Chapter 5
Multi-Agent Systems and Social Networks

Enrico Franchi
DII, Università di Parma, Italy

Agostino Poggi
DII, Università di Parma, Italy

ABSTRACT

The evolution of multi-agent systems theories and technologies has important relationships with the evolution of social networks. In fact, the study of social structures such as organizations and coalitions is one of the most important topics of the research on multi-agent systems; while such a study can take advantage of the works on social network analysis, multi-agent systems can be used both for simulating the evolution of social networks and for providing technological supports for the realization of services for such kinds of networks. This chapter has the goal of describing the relationships between multi-agent systems and social networks and how multi-agent systems technologies and techniques have been used and can be used in support of social networks.

INTRODUCTION

Social networks and multi-agent systems share both the structure and the scope, since they are composed of individuals connected with some kinds of relationship and they are realized for accomplishing individual and/or common goals. A multi agent system is a system composed of multiple interacting agents; therefore, it is natural to think about synergies between social network and multi-agent system research and application. In fact, multi-agent system models, techniques and technologies have been used and have important potentialities for the study of social networks and the development of social network models. Moreover, the results coming from the experimentation of the more widespread social network systems could be used for the improvement of multi-agent system models, techniques and technologies.

DOI: 10.4018/978-1-61350-168-9.ch005

The goal of this chapter is: i) to briefly introduce multi-agent systems models and techniques; ii) to show their relationships with social network models and techniques; and iii) to discuss about the use of multi-agent systems in development of social network theories and systems.

BACKGROUND

Agents and multi-agent systems are one of the most interesting areas in software research and they have been importantly contributing to the development of the theory and the practice of complex distributed systems (Jennings et al., 1995; Muller, 1998; Bordini et al., 2005).

Although there is no single definition of an agent – see, for example, (Genesereth & Ketchpel, 1994; Wooldridge & Jennings, 1995; Russel & Norvig, 2003) – all definitions agree that an agent is essentially a special software component that: i) has autonomy; ii) provides an interoperable interface to an arbitrary system and/or iii) behaves like a human agent, working for some clients in pursuit of its own agenda. In particular, an agent i) is autonomous, because it operates without the direct intervention of humans or others and has control over its actions and internal state; ii) is reactive, because it perceives its environment, and responds in a timely fashion to changes that occur in the environment; iii) is pro-active, because it does not simply act in response to its environment and it is able to exhibit goal-directed behaviour by taking the initiative. Moreover, if necessary, an agent can be i) mobile, showing the ability to travel between different nodes in a computer network; ii) truthful, providing the certainty that it will not deliberately communicate false information; iii) benevolent, always trying to perform what is required; iv) rational, always acting in order to achieve its goals, and never to prevent its goals being achieved, and v) it can learn, adapting itself to fit its environment and to the desires of its users.

Even if a complex system can be based on a solitary agent working within its environment–that may or may not comprise users – usually agent-based systems are realized in terms of multiple, interacting agents, i.e., agent-based systems are normally multi-agent systems. Multi-agent systems are generally considered an appropriate means for modelling complex, distributed systems, even if such a multiplicity naturally introduces the possibility of having different agents with potentially conflicting goals. Agents may decide to cooperate for mutual benefit, or they may compete to serve their own interests. Agents take advantage of their social ability to exhibit flexible coordination behaviours that make them able to both cooperate in the achievement of shared goals or to compete on the acquisition of resources and tasks. Agents have the ability of coordinating their behaviours into coherent global actions.

Coordination among agents can be handled with a variety of approaches including: negotiation, multi-agent planning and organizational structuring. Negotiation is the communication process of a group of agents in order to reach a mutually accepted agreement on some matter (Jennings et al., 2001). Negotiation can be competitive or cooperative depending on the behaviour of the agents involved. Competitive negotiation is used in situations where agents have independent goals that interfere. Agents are never a-priori cooperative – sharing information or willing to back down for the greater good – rather they are always somehow competitive. On the other hand, cooperative negotiation is used in situations where agents have a common goal to achieve or a shared task to execute. Multi-agent planning techniques enable agents to allow the realization of plans that move agents towards their common/individual goal, preventing any possible interference among the actions of the different agents (Tonino et al., 2002). In order to avoid inconsistent or conflicting actions and interactions, agents build a multi-agent plan that details all the future actions and interactions required to achieve their goals, and interleave