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February 2007

Decentralised Control of Complex Systems

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Many modern computing systems have to operate in environments that are highly interconnected, highly unpredictable, are in a constant state of flux, in which there is no centralized point of control, and in which the constituent components are owned by a variety of stakeholders that each have their own aims and objectives. Relevant exemplars include the Web, Grid Computing, Peer-to-Peer systems, Pervasive Computing and many eCommerce applications. Now, I believe that all of these systems operate under the same conceptual model: (i) entities offer a variety of services in some form of institutional setting; (ii) other entities connect to these services (covering issues such as service discovery, service composition and service procurement); and (iii) entities enact services in a flexible and context sensitive manner. Moreover, I believe agent-based computing is an appropriate model computational for such systems (Jennings, 2000; Jennings 2001). In particular, autonomous agents are a natural way of viewing flexible service providers and consumers and the interactions between these autonomous components are naturally modeled as some form of economic trading process that, if successful, results in a service contract (or service level agreement) between the agents involved.

In this talk, the focus will be on the design of the agents and their interactions. Specifically, I will consider the design and implementation of various computational service economies for a number of real-world applications including: virtual organizations (Norman et al., 2004), sensor

networks (Padhy et al., 2006; Rogers et al., 2005; Rogers et al., 2006) and personalized recommendations (Wei et al., 2005; Payne et al., 2006). In so doing, I will touch upon some of the techniques and advances we have made in the areas of game theory (Gerding et al., 2006), auctions (Dash et al., 2007, David et al., 2005), coalition formation (Dang and Jennings, 2006; Dang et al., 2006; Rahwan et al., 2005; Rahwan and Jennings, 2005), automated negotiation (Fatima et al., 2004; Fatima et al., 2006) and computational mechanism design (Dash et al., 2003).

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