Effect Change of Speed on Delay and Throughput for Handover Types in Mobile WI-Max Network

Sana Mahmoud Eltayeb Almansour, Dr.Amin Babekir Abd elnabi Mustafa

Abstract— **Nowadays, Become Mobility issue in wireless networks is very important which represent challenges because requirement, continuous connectivity for internet during movement of mobile. Mobile WI-Max is attractive field and one of the most promising technologies for broadband wireless communication which achieved it. It supports the handover, which keeping continuous connection between the mobile station (MS) and base station (BS).**

This paper represent types of handover for mobile wimax using opnet simulator based on change speed for MS with observed impact it on the throughput and delay of the mobile wax network.

Index Terms— **Hard Handover, Soft Handover, MDHO, FBSS.**

I. INTRODUCTION

Recently, Become broadband access technology fast growing that enables low-cost mobile Internet applications, and realizes the convergence of mobile and fixed broadband access in a single air interface and network architecture.

Mobile Wimax enables convergence of mobile and fixed broadband access in a single air interface with providing flexibility to network architecture.
WI-Max has been always a prefer 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 and Wimax provides an efficient air interface that go's belong evolving third generation networks and that was the reason why so we consider This technology as a candidate for the fourth generation networks [1].

This paper is organized as follows: Section one present the introduction to Mobile WI-Max, Section two presents Main features of Mobile WI-Max, Section three include application and QoS in mobile wimax, section four discusses types and mechanism of handover for mobile wimax, section five include the simulation network model

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II. MAIN FEATURES OF MOBILE WI-MAX:-

A. *OFDMA*

Physical layer for Mobile WiMAX used (OFDM) which is considered as a way access employer to improve performance in an environment (NLOS).

B. *High data rates*

The (MIMO) antenna techniques along with flexible sub channelization schemes, adaptive modulation and coding enable the mobile WI-Max technology to support both peak downlink and uplink high data rates.

C. *Scalability*

The mobile WiMAX utilizes scalable OFDMA (S-OFDMA) and has the capability to operate in scalable bandwidths from 1.25 to 20 MHz to comply with various spectrum allocations worldwide.

D. *Security*

In this section "Mobile WI-Max is representing the most emergency wireless technology because used Cipher-based Message Authentication Code (CMAC), Advanced Encryption Standard (AES) based authenticated encryption, Extensible Authentication Protocol (EAP) based authentication, and Hashed Message Authentication Code (HMAC) based control message protection schemes.

E. *Mobility*

Mobile WI-Max supports the handover schemes with latencies less than 50 ms to ensure real-time applications such as Voice over Internet Protocol (VoIP)". [2]

Application And QoS in Mobile WI-Max:-Table (1) Show Below

QoS Category	Applications	QoS Parameters
UGS Unsolicited Grant Service	VoIP	• Maximum Sustained Rate • Maximum Latency Tolerance • Jitter Tolerance
rtPS Real-Time Polling Service	Streaming Audio or Video	• Minimum Reserved Rate • Maximum Sustained Rate • Maximum Latency Tolerance • Traffic Priority
ErtPS Extended Real-Time Polling Service	Voice with Activity Detection (VoIP)	• Minimum Reserved Rate • Maximum Sustained Rate • Maximum Latency Tolerance • Jitter Tolerance • Traffic Priority
nrtPS Non-Real-Time Polling Service	File Transfer Protocol (FTP)	• Minimum Reserved Rate • Maximum Sustained Rate • Traffic Priority
BE Best-Effort Service	Data Transfer, Web Browsing, etc.	• Maximum Sustained Rate • Traffic Priority

III. Handover in Mobile WI-Max

It is defined as the process of continues of connection at migration MS from the coverage area of BS to another coverage area for BS. So handover is represented basic to mobility and QoS using a wireless service for the subscriber. Connections may be dropped and packets may be delayed during handover. [5]

Handover in mobile wimax is divided two types:-

* Hard Handover
* Soft Handover

A. *Hard Handover*

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 is terminated Connection with the old BS before the new connection is established. In this type of hand over MS communicates with only just one BS in each time. [6]

Handover is executed after the signal strength of neighbor's cell is exceeding the signal strength from the current cell. [6]

The figure shows below Hard handover and mechanism.

