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Substantial Reduction of Handover Delay for Optimum Mobility in WIMAX

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ABSTRACT

WIMAX is one of the fastest emerging technologies which is considered as cheaper alternative to mobile technology protocols such as 3G, 4G or 5G. WiMAX promises high speed data transfer over longer distances and can achieve comparable good quality of service to other mobile protocols .To achieve the goal of providing long distance services with high bandwidth data transfer, WIMAX has to develop the support for high mobility without degradation of the quality of service..To achieve mobility the basic requirement is to support efficient Handover which guarantees continuous and uninterrupted data transfer.This paper discusses the handover process in Mobile WIMAX and tries to find the factors that are involved in handover process which can play a role in improving the mobility in Mobile WIMAX. The standard targeted handover delay is 50 ms over vehicular speed of 72 kmph which has been used as the optimal simulation speed. The OPNET simulation has taken into account testing the following parameters that are linked to the handover success: Link going down factor, Scan iteration, Interleaving Interval and Timeout Parameter. The simulation results show that there has been certain improvement in handover delay such average delay per second and the throughput is better due to the high received signal strength.

Keywords: *Mobile Handover, WIMAX, WIMAX Mobility, Vertical Handover, Horizontal Handover*

1. INTRODUCTION

WiMAX is defined as worldwide interoperability for microwave access which was developed in early 2001 which is capable to provide fixed and mobile data access. The minimum range for WiMAX signal coverage was 30 miles which was capable 75mbps when used at data rate of 20 MHz while the alternative technology WiFi only supported 54 Mhz [1].

The earlier standard was IEEE 802.16 which was considered as basis of WIMAX technology but with added functionality and improvements two different standards evolved as 802.16d which is also called as

FIXED WIMAX and the other one which was 802.16e which is also termed as Mobile WIMAX to provide solution to mobility problems [2]

Mobile WIMAX is still not able to provide complete mobility. In other study they discuss the limitation the mobile users have when they are moving from one base station to next one in Mobile WiMAX environment. They have studied the throughput performance vs different velocities and discussed the Link going down factor but have not looked in detail about the direct effect of this factor [3]

A study where fast base station scanning was applied and tested and which was improved later on.

Was presented where hard handoff was used where time duration is used which resulted in handoff times lower is 50 ms and this was achieved by improving Link going down factor ,scan interaction, Scan duration ,interleaving interval and timeout parameter. [4]

Another study which also discussed the factors affecting the handover process such as Link going down factor, scaniteration, Interleaving Interval and Timeout Parameter *while* explained their effect on Handover latency, throughput and end to end delay .the performance was tested when number of mobile station is constant and velocity was variable and secondly mobile stations was variable and velocity is constant. The simulation results showed improvement in handoff time throughput and end-to end delay [5]

2. HANDOVER IN WIMAX

Mobility is basic building block for any kind of mobile communication and it can be defined as ability to move.

From one location to another location without losing data and connection and this can be ensured by implementation of handover from one base station to another base station. While handover in mobile network terms is termed as change of access point for a mobile device one base station to next one which ensures uninterrupted connectivity [5]

Handover is explained on basis of type of network

a) Vertical Handover

Vertical handover is defined as handover which happens between two different networks

a) Horizontal Handover

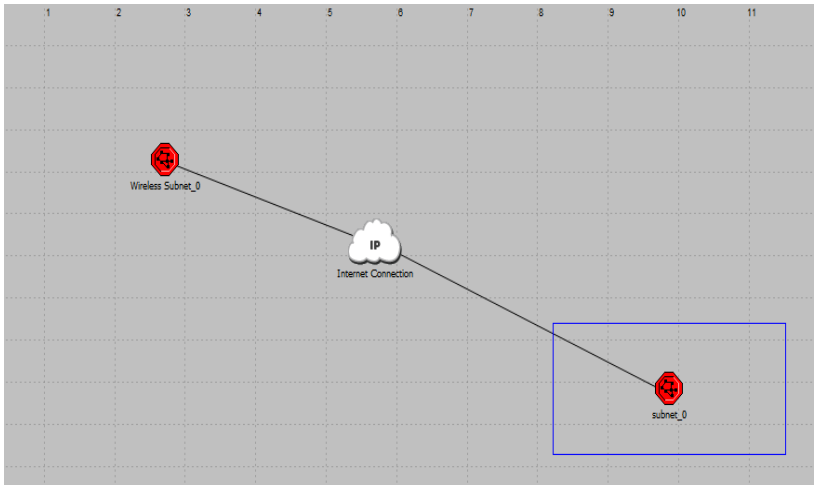
Horizontal handover which happens within same network its form one cell to the next one called horizontal handover. This simulation mainly based on horizontal handover

WIMAX Simulation Scenarios and Results

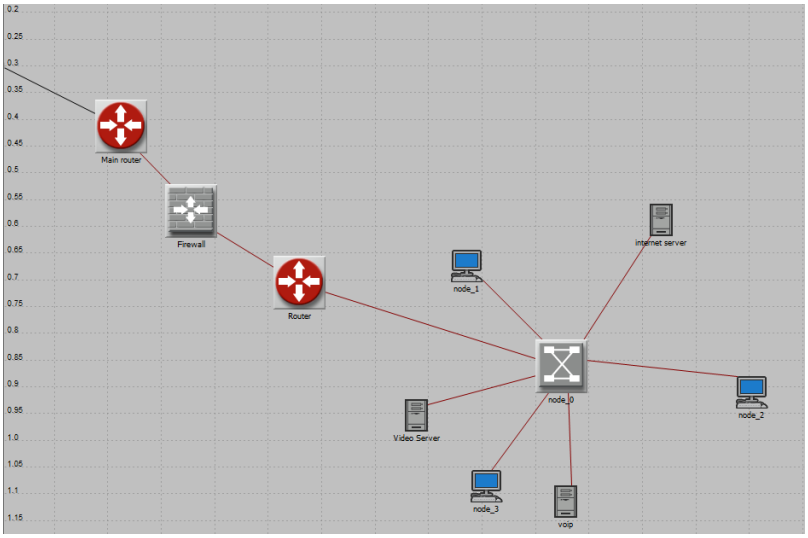
Mobile WIMAX network which is serving large number of mobile stations requires efficient network design and handover scheme and current WIMAX network handover schemes which results in longer handover time and delay which in terms masks results in lower mobility .

