

## Technical Forum Group 2: Self-Organisation in Multi-Agent Systems Short Report

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Decentralised control, self-organisation and emergent behaviour are issues of major interest in distributed complex systems, such as MAS. The Self-Organisation in Multi-Agent Systems (SelfOrg) TFG aims at discussing and investigating these issues through examination of representative case studies and organisation of interdisciplinary interaction activities.

The SelfOrg TFG held its second meeting in Ljubljana, Slovenia. An important outcome of the first meeting in Rome was the decision to establish case studies capable of acting both as benchmarks and as working examples to better understand self-organisation, emergent properties and their underlying mechanisms. Therefore, half of the meeting of the SelfOrg TFG in Ljubljana has been dedicated to the work carried out on the case studies between the two meetings: describing the selected case studies using a uniform framework and proposing agent-based solutions for modelling and/or for implementing them. The first case study is related to computer networks management. It was proposed by Salima Hassas from Lyon University (France). Four approaches used to treat it have been presented based on holonic systems stigmergy mechanisms, peer to peer communications and routing and delegation respectively. Paul Valckenaers from KU Leuven, (Belgium) has proposed the second case study which concerns manufacturing control. In this case study two self-organising mechanisms were applied: ant algorithms and cooperative agents. Finally, the third case study is about simulating space conformation of a molecule. It was defined by Pierre Glize from IRIT (France). This problem was addressed by applying cooperative agents. Since a major aim of the SelfOrg TFG is the establishment of links with other disciplines, the second part of the Ljubljana meeting was devoted to an invited talk presented by Markus Bongard from University Miguel Hernandez, Alicante, Spain. The talk was in the field of neuro-biology and it was about the complexity in mammalian visual system. During the presentation, it was made clear that there is a large potential for using agents in other disciplines, for instance in simulating the behaviour of the brain neurons with agents. Establishing links with other disciplines offers two major advantages: on the one hand, it enables finding new application domains where self-organisation mechanisms could be applied and on the other it facilitates the transfer of self-organising mechanisms applied in other areas to computing applications.

The rest of the meeting has been devoted to the definition of “emergence”. Three aspects of the concept of emergence were examined. Firstly, a number of necessary *characteristics* that an emergent phenomenon must show were highlighted.

Subsequently, the *properties* an artificial system must have to produce emergent phenomena were listed. Finally, the *operational characteristics*, that must be present in systems in order for their behaviour to qualify its result as emergent were enumerated. Although much progress has been in this direction by identifying necessary properties, essential criteria and operational requirements, additional work is still needed to finalise the definition efforts.

The activities of the TFG will continue remotely and an informal meeting is planned for AAMAS 2005. Furthermore, the results of the TFG collective efforts, when finalised, will be refined and comprehensively described in a volume which is planned to appear in 2006.