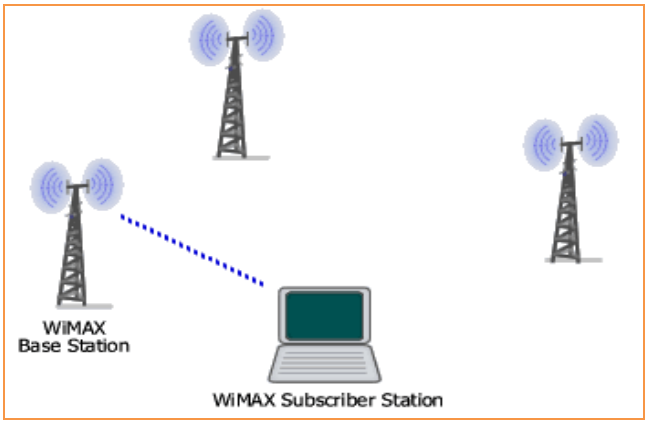


Fig (1) Hard Handover

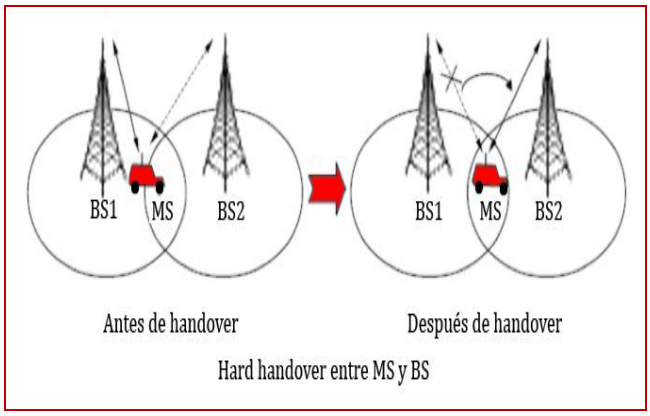


Fig (2) Hard Hand Over Mechanism

Hard handover is divided to: -Horizontal and Vertical cell handover. In first type MS moved from BS to another BS, but both the BS's of same backbone network or operator. However, while Vertical cell handover occurs in MS moved from BS to BS, but both the BS's of different network [7]

B. *Soft Handover:-*

Soft handover is option in mobile wimax network and called "make before break" because MS established a new connection after of them is broken, old connection. At the same time MS can be connected with two or more BS. The Figure shows below

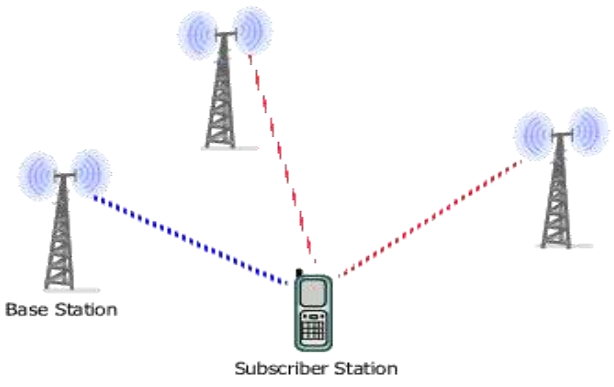


Fig (3) Soft Handover Comparison Between Hard And Soft handover in Mobile

WI-Max:-Table (2) shows below

From	Hard Handover	Soft Handover
Structure	Mandatory	Optional
Complex	Low	High
Cost	Low	High
Handover Time	Small	Large
Handover Represented	Low Speed Mobility (Walking Speed and Low Vehicular Speed)	High Speed
Handover Delay	High	Low
Reliability	Low	High

IV. Types Of Soft Handover In Mobile WI-Max

The SHO is divided into two types: Macro-Diversity Handover (MDHO) and Fast Base Station Switching Handover (FBSS). [8]

A. Macro-Diversity Handover (MDHO):-

It is an optional scheme so must be supported in MS and BS.MS communication all BS's in the active set at the same time. "During uplink communication in MDHO different active BS's receives data signals from MSS and after performing selection diversity the BS which receives the strongest data signal finally makes the transmission"[7]. While downlink communication in MDHO MS received signals from all BS in the active set.

