

## Editorial

**Tristan Behrens · Jürgen Dix ·  
Jomi Hübner · Michael Köster**

Published online: 13 July 2011  
© Springer Science+Business Media B.V. 2011

### Preface

This follow-up special issue, “The Multi-Agent Programming Contest: Environment Interface and Contestants in 2010” (edited by Tristan Behrens, Jürgen Dix, Jomi F. Hübner and Michael Köster), contains, besides the descriptions of the approaches used by the 2010 contestants (in the same format as in the first special issue), a paper proposing an environment interface standard. The question of the precise structure of an environment and the interplay between it and an agent system (via some standardized interfaces) is an important one and no consensus is reached yet. The authors discuss this problem thoroughly and work towards a solution.

The descriptions of the agent systems used by the contestants in this and the previous special issue follow a template that we asked the contestants to fill out. We believe this makes a comparison between the approaches much easier and helps the reader to understand the differences and similarities. Additionally, each system description ends with a short compilation of the answers to some particular questions. In the rest of the editorial we present the structure of the template and state the questions we wanted the contestants to answer.

---

T. Behrens (✉) · J. Dix · M. Köster  
Department of Informatics, Clausthal University of Technology,  
Julius-Albert-Str. 4, Clausthal-Zellerfeld 38678, Germany  
e-mail: behrens@in.tu-clausthal.de

J. Dix  
e-mail: dix@in.tu-clausthal.de

M. Köster  
e-mail: michael.koester@tu-clausthal.de

J. Hübner  
Department of Automation and Systems Engineering,  
Federal University of Santa Catarina, P.O. Box 476,  
Florianópolis, SC, 88040-900, Brasil  
e-mail: jomi@das.ufsc.br

## 1 Introduction

1. Explain the background of your multi-agent system development activities. Are you developing or working on a specific multi-agent system platform in your research group? What are the state of art of your relevant research?
2. What were your motivations for joining this contest? What were your objectives that you aimed to achieve in participating the contest?
3. Explain briefly the preparation and set up of your participation in the contest. Which machines and infrastructures did you use? Which software did you use?

## 2 System analysis and specification

1. Describe the requirements that you used to develop you multi-agent system. Please indicate and explain if you have used a specific requirement analysis approach.
2. How is your multi-agent system specified? Please provide a detailed description of the specification of (1) individual agents, (2) the interaction between agents (or their organization), and (3) the interaction between agents and the simulation environment? If available, please provide formal or semi-formal specifications.
3. Did you use any existing multi-agent system methodology such as Prometheus, Gaia or Tropos? If so, please provide a detailed description of generated specifications. If not, explain how did you have specified your system?
4. How are the following features specified: *autonomy*, *role*, *proactiveness* and *communication*, *team working*, and *coordination*?
5. Is your system a truly multi-agent system or rather a centralised system in disguise? It is important to explain if you use a centralized or distributed coordination mechanism.

## 3 System design and architecture

1. How is your multi-agent system designed? Please provide a detailed description on the design and architecture of (1) individual agents, (2) the interaction between agents (or their organization), and (3) the interaction between agents and the simulation environment?
2. Did you use any existing multi-agent system design methodology to define your system architecture? If so, please provide a detailed description of generated design documents. If not, explain the architecture of your system?
3. How are the following features reflected in your system architecture: *autonomy*, *role*, *proactiveness* and *communication*, *team working*, and *coordination*?

## 4 Programming language and execution platform

1. Explain the technology you used to develop your multi-agent system. Which programming language and development environment did you use to implement your multi-agent system?

2. Provide an overview of the characteristic syntactic constructs (of the employed programming language) that facilitates the implementation of multi-agent issues such as individual agents, agents' organization and coordination structure, and their interaction with the simulation environment. If possible, you can present the syntax of the used programming language. Explain the semantics of these constructs informally.
3. How is the designed architecture (both multi-agent and individual agent architectures) are mapped to programming codes, i.e., how are specific agent-oriented concepts and designed artifacts implemented?
4. Provide a description of the general structure of your programming code. For example, which packages, classes, objects, agents, or artifacts did you use?
5. Which strategies and algorithms did you use in developing different functionalities of individual agents and their coordination mechanisms?

### **5 Agent team strategy**

1. Describe the navigation algorithms, e.g.,
  - obstacle avoiding,
  - agent navigation,
  - strategy for finding and herding cows
  - opponent blocking,
  - robbing opponents.
2. Describe the team coordination strategy (if any).
3. Does your team strategy use some distributed optimization technique w.r.t. e.g., minimizing distances walked by the agents?
4. Describe and discuss the information exchanged (and shared) in the agent team.
5. Describe the communication strategy in the agent team. Can you estimate the communication complexity in your approach?
6. How could the overall strategy of your team be improved in the future based on your experiences during the contest?

### **6 Technical details**

1. Did your system do some background processing? Under background processing we understand some computation which happened while agents of the team were *idle*, i.e., between sending an action message to the simulation server and receiving a perception message for the subsequent simulation step.
2. If possible, please discuss additional technical details of your system like e.g., failure/crash recovery and alike.
3. How stable was your system in retrospective? How could you improve the stability in the future?

### **7 Discussion and conclusion**

In this section please expand a bit on your experience with the contest organization, the proposed scenario, and the setup of the actual contest. Please indicate what do

you see as pros/cons of participating in the Contest with respect to your research in the field.

1. Critical discussion of your approach to the development of the agent team.
2. Did you gain some insights/experiences into developing multi-agent system in the course of participating in the Agent Contest so far? If so, what kind of insights?
3. Describe and discuss possible problems that you face in choosing approach, programming platform or technical infrastructure to participate in this contest?
4. How could the scenario be extended and which insights/results do you expect from these extensions?