Nomadic communication – impacts of agent-based mobile e-commerce applications

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Abstract

Strong growth of both Internet and mobile telecommunication leads to new promising mass-market end-user applications. For some time a remarkable trend towards banking and shopping over the Internet could be observed. As this trend develops the range of services available to both businesses and individuals will grow. With the broader application field the need to provide simple but secure mobile access to such services will get more and more momentum. Modern mobile e-commerce applications will support nomadic communication utilising the inherent autonomy of mobile agents.[1]

Keywords: *agent technology, personal mobility, terminal mobility, mobile agents, e-commerce.*

1. Introduction

Mobile telecommunication networks are currently preparing for mobile data services. Compared with the traditional voice based networks; future generation networks need more flexibility to fill the new purposes. Agents, especially mobile agents seem to be best suited because of their characteristics of autonomy, intelligence, mobility, co-ordination and co-operation [CAM00].

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Considering provisioning of new, sophisticated services by a network operator or service provider, the services should be provided in a more direct and flexible way [Mag96]. For a user this means to receive the features of nomadic mobility, consisting of both personal and terminal mobility.

Using an agent-enabled system, agents can represent almost any party of the system. Some old application processing scenarios can be executed in a more effective and flexible way. In particular, this is valid for new applications in the well-promising area of electronic commerce, because in the past it was only tried to realise these applications in a transaction based manner [Har99]. With the help of agents, it is possible to build these applications easily in an asynchronous way [Lip99].

2. Impact of agent technology on personal mobility

Personal mobility allows a user to access communication services through different devices, e.g., at home, office, mobile phone, notebook, PDA. This means that the user has several different access points. Calls and messages directed to the user should be presented to him at the device he is currently using. Two aspects related to personal mobility are number mobility and service mobility [Har96], see Fig. 1. Number portability allows a user to originate and receive calls at any location

by using the same destination number. The success of the 2nd generation mobile communication standard GSM relies, among other things, on the possibility to roam between networks – and thus between countries – by using a single subscription. This means that subscribers are reachable using a single number and receive a single bill from their home service provider. Service mobility [Jas99] allows a user to access his personal service portfolio independent of the end-device he uses. The concept allowing 'service roaming' is called Virtual Home Environment [VHE99] and is currently under standardisation in the framework of the UMTS standards.

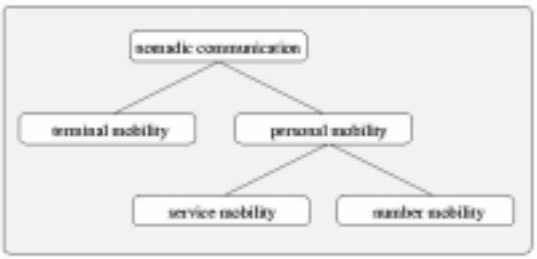

Fig. 1: Nomadic communication

In [Har98] it has been investigated that mobile agents could solve personal mobility requirement by rerouting of digital information (home/foreign agents) and downloading of service agents. A mobile agent called home agent holding the users profile can update its database related to the user's current device and location. Service agents represent a service that can be used by a user or a component. Using a terminal agent it is possible to activate and deactivate specific services. At every terminal service agents have to be download at least one time and can be reused the next time.
However, on each end device should support an agent system, which knows how to handle multiple agents. An agent system which cannot utilize the agent's result data fails, but a mobile agent migrating to an agent system which cannot handle its resource requirements can even cause agent system failures. Considering that some devices are not capable to meet the resource requirements of some services, or services are not available on all devices due to licensing policies, a mobile agent should check in advance whether the agent system the user is currently logged in can utilize the agent.

3. Impact of agent technology on terminal mobility

Terminal mobility allows a user to roam with his end device while making use of communication services. This requires a radio interface between the terminal and the accessed network. The network is able to locate and identify a particular device as it appears within a network domain and while it is in motion, whether or not a call is currently taking place [Har96].

Mobile agent technology facilitates the signalling procedures for communication networks. Instead of using a standard signalling protocol to trigger a sophisticated new service, the user only has to download a so-called service agent or terminal agent, respectively, from the service agency. Hence the selected service can be used even in networks using a different operating system or a different access technology because of the network and access independence of mobile agents. Once the suitable version of a terminal agent is available on the terminal the user can access service agents. The terminal agent sends this information to the service node to check whether the user is authorized to access the required service. If so, the service node instructs the corresponding service agent to move to the connected terminal. However, this scenario could only become true under the assumption of the existence of installed agent system on end-devices and service nodes.

In an agent world consisting of agent systems within a highly reliable wired network the possibility of agent system disconnection or shutdown is quite low. Most of the existing agent systems today such as Voyager [Obj00] and Grasshopper [IKV99] are addressed to this scenario. However, mobile access networks introduce a new level of uncertainty to an agent world. This uncertainty can be solved by a network sensitive migration mechanism. This means that an agent will ask the agent system for the expected transfer times in advance of the

migration. Moreover, the agent system will support an agent suspension and wake-up mechanism for mobile agents waiting for access to migrate to a specific terminal.

Solving the requirements of personal and terminal mobility means to provide the user with opportunities of nomadic communication, see figure 1, to which is also referred to as total mobility [Har96] and ideal user mobility [Tha99].

4. Impact of agent technology on mobile e-commerce applications

The strong growth of the demand for user mobility increases the needs to conduct a transaction such as electronic shopping, payment, banking, gambling, ticketing, etc. anytime and anywhere. This leads to an effort to integrate existing electronic payment systems into the mobile environment. Mobile e-commerce, also referred to as m-commerce, is a subset of e-commerce and deals with the e-commerce issues in the mobile environment [Kel98]. Mobile e-commerce delivers significant opportunities to those working in the banking, transport, retail, and communication industries.

The mobile environment comprises many wireless technologies, such as UMTS, GSM, wireless LAN, DECT, Bluetooth, etc. Each technology has its own characteristics that may impact the realisation of mobile e-commerce. However from the consumer's point of view, mobile e-commerce should meet the following requirements:

- simplicity
- response times comparable to traditional electronic transactions
- security
- convenience

Having in mind that mobile communication is still quite expensive, the bandwidth is limited and bit errors occur frequently, it is necessary to investigate dedicated solutions for mobile e-commerce applications.

Thus, the main requirements for these applications coming from the network and service provider perspective are:

- data integrity,
- secure transmission,
- limited amount of data
- scalability
- rapid, easy and economic creation, testing and introduction of services

All requirements mentioned above have to be taken into account when building an agent-based mobile e-commerce solution too.

However, first examples [Har99] have shown that mobile agents are well suited to well-performing e-commerce applications and it seems that they are able to offer financial services to mobile users in a more flexible way. In particular they lead to decreased costs in communications due to their ability to asynchronously and autonomously without a network connection.

5. Conclusion

Mobile e-commerce applications will soon gain momentum. However, real user demands are still the most ignored matters. Agent technology, especially mobile agents, might be a viable way to fulfil all requirements, such as rapid, easy and economic creation, testing and introduction of applications, and provide the user with personal as well as terminal mobility.

Hence, agent-based applications might pave the ground for flexible environments, where well-know and trusted agents serving the user needs. Thus network operators and service provider should decide to support well-performing and scalable agent-based concepts in order to offer their customers adaptable and efficient service environments, which allows nomadic communication. The authors will work out a concept aiming personal and terminal mobility for building agent-based mobile communication systems in typical mobile environments (e.g., cars, and transport/logistics).

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