Mobile Agent Based Distributed Query System for National Registry Card1

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Abstract

Mobile agents are autonomous programs that can migrate in a heterogeneous network to perform tasks on behalf of their owners. Mobile agents also raise several security issues related to the data carried by an agent itself. In mobile agent based application, both code and data can be transferred together from one machine to another in the form of class. This paper is intended to retrieve data from many distributed computers in which data is stored in several sites that are formed as distributed database. This system will implement as these steps: first, it will implement distributed query frame that will process the user queries and retrieve the necessary information, then, it will use the query rule to enhance this system. This paper implements mobile agent that includes master agent and worker agent. In master agent, the user can retrieve national registry information in which data is stored in master agent's database. Worker agents can only distribute their database to master agent. After distributing, master agent can retrieve national registry information in which data is not only stored in master agent's database but also worker agent's database.

Keywords: Mobile Agent, Distributed Query Processing

1. Introduction

Querying information techniques have to face both the growing amount of data to be processed and the natural distribution of the data over the network. A vast amount the right information can be queried with speed using parallel processing. Parallel processing in the proposed system means that a single processing task is operated simultaneously on distributed database [4]. Distributed database is a collection of multiple, logically interrelated database but which are physically distributed over a computer network [1]. For query processing system on distributed database, mobile agents are autonomous programs that can travel from computer to computer under their own control.

Mobile agent technology is a novel distributed computing archetype that offers the capabilities of autonomy, mobility and reactivity. It reduces the need for bandwidth. Multiple interactions generate network traffic. Mobile agents reduce this traffic by moving the processing to the raw data, instead of moving the raw data to the processing [7]. They are asynchronous. Therefore, when a mobile agent is dispatched, there is no need to remain connected to the network while the mobile agents are out. Mobile agents are autonomous. This particularly suits network discovery, because the mobile agent is learning about the network as it progresses through it [3].

The rest of paper is organized as follow. In section (2) states the related work with my system. In section (3) describes background theory. Next, section (4) explains the overview of system architecture and detail design. And then, states section (5) of implementation of the system. In the last section, describes the conclusion and further extension.

2. Related Work

S.H.Chaung in [6] explored an efficient parallel querying information system which provides fast information service for the internet users on low-cost high-performance PC-NOW environment. In this system, the inverted-index file (IIF) is partitioned into pieces using a greedy declustering algorithm and distributed to the cluster nodes to be stored on each node's hard disk.

S.Adnan in [5] presented the mobile agent executes on a machine that hopefully provides the resource or service that it needs to perform its job. If the machine does not contain the need resource or service, or if the mobile agent resumes execution at the new machine. This will survey mobile agent system. A mobile agent system provides the execution environment for mobile agent. Sometimes called middleware, mobile agents systems also provide a framework in which mobile agent applications can be developed and managed.

Y.Yang in [9] illustrated the mobile agent techniques for autonomous data process and information discovery on the Synthetic Aperture Radar Atlas digital library, which consists of distributed multiagency archives of multi-spectral remote-sensing imagery of the Earth. Their goal is to enable automatic and dynamic configuration of distributed parallel computing and to support on-

demand processing of a remote sensing archive.

3. Background Theory

3.1. Mobile Agent

Mobile agents refer to self-contained and identifiable computer programs, bundled with their code, data and execution state that can move within heterogeneous network of computer systems. By the term *state*, typically the attribute values of the agent mean that help it determine what to do when it resumes execution at its destination. By the term *code*, it means in an object-oriented context, the class code necessary for the agent to execute [8].

A mobile agent is not bound to the system where it begins execution. The mobile agent is free to travel among the hosts in the network. The two fundamental concepts in the mobile agent model are the agent and its execution environment, which the place is termed [2].

3.1.1. Agent

A mobile agent is an entity that has five attributes: state, implementation, interface, identifier, and principals. When an agent moves in the network it takes these attributes along with it.

- ***State*:** needed for the agent to resume computational after traveling.
- ***Implementation*:** needed for location-independent agent execution.
- ***Interface*:** needed for agent communication.
- ***Identifier*:** needed to recognize and locate traveling agents.
- ***Principals*:** needed to determine legal and moral responsibility [2].

3.1.2. Place

The most common view of a place is that it is a context in which an agent can execute. Four concepts play an important role in places [2]:

- ***Engine*:** workhorse and virtual machine for one or more places
- ***Resources*:** databases, processors, and other services provided by the host
- ***Location*:** the network address of a given place
- ***Principals*:** those legally responsible for the operation of a place

3.2. Query Rules

Query rules are the means for evaluations of distributed queries. Among sites, queries need to migrate, and migration rules for the flow of queries among sites are called query rules. There are many query rules such as chaining rule, referral rule and recruiting rule, etc.

In chaining rule, the client send a query to one server, and the receiving server sends a second query to the next server, and so on. The last server sends back the results to the server which forwards the query, and so on.

