

Mobile Agent-based Decision Support System for Media Planning of Advertising Agencies

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Abstract

Decision Support System (DSS) are integrated with set of computer tools and that allow decision makers to interact directly with the computers to create information useful in making decisions. DSS helps managers and decision makers to make suitable decisions. A mobile agent is a software object that has behavior, state and location. A mobile agent represents a user in a computer network, and is capable of migrating autonomously from node to node, to perform some computation on behalf of the user. The reason of using the mobile agent is that the mobile agent based application can transfer and execute both code and data together from one machine to another. Therefore, this thesis is based on decision support system using mobile agent technology. This thesis aims to aid the advertiser for making suitable decision.

There are many tools for implementing mobile agents developed from many companies. In this thesis, we use Java Aglets for Mobile Agent Framework and Java for programming language.

1. Introduction

Mobile Agent (MA) is an autonomous software entity that can migrate between various nodes of the network and perform computations at these nodes on behalf of user. Mobile agents are defined as objects that have behaviour, state and location. MA carries its state information while moving from one node to another. MA has an itinerary (which is a list of nodes to be visited) associated with it. MAs present the following important attributes: [4]

- *reactive*(the ability to respond to changes within agent environment)
- *autonomous* (the mobile agent is able to exercise control over its own actions)
- *goal-oriented* (the agent have a planned itinerary, they do not simply act in response of the environment)
- *communicative* (the ability to communicate with other agents, by exchanging information/knowledge)
- *mobile*(the mobile agent can transport themselves from one host to another.

A mobile agent is a program which represents a user in a computer network, and is capable of migrating autonomously from node to node to perform some computations on behalf of the user. [8]

A decision support system is real time computer system that aids managers in solving problems through quarries and modeling. Decision support system designed specifically for strategic decisions by top-level managers are called executive systems. In this system, mobile agent is commonly used for gaining information for the purpose of decision-making.

How does advertising affect us in our daily lives? There are many diverse aspects of the advertising industry and its role in popular culture. It has an impact on the choices we make and the choices that are available for us to make. It is powerful on attracting consumers psychologically, visually and also culturally.

The objective of a media plan is to select the target audience: the people whom the media plan attempts to influence through various forms of brand contact. Because media objectives are subordinate to marketing and advertising objectives, it is essential to understand how the target audience is defined in the marketing and advertising objectives. The definition may or may not be exactly the same, depending on the marketing and advertising objectives and strategies. Radio advertising is most effective when run at certain times of the day or around certain programs, depending on what market you're trying to reach.

To advertise the product in radio, effective scheduling of advertising is important and necessary. This system is intended to get suitable radio station schedules from different radio station. By using this information, user can make effective advertising plan.

2. Mobile Agent

An agent is a computer system that is situated in some environment, and that is capable of autonomous action in this environment in order to meet its design objectives. There are many types of agent that are employed in many applications in

distributed system. These include intelligent agent, Mobile agents, Information agents, Reactive agents or actors and Middle agents.

A mobile agent is a software object that has behavior, state, and location. A mobile agent represents a user in a computer network, and is capable of migrating autonomously from node to node, to perform some computation on behalf of the user. Its tasks are determined by the agent application and can range from online shopping to real-time device control of distributed scientific computing (see Fig 1).

Agents exist inside some type of agent server. Agents can migrate from server to server carrying their code and state with them. Aglets are example of mobile agent. In which, computation is migrated toward resources. Aglets are the shorthand for *agent* plus *applets*. Aglets can freely migrate across a network near information sources to perform tasks on behalf of user.

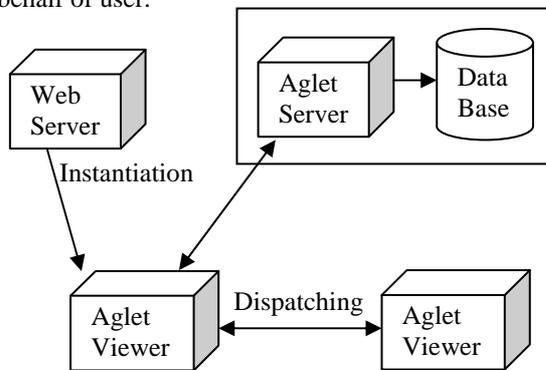


Figure 1. Java Aglets Infrastructure

The Aglet technology is a framework for programming mobile network agents in Java. The aglet technology was developed by the IBM Japan Research Group. The Aglet is a light weight java object that can move autonomously from one computer host to another for execution carrying along its program code and state. An aglet can be dispatched to any remote host that supports the Java Virtual Machine (JVM). This requires to have preinstalled Tahiti, a tiny aglet server program implemented in Java.

