Commodities* provide insight in highly computationally efficient matching heuristics in a marketplace for soft composable commodities (bandwidth products.) In *Two-Sided Learning in an Economy for Information Bundles*, Kephart, Das, and MacKie-Mason investigate the price dynamics in an information bundling economy with learning producers and consumers. Parkes' paper *Optimal Auction Design for Agents with Hard Valuation Problems* describes the interplay between the complexity of the agents' valuation problems and the outcome of specific auctions; the interesting issue of making the right agents

deliberate at the right time is carefully examined. Finally, Esteva's and Padget's contribution *Auctions without Auctioneers: Distributed Auction Protocols* analyze the concept of "interagent", and use p-calculus to specify the protocols of first-price, second-price English and Dutch auctions.

In addition to the papers presented at the workshop and included above, a set of additional events occurred: A demonstration of the *Diplomat* system and a report from a strongly related workshop at AAAI, was given by Grosz. Furthermore, a very stimulating competition proposal called *A Trading Agent Competition for the Research Community* by Wellman and Wurman presented a trading competition. The competition will take place as a workshop at ICMAS 2000, and researchers in the field were encouraged to design their agents for the competition. More information about the competition can be obtained from Michael P. Wellman, University of Michigan ([wellman@umich.edu](mailto:wellman@umich.edu)) or by visiting: <http://tac.eecs.umich.edu>.

Finally, two panels, one on practical issues and one on theoretical issues were also held at the workshop. The panels were indeed lively and interesting, reflecting many of the challenges facing the researchers in the field. Some of the practical issues are legal, security aspects, integrity aspects, as well as issues related to what auctions to use in what situations etc. In the theory session, one issue that was discussed was related to the agent-mediated electronic commerce as a field of study. Some argued that there are no original theoretic contributions in this field - they belong to economics, game theory, or other fields, whereas others insisted that there are new issues in the interplay between computation/communication and economics which belong to this field.

We would like to thank all the members of the program committee and the reviewers of submitted papers for their guidance and their valuable suggestions to authors and organizers. Finally, we would like to mention the encouragement and support we received from the IJCAI-99 conference organizers and staff, and from Alfred Hofmann of Springer-Verlag for the publication of this volume.

March 2000

Alexandros Moukas, Carles Sierra, Fredrik Ygge

## Organization

The workshop was organized in conjunction with the Sixteenth International Joint Conference on Artificial Intelligence (IJCAI-99) held in Stockholm, Sweden. Alexandros Moukas (MIT Media Laboratory / Frictionless Commerce Incorporated, USA), Carles Sierra (IIIA-Institut d'Investigació en Intelligència Artificial, Spain) and Fredrik Ygge (EnerSearch AB, and Uppsala University, Sweden) co-chaired the event.

## Program Committee

|                       |                                       |
|-----------------------|---------------------------------------|
| Ken Binmore           | University College London, UK         |
| Frank Dignum          | U. Eindhoven, The Netherlands         |
| Fausto Giunchiglia    | IRST, Italy                           |
| Robert Guttman        | Frictionless Commerce Inc., USA       |
| Sverker Janson        | Swedish Institute of Computer Science |
| Nick R. Jennings      | Queen Mary and Westfield College, UK  |
| Sarit Kraus           | Bar-Ilan U., Israel                   |
| Yannis Labrou         | UMBC, USA                             |
| Jack Lang             | ESI, UK                               |
| Pattie Maes           | MIT Media Lab, USA                    |
| Joerg Muller          | Siemens, UK                           |
| Pablo Noriega         | LANIA, Mexico                         |
| Julian Padget         | University of Bath, UK                |
| Jeff Rosenschein      | Hebrew University, Israel             |
| Tuomas Sandholm       | Washington University, USA            |
| Katia Sycara          | Carnegie Mellon University, USA       |
| Aphrodite Tsalgatidou | University of Athens, Greece          |
| Hans Voss             | GMD, Germany                          |
| Mike Wooldridge       | Queen Mary and Westfield College, UK  |

## Acknowledgements

We would like to thank the travel support given to Carles Sierra by the European Network of Excellence, AgentLink.



# Table of Contents

|   |     |
|---|-----|
| Shopbots and Pricebots.....   | 1   |
| <i>Amy R. Greenwald and Jeffrey O. Kephart (IBM T.J. Watson Research Center, USA)</i>   |     |
| Civil Agent Societies: Tools for Inventing Open Agent-Mediated Electronic Marketplaces.....   | 24  |
| <i>Chrysanthos Dellarocas and Mark Klein (Massachusetts Institute of Technology, USA)</i>   |     |
| Legal Issues for Personalised Advertising on Internet: The AIMedia Case Study.....  | 40  |
| <i>Vania Conan, Marten Foss, Peter Lenda, Sophie Louveaux, and Anne Salaun (AIM Media Project, Spain, and ECLIPSE Project, Germany)</i>       |     |
| Energy Resellers - An Endangered Species? .....   | 68  |
| <i>Fredrik Ygge (EnerSearch, AB, Sweden)</i>  |     |
| Modeling Supply Chain Formation in Multiagent Systems. ....   | 94  |
| <i>William E. Walsh and Michael P. Wellman (University of Michigan, USA)</i>  |     |
| Jangter: A Novel Agent-Based Electronic Marketplace.....  | 102 |
| <i>Shim Yoon, Ju Young Yun, SooWoong Kim, and Juneha Kim (Samsung Ltd, Korea)</i>   |     |
| Bid Selection Strategies for Multi-agent Contracting in the Presence of Scheduling Constraints. ....  | 113 |
| <i>John Collins, Rashmi Sundareswara, Maria Gini, and Bamshad Mobasher (University of Minnesota, USA and DePaul University, USA)</i>          |     |
| Resource Allocation Using Sequential Auctions. ....   | 131 |
| <i>Craig Boutilier, Moisés Goldszmidt, Claire Monteleoni, and Bikash Sabata (University of Toronto, Canada, and Stanford University, USA)</i> |     |
| Profit-Driven Matching in E-Marketplaces: Trading Composable Commodities. ....  | 153 |
| <i>Apostolos Dailianas, Jakka Sairamesh, Vibby Gottemukkala, and Anant Jhingran (IBM T.J. Watson, USA)</i>                                    |     |
| Two-Sided Learning in an Agent Economy for Information Bundles.....   | 180 |
| <i>Jeffrey O. Kephart, Rajarshi Das, and Jeffrey K. MacKie-Mason (IBM T.J. Watson Center, USA, and University of Michigan, USA)</i>           |     |
| Optimal Auction Design for Agents with Hard Valuation Problems. ....  | 206 |
| <i>David C. Parkes (University of Pennsylvania, USA)</i>  |     |
| Auctions without Auctioneers: Distributed Auction Protocols. ....   | 220 |
| <i>Marc Esteva and Julian Padget (IIIA, Spain and University of Bath, UK)</i>   |     |
| <b>Author Index</b> .....   | 239 |