As show fig (4) below

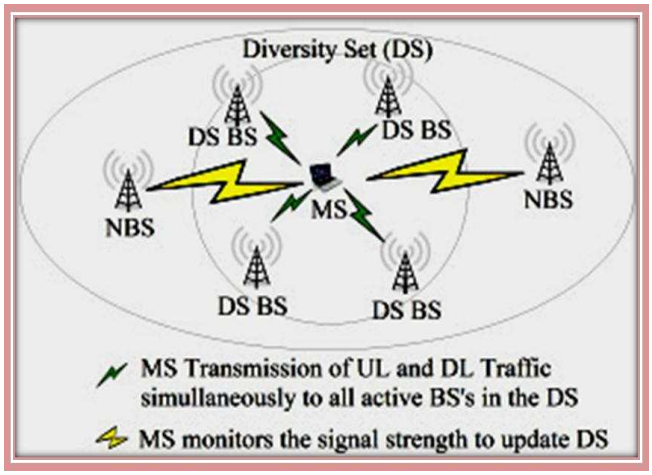
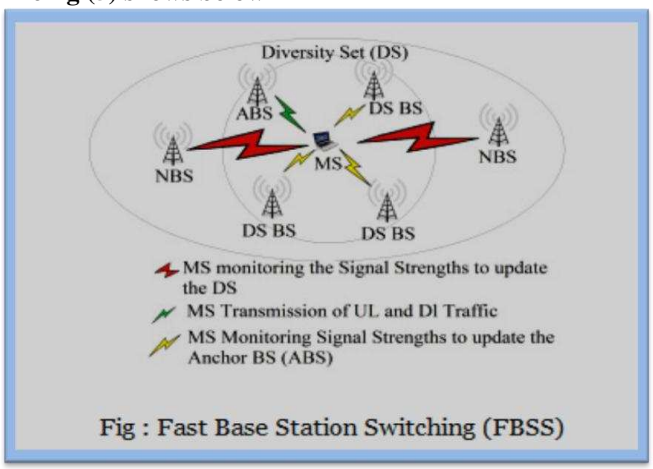


Figure (4) Macro Diversity Handover

B. Fast Base Station Switching Handover (FBSS):-

"In FBSS, the MS and BS diversity set are maintained similar as in MDHO. MS continuously monitors the base stations in the diversity set and defines an "Anchor BS". Anchor BS is only one base station of the diverse set that MS communicates with for all uplink and downlink traffic including management messages. This is the BS where MS is registered, synchronized, performs, ranging and there is monitored downlink channel for control information. The anchor BS can be changed from frame to frame depending on the BS selection scheme. This means every frame can be sent via different BS in diversity set"[8].

The fig (5) shows below



Comparison Between Hard Handover And Types Soft Handover:-

Table (3) shows below

Parameters	Hard Handover	FBSS	MDHO
Latency	High	Medium	Low
Complexity	Low	Medium	High
Reliability	Low	Medium	High
Packet Loss	High	Low	Low
Cost	Low	Medium	High
Support for Delay Sensitive Applications	Low	High	High
Speed	Low	Medium	High
Link Quality	Low	Medium	High

V. Simulation Model For Types Handover In Mobile WI-Max Networks

Represents 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 [9].

The basic component in Mobile WI-Max network is "MS is a node was moved between different numbers of BS's in the network, BS multiple BS's were connected with IP cloud, WI-Max Configuration is represent global configuration object is used to configure parameters such as PHY profiles, efficiency mode and MAC service class definitions are chosen, Application Definition to define multiple application configurations and Profile Definition to define multiple profile configurations". [1]

The purpose of the simulation is to represent the types of Handover in Mobile WI-Max network using OPNET Simulator. The network consists seven Base Station (BS), One Mobile Station (MS) and include three scenarios for Handover.

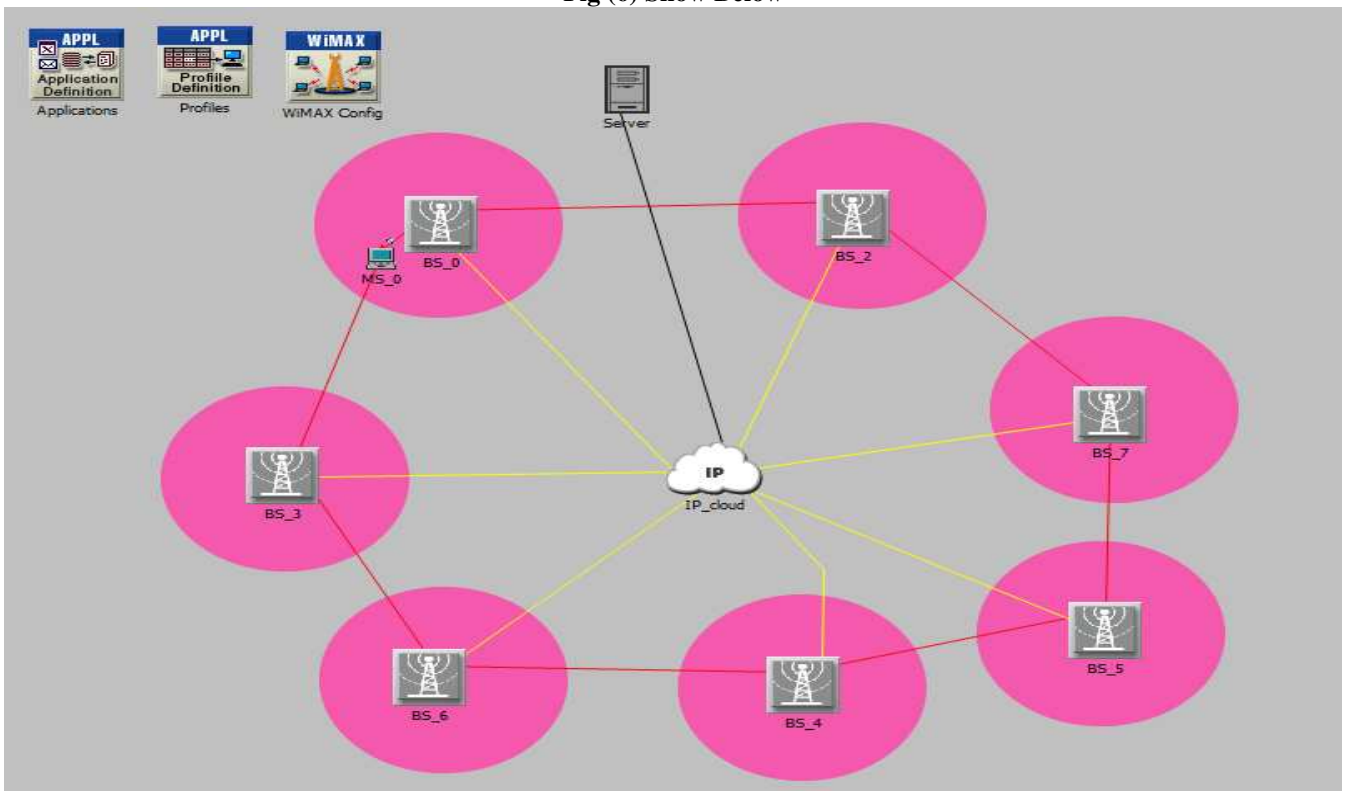
One and Two Scenarios are represented Hard Handover.

