Mobile-Agent Mediated Place Oriented Communication

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Abstract. When we communicate with others in a most primitive way like face-to-face conversation, we normally gather at a common physical place. This physical constraint has been recognized as an obstacle against free communication. To relax this constraint, modern communication systems like post, telephone, and the Internet have been invented. Now we are building a free society with no border on the Internet by using the electronic communication tools to enjoy free communication with people all over the world. On the other hand, in this network society, we face many serious problems like spam mail and malicious access to information resources. We believe that one reason causing these problems is that current communication technologies neglect roles of physical place in primitive communication. Implicitly, a place defines who is allowed to enter it and who is not.

In this paper, we propose the Agent Mediated Communicator (AMC) which creates virtual places for electronic communication on the Internet. Communication on the AMC is mediated by mobile agents and is achieved as interactions among agents and services in a place. When we start a communication with a person, we send a mobile agent to his/her place. Before the agent enters the place, it is authenticated and can enter only when it is allowed. Multiple agents can enter in a single place and they are visible to others. We can install various communication tools called services in a place like E-mail, Talk, Chat, BBS, WWW and so on. To show an example of look and feel of AMC, we developed a prototype of AMC based on a mobile agent platform IBM Aglets.

Place oriented communication by AMC has the following implications.

- It gives a simple and clear security model for communication.
- It gives a platform of communityware where people with a common interest can communicate with each other to create a community.
- It gives an information network platform which is easily adaptable to current physical social systems because our physical society can be viewed as a society consisting of mobile agents.

1 Introduction

When we communicate with others in a most primitive way like face-to-face conversation, we normally gather at a common physical place. This physical

constraint has been recognized as an obstacle against free communication. To relax this constraint, modern communication systems such as post, telephone, and so on have been invented and widespread over the world. By using mail and telephone, we can easily communicate with people who live in distant places.

Information network technology such as the Internet succeeds in alleviating the constraint dramatically. We can exchange messages with people on the other side of the earth in a moment by E-mail and can gather and offer various information from and to the world through the WWW. Now we are building a free society with no border on the Internet by using these communication tools to enjoy free communication with people all over the world.

On the other hand, we face many serious problems in this network society. We are annoyed with uncomfortable incoming mail called spam or junk mail everyday. Our personal information, which is open to the public on the WWW, might be used for an unintended purpose by others. Group communication on a BBS (Bulletin Board System) could be threatened by anonymous malicious posting. Nowadays it is quite difficult to solve these problems just by appealing to the network users to keep "netiquette" as social rules.

We believe that one reason causing these problems is that current communication technologies that support our network society neglect roles of physical place in primitive communication. In our daily life, when we talk with others, we usually consider the place. We usually greet friends or colleagues in a corridor, an elevator, and almost everywhere. For a business or research discussion, we usually do it in a meeting room that is separated from others to avoid interventions. When we talk about private matters, we may use a private room to keep the talk secret from others. Implicitly, a place defines who is allowed to enter it and who is not. A person who is not allowed are refused to enter it, or asked or forced to be out when he/she has already been there. Hence, we choose an appropriate place depending on the contents or participants of communication.

In this paper, we propose the Agent Mediated Communicator (AMC) which creates virtual places for electronic communication on computer network. Communication on the AMC is mediated by mobile agents and is achieved as interactions among agents and services in a place. When we start a communication with a person, we send a mobile agent to his/her place. Before the agent enters the place, it is authenticated, and can enter it only when it is allowed. Multiple agents can enter in a common single place and they are visible to others and can interact with each other. We can install various communication tools called services in a place. Services such as Chat or BBS are shared by multiple agents in the place. Place oriented communication supported by AMC has the following implications.

- It gives a simple and clear security model for communication.
- It gives a platform of communityware where people can communicate with each other to create a virtual community.
- It gives an information network platform which is easily adaptable to current physical social systems because our physical society can be viewed as a society consisting of mobile agents.

In Section 2, we show the basic components of AMC and a prototype implemented by using a mobile agents platform called IBM Aglets. In Section 3, we discuss the above implications in more detail and conclude in Section 4.