3. Decision Support System

Decision Support System (DSS) are a specific class of computerized information system that supports business and organizational decision-making activities. A properly designed DSS in an interactive software-based system intended to help decision makers compile useful information from raw data documents, personal knowledge, and /or business models to identify and solve problems and make decisions.

A DSS is an approach for supporting decision making. It uses a interactive, flexible, and adaptable computer base information system (CBIS) especially developed for supporting the solution for a specific unstructured management problem. It uses data, provides an easy user interface, and can incorporate the decision maker's own insights. In addition, a DSS usually uses models and is built (often by end users) by an interactive and iterative processes. It supports all phases of decision making and may include a knowledge component.

Finally, a DSS can be used by a single user on a PC, or it can be Web-based for use by many people at several locations.

4. Rule-Based Decision Support System

Rule-based systems are a relatively simple model that can be adapted to any number of problems. As with any AI, a rule-based system has its strengths as well as limitations that must be considered before deciding if it's the right technique to use for a given problem. Overall, rule-based systems are really only feasible for problems for which any and all knowledge in the problem area can be written in the form of if-then rules and for which this problem area is not large. To create a rule-based system for a given problem, the following must be had:

- **A set of facts** to represent the initial working memory. This should be anything relevant to the beginning state of the system.
- **A set of rules.** This should encompass any and all actions that should be taken within the scope of a problem, but nothing irrelevant. The number of rules in the system can affect its performance, so you don't want any that aren't needed.
- **A condition** that determines that a solution has been found or that none exists. This is necessary to terminate some rule-based systems that find themselves in infinite loops otherwise. [12]

Rule-based Systems are comprised of a database of associated rules. Rules are conditional program statements with consequent actions that are performed if the specified conditions are satisfied. A rule-based system is one based on condition-action rules. A condition-action rule, also called a production or production rule, is a rule of the form:

if condition
then action.

Rule-based decision support system decides the most suitable decision by applying predefined rules in rule-based systems. Rule-based system behaves like an expert system for representing information and searching for patterns in that information. The

most expert system is rule-based, containing a knowledge base(rule) and an inference engine.

The methods of rule-based system are:

- **Backward Chaining:** To determine if a decision should be made, work backwards looking for justifications for the decision. Eventually, a decision must be justified by facts.
- **Forward Chaining:** Given some facts, work forward through inference net. Discovers what conclusions can be derived from data. [14]

5. Proposed System

The proposed architecture of mobile agent based decision support system involves three participants: Server Station, Advertising Agencies and the Advertiser.

The architecture consists of three rule-bases: in the FM radio station servers. Each rule-base is used for the storage of each FM server's rule.

In the architecture, the clients can get the FM radio schedules and available FM name, program name, broadcast day, target, period, rate(in 10 sec) and total amount . The agents used to get the (DSS) result for this system are Interface agent, Mobile Agent and Server Station agent. This architecture takes advantages of mobile agents for decision support system. The overall architecture of mobile agents based decision support system for this system is shown in figure 2.

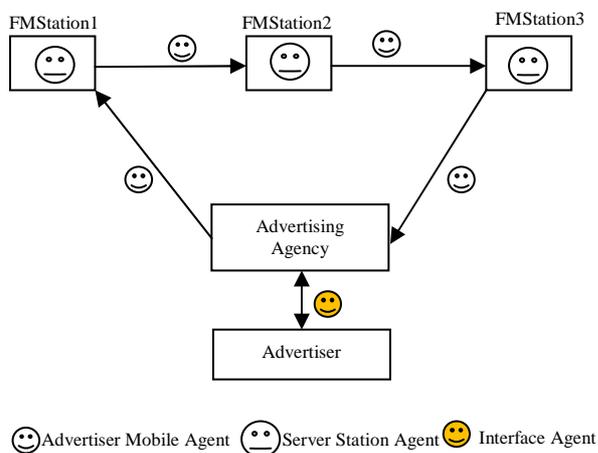


Figure 2: Overview of the System

5.1 Design of this System

Three agents are used in this system, namely:

- Interface Agent
- Advertiser Mobile agent and
- Server Station Agent.

