MAS-Based Agent Societies by Means of Scout Movement

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ABSTRACT

The concept of agent societies (or organizations) has become an important research area in the field of agent-related systems and vice versa. In order to do field-related simulations or to solve a variety of problems based in this research area, Multi-Agent System (MAS) frameworks are necessary. Several good proposals have been presented in this field. This paper presents a new MAS-based framework for agent societies based on the principles of a familiar, global connotation youth movement known as Scouting. The main goal of this paper is not to demonstrate whether the proposal presented here, which is presented by name of MAS-Scout, is better or not than the other current proposals. Instead, MAS-Scout is focusing in the following premise: knowing that Scouting has been a very successful social movement in the world; can its principles be used as a basis for designing a MAS-based framework used for implementing agent societies?

Keywords: Agent Architecture, Agent Society, Framework, Multi-Agent System (MAS), Scouting

1. INTRODUCTION

It has been argued that some Multi-Agent Systems (MASs) can be best understood as computational societies (Artikis & Pitt, 2001). It has also been argued that Agent Societies (ASs) are MASs in which it is required or important to represent agents playing different roles within organizations (Silva et al., 2004). It is then very clear the relationship that exists between an AS and a MAS. Moreover, in MASs and ASs, an efficient way of ensuring coherent behavior and resolving conflicts among agents is to organize agents in reasonable structures. From the organizational perspective, agents of a MAS are grouped into different organizations, and agents of an organization need to manage their activities by following the rules of the organization (Bai, 2007; Jennings, 2001). Therefore, a society of agents is composed not only of agents but also of organizations, roles, environments, and objects (Silva et al., 2004).

According to authors of reference (Artikis & Pitt, 2001), to form an open society the requirements are that: (1) there is a need to make the organizational and legal elements of the multi-society of agents externally visible, and a need to provide institutions and formalizations of agent interactions to protect agents from the actions of other agents; (2) open societies should be neutral with respect to the internal architecture of their members; and (3) in a society, communication and conformance of behavior are as much important as having intelligence. The same authors also indicate that the concepts that constitute a society of agents

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or a norm-governed system are the following: (1) society’s constraints (formalize and give semantics to the society rules/laws); (2) Agent Communications Language (ACL) (semantics of the language used for communication); (3) social role; (4) state of the society (set of propositions/states of affairs that are true at any time); (5) ownership (each agent in a society represents/is owned by either another individual agent—human or artificial—or an institution); (6) sub-societies (having a hierarchy of societies); and (7) a society of model agents. In this regard, the use of the following terms should be noted: organization, neutral architecture, communication, rules, roles, ownership / leadership, hierarchy and model.

On the other hand, and due to the fact that there is a rising awareness that MASs and cyber-societies can best be understood and developed if they are inspired by human social phenomena (Artikis et al., 2001; Castelfranchi, 2000; Zambonelli et al., 2001), authors of reference (Dignum & Dignum, 2001) established that any formalism for the design of open agent societies must fulfill the following requirements: (1) agent societies must describe the roles, norms, and goals of the society instead of just describing the state of the agents; (2) certain mechanisms are needed to verify whether the design of a society of agents satisfies the requirements and objectives stated by its design (Dignum et al., 2001); (3) interactions between members and the expected outcome of roles must be formalized in order to verify the overall animation of the society; (4) the organizational and normative elements of a society must be explicitly specified since an open society cannot rely on its elements being embedded in the intentions, desires, and beliefs of each agent (Dellarocas, 2000; Ossowski, 1998); and (5) communication and the ability to conform to expected role behaviors need to be assumed by members. Once again, the use of the following terms should be noted: organization, communication, rules, and roles / objectives.

Of the terms identified, it is worth noting that “organization” is perhaps one of the most important. This is so because the society of the agents’ model emerges from the idea that in an organizational system interactions between members occur not just by accident, but by aiming at the completion of some desired global goals. Moreover, it is possible to conclude that the same is true in any organized society. So then, organizations are formed because social structure is determined by organizational design and not dependent on the agents themselves (Tikanmaki et al., 2006). Furthermore, norms have been identified in social sciences as crucial tools to solve important (agent) societies’ issues such as coordination, cooperation, trust and, reputation (Tikanmaki et al., 2006).

In the same order of ideas, verification of the behavior of an open society, where the design of participating agents cannot be controllable, must be based on the externally observable effects of agent actions. That is, from the society perspective, different actions that bring about the same state of affairs in the world cannot be distinguished. From the above considerations, it follows that a logical formalism for the society of agents’ model must be able to represent (Tikanmaki et al., 2006): (1) Deontic relations (obligations, prohibitions, permissions); (2) externally observable results of agent actions (changes in state caused through influence of agents); (3) temporal relationships (the effect of actions and agreements is neither instantaneous nor deterministic, several futures are possible at each moment depending on agent decisions and environment changes); and (4) violations and reasoning about effects, and recovery from violated states.

Another term that becomes important in the context of agent societies is the term cooperation. In this regard, in a society of agents it becomes reasonable to talk about cooperation if there is a problem to solve that exceeds the capability of problem-solving of the individual agents. A cooperative activity can take form only if there is a society of agents and a common objective. Moreover, a cooperative activity can be performed if the objective, which is composed of many global goals, is shared by all agents having the capacity of realizing fulfilling their local goals. The needed tools are the role,
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