2 Agent Mediated Communicator

2.1 Overview

In Fig. 1, we show an overview of AMC (Agent Mediated Communicator).

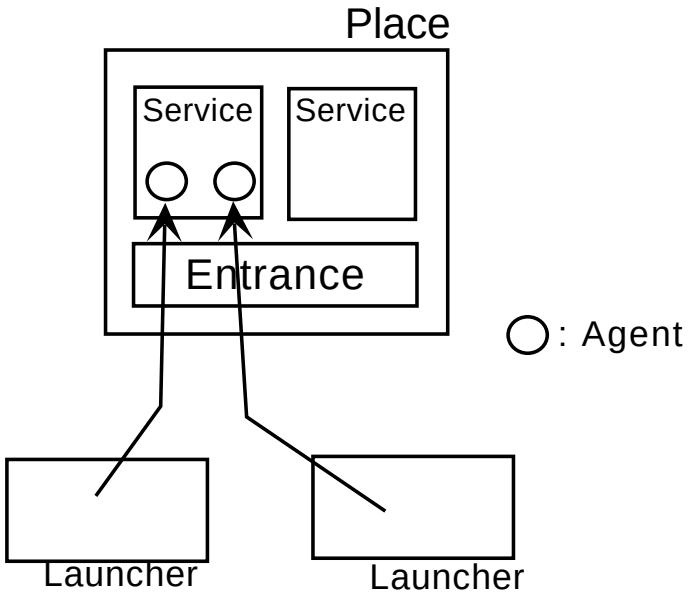

Fig. 1. Overview of AMC.

AMC consists of mobile agents, places, and launchers. An agent is a surrogate of its user with his/her profile information and moves from the user's launcher to designated places.

A place accepts agents and offers communication services to them. The Entrance is a persistent service and gives authentication to an agent that tries to enter the place. Once the agent is allowed to enter the place, it can invoke or use service programs like Mail, Talk, BBS, Chat, WWW, and so on, available there. Multiple agents can enter the same place at the same time. They are visible to others and can interact with each other.

In AMC, we have two ways to establish communication. For example, here we show two ways of mailing as shown in Fig. 2. In one-way mailing (Fig. 2(a)), we send an agent with a message from our launcher to a designated place and

post the message in the Mailbox service. This is similar to the current E-mail system except the agent is required to be authenticated to enter the place.

In two-way mailing (Fig. 2(b)), we send an agent from our launcher to a designated place to invoke the Envelope service there. Then, the Envelope service creates an Envelope agent with an envelope that moves to our launcher. At our launcher, the Envelope agent starts an envelope program and we put our message in the envelope. Finally, the agent returns to its home place and posts our message in its Mailbox.

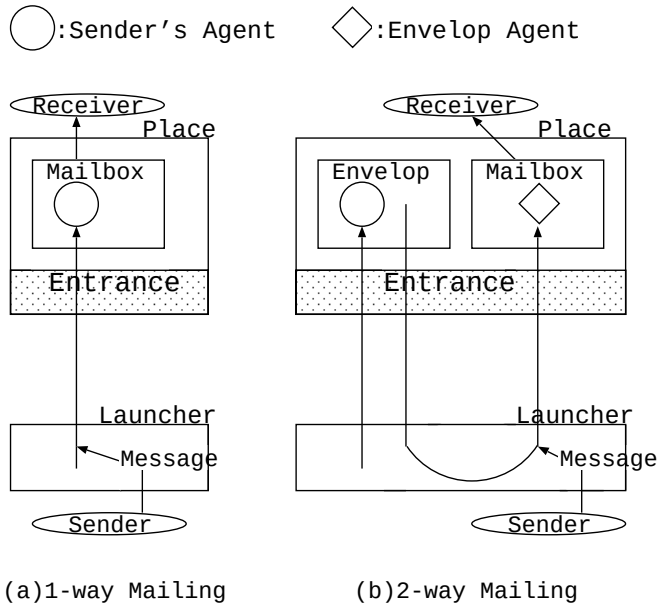

Fig. 2. Two ways of mailing.

