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Author(s)	Mamadou, Tadiou Kone
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Description	Supervisor: Takuo Watanabe, ,

Japan Advanced Institute of Science and Technology

Software Agents and Quality of Service Issues
in Distributed Systems[*]

Mamadou Tadiou Kone

School of Information Science,

Japan Advanced Institute of Science and Technology

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Abstract: The idea of a static or mobile software entity called **agent** that performs tasks on behalf of its owner in a distributed environment or the Internet is now well established. However, as the agent technology evolved, several interpretations and applications brought some confusion in its current landscape. Mobile agents, multi-agent systems, intelligent agents, information agents are some concepts that has sprung in the expanding agent research and development. In this dissertation, we use mobile agents and multi-agent systems to investigate in several steps their application to Quality of Service (QoS). Our contribution articulates around four steps:

• First, we propose an architecture for building an efficient link between a user and resource providers in a distributed multimedia environment. This architecture implements the mobile agent paradigm together with the concept of "logical disc interface" by cleary separating QoS negotiation and resource management. Here mobile agents take care of the QoS negotiation process and a **virtual host** manages (allocation and de-allocation) needed resources.

• Second, we present an agent-based QoS adaptation scheme. In this approach, we introduce the concepts of **macro-adaptation** as all the coarsed grained adjustments and **micro-adaptation** as the set of fine-grained corrective actions on resources. Here, our idea is to structure in an integrated fashion an adaptation strategy spanning all components of a distributed system.

• Third, elements of a multi-agent system need to rely on one another, enlist the support of peers through a meaningful **agent communication language** (ACL) in order to solve complex tasks. ACL is a new field that aims to foster communication, cooperation, negotiation, and improve interoperability in multi-agent systems. To this end, we examine the state of the art in agent communication languages design and suggest some principles for building a generalized ACL framework. Then, we evaluate some emerging ACL models, present some current issues and perspectives.

• Last, we propose a framework for service discovery and network QoS negotiation over large scale networks by applying the multi-agent system and agent communication language concepts. In our approach, a **user** and **service agents** engage in a structured communication through the mediation of a **QoS broker** agent and a **facilitator** agent. The facilitator agent acquires information from service agents and acts as a single point of contact to supply this information to the user via the QoS broker. To illustrate our approach, we implemented a prototype multi-agent system that discovers resources and negotiate network QoS.

Keywords: Mobile Agents, Multi-agent Systems, ACL, Quality of Service.