

# Personalized Parallel Information Retrieval Based on Mobile Agent

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## Abstract

*Mobile agent is particularly attractive in distributed information-retrieval applications. Thus, gathering and retrieving distributed information is now a widely used application. By moving to the location of an information resource, the agent can search the resource locally, eliminating the transfer of intermediate results across the network and reducing end-to-end latency. Mobile agent technology has the ability to travel from one host to another in a network.*

*Therefore, we build mobile agent-based parallel information retrieval system in order to provide user's desired information from distributed sites simultaneously. This system intends not only sites/shops to publish their product catalogue simultaneously according to the user's request but also user to find the preferences shop to make his/her purchases. In this system, when the user gives the input, distributed query is processed parallel on each site by using parallel mobile agent. Then, the result which is the product information is returned to user. It not only*

*supports activities of users but also facilitates parallel processing. The latter is important as more sites/shops can be searched in a shorter time to provide users with better choices in their decision-making. This system is implemented by using Java-based Aglet Software and Microsoft Access Database.*

## 1.Introduction

Due to the explosive growth of the World Wide Web and the dramatically increasing amount of data available via the Internet within less than a decade, Internet search engines have completely changed how people gather information. As the Web is growing much faster than any present technology search engine can possibly index and many web pages are updated frequently, the current search engines cannot visit the web site regularly enough to index new content. New search techniques are on demand and mobile agent-based search is one of these features.

There has been tremendous interest in the past few years in using mobile agent technology for next-generation enterprises. In particular, mobile agents seem to have

been proposed for automating the task of retrieving, organizing and filtering information located at widely dispersed sites. Mobile agents systems have been built and demonstrated to indicate that mobile agents can be used for information retrieval activities.

A mobile agent is an executing program that can migrate during execution from machine to machine in a heterogeneous network. Once a user's request for retrieving information is received by a mobile agent-based system, a number of mobile agents will be generated and dispatched to the network. The agents migrate to the nodes where the data are located rather than transmit data across the network and return back with the results to the user. Thus, the consumption on the network bandwidth will be reduced, especially when the data is located in a remote area. Mobile agent can freely migrate across a network to perform tasks on behalf of many actors in the network system, such as other agents or users. Therefore, mobile agent is a combination of two distinct concepts: mobility and agent.

Today, many electronic shops publish their product catalogue on the Internet, offering a wide variety of

goods. More importantly, users are turning to the Internet for such information as well as to purchase their goods. The search and retrieval of product information is crucial in every electronic commerce applications. While some systems provide the users just with a fixed selection of products, others offer a wide variety of products with different characteristics. However, the wide variety of choices to the users has also introduced the problem of information overloading. Moreover, there are so many e-shops and goods for the users that it has become too time-consuming, if not impossible, to find the best (cheapest) deal. So, mobile agents will become increasingly important to search and retrieve information efficiently and rapidly from widely dispersed sites.

In this thesis, we build a framework for Personalized Parallel Information Retrieval System that exploits Mobile Agent technology. One of the main ideas for creating mobile agent-based Personalized Parallel Information Retrieval System is to assist in searching and retrieving for items information from distributed sources simultaneously on behalf of a user. By using this system, shops publish their product catalogue information according to the user's desired characteristics of that product

(these characteristics will be restrictions for the search). Therefore, users can know the detailed description of the item-related information according to their requirement constraints from distributed sites/shops simultaneously. Besides, a user can choose his/her preferences shop to buy in a shorter time by viewing the relevant information from different sources in parallel.

## **2. Theoretical Background**

The word “agent”, or software agent, has found its way into a number of technologies. The concept of an agent originates from the area of Artificial Intelligence (AI) but has now gained more widespread acceptance in mainstream computer science. The term ‘agent’ has become rather fashionable, and a more mature technology than currently available is often implied.

In the agent community, it is impossible to find a unique definition of what an agent is or it should be. Different research groups have given different interpretations depending on their research interest and their past experience with software engineering and cultural/technical background.

Agents are independent pieces of software capable of acting autonomously in

response to input from their environment. Agents can be of differing abilities, but typically possess the required functionality to fulfil their design objectives. To be described as ‘intelligent’, software agents should also have the ability of acting autonomously that is without direct human interaction.