To test the handover in WIMAX and experimenting on different parameters is done on OPNET Simulator 14.5 including the Wimax module. The mobile devices are moving with fix speed of 72 kmph with circular trajectory with which I creates horizontal handover.

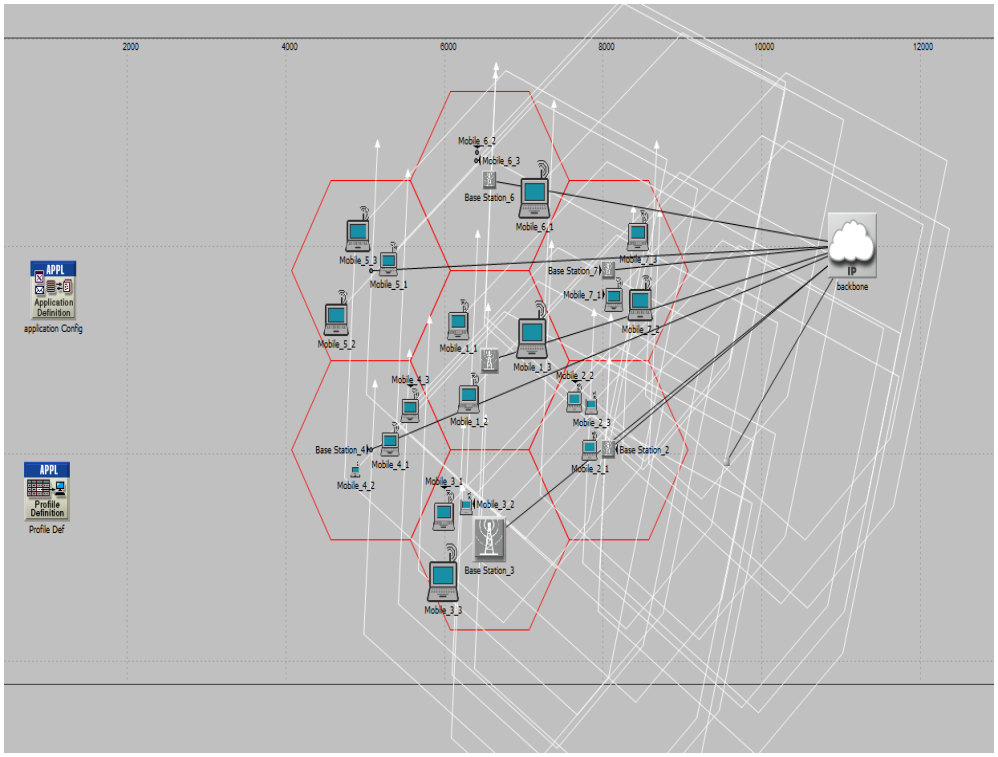
The test network has two nodes wire node (node 0) and wireless node which is connected 1 Gb fiber network



The node 0 or wired node has servers which provide network services such as internet VOIP and data which is configured in OPNET as shown below



The wireless node consists of multiples wireless devices which are connected to WiMAX base stations .As mobile stations change their locations the communication continues from one base station to another.



In this experiment, the parameters which are being tested are:

a) Link going down factor

b) Scan iteration

c) Interleaving Interval

d) Timeout Parameter

a) Link going down Factor

The link going down factor defines how soon the falling link should be detected. This factor can be configured at base station level inside the scanning parameters which can be seen in figure 1.1:

