# Agent communication and social concepts

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The importance of agent communication for multi-agent systems is, of course, beyond any doubt. However, the importance of research in this area seems less obvious. After several years with lots of discussions about standard agent communication languages and possible semantics for them it seems people have the feeling that all the issues in this area are settled. Despite some criticism on FIPA ACL this seems to be the de facto standard for agent communication. Especially after the JADE platform (which is probably the widest used in academic circles) was made FIPA compliant.

However, there is still a wide gap between being able to parse and generate messages that conform to the FIPA ACL standard and being able to perform meaningful conversations. In order to force or even just support agents to perform meaningful conversations some form of a shared semantics of the communication process is needed. Since it is impossible to verify compliance of agents based on internal structures of the agents (that cannot be inspected) the semantics should be based on concepts that are externally observable. Hence the growing interest in the use of social concepts that can be observed and verified outside the agents.

In the context of these developments we are happy to present this special issue. The papers selected for this special issue on agent communication are based on presentations at the Agent Communication workshop of 2004, held in New York. They clearly indicate the general trend in the past few years towards the use of social concepts in defining the semantics of agent communication. Especially "social commitments" and deontic concepts such as "obligations" seem to become a central element in this respect. In three of the four papers in this special issue social commitments form the basis of the theory discussed in that paper. The fourth paper is based on the use of obligations and permissions.

The paper of Fornara et. al. discusses the use of "institutions" as an abstract set of rules that describe how social commitments are changed based on communication

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between agents. Therefore the semantics of the communication within an institutional context becomes exactly this change of commitments. Because the rules of the institution are external to the agents one can verify whether the communication patterns of the agents conform to these rules. Seeing communication rules as institutions also gives the opportunity to embed communication rules in the context of a more specific institution such as an auction.

The paper of Mallya and Singh describes how social commitments can be used in the modeling of protocols. A protocol is defined as the set of commitment affecting interactions that its allows. To decide whether a particular interaction adheres to the protocol then comes down to checking whether the interaction is subsumed by the protocol, that is, if the interaction at least contains the sequence of steps that are required by the protocol. The authors formally define two ways in which protocols can be combined to form larger protocols. The first is the "merge" of two protocols, which results in a protocol that allows any interleaving of the sequences of steps allowed by the individual protocols. The other is the "choice"-combination of two protocols, which yields a protocol that allows the runs of the one protocol as well as of the other. These operators form the core of a protocol algebra that can be used by protocol designers to reason about the equivalence of (combinations of) protocols.

In the paper of Flores et. al. the relation between message interpretation and social commitments is explored. The authors develop a formal framework that divides the process of message interpretation into four distinct layers. The lowest layer (the "compositional layer") contains the rules to determine, solely on the basis of the constituents of the message, its speech act type. The "conversational layer" then checks whether and how this speech act fits in the context of current conversations. On the basis of this and other information the effects on the social commitments are computed. This is done at the "commitment layer". Finally, the rules of the highest layer (the "joint activity layer") determine the exact contribution of the message with respect to the joint activities that the conversational partners are involved in. The theoretical rules and principles of the different layers are defined in operational terms, thus paving the way for a subsequent implementation of the framework.

The last paper in this special issue is from Kagal and Finin. It is the only paper that does not use social commitments. However, it describes the constraints on conversation policies in terms of obligated and permitted communication. Every speech act leads to new obligations and permissions influencing further conversation. The use of deontic concepts to describe the conversation policies allows the design to be very modular. One can easily add more rules or delete some of them. The interaction with the other rules is taken care of by the formalism. As deontic formalisms also allow for contradictory norms to be specified one can also have contradictory conversation policies coming from different sources. Again the deontic formalism can be used to solve these contradictions through priorities on the norms. This mechanism is therefore very suitable for combining general conversation policies with more domain dependent policies.

Although all papers in this special issue use social concepts to define aspects of agent communication, little is said in these papers about the characteristics of these social concepts themselves. Hopefully this special issue can function as a starting point of research in the foundations of these social concepts that play such an important role in agent communication and thus in multi-agent systems.