Agent-based computing is a new software paradigm in Information Technology today. Agents are autonomous programs situated within an environment, which sense the environment and act upon it using its knowledge base to achieve its goals.

As the Internet constantly expands, the amount of available on-line information expands as well. The issue of how to efficiently find, gather, and retrieve this information has led to the research and development of systems and tools that attempt to provide a solution to this problem.

So, Mobile intelligent agent technology has drawn a tremendous amount of attention from researchers in Internet computing recently as it promises to provide an elegant and efficient way of solving complex distributed problems, as well as offering a new approach to human-computer-interaction. In most mobile intelligent agent systems, the software agent

travels autonomously within the agent enabled networks, executes itself in the agent execution environment, collects useful information and makes its own decision on behalf of its owner.

A mobile agent consists of the program code and the program execution state (the current values of variables, next instruction to be executed, etc.). Initially, a mobile agent resides on a computer called the home machine. The agent is then dispatched to execute on a remote computer called a mobile agent host (a mobile agent host is also called mobile agent platform or mobile agent server) [10]. When a mobile agent is dispatched, the entire code of the mobile agent and the execution state of the mobile agent is transferred to the host. Mobile agents can decide where and when to move in a network.

In other words, the agent can suspend its execution, migrate to another machine, and then resume execution on the new machine from the point at which it left off. On each machine, the agent interacts with stationary agents and other resources to accomplish its task. Mobile agents have several advantages in distributed information-retrieval applications. By migrating to an information resource [4], an

agent can invoke resource operations locally, eliminating the network transfer of intermediate data. By migrating to the other side of an unreliable network link, an agent can continue executing even if the network link goes down, making mobile agents particularly attractive in mobile-computing environment. Some of the benefits provided by mobile agents for creating distributed applications include reduction in network load, overcoming network latency, faster interaction and disconnected operation. Software mobile agents help people with tedious repetitive job and time-consuming activities.

### **3. Presentation of the System Architecture**

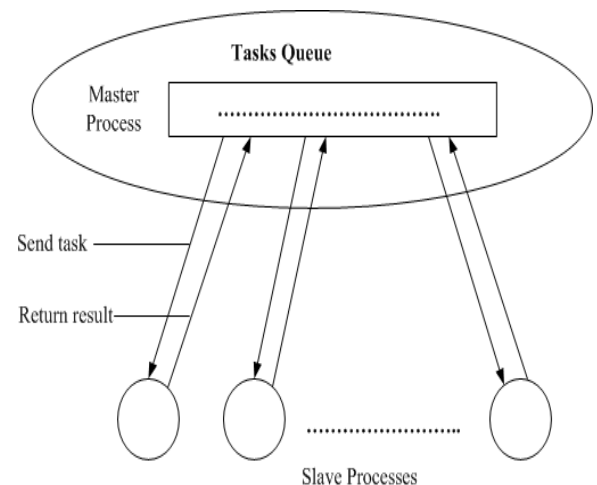
A mobile agent is an executing program that can migrate during execution from machine to machine in a heterogeneous network. On each machine, the agent interacts with stationary service agents and other resources to accomplish its task. Mobile agents are particularly attractive in distributed information-retrieval applications. By migrating to the location of a needed resource, an agent can interact with the resource without transmitting intermediate data across the network, conserving bandwidth and reducing latencies. Similarly, by migrating

to the location of a user, an agent can respond to user's actions rapidly. In either case, the agent can continue its interaction with the resource or user even if network connections go down temporarily. Instead of transmitting huge amounts of data across network, the mobile agents can communicate with local stationary agent or access the local data, such as Extensible Markup Language (XML) documents or database, directly. Mobile agents, thereafter, finally return to the original home node (user). Therefore, mobile agents can utilize the bandwidth of the network much more efficiently than accessing the distributed information remotely using direct connection; they can reduce the execution time, mainly by diminishing communication latency and traffic volume.

Mobile agents are mobile, flexible, autonomous, dynamic and efficient. When encapsulated with a task, a mobile agent can be dispatched to a remote host by the original host. After executing and accomplishing its tasks locally, it can send the results back by returning to the original host or sending through a message.