Group communication services such as Chat and BBS can be implemented by using the two-way method because they need a client-server setup for bilateral message exchange. In the place, a service starts a server program that stores messages. When an agent requests to use the service, the service creates an client agent that moves to a launcher where the request agent is originated and starts its client program to read and write messages from and to the server. One advantage of this method is its easiness of version-up of client and server programs because client programs are transferred by client agents. Another advantage is the visibility of agents. Because agents are visible to others in the place, they can recognize not only who writes messages but also who can read them. Hence, we can use this mechanism to create an active community sharing a common interest or to monitor malicious inspections from anonymous agents.

2.2 Prototype System

We developed an AMC prototype by using a mobile-agent platform IBM Aglets [3]. At this moment, we have not implemented the authentication mechanism.

A place is managed by a window shown in Fig. 3 with the following functions.

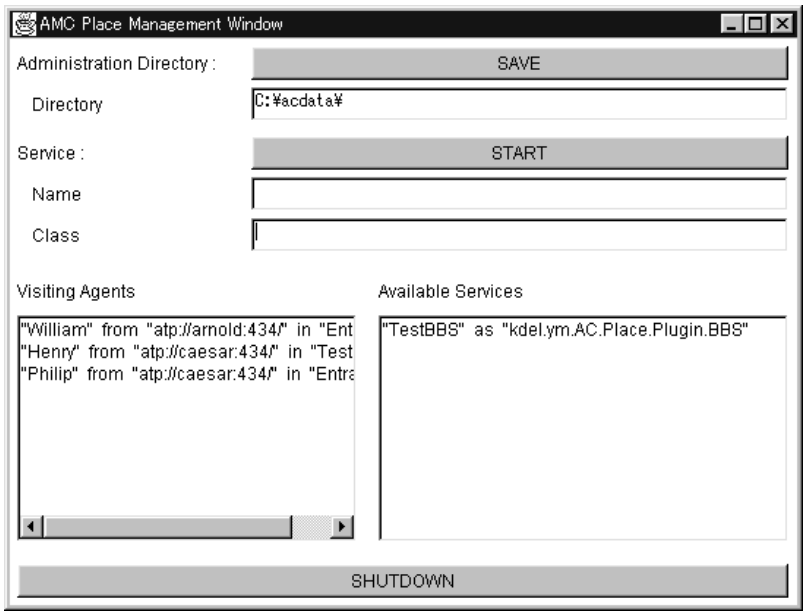

Fig. 3. Place management window.

Administration Directory specifies a directory where the configuration and logs of services offered in the place are stored.

Service starts a new service program at the place by specifying the name and the Java class and clicking the START button.

Visiting Agents lists visiting agents; name, originated address, and service being offered at the place.

Available Services lists available services at the place.

Shutdown terminates the place.

In Fig. 3, agent Willy from launcher arnold and agents Henry and Philip from launcher caesar are at this place and receives Entrance and TestBBS services. At the place, a service TestBBS is available. Entrance service is a default and persistent service, so it is not shown in the list.

A launcher is managed by a window shown in Fig. 4 with the following functions.

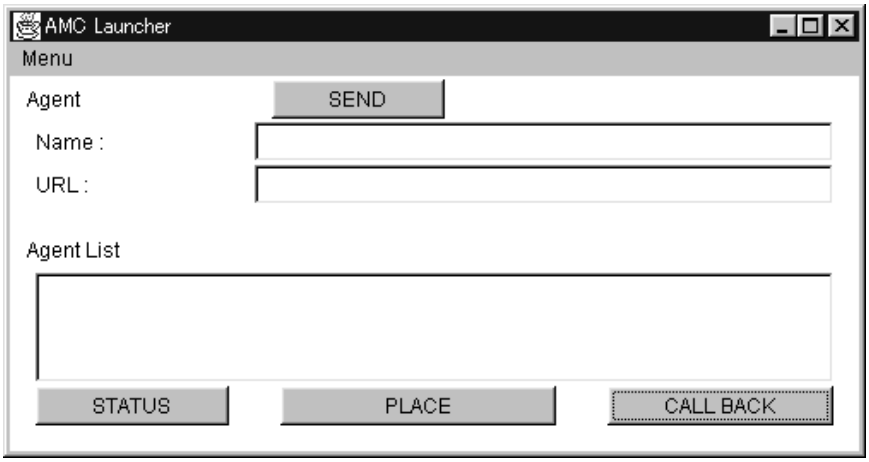

Fig. 4. Launcher management window.

