

Abstract

This dissertation describes an approach to the visual modeling of software systems which are composed of autonomous and proactive software entities interacting with their environment. These entities are named software agents.

More and more software systems are distributed, dynamic and open with respect to their environment. Software agents shall ease the development of such systems. Agent based systems provide a modular structure. They are robust and can be adapted dynamically to changing requirements. The notion of software agent relies on the fundamental properties of autonomy, proactivity and structured interaction. According to these properties agents are distinguished from objects and components. For the development of agent based systems an appropriate modeling language and a process model describing the correct usage of the language are demanded. For both aspects only unsufficient or incomplete approaches exist. This thesis contributes to the solution in the following way:

A new abstract and formal model of agent based systems shows, that the fundamental properties can be expressed precisely. Differently from existing models not only a single agent but a multi agent system can be modeled. The most important architectural models of agent-based systems are compatible with the abstract model. The rather restricted structure of the abstract model motivates the refinement by a model of coupled I/O-automata.

The Unified Modeling Language is widely used in industrial software development. Therefore, the new language AML (Agent Modeling Language) for the development of agent-based systems is defined as a UML profile. The semantics of AML models is defined in the semantic domain of graph transformation. The semantic domain is restricted to an adequate agent-oriented domain. There the constituents of the fundamental agent properties are defined. Agent based systems which are described using AML are shown to be compatible with I/O-automata model of multi agent systems.

Constituents for proactivity are goals and strategies. In this thesis, it is shown that the reachability of goals through the application of strategies can be checked by applying a model checking method.

The new process model APM describes, how the language AML can be applied to the modeling of agent-based systems.