PERSONAL WIRELESS COMMUNICATIONS

Edited by
Józef Woźniak
Jerzy Konorski

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IFIP TC6/WG6.8 Working Conference on Personal Wireless Communications (PWC'2000), September 14–15, 2000, Gdańsk, Poland

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IFIP - The International Federation for Information Processing

IFIP was founded in 1960 under the auspices of UNESCO, following the First World Computer Congress held in Paris the previous year. An umbrella organization for societies working in information processing, IFIP's aim is two-fold: to support information processing within its member countries and to encourage technology transfer to developing nations. As its mission statement clearly states,

IFIP's mission is to be the leading, truly international, apolitical organization which encourages and assists in the development, exploitation and application of information technology for the benefit of all people.

IFIP is a non-profitmaking organization, run almost solely by 2500 volunteers. It operates through a number of technical committees, which organize events and publications. IFIP's events range from an international congress to local seminars, but the most important are:

- The IFIP World Computer Congress, held every second year;
- open conferences;
- working conferences.

The flagship event is the IFIP World Computer Congress, at which both invited and contributed papers are presented. Contributed papers are rigorously refereed and the rejection rate is high.

As with the Congress, participation in the open conferences is open to all and papers may be invited or submitted. Again, submitted papers are stringently refereed.

The working conferences are structured differently. They are usually run by a working group and attendance is small and by invitation only. Their purpose is to create an atmosphere conducive to innovation and development. Refereeing is less rigorous and papers are subjected to extensive group discussion.

Publications arising from IFIP events vary. The papers presented at the IFIP World Computer Congress and at open conferences are published as conference proceedings, while the results of the working conferences are often published as collections of selected and edited papers.

Any national society whose primary activity is in information may apply to become a full member of IFIP, although full membership is restricted to one society per country. Full members are entitled to vote at the annual General Assembly, National societies preferring a less committed involvement may apply for associate or corresponding membership. Associate members enjoy the same benefits as full members, but without voting rights. Corresponding members are not represented in IFIP bodies. Affiliated membership is open to non-national societies, and individual and honorary membership schemes are also offered.

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Preface

There are numerous factors contributing to the dynamic growth of wireless communication systems we've been observing in the past 10 years, the most important being the increasing network user mobility and the technological advances in high-speed data transmission over radio channels. Research centres and standards-making institutions the world over conduct works on 3G integrated systems of person-to-person and person-to-computer communications, wireless counterparts of classical LAN, ATM and IP architectures, satellite and access networks as well as advanced service platforms like WAP and other concepts.

Among the many commercial and non-profit organisations professionally involved in the development of the new information infrastructure, of particular influence is the International Federation for Information Processing. Within its Technical Committee TC-6, a working group WG 6.8 has been set up to co-ordinate IFIP activities in the area of wireless communications. It has done so, among others, by arranging regular meetings of academic and industrial researchers, known as IFIP TC-6 WG 6.8 Workshops on Personal Wireless Communications (PWC). Such workshops were held in recent years in Prague, Frankfurt/M, Tokyo and Copenhagen, and their success has resulted in the promotion of PWC to the status of IFIP Working Conference.

This year's PWC'2000 is hosted by the Faculty of Electronics, Telecommunications and Infomatics of the Technical University of Gdańsk, Poland, and the volume we're now introducing to you contains all the 17 contributions accepted for publication, out of 23 submitted, along with 4 invited papers by prominent researchers active in the area. These should constitute a solid basis for fruitful discussions and hopefully will stimulate

an interesting exchange of views on the evolution of wireless systems in the years to come.

We believe that the relaxed end-of-summer atmosphere of the picturesque millennium-old Gdańsk, the home of Hevelius, Fahrenheit and Schopenhauer, will be one more thing to remember PWC'2000 for.

It is our obligation and pleasure to express gratitude to the IFIP bodies sponsoring the Conference, TC-6 and WG 6.8 and their Chairmen, for encouragement and advice. Much credit should go to the Program Committee members and other reviewers who, through their detailed screening of the submitted papers, helped shape up the final program. Finally, our thanks extend to the supporting organisations and the authorities of the Technical University of Gdańsk.

Józef Woźniak
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Contents

Wireless Internet Architectures: Selected Issues[1]

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Key words: Wireless, Internet, Mobility

Abstract: After discussion of both: basic issues related to wireless data transmission and internet principles we identify and discuss fundamental problems of their merge. Following this discussion a vision of a specific approach and architecture for organizing wireless internet access called AMICA is outlined.

