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Delay and Throughput Comparison between Hard Handover and Soft Handover by Varying the Speed in Mobile WIMAX

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***Abstract*- Nowadays, mobility issue in wireless network is highly essential which represents challenges because of requirement of continuous connectivity for internet during movement of mobile. Mobile WIMAX supports the handover (handoff), which keeps continuous linking among the Mobile Station (MS) and Base Station (BS). This paper signifies the types of handover for mobile WIMAX using OPNET simulator based on change in speed of MS. Three different scenarios for handover (two for hard handover and one for soft handover) in mobile WIMAX network has been analyzed with the speed of 10km/h, 60km/h and 300km/h. The results obtained are helpful in investigating the impact on throughput and delay with the change in mobile speed for handover in mobile WIMAX network.**

***Keywords*- Handover, Hard Handover, Soft Handover, Mobile WIMAX, OPNET, Handover Delay, Handover Throughput.**

INTRODUCTION

Mobile WIMAX has become the newly emerging broadband access technology which allows inexpensive mobile Internet applications and analyzed that mobile WIMAX allows the union of mobile and fixed broadband access in network architecture and single air interface [1].

WIMAX have always been a preferred choice by the operator. WIMAX provides great advantages to the operators making capacity upgrades one of their priorities. Through combing OFDMA and advanced MIMO scheme with rapid link adoption, enabling the delivery of value added broadband services. WIMAX provides an efficient air interface that belongs to evolving third generation networks and that was the reason why so we consider this technology as a nominee for the fourth generation networks [2].

WIMAX is an attractive field and is the highest promising technologies for broadband wireless communication which it has achieved [1].

RELATED WORKS

Handover performance in mobile WIMAX networks, Yadav, Jyoti, and Bijender Mehandia (August 2014) [3], in this paper they have shown that the chief deliberation of Mobile WIMAX is WIMAX is to attain flawless handover like there is no loss of data. In WIMAX both MS and BS scans the adjoining BS for choosing the finest BS for a possible handover. They have projected a procedure to choose a BS for possible soft handover in WIMAX. They have evolved a BS assortment process that will enhance the soft handover like there is no data loss; handover verdict is taken rapidly and therefore upgrading handover performance on the whole.

Effect Change of Speed on Delay and Throughput for Handover Types in Mobile WIMAX Network**,** Almansour, Sana Mahmoud Eltayeb and Amin Babekir Abd elnabi Mustafa(September 2014)[1], this paper represents not only the manner in which they measured delays and throughput as one of the most important parameters of QoS for which types of handover, handover in Mobile WIMAX networks is a very important and sensitive issue as they affect QoS and thus the efficiency of the network, which represented two scenarios for hard handover and one scenario for soft handover but also types of handover for mobile WIMAX using OPNET simulator based on change speed for MS with observed impact it on the delay and throughput of the mobile WIMAX network.

Comparative Study of Various Handover Scenarios in WIMAX Network**,** Gupta, Chandan (August 2012) [4], has focused on present increasing network demand - Mobility and handover method has been used to support mobility. Thus, it has been stressed upon the comparative study of different types of handover namely hard and soft handover. They talked over that even though hard handoff is functional for slow speed mobile WIMAX networks but it is affordable and unadorned then soft handover. But the requirement of high speed mobility has preferred soft handoff regardless of being complicated and costly. Therefore, soft handover has wider scope being extra reliability and compatibility with high speed. Also it has been concluded that handover method is architecture dependent. Both the fundamental classification of handovers may be acquired at the level of layer 2 or layer 3 of the Open Systems Interconnection (OSI) network model.

Handover Delay in Mobile WIMAX: A Simulation Study**,** Ashoka et.al, (2011) [5], explains the array to enhance the

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effectiveness of handoff schemes. The paper represents an analytical survey on host-based and network-based handovers into mobile WIMAX. Study of the performance of the both handoff technologies, that is to say the ASN-based Network Mobility (ABNM) and the Mobile IP, in mobile WIMAX were made by means of simulation. In totality the paper established that the ABNM handoff plan can reinforce the ability of mobile WIMAX network operators to administer and organize their networks additional proficiently regarding throughput and handover delay.