The process of this system is shown in figure 3.

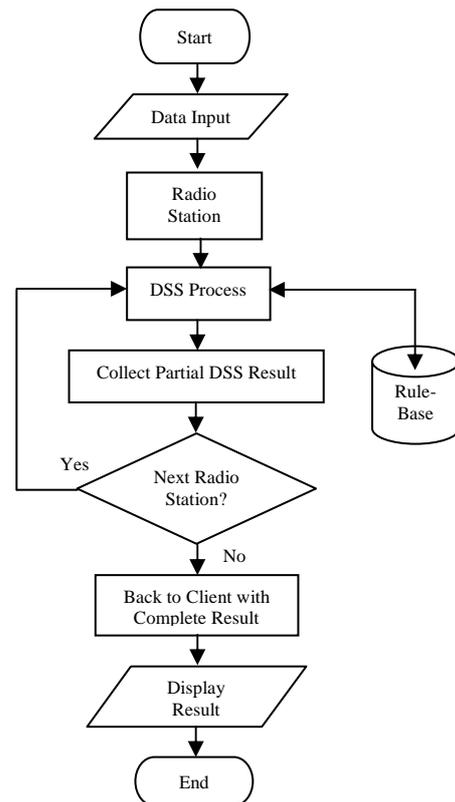


Figure 3: System flow diagram

5.1.1 Interface Agent

The main task of this agent is to send user information and display DSS result from each FM radio station.

5.1.2 Advertiser Mobile Agent

The main task of this agent is to get user information from the interface agent and send it to radio station.

On creation of the agent at the client site, the agent gets the user information. After getting these information, the agent goes to the server stations with the message "fromAgency" by carrying information.

On arrival of the agent at FMStation1 server, it checks its message by invoking handleMessage() method. The agent matches the rule-base at the FMStation1 server site. Then the agent collects the partial result and goes to the next server.

On arrival of the agent at FMStation2 server, it matches the rule-base at the FMStation2 server site. Then the agent collects the partial result and goes to the last server. When the agent arrived the FMStation3 server, it matches the rule-base at the FMStation3 server site. Then the agent collects the complete result, go back to the advertising agency.

The component interaction diagram for this agent is displayed in figure 4 and the algorithm of advertiser mobile agent is displayed in figure 5.

