A Communication Protocol for Conflict Resolution

Pierre Azéma, François Vernadat, Jean Luc Albacete
Laboratoire d'Analyse et d'Architecture des Systèmes - Centre National de la Recherche Scientifique
7 avenue Colonel Roche, F-31077 Toulouse cedex
albacete@laas.fr, azema@laas.fr, vernadat@laas.fr

Abstract

This paper deals with communication requirements for cooperating agents. A formal technique, VAL, is used for specifying and analysing cooperation and conflict resolution protocols among distributed agents.

Whithin the **Multi Agents System** framework, the coordination of distinct agents is one of the most important tasks [MAR 93].

A first aspect concerns the plans themselves: How formalize them ? Which operators are requested for plan coordination and modification ? An other difficulty of the coordination of autonomous agents results for a large part from the distributed nature of the system : equal distribution of control and authority among the partners, no shared memory between agents, no specific agent in charge of a dedicated task such as conflict detection, resource allocation, ... This proposal is mainly concerned by this second issue and consists into providing distributed solutions for conflict detection, meeting organization and distributed agreement.

The **VAL Formalism** is based upon extended Predicate/Transition Nets, which explicitely takes into account *communication* and *dynamicity* [VAL 95]. The purpose of VAL is the prototyping of distributed computing systems. The agent interactions explicitely rely on mechanisms for messsage sending and receiving and agent synchronisation. The considered systems are dynamic : an agent may disappear, it may decide to create new agents.

The agent behavior is parameterized by its acquaintances, i.e. the knowledge of its own current state and about its environment. The agent acquaintances may evolve in time as a consequence of message exchanges and of the resulting knowledge acquisition.

The ability to describe dynamic systems, through creation and suppression, and mobile processes, through addressing by name and logic unification, supplies the designer with a great flexibility.

The plan of a single agent, the communication strategy between partners and the actual moves of entities may be represented by Petri Nets. Conflict and cooperation are two dual operations which are simultaneouly involved in many communication protocols.

The **Prototyping of Communicating Systems** consists of three complementary steps: a formal description of the system behavior, the specification of the expected properties, and a verification step for checking whether the observed system behavior enjoys the required properties, that is absence of deadlock, guarantee of progress, ...

An *executable specification* of the system is derived from a VAL description. This description may be simulated, for debugging purpose, and analyzed, by means of an exhaustive derivation of the state space. A formal verification may then be conducted by using temporal logic model checking and/or bissimulation techniques [AVL 90]. A software environment is available.

The **current work** concerns the definition of generic agents whose behavior consist in the execution of working plans. The conflicts result from discrepancies between *intended behavior* and *actual behavior*. In order to allow a dynamic modification of these plans, specific agents such as negotiators, coordinators have to be provided. Distributed protocols for coordinating remote agents have to be furnished [DVVA 94].

An other direction concerns the *agent architecture*. Currently, the architecture is communication-oriented and could integrate new points of view such as a coordination/cooperation scheme.

References

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