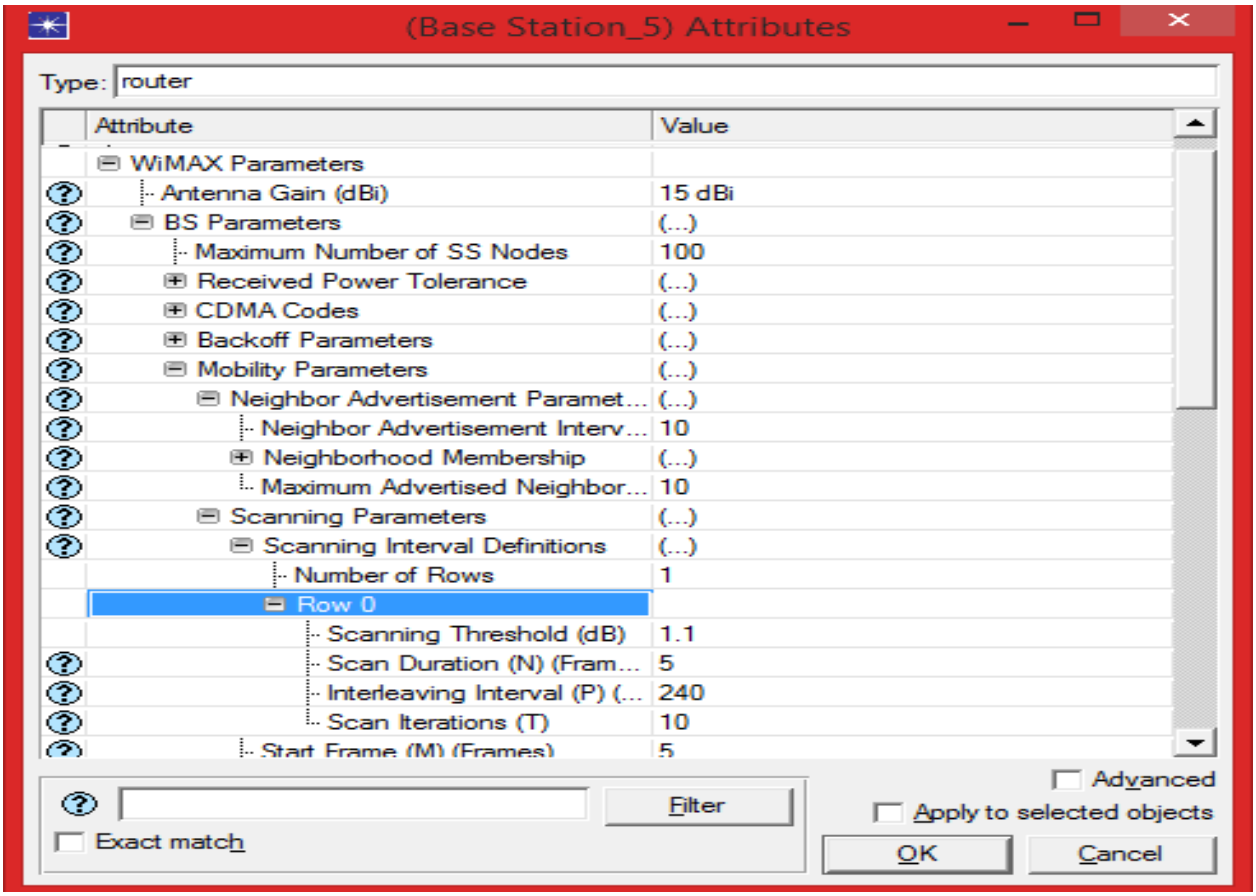


Figure 1.1

The simulation results as shown in figure 1.2 describes that when the mobile device moves with 72 kmph and the simulation results shows that handover delay is at minimum when LGD factor is at 1 and 1.3.the results below clearly defines that if the LGD value is kept either at 1 or at 1.3 the signal broad cast will show minimum hand over delay while if the vale is increased more than 1.3 the handover delay moves to highest point.

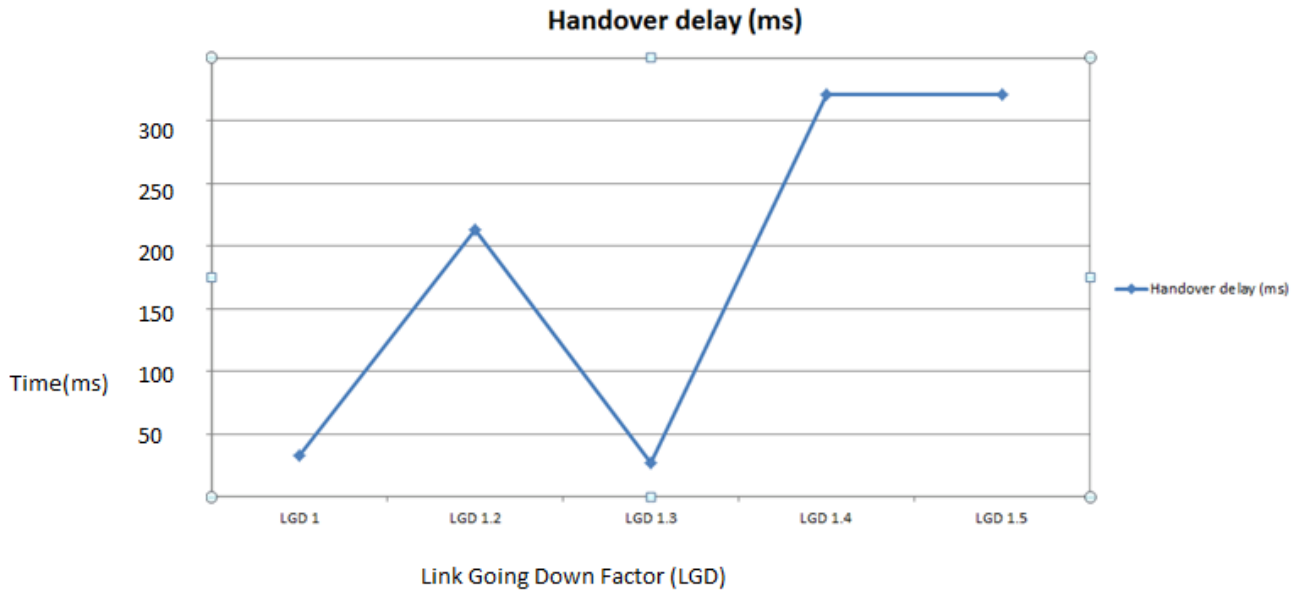


Figure 1.2

b) Scan iteration

SI (Scan iteration) can be described as it is the number of scanning interval which is required by mobile station. To test this attribute the configuration is done at base station level. Figure 1.3 shows base station configuration configured during the simulation