Handovers in the Mobile WIMAX**,** Becvar, Zdenek, and Jan Zelenka (2006) [6], the paper has discussed about the explanation of full mobile WIMAX which supports mobile nodes. It has also focused on outline of the different types of handover. According to the need of user mobility different handover types in WIMAX technology were presented. Hard handover just allow lesser speed mobility (simple mobility or portability) and the set of the soft handovers consists of MDHO and FBSS that were enforced for greater speed mobility (full or simple mobility, portability). In both soft and hard handover the diversity set is preserved. MDHO and FBSS differs in the sense that in MDHO the selection diversity in UL and diversity combining in DL is implemented while in FBSS every data traffic can be evaluated in the anchor BS only. The several WIMAX access types have also been discussed in the paper such as Nomadic access, fixed access, Simple mobility and Full mobility and Portability.

HANDOVER IN MOBILE WIMAX

It is defined as the process of continuous connection of migration from MS to the coverage area of one BS to the other. Thus handover is represented as basic to mobility and QoS using wireless services for the subscriber. Connections may be dropped and packets may be delayed during handover [1].

Mobile WIMAX can be categorized into two types of handoff:-

A. Hard Handoff
B. Soft Handoff

A. Hard Handoff

Hard Handover is the simplest of all types of handover. It is mandatory in mobile WIMAX network and also known "Break before Make" because MS terminates link with the old BS before the fresh link is set up. In this handoff type MS is communicating with single BS at a time [7].

When signal strength of present cell is under passed by signal strength of the neighbors' cell, handover is executed [7].

Fig.1 and Fig.2 below, shows hard handover and mechanism respectively.

Fig. 1. Hard Handoff

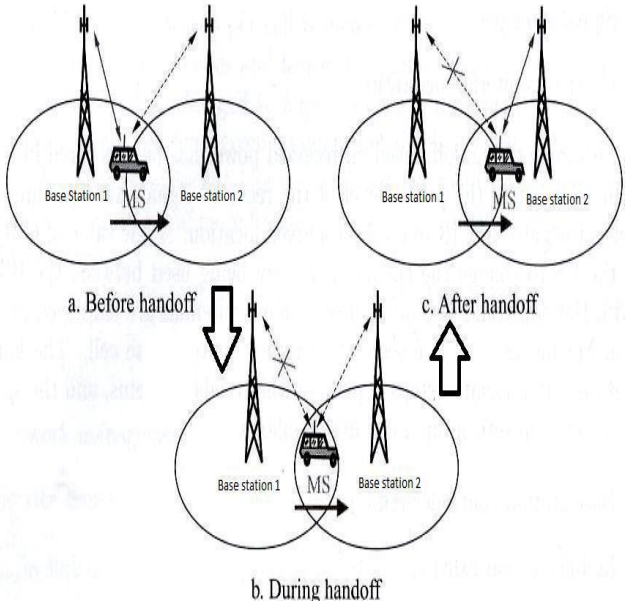

Fig. 2. Hard Handoff Mechanism

Hard handover is divided into Horizontal and Vertical cell handover. In first type MS moved from one BS to other, but both are of same backbone network or operator. However, while Vertical cell handover occurs in MS moved from one BS to other, but both of them are of different network [4].

B. Soft Handoff

Soft handover is optional in mobile WIMAX network and called "make before break" because MS established a new connection before the old connection is broken. At the same time MS can be connected with two or more BS [7].

The Fig 3 below shows soft handoff.

