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Manolis Koubarakis (Eds.)

Agents and Peer-to-Peer Computing

First International Workshop, AP2PC 2002
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Revised and Invited Papers

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Series Editors

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

Volume Editors

Gianluca Moro
University of Bologna
Department of Electronics, Computer Science and Systems
Via Rasi e Spinelli, 176
47023 Cesena (FC), Italy
E-mail: gmoro@deis.unibo.it

Manolis Koubarakis
Technical University of Crete
Department of Electronic and Computer Engineering
Intelligent Systems Laboratory
University Campus - Kounoupidiana
73100 Chania, Crete, Greece
E-mail: manolis@intelligence.tuc.gr

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Preface

Peer-to-peer (P2P) computing is currently attracting enormous media attention, spurred by the popularity of file-sharing systems such as Napster, Gnutella, and Morpheus. In P2P systems a very large number of autonomous computing nodes (the peers) rely on each other for services. P2P networks are emerging as a new distributed computing paradigm because of their potential to harness the computing power of the hosts composing the network, and because they make their underutilized resources available to each other.

In P2P systems, peer and Web services in the role of resources become shared and combined to enable new capabilities greater than the sum of the parts. This means that services can be developed and treated as pools of methods that can be composed dynamically. The decentralized nature of P2P computing makes it also ideal for economic environments that foster knowledge sharing and collaboration as well as cooperative and non-cooperative behaviors in sharing resources. Business models are being developed that rely on incentive mechanisms to supply contributions to the system and methods for controlling free riding. Clearly, the growth and the management of P2P networks must be regulated to ensure adequate compensation of content and/or service providers. At the same time, there is also a need to ensure equitable distribution of content and services.

The wealth of business opportunities promised by P2P networks has generated much industrial interest recently, and has resulted in the creation of various projects, startup companies, special interest groups, and a working group for standardization activities. Compared to industry, the academic community has been somewhat slow in reacting to the P2P wave. Although researchers working in distributed computing, multiagent systems, databases, and networks have been using similar concepts for a long time, it is only recently that papers motivated by the current P2P paradigm have started appearing in high-quality conferences and workshops.

Research in agent systems in particular appears to be most relevant to P2P computing because, since their inception, multiagent systems have always been thought of as networks of equal peers. The multiagent paradigm can thus be superimposed on the P2P architecture, where agents embody the description of the task environments, the decision-support capabilities, the collective behavior, and the interaction protocols of each peer. The emphasis in this context on decentralization, user autonomy, ease and speed of growth that gives P2P its advantages also leads to significant potential problems. Most prominent among these problems are coordination, the ability of an agent to make decisions on its own actions in the context of the activities of other agents, and scalability, the value of the P2P systems lies in how well they scale along several dimensions, including complexity, heterogeneity of peers, robustness, traffic redistribution, etc. It is important to scale up coordination strategies along multiple dimensions to enhance their tractability and viability, and thereby to widen the application

domains. These two problems are common to many large-scale applications. Without coordination, agents may be wasting their efforts, squandering resources and failing to achieve their objectives in situations requiring collective effort.

This volume brings together the papers presented at AP2PC 2002, the 1st International Workshop on Agents and P2P Computing¹ that took place in Bologna on July 15, 2002 in the context of the 1st International Joint Conference on Autonomous Agents and Multi-Agent Systems (AAMAS 2002). AP2PC 2002 was devoted to the discussion of methodologies, models, algorithms and technologies, strengthening the connection between agents and P2P computing. This was realized by bringing together researchers and contributions from these two disciplines but also from more traditional areas such as distributed systems, networks and databases. In particular, the workshop aimed to address the following issues:

- Intelligent agent techniques for P2P computing
- P2P computing techniques for multiagent systems
- The Semantic Web, semantic coordination mechanisms and P2P systems
- Scalability, coordination, robustness and adaptability in P2P systems
- Self-organization and emergent behavior in P2P systems
- E-commerce and P2P computing
- Participation and contract incentive mechanisms in P2P systems
- Computational models of trust and reputation
- Community of interest building and regulation, and behavioral norms
- Intellectual property rights in P2P systems
- P2P architectures
- Scalable data structures for P2P systems
- Services in P2P systems (service definition languages, service discovery, filtering and composition, etc.)
- Knowledge discovery and P2P data mining agents
- Information ecosystems and P2P systems.

In response to the call for papers for AP2PC 2002, we received 19 papers. All submissions were thoroughly reviewed for scope and quality by the program committee. As a result of the review process, 9 full papers and 5 posters as short papers were accepted for presentation at the workshop. The volume was organized according to the following main aspects of agent and P2P computing covered by the accepted papers:

- P2P services
- Discovery and delivery of trustworthy services
- Search and cooperation in P2P agent systems
- Metadata management and content distribution

Among specific aspects we mention load balancing in P2P environments, market models for P2P systems, metadata in P2P systems, mobile agents and P2P systems, and specialized hardware for P2P computing.