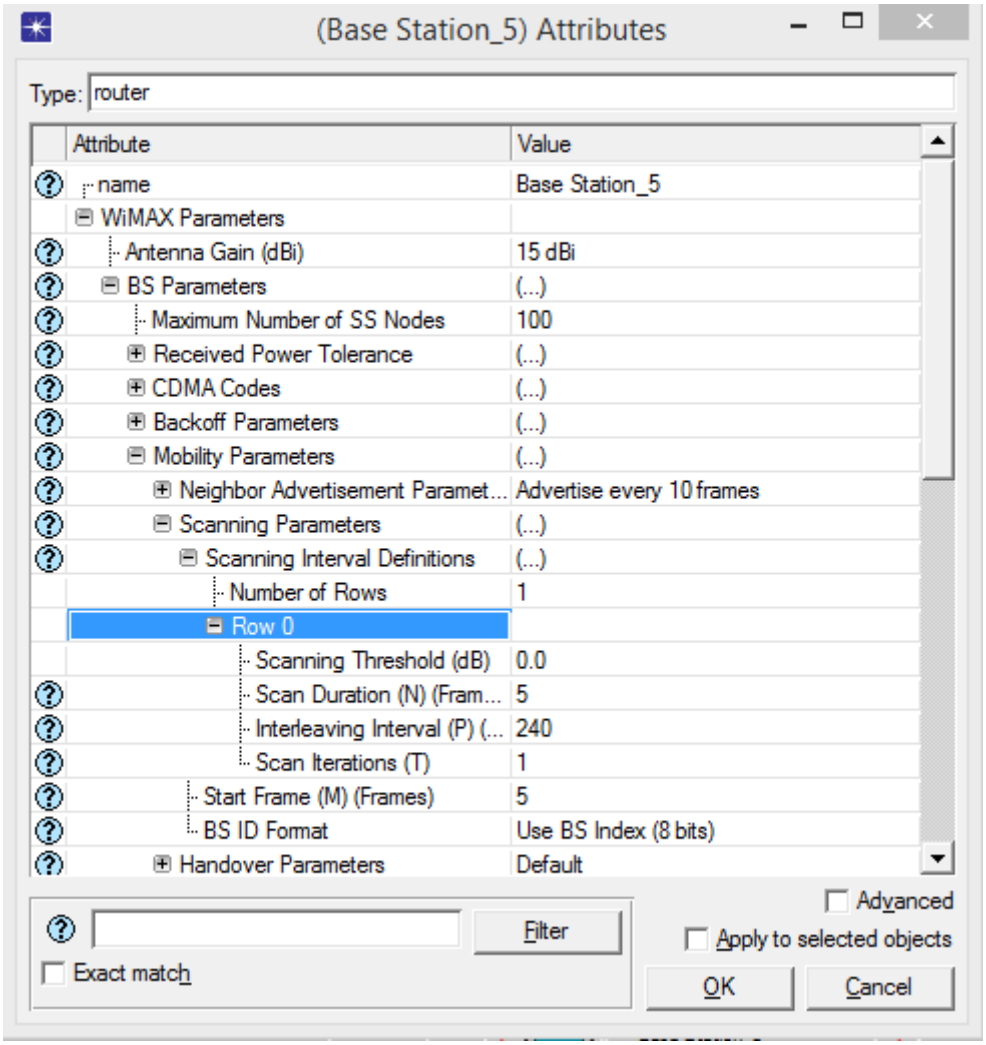


Figure 1.3

The simulation results show the higher the level of scan interaction higher will be the handover time. which clearly explains in order to keep hand over delay low we have to keep SI factor at low level and the simulations results show the best SI where there is minimum handover time is 5 ms.

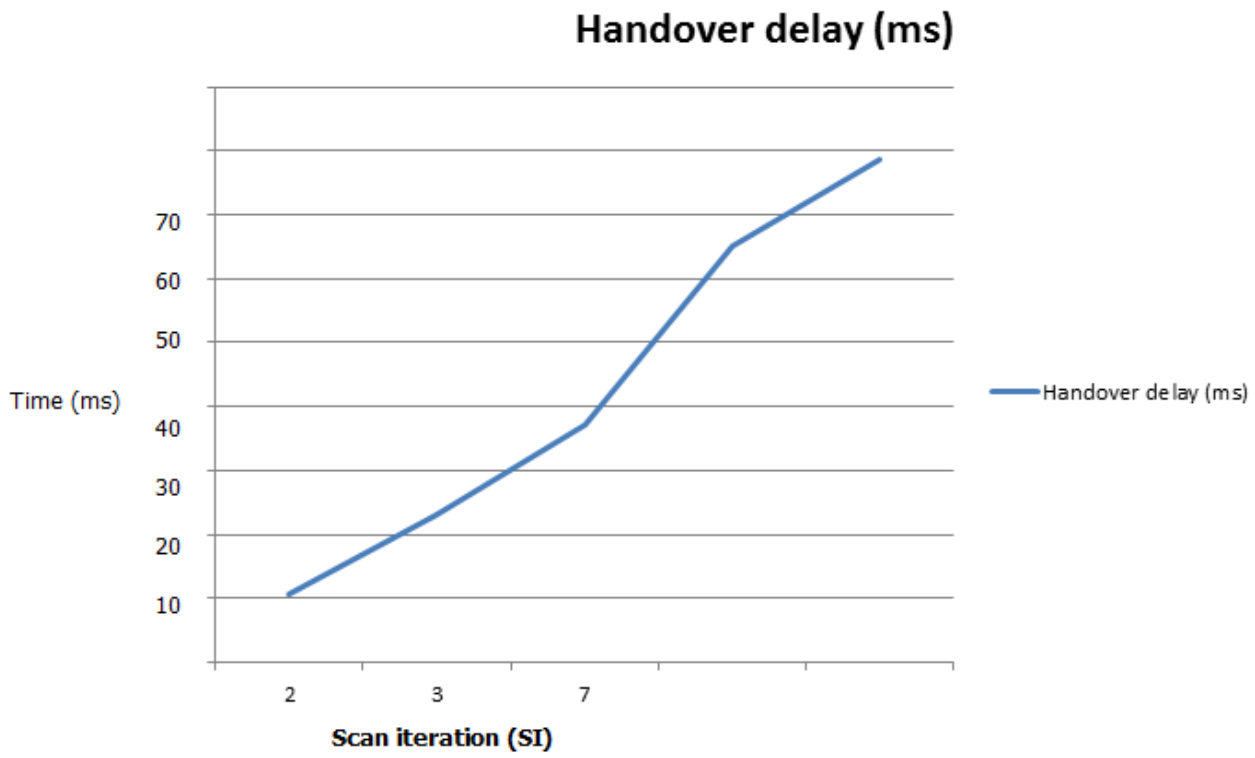


Figure 1.4

c) Interleaving Interval

Interleaving interval can be explained as it as the time duration between scanning period and normal frames in mobile station.

To simulate this factor Opnet simulation should be configured at base station level and for every situation this value is changed while other values are kept standard The simulation results show that there is very small effect of interleaving interval till 20 and it increases once its crosses this value.