However Third Scenario represents represents Soft Handover. Differences between all scenarios in speed of the mobile node. First Scenario in Hard Handover, assume the value of mobile speed is 5Km / h (5.000 m/h), which represent a speed walk in person. While Second Scenario in Hard Handover, assume the value of mobile speed 30 km / h (30.000m/h) which represent low speed for vehicular. However, in Scenario Soft Handover assume the value of mobile speed is 240 km / h (240.000 m/h) which represent the high speed for vehicular.

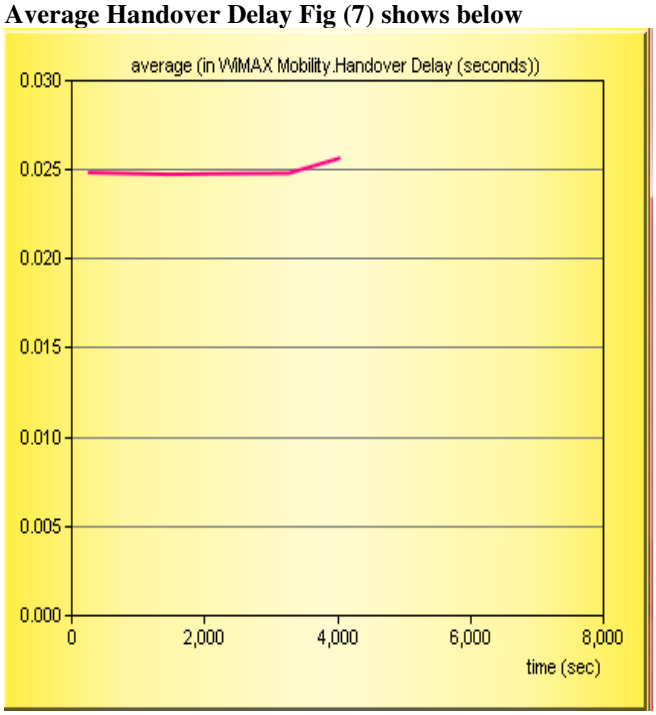
VI. RESULT

First Scenario mobile speed is 5Km / h (5.000 m/h).

