
FlyingCloud - A Prototype of Mobile Agent Service Networks

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Abstract

To make information ubiquitously available to the people in the world requires not only the Information Superhighway, it also requires a new computing paradigm to overcome the intermittent connection problem inherent in mobile environments as well as many commercially viable service networks providing various information services to the users. In this research, we proposed an open architecture that allows new services and facilities easily be added into networks, and a mobile agent service network on top of that architecture. The users of a mobile agent service network can submit a message containing an executable script to the network performing tasks on behalf of the user. Our researches focus on the issues regarding to the operation, administration, and maintenance (OA&M) which are critical components of a service network. We have been developing a prototype of such a service network, FlyingCloud , in NCCU. The FlyingCloud will facilitate further study on various OA&M issues that are special to his new computing paradigm.

The agent in FlyingCloud is autonomous and self-contained. After being submitted to the network, it can be executed by a sequence of servers one-by-one. A server can execute the agent and forward it to the next one according to the script carried by the agent. Different from the RPC (Remote Procedure Call) approach, the

execution of an agent in each server is atomic so that the control of an agent in a server is completely released after the agent moves to another server.

We have designed a script language allowing users to specify their demands. We proposed the "script-rewriting" technique for environment migration. When an agent is moving from one server to another, the agent is wrapped together with its execution environment into another agent and is then forwarded to the next server. The receiving server can execute the agent as if it is a new agent to recover the execution environment. This "script-rewriting" technique is particularly good for heterogeneous environment where "image-copying" technique is difficult to apply. One basic OA&M function for a mobile agent service network is the control of the agent. We have defined a "finite state machine" to represent the life-cycle of an agent and several new control functions which have not been seen in any other computing environment.

Tracking the location of agents is another critical problem in managing a service network. One class of strategies is to have the target agent report its locations periodically so that it can be located immediately. To avoid the unnecessary messages for location reporting, another class of strategies searches the target agent "on-demand", at the cost of paying extra searching time. In our research, we have developed several search strategies corresponding to various situations. Most search strategies are a variation of the Basic Binary Search (BBS) which is very similar to the conventional binary search algorithm used to locate a data object in a sorted array. Unfortunately, BBS may fail to locate a target agent because the target agent is moving and may "slip-through" the search window. Thus, We proposed the Extended Binary Search (EBS) to correct the problem. To further reduce the number of search probes, we then proposed several other search algorithms to enhance the EBS.

In the case when the service time of each server on the network is statistically predictable, the number of search probes can be further reduced by predicting the current location of the target agent using service time statistics. Based on this technique, we proposed the Intelligent Search strategies and several formula which can closely predict the location of the target agent.