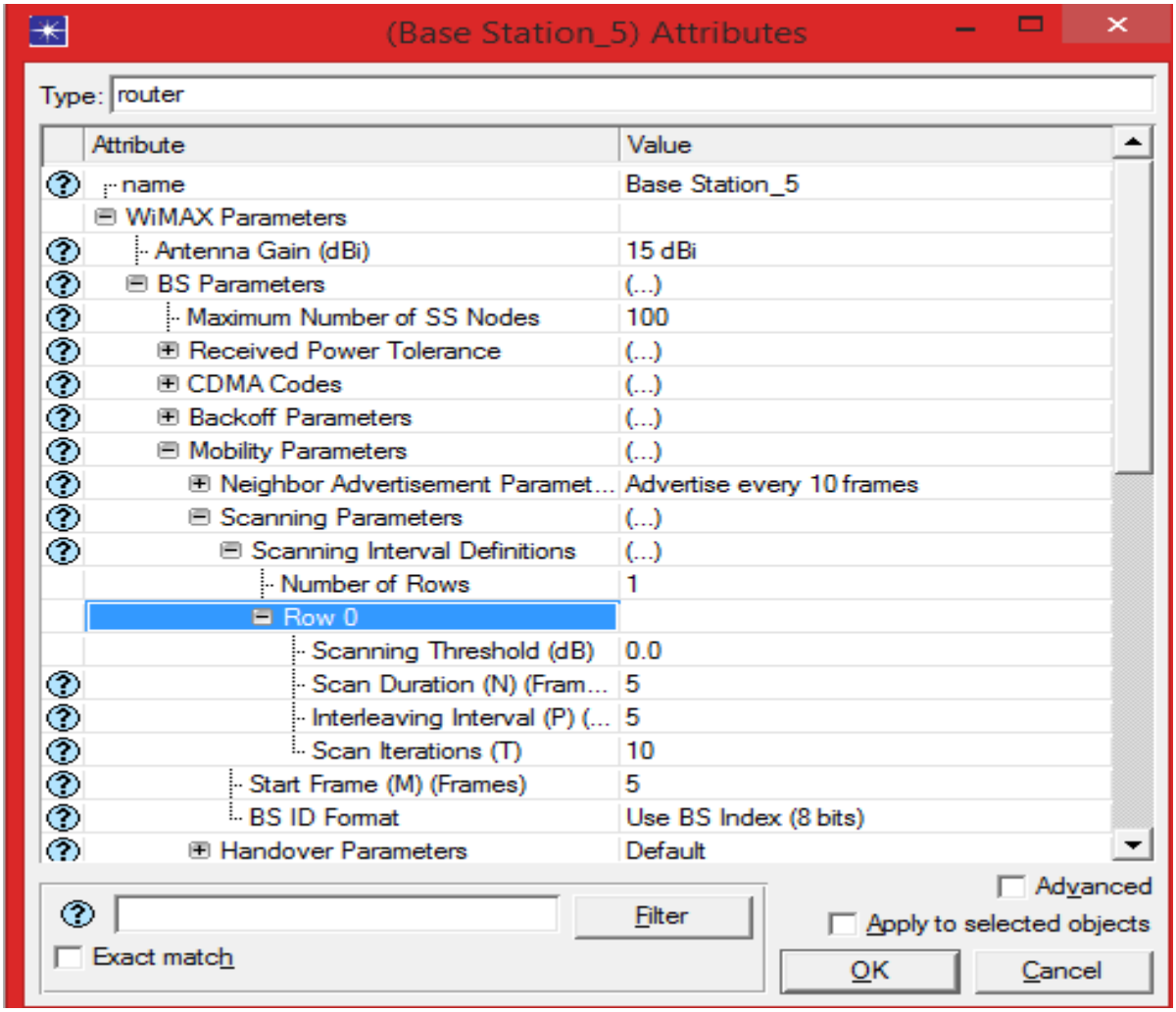


Figure 1.5

The figure 1.6 shows the simulation results at different values and this diagram shows that The simulation results show that there is very small effect of interleaving interval til 20 and it increases once its crosses this value

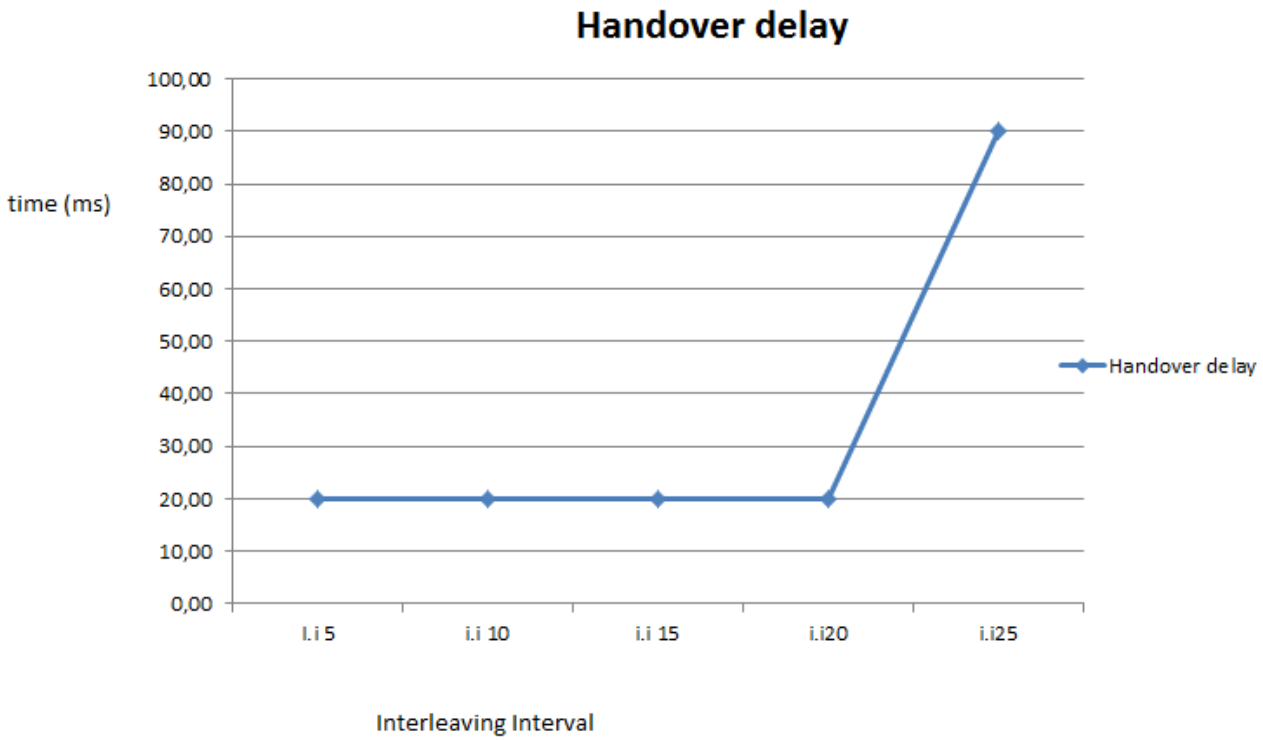


Figure 1.6

d) Timeout Parameter

Timeout parameter can be explained as it is the time required for mobile station to receive down link map message. This values can also be manually configured at base station level and while simulating this network this parameter will also be configured in base station attributes in OPNET shown in figure 1.7.