Fig (6) Show Below

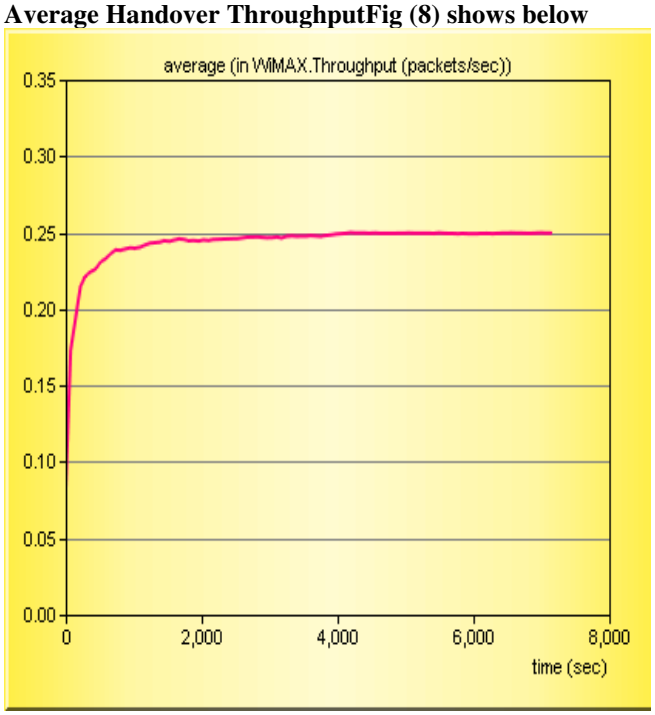


Average Handover Delay Fig (7) shows below



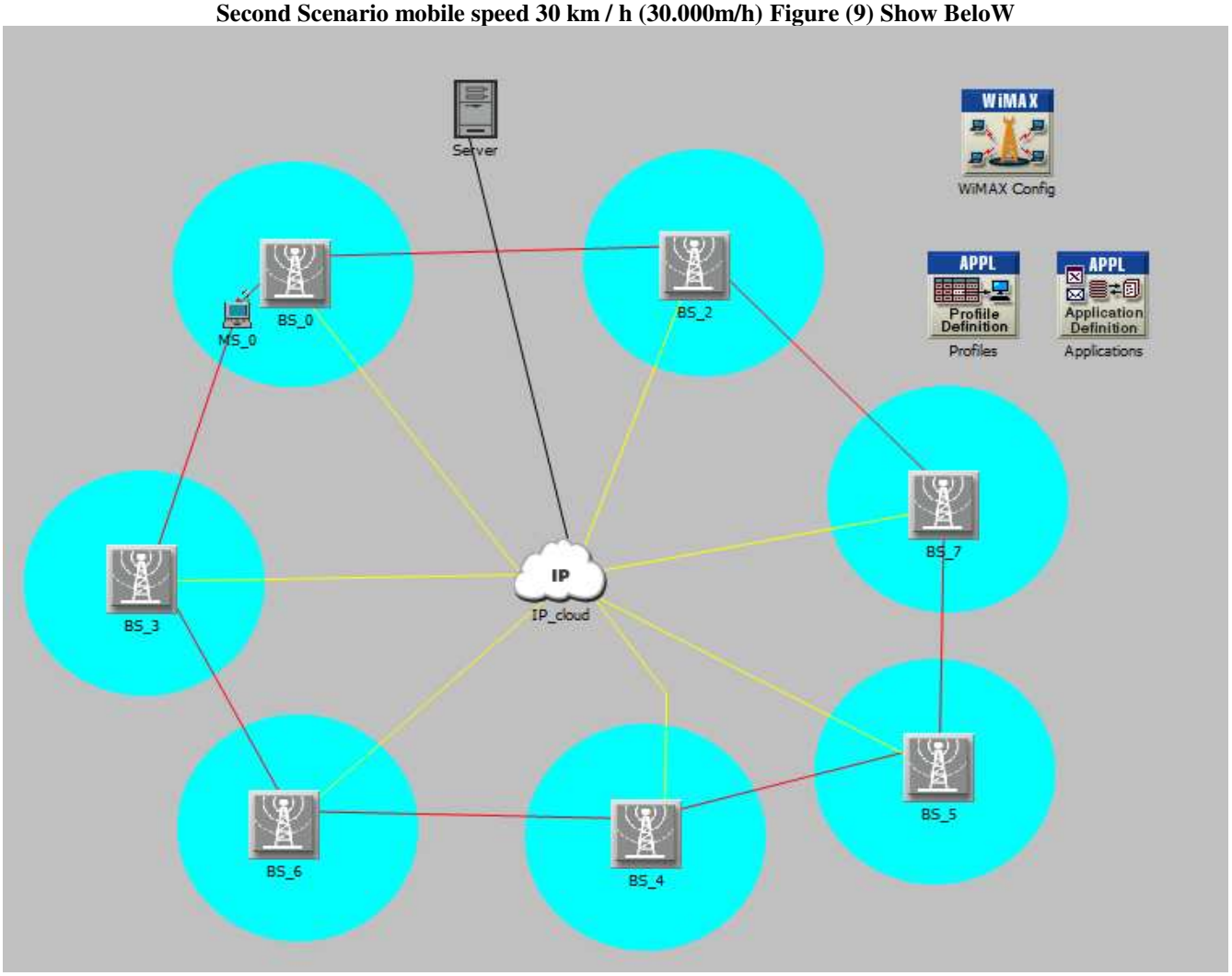
Observe from the fig average value of handover delay is 0.025 Sec when came time equal 1:16:23 and run time 2hour.

