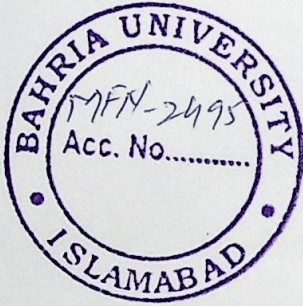


# A NOVEL HANDOVER ALGORITHM FOR MOBILE WIMAX



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## **DEDICATION**

I would like to dedicate my efforts to my Dearest Parents, who always pray for me and help me at every step of life especially in my studies. They encouraged me throughout my study tenure. Without their moral and material support, I would not have been able to accomplish my target successfully.

**Naima Rehmani**

## **DECLARATION**

I hereby declare and affirm that this thesis, neither as a whole nor as a part thereof, has been copied out from any source. It is further declared that I have performed this research and the accompanying report entirely on the basis of my personal efforts, made under able guidance of my supervisor, Dr. Abid Ali Minhas. If any part of this system is proved to be copied out or found to be a report of some other person, I shall stand by the consequences. No portion of the work presented in this report has been submitted in support of another university or institute of learning.

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**MS - T&N**

## ABSTRACT

For the end user mobility is one of the distinctive values that wireless technology offers. One of the main mobility challenges is to maintain an ongoing session without interruption while on the move, even at vehicular speeds. This challenge is referred to as handoff, commonly known as Handover (HO). Performing HO well is critical to providing a good user experience. It is one of the key issues for every mobile network, whether it's GSM Network, UMTS, or Mobile WiMAX, HO is equally important.

This thesis presents a new method to upgrade performance of HO in mobile WiMAX. This novel mechanism of HO follows HO recommendations in the Institute of Electrical and Electronics Engineers (IEEE) 802.16e system i.e. cell reselection via scanning, HO decision, initiation and network entry including synchronization and ranging with a target Base Station (BS).

To make this study more interactive, it demonstrates different performance metrics of HO via simulation and the steps involved in it from one BS to other BS for successful HO. This proposed HO algorithm takes latency as a key metric to evaluate, as it has direct impact on application performance perceived by a user. Total handover latency is decomposed into other several latency elements.

The system is to be modeled using 3 tier cell topology. For simplicity, 5 mobile MS and multiple fixed MSs are modeled as a basic step for the mobility simulations. The mobility related performance metrics are to be computed only for these 5 mobile terminal and the locations of all other MSs are assumed to be fixed. Handover performance metrics statistics are collected for the moving MSs only. Simulation experiments have revealed that this proposed algorithm has improved Network Entry Time, Connection Setup Time and Service Disruption Time.

## PREFACE

With the developments in wireless networks there have been many improvements and new areas have been introduced like wireless sensor networks, GSM based networks, IP based networks, IEEE based mobile WiMAX, and Wi-Fi. Wi-Fi introduced the concept of hotspots; like Wi-Fi, mobile WiMAX is developed to provide better services at vehicular speed, and one of the very concepts being used in mobile WiMAX is handover or handoff. Handover facilitates mobile stations and hands over them to another BS that provides better signal quality and quality of services.

The basic theme of the development of this thesis is to analyze the latency parameters during handover for mobile WiMAX and design a handover algorithm within minimal use of resource and introduce a new handover process.

This document contains the detailed description of handover algorithm simulation and its aspects. Where needed some of the aspects are described diagrammatically. This document includes six chapters, each containing detailed information about the algorithm and appendices respectively.

Chapter one provides background, introduction to the wireless networks and IEEE 802.16e, and overview to handover algorithm, its objectives, scope statement and project plan.

Chapter two is about literature survey, contains details about the recent research work done related to mobile WiMAX HO.

Chapter three provides information regarding the architecture of IEEE 802.16e standard, topology and details about physical layer and MAC layer.

Chapter four is about proposed handover algorithm. It contains details about mobility, proposed HO algorithm design, its building blocks and proposed HO process.

Chapter five is about simulation results, discusses simulation environment, HO algorithm simulation, its path loss, improved latency parameters and its performance analysis.