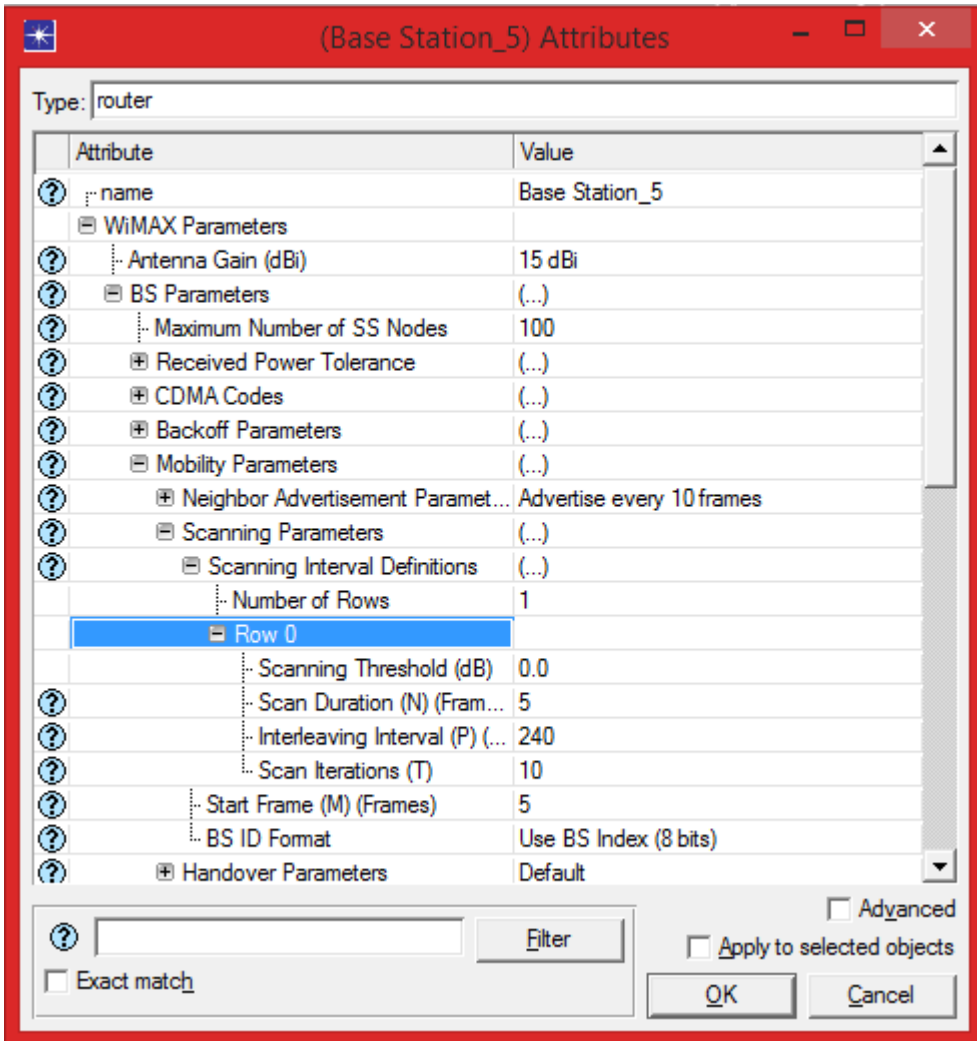


Figure 1.7

The figure 1.8 shows the simulation results which describes how much minimum delay can be achieve at particular level and the simulation results show that the handover time remains same between 5 to 20 ms .There is sudden increase in handover delay after time out value gets higher than 20 .

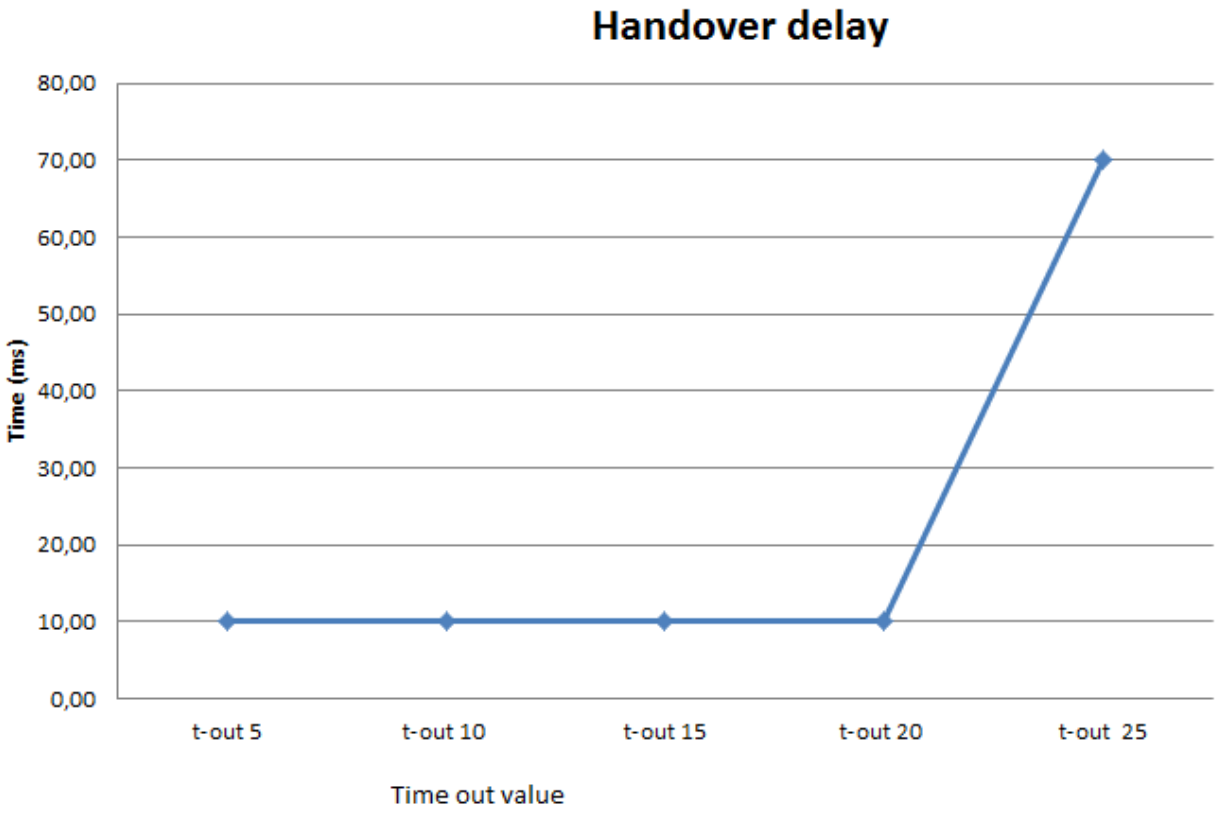


Figure 1.8

Using combined results to achieve maximum mobility

After individual simulations where we received maximum mobility and lower handover time .in order to understand and how these parameters applied at single signal stream and how they will affect the handover delay together .The scanning parameters which we have identified to be more effective and their vales which we have identified with individual simulation will be applied in a single simulation .