Average Handover ThroughputFig (8) shows below



From fig observe average handover throughput start 0.10 and increase to 0.25packet/Sec.

Second Scenario mobile speed 30 km / h (30.000m/h) Figure (9) Show BeloW



Average Handover Delay Fig (10) shows below

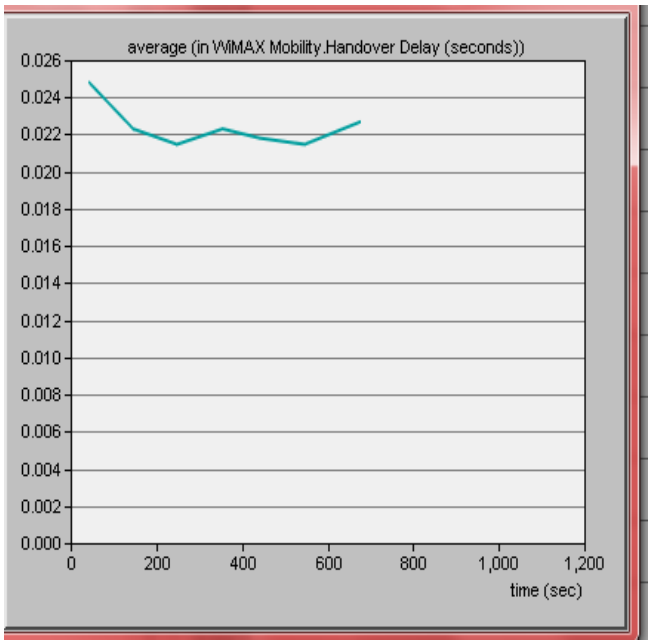


Fig (10) value average handover delay 0.0248 Sec when came time 11min and run time 14min

Average Throughput Of Handover Fig (11) shows below

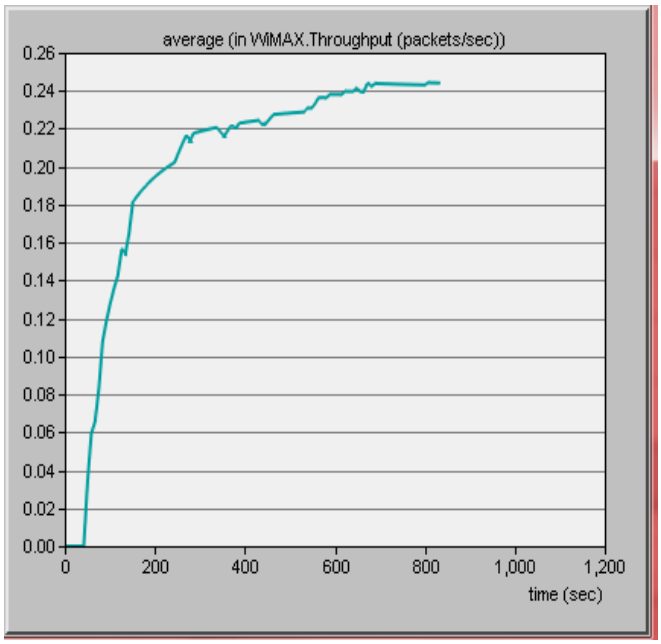
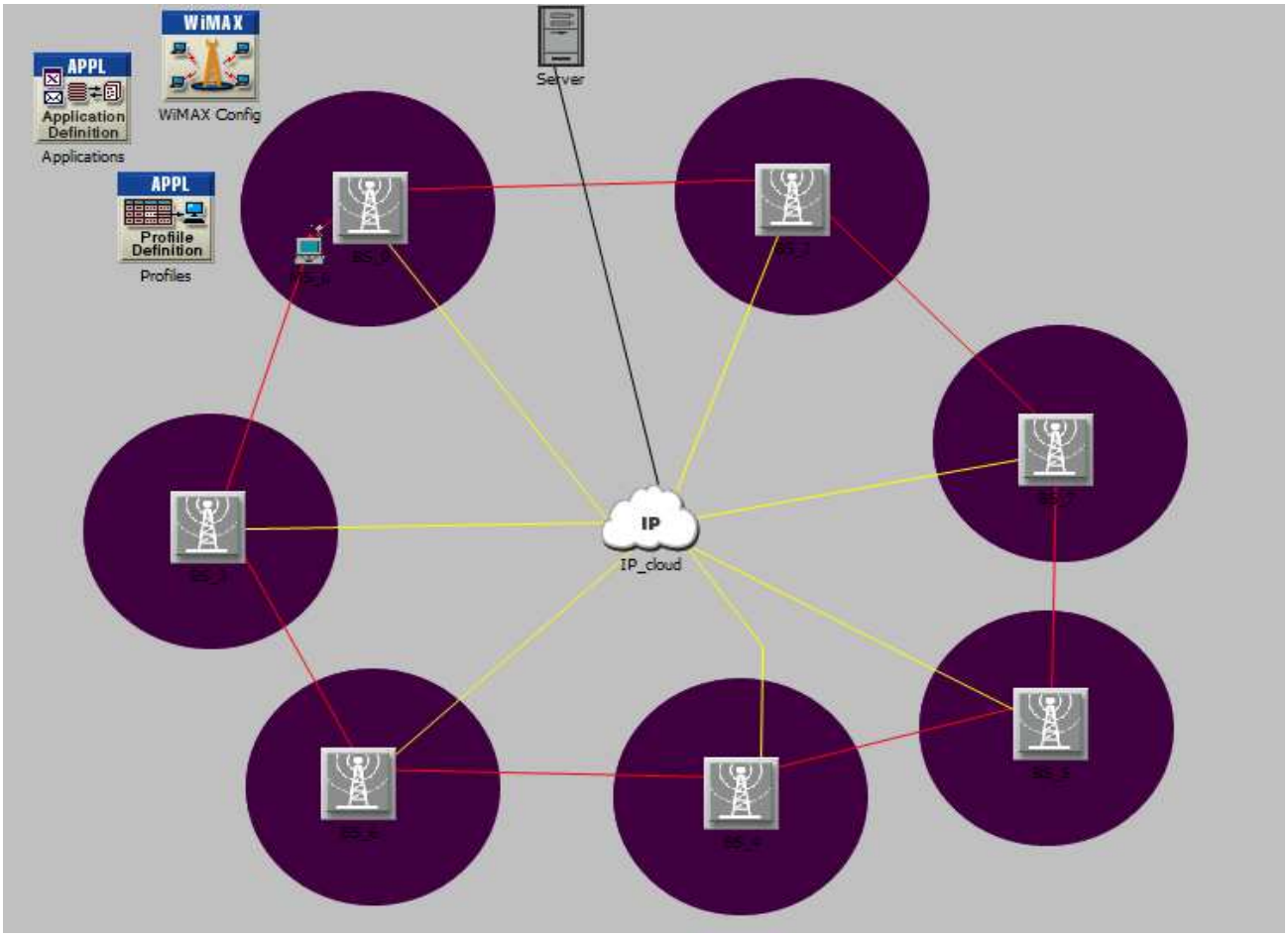


