Merging Virtual and Real Worlds – Holistic Concepts for the Office of the Future

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Abstract. Information, communication, media, building and security technologies are growing together. The key to the integration of all infrastructure systems is the use of IP in all technical systems. The real and the virtual worlds are merging. This means that the real world around us and the world of IT systems are connected to one another. This paper shows how these concepts can be implemented in an innovative office infrastructure to increase the efficiency in the office.

Keywords: Virtual and Real World; All-IP; Office of the Future; Location-based Services; Building Automation.

1 Introduction

In future, office work will be much more flexible as teams distributed around the planet work together on projects. Knowledge workers will not just be productive in the office, but also when out and about and when at home. Working hours will be managed more flexibly, as what was previously a more rigid separation between professional and private life takes on new forms. Information has to be pervasively available (everywhere and at any time).

To provide better support for these new professional and private lifestyles, at Deutsche Telekom Laboratories a whole range of well-matched systems is being developed and tested to help knowledge workers. This work is based on earlier activities at other offices of Deutsche Telekom (see [1] and [2]).

Infrastructure components which have previously been inflexibly fixed in the real world are being virtualized and thus made accessible to optimization by IT systems. This can increase the efficiency of knowledge work while at the same time permitting more sustainable use to be made of the necessary resources. Intuitive usability is achieved by a consistently ergonomic user interface concept.

2 Holistic Concepts for the Office of the Future

The newly developed modules for the office of the future are based on a holistic approach. Information, communication, media, building and security technologies, which used to be separate, are growing together. This means that the organizational structures

B.-T. Karsh (Ed.): Ergonomics and Health Aspects, HCII 2009, LNCS 5624, pp. 49–55, 2009.

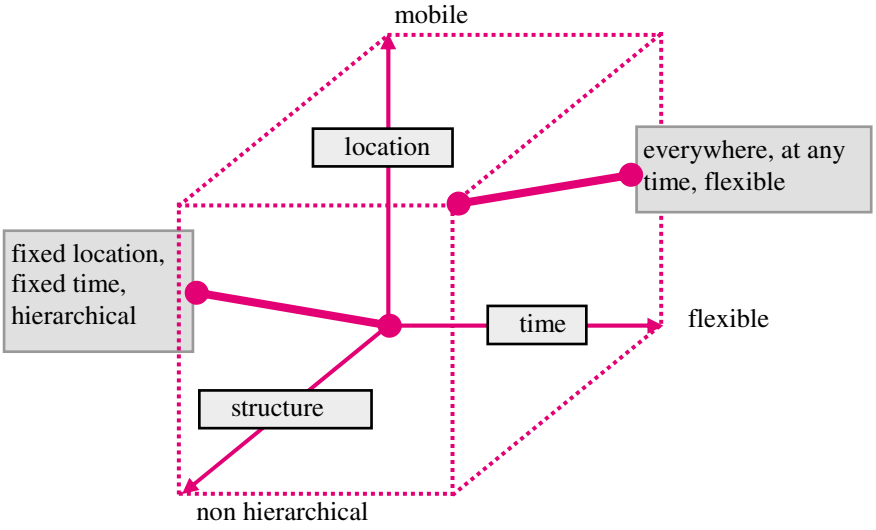

Fig. 1. Collaboration in three dimensions: mobile, flexible and non-hierarchical work environment

responsible for IT, for telecoms and for facility management can also be combined in future. The complete solution results in efficiency savings, despite the higher investment costs involved. This is because of the operational aspects, which can now be optimized as a whole, and because of the use of ideas such as desk sharing, which make best use of resources.

The key to the integration of all infrastructure systems is the use of IP in all technical systems. Not just the data network and the telephone system are based on this, both building services and media technology components also communicate via IP. This allows applications to be implemented which use several systems as well as permitting all infrastructure components to be managed and operated with unified processes.

The real and the virtual worlds are merging. This means that the real world around us and the world of IT systems are connected to one another so that procedures in the real world can be made more efficient by the use of processes supported by IT. To this end, more and more sensors, actuators and output devices will be installed in the office environment, such as interactive door-signs, RFID readers and intelligent, personalized building automation solutions.

