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Collation of Mobile operatives

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ABSTRACT
Many of mobile devices suffer from limited computation resources (memory and processors), limited network connection, bandwidth and limited battery life. For minimizing these problems mobile agents are premising technology. However, for clients and servers most mobile agent systems are very resources demanding. This research paper describes an approach to run mobile agents on different devices from mobile phones and Personal Digital Assistants (PDAs) to powerful PCs. It proposes a simple mobile agent architecture and middleware that makes it possible for accessing a mobile agent system on different devices. This architecture and middleware proposes that clients will state their abilities. Depending on these abilities, the client will either run the full mobile agent on the device or only run a light-weight version of the agent on the device. The mobile agents are basically same on all clients, but code of the mobile agent is removed for small devices. This means that only the data of the agent can be changed for mobile devices with minimal resources. The code of this agent is stored at the server. When the agent returns to the server, the two parts are joined and the agent is ready to be executed. The joined mobile agent can migrate to other agent servers and clients. A middleware is also proposed that makes it possible to establish communication between different heterogeneous devices.
Keywords: Personal Digital Assistants (PDAs), Mobile Agent, thick agent client, thin agent client, agent initiator, agent joiner/splitter and mobile agent dispatcher.

I. INTRODUCTION

Many people use electronic devices like mobile phone and PDA's for their personal use and for professional use and for pleasure but these devices suffer from limited battery life, limited memory and limited data storage, small screens, limited processing power and limited network bandwidth and network connection. In distributed mobile computing environment, there is a lack of such standard middleware and even if it exists, it is limited to a few applications like data base access [1-2] and web browsing [3-4]. Mobile agents have suggested as a technology to compromise with challenges such as the increased need for personalization, high latency, demand for large transfer and disconnected operation that's why mobile agent can be ideal for mobile devices. Battery power can be saved by sending a mobile agent to another computer for data collection and computation,. Dispatching agent to another machine and get the agent with the result back when finished can reduce problems with slow and error prone network connection.

In this research paper, an architecture and middleware are proposed that makes it possible to run the mobile agent on various kinds of mobile devices. There are many motivations behind it to remove the heterogeneity between the devices, Simplify application development for complex environments, dynamically gather context information, allow application developers to program directly to application's needs, seamlessly adapt to environmental changes, transparently help programmers cope with problems inherent in ubiquitous networks.

II. EVOLUTION OF MOBILE COMPUTING

The Idea of mobile computing has only been around since the 1990s. Since then, Mobile computing has evolved from two-way radios that use large antennas to communicate simple messages to three inch personal computers that can do almost everything a regular computer does. The term mobile computing is quite new which has no clear definition, although some studies have been done already to explore this fast-growing area of information technology. These does not only involve mobile computing devices (laptops, wearable computers and PDAs) which are designed to be carried around, but also the mobile networks to which these devices get connected. Mobile services are the third component, turning out this definition of mobile computing. There are a number of well-known academic mobile agent systems such as Agent Tcl [9], Mole [5], Ara [10] and Tacoma as in [8] and industrial mobile agent systems such as Aglets [6] and Concordia [7].

2.1 Challenges Behind Mobile Computing

Various characteristics of mobile agents are as follows:-

- High bandwidth variability
- Frequent disconnections
- Predictable disconnections
- Physical support for broadcast
- Monetarily expensive
- Asymmetry
- Relatively unreliable
- Low bandwidth

Different types of network disconnections are Voluntary or forced, Short disconnections and long and Predictable or sudden

These are different challenges in mobile computing. The major challenges are to support the disconnected operation. Mobile agents are the backbone of mobile computing. They are an excellent paradigm for implementing distributed applications, particularly in the context of partially connected computers and mobile devices. To be effective, however, the agent system must support disconnected operation in several ways.

- An agent must be able to jump off a partially connected computer (such as a laptop) and return to it later, even if the computer was only connected for brief periods and changes its address upon reconnection.
- An agent must be able to navigate through the Internet to find the services that it needs.
- An agent must be able to sense and react to the network environment state, so that it may act autonomously while its user is disconnected.
- An agent must be able to communicate effectively with other agents.

