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Performance Evaluation of VOIP Over WIMAX

Batoul Alia Baker Koko[1], Dr. Mohammed Abaker[2]

Department of Communication Engineering, Al-Neelain University

Abstract: ***VoIP applications are being widely used in today's networks challenging their capabilities to provide a good quality of experience level to the users. In particular, new wireless broadband technologies, such as WiMAX, deployed and their performance needs to assess in order to check the performance levels of VoIP services. The QoS is the main issue of implementation VOIP over WiMAX networks. This paper makes an effort to study the performance evaluation of VoIP for fixed users, as well as, the variation of the QoS parameters. The experimental results had showed that using sector antenna for both BS and SS and reduce the distance between them, increase the average MOS and decrease the average packet end-to-end delay.***

Keywords: Worldwide interoperable Microwave Access (WiMAX); Voice over Internet Protocol (VOIP); Physical (PHY) layer; and Optimized Network Engineering Tools (OPNET), Quality of Service (QoS)

1. Introduction

VoIP (Voice over Internet Protocol) is widely deployed technology and telecommunication operators seek to profit from it. The main advantage of this technology is utilization of existing infrastructure in the form of internet connection. The usage of this type of communication is very cost effective. Unfortunately, this advantage brings some weak points that are expectable due to the low quality of internet connection. The Quality of Service (QoS) is mostly monitored issue by telecommunication operators and vendors. The quality of speech affected by many factors such as packet loss, packet delay, jitter, echo, noise [1], harmonic and inharmonic distortion [2], etc.

The QoS parameters are closely connected; with user**'s satisfaction with a receive speech quality. The user's satisfaction expressed** with a subjective listening score that is a result of subjective listening tests. The substitutions to the subjective tests are objective methods. WiMAX forum promise to offer high data rate over large areas to a large number of users where broadband is unavailable. Use this first industry wide standard can for fixed wireless access with substantially higher bandwidth than most cellular networks [4]. WiMAX (IEEE802.16) technology ensures broadband access for the last mile up to 30 miles (50 km) for fixed stations, and 3 - 10 miles (5 - 15 km) for mobile stations. The rest of the paper organized as follows. Section (2) gives background VoIP. Section (3)] deals with the Performance Metrics, Section (4) deals with Results and Discussion. Finally, in Section (5) we conclude this paper and future work.

2. VoIP Overview

VoIP, known as IP Telephony, is the real-time transmission of voice signals using the Internet Protocol (IP) over the public Internet or a private data network [8]. In simpler terms, VoIP converts the voice signal from your telephone into a digital signal that travels over the Internet. One of the most significant advantages of VoIP over a traditional public switched telephone network (PSTN) is that one can make a long distance phone call and bypass the toll charge. This integrated voice/data solution allows large organizations (with the funding to make the transfer from a legacy network to a VoIP network) to carry voice applications over their existing data networks. Not only will this technological advancement have an impact on the large traditional telecommunications industry, it will alter the pricing and cost structures of traditional telephony [9]. Furthermore, when compared with circuit-switched services, IP networks can carry 5 to 10 times the number of voice calls over the same bandwidth.

3. Methodology

In our simulations, we use the following metrics to evaluate the performance of WiMAX network in terms of end-to-end QoS for VoIP.

Packet delay variation (PDV)
PDV defined as the variance of the packet delay,

Table 1: The voice parameter's

Item	*Description*
Voice	PCM Quality Speech
Codec type	PCM G.711with silence
Frame size	suspicion 10 ms
Coding rate	64kbit/s
Voice frames per packet	1 frame
Compression and decompression delay	0.02 sec

Table 2: The IEEE802.16 parameters

Comparison	Scenario No	Distance between BS&SS	Antenna type	Transmission Power
Antenna	1	50 km	Omni	0.5 W
	2	50 km	Sector	0.5 W
power	3	50 km	Omni	0.4 W
	4	50 km	Omni	0.5 W
	5	50 km	Omni	0.6 W

4. Results and Discussion

This implementation was performed using OPNET 14.5 on an Intel Core I 7; 1.7 GHz/2MB Cache processor sing Windows-7 64-bit operating system.In our OPNET modeler implementation of VOIP over WiMAX, there are some parameters in which specified as Voice parameters, which listed in Table.2 for all scenarios and some specified as IEEE802.16 parameters. The IEEE802.16 physical layer parameters like distance between BS and SS, Transmitter &receiver antenna and transmission power listed in Table.3 for different scenarios. The simulation duration 15 min.

