

Performance Analysis of UGS and BE QoS classes in WiMAX

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Abstract

IEEE 802.16 (WiMAX) is an innovative and cost effective technology that allows fast and easy delivery of broadband wireless access for fixed as well as mobile users. As Quality of Service is an essential parameter to judge performance of any network, so this paper focuses on analyzing essential QoS parameters for WiMAX Network. QoS parameters like packet loss, average throughput, average jitter and average end to end delay are analysed with CBR traffic and effect of mobility is evaluated using QualNet 6.1 Wireless network Simulator for BE and UGS flows in order to use them in a proper way for real life scenarios.

Keywords: IEEE 802.16, BE, UGS, mobility.

1. Introduction

WiMAX (IEEE 802.16) is the most rising technology that permits fast and easy delivery of broadband wireless access for fixed and mobile users in the new era of communication. The IEEE 802.16 standard is developed to introduce broadband wireless access into the market place. Before the introduction of the IEEE 802.16 standard, the fore most effective ways to obtain access to broadband net service were chiefly through T1, Digital Subscriber Line (DSL), or cable modem. However, these wired infrastructures are significantly costlier, particularly for use in rural areas and developing countries. This limitation propelled the industry to plot an alternative means of getting broadband internet access and the approach taken was via the wireless medium. The notable companies like Motorola and Samsung are already developing WiMAX phones and PDAs and they are already in use in Korea with

WiMAX cousin technology, WiBro (Wireless Broadband) [1]. Nowadays WiMAX [4] is considered as one of the main technologies for next generation high speed wireless access networks. Several technologies used by WiMAX, such as Orthogonal Frequency-Division Multiple Access (OFDMA) and resource allocation methods with differentiated QoS are parts of Next Generation Networks (NGN) standards [2]. WiMAX can be convenient for Hybrid Networks, Local Area Networks or long range transmission thanks to MAC relays defined in 802.16j [3].

2. Simulation Scenario

Simulation is an essential tool for the development and performance evaluation of communication networks. So, we have chosen simulation based methodology for our research. Among the available tools for networks simulation, QualNet 6.1 Wireless network Simulator [5] is used to evaluate the performance of WiMAX. WiMAX scenario is created using nodes and subnets. Two homogeneous networks are considered and one node of each network is assigned to act as a Base Station (BS) whereas all other nodes are assigned to act as a Subscriber Stations (SS) as shown in Figure 1. In the first case, WiMAX scenario is simulated for CBR traffic application without any mobility model and the results are noted down. In the second case, it was simulated by enabling random way point mobility at different speeds and results are compared.

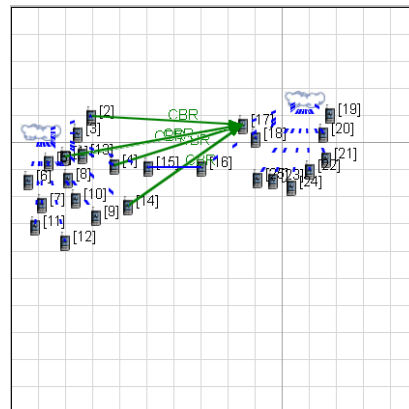


Figure 1: Simulation Scenario.

3. Simulation Parameters

System parameters like simulation time, channel frequency, bandwidth, transmission power etc were specified as per IEEE 802.16e standard as shown in the Table 1. Simulation run simulates for 10 minutes of real operation of the network which took around 1/2 minute as simulation time. Bellman Ford routing protocol is used as a default one, which is a distance vector routing algorithm utilising UDP for control

packet transmission. IP Output Queue Scheduler used is Strict Priority. In this scheduler, the selection of packets is based on the priority assigned to the traffic. The packets are allocated into different priority queues only after being categorized by the scheduler depending on the Quality of Service classes of the traffic. The algorithm first serves the queue with highest priority until it is empty, then it moves to the next highest priority queue. This procedure can also result in bandwidth starvation for low priority QoS classes where the packets may not even get forwarded and no guarantee is offered to flow which has least priority [5]. Eight queues are used in order to avoid queuing packets of different service types into one queue.

Table 2: Simulation Parameters.

Parameters	Value
Simulator	QualNet 6.1
Simulation Time	10 min
Service Types	BE, UGS
Antenna Height(meter)	5
Antenna Model	Omni directional
Interval between Packets	0.0007 sec
Channel Frequency	2.4 GHz
Item Size	512 bytes
Node Placement	Random
Precedence Value	0,7
Radio Type	802.16 Radio
FFT Size	2048
Items to send	1000
Traffic Type	CBR

4. Simulation Results

The perceived quality of service can be measured quantitatively in terms of several parameters. In the analysis, the total message received, received throughput, average end to end delay and average jitter were considered. The comparative plots of BE and UGS flows are given in Figure 2 to Figure 5.

Total Message Received

Figure 2 shows comparative plot of the total message received with respect to speed for BE and UGS service flows.

