Conversational QoS Comparison Between WiMAX and UMTS

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ABSTACT: *This paper has been specially oriented towards the study of mobility and QOS between WiMAX and UMTS networks. We use three kinds of comparison algorithms. This has been implemented in a simulator of our design in order to evaluate in a situation of mobility in a heterogeneous network. Following the simulations, the results show that in terms of performance in the context of the conversation WiMAX networks is superior than UMTS.*

Keywords: Wimax, UMTS, QoS, Network

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1. Introduction

Given the convergence of new wireless communication technologies such as WiMAX and UMTS, as well as the emergence of new services, customers are becoming more stringent about the quality of service. They impose more requirements compared to seamless mobility. However, such mobility is the consideration of some fundamental questions: What are the methods of management of the most efficient mobility? What is the proper implement for the interconnection network architecture?

When we talk about improving the performance of vertical handover, it will especially reduce the latency of the process and packet loss, while still ensuring that the best possible connection you have. Therefore, it is essential, in terms of the mobility of users, to develop optimal algorithms for connection management and resource allocation. We propose to exploit the resulting notifications from layer $L2$ to help accelerate the handover process. To do this, we set ourselves the goal of implementing a BI architecture leveraging the benefits of the MIH protocol (media independent handover). We may then compare the performance of decision algorithms used.

Thus, in this work, it will be addressed in the first instance, the solution proposed tracking algorithms considered decisions and their implementations in a second step, the analysis of simulation results performed following the handover parameters chosen.

2. State of Art

2.1 Quality of Service

Network Services are considered end-to-end, this means from a Terminal Equipment (TE) to another TE. An End-to-End Service may have a certain Quality of Service (QoS) which is provided for the user of a network service. It is the user that decides whether he is satisfied with the provided QoS or not.

To realize a certain network QoS a Bearer Service with clearly defined characteristics and functionality is to be set up from the source to the destination of a service.

A bearer service includes all aspects to enable the provision of a contracted QoS. These aspects are among others the control signaling, user plane transport and QoS management functionality. A UMTS bearer service layered architecture is depicted below, each bearer service on a specific layer offers its individual services using services provided by the layers below.