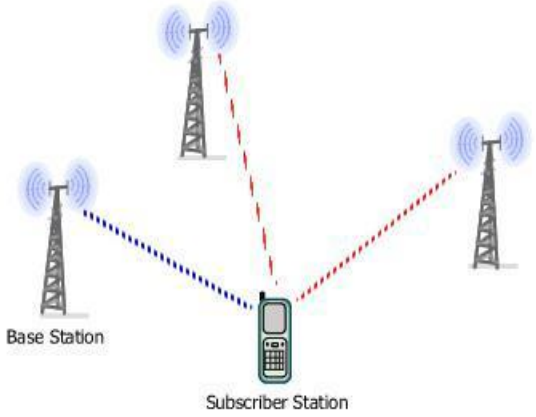

Fig. 3. Soft Handoff

The Soft Handover is divided into two types - Macro Diversity Handover (MDHO) and Fast Base Station Switching Handover (FBSS).

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TABLE I. COMPARISON BETWEEN HARD AND SOFTHANDOVER IN MOBILE [4]

Characteristics	Hard Handover	Soft Handover
Structure	Compulsory	Optional
Complex	Low	High
Cost	Low	High
Handover Time	Small	Large
Handover Represented	Low speed Mobility (Low Vehicular Speed and Walking Speed)	High Speed(High vehicular Speed)
Handover Delay	High	Low
Reliability	Low	High

SIMULATION MODEL FOR SOFT AND HARD HANDOVER IN MOBILE WIMAX NETWORK

Representing a simulation of the networks is very important methodology in the research field, the networks where it's a way to study the behavior of the network by calculating the interactions between devices [8].

The basic component in Mobile WIMAX network is MS. MS node was moved in the network between various BS's. IP cloud is used to connect the number of BS. The parameters such as PHY profiles, efficiency mode and MAC service class definitions are selected which are configured by global configuration object (represented by WIMAX configuration). MAC service class definitions, application definition and profile definition which defines multiple application configurations and multiple profile configurations respectively [2].

The MS is moving from BS0 to BS9 in anticlockwise direction. Every links are 100 BASE T. In the WIMAX handover setup, the MS node travels from the Home Agent to the 9 Foreign Agent BS nodes, prior to coming back to the Home Agent. As it travels away from BS_0, it connects itself with the BS_1 and so on etc. All the BSs are connected to IP cloud that provides and maintain the IP for each base station [9].

The purpose of the simulation is to represent the types of handover in mobile WIMAX network using OPNET Simulator. There are nine BSs, one MS in network and includes three scenarios for handover. One and two scenarios are represented hard handover. However third Scenario represents Soft Handover. Difference between all scenarios is speed of the mobile node.

In first scenario, for Hard Handover which has mobile speed of 10 km/ h, which represent a speed of a walking person as shown in Fig 4. The simulation time taken in this scenario is 2 hours.

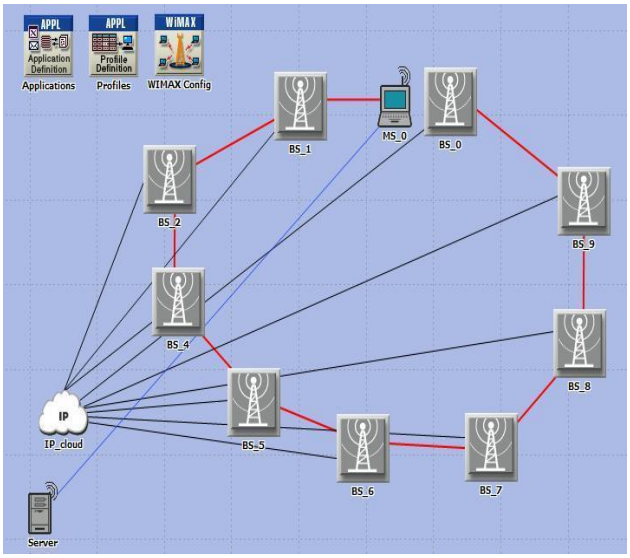

Fig. 4. Scenario 1 hard handover in mobile WIMAX network with mobile speed of 10km/h

In second scenario, it is also for Hard Handover assumes the value of mobile speed of 60 km/ h which represent low speed of a vehicle as shown in Fig 5. The simulation time is taken as 14 minutes.

