

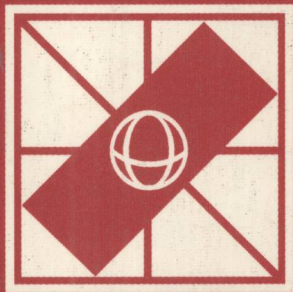
Ignas Niemegeers

Sonia Heemstra de Groot (Eds.)

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# Personal Wireless Communications

IFIP TC6 9th International Conference, PWC 2004  
Delft, The Netherlands, September 2004  
Proceedings



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Ignas Niemegeers  
Sonia Heemstra de Groot (Eds.)

# Personal Wireless Communications

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## Preface

The IFIP TC-6 9th International Conference on Personal Wireless Communications, PWC 2004 is the main conference of the IFIP Working Group 6.8, Mobile and Wireless Communications.

The field of personal wireless communications is steadily growing in importance, from an academic, industrial and societal point of view. The dropping cost of WLAN and short-range technologies such as Bluetooth and Zigbee is causing the proliferation of personal devices and appliances equipped with radio interfaces. Together with the gradual deployment of powerful wireless infrastructure networks, such as 3G cellular systems and WLAN hotspots, the conditions are being created for affordable ubiquitous communication involving virtually any artifact. This enables new application areas such as ambient intelligence where a world of devices, sensors and actuators surrounding us use wireless technology to create systems that assist us in an unobtrusive way. It also allows the development of personal and personalized environments that accompany a person wherever he or she goes. Examples are Personal Area Networks (PAN) physically surrounding a person, and personal networks with a potentially global reach.

PWC 2004 reflects these developments, which are happening on a global scale. Researchers from all over the world, and in particular a large number from Asia, made contributions to the conference. There were 100 submissions. After a thorough reviewing process, 25 full papers and 13 short papers were retained for presentation in the technical sessions. The papers cover the whole range of wireless and mobile technologies: cellular systems, WLAN, ad hoc and sensor networks, host and network mobility, transport protocols for wireless systems, and the physical layer.

PWC 2004 was made possible by the enthusiasm, dedication and cooperation of many people. In particular we would like to thank the TPC members and the reviewers who were responsible for the high-quality reviewing process, and the Executive Committee for making the final selection of papers and the composition of the sessions. Of course, a special thanks to all the authors who showed their interest in the conference by submitting their papers. Also thanks to the organizations that supported the conference through various forms of sponsoring: KPN Mobile, Nokia, TNO Telecom and WMC. Last but not least, many thanks to the Organizing Committee that worked very hard to make sure that all organizational processes, the website, the electronic submissions, the financials, the social event and all the practical matters, were taken care of.

July 2004

Ignas G. Niemegeers,  
Sonia Heemstra de Groot

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# Self-Organization of Wireless Networks: The New Frontier (Keynote Speech)

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**Abstract.** The size of the internet will increase with the mainstream adoption of the broadband mobility connecting a myriad of devices and sensors at homes and businesses and the use of IPv6. All this will add to the spatio-temporal complexity of the network topology and dynamics. We present a brief overview of the role that self-organization can play in this new era of complexity. Issues of QoS, scalability, robustness, and reachability, among others (e.g., heterogeneity) will dominate the research in the future. First, we present the definition, scope, and applicability of self-organization. Then we briefly articulate the need for self-organization, and some recent breakthrough advances in this emerging area of research. This is followed by some near- and long-term scenarios where self-organization can be applied, and some results that we have obtained. We conclude the talk with a discussion on the key challenges that lie ahead.

# The Impacts of Signaling Time on the Performance of Fast Handovers for MIPv6\*

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**Abstract.** A Fast Handover protocol (FMIPv6) in IETF working group is proposed to reduce the handover latency in Mobile IPv6 standard protocol. The FMIPv6 proposes some procedures for fast movement detection and fast binding update to minimize the handover latency. Additionally, to reduce the lost packets caused by a handover, this protocol introduces buffers in access routers. However, the handover latency or the amount of lost packets are affected by the time to send signals such as Fast Binding Update message for the fast handover. In this paper, we inspect the impacts of the signaling time on packet loss and handover latency in FMIPv6 through the numerical analysis, we propose the optimal signaling time to improve the performance of FMIPv6 in terms of the handover latency and lost packets.

