Software Engineering for Large-Scale Multi-Agent Systems – SELMAS'2002

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ABSTRACT

Objects and agents are abstractions that exhibit points of similarity, but the development of agent-based software poses other challenges to software engineering since software agents are inherently more complex entities. In addition, a large-scale multi-agent system needs to satisfy multiple stringent requirements such as reliability, security, interoperability, scalability, reusability, and maintainability. This workshop brought together researchers and practitioners to discuss the current state and future direction of research in software engineering for large-scale multi-agent systems. A particular interest was to understand those issues in the agent technology that difficult and/or improve the production of large-scale distributed systems.

1. MOTIVATION

Advances in networking technology have revitalized the investigation of the agent technology as a promising paradigm to engineer complex distributed software systems. In general, software agents are viewed as complex objects with an attitude. Like objects, agents include a specific set of services for their users. In fact, objects and agents exhibit points of similarity, but the development of agent-based software poses other challenges to software engineering since software agents are inherently more complex abstractions. A single agent is driven by beliefs, goals, plans, roles and a number of behavioral properties such as autonomy, adaptation, interaction, collaboration, learning and mobility. Each of these features introduces additional complexity to the system modeling, design and implementation, and consequently, increases the probability of exceptional situations manifestation, security pitfalls and so on. In addition, as the agent paradigm is devoted to the complex distributed system development, a large-scale multi-agent system encompasses multiple types of agents, each of them having distinct agency properties, and it needs to satisfy multiple stringent requirements such as reliability, security, adaptability, interoperability, scalability, maintainability, and reusability. However, many existing agent-oriented solutions are far from ideal; in practice, they are often built in an ad-hoc manner and are error-prone, not generally applicable, not scalable, and not dynamic.

In this context, research in multi-agent software engineering has been carried out according two different approaches: (i) agent-based software engineering, and (ii) object-oriented software engineering for multi-agent systems. Researchers in the first approach argue persuasively that multi-agent systems are often much more complex than object-oriented systems and hence the traditional object model generally fails to capture the complexity of multi-agent systems. In this approach, agents are a new abstraction that substitutes the object abstraction realizing the agent abstraction as a new software engineering paradigm. As a result, proponents of this approach claim it is necessary to develop new software engineering techniques, methods, and methodologies that are specifically tailored to agents. On the other hand, researchers in the second approach propose the integration of agents into the object-orientation world and, thus, they think of objects and agents as complementary abstractions. As a result, they have centered on using and extending existing techniques from object-oriented software engineering, such as design patterns, frameworks, and modeling languages, to multi-agent software engineering.

2. GOALS

The main goal of this workshop was to bring together researchers and practitioners from both research approaches to discuss the

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current state and future direction of research in software engineering for large-scale multi-agent systems. In addition, the workshop was a forum to learn about the latest research, and also discuss and exchange ideas concerning ongoing work. Particular interests of this workshop were:

- determine the overlap and integration of the two general research approaches for multi-agent software engineering,
- understand those issues in the agent technology that difficult or improve the production of large-scale distributed systems, and
- provide a comprehensive overview of software engineering techniques that may successfully be applied to deal with the complexity associated with realistic multi-agent software.

3. PROGRAM COMMITTEE

Alessandro Garcia (PUC-Rio – Brazil) - **Chair**
Alexander Romanovsky (University of Newcastle - UK)
Anand Tripathi (University of Minnesota - USA)
Andrea Omicini (University of Bologna – Italy) - **Chair**
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Martin Fredriksson (Blekinge Institute of Technology - Sweden)
Mike Wooldridge (University of London - UK)
Mohamed Fayad (University of Nebraska - USA)
Nick Jennings (University of Southampton - UK)
Ruy Milidiú (PUC-Rio - Brazil)
Simon Stobart (University of Sunderland - UK)
Van Parunak (Altarum Institute - USA)

4. WORKSHOP ACTIVITIES

SELMAS'2002 was a full-day event, structured around sessions of theme-oriented presentations. Following each session, the workshop participants engaged in structured discussion. Prior to the workshop, participants were asked to read all papers in his/her session. The idea was to foster the exchange of ideas and information in an informal setting, but with some boundaries placed on topics and time to ensure that the workshop stays on schedule.

The format of the sessions combined presentations on submitted position papers, invited talks, and focused discussion groups. SELMAS'2002 provided an opportunity for exchanging information related to exciting new research and empirical results in areas including (but not limited to):

- Comparative studies between multi-agent and OO systems
- Experiments and case studies
- Advanced separation of concerns
- Design patterns, design principles, and architectural styles
- Frameworks and software architectures
- Reflection and meta-level software architectures
- Coordination technologies, infrastructures, and tools
- Domain-specific languages
- Requirements engineering
- Fault-tolerance techniques
- Software testing, verification and validation techniques
- Analysis and design methodologies
- System modeling
- Product and process metrics

By assembling together a diverse set of people with expertise in this broad range of topics, we motivated the creation of the milieu necessary to focus our attention on themes that integrate rather than differentiate our perspectives on software engineering for large-scale systems. At the end of the workshop there was a general discussion, including a brainstorming session about areas or topics of research that the participants perceived as important.

5. WORKSHOP OUTPUTS

All the results obtained by discussion were summarized and published as a technical report and made electronically available in the workshop web site. It aims to highlight outstanding issues that should form a part of the forthcoming research agenda. For further details, please visit our web site:

www.teccomm.les.inf.puc-rio.br/selmas2002/