AgentLink Technical Forum Group on

Multiagent Resource Allocation (TFG-MARA)

28th February & 1 March 2005
Jožef Stefan Institute, Ljubljana, Slovenia

organised as part of
THE SECOND AGENTLINK III TECHNICAL FORUM (AL3-TF2)

Aims and Scope

Negotiation over the allocation of resources is widely regarded as one of the central research issues in the multiagent systems community. The AgentLink Technical Forum Group on Multiagent Resource Allocation (TFG-MARA) aims at providing a venue for the exchange of ideas in this area and puts special emphasis on the knowledge transfer between microeconomics and social choice theory on the one hand and computer science and AI on the other.

At the level of individual agents, TFG-MARA will address the compact representation of preferences, building on both classical decision theory and recent advances in logic-based representation formalisms. At the system level, the overall performance of a multiagent system for resource allocation can be measured in terms of various notions of social welfare as studied in welfare economics. Here we are particularly interested in "non-standard" notions of social welfare, including those imposing different fairness constraints on allocations. Another focus of TFG-MARA will be the complexity of multiagent resource allocation problems. This includes the computational complexity of relevant decision and optimisation problems, as well as issues in communication complexity (length of negotiation processes, amount of information exchanged between agents). The scope of this TFG includes both (combinatorial) auction-based resource allocation mechanisms and less stringent forms of negotiation and it will address the respective merits and drawbacks of different negotiation topologies (one-to-one, auctions, multilateral). Finally, we are interested in the implementation of prototype systems, which can inform theoretical research by providing empirical data and a test-bed for negotiation heuristics. In short, topics of interest include, but are not limited to:

- Compact representation of agent preferences
- Preference aggregation and notions of social welfare
- Resource allocation and fair division
- Complexity of negotiation
- Comparison of different negotiation topologies
- Protocol design for negotiation over resources
- Implementation, simulation, experimentation, heuristics

Promoters

- Yann Chevaleyre, LAMSADE, University of Paris-Dauphine
- Paul E. Dunne, Department of Computer Science, University of Liverpool
- Ulle Endriss (chair), Department of Computing, Imperial College London
- Jérôme Lang, IRIT, University Paul Sabatier, Toulouse
- Nicolas Maudet, LAMSADE, University of Paris-Dauphine
- Juan A. Rodríguez-Aguilar, Artificial Intelligence Research Institute (IIIA-CSIC), Barcelona

Contact

For all enquiries regarding TFG-MARA, please contact Ulle Endriss (`ue@doc.ic.ac.uk`). For up-to-date information on the activities of the group, please visit the TFG-MARA website:

`http://www.doc.ic.ac.uk/~ue/MARA/`

AgentLink

TFG-MARA is sponsored by AgentLink III, the premier Coordination Action for Agent-based Computing, funded by the European Commission's 6th Framework Programme. For more information, please visit the AgentLink website:

`http://www.agentlink.org/`

Programme

The first meeting of TFG-MARA will be held as part of the Second AgentLink III Technical Forum at the Jožef Stefan Institute in Ljubljana, Slovenia. The Technical Forum runs from Monday 28 February until Wednesday 2 March 2005; TFG-MARA takes place on Monday afternoon and on Tuesday morning. For details of the venue, please refer to the AL3-TF2 programme, which is available at `http://www.agentlink.org/activities/al3-tf/tf2/`.

Monday, 28 February 2005

14.15–14.30	**Welcome**
14.30–16.15	**Session A** (Chair: Jérôme Lang)
14.30–15.05	Yann Chevaleyre (LAMSADE, Pars-Dauphine) *On Maximal Classes of Utility Functions for Efficient on-to-one Negotiation*
15.05–15.40	Paul E. Dunne (Liverpool) *Complexity Issues in Multiagent Resource Allocation*
15.40–16.15	Nicolas Maudet (LAMSADE, Pars-Dauphine) *Notes on the Communication Complexity of Multilateral Negotiation*
16.15–16.30	*Coffee Break*
16.30–18.15	**Session B** (Chair: Juan A. Rodríguez-Aguilar)
16.30–17.05	Sylvain Bouveret (IRIT, Toulouse) *Efficiency and Envy-freeness in Fair Division of Indivisible Goods*
17.05–17.40	Michel Lemaître (ONERA, Toulouse) *Equitable Allocation of Earth Observing Satellite Resources*
17.40–18.15	Ulle Endriss (Imperial College London) *Multiagent Resource Allocation: What to optimise, how, and why?*
18.30–19.15	**Plenary Session** (Introduction to AL3-TF2; The AL3 Roadmap)
19.30–20.30	**Drinks Reception**

