

# A Framework for Building Adaptive Mobile Agents

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## ABSTRACT

In our work, we propose a component-based generic architecture for adaptable mobile agents. These agents can be either adapted statically by a user who adds new components, or self-adaptive by being aware of their execution context and dynamically customizing their architecture.

## Categories and Subject Descriptors

I.2.11 [Artificial Intelligence]: Distributed Artificial Intelligence – *intelligent agents, multiagent systems*.

## General Terms

Design, Experimentation.

## Keywords

Intelligent agents, Mobile agents, Component-based software engineering, Context-awareness, Self-adaptation.

## 1. PROPOSITION

Nowadays, software mobile agents are an exciting programming paradigm that can be applied with significant advantages in many domains. They are especially attractive to perform complex, tedious or repetitive tasks in open and dynamic systems [1]. Nevertheless, the current technology in real applications is far away from researchers' expectations. One important reason for this is that programmers are almost forced to develop new mobile agent programs from scratch for each new application. Moreover, current mobile agent architectures are mainly implemented as object-oriented frameworks providing a collection of classes. These classes model typical agent concepts that are often kept simple (no cognitive features) and specified at the implementation level. In addition, during their migration, mobile agents may face heterogeneous and changing execution environments so that their initial implementations become unsuitable and need the intervention of the programmers.

To overcome these limitations (limited reuse and extensibility, and the lack of adaptability), we propose to give up traditional object-oriented mobile agent architectures and take advantage of CBSE (Component-based Software Engineering) [2] to build a Generic architecture for Adaptive Mobile Agents GAMA.

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The proposed architecture provides a set of reusable software components that offer the mobile agent core services: *Own control, Agent Profile, Mobility, Messages Center, Actions and Knowledge Base*. These components exhibit the required features of autonomy, mobility and pro-activity and can be augmented with social abilities. In fact, a second important feature of our work is to make the GAMA agents extensible in order to come up the users new requirements or different utilization of the agent that have not been planned. Thus, the programmer can process to the agent's static adaptation by first stopping it, then inserting the components corresponding to the new functionalities (edited as XML schemes).

Another important contribution of our work is to allow dynamic reconfiguration of our mobile agents in order make them self-adaptive [3]. Since mobile agents have to move from host to host in order to perform their tasks, they are continuously expected to run in heterogeneous and changing execution environments. To survive, a mobile agent has to be aware of its execution context and thus adapt itself to the environment where it is running. The adaptation is achieved by dynamically composing an environment-specific version of the agent that assembles the appropriate components, without termination of the agent. This approach is guided by two kinds of knowledge. The first kind of knowledge is about the agent's execution context [4] and we refer to as "context-awareness". The second kind of knowledge is about the agent's constituents and we refer to as "own structure-awareness". Agents awareness about their execution context is achieved by exploring information representing different entities in this context, and detecting meaningful changes. Self-adaptation is triggered whenever these changes reveal an incompatibility with the agent structure provided by a meta-model maintaining an updated description of the agent components. After that, the components to replace are selected and linked to the agent's core according to some adaptation policies.

## 2. REFERENCES

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