Being able to locate people inside and outside of office buildings permits new, sophisticated functions. Several sensor systems are used to detect the last position of people: RFID cards are used to open doors, to book a workplace or to receive information at an information screen. Whenever a RFID card is used, the position of the user is determined. Whenever a phone is used, the system assumes that the user of the phone is at the known location of the phone. Additionally an experimental system component uses WLAN localization [6].

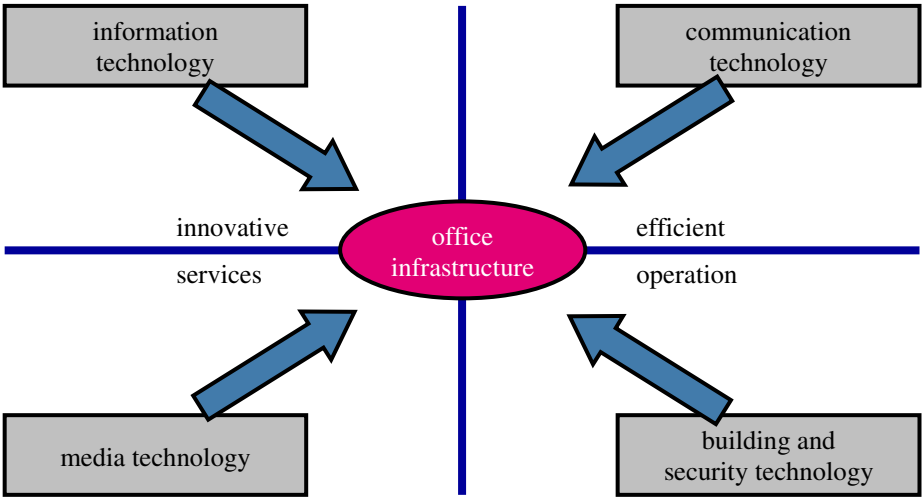

Fig. 2. Integrated services and an innovative office infrastructure for more efficient Information Workers

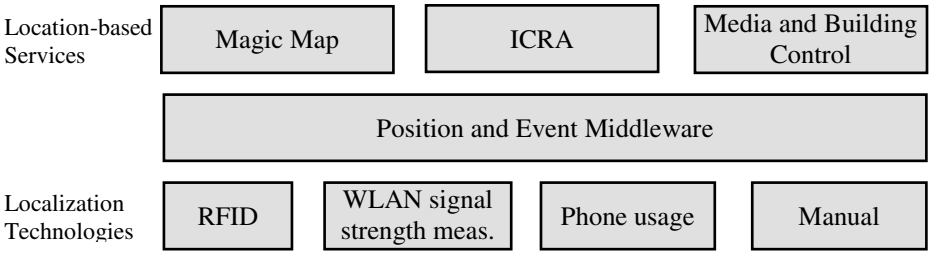

Fig. 3. Location-based services (LBS) are used to take advantage of location to automate services

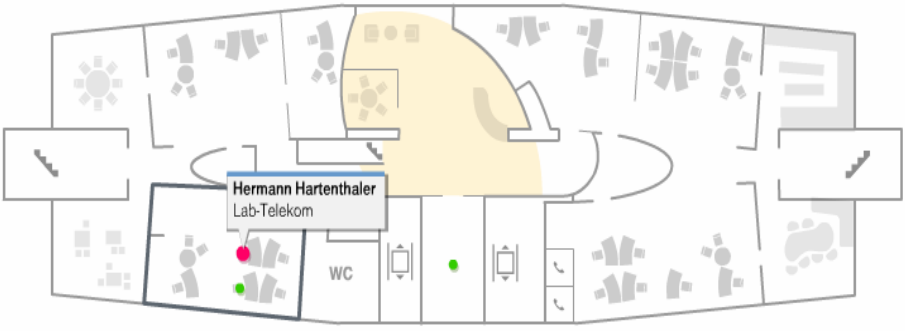

Fig. 4. The Magic Map shows the last monitored position of colleagues

Several location-based services were deployed and tested at Deutsche Telekom Laboratories:

- Magic Map – display the current location of colleagues
- ICRA – Intelligent Call Routing Agent to automatically redirect incoming calls
- Media & Light control – control features provided only where the user is currently located.

