ISBN 978-93-5156-328-0
International Conference of Advance Research and Innovation (ICARI-2015)

# Quality of Service Based Handoff Schemes for WiMAX/WLAN Networks

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**Article Info**
Article history:
Received 9 January 2015
Received in revised form
15 January 2015
Accepted 22 January 2015
Available online 31 January 2015

**Keywords**

**Abstract**

The latest technology that provide broadband access with large coverage area is Worldwide Interoperability for Microwave Access (WiMAX), Since Mobile WiMAX has an important advantage to serve large coverage areas per base station, Mobile WiMAX has become a popular technology for handling mobile users. As we know that for serving a large number of Mobile Users in practice requires an efficient handover scheme. Currently, mobile WiMAX has a long handover delay that contributes to the overall end-to-end communication delay. Recent research is focusing on increasing the efficiency of handover schemes. In existing system whenever stations are out of range of all APs and BSs then there is no communication for that particular stations.In this paper we present whenever stations is out of range of all APs and BSs, then it can communicate through any other station which are in range based on ad-hoc network technology.

## 1. Introduction

The latest technology that provides broadband access with large coverage is worldwide interoperability for Microwave Access (WiMAX). WiMAX can guarantee user mobility in a large area. It has high speed internet access over an area of 30 miles and provides speed up to 70Mbps. As a cost solution, multi hop communication is becoming more and more important to WiMAX systems. The advantages are increasing transmission rates, cost effective deployment and Quality of Service.

WiMAX provide broadband access to anywhere. It supports both fixed and mobile AP wireless technology with IEEE 802.16 standard based that provides broadband connections over long distance and it supports mobile internet which transfers data, voice, and video. Supporting both fixed and mobile broadband wireless access 802.16e based base stations are used. It fully supports mobility. There are two modes of IEEE 802.16. They are point-to-multipoint and mesh in the medium access control layer. In our proposed work we research on a cost-based adaptive handover scheme that can realize the handover parameter optimization for self-optimization on the network handoff.

## 2. Previous Work

A.V. Garmonov et al. [5] performed the work on quality of service oriented intersystem handover between the IEEE 802.11b network and the overlay network. In which the minimum data rate, the maximum data block delay and the maximum bit error rate are considered as a QoS parameters. The proposed system simultaneously meet the three key QoS parameters as well as the maximum call-dropping probability and the maximum average number of ping-pongevent constraints for the arbitrary number of downlink and uplink multiservice connections but for real–time traffic When the number of fixed stations in the IEEE 802.11b cell is high, the station collision probability is also high and the QoS requirements of the mobile stations arriving at the IEEE 802.11b cell cannot be satisfied. N. Nasser et al. [6] performed the work on efficient handoff schemes to improve the quality of service and provide flawless mobility. Alsoin this paper author clearly presents the classification of handoffs, handoff process, vertical handoff decision functions and handoffs in 4G heterogeneous networks. C. Guo et al. [7] performed the work on an end-to-end mobility management system for seamless and proactive wandering across heterogeneous wireless networks. In this paper author proposed a heterogeneous wireless network which is competent of reacting to roaming events proactively and precisely and maintaining the connection's continuity with small handoff delay but the technical details such as network delay and bandwidth estimation, as well as end-to-end mobility management were not fully addressed. A.B. Pontes et al. [8] performed the work on the most recent research efforts in the area of handover management in integrated WLAN and wireless metropolitan area networks (WMANs). In which the handover decision algorithm is based on MIH framework but it does not consider the packet delay and bandwidth while handoff is occurring. C.W. Lee et al. [9] performed the work on architecture of integrated WLAN and WAAN networks based on Mobile IPv6 and also presents an overview of issues related to horizontal and vertical handoffs. In this paper author considered overlay network to improve the different characteristics of wireless access network technologies, but setting up a network using wide area access network can be costly and complicated and also its security is a real issue. R. Prasad et al. [10] performed the work on specific bandwidth-related metrics, highlighting the scope and relevance of each. Specifically, in this paper author differentiates between the bandwidth of a link and the bandwidth of a sequence of successive links, or end-to-end path but didn't consider about the factors like packet delay and bit rate.

## 3. Literature Review

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Since its initial conception, new applications for WiMAX have been developed and as a result there are two "versions" of WiMAX technology that are available:

- 802.16d (802.16-2004)
- 802.16e (802.16-2005)

The two versions of WiMAX technology are used for different applications and although they are based on the same standard, the implementation of each has been optimized to suit its particular application.

### 802.16d - DSL Replacement

The 802.16d version is often referred to as 802.16-2004 and it is closer to what may be termed the original version of WiMAX defined under 802.16a. It is aimed at fixed applications and providing a wireless equivalent of DSL broadband data. In fact the WiMAX Forum describes the technology as "a standards-based technology enabling the delivery of last mile wireless broadband access as an alternative to cable and DSL."802.16d is able to provide data rates of up to 75 Mbps and as a result it is ideal for fixed, DSL replacement applications. It may also be used for backhaul where the final data may be distributed further to individual users. Cell radii are typically up to 75 km.