Agent creates an agent with a specified name and sends it to a specified URL by clicking the SEND button.

Agent List lists agents being sent from the launcher and at remote places. By clicking buttons, we can send commands to the agents. "STATUS" shows the current status of service that the agent is offered. " PLACE" shows other agents at the visiting place. "CALL BACK" calls back the agent from the place and terminates it.

When we send an agent to a place, by default the agent invokes its Entrance service. The service creates an Entrance agent and sends it back to our launcher to open a window shown in Fig. 5. Then, we can choose services through this window.

Agents in the visiting place are displayed through a window shown in Fig. 6 by clicking the "PLACE" button of launcher management window. We can interact with other agents by clicking the following buttons.

TALK starts a talk to the designated agent.
INFORMATION shows the user profile of the designated agent.
CLOSE closes the window.

Here we show how to use a BBS service at a remote place. First we send an agent from our launcher to a place where a BBS service is available. When it succeeds to enter the place, a window shown in Fig. 5 appears. We choose TestBBS, then a BBS agent comes from the place to our launcher. It starts a BBS client program, a window in Fig. 7 opens, and a connection between the client at our launcher and the server at the remote place is established. By specifying our name and message in NAME and MESSAGE boxes respectively and clicking the WRITE button, the message is sent to the BBS service and forwarded to the other connected agents.

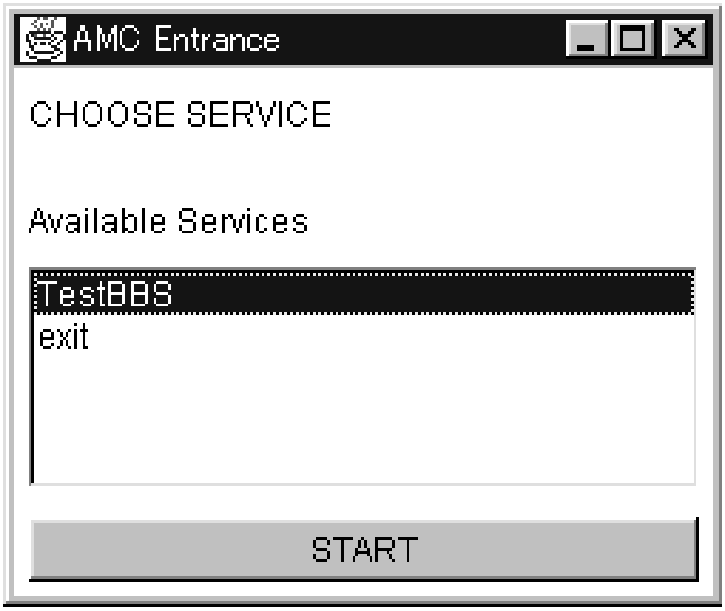

Fig. 5. Entrance window.

