International Journal of Current Engineering and Technology
E-ISSN 2277 – 4106, P-ISSN 2347 - 5161

Available at http://inpressco.com/category/ijcet

Research Article

# Performance analysis of mobile WiMAX handover with various speeds using CBR application

Santosh Kumar Yadav[Á*], Rajeev Paulus[Á], A.K.Jaiswal[Á] and Ashish Xavier Das[Á]

[Á]ECE, SHIATS-DU Allahabad, U.P, INDIA

Accepted 26 May 2014, Available online 01 June 2014, **Vol.4, No.3 (June 2014)**

***Abstract***

*WiMAX is fourth generation wireless communication technology WiMAX is inexpensive establishment wider coverage and high data rate make WiMAX worldwide interoperability for microwave access to be one of the most developing technology for wireless last mile connection. Enhance mobility wireless access are designed such as 802.16e to operate on the move without any interfere of services. Mobile WiMAX support roaming services in metropolitan and regional network, so allow mobile connectivity to mobile user. Mobile WiMAX is advantageous in supporting low-latency data, video and real-time voice services for mobile user at high speed .In this paper the Performance analysis of mobile WiMAX handover with various speed using CBR application has been undertaken.*

***Keywords:*** *WiMAX, Constant bit rate. , Wi- Fi, Handover.*

## 1. Introduction

Today, in the era of Laptops, tablets, and mobile phones fax electronic gadget there is often a requirement to set up a network to enable communication among some of these devices. Worldwide Interoperable Microwave Access (WiMAX) Networks are one of the solutions that provide data rates up to 150 Mbps in a wireless network, at distances in range of 3 −5kms (Anonim, 2008). This long distance transmission is possible due to the usage of high transmitting power. WiMAX is the advanced version of the IEEE 802.16 Broadband Wireless Access standard. While initial versions of IEEE 802.16 supported for a mesh network also, the most recent standard supports only the centralized network, i.e., each Mobile Station (MS) is connected to a centralized entity, namely the Base Station (BS) and MSs cannot communicate among themselves. This working mode is termed as Point to Multipoint (PMP) mode in WiMAX networks (West all, et *al*, 2011). WiMAX uses Orthogonal Frequency Division Multiple Access (OFDMA) technology to minimize interference at the physical layer.

This eliminates the Inter Carrier Interference (ICI), Inter Symbol Interference (ISI) and the Multipath interference that can occur between a transmitter and receiver moving with high velocities (Ashok, et *al*, 2006). In IEEE 802.16e, the total handover occurs in phases. Total procedure does not free form ambiguities, unwanted handover occur due to the synchronization activity and scanning. Extent of scanning of scanning activity become limited with targeted task in IEEE 802.16 system. All the uplink and downlink traffic are buffered. During the traffic. It take the few mili hundred time to decide to best handover with best station. [Ashok *et al*. 2006] Here same steps are involved it improvement in both phase of BS selection. WiMAX has two form, first is NLOS (Non Line of sight) and second is LOS (Line of sight).

In NLOS, WiMAX technology small antenna near the computer connect to tower. In this process WiMAX use the frequency range 2GHz to11 GHz. In LOS fixed a dish antenna which behave as a point straight at WiMAX tower from a pole. LOS connection is stronger and more stable than NLOS.

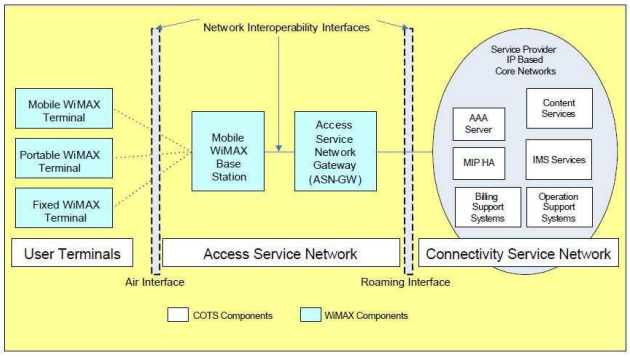


**Fig 1**: WiMAX Network IP Based Architecture

The LOS (Line of Sight) connection capable to send a lot of data with minimum error (Barber, et *al*, 2003). The LOS connection usage higher range of frequency, at higher frequency interference possibility become very loss. All the characteristics of WiMAX shows if TX antenna send the data (Makelainen *et al*, 1987). The WiMAX enable the computer, routers set up within the transmitter of 30 miles radius.