The mobile agent approach is also suitable for deploying parallel processes over distributed sites or data sources. The

tasks can be decomposed and encapsulated into multiple mobile agents. Every mobile agent can run independently to accomplish its task. Thus, a set of mobile agents can run in parallel on distributed sites simultaneously in order to let them work in parallel. So, the whole task can be completed in a shorter time. Hence, the mobile agent technology is naturally suitable for deploying parallel and distributed computing.



**Figure 3.2 Master/Slave Process**

## 4. Implementation of the System

In this system, the parallel information retrieval process with the mobile agents consists of four major steps:

The user enters a system to search the item-related information from distributed sites by accessing parallel information retrieval system. Then, the original host sends agents, the mobile agents, to the

remote servers. The mobile agents then collect the relevant information from the resources in the visiting server sites. According to the user's requirement constraints, the collected information is then returned to the original host.

The detailed description of the information retrieval system based on mobile agent is as follows.

1. A set of item information (such as item name, brand name, and willing price) is entered on the client computer.
2. A master agent is loaded on the original host, and the master agent creates mobile query agents to search user's desired information in parallel from different sites/shops simultaneously.
3. Dispatch the mobile query agents to remote sites.
4. If mobile query agents reach at server sites, they will use the databases that include product information to search the item catalogue at each site. When the user gives the input, distributed query is processed parallel on each shop.

Mobile query agents are disposed after they transmit the search results to the master

agent. The process design of the system is illustrated in Figure.

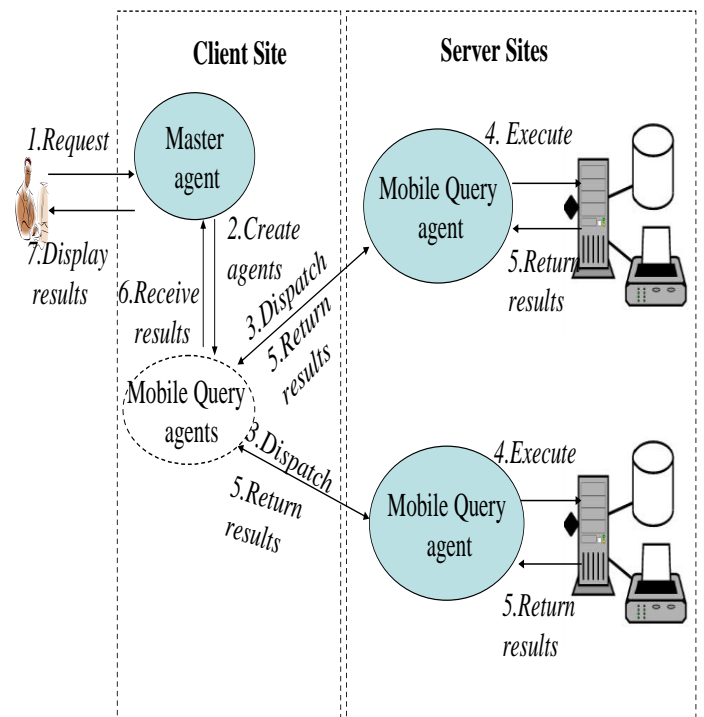


Figure 4.1 Process Design of the System

## 5. Conclusions

We presented a personalized parallel information retrieval system, which enables the processing of product information services without the frequent user intervention by adopting mobile agents. The searching and retrieving system based on mobile agent technology has overcome the lack and deficiencies of the traditional searching system, provides users with accurate, fast and real time information retrieval services and maximizes savings in network bandwidth.

This system assists in searching and retrieving for items information from distributed sites simultaneously on behalf of a user. By using this system, it reduces the problem of information overloading by publishing the catalogue information according to the user's requirement constraints. Besides, a user can view the detailed description of the item information in parallel from different sites simultaneously and can choose his preferences shop to buy in a shorter time. Moreover, it helps the user to save the time-consuming for choosing the best deal (cheapest) shop by using mobile agents. In this system, shops will publish their product catalogue according to the user's desired characteristics of that product (these characteristics will be restrictions for the search). Mobile agents around the network search for a user's specified item from different shops. With the mobile agents moving to the shops, the number of information exchange is local and is not over the network, thus saving network latencies and load. Using the mobile agent technology client specific queries could be executed at the shop sites. This system can be used to assist users for shopping. Therefore, we believe that it will be a useful system for users and shops. The presented

system has been implemented with Java-based Aglet Software.

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