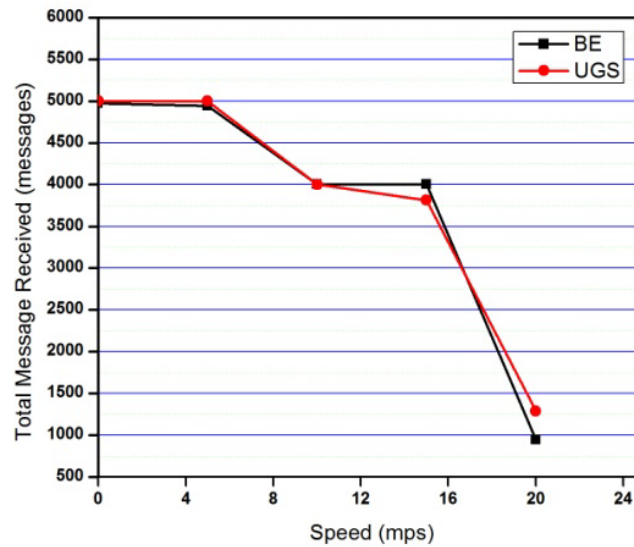


Figure 2: Total message received WRT speed.

Initially at no speed when the mobile is stationary, total message received is equal to total message sent i.e. 5000 messages for both service flows. When the speed increases, the message received decrease in both the cases. The decrease is more in the case of BE service flow as compared to the UGS flow.

Received Throughput

Figure 3 shows comparative plot of the received throughput with respect to speed for BE and UGS service flows.

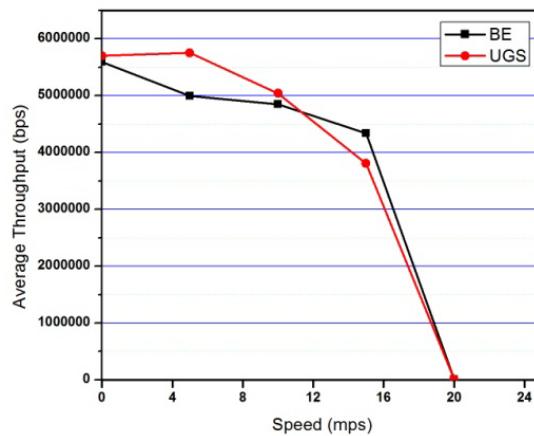


Figure 3: Received throughput WRT to speed

The received throughput decreases with the increase in speed as with the increase in speed the total message received decreases. The overall decrease is more in case of BE service flow as compared to UGS flow.

Average end to end delay

Figure 4 shows comparative plot of average end to end delay with respect to mobility for BE and UGS service flow. The delay is more for BE service flow as it handles applications on best available basis. So, this is the expected result as this service flow is provided with the least precedence and hence it has encountered high delay. UGS flow has the highest value of precedence so as expected it encounters the least delay.

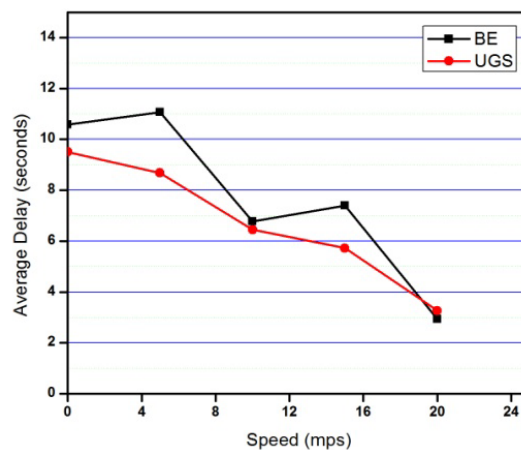


Figure 4: Average end to end delay WRT speed.

Average Jitter

Figure 5 shows comparative plot of average jitter with respect to speed for BE and UGS flows. The value of average jitter is more in case of BE service flow as compared to UGS flow. This is the expected behaviour as the precedence of UGS flow is greater as compared to the BE flow.

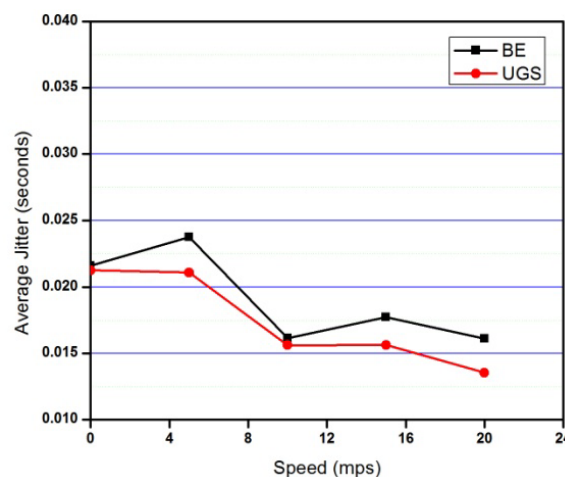


Figure 5: Average jitter WRT speed.

5. Conclusion

The paper presents an extended comparison of the UGS and BE service flow with the CBR traffic. The effect of speed has been studied in detail for BE and UGS flow. It is concluded that UGS flow performs better than the BE service flow in case of the CBR traffic and serves the traffic in the best possible way.

References

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