Chapter six includes future enhancements to the system; it describes briefly future recommendations and includes conclusion.

Appendix A provides list of abbreviations used in this document.



At the end of this document details about the references are mentioned that were helpful during the development of this proposed algorithm and simulation for handover.

**Naima Rehmani**

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I would like to express my appreciation to those people for their help, directly and indirectly, with this thesis in accomplishing my goal of completing this handover simulation. My great accomplishment is due to Allah's mercy and sympathy on me that I have achieved my targeted goal.

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My special thanks and regards to one of my friend, for being so kind and cooperative and guiding me with her excellent ideas. In fact, she provided me necessary material, useful tips and tactics towards my successful goal.

I am also grateful to my superb and comrade supervisor, guide, teacher **Dr. Abid Ali Minhas**, for his valuable comments and legitimate help rendered in development of this handover scheme. I benefited from his useful ideas which would provide maximum benefits to the end results of this thesis.

I am also indebted to my siblings, friends and all near and dear ones who always make me smile during my tough hours in conducting this thesis and spent their precious time with me in the completion of this thesis.

**Naima Rehmani**

## EXECUTIVE SUMMARY

Since the advent of telecommunication, it has made a great impact on lives of individuals and working organizations. Telecommunication is not a new communication platform. It has been connecting people and organizations together in any way the individual components require. It's something that brings us as individuals and organizations together in new and exciting ways. This technology will twist, turn, re-evaluate and re-engineer every single day to day process that affects our lives.

One of the fields that telecommunication has mostly benefited is business. This revolution has dramatically changed the way organizations conduct business with its consumers and with each other. The geographic boundaries that offer limited access to goods and services are crumbling, and companies of all sizes are busy building telecom solutions and adapting the new ways of doing business.

By the advancement of wireless technologies there have been many new areas like wireless sensor networks, GPS system, mobile communication, mobility management and technologies like GSM, UMTS, Wi-Fi, WiMAX and one of the very concepts being used in mobile WiMAX is its feature of mobility and performing handover from one cell to other without interrupting user activity while maintaining quality of services.

A new algorithm has been designed specifically to meet the mobile WiMAX handover needs, which includes improvements to the latency parameters; network entry time, service disruption time and connection setup time. While finding the path loss for the simulation and minimizing the HO process.

The simulation followed recommended procedures for HO laid down in the Institute of Electrical and Electronics Engineers (IEEE) 802.16e system i.e. cell reselection via scanning, HO decision, initiation and network entry including synchronization and ranging with a target Base Station (BS).

Additionally, the system is modeled using 7 cell topology with 3 tier cell cluster. For simplicity, 5 mobile MS and multiple fixed MSs are modeled as a basic step for the mobility simulations. The mobility related performance metrics are to be computed only for these 5 mobile terminal and the locations of all other MSs are assumed to be fixed.

## **Overview**

### **Project**

A Novel Handover Algorithm for Mobile WiMAX

### **Developed By**

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### **Objectives in brief**

- Exploring the challenges for handover in Mobile WiMAX.
- To perform background study of the existing widely known handover techniques in mobile WiMAX.
- To propose a handover scheme provided handover latency should be no more than a few hundreds of milliseconds, while not degrading system performance.
- To model a system for simulation of handover process and evaluate its performance metrics, on the basis of the study carried out. This helped out to prove through simulation results whether the proposed scheme works up to mark. For simulation purpose VB.NET 2008 is used.
- Comparative analysis of proposed handover scheme with existing HO schemes for mobile WiMAX.
- Thesis Work.
- Research contribution in terms of research paper.

## **Tools and Techniques**

- MS Visual Studio 2008
- MS Office Word 2003
- MS Office Visio 2003
- Internet Explorer 8.0

## **Languages Used**

- VB.Net 2008

## **Operating System Used**

- Windows XP Professional

## **Hardware**

- Intel® Core™ Duo CPU
- 2.00 GHz of RAM

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# CHAPTER No. 1

## Introduction