¹ <http://p2p.ingce.unibo.it/>

Full revised versions of the papers, taking into account the comments and lively discussion that took place during the workshop, are included in this volume. The volume also includes three contributions invited by the panel Chair which address some issues raised in the context of the panel debate: namely whether agents can be a good abstraction for P2P systems, and which are the agent-based P2P emerging research challenges that will address the needs of real systems, such as semantics-based interoperability, cooperation and search, scalability and control decentralization, and self-organizing applications.

Finally, we are glad to thank the authors, the program committee members, the invited panelists Karl Aberer (EPFL, Switzerland), Sonia Bergamaschi (University of Modena and Reggio-Emilia), Paolo Ciancarini (University of Bologna), and Munindar P. Singh (North Carolina State University), the steering committee, and the two sponsors mentioned below that contributed with their support to the success of the workshop. To end, we would sincerely like to thank the more than 40 participants in this first edition of the workshop for their active contribution to the interesting debate during the presentations and the panel.

Gianluca Moro
Manolis Koubarakis
Aris M. Ouksel

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Table of Contents

Agents and Peer-to-Peer Computing: A Promising Combination of Paradigms	1
<i>Gianluca Moro (University of Bologna), Aris M. Ouksel (University of Illinois at Chicago), Claudio Sartori (University of Bologna)</i>	
Peer-to-Peer Services	
Peer-to-Peer Computing for Information Systems	15
<i>Munindar P. Singh, (North Carolina State University)</i>	
Peer Services: from Description to Invocation	21
<i>Manuel Oriol (University of Geneva)</i>	
Execution Environment of Peer-to-Peer Services in a Mobile Environment	33
<i>Tadashige Iwao, Makoto Okada (Fujitsu Laboratories Ltd.), Kazuya Kawashima, Satoko Matsumura, Hajime Kanda, Susumu Sakamoto, Tatsuya Kainuma (Fujitsu Prime Software Technologies Ltd.), Makoto Amamiya (Kyushu University)</i>	
Discovery and Delivery of Trustworthy Services	
An Agent-Based Approach for Trustworthy Service Location	45
<i>Pinar Yolum, Munindar P. Singh (North Carolina State University)</i>	
Trust-Aware Delivery of Composite Goods	57
<i>Zoran Despotovic, Karl Aberer (Swiss Federal Institute of Technology)</i>	
Engineering an Agent-Based Peer-To-Peer Resource Discovery System ...	69
<i>Andrew Smithson, Luc Moreau (University of Southampton)</i>	
Search and Cooperation in Peer-to-Peer Agent Systems	
Peer-to-Peer Paradigm for a Semantic Search Engine	81
<i>S. Bergamaschi, F. Guerra (Università di Modena e Reggio Emilia)</i>	
Modeling and Evaluating Cooperation Strategies in P2P Agent Systems .	87
<i>L. Penserini (University of Ancona), L. Liu, J. Mylopoulos (University of Toronto), M. Panti, L. Spalazzi (University of Ancona)</i>	
A Distributed Implementation of the SWAN Peer-to-Peer Look-Up System Using Mobile Agents	100
<i>Erwin Bonsma, Cefn Hoile (BTexact Technologies)</i>	

XII Table of Contents

HyperCuP – Hypercubes, Ontologies, and Efficient Search on Peer-to-Peer Networks	112
<i>Mario Schlosser (Stanford University), Michael Sintek (German Research Institute for Artificial Intelligence), Stefan Decker (Information Sciences Institute/USC), Wolfgang Nejdl (Stanford University)</i>	

Messor: Load-Balancing through a Swarm of Autonomous Agents	125
<i>Alberto Montresor (University of Bologna), Hein Meling (Norwegian University of Science and Technology), Özalp Babaoğlu (University of Bologna)</i>	

Posters

Metadata Management and Content Distribution

Market Models for P2P Content Distribution	138
<i>P. Antoniadis and C. Courcoubetis (Athens University of Economics and Business)</i>	

The Resource Management Framework: A System for Managing Metadata in Decentralized Networks Using Peer-to-Peer Technology	144
<i>Steffen Rusitschka, Alan Southall (Siemens AG, Corporate Technology)</i>	

Using an O-Telos Peer to Provide Reasoning Capabilities in an RDF-Based P2P-Environment	150
<i>Martin Wolpers, Ingo Brunkhorst (University of Hannover), Wolfgang Nejdl (Stanford University)</i>	

A Mobile Multi-agent System for Distributed Computing	158
<i>Stefan Kleijkers, Floris Wiesman, Nico Roos (Universiteit Maastricht)</i>	

Implementation of a Micro Web Server for Peer-to-Peer Applications	164
<i>F. Callegati, R. Gori, P. Presepi, M. Sacchetti (University of Bologna)</i>	

Author Index	171
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