## 1 Introduction

In mobile network, a mobile user should communicate with its correspondent nodes via its IP address regardless of its location. However, the IP address is some location-dependent, so its IP address may be changed at its location change, and its communication also may be disconnected at its new location. To solve this problem, Mobile IP is proposed [1].

In MIPv6, MN has a home IP address (HoA) for identification and a temporal IP address for routing information. When MN moves to a new subnet, that is, it may disconnect with the current link and connect with a new link in link layer, and it should obtain a new temporal address called Care-of-Address (CoA) through stateless or stateful (e.g. DHCPv6) address auto-configuration [2] according to the methods of IPv6 Neighbor Discovery [8]. Then MN should register the binding its new CoA with its HoA to its home agent (HA) and its CNs. Therefore MN can maintain the connectivity with CNs regardless of its movement.

On the other hand, when MN in MIPv6 conducts these procedures which are called a *handover*, there is a period the MN is unable to send or receive packets;

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that is, the *handover latency* is defined as a duration from reception of last packet via previous link to reception of first packet via new link. This handover latency results from standard Mobile IPv6 procedures, namely movement detection, new Care of Address configuration and confirmation, and Binding Update, as well as link switching delay, and these procedures are time consuming tasks, so it is often unacceptable to real-time traffic such as VoIP.

To reduce the handover latency, Fast handovers for Mobile IPv6 (FMIPv6) [3], has been also proposed in IETF. FMIPv6 supports a fast handover procedure allowing starting handover in advance a movement [3]. In this proposal, MN obtains the new CoA (NCoA) before actual movement to new subnet through newly defined messages: *Router Solicitation for Proxy* (RtSolPr) and *Proxy Router Advertisement* (PrRtAdv). It also register its NCoA to previous AR (PAR) to indicate to forward the packets to its NCoA, so as soon as MN moves to the new subnet and connect with a new link, it can receive the forwarded packets from PAR. If feasible, buffers may exist in PAR and NAR for protecting packet loss. Therefore this proposal reduces the service disruption duration as well as the handover latency [3]. However, the various signaling in FMIPv6 makes it complicated to analyze the performance, which should be investigated, so we analyze the signaling time of FMIPv6 on the performance in terms of handover latency, packet loss, and required buffer size.

This paper is organized as follows: we will describe FMIPv6 protocol in Section 2; we will explain the analytic models and calculate the performance functions for the handover latency, the number of lost packets, and the required buffer size, and then we will show the numerical results in Section 3; we will inspect of signaling time on the performance of FMIPv6 and propose the optimal signaling time for more effective FMIPv6 in Section 4; and we will conclude this paper with some words in Section 5.

## 2 FMIPv6

FMIPv6 is proposed to reduce the handover latency of MIPv6 by providing a protocol to replace MIPv6 movement detection algorithm and new CoA configuration procedure. Providing FMIPv6 is operated over IEEE 802.11 network, the new AP is determined by the scanning processes. The new associated subnet prefix information is obtained through the exchange of the *Router Solicitation for Proxy* (RtSolPr) and *Proxy Router Advertisement* (PrRtAdv) messages. Although the sequential L2 handover processes of scanning, authentication, and re-association are performed autonomously by firmware in most existing IEEE 802.11 implementations, these processes should not be executed autonomously in FMIPv6 to exchange RtSolPr and PrRtAdv messages, and *Fast Binding Update* (FBU) and *Fast Binding Acknowledgement* (FBAck) messages.

In FMIPv6 operated over IEEE 802.11 network, MN firstly performs a scan to see what APs are available. The result of the scan is a list of APs together with physical layer information, such as signal strength. And then, MN selects one or more APs by its local policy. After the selection, MN exchanges RtSolPr and PrRtAdv to get the new subnet prefix. In fact, there may or may not some delay