Tuesday, 1 March 2005

9.00–10.30	**Session C** (Chair: Nicolas Maudet)
9.00-9.35	Raj Dash (Southampton) *Trust-based Mechanism Design*
9.35–10.10	Juan A. Rodríguez-Aguilar (IIIA-CSIC, Barcelona) *Towards Automated Procurement via Agent-aware Negotiation Support*
10.10–10.30	Steve Phelps (Liverpool) *JASA: A High-performance Open-source Auction Simulator*
10.30–10.45	*Coffee Break*
10.45–13.00	**Session D** (Chair: Ulle Endriss)
10.45–11.20	Jérôme Lang (IRIT, Toulouse) *Logical Languages for Compact Preference Representation*
11.20–12.00	Position Statements (see pages 6–10)
12.00–13.00	Discussion: Open Questions / Connections / Future Plans
13.00–18.30	*Breaks and opportunity to participate in other TFGs*
18.30–19.15	**Plenary Session** (Reports on MARA and other TFGs; Discussion)
20.30–	**Social Dinner**

For the discussion on Tuesday morning, we plan (1) to further discuss any questions raised during the presentations (including open problems in the field); (2) to identifying connections between the work carried out at different sites; and (3) to discuss future plans for TFG-MARA.

Talk Abstracts

- Sylvain Bouveret (IRIT, Toulouse)
  Efficiency and Envy-freeness in Fair Division of Indivisible Goods: Logical Representation and Complexity

  We study fair division of indivisible goods among agents from the point of view of compact representation and computational complexity. We identify the complexity of several problems, including that of deciding whether there exists an efficient and envy-free allocation when preferences are represented in a succinct way. Many of these problems are located at the second level of the polynomial hierarchy. We also draw connections to nonmonotonic reasoning.

- Yann Chevaleyre (LAMSADE, Paris-Dauphine)
  On Maximal Classes of Utility Functions for Efficient on-to-one Negotiation

  In the framework of multiagent resource allocation, reaching an optimal allocation potentially requires very complex multilateral deals. Therefore, we are interested in identifying classes of utility functions such that any negotiation conducted by means of deals involving only a single resource at a time is bound to converge to an optimal allocation whenever all agents model their preferences using these functions. We show that when side-payments are allowed, the class of modular utility functions is not only sufficient but also maximal, in the sense that no superset of this class does permit convergence. A similar result is shown for deals without side-payments.

- Raj Dash (Southampton)
  Trust-based Mechanism Design

  We define trust-based mechanism design as an augmentation of traditional mechanism design in which agents take into account the degree of trust that they have in their counterparts when determining their allocations. To this end, we develop an efficient, individually rational, and incentive compatible mechanism based on trust. This mechanism is embedded in a task allocation scenario in which the trust in an agent is derived from the reported performance success of that agent by all the other agents in the system. We also empirically study the evolution of our mechanism when iterated and show that, in the long run, it always chooses the most successful and cheapest agents to fulfil an allocation and chooses better allocations than other comparable models when faced with biased reports from agents.

- Paul E. Dunne (Liverpool)
  Complexity Issues in Multiagent Resource Allocation

  A number of solution paradigms have been proposed in order to address the question of how best to distribute a finite resource collection among a set of agents. A significant problem, however, is that, excepting very restricted environments, all such methods ultimately face issues of computational intractability. Such is the case whether one employs highly centralised mechanisms, e.g. combinatorial auctions, or more distributed methods. In this talk recent results in this area will be reviewed concerning both the issue of determining the existence of allocations with specific attributes and properties of a particular distributed negotiation regime. Some open questions and conjectures will also be discussed.

- Ulle Endriss (Imperial College London)
  Multiagent Resource Allocation: What to optimise, how, and why?

  The aim of this talk is to make a first step towards enumerating some of the design parameters relevant to the specification of a of system for multiagent resource allocation. In particular, I shall discuss some of the options available when choosing an allocation procedure (centralised or distributed), a language to encode agent preferences (balancing expressiveness and succinctness), and a metric for assessing overall system performance (corresponding to a suitable notion of social welfare).