To test these values OPNET is used and these values such as

Link going down factor 1.3

Scan iteration 5

Interleaving Interval 20

Timeout Parameter 20 are Configured at base station attributes as seen in figure 1.9:

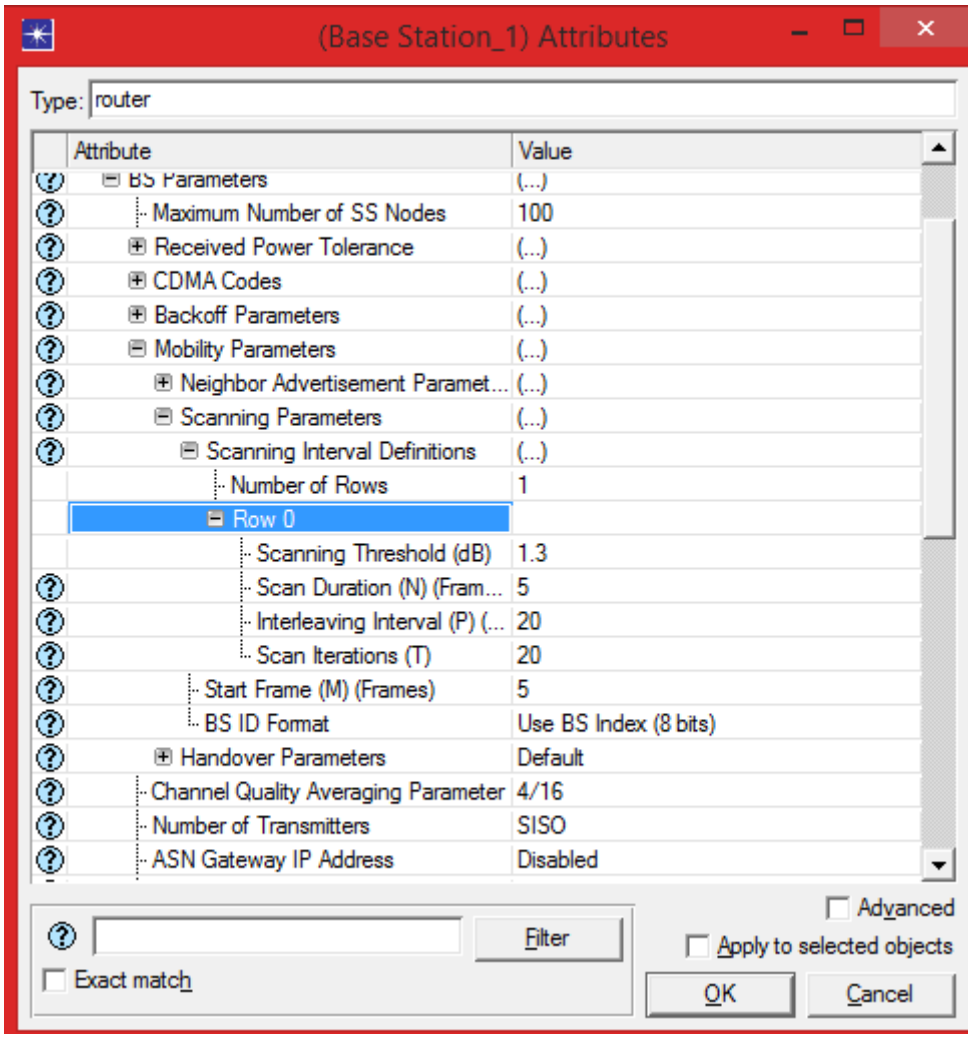


Figure 1.9

The simulation results below in figure 1.10 and figure 1.11 shows there has been certain improvement in handover delay such average delay per second has been and in same way the throughput better signal strength .

