

Self-adaptive Coordination for Organizations of Agents in Information Fusion Environments

Sara Rodríguez, Belén Pérez-Lancho, Javier Bajo, Carolina Zato,
and Juan M. Corchado

University of Salamanca, Plaza de la Merced s/n, 37008 Salamanca, Spain
{srg, lancho, jbaajo, carol_zato, corchado}@usal.es

Abstract. Each organization of agents needs to be supported by a coordinated effort that explicitly determines how the agents should be organized and carry out the actions and tasks assigned to them. The interactions of a multi-agent system cannot be related only to the agent and their communication skills, if not that it's necessary to use the concepts of organizational engineering. This research presents a new global coordination model for an agent organization. The innovation of the model consists of the dynamic and adaptive planning capability to distribute tasks among the agent members of the organization as effectively as possible.

Keywords: Multi-Agent systems, Virtual Organizations; Dynamic Architectures; Adaptive Environments.

1 Introduction

Open MAS should allow the participation of heterogeneous agents with different architectures and even different languages [17][5]. The development of open MAS is still a recent field of the multi-agent system paradigm and its development will allow applying the agent technology in new and more complex application domains. However, this makes it impossible to trust agent behavior unless certain controls based on norms or social rules are imposed. To this end, developers have focused on the organizational aspects of agent societies, using the concepts of organization, norms, roles, etc. to guide the development process of the system.

Virtual organizations [9] are a means of understanding system models from a sociological perspective. From a business perspective, a virtual organization model is based on the principles of cooperation among businesses within a shared network, and exploits the distinguishing elements that provide the flexibility and quick response capability that form the strategy aimed at customer satisfaction. Even so, within the development of organizations, both at the business and agent level, we find a set of requirements [15] that call for the use of new social models in which the use of open and adaptive systems is possible [17].

Given the advantages provided by the unique characteristics found in the development of MAS from an organizational perspective, and the absence of an adaptive

planning process for any social model, this study proposes a model that can coordinate a dynamic and adaptive planning system in an agent organization.

The development of the model enables the use of information to improve the allocation tasks. The proposed notions will be validated via the development of an experimental system consisting of a small-scale fusion and planning model located at each of the participating agents.

The article is structured as follows: Section 2 describes the state of the art for current studies of the agent organizations and its adaptation. Section 3 presents the proposed planning model. And finally, Section 4 demonstrates how the model can be used in a case study in an information fusion environments and some conclusions and experimental results.

2 Organizational Approaches

There are several different organizational approaches[7][17]. However, while these studies provide mechanisms for creating coordination among participants, there is much less work focused on adapting organizational structures in execution time or norms defined in design time. For example, [12] proposes a model for controlling adaption by creating new norms. [10] propose a distributed model for reorganizing their architecture. [1] requires agents to follow a protocol to adapt the norms. Each of these studies focuses on the structure and/or norms based on adapting the coordination among participants. Another possibility is the development of a MAS that focuses on the concept of organization/institution. One electronic institution [8] should be considered a social middleware between the external participating agents and the selected communication layer responsible for accepting or rejecting the agent actions. The primary difference with the other proposals is that the adaption is carried out by the institution instead of by the agents. Lastly, there are approaches focus on social group mechanisms based on the social information gathered during the interactions [16].

None of these approaches is capable of coordinating tasks for the member agents of the organization to solve a common problem, nor do they consider that task planning should adapt to changes in the environment. The architecture selected for this study is OVAMAH [3][11], which focuses on defining the structure and norms. OVAMAH (*Adaptive Virtual Organizations: Mechanisms, Architectures and Tools*) is the evolution of architecture THOMAS (*MeTHods, techniques and tools for Open Multi-Agent Systems*) [6][11]. The following section will present the planning model proposed integrated into OVAMAH whose goal is to carry out an adaptive planning process within an agent organization. The architecture is essentially formed by a set of services that are modularly structured. OVAMAH uses the FIPA architecture, expanding its capabilities with respect to the design of the organization, while also expanding the services capacity. OVAMAH has a module with the sole objective of managing organizations that have been introduced into the architecture, and incorporates a new definition of the FIPA Directory Facilitator that is capable of handling services in a much more elaborate way, following the service-oriented architecture directives. From a global perspective, the OVAMAH architecture offers a total integration enabling agents to transparently offer and request services from other agents