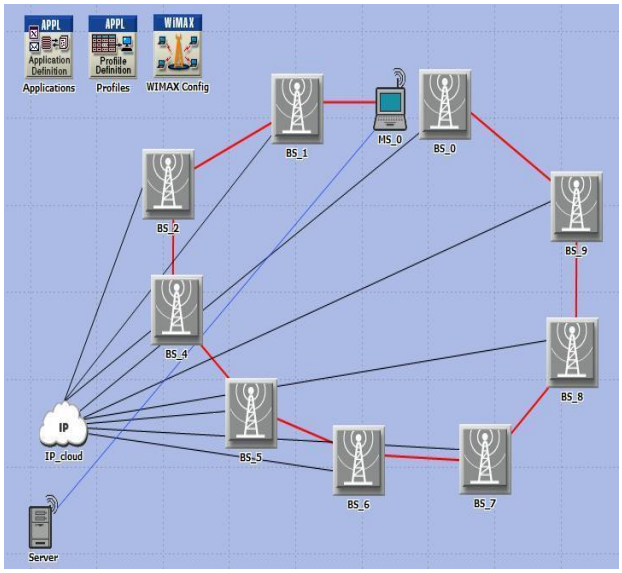

Fig. 5. Scenario 2 hard handover in mobile WIMAX network with mobile speed of 60km/h

In third Scenario, for soft handover has used the same simulation technique as in first and second scenario but with difference in mobile speed. It assumes mobile speed of 300 km/ h which represent the high speed of vehicle as given in Fig 6. The simulation time is taken as 3 minutes.

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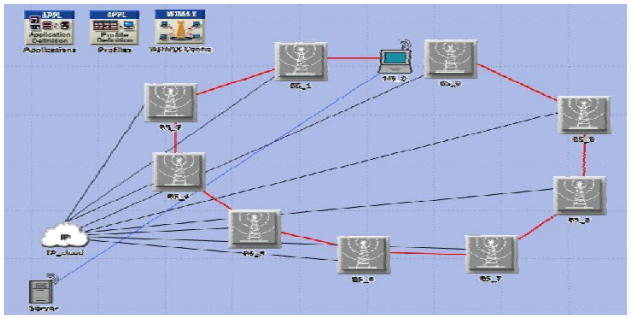

Fig. 6. Scenario 3 soft handover in mobile WIMAX network with mobile speed of 300km/h

SIMULATION PARAMETERS FOR HANDOVER IN MOBILE WIMAX NETWORK

The various parameters for MS in WIMAX are shown below in Table 2.

TABLE II. MOBILE STATION PARAMETERS

Parameters	Value
Scenario 1 Mobile Speed(Km/h)	10km/h
Scenario 2 Mobile Speed(Km/h)	60km/h
Scenario 3 Mobile Speed(km/h)	300km/h
Antenna Gain(dBi)	-1 dBi
MAC Address	Auto Assigned
Maximum transmission Power(W)	0.5
PHY Profile	Wireless OFDMA 5 MHz
PHY Profile Type	OFDM
BS MAC Address	Distance Based
Pathloss Parameters	Vehicular
Ranging Power Step (mW)	0.25
Scanning Threshold (dB)	27
Scan Duration (N) (Frames)	4
Interleaving Interval (P) (Frames)	240
Scan Iterations (T)	10
MS Handover Retransmission Timer(ms)	30
Maximum Handover Request Retransmissions	6
Handover Threshold Hysteresis (dB)	0.4

VI. SIMULATION RESULTS AND DISCUSSION

A. Handover Delay comparisons of Hard Handover and Soft Handover

The Evaluation of handover delay is started from the time when MS sends a MOB_MSHO-REQ notification. The receipt of this notification starts a handover process. This delay is measured until the initial ranging through the new Serving BS is effectively finished. It is measured in seconds.

