

Guest Editorial

Special issue: Agent Based Computing: From Model to Implementation

Maria Ganzha^a, Marcin Paprzycki^b, Costin Badica^c and Rainer Unland^{d,*}

^a*Systems Research Institute, Polish Academy of Sciences, Warsaw and University of Gdansk, Warsaw, Poland*

^b*Systems Research Institute, Polish Academy of Sciences, Warsaw and Management Academy, Warsaw, Poland*

^c*Software Engineering Department, Faculty of Automatics, Computers and Electronics, University of Craiova, Bvd.Decebal, Craiova, Romania*

^d*University of Duisburg-Essen, Institute for Computer Science and Business Information Systems (ICB), Practical Computer Science, Data Management Systems and Knowledge Representation, Essen, Germany*

This special issue presents extended versions of the best papers of the 7th Workshop on Agent Based Computing: from Model to Implementation (ABC:MI'10). This workshop took place within the framework of the 5th International Multi-conference on Computer Science and Information Technology, on 18–20 October 2010 in Wisła, Poland.

The field of agent technology is rapidly maturing. One of key factors that influence this process is the gathered body of knowledge that allows in-depth reflection on the very nature of designing and implementing agent systems. As a result, we know better how to design and implement them. We also understand the most important issues to be addressed in the process. Therefore, on the top-most level, we see progress in development of methodologies for design of agent-based systems. Furthermore, these methodologies are usually supported by tools that allow not only top level conceptualization but guide the process towards implementation (e.g. by generating at least some code). Next, we can see that new languages for agent based systems are created, e.g. AML or API Calculus. Separately, tools / platforms / environments that can be used for design and implementation of agent systems have been through a number of releases, eliminating problems and adding new, important features. Resulting products are becoming truly robust and flexible. Furthermore, open source products (e.g. JADE) are surrounded by user communities, which often generate powerful ad-on components, further increasing value of existing solutions.

The ABC:MI'10 workshop mainly concentrated on all aspects of the process that leads from the model of the problem domain to the actual agent-based solution. These aspects covered both principled

*Corresponding author. E-mail: rainer.unland@icb.uni-due.de.

approaches and established practices of software engineering, aimed at producing high quality software. In this context, research into the application of agent-based solutions to key challenges faced by software engineering (e.g. reduction of costs and delivery times, coping with a larger diversity of problems) was of primary importance.

From contributions accepted (after refereeing by a minimum of two referees) and presented during the ABC:MI Workshop, the following six papers were selected:

An agent based network resource planner for workflow applications, by Zhiming Zhao, Paola Grosso, Jeroen van der Ham, Ralph Koning, Cees de Laat.

Scientific workflow applications often generate huge amounts of data, e.g., data collected from sensors or instruments or data produced during simulations. Such data is often processed at a different location from where the data is stored. Moving large quantities of data among different locations is thus a frequently invoked process. These data transfers often have high quality requirements on the network services, especially when the application requires steering from human interaction. Advanced networks such as hybrid networks make it feasible for high level applications to request network paths and service provisioning. However, current workflow applications tune the execution quality neglecting network resources. However, including network services in the resource scheduling would add another relevant dimension for the optimization of the runtime performance. This paper presents such an approach by proposing an agent-based planner, called NEWQoSPlanner, that complements existing workflow systems on selecting network resources in the context of workflow composition, scheduling and execution when advanced network services are available.

Agent-Based Approaches to Managing Fault-Tolerant Networks of Distributed Multi-Agent Systems, by Dejan Mitrovic, Zoran Budimac, Mirjana Ivanovic, and Milan Vidakovic.

Large-scale agent-based software solutions need to be able to assure constant delivery of services to end-users, regardless of the underlying software or hardware failures. Fault-tolerance of multi-agent systems is, therefore, an important issue. This paper presents two algorithms for an easy and flexible introduction of fault-tolerance to existing agent frameworks. The first algorithm is based on a new type of mobile agent, named ConnectionAgent, for efficient construction and maintenance of fault-tolerant multi-agent system networks. The algorithm was experimentally verified and then significantly optimized by relying on the mobility feature of ConnectionAgents. The second algorithm realizes a robust agent tracking technique based on a special type of agent, named RemnantAgent.

