Multimedia Workplace of the Future

Herbert Kuhlmann
ZGDV, Rundeturmstrasse 6, 65283 Darmstadt, Deutschland
Tel: 06151-155 120; Fax: 06151-155 450; E-mail: Herbert.Kuhlmann@zgdv.de

Abstract. The focus of MAP is the development of special technologies, components and new methods for multimedia interactions that use novel and intelligent systems offering assistance and supporting delegation. In the MAP system, software agents do routine tasks that have little structure or are time-consuming - no intervention of the user is needed. The results can then be reported back and presented in adapted multimedia presentations

1. Introduction

Working environments, especially computer-supported workplaces, have changed dramatically over time. Figure 1 shows how the user communities, system integration and usage of computers has changed.

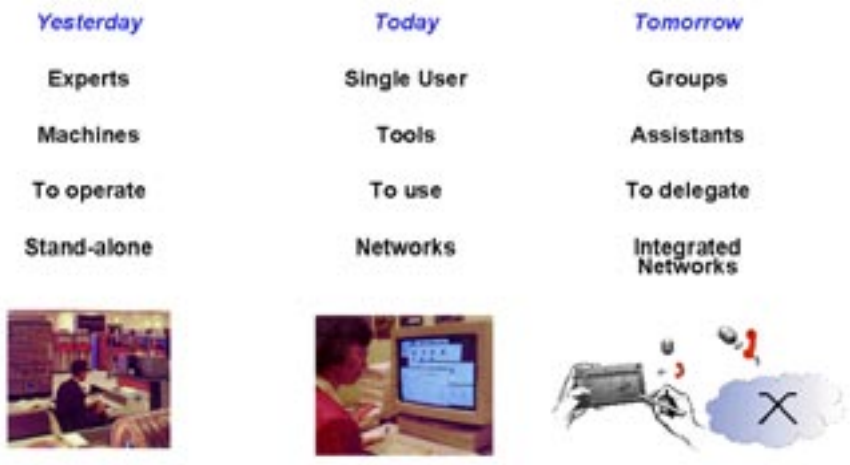

Figure 1: Changes in computer-based working over time

In times of mainframe computers, experts operated the machines. From the 80s and 90s, until today, computers have mainly been used by single users. The user has to work with »tools« and must perform tasks himself. In the future, the computer will not be »used« anymore but the user – who will increasingly function as an actor – will delegate tasks. The computer will be more like an assistant. Furthermore, the integration and use of different kinds of networks, from high-bandwidth LANs down to low-bandwidth wide-area cellular networks,

will be seamless. In today's working environments, there is a need to respond quickly, flexibly and to plan ahead.

This requires new and more dynamic ways of working with computers. The new role of the computer is the focus of the project MAP. Together with the consideration of new working structures which lead more and more to mobile work, the topics delegation, assistance as well as support of mobile devices and integrated networks will play a main role in our developments. One goal of the MAP project is the development of a kernel-system, which includes the support of agent technology, new human-computer interaction mechanisms, the integration of security mechanisms, and the support of mobile devices and context-aware working.

2. MAP System Model

Today's user must be able to understand, handle and evaluate data at his multimedia workplace, whether at the office or on-site and also when at home to delegate work back to the office. Software agents do routine tasks that have little structure or are time-.consuming: -- no intervention of the user is needed. The results are reported back and presented in adapted multimedia presentations. The developments of MAP include:

- the development and implementation of security mechanisms in a MAP platform
- the integration of virtual reality and ubiquitous computing into a hybrid concept,
- the development of delegation mechanisms using agent based systems,
- new interfaces with speech and handwriting recognition and anthropomorphic presentation,
- adaptation to mobile environments, including laptops, organizers, and mobile phones
- preparation of mobile assisted functions with location awareness..

These developments are also represented by the working structure of the MAP project (cf. Figure 2).