### 802.16e - Nomadic / Mobile

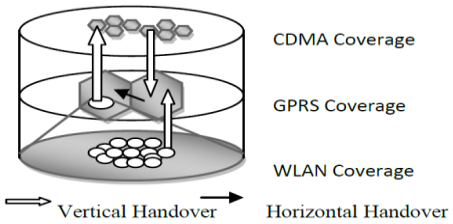
While 802.16 / WiMAX was originally envisaged as being a fixed only technology, with the need for people on the move requiring high speed data at a cost less than that provided by cellular services and opportunity for a mobile version was seen and 802.16e was developed. This standard is also widely known as 802.16-2005. It currently provides the ability for users to connect to a WiMAX cell from a variety of locations, and there are future enhancements to provide cell handover.802.16e is able to provide data rates up to 15 Mbps and the cell radius distances are typically between 2 and 4 km.

## 4. Handoff in Wimax

Mobility is the most important key factors of a wireless cellular communication system. Continuous service is achieved by supporting handoff (or handover) from one cell or base station to another; it means stop communication in one cell and start communication in another cell or base station so the process of transferring mobile station from one cell or base station to another is called handoff. The handoff is mainly classified into two types' horizontal handoff and vertical handoff.

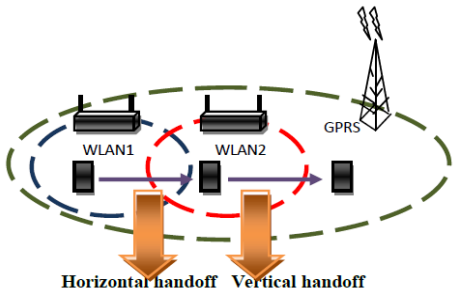
## 5. Types of Handoffs in WIMAX

### A. Horizontal Handoff (HHO)




The handoff between two base stations of the same network is called as Horizontal handoff. In Horizontal handover the users use the same network access technology and mobility perform on the same layers of system. Horizontal handoff involves a terminal device to change cells within the same type of system (same network) to maintain service continuity. It can be further classified into Link layer handoff and Intra-system handoff. Horizontal handover between two base stations, under same foreign agent (FA) is known as Link layer handoff. The horizontal handoff occurs between two base stations that belong to two different FAs and both FAs belong to the same system and hence to same gateway foreign agent (GFA) is called Intra-system handoff.

### B. Vertical Handoff (VHO)




Vertical handoff refers to a network node changing the type of connectivity it uses to access a supporting infrastructure, usually to support node mobility. Vertical handovers refer to the automatic fall over from one technology to another in order to maintain communication. This is different from a 'horizontal handover' between different wireless access points that use the same technology in that a vertical handover involves changing the data link layer technology used to access the network..

## 6. Proposed Network Architecture

The main objective of this paper is to keep stations always being best connected, for that purpose we implement the ad-hoc technology. In existing system whenever stations are out of range of all APs and BSs then there is no communication for that particular stations. But In our proposed system whenever stations is out of range of all APs and BSs, then it can communicate through any other station which are in range based on ad-hoc network technology. For this interworking of WiMAX and WLAN we design a Handoff scheme which enable stations to smartly monitor the quality of current connection and make an accurate handoff decision. The proposed interworking architecture of WLAN and WiMAX are shown in Figure.

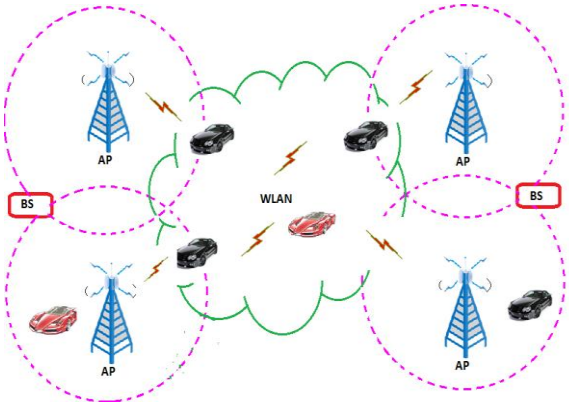



**Fig: 3.** Proposed Architecture

In ournetwork architecture we include 2 Base Stations (BS), 4 Access Points (AP), a intermediate Wireless Local Area Network (WLAN) and several Mobile Stations (MS). These all are describe as:

Subscriber Station, SS / Mobile Station, MS: The Subscriber station / Mobile station are the users which connect with WiMAX through any of the AP,which are moving from the range of one AP to another AP whether they are belonging to same BS or not. Mobile Stations may also be used as the form of a dongle for a laptop, etc.

Base Station, BS: The base-station is an important part of the WiMAX network. It provides the air interface connectivity between subscriber and mobile stations and also provides additional functionality like handoff triggering and tunnel establishment, radio resource management, QoS policy enforcement, traffic classification, DHCP (Dynamic Host Control Protocol) proxy, key management, session management, and multicast group management.

Access Point (AP): The Access Point allows wireless devices to connect to a wired network using Wi-Fi, or related standards. The AP usually connects to a router (via a wired network) as a standalone device, but it can also be an integral component of the router itself. An AP is differentiated from a hotspot, which is the physical space where the wireless service is provided.

Wireless Local Area Network (WLAN): In our proposed work WLAN play an important role. If any of MS change their location from range of all APs to another within different BS Regions, at that time the MS or mobile host will use this WLAN Adhoc network for communication until they will again not come in range of any other AP of WiMAX network.

## 7. Conclusion

We have proposed a Handoff scheme with the help of a new Architecture of WiMAX and WLAN which provide always the best Communication Service to users. We used and combined WiMAX and WLAN architectures so that we are able to provide better services to users. We use ad-hoc technology which is the best option to provide the best communication connectivity anywhere. We are very much Sure about Simulation results of our proposed strategy that it always have a higher performance than any other normal strategy.

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