- Jérôme Lang (IRIT, Toulouse)
  Logical Languages for Compact Preference Representation

  The specification of a decision making problem needs before all the expression of the preferences of the agent over the set of feasible alternatives. Now, in many real-world domains, the set of alternatives is the set of assignments of a value to each of a given set of variables. In such cases, there are exponentially many alternatives and it is not reasonable to ask agents to report their preference in an explicit way. For this reason, several logical languages have been studied in Artificial Intelligence for encoding compactly preference relations or utility functions over a set of alternatives. Such preference representation languages are often built up on propositional logic, and allow for a much more concise representation of the preference structure than an explicit enumeration, while preserving a good readability and hence a similarity with the way agents express their preferences in natural language. This talk tries to give a synthetic review of these languages, especially from the point of view of complexity and succinctness issues.

- Michel Lemaître (ONERA, Toulouse)
  Equitable Allocation of Earth Observing Satellite Resources

  Large space projects like Earth Observing Satellites (EOS) are often co-funded by several agents (countries, civil and military agencies, ...). Accordingly, their exploitation must take into account a specific requirement: the allocation of resources among the different agents must be equitable. But it must also be efficient, that is, the available resources must not be under-exploited. This talk will describe the problem of defining equitable and efficient allocations of resources, in the context of EOS mission management. The context of EOS is stated, then the problem is formally defined. Different procedures are proposed to solve it, based on different ways of taking into account the inevitable trade-off between efficiency and equity.

- Nicolas Maudet (LAMSADE, Paris-Dauphine)
  Notes on the Communication Complexity of Multilateral Negotiation

  While the complexity of a multilateral negotiation framework can be studied abstractly, we focus in this talk on different notions of complexity relevant to agents engaged in a negotiation: How many deals are required to reach an optimal allocation? How many communicative exchanges are required to agree on one such deal? How expressive a communication language do we require? How complex is the reasoning task faced by each agent at each step? How complex is it to identify rational deals? We conclude by giving examples of concrete protocols designed to tame this last type of complexity.

- Steve Phelps (Liverpool)
  JASA: A High-performance Open-source Auction Simulator

  JASA is a high-performance auction simulator that allows researchers in agent-based computational economics to run trading simulations using a number of different auction mechanisms. In this talk, I will give a brief overview of the JASA's features and design objectives.

- Juan A. Rodríguez-Aguilar (IIIA-CSIC, Barcelona)
  Towards Automated Procurement via Agent-aware Negotiation Support

  Negotiation events in industrial procurement involving multiple, highly customisable goods pose serious challenges to buying agents when trying to determine the best set of providing agents' offers. Typically, a buying agent's decision involves a large variety of constraints that may involve attributes of a very same item as well as attributes of multiple items. In this talk we describe iBundler, an agent-aware negotiation service to solve the winner determination problem considering buyers' and providers' constraints and preferences.

- Peter Gradwell and Julian Padget (Bath)
  Distributed Resource Allocation

  Combinatorial auctions (CA) are an obvious solution to the optimal allocation of bundles of heterogeneous resources (e.g. a database, a math library, cpu time), such as those required to support Grid computations. However clearing a CA is NP-complete and requires complete knowledge of all bids and goods which is unrealistic for the Grid, where participants are disparate and unrelated.

  In response to this problem we are developing an analogue of physical commodities markets in which there is a single auction space, but multiple (continuous double) auctions taking place. Due to the radically different nature of the approaches, an analytical comparison seems infeasible at this stage, so we are developing a simulation to enable empirical comparison of the two.

  Our Grid Commodities Market (GCM) is animated by trader agents who seek to put together bundles, either to order, or speculatively. The CA is purely algorithmic, whereas the GCM has the characteristics of a complex system, where many factors could influence outcomes, such as incompleteness of knowledge, trust, urgency, time to delivery and reputation.

  The credibility of the Grid Commodities Market (GCM) approach depends on how well its performance compares against a classic CA. Is it possible to achieve optimality with multiple separate auctions as we would in a single CA? Can we solve more complex problems within some bounds of the optimal solution? What is the trade-off? We believe that for a simple optimisation a CA will be most effective, whilst it becomes less effective as the complexity and scale of the problem increases.

  From this theoretical starting point, we are building a simulation environment to help us compare and contrast the performance model of a CA and a GCM with a view to determining the point at which the performance model of the two strategies diverges and at which point the GCM system offers a scalable approach beyond that which the CA can offer. A second spur of this work is to determine, if possible, how close the GCM solution approaches Pareto optimal, whether this can be bounded and what factors affect the proximity of GCM to Pareto optimal.

  Following on, we intend to integrate the GCM into some of the better known grid resource management frameworks, such as Globus (`http://www.globus.org/`) so that it can take advantage of our scalable auction based allocation system—thus making auction based allocation for disparate systems seamlessly available.

