

Domain characteristics lead choice for MAS approach

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Our main hypothesis is that it is impossible to have one MAS approach that fits all application domains. The lack of uptake of MAS technology stems at least in part from the fact that industry does not get handles on which type of approach is suitable for which type of problem. Therefore it becomes very difficult to assess the possibility of success of this new technology and people rather stick to known technologies.

Current approaches to the design and implementation of agents and multi-agent systems exhibit large differences amongst themselves both at conceptual and engineering levels. The analysis of a problem domain will give rise to different decisions concerning the practical implementation of the following principles of MAS: the decomposition of problems into individual tasks or goals for the agents; deciding on interoperability and communication options for agents; coherence of action and avoidance of conflicts and harmful or useless interaction; and individual possibilities for representation and reasoning about actions, plans and knowledge of others. For example, the decision to use a blackboard structure instead of an ACL for agent communication leads to different types of agent systems (suited for different types of domains).

There is thus a need for a classification that can be used as a starting point in determining what type of MAS should be developed for which type of situation (and thus can co-determine agent methodology, platform, etc.). Of course we would also need a methodology to determine the right class of MAS given a certain application area, such that we could start the design of the MAS from the situation at hand instead of starting from a particular MAS and adjust the situation to fit that type of MAS. So, we are concerned with the relation between system and environment and how to determine which kind of agent approach better suits environment characteristics.

Developers of agent systems have typically a fixed number of system components that can be manipulated, while others are uncontrollable. These components are the agents, their interfaces to the system environment (API), the agent communication channels, and the agent environment. In one extreme, the developer has full control over the agents' internal architecture and interaction while there is no control over any of the agent environment. In the other extreme the agents are unknown and uncontrolled and the developer fully controls the agent environment where interaction occurs. Depending on what is controlled and how those components are specified, different types of agent systems arise.

Hardly any research has been done in the area of decision support to the choice of (MAS) design methodology. We position that such choice should be guided by the characteristics of the domain. Important aspects to consider are the possibility/desirability to control the design of the agents and of the overall organization; the existence of global goals external to the agents; the degree of control over the interactions; requirements related to the control of systemic and agent behavior; and, the need for emergent behavior. We are currently holding a survey to determine the link between domain and approach. Future work is required to further develop these issues, by extensive evaluation of existing systems and starting a discussion between different AOSE research groups in order to understand and make explicit the motivations and differences between approaches.