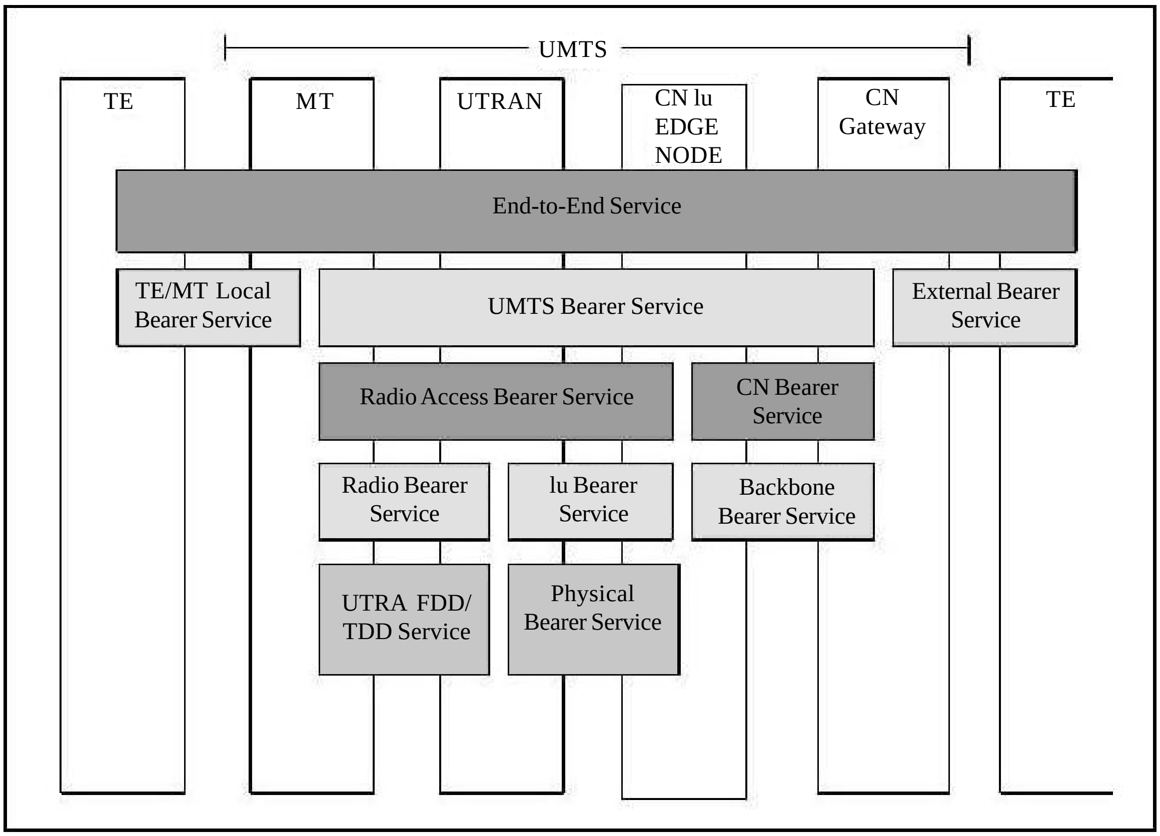

Figure 1. QoS Architecture

2.2 There are four different QoS classes

- Conversational class
- Streaming class
- Interactive class
- Background class

3. Simulation Model

Our simulation model is formed by a network composed of two heterogeneous PoA, one for UMTS and one for WiMAX. The UMTS network coverage extends to a radius of 2000 *m*, while the WiMAX network is 1500 m. The cell arrangement is illustrated in Figure 2, where the size of the topology of the network is 4000 * 4000 *m*. In this topology, the two cells are placed in WiMAX area.UMTS and WIMAX cell coverage are in the figure 2.

Traffic class	**Conversational class** **Real Time**	**Streaming class** **Real Time**	**Interactive class** **Best Effort**	**Background class** **Best Effort**
Fundamental characteristics	- Preserve time relation (variation) between information entities of the stream - Conversational pattern (stringent and low delay)	- Preserve time relation (variation) between information entities of the stream	- Request response pattern - Preserve payload content	- Destination is not expecting the data within a certain time -Preserve payload content
Example of the application	voice	streaming video	web browsing	telemetry, emails