III. PROPOSED MOBILE AGENT ARCHITECTURE FOR HETEROGENEOUS DEVICE:

Mobile electronic devices such as mobile phones and PDAs have a type of heterogeneity. These devices suffer from limited battery time, memory, data storage, limited processing power, small screens, cumbersome input, network bandwidth and network connections. Mobile agents have been suggested as a technology to deal with challenges such as the increased need for personalization, high latency, demand for large transfers and disconnected operation. Therefore mobile agents can be ideal for mobile devices. Sending a mobile agent to another computer to do the data collection and computation can save battery power. This also means that heavy computations that will take long time on a mobile device can be executed at a more powerful computer with more memory, faster CPU and without any power limitation. In addition, dispatching the agent to another machine, and get the agent with the result back when finished can reduce problems with slow and error-prone network connections. Most mobile devices will consume a lot of battery power when transferring data over a network a long period of time. Mobile agents can reduce these problems. A logical view of the architecture of heterogeneous mobile agent system [11] is illustrated in figure 1.

Central part of architecture is agent system repository where agent information can be stored along with client information such as client device capabilities. In this research paper, thin agent clients have been introduced which only deal with the agent state where the code of the agent is stored on the agent server. They also have code for transmitting and receiving agent data and a simple GUI for manipulating this data. Devices which have sufficient memory and CPU, mobile agents can run locally on the device. The general agent server services are located above the repository that controls the essentials agent services such as locating agents, registration of agents, management of agent lifetimes (initiate agents, kill agents , clone agents) etc.

The rest of the architecture has been split into following main parts.

- Thick agent clients: these are able to execute mobile agents locally.
- Thin agent clients: these are only able to manipulate the agent data (state).
- Agent joiner/splitter: they distinguish between the architecture of the thick and thin agent client. They also make it possible to split the data and code of the mobile agents before dispatching the agent to thin client which makes it possible to access mobile agents on less capable devices. For thin clients they are used to assemble the agent when received from the client.
- Agent initiator*:* it is responsible for initiating the agent clients first time or reconfiguring the agent client based on changes in the mobile agent software or hardware/software on the client.
- Mobile Agent Dispatcher: This is the last component of the architecture *which* makes it possible to dispatch agents between clients and server .

IV. CONCLUSION

Mobile devices have many limitations compared to stationary PCs. Not all of these

limitations such as the screen size, network bandwidth, battery capacity and input devices have much influence on a mobile agent application. There are other more noticeable constraints that limit an agent application. However, these constraints are possible to overcome. The most noticeable limitations when making a mobile agent application for mobile devices are Limited connection time, Memory and No object serialization.

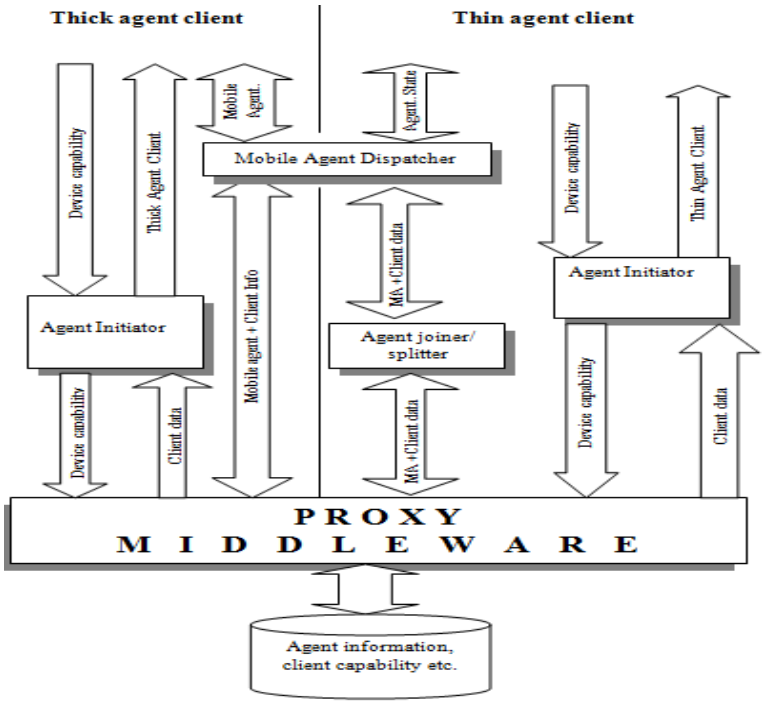

Fig 1: logical View of heterogeneous mobile agent system

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