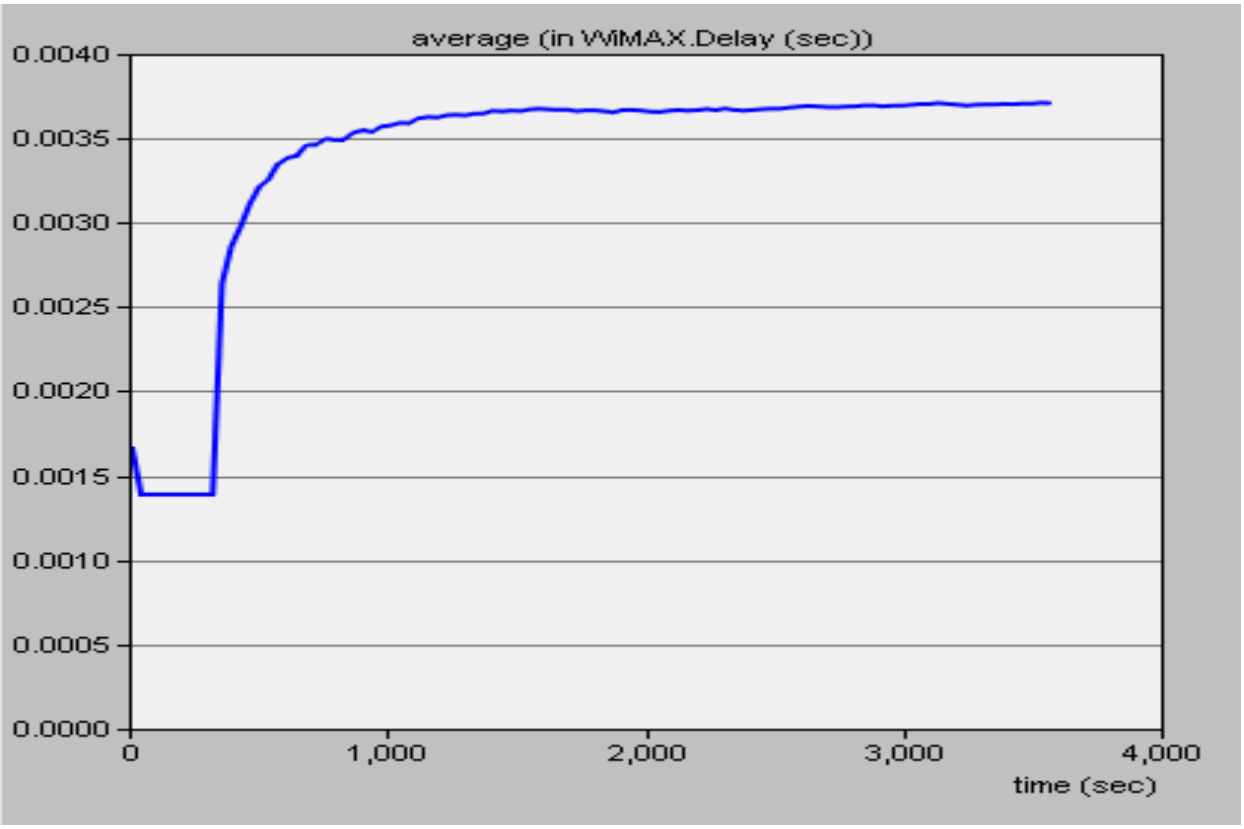


Figure 1.10

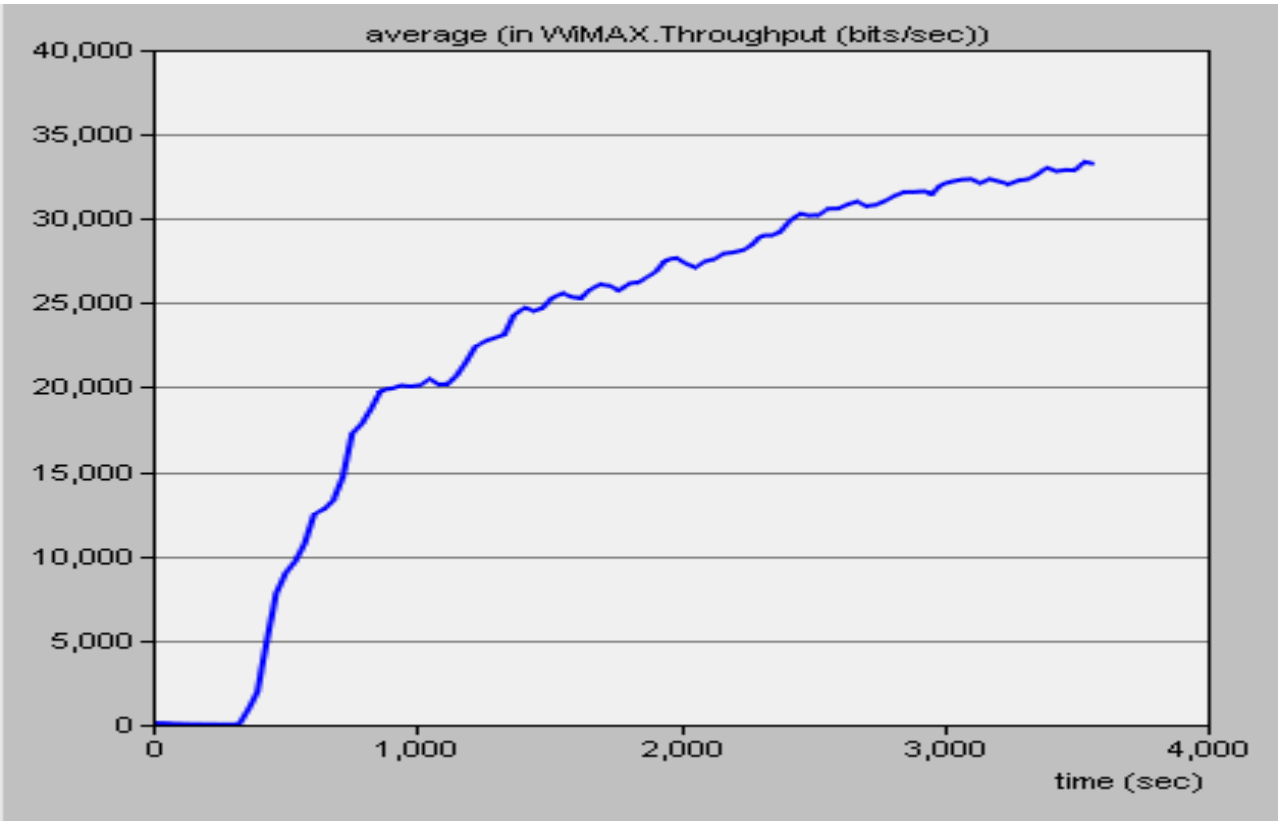


Figure 1.11

3. CONCLUSION

In the simulation above we have tested number the possibility of removing or minimizing the handover delay to a level where its significance in signal transmission becomes minimal .The simulation covered the testing of factors which is considered to be the most effective in reducing handover delay.

We have tested the effect of these factors individually and noticed they have certain effect at certain level such as if link going down factor is kept either 1 or 1.3 .the handover delay will be minimum.in same way if Scan iteration is kept at 5 ms while other factor are kept at constant will case minimum handover delay and when Interleaving interval causes no effect and keeps the handover delay is at minimum while Interleaving interval is kept between 5 till 20 and in same way Timeout parameter acts the same way when its kept between 5 till 20 will cause minimum handover delay.

So in order to achieve maximum mobility and minimum handover delay the individual results were combined

And applied in simulation which showed improvements in handover delay but didn't reduce the handover delay to a level expected.

There has been continues improvement with standardizing the factors but they cannot fully remove or minimize the handover delay in Wimax to minimal level . The future work would be to develop and Implement handover algorithm to reduce handover delay and to be tested to support high speed mobility.

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