The geographic separation of company locations loses some of its drawbacks if all of the infrastructure services can be offered whatever your location is. Even home offices can become an integral part of the corporate infrastructure due to ubiquitous, high bandwidth connections to the Internet.

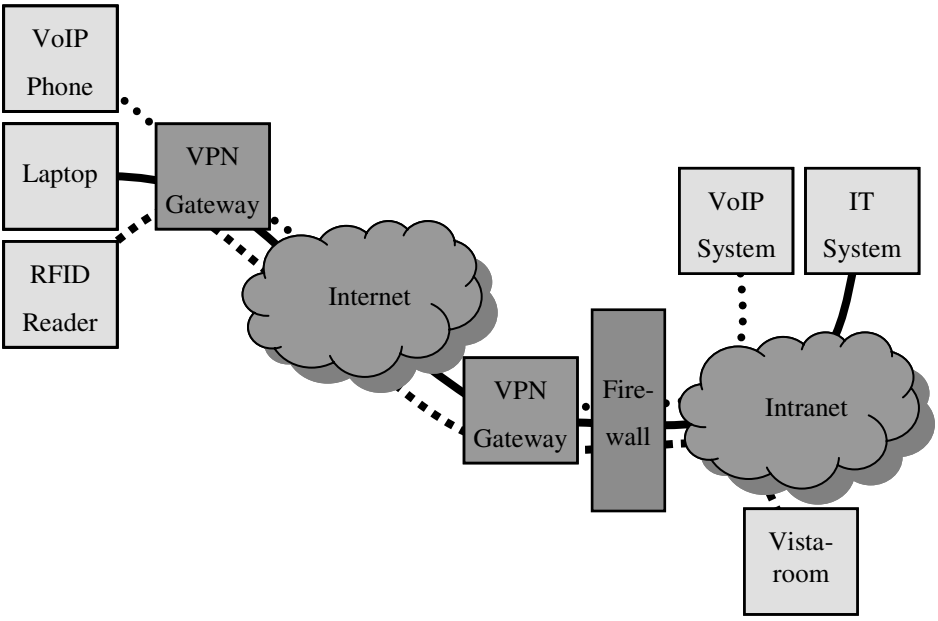

Fig. 5. Home offices can be connected to the intranet of the company

Mobile work in and out of the office is supported by WLAN and UMTS technologies. Even physically connected data networks can be flexibly used by dynamically assigned virtual networks. The use of virtual LANs (VLANs) means that current restrictions, when assigning IP networks with differing security guidelines to the computers concerned, can be loosened up.

The use of desk sharing is supported by a workplace booking system [7], where the workplace booked can be customized to your personal preferences via an RFID card. This is detected at the desk concerned and configures the IP phone for your personal phone number and programs the buttons with your settings, as well as activating your own scenario for the building services at the location. To make this work, the building automation system is integrated into the infrastructure management system via IP.

This means that the use of energy can be optimized as, in contrast to conventional building automation systems, the control system can take account of the planned use. Traditional administration of building automation services regards them as having a confined scope, operating in isolation or tightly coupled and providing only minimal support for an overall coordination and a holistic management approach. IP-based building automation components and services can be integrated more easily.

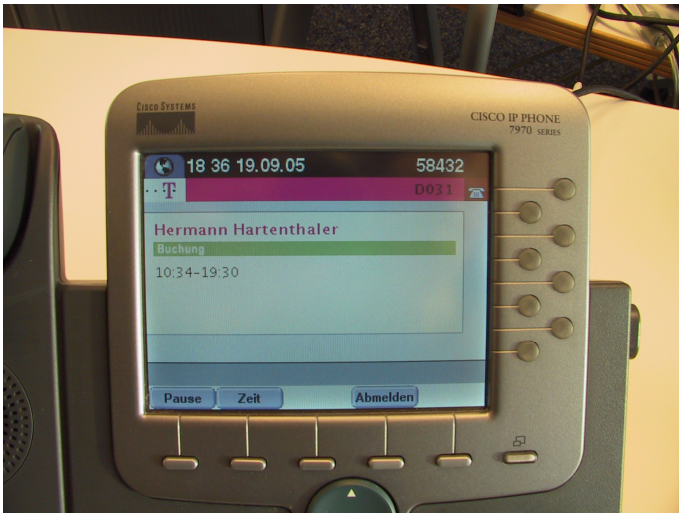

Fig. 6. Booking of workplaces and control of lights and blinds are possible using an IP-Phone or a browser application

The booking of items such as workplaces, rooms or even lockers for personal documents, always uses the same sequence of operations so that it is easy to get to know and then to use the system.