Table 1. UMTS QOS Classes

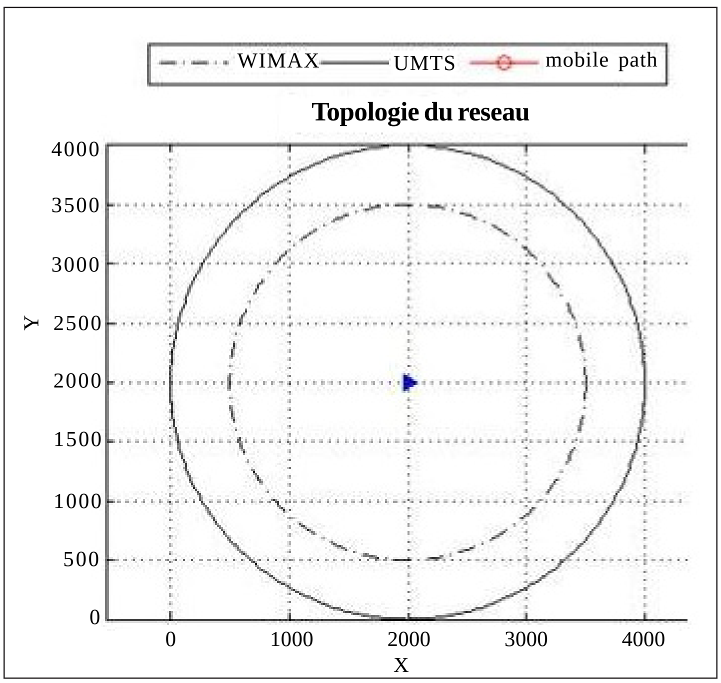

Figure 2. Network topology for simulation

The mobility model is adopted by the mobile RW (Random Walk). Therefore the mobile moves from one point to another, with a direction and speed selected randomly in the ranges [0, 2p] and [10, 130] *m* / *h*. Each movement is given a time interval or a constant distance.

During the simulation, the measured values of the QoS parameters for each network correspond to those in Table 4.08. They are kept constant in order to determine the influence of speed on the network selection process.

Parameters	UMTS	WiMAX
Off rate (Mbps)	0, 2	45
Time from end to end (ms)	30	100
Jitter (ms)	6	4
PLR (par 10)	80	80
User cost (%)	60	40

Table 2. Values of QoS Parameters for Different Networks

4. Results and Analysis

In this section, we present and analyze the results of our simulations. Since we have three different algorithms to evaluate, so we conducted several rounds of simulation. To obtain a quantity enough of data analysis part, each simulation is run for an average of 60 minutes.

An example of the evolution of the terminal in the network for mobility model *RW*. Each segment corresponds here to a movement with a speed *V* (10 to 120 *km* / *h*) and a service *S* (conversational or streaming). The mobile starts in the central part that is to say in the area covered by all base stations. The intersection of a straight line and a circle indicates either the detection of a new base station, or loss of the current link, the direction and the previous state of the link of the mobile.

In the following sections, we will proceed to the analysis of the results obtained with the three algorithms for different classes of service considered.

4.1 Conversational Service

As we can see from Table 1, the conversational service does not require high throughput. However, in terms of other parameters, it is very demanding, especially with regard to time and change. In principle, UMTS should be a potential candidate because it is oriented to voice services. In addition, it provides an acceptable timeframe. However, that is obtained as a result did not reflect this assumption. Indeed, the trend toward the door here WiMAX network.

With AHP, we can see in Figure 3 that the higher the speeds the more the curves of the two networks tend to move away, then come closer to each other. The WiMAX network increases up to a certain limit and then decreases, while that of the UMTS network decreases and then increases. This is normal since the sum of the weights of alternatives must always be equal to 1 for the AHP. So if one curves crease, the other must decrease in order to maintain the balance of values.

We can say that with the AHP method, the speed greatly influences the choice of network during the vertical handover process. This explains the curves. We have already mentioned earlier that the speed limit is not supported even from one network to another. That of UMTS is estimated between 90 and 100 *km* / *h* whereas WiMAX is up 130/150 *km* / *h*. For low speeds, that is to say speeds between 0 and 50 *km* / *h*, the two networks still have weights that are relatively close. Against by, as the speed approaches the limit for the UMTS, the weight of the latter is to be assigned. Beyond this limit, the speed will tend towards the limit value for the WiMAX network, hence the fact that the curve decreases.

As for the results obtained from MEW and SAW methods, we can say they are pretty similar. We see that despite a large variation in the weight of each network is always WiMAX is the most used.

Unlike the AHP method, the speed of the mobile has no great impact on the selection process involving SAW and MEW. Indeed, as it is not a parameter own networks, only the relative weight. For this is the network load is the only parameter that influences during the selection process. Hence the variations observed in the curves.