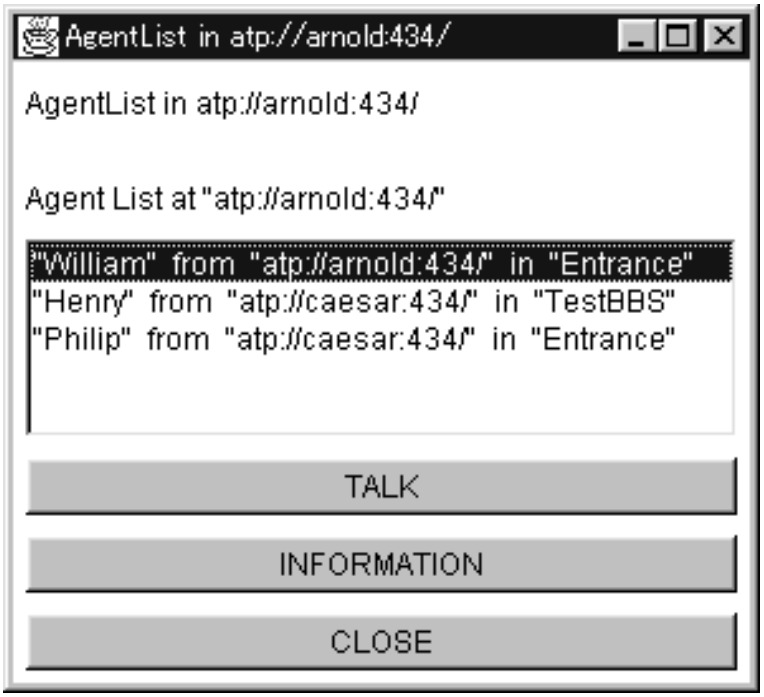

Fig. 6. Agents at a place.

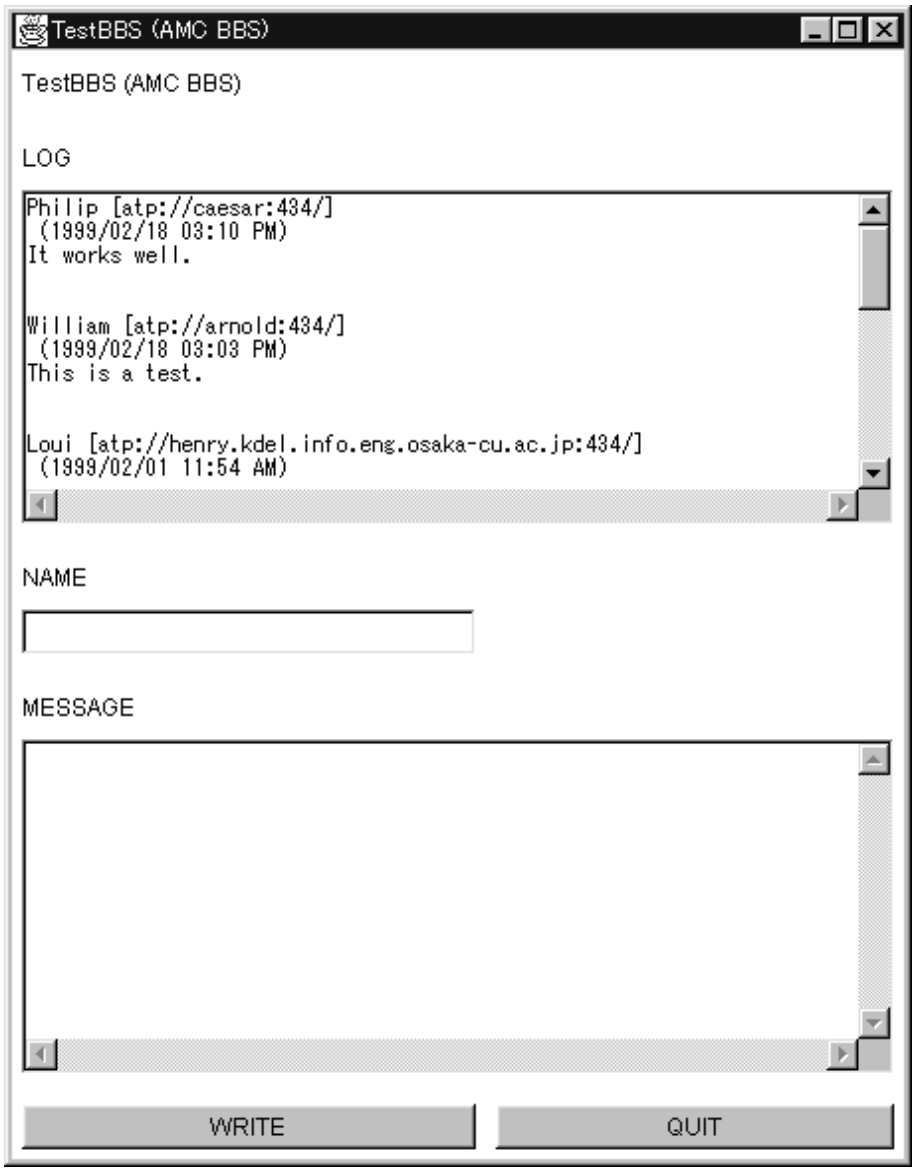

Fig. 7. BBS Service.