Paper mail is distributed via an electronic mailbox. If someone puts physical mail such as magazines or even contracts into a pigeon-hole for a user, they also activate a push-button, which triggers an email to the user saying "You have mail". Physical and electronic mail are thus linked together.

A video conference system at the workplace supports communication processes, which amongst other things is also compatible to UMTS picture phone applications. A video conference solution fixed to a particular room is also used, to protect the environment and to save travelling time and expenses. Here, a telepresence approach [8] is pursued, where all of the video conferencing rooms are identically equipped with very large HDTV monitors, creating the feeling for the participants in a meeting, that the physically separate rooms merge to a single, virtual conference room.

3 Increasing the Efficiency in the Office

When planning a meeting, the date is fixed, the room booked and the agenda is produced, all in virtual space (using Microsoft Sharepoint (MOSS) [9]). When the meeting

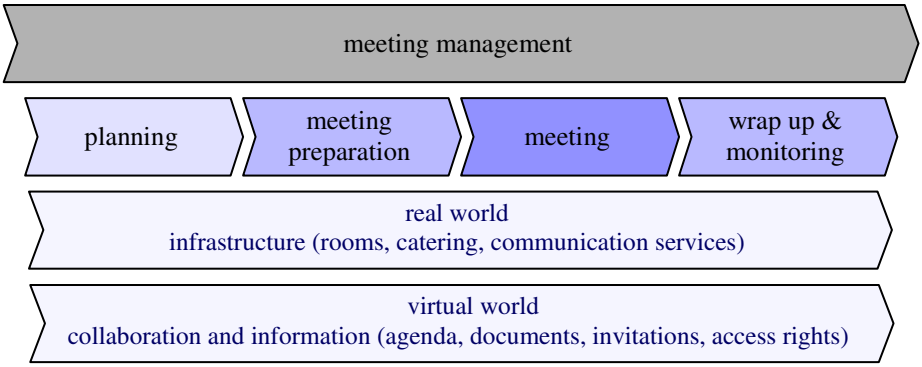

Fig. 7. Real and virtual world are interconnected in the process "Meeting Management" for more efficient meetings

starts, the interactive doorplate on the physical conference room will show the name of the meeting, the invited participants will have access to the room and the projector will show the agenda already.

In the conference rooms involved, interactive whiteboards are used on which presentations can be projected and on which special pens can be used to "write", and the writing then becomes a graphical object in the presentation. This makes the transition from "real" drawing on the board, to saving in a "virtual" document very easy.

4 Experience

The modules which have been implemented and integrated have now been used on a daily basis for three years in everyday work. About 160 employees are using 120 desk-sharing workplaces at two locations, one in Berlin, Germany, and another one in

Table 1. Advantages and Disadvantages of new office environment

Advantages	Disadvantages
Flexibility with the office organization allows dynamic change processes.	Excessive compaction of office space leads to strong work load.
Integration of all technical areas leads to more comfortable and efficient structures.	Higher complexity requires more broadly qualified infrastructure staff.
Open space office leads to more communication and fewer barriers.	Fewer walls mean more noise and more disturbances for employees.
Work at any time and everywhere by telepresence and flexible work models leads to increased efficiency.	Permanent accessibility and omission of unproductive working phases lead to higher load of the employees.
Knowledge management and central information systems lead to a better availability of information in the enterprise.	Inadmissible monitoring of the employees must be prevented.

Los Altos, California. Another 150 colleagues are using traditional workplaces at three other locations in Germany. The complete solution has led to very efficient use of office space and other resources; it has led to increased flexibility for the project teams and to a working atmosphere which is quite an inspiration.

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