Fig (11) shows value for average throughput of handover start zero and increased to 0.245packet/Sec

Third Scenario when mobile speed 240 km / h (240.000m/h) Fig (12) Show Below



Average Handover Delay Fig (13) shows below

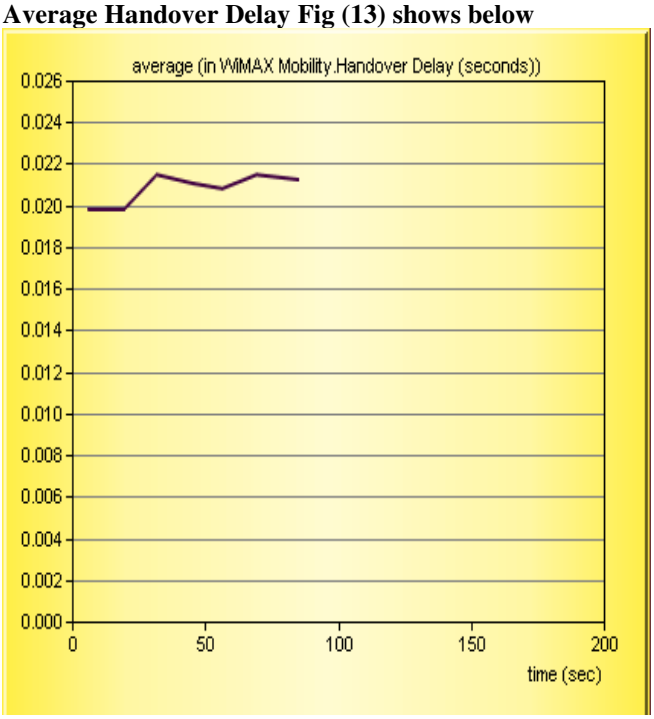


Fig (13) shows value average handover delay equal 0.0219sec when aquarium time 2:13min and run time 3min