*Corresponding author: **Santosh Kumar Yadav**

IEEE 802.16e conduct in NLOS mode between the range of

2-11GHz. WiMAX in NLOS mode improve multipath performance. At is LOS orthogonal frequency division multiple access introduced in IEEE 802.16e to support scalable channel which bandwidth ranging from 1.5 to 20 MHz (Shanti, et *al*, 2006). It support as guaranteed bandwidth up to 15 MHz there are many silent Feature which support the WiMAX.

*1.1 High Data Rate*

WiMAX technology supported of advanced coding and modulation which download data rate up to 63 mbps per sector and uploading data rate up to 20 mbps per sector in 10 MHz channel bandwidth.

*1.2 Quality of service*

Quality of service define the call flow which can be map to difference service code that enable end to end IP based, on a frame by frame basis sub channel and map based signaling available suitable mechanism.

*1.3 Scalability*

WiMAx proceed and make able to scale to work with different canalization from 1.25 to 20 MHz with change worldwide requirement. Mobile WiMAX allows diverse economies multi-faceted benefit.

**2. Mobility Management**

Mobility management realized the handover function among the neighboring BS. Handover refers to the operation of converting the wireless link connecting MS to one BS to another BS. In mobile WiMAX, two types of handover, first is hard handover and second iis soft handover. In the hard handover releases the previous link before making a new call to another base station. In the mobile WiMAX only support a hard handover, whereas 802.16e support a both types of handover is hard and soft handover.

*2.1 Handover Process*

Hard handover is perform two steps once is network topology acquisition process and other is handover execution process. Network topology acquisition is indicate to the process of periodically parameter value that are necessary to make handover decision and initiation, synchronize to destination BS downlink, ranging and termination of the MS context process.MS periodically receive the channel parameter information of neighboring BS via the anchor BS. MS station send a scanning request parameter necessary to perform a scanning process in the case of inter frequency handover. If the mobile station analyses the CINR value of the neighboring is good enough to perform a handover., it send to start the handover to the anchor BS station .the anchor BS mention the neighboring BS of MAC address.

In order to increase the cell coverage area and improve the quality of service, Soft handover are used. Two types of soft handover in 802.16e, first is Macro diversity handover and second is Fast BS switching handover. In the MDHO handover, the MS communicate continuously with the collection of BSs within the diversity set that allocate wireless resource to the MS. In the FBSS handover the MS communicate only with anchor BS that MS was initially registered with and synchronized.

Both the MDHO and the FBSS use the concepts of Diversity Set (DS) and Anchor BS (ABS). Each MS maintains a DS of its own. At any time, depending on the signal strengths, the DS includes the most active NBSs that could be involved in a handover. In a DS, the ABS is chosen to be the BS with the most powerful signal strength.

*2.2 Power Saving*

Mobile device are likely to be compact and portable, the battery size is small and power saving is most important factor of mobile WiMAX system .Mobile WiMAX support two mode , first is sleep mode and second is Idle mode.

In the case of sleep mode, each MS and BS exchange the sleep request and response message for the the transition to sleep mode.

In the case of idle mode, MS does not register in particular BS while moving over cell but only receive the downlink broadcast traffic periodically.

**3. Mobility Management Architecture**

The WiMAX mobility management architecture was designed to:

- WiMAX was designed to reduced packet loss and handover latency.
- Order of maintaining packet support and seamless handover.
- Mobility management Supporting proper macro diversity handover (MDHO) and fast base station switching (FBSS).
- Minimize signaling mobility management article support.
- Mobility management Support IPv4 and IPv6.
- Mobility management support multiple IP addresses.
- Mobility management support vertical or inter-technology handovers and roaming between network service providers (NSPs).

