

# Improving global coherence by adaptive organization in a multi-agent system.

Rémy FOISEL, Vincent CHEVRIER and Jean-Paul HATON

CRIN-CNRS & INRIA Lorraine  
BP 239, 54506 Vandoeuvre-lès-Nancy Cedex, France  
foisel, chevrier, jph@loria.fr

We present a model based on the notion of interaction which aims to provide an organization structure for a multi-agent system where agent autonomy and local perspective are preserved. The model represents the organization through two aspects: a static aspect that defines the organizational structure as a pattern of relationships between agents in which the interactions take place, and a dynamic aspect that makes this structure evolve by the agents themselves according to their local point of view.

## Interaction description

An interaction is envisaged as a structured communication (or action) sequence between agents in order to achieve some goal (informing, requesting for a resource, ...). It is described by three components:

- a *motivation* (the goal that can be achieved by the interaction, the resource that can be obtained,...),
- the *agents* involved in the interaction,
- the way exchanges will take place (the *interaction protocol*).

The interaction protocol describes how the interaction is composed in terms of action sequence. It distinguishes two agent roles: the *initiator* of an interaction that sends the first message, and the *counterpart* which receives this message.

## The organizational structure

The organizational structure is built by instantiating the interaction patterns in each agent, i.e., by providing each agent with a description of its acquaintances according to its point of view. That defines the agent knowledge base describing the set of its potential interactions.

Since an agent can have several acquaintances for the same motivation, a level of qualification is associated to each acquaintance to reflect the agent preference. The qualification has two aspects: *confidence* and *attention*. The first is used by an initiator to an interaction and the second by the counterpart to select which interaction will be answered.

This represents the static aspect of the society. However, agent autonomy is not fully preserved since this structure describes which agent to contact and which one to answer to.

## The structuring mechanism

Agents are provided with abilities to assess the benefit they can gain by interacting with each other.

When starting an interaction, an agent refers to the static description of the organization to select an acquaintance. When the interaction is finished, the agent estimates the benefit that it has gained by participating to this interaction. Positive interactions (according to the agent point of view) are reinforced by increasing their qualification. Other interactions are weakened.

This mechanism is used to rank potential acquaintances with which to initiate an interaction (through confidence qualification), as well as to rank messages that have to be read (through the attention qualification).

## Conclusion

This model has been implemented and two sets of experiments have been undertaken on a multi-commodity flow problem. They demonstrate that the model has some interesting characteristics. In the first set of experiments, initial organizations were set such as agent goals could not be satisfied. Organizations converged to a new stable structure in which agent goals were satisfied. In the second set, after a structure had been found, perturbations were introduced that make some agents goals unsatisfied. A new structure was found.

A current limitation of our model is that the assessment of interaction is based on a priori criteria. The designer has to know the context in which the system takes place to state this criteria.

Future work will focus on domain independent interaction assessment and on multi-protocol interaction, i.e., having several protocols for the same interaction with the possibility to dynamically change the protocol.