3 Implications of Place Oriented Communication

With AMC, we bring back roles of place to electronic communication on computer network and propose "place oriented communication (POC)." POC has several implications as follows.

3.1 Security

Security in electronic communication is one of important issues [4]. For example, we build a firewall around our intranet and protect our information resource from malicious access. However, a firewall controls communication of the whole organization but it is not suitable for a user to flexibly control accesses to his/her own resource individually. Application oriented control such as WWW access control by password or access configuration file is not easy enough for novice users. Moreover, if we have to configure access control for each application individually, it would be tiring and too complex to understand the whole view of access control. The AMC gives a simple and unified security model by introducing places into communication. We can control access by allowing an agent to enter the place or not, and all communication service is done through this agent.

Another security problem is how to deal with spam mail. In the current E-mail system, once our address is open to public, we cannot stop incoming messages whether they are good or bad. Even we try to complain about uncomfortable messages to the sender, he/she may use a fake address, and what is worse, he/she may pretend to use our familiar address.

As shown in Fig. 2, the AMC mailer can protect us from uncomfortable incoming messages by two methods. In the one-way mailing method, an agent with a message is required to be authenticated before it enters the place to post it. We can filter out most of anonymous messages and messages from fake addresses by rejecting the agents to enter. In the two-way mailing method, we send an agent to collect a message from its sender, so the sender can not pretend. Moreover, by this method, we can control the number of incoming messages by limiting the number of collection. Hence, we can control incoming messages depending on the origins and the number of messages that we like to read.

3.2 Communityware

In AMC, an agent is visible to other agents in the same place. This function may be useful to create a community of people with a common interest, which is a main purpose of building communityware [1]. When we have a special interest in some topic, we open a place and invite others with the same interest to send agents to the place. Agents are visible and have profile information of their users, so we may have more and better chances to know others and to make friends with them.

In the place, agents store and exchange information concerning the common interest. The current WWW technology is suitable for distributing knowledge, but we believe the AMC helps to collect and accumulate knowledge through

interactions among agents. For example, we can install a special service for developing a software product like Linux where we need many developers to collaborate. The service provides a testbed and developers send agents with software modules to check whether they work together properly.

3.3 Adaptability to Physical Social System

As the Internet spreads out over the world, we are going to create a network society with no border. It is said that our social regulation system such as laws cannot catch up with the advancement of the technology. Here we quote an example from an article on E-commerce [2].

> For example, does clicking Accept using a mouse in New York to download a new Netscape browser constitute a binding contract of adhesion? If so, where is the contract considered valid – in New York where the click occurs or in California where the server is located? If a dispute arises, what state has jurisdiction?

Current electronic contract on the Internet loses the concept of place. In our physical world, a contract between two parties are often made through human agents and one of them may go to an office of the other party to put his/her signature on documents. The AMC based on mobile agents can naturally model this process.

The above problem shows that there is a gap between the physical society where place has a meaning and the network society where it loses its meaning, and how to narrow this gap will be an important issue. Our solution to this issue is by an approach from the technology side. We believe that it is better to build a network society that is a natural extension of the physical society than an isolated one. The AMC can help to build such a network society because our physical society can be viewed as consisting of places and agents.

4 Conclusion

We proposed the Agent Mediated Communicator (AMC) which is a communication platform consisting of places and mobile agents. We developed a prototype system by using a mobile-agent platform IBM Aglets. In addition, we mentioned its implications from security, communityware, and its adaptability to physical social systems.

In this paper, we just proposed initial ideas of place oriented communication by AMC. Our future work is to add an authentication function to AMC and to develop various services to show its advantages. We also should consider the connectivity to current communication tools like E-mail, WWW, and so on and incorporate them into the AMC platform.

By incorporating mobile agents, we may introduce another security issues like kidnapping, analyzing, and converting agents, so we need to study more about these issues.

Acknowledgement

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