In recruiting rule, the first server receives the query, rewrites the query to resolve the local data, and passes the query to the next server and so on. When the query reaches the final server, this server directly sends back the data to the client.

In referral rule, the first server that generates the query has the full responsibility to give the result. This server sends a query to other servers and other servers give the partial results. These partial results are combined together at the server which originates the query and give complete result to the user. The referral rule is used in this system.

3.3. Distributed Query Processing

Distributed Processing means that distinct machines can be connected together into a communication network such as the Internet, such that a single data-processing task can span several machines in the network. The term parallel processing is also sometimes used with essentially the same meaning, except that the distinct machines tend to be physically close together in a parallel system and need not be so in a distributed system.

A distributed database system consists of a collection of sites, connected together via some kind of communications network, in which each site is a full database system site in its own right, but the sites have agreed to work together so that a user at any site can access data anywhere in the network exactly as if the data were all stored at the user's own site [1].

Query processing is one of the DBMS functions affected most by the mobility of the environment. The effects are both in terms of the queries that are posed and the optimization techniques that can be used. [4]. Four stages in query processing are cast the query into the internal form, convert to canonical form, choose candidate low-level procedures and generate query plans and choose the cheapest [1].

4. Overview of System Architecture

Actually, most of the databases are located in separate sites. The system architecture is based not only on distributed database but also on mobile-agent architecture.

This paper intends to implement the system that acts as a registry office by using referral rule (presented in section 3.2). When the user made enquiry about register person's data, the agent search and send the appropriate sub queries to each site in which the data is stored by using the mobile agent. Each site accepts and processes the query and returns the partial result. These partial results are combined together and give the complete result to the user.

Figure 1 shows overview of system architecture.

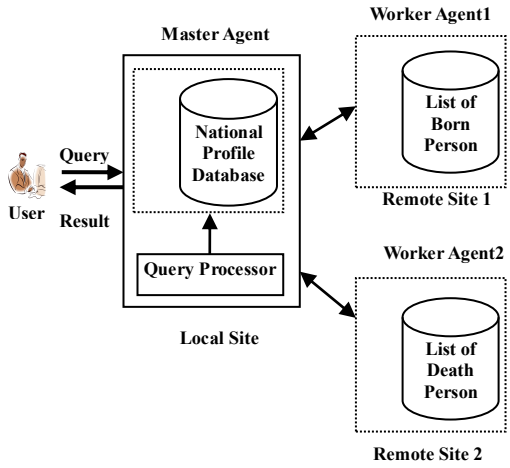

Figure 1. Overview of System Architecture

In distributed query processing, if the user wants to query to local database in their own database, then the query processor access to local database.

Eg. SELECT *
FROM National Profile

If the user wants to the query the remote database from remote site, then the query processor gathers site and database information. Then, access to appropriate remote database.

Eg. SELECT *
FROM National Profile, List of Born Person, List of Death Person
WHERE National Profile. Register No= List of Born Person. Register No
AND List of Born Person. Register No= List of Death Person. Register No

4.1. The Function of Query Processor

Functions of query processor are as follows:

- Accept query fro user.
- Check query is either local or remote.
- It the query is local, then access to local database.
- If the query is remote, then access to appropriate remote site.
- Accept the query result from worker.
- Gather information from workers and send the result to user.

4.2. Databases on Different Sites

In this system, National Profile Database in master agent consists of Register Person table, Register Person's Generation table and Register Person's Husband or Wife Table. Master Agent's database is stored in local database. In worker agents, there are list of Born Person Database consists of Born Person table and list of Death Person Database consists of Death Person table. Worker agents' databases are stored in their remote sites. Figure 2 shows database design of the system.

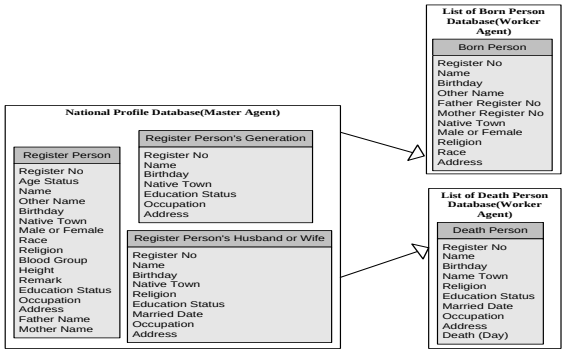

Figure 2. Database Design of the System

4.3. Agent and Their Responsibilities

There are two main agents in this system. They are master agent and worker agent.

4.3.1. Master Agent

At first, the system initializes TCP network port and then creates local (master agent) database and remote (worker agent) database in database explorer. If the user has SQL knowledge, the user can create SQL statement. If the query is local, then access to local database. If the query is remote, then access to appropriate site. Master agent accepts and collects query results from worker agent and sends query results to the user. Figure 3 shows system flow diagram for master agent.