- Geert Jonker (Utrecht)
  Mechanism Design for Airport Traffic Planning

  We aim to implement agent techniques in the domain of airport traffic tactical planning. In the last stage of planning, just before execution, various disrupting events can occur that disrupt the planning at an airport. Determining the best way to solve these disruptions is a typical multiagent resource allocation problem, in the sense that it has to satisfy certain criteria: efficiency, fairness, incentive compatibility. Efficiency: the solution should maximize total utility. Fairness: agents should be equally happy (this is because no airline would accept being delayed all the time while others aren't). Incentive-compatibility: we need agents to supply their preferences over possible solutions, but in such a way that it is unattractive for them to lie, i.e., they are not tempted to manipulate the outcome. We have found that these criteria are difficult to combine. Our approach thus far has been to develop a decision mechanism based on the Clark Tax mechanism. This mechanism is a well known incentive compatible mechanism that achieves efficiency. We tried to extend this mechanism to achieve fairness by remembering histories of utilities of agents, and involving this factor in the decision process. In this way we would get solutions that maximize both efficiency and fairness in the long run. However, these histories cancelled the incentive-compatibility property; under certain circumstances it would be beneficial for an agent to lie.

This outcome led us to conjecture that fairness is incompatible with incentive-compatibility. We are currently looking into this and hoping to prove it.

- Beatriz López, Pere Urra, Silvia Suárez and Isabel Cuevas (IIiA, Girona)
  Multi-Agent Resource Allocation for Collaborative and Competitive Scenarios

  In this short position statement we are describing the problems we are currently dealing with, in order to show our interest on the activities and results of the AgentLink TFG on Multi-Agent Resource Allocation. We are first introducing the problem domains, then we provide some sketches of our research lines, and we end by giving some data regarding our funding projects and publications.

  Which are the problems we are dealing with? Our research is concerned with resource allocation in the following problem domains:

  – Crisis management. How we can coordinate rescue team agents (resources) to perform rescue activities (victim rescue, fire extinguishing, etc.) in a disaster scenario? In such a scenario communication infrastructures are damaged and agents have access mainly to local information. Rescue activities require the collaboration of different kind of agents. For example, an ambulance team can rescue a victim if the fire is first extinguished by fire brigades. Moreover, each rescue agents has some limited capabilities: water tanks, hose length, etc. Which agent must help which other agent in a rescue activity? The experimental platform we are currently using is Robocup Rescue.

  – Inter-urban transport. European legislation regarding passenger safety in interurban transport are making drive allocation a difficult task for human operators. Driving times should be combined with presence and waiting times, to compute the overall driving journey of a driver, that must be below a maximal value (8 hours a day) with some exception (9 hours is allowed under specific situations). Drivers licenses constraint the kind of buses to be assigned to a given driver, while buses features are normally determined by the kind of service to be performed (amount of people, distance, etc). How to allocate drivers to buses regarding the client services? How many drivers? How to re-allocate drivers in case of incidences?

  – Ambulance allocation. Ambulance service in Spain is carried out by private companies. When a citizen requires the service of an ambulance, either by phone or by means of a health center, it is necessary to decide which ambulance will bring the patient to the hospital. Which one should be chosen? The closest one or the trustworthy one? The first scenario is clearly a collaborative one. The second problem is half collaborative and half competitive, since personal interest of drivers can be taken into account in the allocation process. The last scenario is, unfortunately, a competitive one: ambulance companies are paid according to the number of services provided.

  In order to deal with the problems described above, we are investigating in the following research lines: (1) Distributed constraint satisfaction: specially regarding the inter-urban transport problem, in which complex constraints should be taken into account. (2) Combinatorial auctions: in order to deal with the ambulance allocation problem and also in the crisis management problem. Especially the latter, poses us some challenges regarding the continuous arrival of new tasks, and precedence and capacity constraints on resources. We are currently running the MEC Spanish project TIN2004-06354-C02-02 that gives us financial support from January 2005 to December 2007. On December 2004, we finish the MCYT Spanish project DPI2001-2094-C03-01.

[1] López, B., Suárez, S., de la Rosa, J.L. Task allocation in rescue operations using combinatorial auctions. *Artificial Intelligence Research and Development* IOS Press, 2003.

[2] Suárez, S., López, B., de la Rosa, J.L. MCD method for resource distribution in a large-scale disaster. *X Conferencia de la Asociación Española para la Inteligencia Artificial*, 2003.