The WiMAX network supports two types of mobility:

*3.1 ASN-anchored mobility (intra-ASN mobility)*

ASN support at that situation in which mobile move from one place to another place. In ASN MS movement activity has no limitation and has no interaction on network layer , the data path function decided setting up and managing message path in which involved the handover.in ASN include packet forwarding, low latency and special need. ASN responsible for proper handover it support network initializing handover and mobile. In ASN

context function is responsible for direct exchange information between network elements.

### 3.2 CSN-anchored mobility (inter-ASN mobility)

CSN anchor decided the mobility of MS across different ASN foreign agent (FA). It has specific mobility limitation in same network provider and foreign agent. In CSN anchor involved mobility of different IP subnet. WiMAX support IPv4 network and IPv6 while CSN anchored mobility management support only IPv6. Which are differ from IPv4.

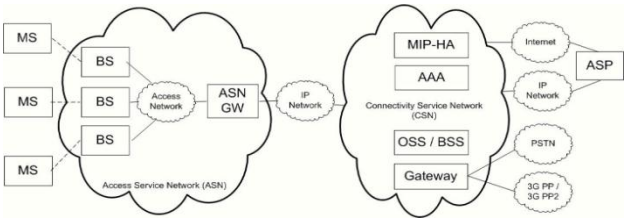


**Fig. 4** WiMAX Network Architecture based on IP

*3.3 Performance Matrices*

**Throughput-** Throughput is defined as the ratio of the total data receive at receiver to divided time it takes. The throughput is measured in bits per second (bit/s or bps). Higher throughput is always acceptable in communication. **Average End-To-End Delay**-End-to-end delay indicates that data packet may take a longer time to reach source to destination. It represents the average data delay an application or a user experiences when transmitting data. **Average Jitter -** Jitter is the variation in the time between packets arriving, caused by network congestion, timing drift, or route changes.

### 4. Simulation Setup

In this paper, we have used network simulator Qualnet 6.1 to analyze the Performance analysis of mobile WiMAX handover with various speed using CBR application over an area of 1500m x 1500m with a channel frequency of 2.40 to 2.44 GHz. Performance can be analyzed using parameters like throughput, average jitter, average end-to-end delay and message received.

**Table1** Simulation parameter

| | |
|---|---|
| Mobility modal | Random way point |
| Simulation area | 1500x1500 |
| Speed | 0-10mps, 0-20mps |
| FFT | 1024 |
| Channel frequency | 2.4, 2.42,2.44 |
| Simulation Time | 500 |
| No of Base Stations | 2 |
| No subscriber stations | 10 |
| No nodes | 13 |
| Relay node | 1 |
| No of packet sent | 100 |
| No of channels | 3 |
| CBR | 2 |

### 5. Result and Discussions

In this simulation network various performance of WiMAX handover of random way point model are used different speed application in Qualnet 6.1 simulator. The simulation is used with a three channels of bandwidth of 2.4, 242, 2.44 GHz The figure 5 shows the simulation network consists of 13 nodes including two base station and 10 subscriber station with single relay node which is placed randomly over the simulation area of 1500m*1500m.

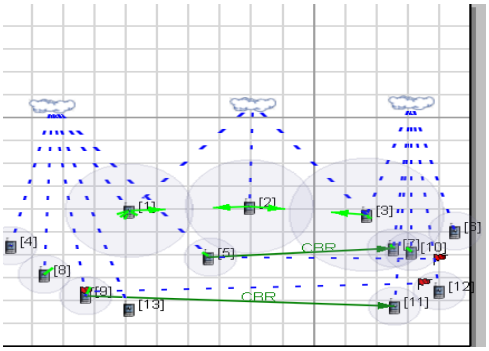


**Fig.5** Simulation scenario using various speed.

Fig: 5.1 shows that node 7 having low speed i.e 10mps as compared to node 11with high speed i.e 20 mps attains a high throughput .