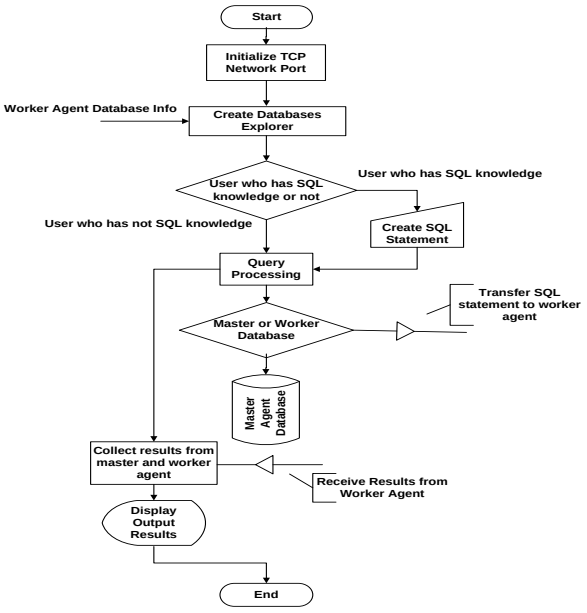

Figure 3. System Flow Diagram for Master Agent

4.3.2. Worker Agent

At first, the system loads agent setting and initialize TCP network port. Worker agent receives SQL statements from master agent and processes the query. It sends query results to master agent. Figure 4 shows system flow diagram for worker agent.

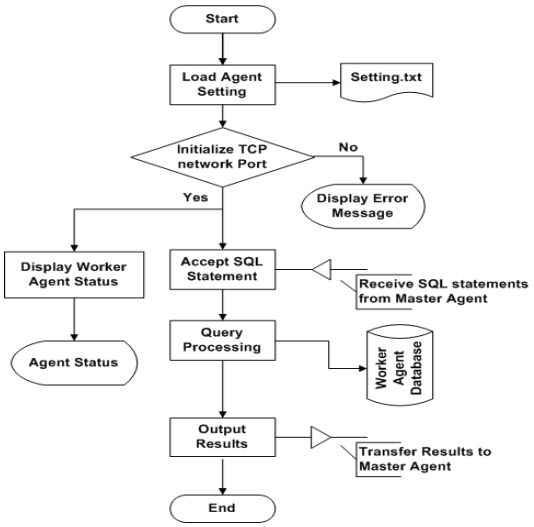

Figure 4. System Flow Diagram for Worker Agent

5. Implementation of the System

The system can show the tables of master agent's database in the database explorer. If the worker agents distribute their databases to master agent, the system can show tables of master agent database and tables of worker agent database. The query statements can be written in this system to retrieve national registry information as shown in figure 5.

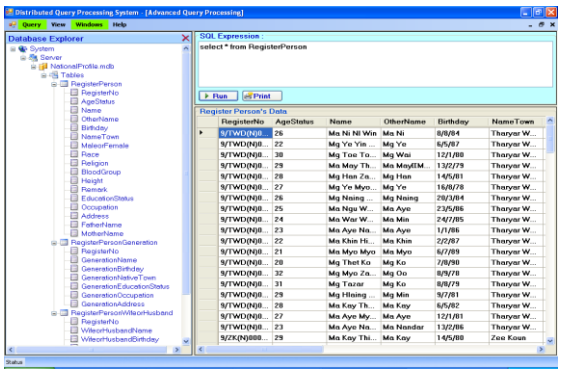

Figure 5. Query Processing

This system can be used without knowing SQL expression to obtain information for one register person. If the user who has not SQL knowledge, the user selects town, register no and register person's name to retrieve information as shown in figure 6.

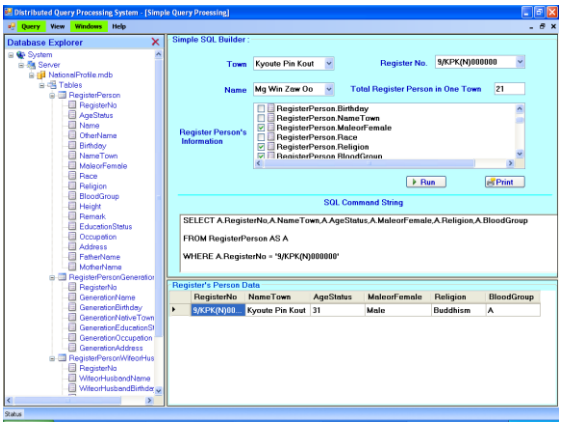

Figure 6. Query Processing for a register person

6. Conclusion and Further Extension

The use of mobile agents can be more scalable, more robust, can be easily upgraded and customized, and so they reduce the traffic in the network. The mobile agent is an emerging infrastructure for High Performance Computing and Parallel and Distributed Computing is also the efficient computing. This system intends to use various distribution registry departments. The branches of registry department suited at different locations. By using mobile agent based distributed query system, the user can achieve low cost and rapid way for acquiring register person's data.

This system will be useful for registry office in the whole Myanmar. It is also useful for other fields such as business, finance, government and so on. This system can be extended to other registry office distributed in other divisions and states. Other attributes of register person's can extend in this system.

7. References

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