Linguistic Support for Agent Migration

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We proposed[1] some linguistic features to support the migration of agents between societies that have different communication mechanisms. In other words, we dealt with the problem of an agent entering any existing society whose communication means were not previously known. We think that such features will become increasingly important in the account of complex, heterogeneous, adaptive, evolutionary, continuously running, open systems. It is noteworthy that an important outcome of these ideas is *interoperability*.

Intuitive ideas concerning the architecture of multi-agent systems where this migration phenomenon may occur were provided. This work concentrated on conceiving the architecture and functioning of the *Communication Sub-agent*, which is responsible for the adaptation to a new society and afterwards for the management of the communication processes (i.e., conversations) while interacting in that society. We considered only the adaptation in the so called *Language and Interaction Level*. In another project, we have been dealing with the adaptation in the *Knowledge and Performance Level*, which is intended to allow agents to find out the most suitable partners with whom it should interact. We claimed that the specific agents that have the ability to migrate among societies must comprise a meta-language interpreter. That is the language universally used to express in a formal way the syntax and semantics of the *Protocol Description Language* and the *Protocol Execution Language* used in all possible *target-societies* that *migrating-agents* might move to. These are the languages an *immigrant-agent* must learn by interpreting their formal definition which must be public in the unknown society it is entering. We also proposed that the arriving agents must have access to some minimum *meta-protocols* (i.e., public protocols for handling current protocols).

A sample target-society was conceived. We proposed a language for the execution of protocols, allowing agents to have interactions of complex structure. Formal semantics was given for both a (slightly improved) Protocol Description Language presented in the literature and the Protocol Execution Language we proposed. We accomplished that using both the Structural Approach to Operational Semantics and the Denotational framework. It seems that any framework for giving formal semantics can be used as the universal meta-language we are referring to. For that sample society, two meta-protocols were specified: the first one dealing with protocol version mismatches and the second with protocol exchanges among agents.

We have also elaborated on some discussions that arose during the development of this project concerning: the advantages of using such meta-language approach, the boundary of interaction complexity that migrating-agents can reach, and complementary works accounting for further levels of agent adaptation. We have implemented (using the ML programming language and ML-Yacc) the kernel of the Communication Sub-agent that learns protocol languages from formal specifications. Accordingly, it can also be seen as a testbed for new protocol languages.

Concluding, we claim that these ideas can be used in a elaborate conception of system interoperation through migration of peculiar agents among societies. Since the intended agents are able to adapt themselves to different societies, most the work for integrating a number of systems does not have to be done by designers. Furthermore, this seems to account for all that mentioned features of Multi-agent Systems. Another motivation for this work relates to interdisciplinary interests on communicative skills acquisition.

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