4.2 Number of vertical handover executed

While selecting the right network remains a priority during the vertical handover process. However, a point that should not be ignored is that if the number of handover tends to increase too, QoS may be affected. Indeed, accumulation of the delay caused

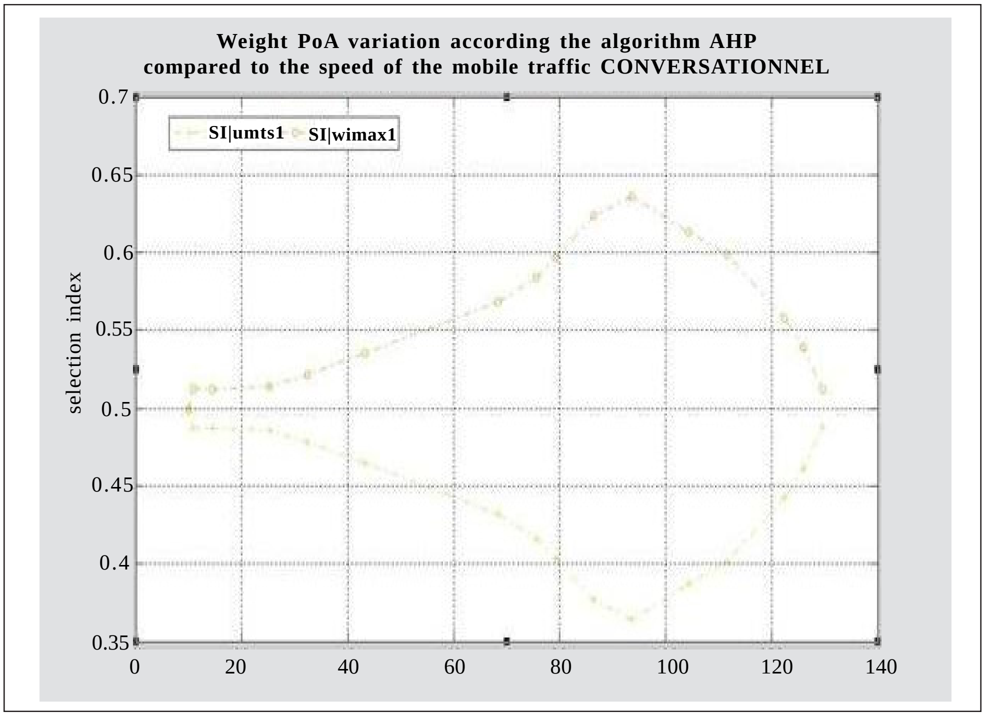

Figure 3. Performance of the AHP algorithm for conversational service

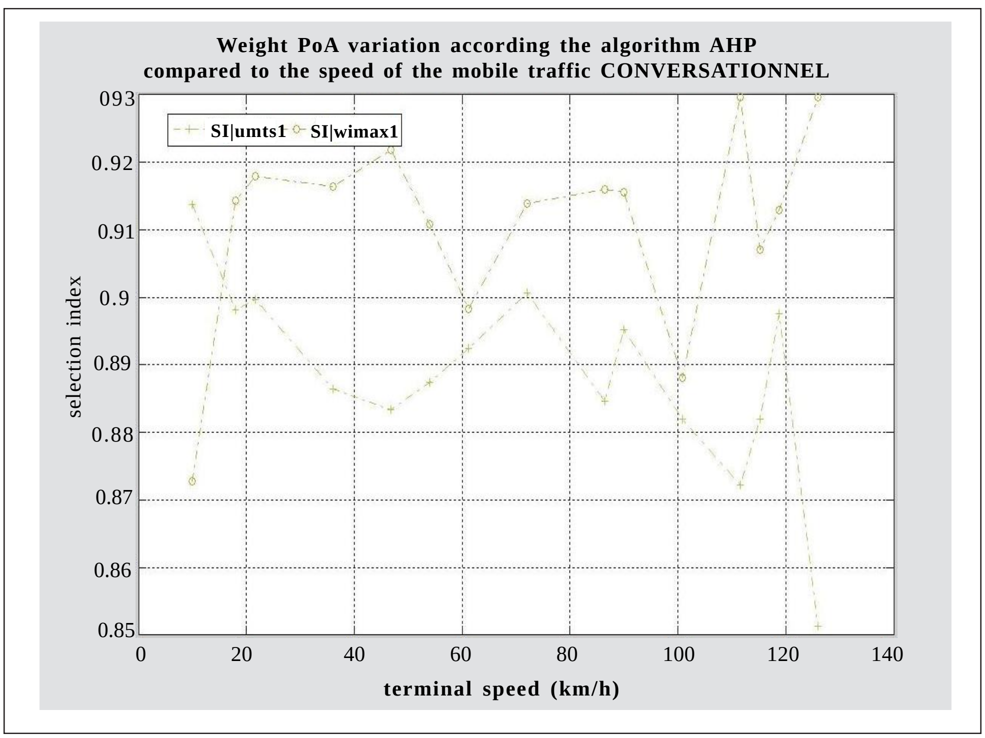

Figure 4. Weight PoA Variation

by the process will cause degradation of service in progress, and therefore the discontent of the user. Thus, the number of handover, whether vertical or horizontal, is minimized.

Figure 6 shows the number of vertical handover according to the algorithm used. We note that this is the AHP offering a minimum number of vertical handover. However, we do not see any big difference between the three methods. In addition, given the percentages, which are quite low, we can say that these three methods provide the same performance.