1. INTRODUCTION

Usage of internet services not only becomes a habit, in fact both in their professional and everyday life people become increasingly dependent on the access to these services. Or might achieve significant profit – both in the business and quality of life sense – if such access would be possible frequently enough. In fact, there are good reasons to consider moving all the communication solutions to the internet platform. Wireless transmission technologies have definitely a potential to contribute to the deployment of easy accessible, flexible internet access. The merger of wireless transmission with the already established internet paradigm appears, however, to be more complex than it might have been expected at the first glance. Therefore this merger is recently one of the hottest research topics in the area of telecommunication networks. In order to focus our discussion let us start

[1] This work has been supported in part by the German Ministry of Research (BMBF) within the Project IBMS in the research area ATM Mobile, as well as by grants from German Telecom, DFG within the Graduate College "Communication Based Systems" and ICSI, Berkeley. More details can be found under http://www-tkn.ee.tu-berlin.de.

with an informal, intuitive definition of the notion of wireless internet access.

For the sake of simplicity let us constrain ourselves to a very classical kind of terminals: just laptops or personal digital assistants. Let us also assume, that terminals can use some kind of digital wireless transmission to/from another device, called further an access point, being in turn connected to the world-wide internet using fixed lines. We assume further that the real data exchange takes place in periods called further sessions, separated by idle periods. Initiation of each session will be mostly triggered by terminal itself, but might be also triggered by some other systems, called corresponding systems.

Our further considerations will be structured as follows: In section 2 we will discuss some basic scenarios and identify major general differences between wireless and wired access. In section 3, we will recall basic internet paradigms, consider what are the implication of introducing a wireless hop in internet, and discuss the different possible meanings of the notion of internet access. Finally in section 4 we will outline AMICA - our specific system vision, with special attention being paid to the transport layer services.

2. WIRELESS ACCCESS

Let us first introduce three different scenarios for the usage of wireless access in general:

In the first scenario, which we will refer to as **basic wireless access** the motivation for using wireless technologies is mainly avoiding installation of cable, which might be kind of cumbersome. In this scenario terminals can be moved exclusively within the range of a single, always the same access point, and the movements are slow (if any)[2]. Let us think here for example about a swimming pool area, or just university courtyard. On the other hand, even using the terminal at home (say in ones favorite armchair, or at the kitchen table) gives good reasons for wireless transmission. One could consider this variant as generalization of cordless telephony. The major challenge in this case is assuring the proper quality of service to the terminal. Numerous wireless transmission technologies are already available, or will

[2] The transmission range might be, technology depend, short or large. By the way: wireless access is attractive also in the case of no movement at all- this case is in the classical telephony referred to as the WLL- wireless local loop. Due to fixed positioning of the terminals relative to the access point several techniques for improvement of the quality of signal might be applied. We will not discuss this case in depth in this paper.

soon become available, for the support of such scenario: Wireless LANs, Bluetooth, IrDA belonging to the most frequently mentioned ones.

In the second scenario, which we will refer to as **nomadic wireless access** the terminal is expected to be moved over distances essentially exceeding the transmission range of a single access point. It is assumed, that multiple access points will be deployed over some area (which might be a building, a campus, a city or a continent) creating islands of connectivity around these access points. We assume for this scenario that terminals may switch between the access points only between the consecutive sessions. This movement takes usually times which are long as compared to the session duration (one might think here in the terms of a scientist visiting in turn several universities). In fact there are no hints in which location – close to which access point – the terminal might appear after movement[3].

Let us stress that multiple parameters like supported bit-rate, error rate, the maximum speed of mobility and the supported range around the given access point are in general not identical even among individual access points supporting the same technology (due to static or dynamic set-up differences). Assuring a simple set-up in the new environment seems to be a major challenge for this scenario (different access points in distant locations might even support heterogeneous technologies). An additional challenge is assuring reachability under the original address in the actual, temporary environment as well as security considerations. This problem is frequently referred to as roaming.

Finally in the third scenario, which we will refer to as **true mobile access**, dynamic changes of the supporting access point during a session, usually referred to as handover, are expected to appear (possibly even several times during a single session). For mobile access to be attractive, the deployment of the access points should be more dense as for the nomadic wireless access, usually a significant (although not necessarily all) part of the area will be in the range of at least one of these access points. We frequently use the notion of coverage while referring to the ratio of the area being within the range at least one access point to the whole area under consideration. In this scenario.

The grade of service continuity in spite of handover is one of the essential quality features for this scenario. Continuity of service might be expressed in terms of no information loss during the handover, sometimes even so called seamless handover, i.e. handover not observable by the user at

[3] It should be pointed out that the principle of nomadic access is in general NOT necessarily to be discussed in the context of wireless communication, nomadic computing can be also considered using wired transmission. It seems, however, that wireless transmission might encourage broader deployment of nomadic computing- think for example in the terms of passengers in airports or scientific conference participants