

# Report of STSM

## Cost Action IC0801 “Agreement Technologies”

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Roberto Centeno Sánchez

Centre for Intelligent Information Technologies (CETINIA)

University Rey Juan Carlos, Móstoles (Spain)

### HOST INSTITUTE

Dr. Eduardo Alonso

Department of Computing

City University

London (United Kingdom)

### PERIOD

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## Purpose of the visit

Our current work is framed in the regulation of Open MultiAgent Systems by using coordination mechanisms. In particular, we propose an incentives mechanism able to *i)* discover preferences of agents participating in such a system, and *ii)* provide the efficient incentives such that both the individual (agents) and global (system) preferences are aligned. With this in mind, the main objective of the STSM was to endow such an incentives mechanism with learning techniques, so as to provide the mechanism with the necessities tools for preferences discovering phase.

## Description of the work and results obtained

As I said previously, our work focuses on how to regulate an open multiagent system by using coordination mechanisms. This kind of systems is characterized by being populated by autonomous, unknown beforehand agents, which can be even built for third parties. With this in mind, we cannot assure that such agents will behave according to the global preferences of the system. So, these systems have to be endowed with some mechanisms that allow the administrator to direct the agents' behaviour towards valid actions from the point of view of the own system.

In our previous work, we defined that such a regulation can be carried out through three kinds of mechanisms: informative, incentive and coercive. At the present, we are focusing on the incentives based mechanisms and an incentives infrastructure has been proposed that is able to *i)* discover the preferences of agents participating into an open system; and *ii)* perform the correct modification in the consequences of actions, such that efficient incentives are provided. The incentives infrastructure is composed of a set of institutional agents whose behaviour is control by the own system called *incentivators*. Each incentivator is assigned to an external agent whose preferences it tries to discover so as to incentivize it.

Taking advantages of the deep experienced of the professor Eduardo Alonso in learning field, the results obtained as consequence of the STSM carried out under his supervision have been the following:

- Institutional agents (*incentivators*) have been endowed with a reinforcement-learning model such that the preferences of agents are discovered. In particular, a preferences discoverer module has been introduced into the architecture of institutional agents. This module uses a well-known mechanism, Q-learning with immediate rewards and  $\epsilon$ -greedy action selection. In this way, incentivators are able to discover which attributes affect the utility function of each agent, providing individualised efficient incentives.
- Multiagent learning mechanisms have been studied in order to extend incentivators with cooperative learning abilities. The objective is that institutional agents learn the preferences and incentives for each agent in a cooperative way, that is, the joint action made by all incentivators (i.e. the set of incentives provided) is the best from the point of view of the system. Important steps have been taken in this direction as consequence of the STSM carried out.

As future work, we plan to continue our collaboration in order to develop and apply the multiagent learning techniques studied in the current STSM.