Chapter 25
Mobile Agents for a Mobile World

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ABSTRACT

Mobile devices such as smartphones and tablets have become very popular and together with the enhancements on mobile networks have changed the way the users interact. New applications and paradigms (such as social and collaborative networks) have appeared, and their development is now more important than ever. In this scenario, the technology of mobile software agents is an adequate option, since mobile agents can be used to overcome the difficulties and limitations of such an environment. Mobile software agents need a middleware (the agent execution platform) that allows them to exist and provides them the means to develop their potential. There exist a number of such platforms with different features but also some limitations. In this chapter, the authors discuss in detail all these questions and survey the most popular agent platforms from the point of view of their potential use in mobile environments.

1. INTRODUCTION

In the last years, the demand of mobile applications has grown considerably (Andersson et al., 2006) thanks to the miniaturization of devices (which are more and more powerful and cheaper) and the deployment of global wireless communication networks. It is now possible to access an increasing number of Internet-based services and applications, anytime and anywhere, in a fast and easy way. However, the development of more complex and efficient services can be a challenging issue in such a mobile environment due to the existence of a high number of users, a variety of devices (in terms of features and computational capabilities), and mobile communication limitations. In order to deal with these issues, mobile agents (Milojicic et al., 1999) have been proposed as a promising technology that allows the development of distributed and intelligent systems in both a flexible and robust way. The great number of possibilities they offer has led to significant research in this field.

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An agent (Woolridge & Wooldridge, 2001) is a software entity characterized by having a high autonomy and intelligence, which allows it to execute in a self-contained way. Agents can take their own decisions based on information received from their execution environment, from other agents, or from a previously existing knowledge base. Besides, their communication capabilities allow them to exchange efficiently information with other agents by means of the use of especially-structured communication languages. Moreover, there is another feature that, although it is not mandatory for agents, makes them special. This feature is mobility, which allows an agent to travel through a computer network from one execution environment to another. These are the so-called mobile agents (Braun & Rossak, 2005; Milojicic et al., 1999), in contrast to those that are executed always in the same environment and do not move, which are called stationary/static agents. A key component needed to build mobile agent-based systems is the middleware that they need to be executed (the mobile agent platform).

Many applications can take special advantage of the features of agents (Ferber, 1999; Luck et al., 2003; Valckenaers et al., 2007). For example, in the case of:

- Problems where a solution can be reached after some kind of negotiation, which can be achieved thanks to the intelligence and communication capabilities of agents.
- Problems that can be decomposed in different parts, which can be solved independently in parallel, and where the partial results can then be gathered to build the final solution.
- Tasks where a large amount of data located in different places must be processed and where, due to different reasons (e.g., the need to minimize the communication cost), these data cannot be transmitted to a central location for processing.

- Tasks where the data to process are scattered among many places or stored in many different formats, being very hard to find or process them in a uniform way.

For example, in the last case, mobile agents can visit the different places (thanks to their autonomy and mobility capabilities), evaluate locally their conditions (thanks to their intelligence), and bring the most appropriate algorithm to process that particular data format in the best possible way. In general, mobile agents can bring the processing wherever it is required.

In this chapter, we focus on mobile agents and their mobile agent platforms. The success or failure of mobile agent applications depends, in many cases, on the features provided by the mobile agent platform used. Thus, a mobile agent platform can ease the development and implementation of a system and will also have a great influence on its final performance.

The rest of the chapter is organized as follows: In Section 2 we explain why mobile agents can be useful in mobile environments. In Section 3 we describe general concepts about mobile agent platforms and their characteristics, highlighting the challenges arising in mobile environments. In Section 4 we focus on platform features that are desirable in a mobile environment. In Section 5 we present a survey of some mobile agent platforms. Finally, in Section 6 we present our conclusions.

2. MOBILE AGENTS IN MOBILE ENVIRONMENTS

Mobile environments have a number of limitations and variable conditions that make the implementation of conventional applications difficult. In this section, we will first provide an overview of the limitations of mobile devices and then motivate the importance of mobile agent technology in this context.