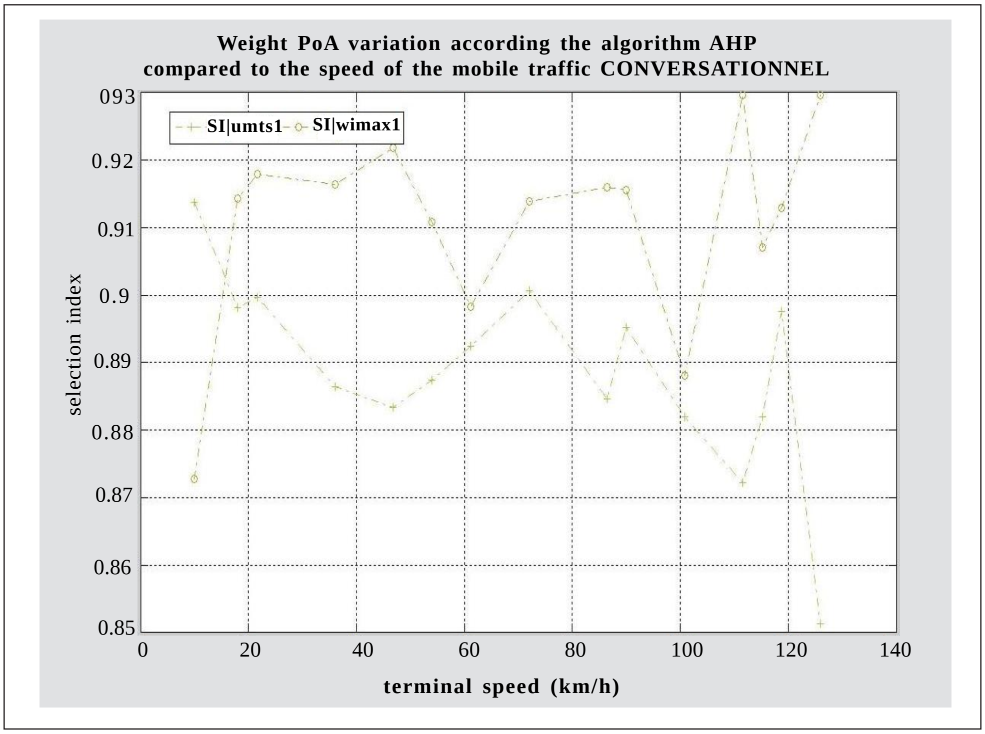

Figure 5. Performance of the SAW algorithm for conversational services

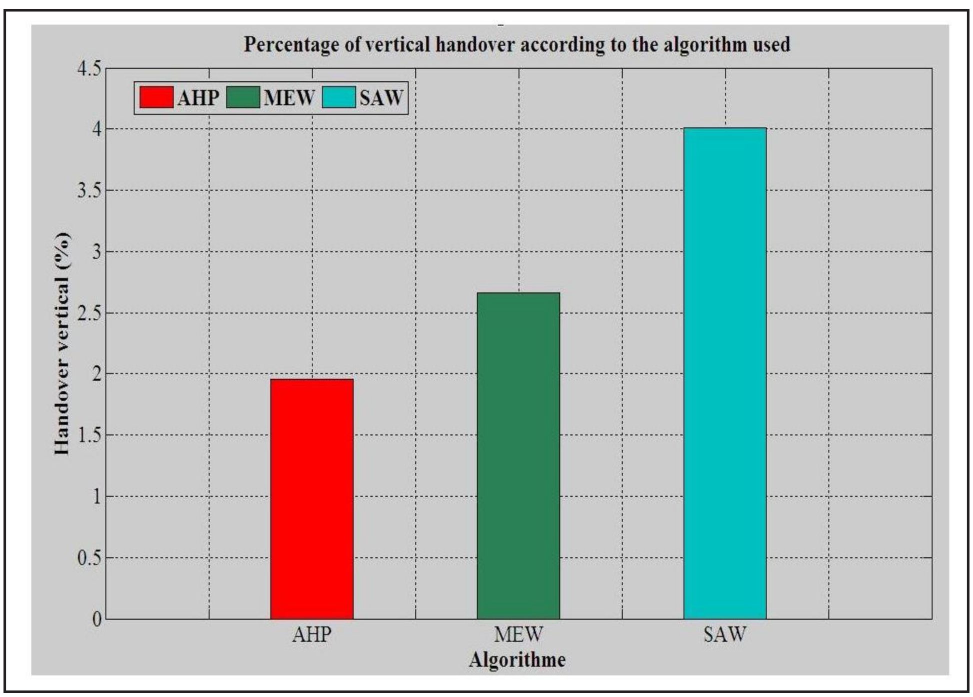

Figure 6. Performance in terms of number of vertical handover

4.3 Discussion

On the one hand, for extended coverage radius, UMTS can support large subscriber mobility, while ensuring low and medium speeds. On the other hand, WiMAX, the IEEE 802.16e-2005 version can enable both mobile and broadband services to broadband. The comparison of these networks has revealed the existence of a certain complementarities between the two technologies. This allowed us to consider their interconnection.

By cons, it is the mobility management in heterogeneous architecture thus created is not easy. The QoS level required by different applications, especially in real time such as video conferencing or video streaming, imposes the implementation of truly effective techniques. The advantage of this proposal i to take advantage of various services offered by the IEEE 802.21 protocol and the effectiveness of the algorithms mentioned in this paper. After the simulations, we can conclude that our model proves effective in a heterogeneous environment.

Integrated convergence of UMTS and WiMAX networks has been the subject of numerous studies and research. However, there is still no concrete solution application on vertical handover between these two networks. But the question still remains relevant, especially with the rise of the fourth generation. Thus, the prospect of future work, we propose to expand our field of study to more recent technologies such as Release 10 of the 3GPP and IEEE 802.16m standard. We will consider to apply our model solution to these networks, while seeking further improvements that could be added, and it always having in mind the importance of QoS for users who are in vertical handover.

5. Conclusion

The main objective of our work proposed in this paper is to allow the mobile to have a better level of QoS throughout its movement in a heterogeneous network by comparing two wireless technologies UMTS and WIMAX. To do this, the combination of different protocol with different algorithms, which are based on several relevant parameters, the terminal can make the best decision in choosing the right network for handover. Through various simulations, we were able to test this solution. In the end, the results obtained show conclusive in terms of QoS conversational, required for each type of traffic considered. And from observations, the three algorithms appear to be effective.

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