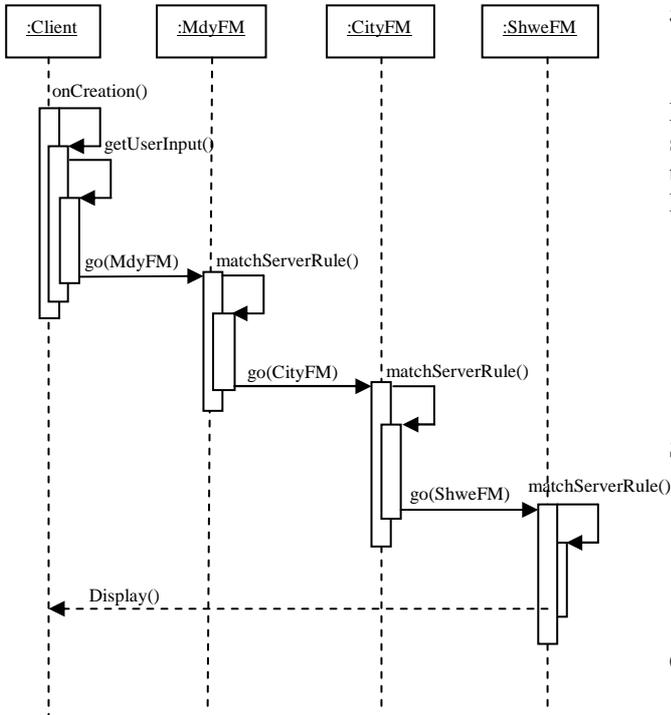


Figure 4. Component Interaction for Advertiser Mobile Agent

```

Class AdvertiserMobileAgent{
void onCreate() {
    home=setlocalAddress();
    int n=3; //for 3 FM station (MandalayFM, CityFM and ShweFM)
    int i=0;
    radio[ ] = getRadioAddress(n);
    agent.go( radio[ i++ ], "toMandalay");
}

boolean handleMessage(Message msg){
    if(msg.samekind=="toMandalay") {
        Mandalay(msg);
    }else if(msg.samekind == "toCityFM") {
        CityFM(msg);
    }else if ( msg.samekind=="toShwe" ) {
        Shwe(msg);
    }else if ( msg.samekind=="returnHome" ) {
        DisplayDSSResult(msg);
    }
}

void Mandalay( Message msg){
    mdy(); /*collaborate with mandalyFM Station agent*/
    agent.go( radio[i++], "toCityFM");
}

void CityFM( Message msg) {
    city(); /* collaborate with cityFM Station agent */
    agent.go( radio [i++], "toShwe");
}

void Shwe(Message msg ) {
    shwe(); /* collaborate with shweFM Station agent */
    agent.go(home, "returnHome");
}

void DisplayDSSResult( Message msg){

```

```

/*Display the final DSS result*/
}
}

```

Fig 5. Algorithm for Advertiser Mobile Agent

5.1.3 Server Station Agent

The system uses three server stations: MandalayFM, ShweFM and CityFM. Each server station has their respective rule-base. Examples of the rules are described as follows:

MandalayFM:

- each program allow advertising only three period
- each period must has no more than three minutes
- a program doesn't allow the advertisement of the same product with the sponsor product of this program.

ShweFM:

- each program allow advertising only two period
- each period is limited to no more than eight minutes
- a program that it has sponsor product, it isn't advertising the same product

CityFM:

- each program allow advertising only four period
- each period no more than three minutes
- even a program that it has sponsor product, it isn't advertising the same product

Figure 6 is the interaction design for user input process. Through this window, the users can request information of three server stations. According to the user input; product category, product target and duration (seconds), match the rule base form the three server stations. And then displays DSS result in figure 7.



Figure 6 : The Interaction Design for DSS Agent

| FM Name | Program Name | Broadcast Day | Target | Period | Rate (in 10 sec.) | Total Amount |
|------------|------------------|----------------|------------------|--------|-------------------|--------------|
| MandalayFM | Heart to Heart | Sunday,Mond... | Girl, Youth | 2 | 5000 | 40000 |
| MandalayFM | Heart to Heart | Sunday,Mond... | Girl, Youth | 3 | 5000 | 40000 |
| MandalayFM | New album | Wednesday | Girl, Youth, Boy | 1 | 5000 | 40000 |
| MandalayFM | New album | Wednesday | Girl, Youth, Boy | 2 | 5000 | 40000 |
| MandalayFM | New album | Wednesday | Girl, Youth, Boy | 3 | 5000 | 40000 |
| ShweFM | New Series In... | Monday,Thur... | Youth, Boy, Girl | 2 | 20000 | 160000 |
| CityFM | New Series In... | Monday,Thur... | Youth, Boy, Girl | 2 | 20000 | 160000 |
| CityFM | New Series In... | Monday,Thur... | Youth, Boy, Girl | 3 | 20000 | 160000 |
| CityFM | New Series In... | Monday,Thur... | Youth, Boy, Girl | 4 | 20000 | 160000 |

Figure 7:DSS Results of Advertiser Mobile Agent Form

6. Conclusions

Most applications of mobile agents center on using the mobile agent as the representative of user, and the mobile agent travels around the network performing tasks on behalf of user. The mobile agent paradigm is much more powerful than this and extremely well suited for designing large-scale applications.

A decision support system is real time computer system that aids managers in solving problems through queries and modeling. Decision support system designed specifically for strategic decisions by top-level managers are called executive systems. In this system, mobile agent is commonly used for gaining information for the purpose of decision-making.

The proposed system intends to get suitable program from FM radio stations. The following advantages are specific to the proposed system using mobile agents.

- They reduce network load.
- They overcome network latency.
- They encapsulate protocols.
- They adapt dynamically.

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