Programming Groups of Rational Agents*

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Computational power is increasing, and increasingly available, for example via the development of ubiquitous computing. Once large numbers of computational elements can communicate with each other, via wireless networks or the World-Wide Web, then new problems arise in engineering software for such systems. By representing these computational elements as agents, we can provide a simple and intutive metaphor for both individual computation and that within multi-agent systems. However, software designers need to have appropriate and semantically clear mechanisms for controlling not only how individual agents adapt and evolve, but also how agents interact and combine to form new systems. Without this control not only will the practical development of complex multi-agent systems remain difficult, but agents themselves will not be trusted for use in critical applications.

In this talk, I will outline some of our work on developing agent programming languages based upon computational logic. In particular, I will describe:

1. the implementation of individual agents through the direction execution of a formal description of individual (rational) agent behaviour given using a combination of temporal logic and logics concerning belief and ability;
2. the core notion of agent groups and how such groups contrast with individual agents; and
3. the ways in which multi-agent applications might be developed, by utilising the combination of executable logic (as in 1) and group evolution (as in 2).

This talk includes work carried out over a number of years, where we have attempted to use intuitive logical aspects to provide a simple, but effective, mechanism for describing agent computation. It is our assertion that computational logic in general (and executable temporal logics in particular) can provide an appropriate tool for studying not only verifiable agent descriptions, but also novel concepts that can form the basis for the future programming of agent-based systems.

The work presented in this talk can be traced back to previous work produced with a number of co-authors on executable temporal logics [1, 2], programming rational agents [3, 4] and programming multi-agent computation [5–7].

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