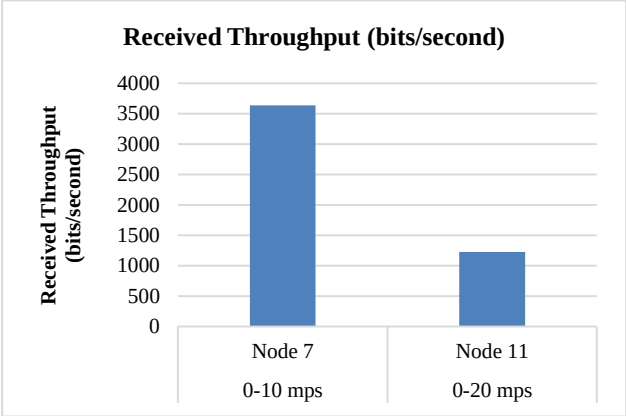


**Fig.5.1** Unicast received throughput for various speed.

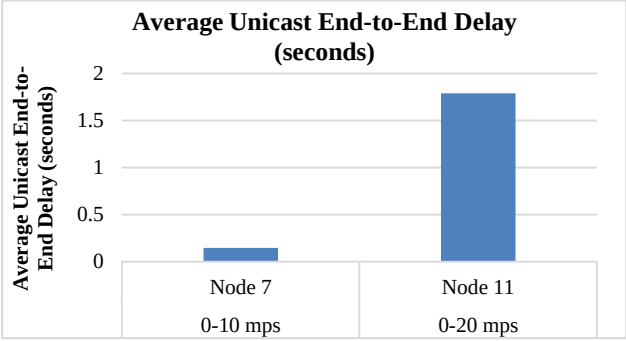


**Fig.5.2**Average unicast end to end delay for various speeds

From Fig: 5.2, It is concluded that node 7 having low speed, the end to end delay is better than the node 11 having high speed.

Fig: 5.3 shows that for node 7 having low speed the average unicast jitter is better than the node 11 with high speed.

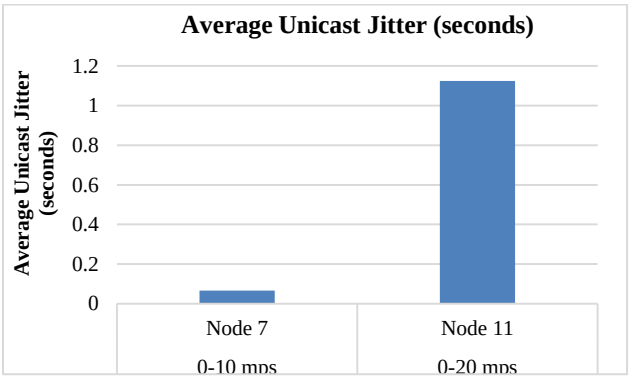


**Fig.5.3** Average unicast Jitter for various speed.

Figure 5.4 shows number of packet received at the destination .In case of node 7 no of packet received are 24.07 out of 100 .while in case of node 11, no of packet received are 24.05.This shows that node 7 gives better performance than node 11 in case of handover.

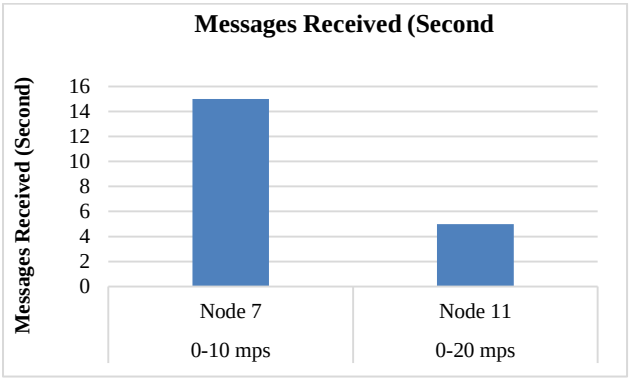


**Fig.5.4** Message Received with various speed

## Conclusion

In this paper the handover performance is analyzed with various speed of random way point mobility for two mobile WiMAX cell by using qualnet simulator 6.1. WiMAX handover performance is analyzed in terms of throughput, end to end delay, average jitter and total message received. Also different mobile node are used with different speed, due to variation of speed the performance of mobile handover is influenced. It is also concluded that the node having minimum speed will perform better than the node having maximum speed.

