A Cost-Oriented Reorganization Reasoning for Multiagent Systems Organization Transitions

(Extended Abstract)

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1. INTRODUCTION

Current trends in the Multiagent Systems (MAS) research community, encourage to provide models able to define organizations that can dynamically be adapted according to changes in the environment or in the organization specification. This dynamic adaptation involves modifications in the structure and behavior of a MAS, such as adding, removing or substituting components, that are done while the system is running and without bringing it down [4]. The process that changes an organization into a new one is commonly known as reorganization [5].

Most existing approaches for reorganization in MAS define adaptation processes due to organizational changes. Some of these approaches propose solutions for reorganization when changes prevent the organization from satisfying current goals (such as when an agent leaves the organization) [3], other approaches focus reorganization as a process triggered by the domain [11], but most of current approaches focus reorganization for achieving better utility [6, 10, 9].

2. MOTIVATION

A reorganization process should provide some kind of increase in utility. However, as far as we are concerned, this utility should take into account not only the gain in utility but also the cost of achieving the new organization. As stated in [7], human organizations may encounter problems when certain changes are required: they often take longer than expected and desired; the cost of managerial time may increase; and there may be resistance from the people involved in the change. Similarly, in MAS, not every agent is able to change its role at the same cost (for example, the cost for an agent to change its role will not be the same if an agent is acting alone or is interacting with other agents). Nor can every new norm be added at the same cost (for example, some norms may affect every agent of the organization and other norms may only affect a few agents).

In [2] we compare the most relevant approaches for reorganization according to what they support for the different phases of a reorganization process: *monitoring*, *design*, *selection*, and *evaluation*. We conclude that current approaches for reoganization present some lacks that can be addressed from two different perspectives. On the one hand, current approaches do not take into consideration an evaluation of the costs associated to the reorganization process. Therefore, we are not able to measure the suitability of the new organization as a trade-off between the change cost and the profit obtained by the new organization. On the other hand, the utility of the future organization as long as the suitability of the reorganization process, are paramaters that are hard to measure without considering an evaluation process which accurately assesses whether or not the final utility is what it should be, and whether or not the reorganization process has been applied in the space time that was expected.

Reorganization models which provide information regarding these two perspectives become necessary for the development of realistic reorganization solutions. These models should provide mechanisms for reasoning about reorganization and answering questions from two different dimensions: (*i*) *before reorganization* (how the agents will work, what composition of services minimizes the reorganization cost, how costly would be to add some specific agents to the organization); and (*ii*) *after reorganization* (the suitability of the reorganization according to what was expected, the agents response to the reorganization according to what was expected), which become essential information to be considered in future organizational changes.

As stated in [8], social factors in the organization in Multiagent Systems will become increasingly important in an open and dynamic online world. This relates to the support for agents to be able to enter and leave societies at different times and properly assign roles, rights, and obligations. Thus, support for *open system*, *emergence*, and *agent dynamics* must be considered in reorganization models. With this respect, the adaptation and evolution of the

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agents skills have not been broadly considered in current reorganization approaches. Thus, costs associated to organizational changes should also consider costs dependent on the evolution of agents capabilities, the evolution of their relationships and their interactions.

With these requirements in mind, we consider that reorganization models able to reason about reorganization not only by considering the profits of the new organization but also the cost of changes, become necessary for the next generation of open and dynamic systems. These models must provide an evaluation of the parameters involved in the reorganization process before this process is carried out, as long as an evaluation of the reorganization process once this has been applied. Furthermore, we have also identified several open issues related to reorganization in MAS that can be addressed using our reorganization model: distributed reorganization reasoning and negotiation (where several agents have full or partial information about the organization and participate in the reorganization process); norms which affect the reorganization process (norms that must be accomplished during the reorganization process and norms which emerge from it); reorganization to instances of organizations that are unachievable from the current specification of the organization, etc.

3. WORK PLAN

Our main aim for this thesis is to provide a platform-independent reorganization model which take into consideration the costs associated to the reorganization process. The reorganization model must provide the measurament of costs from the agent perspective (what does it cost the agent to play a new/other role) and from the organization perspective (what does it cost the organization to have an specific agent playing an specific role and how does it benefit from that). Furthermore, this measurement should be defined for static costs (what does it cost the agent to play a new/other role right now) and also for dynamic costs (what does it cost the agent to play a new/other role depending on its increase/decrease of performance over some interval, what does it cost depending on the capacity of the agent to provide certain services or what does it cost depending on the evolution of the agent skills).

This reorganization model will be based on the concept of organization transitions [3] which allow us to relate two different instances of the same organization in different moments. This reorganization model will allow us to reason about both reorganization dimensions: before and after reorganization. The first dimension is focused on measuring the effectiveness of the organization in the future and analyzing whether the organization will be able to cope with some changed circumstances. The second dimension is focused on measuring the impact of the problems appeared during the reorganization process in the cost of change. Related to this respect, we have proposed a reorganization model which computes the less cost transition between two organizations and provides the sequence of steps required to adapt the current organization to the future one [1].

The reorganization model will be integrated as a reorganization component of a Multiagent Framework which provides support for dynamic organizations: agents that can enter and exit the system, the definition and deletion of roles, goals, norms, etc. This implementation should include mechanisms for reasoning about reorganization by using techniques to manage past experience which allow us to consider this experience in future reorganizations. In order to agents are able to use the reorganization component, we require define an access interface and a reorganization ontology.

Finally, the hypothesis and the proposal of the thesis will be validated in two different ways: (*i*) anallytically with synthetic data for obtaining an exhaustive evaluation of the model by testing different configurations and parameters; and (*ii*) by means of real experiments which will demonstate the use of the reorganization model in real MAS-based applications.

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