As it can be inferred from the result in scenario 1for hard handover, mobile speed was slow and assumes the value of 10km/h (speed of a walking person). The average handover delay found in this case was 0.0248sec. In scenario 2 for Hard Handover the value of mobile speed was 60km/h (low speed of a vehicle) and the average handover delay for this was 0.0218(sec.). Scenario 3 for Soft Handover has the highest mobile speed with the value of 300km/h (high speed of vehicle) and the average handover delay obtained was 0.0193(sec.). Fig 7 shows that the smallest value of the delay in case of soft handover and highest value for delay in case of hard handover as the speed in case of soft handover is much more than hard handover [4].

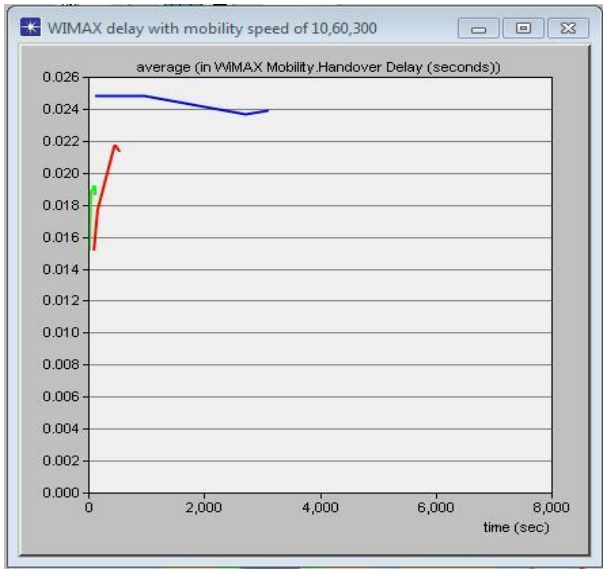

Fig. 7. Average Delay for handover in all scenarios

B. Handover Throughput comparisons of Hard Handover and Soft Handover

The total data traffic (packets/sec) which is effectively received and forwarded by WIMAX MAC to the higher layer is known as throughput.

It can be concluded from the consequences of scenario 1for hard handover, mobile speed was slow with the value of 10 km/h (speed of a walking person). The average handover throughput in this case started from 0.084 and increased upto 9.098 packet/sec. In scenario 2 for hard handover the value of mobile speed was 60 km/h (low speed of a vehicle) and the

average handover throughput for this started from zero and the value increased to 4.842 packet/sec. Scenario 3 for soft handover has the highest mobile speed of 300 km/h (high speed of vehicle) and the average handover throughput obtained started from 0-50 after that, gradually increased to 3.1 packet/sec. Fig 8 shows the smallest average value for handover throughput in scenario 3 for soft handover and the highest value for handover throughput in scenario 1 for hard handover which has smallest speed.