Average throughput of handover Fig (14) shows below

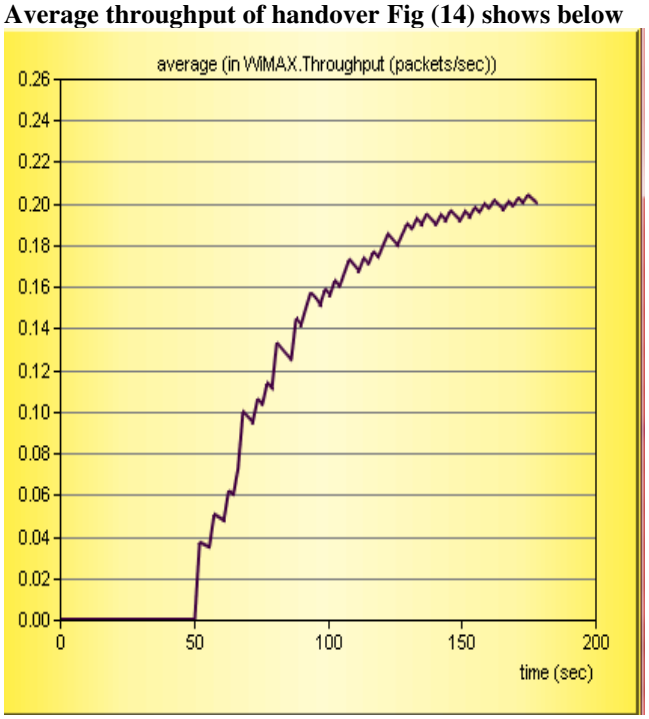


Fig (14) shows the average throughput of soft handover value stated from 0-50sec after that, gradually increase to 0.20packets/Sec

Average Delay Of Handover In All Scenarios Fig (15) shows below

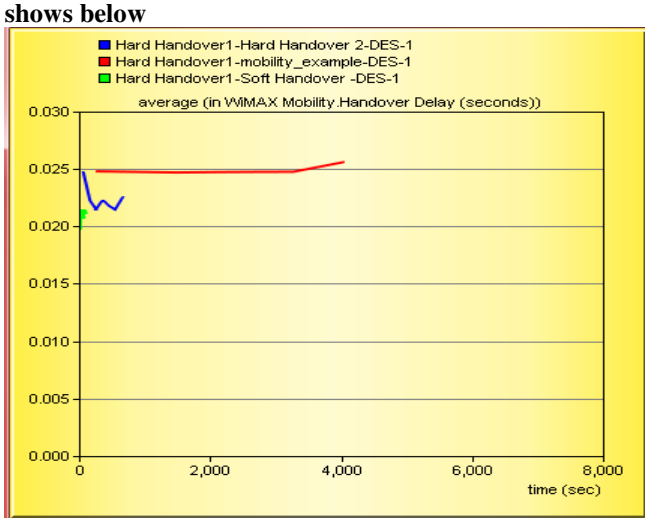
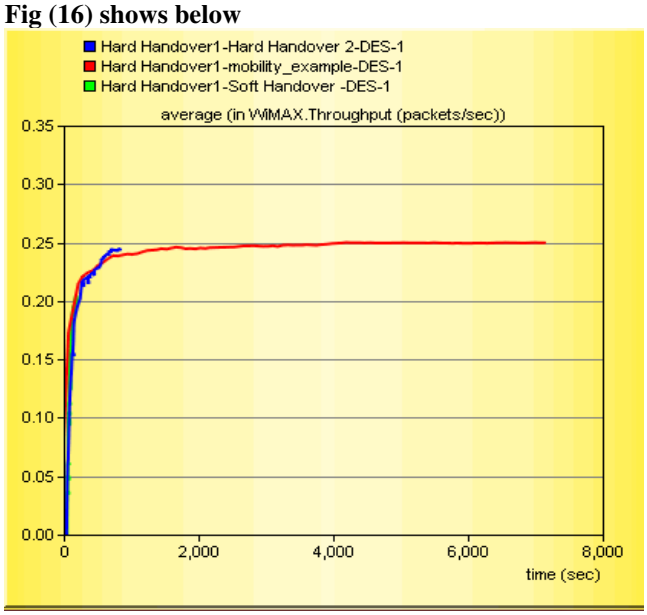


Fig (15) shows that the smallest value of the delay when the soft handover scenario and highest value for delay handover when hard handover one zero

Average throughput for handover in all scenarios Fig (16) shows below



From fig (16) shows the smallest average value for handover throughput in scenario3 however the highest value for handover throughput in scenario1when speed mobile 5km/h

.

VII. Conclusion And Further Work:-

Handover in Mobile WiMAX networks is a very important and sensitive issue as they affect QoS and thus the efficiency of the network

In this paper, we measured delays and throughput 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.

We have found through Result that Hard Handover more efficient than soft handover, where uses a single channel for sending and receiving, making it enjoys the highest throughput and the value of the delay has to exceeding the allowable limit of 50 miles/seconds per second.

Further work handover is still the issue of delivery constitutes a big challenge and can be more work on improving and developed handover.

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