

# Software Engineering for Large-Scale Multi-Agent Systems – SELMAS'2003

Carlos Lucena    José Alberto Sardinha  
Alessandro Garcia

Departamento de Informática – Grupo TecComm  
Pontifícia Universidade Católica do Rio de Janeiro - Brazil  
{lucena,sardinha,afgarcia}@inf.puc-rio.br

Alexander Romanovsky  
School of Computing Science  
University of Newcastle upon Tyne - UK  
alexander.romanovsky@ncl.ac.uk

Jaelson Castro

Centro de Informática  
Universidade Federal de Pernambuco - Brazil  
jbc@cin.ufpe.br

Paulo Alencar    Donald Cowan

School of Computer Science  
University of Waterloo - Canada  
{palencar, dcowan}@csg.uwaterloo.ca

## ABSTRACT

Objects and agents are abstractions that exhibit points of similarity, but the development of multi-agent systems (MASs) poses other challenges to Software Engineering since software agents are inherently more complex entities. In addition, a large MAS needs to satisfy multiple stringent requirements such as reliability, trustability, security, interoperability, scalability, reusability, and maintainability. This workshop brings together researchers and practitioners to discuss the current state of the art and the future research directions in software engineering for large-scale MASs. A particular interest is to understand those issues in the agent technology that make it difficult and/or improve the production of complex 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. Nowadays, the agent technology has been applied in a wide range of application domains, including e-commerce, human-computer interfaces, telecommunications, and concurrent engineering. In general, software agents are viewed as complex objects with an attitude. Like objects, agents provide a specific set of services for their users. In fact, objects and agents exhibit points of similarity, but the development of multi-agent systems (MASs) poses other challenges to Software Engineering since software agents are inherently more complex abstractions.

A single software agent is driven by goals, knowledge, and a number of behavioral properties such as autonomy, adaptation, interaction, collaboration, learning and mobility. While these features introduce additional complexity to the different phases of the software process, there are many techniques for dealing with individual agents or systems built using only few agents. Unfortunately, existing software engineering approaches are still unable to cope with the complexity of large MASs. It is because software engineering for MASs is still in its infancy. MAS features are now being applied to the development of large industrial software systems. Such systems involve hundreds, perhaps thousands of agents, and there is a pressing need for software engineering techniques that allow their complexity to be effectively managed, and principled methods are also required to guide the process of MAS development. Without adequate development techniques and methods, such systems will not be

sufficiently dependable, trustable, extensible, difficult to comprehend, and their components will not be reusable.

The complexity associated with large MASs is not straightforward and involves numerous facets and dimensions. When a huge number of agents interact over heterogeneous environments, various phenomena occur which are not as easy to explain as the behavior of few agents in a closed environment. As the multiple software agents become highly collaborative, new problems appear. It makes their coordination and management more difficult and increases the probability of manifestation of heterogeneous exceptional situations, security holes, privacy violations, unexpected global effects, and so on. Moreover, since users and software engineers delegate more autonomy to their MASs, and put more trust in their results, new concerns arise in real-life applications. Commercial success for MAS applications will require scalable solutions based on software engineering approaches in order to enable reuse and effective deployment. However, many existing agent-oriented solutions are far from ideal; in practice, the systems are often built in an ad-hoc manner and are error-prone, not scalable, not dynamic, and are not generally applicable to large-scale MAS.

## 2. GOALS

This workshop follows up on the success of the 1st Workshop on Software Engineering for Large-Scale Multi-Agent Systems (SELMAS'02), held in Orlando, USA, May 19, 2002, as part of the ICSE'02. The 1st SELMAS workshop was very successful due to the high quality of the submissions, the active participation of the audience, the exceptional profile of the panelists, and the edition of a Springer book publishing extended workshop papers. The goal of this workshop is to bring together researchers and practitioners from both approaches to discuss the current state of the art and the future research directions in software engineering for large-scale MASs. Particular interests of this workshop are:

- Investigate the overlap and integration of agent-oriented software engineering and agent-based software engineering;
- Understand those issues in the agent technology that difficult and/or improve the production of complex distributed systems;
- Provide a comprehensive overview of existing software engineering techniques and methods that may successfully be

applied to deal with the complexity associated with realistic multi-agent software.

### 3. PROGRAM COMMITTEE

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A. Romanovsky (Univ. Newcastle upon Tyne-UK) – **Chair**  
Anand Tripathi (University of Minnesota - USA)  
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Martin Griss (HP Research Laboratory - USA)  
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Michael Stal (Siemens - Germany)  
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Tom Maibaum (King's College London - UK)  
Van Parunak (Altair Institute - USA)  
Yannis Labrou (Fujitsu Laboratories of America - USA)

### 4. WORKSHOP ACTIVITIES

SELMAS'2003 is a two full-day event, structured around sessions of theme-oriented presentations. Following each session, the workshop participants will engage in structured discussions. Prior to the workshop, participants will be asked to read all papers in his/her session. The main purpose is 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 combines presentations on submitted position papers, invited talks, and focused discussion groups. SELMAS'2003 provides an opportunity for exchanging information related to exciting new research and empirical results in areas including (but not limited to):

- Software engineering theories for large-scale MAS
- Comparative studies between MAS and OO systems
- Experiments and case studies with large MAS development
- Advanced separation of concerns in the context of MAS
- Design patterns, design principles, and architectural styles
- Frameworks and software architectures
- Reflective software architectures
- Coordination architectures, infrastructures, and tools
- Domain-specific languages for MAS
- Requirements engineering for MAS
- Software reliability engineering and MAS
- Exception handling and fault-tolerance techniques
- Mobility and security issues in large MAS
- Software engineering techniques for resource-bounded MAS
- MAS development and pervasive computing
- Verification and validation techniques for MAS
- Software development environments for real-life MAS
- Modeling of large MAS
- UML application to large-scale MAS
- Methodologies for agent-oriented analysis and design
- Testing and metrics for MAS

By assembling together a diverse set of people with expertise in this broad range of topics, we will motivate 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 MAS. At the end of the workshop there will be 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 will be summarized and published as a technical report and made electronically available in the workshop web site. The aim is 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/selmas2003](http://www.teccomm.les.inf.puc-rio.br/selmas2003)**