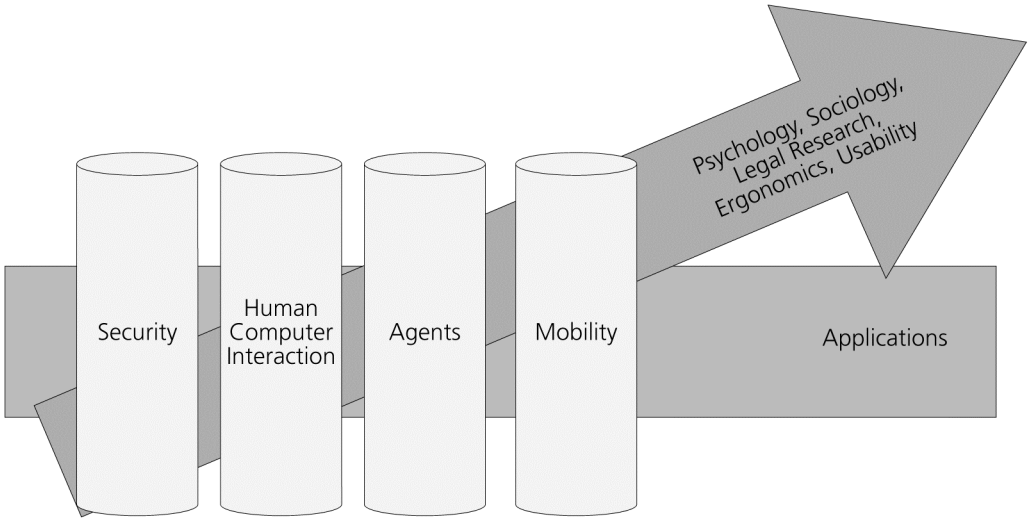

Figure 2: Working structure of the MAP project

In this project, components are created which enhance the working quality significantly by addressing the requirements of complex coordination and adaptive information presentations. Typical working processes, including high mobility and multiple tasks processing, will be part of the MAP applications. There are two main phases during the project work: the development and testing of prototypes of multimedia workplaces and user evaluation in a field trial. Furthermore, the MAP system will be developed in two generations. The results of MAP will allow industries to use resources efficiently and this will enhance productivity, especially when done on the move. The results will further be the basis of a new standard for mobile multimedia workplaces.

3. Secure Agent Platform

MAP is implemented as an agent-based system; the agent platform used is SeMoA (Secure Mobile Agents) developed by Fraunhofer IGD. The server is written in Java, and agents can be written in Java as well. Mobile agents push the flexibility of distributed systems to their limits since not only computations are distributed dynamically, the code that performs them is also distributed. Mobile agents roam the network, seek information, and carry out tasks on behalf of their senders autonomously. Upon return to their senders the agents present the results of their endeavors. Meanwhile the user is freed of the obligation to permanently monitor the application's progress. This makes mobile agents particularly useful in mobile environments (disconnected operation), because no permanent network connection must be maintained in order to run the agent-based application. Mobile agents also offer great benefits to applications in "wired" networks by adding client-side intelligence and functionality to server-side services unified under a homogenous access paradigm. Furthermore, mobile agents offer considerable network bandwidth savings because they can migrate to, and process data, at the source of that data, which therefore need not be shipped back and forth across the network.

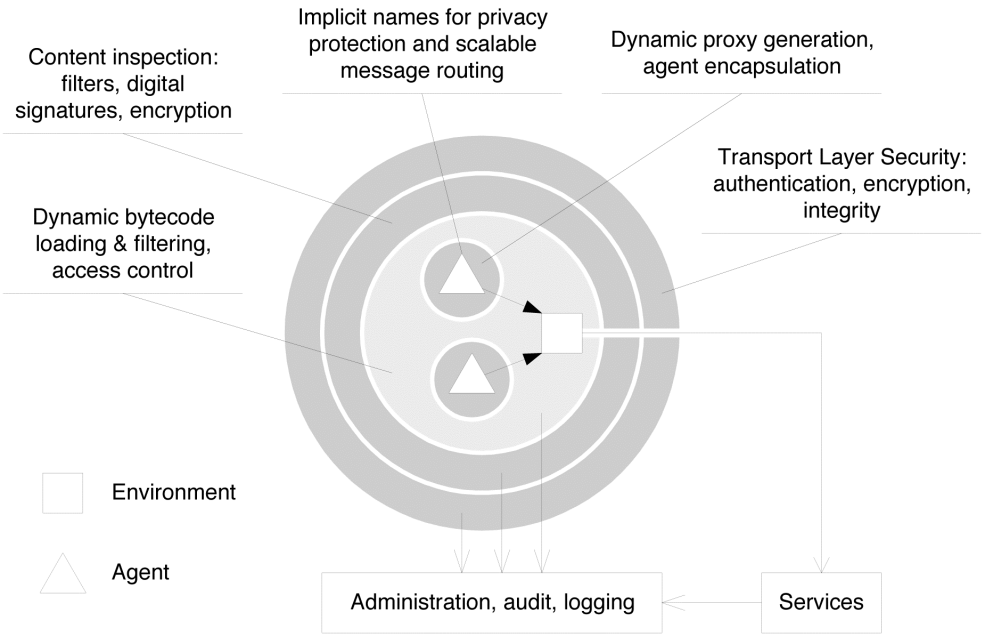

Figure 3: Security architecture

In order to exploit benefits such as the ones described above, mobile agent frameworks have to cope with a number of security threats. A mobile agent's itinerary in general spans a number of servers, which might be run by competing operators. Apart from monitoring, manipulating, and stealing data from mobile agents, malicious hosts might try to abuse passing agents as Trojan Horses in attacks on competing servers while incriminating the agent's owner in the process. On the other hand, hosts have to be aware of malicious agents breaking into the server in order to harm other agents hosted by it, or to gain unauthorized system access. SeMoA builds on JDK 1.3 and is a ``best effort'' to provide adequate security for mobile agent systems, servers as well as agents. The security architecture of the SeMoA server compares to an onion: agents have to pass all of several layers of protection before they are admitted to the runtime system (see Figure 3 for illustration) and the first class of an agent is loaded into the server's JVM.

4. Human Computer Interaction

The ongoing trend of device miniaturization creates new ways of mobile computer usage. The MAP software architectures is designed to handle

- interaction- and situation-aware device and media management in an integrated management system
- efficient information presentation with mobile devices, adapting to limited transmission bandwidth and device capability.