## References

Ashoka, B. Eyers, D. Zhiyi Huang,(2006) ''Handover Delay in Mobile WiMAX: A Simulation Study'',*IEEE International conference communications*,pp 305-312, 2012.

Bai, Fan, and Ahmed Helmy. A survey of mobility models. Wireless Adhoc Networks. *University of Southern California, USA* 206, 2004.

Daniel, K.; Rohde, S.; Subik, S.; Whitefield, C. (2009) ''Performance Evaluation for Mobile WiMAX Handover'' Mobile WiMAX Symposium, pp 30-35, October 2009.

D. H. Lee, K. Kyamakya and J. P. Umondi (2006.), Fast handover algorithm for IEEE 802.16 e broadband wireless access system, Wireless pervasive computing, 1st *international Symposium on. IEEE*

Jain R, Ramakrishna K. (April 1987.) Congestion Avoidance in Computer Networks with a Connectionless Network Layer. Part I- Concepts, goals and alternatives. DEC Tech. Rep. TR-507, *Digital Equipment Corporation, Littleton, Mass.*

L. M. Carlsberg, and A Demander (2006), WiMAX-A study of mobility and a MAC-layer implementation in GloMoSim, *Master's Thesis in Computing Science* Makelainen, Antti. Analysis of handoff performance in Mobile WiMAX networks. Diss. *Helsinki University of Technology*, 2007.

P. Barber, (2004) Revision of Handover Mechanism for Mobility Enhancement. IEEE 802.16 *Broadband Wireless Access Working Group Project*, IEEE C802.16e-03/57,30.

Qi Lu, Maode Ma (Feb 2011) Group mobility support in mobile WiMAX networks *in Journal of network and computer applications*,pp. 1272–1282,

Rahim, R. ; El Hassan, B. ; Afifi, H, (2004) ''Evaluation of handover time in different network technologies'', *IEEE International conference communications*, pp 217-218

Shanti, K. R. and G. S. Kumararn. (2006). Migration to 4G: Mobile IP based Solutions. Proceedings of the Advanced *International Conference on Telecommunications and International Conference on Internet and Web Applications and Services*.

Sun, H. M., S. Y. Chang, Y. H. Lin, and S. Y. Chiou. (2008). Efficient Authentication Schemes for Handover in Mobile WiMAX. Proc. of 8 th Int'l Conf. on Syst. Design and Applications, pp. 44–49.

West all, James M., and James J. Martin. Performance characteristics of an operational wimax network. *Mobile Computing, IEEE Transactions*, 941-953, 2011

## Authors

**Santosh Kumar Yadav** is pursuing M.Tech. In Wireless Communication from SHIATS Allahabad, He has 4 years' experience in NSN & ALUMS as a Senior Engineer in Mumbai. His field of interest is focused on Handover issue in WiMAX.

**Rajeev Paulus** is working as an Assistant Professor in ECE in SHIATS, Allahabad. He received the degree of Ph.D. from SHIATS Allahabad and the degree of M. Tech. from MNNIT, Allahabad. He has presented & published various research papers in national and international journals and conference. Currently he is guiding various Ph.D. scholars in area of wireless Communication Engineering. His area of interest includes Optical Networks, Wireless communication and high speed cellular networks.

**A.K. Jaiswal** is Prof. and Head of ECE Dept. at SHIATS-Allahabad. He Obtained M.Sc. in Tech. Electronic & Radio Egg. From Allahabad University in 1967.He guided various projects & research at undergraduate & postgraduate level. He has more than 35years Industrial, research & Teaching experience and actively involved in research and publications. His area of interest includes Optical Networks and satellite communication.