

Quality-of-Service-Aspects in a Mobile Context

*Diploma thesis by: Noman Basit
Supervisors: Dipl.-Inform. Matthias Finke*

»Mobile Computing« is playing a major role in our life. Users with their mobile devices would like to get access to resources in the networks and to various multimedia-applications (like videoconference). Because of the physical characteristics of mobile networks the quality may suffer. Multimedia-datas are very time-critical, therefore a special solution is needed.

These problems can be expressed through Quality-of-Service (QoS). This research describes QoS regarding »multimedia« and »mobile computing.« Various QoS-parameters are introduced and described herefore. Further, this research deals with new mobile-communication-technologies and gives a short introduction in BLUETOOTH and UMTS (Universal Mobile Telecommunications System).

Mobile Internet-Services

*Diploma thesis by: Sven Tristram
Supervisor: Dipl.-Inform. Luc Neumann, Dipl.-Inform. Jürgen Schirmer*

With the introduction of the new defacto standard Wireless Application Protocol (WAP) the Internet becomes more interesting for mobile users. The new technology takes consideration to the limitations of the mobile Internet-access. This work gives an overview of new mobile devices that provide the new standard. Furthermore, mobile internet-services are analysed and classified. Then, guidelines for the development of user interfaces on mobile services are defined. Finally, an example mobile Internet service has been realized.

One central topic in this work is the examination of the new language WML (wireless markup language), that is part of the WAP standard, with all its capabilities in regard to the realization of information services on mobile devices. The different possibilities in formatting and layouting content give the necessity of creating rules and guidelines in regard to the properties of mobile devices. These

guidelines are used for the realization of example WAP-services.

A further objective of this thesis was the design and development of a mobile Internet-portal. With this portal the access to favourite WAP-services becomes easier and faster. The implementation of the portal is embedded in an existing concept that adapts standard Internet content for small displays – the AdaWeb. One reason for the integration of the Internet-portal in AdaWeb was the personalization of the individual portals, which are supported by the user-management of AdaWeb. The other reason is that AdaWeb can be extended to adapt WML-content for different mobile devices. With this integration both types of browser – which are capable of displaying HTML-content or the new WML-content – are able to use AdaWeb.

Based on the guidelines worked out a mobile Internet-service in the area of Mobile Commerce has been developed. In the realization of the example »mobile banking«-service the requirements of usability on mobile devices with limited interaction capabilities are considered so that this service is a validation of the developed guidelines.

Mobile Computing and Mobile Agents

*Diploma thesis by: Ping Hou
Supervisors: Dipl.-Inform. Jürgen Schirmer*

Mobile devices make it possible for the user to access the information and online-services over the wireless network independent upon the time and location. Mobile agents are gaining an increasing attention within mobile computing. Mobile agents are programs which are dispatched to remote computers, where they execute their tasks autonomous in interaction with agents and services.

Currently, available mobile agent platforms do not take sufficient considerations upon the special requirements on agent applications for mobile device users. In regard to the limited computing power, the memory capacity and expensive wireless network connection, the mobile agent platform and the mobile agent application should moreover not be installed completely on the mobile device.

In this thesis, an Agent Gateway was developed, which serves as an application bridge into the mobile

agent infrastructure (SeMoA) and provides various agent services for mobile device users to delegate tasks.

The process of task delegation involves the selection of mobile agents from an Agent Gateway as remote agent provider, the configuration and remote start of mobile agents. In order to accomplish these tasks it maintains both user related data describing user profile and agent related data for registered users. On the other side it should have direct access to mobile agent platform in order to generate and start mobile agents, which execute the user tasks, and to acquire feed back, which should be returned to the user. Furthermore the agent gateway can cooperate with other agent gateways by maintaining entries to agent services available on other agent gateways so that in necessary cases it forwards user requests for certain services to them. In this way the agent gateway is also associated with some features similar as yellow page. In this paper SeMoA (Secure Mobile Agents) is used as the mobile agent platform.

