MobiliTools: A Toolbox for Agent Mobility and Interoperability Based on OMG Standards

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Introduction to MobiliTools

Mobile agent platforms typically come with a fixed combination of a communication model, an activity model and a mobility model. As a matter of fact, mixing autonomous activities with remote communication and mobility requires an accurate assembly job in practice.

But is this a sufficient reason for turning mobile agent platforms into strongly integrated frameworks? Such an approach leads to specific platforms that are dedicated to specific needs, while there is no ultimate agent model suited to every need. Moreover, these heterogeneous specific platforms typically don't interoperate very well.

However, several standardization efforts are in progress in the agent technology field (e.g. FIPA, OMG's Mobile Agent System Interoperability Facilities). Voyager's CORBA support and Grasshopper's MASIF and FIPA compliance show encouraging efforts towards interoperability.

In this context, MobiliTools intends to provide a set of "middleware" components that make it easy to build a number of customized, ad hoc mobile object/agent platforms, with various communication and activity models, while providing a basic level of interoperability support, based on OMG standards (CORBA, MASIF).

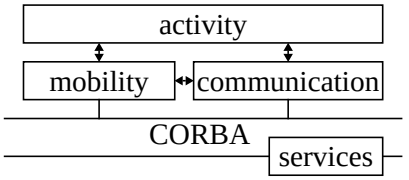

Fig. 1. MobiliTools architecture

These components can be used either together, or independently in other mobile agent platforms, to introduce interoperability bridges.

SMI, Simple MASIF Implementation

SMI is a minimal and generic MASIF implementation playing the role of MobiliTools' mobility component. MASIF's framework consists of *mobile agents*, identified by a unique *name*, acting on behalf of an *authority*, moving from *agent system* to agent system, and executing in *places*. Agent systems also have unique names, and are bound to an authority. Agent systems implement the MAFAgentSystem CORBA interface, mainly for managing agents lifecycle and mobility. A directory and lookup service for agents, places and agent systems, is also available through the implementation of the MAFFinder CORBA interface.

SMI straightforwardly implements this framework in Java, while adding a couple of operations that are lacking in both MAFAgentSystem and MAFFinder interfaces. SMI provides two possible levels of customization, through the open implementation of two Java interfaces:

1. interface MobileObject has to be implemented by agents in order to react to lifecycle events: creation, successful or aborted mobility, activity suspension or resumption, death, and agent system shutdown. These events trigger dedicated agent call-backs, which have to be defined by the programmer, to actually manage agent activity;
2. interface AgencyPersonality may be optionally implemented by the programmer in order to prepare for, and then acknowledge, agent lifecycle events. An agency personality may also wrap every agent in another MobileObject implementation in order to trap lifecycle events and serialization. As a result, an agency personality makes it easier to implement a management kernel or scheduler for agent activities, while customizing an SMI generic agent system into a specific agent system.

At the present time, a passive agent model and an active agent model with one thread per agent have been (very quickly and easily) implemented. Another model, based on a synchronous programming model, is under construction and promising, especially regarding scalability and transparency issues. We are also envisaging the implementation of a sort of ODP “cluster” model.

ACTS, Agent Communication Transport Service

ACTS is a CORBA service for transporting messages between heterogeneous agents, whether mobile or not, and whether CORBA objects or not. It can be operated in both a message push and a message pull model. It may be wrapped and customized in a number of ways, to implement a variety of communication models and architectures, but still supporting interoperability at transport level. For instance, private mailboxes with name-based addresses, multicast and unicast features, and a FIPA-compliant communication architecture have been implemented.

Although it is independent of MASIF, ACTS may be regarded as a complement enabling interoperability between agents for remote communication, through the definition of extra CORBA interfaces.

On-going work. We are developing various agent activity models, focusing on transparency, interoperability and scalability issues, for both communications and mobility.

Availability. MobiliTools is available free of charge on signed demand, for non-commercial use (mail bruno.dillenseger@rd.francetelecom.fr).

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