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OPNET Scenarios of WiFi and WIMAX Networks Performance Analysis

Adnan Hussein Ali, Ahmed Rashid Ajel

Abstract: ***Worldwide interoperability for microwave access (WiMAX) network and wireless (WiFi) fidelity IEEE 802.11 and IEEE 802.16 standards.WiFi and WiMAX, wireless LANs, MANs and LAN promise broadband access solutions. WiMAX technology provides wireless broadband access in the IP network the most exciting solutions for high data transfer rates and high-quality of service (QoS) fixed and mobile devices, WiFi is a wireless broadband access to indoor, commercial Internet subscribers. Use the OPNET Modeller sub-regional networks, simulate and finish the performance in terms of WiFi and WiMAX, compare and compare MAC delay voice packets. Simulation results show that.***

Keywords: Worldwide, (WiMAX), Network, LANs, WiFi, (QoS), MAC, IEEE 802.11 and IEEE 802.16 standards.

I. INTRODUCTION

In 1990 without using IEEE802.11 wireless local area network (WLAN) is displayed in the early best effort packet access network. You must therefore all users purchase WLAN products in WLAN offers gets permission to use any unlicensed bands. This reality extends to the consumer market, embedded in many portable devices, WLAN to help out [1] [2]. Several companies take part in 1999 to format WiFi Alliance and the necessity of the introduction of the standard accepted in the unique world of one of the largest wireless LAN. Universal interoperability testing that can handle many wireless LAN products, manufacturers to make the WiFi Alliance certification program. The technologies for Wireless Local Area Network (WLANs) include Wireless Fidelity (WiFi) and World LAN Worldwide Interoperability for Microwave Access (WiMAX). They are based on the IEEE 802.11 and IEEE 802.16 [3]. Both of them are designed for the Internet protocol applications. WiMAX is aiming for high speed wireless wide area networking (WWAN), WiFi high speed wireless LAN best is very. At a speed of 54 Mbps WiFi working range up to 70 Mbps speed runs WiMAX up to 40 miles in just a few hundred feet [4]. On the other hand, WiMAX covers a small area network to cover the entire city, WiFi only in the area of the Office and the campus. Created mobile WiMAX and WiFi not independently, had different targets in the standard group for each different application, and different frequency band: as a wireless extension to an existing was aimed at the WiFi local area network to a task, Mobile WiMAX is indicated to present the wireless access method to a wide-area network to provide [5].

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*Correspondence Author(s)
Dr. Adnan Hussein Ali, Department of Information & Communication Technology, Institute of Technology, Middle Technical University, (Baghdad) Iraq.
Dr. Ahmed Rashid Ajel, Department of Information & Communication Technology, Institute of Technology, Middle Technical University, (Baghdad) Iraq.

World by region available are shown. 1 [6]. In the world in North America and Europe and Europe than in the rest of the year growth in WiFi better using WiFi, much higher than in North America form 91 percent of WiFi around the world can see.

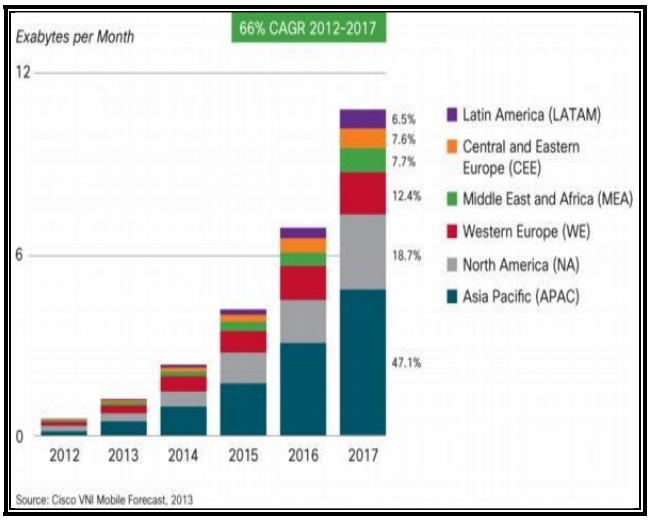

Figure 1: WiFi usage by World Regions [6].

Orthogonal frequency division multiplexing (OFDM) considers WiMAX communication technologies make it easy to send high speed data transfer to larger geographic areas, from base stations (BS) and appointed subscriber station (SS) [7]. WiMAX back up fixed and mobile Internet access [6]. An all Scalable orthogonal frequency division multiple access (SOFDMA), orthogonal frequency division multiplexing (OFDM), not using the 802.16 e standard. It uses two multiple duplex: frequency division duplex (FDD) and time division multiplexing (TDD). Use the WiMAX base stations, from T1 (1.544 Mbps) in the frequency band of hundreds of Internet subscribers provides bandwidth may 10 GHz to 66 GHz [8].