An agent browser for remote access of mobile agents by mobile device user is needed to facilitate the human-agent interaction though a message exchange with the agent gateway and mobile agents. The agent browser should be designed in conformity with special properties of mobile devices for example limited resources, limited display size, low bandwidth of wireless networks, expensive wireless connection etc. With the user interface provided by the agent browser a human user can specify initial mission for mobile agents, inquire about agent status and intermediate results, update his intention, give further instructions etc. The feed back and results from mobile agents should also be represented with dialog elements for human users. Concerning the human-agent interaction the people's psychological feeling is a very important aspect. Regarding that mobile agents execute their tasks autonomous roaming over the network the people would get easily doubtful against mobile agents and reject to delegate tasks to them. In order to improve the acceptability the agent browser should help human users understanding the activities of mobile agents and convince them that they really have the control over agents.

In this paper KQML (Knowledge Query and Manipulation Language) is selected as agent communication lan-

guage and as interface to connect the agent browser to the agent gateway. An agent communication protocol for the interaction between the agent browser to the agent gateway is defined with KQML, using reserved performatives of the KQML Specification 97 and a few self defined performatives. KQML should use a communication protocol to transfer KQML messages over the network. It can work over HTTP, SMTP, FTP, RMI and other transport protocols. Using the combination of SMTP and POP to send or receive KQML messages is a suitable solution for mobile devices. So existing mailing infrastructure including outgoing and incoming mailserver are directly available for message transport. With a single connection mobile devices can get from POP mailserver several e-mails which KQML messages are embedded in. Using the MIME standard it would be very convenient to transfer files including multimedia elements together with KQML messages embedded in e-mails.

Based on the concept developed in this paper a prototype for the Agent Gateway Browser are implemented using JDK 1.2. As application example, a travel planning agent incorporating a hotel and flight ticket agent is sketched to evaluate the concept.

Valuation of Deformation by Gradients of the Mapping Function

*Diploma thesis by: Kai Kreuzer
Betreuer: Dipl.-Inform. Marc Alexa*

This paper introduces a method that solves the path problem in object morphing. The objects should be represented by simple polygons, i.e. as linear approximations of their outer bound.

Assuming that the correspondence problem is solved we construct compatible triangulations of the given polygons. We introduce a notion of similarity on these triangulations: The similarity of two triangulations is defined as the median similarity of their corresponding triangles. The similarity of two triangles can be expressed by the gradient of their mapping. This is done by cost functions of the Jacobi matrix. Such a cost function must meet the following demands: scaling, stretching and shearing should entail costs, while translations and rotations should have no costs. Flipping a triangle must entail infinitely high costs in order to avoid illegal triangulations.

We propose three different cost functions:

- Comparison with a rotational matrix: Difference of the determinant to 1 and of other characteristics entails costs.
- Consideration of the images of the unit vectors. There are costs, if the vectors are scaled by the same factor, scaled independently or sheared to each other.
- Consideration of the eigenvectors. They are perpendicular after removing the rotational part from the mapping. Hence there must be costs only for scaling work, as in proposal 2.

The third version appears to be the best suitable and will be used for the further proceeding. The influence of the triangulation can be reduced by optimization of the vertex coordinates, so that similar figures are triangulated similarly.

The path problem can now be solved by the notion of similarity: Recursively we define an intermediate triangulation, which minimizes the sum of the costs to the two given objects. Since the function to minimize is very complex, it is not possible to give an analytic solution, which solves the minimization problem. Instead we use an iterative algorithm: Starting with suitable coordinates for the vertices, we move single vertices in a way that the costs decrease until we reach convergence. The direction in which a vertex should be moved best can be obtained by partial derivatives of the coordinate variables.

The results match the expectations: The guaranteed legal triangulations show nicely morphed objects, which, whenever possible, rotate parts of the given objects instead of deforming them. A problem is that the method has a tendency to construct asymmetric objects, even if the given objects are symmetric.