The software architecture developed allows for handling complex tasks with mobile devices ranging from PDAs and mobile phones to web pads and laptops. The concept of conversational user interfaces shall enable us to create a new class of interactions. These interactions resemble interpersonal communications much more than interactions using traditional interactive tools. ZGDV developed an anthropomorphous user-interface agent (avatar) which is able to communicate by using human-like interaction techniques, such as lip-synch speech, facial expressions, and gestures. A conversational user interface should be pro-active, narrative, and emotional and should represent a certain “role metaphor”. In the mobile MAP context, interactions also have to be environment-aware. During a meeting, while traveling by train and being on a construction site all require distinct ways of getting the users awareness and interacting with him.

5. A MAP Usage Scenario

Mobile and intelligent agents are the basis for building software for delegating tasks. Analogous to traditional responsibilities, we conceptualized and propose software agents, for example, for the following chores: Agent-based group scheduling (Negotiation, Reminder functions for personal and group meetings, including resource management); Communication agents (Representation of the user to the external world, filter and blocking operations for email, phone, fax management, automatic message routing); Agent-based personal information management (collecting and consolidation of contacts and addresses), and User Interface

agents (Avatar-based assistants to the user). In the sequel, part of a scenario for using MAP agents is outlined.

Mrs. K. is sitting at home having breakfast and getting ready for the day's work. She is using her MAP to check today's appointments. On being switched on, the MAP is validating her identity via the inbuilt fingerprint scanner. The MAP suggests starting a mobile agent for booking a flight to Berlin for the meeting at 20:00. The agent recommends the flight at 17:10; Mrs. K. confirms the booking. The MAP agent migrates to the airline reservation computer and buys the ticket. Mrs. K. starts her drive to the office; the MAP is in its cradle in the car and switches automatically to voice input/output. Via its navigation service, the MAP detects a traffic jam and gives detour instructions to Mrs. K. After arriving in the office, she attends a meeting; the MAP switches to conference mode ensuring that only important messages disturb the meeting. In the meeting, Mrs. K. is giving an important presentation. Afterwards, she instructs her MAP to send the document to the other participants. Because it contains confidential information, the MAP automatically selects a secure encrypted transfer.

The meeting lasts longer than expected. The MAP reminds her on the 17:10 flight to Berlin. After another 30 minutes, the MAP suggests changing the flight reservation to 19:30, to arrange for a taxi, and to notify the people waiting in Berlin. Mrs. K. confirms this and can concentrate again on her meeting. The MAP arranges for the change. At 18:00 it reminds Mrs. K. on the waiting taxi. She drives to the airport and takes her flight. After the arrival, the MAP uses mobile communication and informs her on the restaurant, where the other persons are having dinner.

6. MAP and the Future of Work

Integral part of the MAP project is the discussion on how mobile work with MAP-like systems will change the working life of the people. Having ubiquitous access to one's working environment will fundamentally change the underlying organization concept of companies and people's life. The office will no longer be at a fixed location, but wherever the MAP user is, access to the data environment is possible. This may also lead to dissolving the fixed time frame of nine to five, 5 days per week. Having all data in a globally accessible repository – a prerequisite for efficiently using MAP-like systems – will also loosen the close correlation between person and work. Work itself may become mobile and person-independent.

Once companies adapt to this new form of organizing their workflow, the relations between employer and employee may also follow new paradigms. Virtual companies can easily be formed to handle time-limited projects and be disbanded afterwards. Employees may even work for several virtual companies in parallel. The dominance of work-location-company relations will be loosened.

Legal experts investigate and monitor legal implications of MAP-like systems. Requirements stemming from regulatory and legal constraints are taken into account while designing the system. Protecting the privacy of users and the confidentiality of data is of equal importance to making legally binding transactions with mobile workplaces possible.

Note: An extended version of this scenario is available on the MAP website as flash animation.

7. The MAP project consortium

MAP is one of the focus projects in the area of Human-Technique- Interaction and is partly funded by the German Federal Ministry of Economics and Technology (BMWi). The MAP consortium consists of 10 industrial partners, including 6 SMEs and 6 research partners. This consortium was brought together by the Computer Graphics Center (ZGDV) and Fraunhofer IGD in 1998. The consortium is headed by Alcatel SEL. The focus of MAP is the development of special technologies, components and new methods for multimedia interactions that use novel and intelligent systems offering assistance and supporting delegation. These new technologies will be field tested in a construction scenario. Software companies like Nemetschek participate in MAP and will link their commercial software systems to the MAP environment.

The project started in July 2000 and will end in 2003. Initial field test in a construction scenario will commence beginning of 2002.

8. Conclusions

The goal set for the MAP consortium is to set up a mobile workplace environment for the integration of user systems, network and supporting services, to evaluate multimodal interactions for delegation and assistance tasks. The system is based on a secure agent architecture. Devices supported include laptops, PDAs and mobile phones. The system is targeted at all types of users asking for mobile platforms with needs to access and maintain information on demand.

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