Packet delay variation (PDV)

Packet delay variation plays a crucial role in the network performance degradation and affects the user-perceptual quality. Higher packet delay variation results in congestion of the packets, which can results in the network overhead. Figures11, 12 and Figure 13 plot packet delay variation for different scenarios

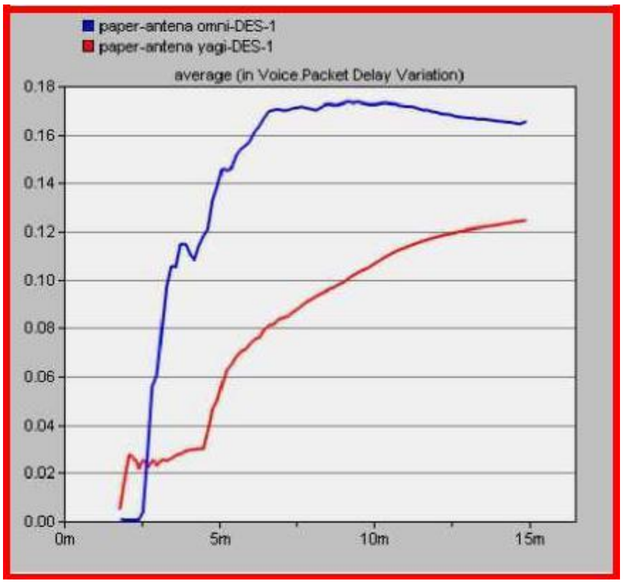

Figure 1: Packet delay variation (PDV)(Antenna)

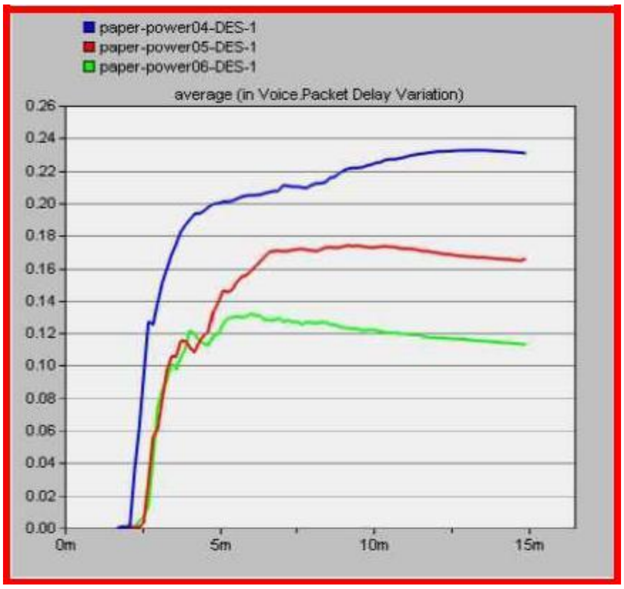

Figure 2: Packet delay variation (PDV) (Power comparison)

5. Conclusions

Next generation networks with multiple technologies offer different multimedia services to the user. It also provides the luxury of utilizing the best available technology for the required service to a user, companies and business organizations. In this study, we have conducted extensive simulation study to evaluate the performance of WiMAX for supporting VoIP traffic. We have analyzed several important critical parameters such as MOS, end-to-end delay, jitter and packet delay variation. Simulation results show that when increase the distance between BS and SS, the average MOS deceased and the average delay increased. If we use sector antenna the average MOS approximately as it was in Omni antenna but the average delay decreased, finally when we raised the transmission power, the average MOS for transmission power = 0.4 watt better than transmission power = 0.5 or 0.6 watt. This study is our first step towards exploring possible implementations of the next generation wireless networks. Future work includes the auto-configuration mechanism for the guarantee of QoS requirement during network switching.

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