[3] Suárez, S., López, B., de la Rosa, J.L. Cooperation strategies for strengthening civil agents lives in the RoboCup-Rescue simulator scenario. *First International Workshop on Synthetic Simulation and Robotics to Mitigate Earthquake Disaster (Robocup)*, 2003.

[4] Suárez, S., López, B., de la Rosa, J.L. Girona-Eagles Rescue Team. *RoboCup-2003*.

[5] Suárez, S. *Resource and task allocation in distributed environments. A Multi-agent system approach*. MSc thesis, University of Girona, 2004.

[6] Suárez, S., López, B., de la Rosa, J.L. *The use of combinatorial auctions for resource and task allocation in disaster situations*. Report IIiA, 2004.

[7] Suárez, S., López, B., de la Rosa, J.L. *A combinatorial auction algorithm for dynamic and unpredictable environments. Application to a disaster scenario*. Report IIiA, 2004.

[8] Suárez, S., López, B., de la Rosa, J.L. *Improving heuristics in a combinatorial auction mechanism for task allocation in disaster environments*. Report IIiA, 2004.

- Ana Madureira (GECAD, Polytechnic of Porto)
  Multi-Agent System for Distributed Manufacturing Scheduling with Genetic Algorithms and Tabu Search (MASDScheGATS)

  Traditional scheduling methods, encounter great difficulties when they are applied to some real-world situations This fact incites researchers to explore new directions. Multi-Agent technology has been considered as an important approach for developing industrial distributed systems. The problem of dynamic scheduling is one that is receiving increasing attention amongst both researchers and practitioners. Researchers have begun to try solving the complex dynamic scheduling problems in a distributed way using the Multi-Agent paradigm. The Multi-Agent paradigm represents one of the most promising approaches to building complex, flexible, and cost-effective scheduling systems because of its distributed and dynamic nature.

  In MASDScheGATS (Multi-Agent System for Distributed Manufacturing Scheduling with Genetic Algorithms and Tabu Search) Project we will model a Manufacturing Systems by means of a Multi-Agent Systems, where each agent may represent a processing entity (e.g. a machine). The project has as objective to deal with the complex problem of Dynamic Scheduling in Manufacturing Systems. We will try to prove that a good global solution for a scheduling problem may emerge from a community of machine agents solving locally their schedules and cooperating with other machine agents that shares some relations between the operations/jobs (e.g. a precedence relation). Genetic Algorithms and Tabu Search can be adapted to deal with dynamic problems, reusing and adapting populations in accordance with the dynamism of the Manufacturing System. The self-parameterization of the Genetic Algorithms and Tabu Search will allow a better adaptation to the situation being considered. Notice that solving locally problems and joining them will not guarantee the feasibility of schedules. A repair mechanism will allow solving problems found in the feasibility of the schedules, when these problems are not solved by the coordination mechanism.

  MASDScheGATS project is a new challenge for the research group GECAD, since a hybrid approach using Genetic Agents and Tabu Search Agents will be experimented to solve complex dynamic job-shop scheduling problems. We expect to prove that this is a feasible combination of techniques. Notice that optimal solutions are not possible in dynamic scheduling environments. As objectives of the MASDScheGATS project we will try to make studies to prove the following 4 assertions:

  - Manufacturing Systems are well modeled by means of Multi-Agent Systems, where each agent may represent a processing entity in the Manufacturing System (e.g. a machine)

  - A global solution for a scheduling problem may emerge from a community of machine agents solving locally their schedules and cooperating with other machine agents that shares some relations between the operations/jobs (e.g. a precedence relation)
  - Genetic Algorithms and Tabu Search methods can be adapted to deal with dynamic problems, reusing and adapting individuals/populations in accordance with the dynamism of the Manufacturing System
  - The self parameterization of the Genetic Algorithms will allow a better adaptation to the situation being considered.

- Philippe Mathieu and Marie-Hélène Verrons (LIFL, Lille)
  GeNCA: A Generic Negotiation Model and API

  The aim of our work is to conceive a general negotiation model (called GeNCA: Generic Negotiation of Contracts API), and to give an implementation of it. This allows a user wishing to develop a negotiation application not to have to do the whole job but to have a model that will facilitate his work.