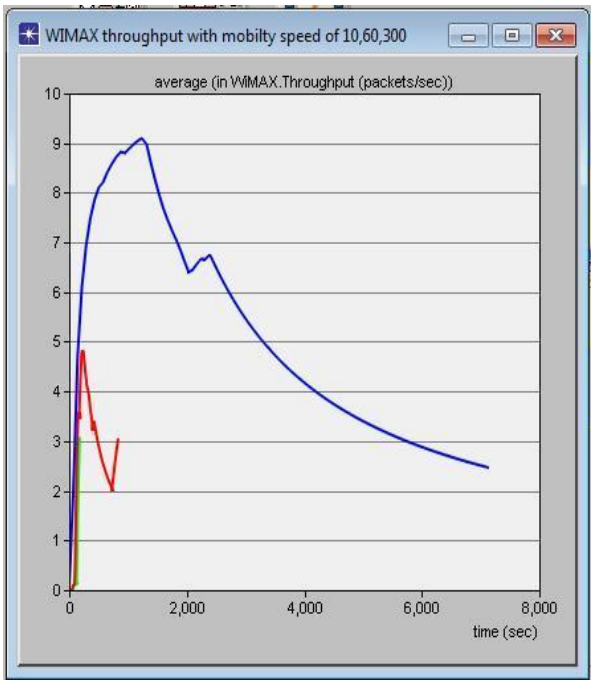

Fig. 8. Average throughput for handover in all scenarios

VII. CONCLUSION

Handover in Mobile WIMAX networks is a very vital and sensitive issue as they affect QoS and thus the efficiency of the network. In this paper, we have measured handover delays and throughput in mobile WIMAX network as one of the most important parameters of QoS for which types of handover, which represented two scenarios for hard handover and one scenario for soft handover. For satisfying the user's need these parameters play a vital function for any WIMAX or any broadband wireless communication. We have found through the observation obtained from different mobile WIMAX network scenarios, that Soft Handover is more efficient than Hard Handover, which provides higher mobile speed than hard handover, consequently giving it the smallest value of the delay and throughput.

VIII. REFERENCES

[1] Sana Mahmoud Eltayeb Almansour, Amin Babekir Abd elnabi Mustafa. "Effect Change of Speed on Delay and Throughput for Handover Types in Mobile WIMAX Network." *International Journal of Modern Communication Technologies & Research (IJMCTR)* Volume-2, Issue-9, September 2014.

[2] Al-Saedi, Firas Abdullah Thweny, and Wafa A. Maddallah. "Evaluation of Handover Process in WIMAX Networks." (2012).

[3] Yadav, Jyoti, and Bijender Mehandia. "Handover performance in mobile WIMAX networks." *Scanning* 3.8 (2014).

[4] Gupta, Chandan. "Comparative Study of Various Handover Scenarios in WIMAX Network." *International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering* 1.2 (2012).

[5] Ashoka, Bhaskar, David Eyers, and Zhiyi Huang. "Handover Delay in Mobile WIMAX: A Simulation Study." *Parallel and Distributed Computing, Applications and Technologies (PDCAT), 2011 12th International Conference on*. IEEE, 2011.

[6] Becvar, Zdenek, and Jan Zelenka. "Handovers in the mobile WIMAX." *Research in Telecommunication technology* 1 (2006): 147-50.

[7] Available: http://www.conniq.com/WiMAX/handoff.htm

[8] Lu, Zheng, and Hongji Yang. *Unlocking the power of OPNET modeler*. Cambridge University Press, 2012.

[9] Dhiman, Abhishek, and Karamjit Singh Sandha. "Vertical and Horizontal Handover in Heterogeneous Wireless Networks using OPNET." *International Journal of Engineering Research and Technology*. Vol. 2. No. 6 (June-2013). ESRSA Publications, 2013.

[10] Dhiman, Abhishek. *Vertical and horizontal handover in heterogeneous wireless networks*. Diss. THAPAR UNIVERSITY, 1956.

[11] Available: http://www.opnet.com/university_program/itguru_academic_edition/

[12] Kumar Abhinav, Purohit Hemant. "A Comparatives Study of Different Types of Handoff Strategies in Cellular Systems." *International Journal of Advanced Research in Computer and Communication Engineering* Vol. 2, Issue 11, November 2013.

[13] Ahmed, Ejaz, Bob Askwith, and Madjid Merabti. "Handover Optimization for Real-Time Application in Mobile WIMAX/IEEE 802.16 e." *Proc. 11th Annual Post Graduate Symposium on the Convergence of Telecommunications, Networking and Broadcasting*. 2010.

[14] Bauer, Carolin I., and S. John Rees. "Classification of handover schemes within a cellular environment." *Personal, Indoor and Mobile Radio Communications, 2002. The 13th IEEE International Symposium on*. Vol. 5. IEEE, 2002.

[15] Zeng, Qing-An, and Dharma P. Agrawal. "Handoff in wireless mobile networks." *Handbook of wireless networks and mobile computing* (2002).