The method can be extended to three-dimensional objects. Further usage of it can be made to solve the correspondence problem or to morph textured objects.

Conception of an Agent-based Electronic Market Place System

*Study thesis by: Christian Schmidt
Supervisor: Dipl.-Inform. Jürgen Schirmer*

The Internet and the World Wide Web are becoming an increasingly important channel for retail commerce. In spite of the rapid development of the past few years, today's (rational) online shopping is still a timely and cumbersome process. This is mainly because human interaction is still needed in all stages of the buying process (e. g. product selection, merchant selection, negotiation, etc.).

Recently the concept of software agents has been applied to the domain of electronic commerce and online shopping in particular to address these present limitations. This leads to the development of so-called agent-based electronic market place systems, in which the market participants are represented by software agents.

This thesis proposes a concept for the development of such an agent-based electronic market place system for the business-to-consumer area. It starts with a detailed analysis of the buying processes running in the market place. These are shown to comprise several different stages. It becomes clear that the used negotiation protocols have substantial influence on the nature of the activities in the market place. Integrative negotiation protocols, in which market participants negotiate co-operatively along several dimensions of a transaction prove to be superior to conventional distributive negotiation protocols (and thus in particular to the popular single auctions) for most goods.

Next is a comprehensive requirements analysis for agent-based electronic market place systems. In this context quality improvements of the buying processes as well as their complete automation can be identified as primary objectives. Motivated by their growing importance, the idea of integrating mobile devices (e. g. mobile telephones, personal digital assistants) and thus mobile users into the overall concept is put forward.

What follows is the analysis of already existing agent-based electronic market place systems. This includes Massachusetts Institute of Technology's prototype systems Kasbah and Tête-à-Tête.

Finally the conceptual design of an agent-based electronic marketplace

system takes place. It starts with the selection of a suitable basic architecture. For lack of any appropriate literature references, a new classification scheme is developed first. The selected model includes neutral market platform operators and mobile agents on the buyer's side. It thus enables buyer's mobility. In a next step the segmentation of the market place system according to different negotiation protocols is proposed. Finally the detail conception of an integrative market place segment is presented. It makes use of a set of elements from the Tête-à-Tête – system. The design is based on a three-stage phase model of the buying process consisting of a consulting phase, an integrated phase for product brokering, merchant brokering and negotiation as well as a concluding phase for contracting and fulfilment. The presented model enables the integrative negotiation over all dimensions of a transaction. It enables potentially complete product and provider transparency and allows the automation of the entire buying process.

Plastic deformation of spline-like structures with constant length

*Diploma thesis by: Martin Thoma
Supervisor: Dipl.-Inform. Elke Hergenröther*

Car- und aircraft designers often use virtual prototypes during development. These prototypes are used to design the shape, but also increasingly to perform tests of the physical behavior. Therefore spline-like structures like tubes, cables, ropes etc. become more and more important. A car contains more than 2 km of cables, often connected to a cable harness. There is almost no technical device without cables.

The cables are to be installed into a car. During this, the deformation of the cables should be correctly simulated. Furthermore, the cables have to interact with other objects. For example they could be layed around other objects. To allow the user to work interactively, the used algorithms have to be real time capable.

In this diploma thesis, the behavior of cables on a horizontal plane is simulated in real-time. Cables can be dragged on the plane. The friction between cable and plane is considered.

The physical model connects nodes with unflexible segments. At every joint there is a spiral spring acting

against the excursion of the joint. The parameters of the springs define the properties and therefore the behavior of the cable. The positions of the nodes are calculated with the algorithms presented in this diploma thesis. The segments between the nodes are interpolated with the algorithm introduced by P. Daehne.

To simulate the dragging of the cable over the plane, four algorithms have been developed and implemented, which are used depending on the situation. The presented algorithms are scalable. Depending on the used hardware, the user can choose between a fast execution and an exact simulation. Generally, the results seem to be visually correct even when a lower precision is used.