  Contracts involve resources that are either common to each agent (for example time-slots) or individual to each agent (it is for example the case of goods in auctions). Each agent can initiate a negotiation over its own resources or common ones. Negotiation takes place between agents either to share resources or to allocate them. Several participants are involved in the negotiation and the resources can be shared between or given to a subset (perhaps empty) of these participants. We propose a general negotiation model using the protocol described in [2], which allows several rounds of counter-proposals, and having a management of negotiations mechanism, which allows to negotiate contracts on disjoint sets of resources in parallel, and to negotiate contracts having conflicts on resources sequentially. This model also allows to automatically renegotiate contracts that cannot be met any longer. Our proposition is based on a three-level architecture, that separates the communication part between agents, the negotiation part and the negotiation strategy part of an application. As a matter of fact, the way agents communicate doesn't play a role in the way negotiation is made, and different communication ways can be used in a same application executed on different environments. We equally show that it is important to separate the negotiation strategy from the two other levels, to allow a user to choose which negotiation strategy he will use without disturbing the remaining of the application. Moreover, the negotiation strategy is intrinsically linked to the negotiation application. In order to help the user in defining a strategy, we provide a priority list for resources and one for participants. Users can then order resources and participants according to their preferences.

  Our model has been implemented by a Java API also called GeNCA that has been used to achieve different applications. Further informations can be found on GeNCA's web site `http://www.lifl.fr/SMAC/projects/genca`.

  [1] P. Mathieu and M.-H. Verrons. A generic model for contract negotiation. *Proceedings of the AISB Convention*, 2002.

  [2] P. Mathieu and M.-H. Verrons. ANTS: An API for creating negotiation applications. *Proceedings of the 10th ISPE International Conference on Concurrent Engineering: Research and Applications*, 2003.

  [3] P. Mathieu and M.-H. Verrons. A Generic Negotiation Model for MAS using XML. *Proceedings of the ABA workshop Agent-based Systems for Autonomous Processing*, IEEE Press, 2003.

  [4] P. Mathieu and M.-H. Verrons. Three different kinds of negotiation applications achieved with GeNCA. *Proceedings of the International Conference on Advances in Intelligent Systems – Theory and Applications (AISTA)*, 2004.

- Paul Valckenaers and Paul Verstraete (PMA, KU Leuven)
  Stigmergy and Multi-agent Resource Allocation

  Much research on multi-agent resource allocation investigates negotiation and/or auction mechanisms. The counterparts of these mechanism in human society are typically used for infrequent and quite important resource allocation tasks (e.g. renting or buying a house). In contrast, human society, and especially in the better-developed countries, uses more fine-grained allocation mechanisms for small repetitive/frequent resource allocation tasks. An example is buying groceries in a supermarket. The goods are displayed and labeled, and the allocation happens according to a first-come-first-served manner. The fine-grained and repetitive nature of these mechanisms enables adaptation mechanisms to act with some delay (price adaptation can be triggered, among others, by recent transactions in the past). It is more optimal to tolerate slightly suboptimal pricing than to spend effort and suffer delays to get a more accurate price setting. This coordination through signs in the environment is called stigmergy.

  The research at K.U.Leuven-PMA uses stigmergy to perform fine-grained coordination and resource allocation in MAS manufacturing control and supply network management, environments characterized by heterogeneity, changes and disturbances. Because of the lightweight nature of the coordination mechanism, the resource allocation is able to provide some significant lookahead functionality.

- Sieuwert van Otterloo (Liverpool)
  Games and Logic for Mechanism Verification

  Formal protocols, such as auctions and voting, can be used by agents to make joint decisions. It is often important to verify such protocols. For instance it is important to know whether in a certain protocol each agent has the appropriate amount of influence on the outcome. My research is concerned with modal logics that can be used for expressing properties of multi-agent protocols. Most of these logics are extensions of modal logic with operators for preferences, strategies, abilities and sometimes knowledge. These logics are interpreted over extensive games, often using game-theoretic solution concepts. The major challenge in this research effort is to identify which logics have attractive computational properties, so that the logical approach can be applied to examples of realistic size. So far it seems that for protocols with perfect information the complexity is typically low, whereas the verification of protocols with imperfect information is intractable. However, there are exceptions to this general principle.

- Sylvia Estivie (LAMSADE, Paris-Dauphine)
  A Platform for Multiagent Resource Allocation

  We give a brief description of our on-going work regarding the development of a tool for the simulation of decentralised resource allocation. Whereas most existing platforms deal with (different sorts of) centralised mechanisms (e.g. auctions), our tool will put a special emphasis on the process of negotiation (types of deals, protocols, length of negotiation sequences, ...) Our objective is (i) to back theoretical results with empirical evidence, (ii) to induce new theoretical results, and (iii) to obtain results when no convergence property can be formally stated.