

Agent-based Computing for Enterprise Collaboration – What Can Agents Learn from Human Collaboration?

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Abstract

The first “Agent-based Computing for Enterprise Collaboration” workshop at WETICE aimed at bringing together researcher in the field of collaboration supported by software agents. This paper briefly discusses the content of the papers as presented by the participating authors. Moreover, there is a summary of the main issues of the concluding panel discussions.

1 Introduction

“Agent-based Computing for Enterprise Collaboration” is a workshop in its first year at WETICE. In earlier years, similar workshops have addressed the general issue of web-based infrastructures and mechanisms for collaborative enterprises. However, this is the first workshop at WETICE that focuses, specifically, on how intelligent software agents can be used to address problems in this domain of automated enterprise collaboration.

In the past, on-line enterprises have collaborated among themselves mainly through information exchange. With the onset of such technologies as Semantic Web Services, Service-Oriented Architectures (SOA), and enhancements to bandwidth, these on-line businesses are realizing the flexibility of collaborating via the exchange of universally accessible services. However, with this flexibility comes the increase of complexity.

In organizing this workshop, we believe the autonomy and intelligence of software agents can be applied in this domain and lessen the complexity of both services-based

and informational collaboration. A major benefit of using agents is the ability to assist in the coordination and collaboration of humans and software mechanisms, alike. Agent-enacted collaboration and coordination can be extremely helpful in related areas such as Computer Supported Collaborative Work, Workflow and Supply Chain Management, Automation in Virtual Enterprises, and Services-based Composition.

In the following sections, we summarize the papers from the workshop that focus on the use of agents in domains such as electronic commerce, medical collaboration, and e-service composition. A common thread in each of these papers is a discussion on how agent capabilities, protocols, and paradigms can be used to address the problems of collaboration. Subsequent section presents the discussions that culminated the forum.

2 Overview of the Papers

We received papers from different countries and, after the review process, we decided to accept four full papers and one short paper. A positive point is that we had both papers that showed application fields and more perspective papers. All papers were presented at the workshop except the last, due to a sudden illness of the speaker.

Daniel Frey, Tim Stockheim, Peer-Oliver Woelk, and Roland Zimmermann proposed the paper “Integrated Multi-agent-based Supply Chain Management”. The authors propose the use of a multiple agent system for supply chain management with respect to such perspectives as planning, control, and execution. In addition, this approach considers nonfunctional concerns such as flexibility and reliability and incorporates the use

of industry-standard modeling techniques using the Unified Modeling Language (UML). There is also a positive evaluation of the approach based on the impact on throughput time.

The second paper was written by Stefan Kirn, Christian Heine, Rainer Herrler, and Karl-Heinz Krempels, and was entitled “Agent.Hospital - agent-based open framework for clinical applications”. In this paper, the authors present an agent-based architecture and framework to support the collaboration of distributed applications in the health care domain. The authors describe each of the components of this framework (partially implemented) and how certain agent characteristics and capabilities have relevance to specific operational concerns in the health care domain. Finally, the authors demonstrate their framework using a *clinical trials* scenario.

Ismail Khalil Ibrahim, Gabriele Kotsis and Wieland Schwinger propose the paper “Mapping Abstractions of Norms in Electronic Institutions”, where present electronic institutions as the agents’ counterpart of human organizations, in particular with regard of support, trust, and legitimacy in electronic commerce applications. They survey two approaches in which agents are governed by social norms, coordination and cooperation, and try to find out the similarity between them. Finally, they propose an appropriate logic to describe the norms in agent institutions.

In “A Case Study in Role-based Agent Interactions” Giacomo Cabri, Luca Ferrari and Letizia Leonardi propose a mobile agent based application that is exploited to study different kinds of agent interactions. Such interactions are managed separately from the agent logic (in particular from mobility) by means of roles. The paper shows the advantages of such an approach, which enables the development of flexible and reusable agent-based applications at the enterprise level to perform automatic or administrative tasks.

Zakaria Maamar and Fahim al Akhter, in the paper “An Agent-based Approach for Specifying a Web Service-oriented Environment” propose the use of software agents for the specification of a Web service-oriented environment. Their idea is that users can exploit agents to compose Web services into high-level business processes. The paper proposes three levels of specification: intrinsic, organizational/functional, and behavior.

3 A Comparison between Agent and Human Collaboration

The discussions of the workshop involved the authors

themselves and other people who attended the workshop. The organizers proposed a comparison between human and agent collaboration in order to focus the discussion.

All the participants agreed on the fact that agents are faster than humans in managing information, and have automated means of information processing. Nevertheless, there are still some features that agent developers can learn from human collaboration in engineering agent-based collaborative applications. In particular, the participants found out three features: *negotiation*, *rules* and *roles*. We remarked that these features are very important in open and dynamic environments, such as the Internet, where precise assumptions cannot be made and agents belonging to different applications interact in order to collaborate or to compete for resources.

With no doubt, agent collaboration should be more *flexible* than a simple request-reply model adopted in traditional distributed systems. We thought that agent developers should learn from human negotiation, which is a very common way to interact in the real life. The contract-net protocol and the auctions are widely exploited dynamic negotiation approaches in the agent area, but are there other kinds of negotiation that can be fruitfully exploited by agents?

With regard to *institutions*, we agreed on the need of *rules* that mandate the agent activities. Institutions can model human organizations leading to two advantages; on the one hand, agent interactions can be not only secure, but also fair, and respect the expected behavior; on the other hand, this modeling helps developers since the agent world becomes more similar to the human world, so easier to understand. The importance of rules is especially true in environments where agents from different applications meet and interact. But, norms can be useful also in collaborating agent systems, where sometimes it is difficult to control every single agent, and defining rules can enforce emerging behaviors. Rules can be mandatory (constraints) or expected (*norms*).

Finally, *roles* represent a useful means to develop some agent features, in particular interactions. A Role can be considered as a stereotype of behavior common to different agents. Martin Fowler says that roles are “some common behavior” of entities that “do not have the same behavior”. The main advantage of a role-based approach is the separation of concerns, but it leads also to flexibility, dynamism, reuse of solutions, context-dependency. Last but not least, roles are a concept quite close to the human society, thus they promote the advantages sketched in the previous paragraph.

With regard to the last two issues, an emerged question is how we can describe the rules and the agent collaboration, by some kind of notation. Two papers gave

two different answers: by an appropriate logic and by XML. Far from a definitive answer, we believe this is an open issue and propose the question to the greater community of researchers in the area.

4 Acknowledgements

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The slides containing the final presentation of the group discussions that were produced at the workshop are available on the Web at the location <http://agentgroup.unimo.it/WETICE03>.