BeesyBees: A Mobile Agent-based Middleware for a reliable and Secure Execution of Service-based Workflow Applications in BeesyCluster, by Pawel Czarnul, Mariusz Matuszek, Michał Wójcik, Karol Zalewski.

Integrating distributed services into workflows comes with its own set of challenges, including security, coordination, fault tolerance and optimisation of execution time. This paper presents an architecture and implementation, called BeesyBees, which supports a distributed execution of workflow applications in BeesyCluster using agents. BeesyBees relies on BeesyCluster, which is a middleware that gives users access to distributed resources, permits to publish applications as services, defines service costs, grants access to other users' services and permits to consume services published by others. Workflows created in the BeesyCluster middleware are exported to BPEL and executed by BeesyBees agents in a distributed environment. The paper demonstrates that engaging several agents in the execution of a workflow in a distributed way is more efficient than a centralised approach. It also discusses negotiation time tradeoffs if too many agents are assigned to the task. An algorithm is proposed which supports the migration of agents to the location where the service is needed so that the workflow execution time is minimised. The paper also shows that an execution in the proposed environment is reliable even in the case of failures.

If a service fails, a task agent decides on a new equivalent service at runtime. If one of the task agents fails, another agent from the set of remaining agents takes over its responsibilities. The communication between the middleware, agents and services is encrypted.

An Analysis of Java-based Mobile Agent Platforms for Wireless Sensor Networks, by Francesco Aiello, Giancarlo Fortino, Stefano Galzarano, Raffaele Gravina, Antonio Guerrieri.

Wireless sensor networks (WSNs) represent a new form of pervasive and ubiquitous computing systems successfully exploited in many different application areas within which they will play an increasingly important role in future. However, the development of applications for WSNs is an extremely challenging and error-prone task, so that the need for high-level, effective programming approaches is evident. Among the programming paradigms proposed so far, the agent-based approach can be seen as an effective and promising solution on the basis of which a few software platforms for WSNs have been already developed. This paper proposes an in-depth analysis of the only two available Java-based mobile agent frameworks for WSNs: Mobile Agent Platform for Sun SPOT (MAPS) and Agent Factory Micro Edition (AFME). In particular, the architecture, programming model and basic performance of MAPS and AFME are described and compared. Moreover, a simple yet effective case study concerning a mobile agent-based monitoring system for remote sensing and aggregation is proposed. This case study is developed both in MAPS and AFME on Sun SPOTs so as to allow both an analysis of efficacy of their programming models and an evaluation of their performances.

Oversight of Reorganization in Massive Multiagent Systems, by Henry Hexmoor.

This paper explores mechanisms for converting organizations to an edge type organization. Beyond structural differences, organizations differ in information flow networks and information sharing strategies. The paper concentrates on organizational adaptation. A model of computational organization and reorganization is presented using dynamic roles. In addition to self-organization, the proposed model allows human oversight and guided reorganization. This article lays a foundation for automatic organizational adaptation and human supervision. The proposed model is exemplified with simulated soccer.

A Formal Model of Agent-Oriented Virtual Organisations and their Formation, by Jarred McGinnis, Kostas Stathis, Francesca Toni.

This paper presents a formal model for agent-oriented Virtual Organisations (VOs) for service grids. It also discusses an associated operational model for the creation of VOs. The model is intended to be used for describing different service grid applications based on multiple agents and, as a result, it abstracts away from any realisation choices of service grid applications, the agents involved to support the applications, and their interactions. Within the proposed framework VOs are created within societies of agents, where agents are abstractly characterised by goals and roles they can play within VOs. In turn, VOs are abstractly characterised by the agents participating in them with specific roles, as well as the workflow of services and corresponding contracts suitable for achieving the goals of the participating agents. The proposed framework is illustrated with the help of an earth observation scenario.

After resubmission, each paper was refereed according to the MAGS journal criteria and further improved. Here, we would like to express our gratitude to the referees of both original ABC:MI submissions, as well as of extended papers found in this Special Issue and, especially, to the two external reviewers Dr. Paola Grosso and Alex Muscar.