

# Mobile Agents: What about Them? Did They Deliver what They Promised? Are They Here to Stay?

(PANEL)

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## Abstract

*Mobile Agents have brought around a new way to perform computations and develop distributed application and it is now struggling for a visible position in the area of distributed and wireless computing. This panel explores the issues that affect and direct the acceptance or not of this computing paradigm, i.e., mobile agents technologies.*

**Keywords:** Mobile agents

## 1. Mobile Agents or not Mobile Agents?

*“Mobile agents are processes dispatched from a source computer to accomplish a specified task [3, 4]. Each mobile agent is a computation along with its own data and execution state. After its submission, the mobile agent proceeds autonomously and independently of the sending client. When the agent reaches a server, it is delivered to an agent execution environment. Then, if the agent possesses necessary authentication credentials, its executable parts are started. To accomplish its task, the mobile agent can transport itself to another server, spawn new agents, or interact with other agents. Upon completion, the mobile agent delivers the results to the sending client or to another server.”*

**“A broad definition of a Mobile Agent”**

Mobile Agents appeared in the scene the last decade of the previous millennium. They have been embraced by researchers and practitioners as a potential technology that could revolutionize the way we perform computations, develop applications and systems. They were, and still are, viewed as a unique way to approach mobile and wireless computing.

Indeed, this is not an exaggeration; mobile agents have been used in a variety of applications and computing areas. The driving force motivating mobile agent-based computation is multifold: Mobile agents provide an efficient, asynchronous method for searching for information or services in rapidly evolving network; mobile agents may be launched into the

unstructured network and roam around to gather information. Second, mobile agents support intermittent connectivity, slow networks, and light-weight devices. Thus, mobile agents provide many benefits in Internet system programming (otherwise networking programming) [1, 2, 4], in which there is a need for different kinds of integrated information, monitoring and notification, encapsulating artificial intelligence techniques, security and robustness [2, 12, 13, 17, 18]. Also the mobile agent paradigm has demonstrated satisfactory performance when deployed for distributed access to Internet databases, distributed retrieving and filtering of information and minimizing network workload [11, 12, 15, 16, 17, 19]. Finally, mobile agents have proved very effective in supporting asynchronous execution of client requests, weak connectivity and disconnected operations and the dynamic adaptation to the various types of user connectivity common in wireless environments [12, 14, 15].

Various mobile agent platforms have been developed. They can be broadly categorized as Java and non-Java based ones, **and they can be further split into experimental and commercial ones**<sup>1</sup>. There is an increasing interest in Java-based platforms due to the inherent advantages of Java, namely, platform independence support, highly secure program execution, and small size of compiled code. These features of Java combined with its simple database connectivity interface (JDBC) that facilitates application access to multiple relational databases over the Web, make the Java approaches very attractive. And in fact, is this JAVA orientation of the Mobile Agent technology that gave it the boost we have seen so far and the hope (or illusion?) that this technology can do and offer much more.

While, however, everything is here, the infrastructure, the proof of concepts in such a variety of applications

<sup>1</sup> The Java-based mobile agents platforms include IBM Aglets Workbench [5], Recursion Software's Voyager[6], Mitsubishi's Concordia [7], IKV++ Grasshopper [8] and General Magic's Odyssey [4]. The non-Java-based systems include, for example, TACOMA [9] and Agent Tcl [10].

areas in wireless, mobile or fixed networks, the big question is: “**Why hasn’t the industry embraced this technology as most of us expected?**”

What is missing, what is actually needed, what is that final touch that could have transform this good “painting” to a brilliant Rembrandt? Why haven’t we see the convergence of agents technologies (AI agents, mobile agents, moving objects etc) into one powerful seamless concept that could serve all kind of applications (e.g., eCommerce, m-Commerce, mobile and wireless applications etc) at a level higher than the one seen so far. Is it,

- The security problem?
- Java and its unwillingness to make the basic agent execution environment part of it?
- Is it simply still too early?
- The diverge definitions of what is an agent and maybe its incompatibility with what we came to think of a mobile agent?
- Is it development effort? Lack of scalability or performance? Lack of a standard? Lack of proper education in mobile agents?

Is it possible to get answers to these, and possible many other, questions and maybe figure out how this new technology could in fact deliver what it promised or, even better, what we came up to hope for? What researchers, practitioners and industrialists can do or propose to aid the understanding of the direction the mobile agent technology should aim for? Or any effort is futile and assimilation of this technology not really possible?

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