II. COMPARISON BETWEEN WiFi And WiMAX

While creating a mesh WiFi network with peer-to-peer connection is available. In the Internet/LAN connection provided the AP. WiMAX provides a contrast greater than providing high-bandwidth, high-speed communications services and fourth-generation 4 G mobile phone data coverage. Can be used in WiMAX WiFi hotspot connectivity. Whether or not access to submit disputes WiFi AP exams and the AP racing hires data on Mac. WiFi is, fundamentally, increasing productivity and the suitability of employees for cable distributes high-speed Internet access in a wireless hot spot.

High speed wireless LAN, WiFi today, there are millions of homes, Office, airport, hotel, restaurant, and other popular sites. The WiFi employment popularity increased in 4 times table 1 as summarized in all markets around the world in 2009, and in 2004. [9]

Table 1: Wi-Fi Users by Region [9]

	2004	2005	2006	2009
Asia Pacific	32,937	55,341	81,048	168,193
Western Europe	16,681	24,877	33,546	63,746
Central and Eastern Europe	2,109	3,172	4,383	9,875
Latin America	2,386	3,401	4,528	8,331
Africa/Middle East	287	664	1,096	2,747
North America	20,570	30,235	40,454	74,174
Total	74,969	117,690	165,056	327,066

IEEE 802.16, WiMAX is a vast standard for presenting the popular wireless broadband access in the region. WiMAX technology is essentially cable networks for fixed and mobile station or Wi-Fi hot spot connections without the need to enable data transmission. WiMAX is "a standards-based technology enabling the delivery of last mile broadband wireless access as an alternative to cable and DSL"[10]. Mobile WiMAX IEEE 802.16 e has been established in orthogonal frequency division multiple access (OFDMA access method) technology and can back up each other's fixed and mobile users.

WiFi and WiMAX application raises the Internet Protocol (IP) is both an IEEE standard. Very high speed of because they have been designed for various purposes. WiFi is optimized for WiFi, WiMax wireless wide area network (WAN) such as optimized. By integrating both standard service provider can show many users a more complete high speed broadband services in different geographical areas [11]. Using WiMAX licensed spectrum, covering many km range. No license is designed for wireless LAN, WiFi, in the range of tens of meters band. While using the WiMAX MAC layer for connection-oriented and connectionless WiFi, carrier sense multiple access / collision avoidance (CSMA/CA) Protocol. All users who need to compete to get services from the implementation depends on the WiMAX QoS control algorithm based on scheduling, interrupt a random Wi-Fi access point (AP). WiFi device is known by many consumers considered. Expand with the introduction of WiMAX and WiFi are listed in table 2 together.

Considering most people a powerful WiFi, WiMAX they both wireless technologies. Demonstrates how to use WiMAX in the larger network coverage area and Wi-Fi than a simple comparison fast transfer rate. WiMAX is its position in the market because of technical reasons and standardization issues, does not show better performance. Reduces newborn WiMAX technology and standardization issues, and market occupies relatively high prices.

Table 2: common wireless technology's performance

	3G	Wi-Fi: 802.11	WiMAX: 802.16	Mobile-Fi: 802.20
Max speed	2Mbps	54Mbps	100Mbps	16Mbps
Coverage	Several miles	300 feet	50 miles	Several miles
Airwave	Licensed	Unlicensed	Either	Licensed
Advantages	Range, mobility	Speed, price	Speed, range	Speed, mobility
Disadvantages	Slow, expensive	Short range	Interference issues?	High price

The following graph (Fig. 2) Provides an overview of how to integrate Wi-Fi and WiMAX to improve cooperation approach distances and speeds performance.

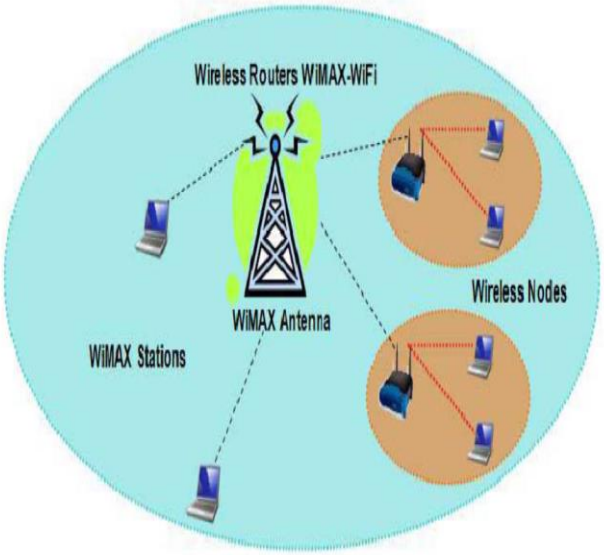

Figure 2: WiFi and WiMAX network convergence

III. WiMAX (802.16e) BACKGROUND

WiMAX IEEE 802.16-based optimal conditions the maximum data transfer rate of 75 Mbits / s. Until many kilometers to cover the WiMAX framework. Use broadband last-mile alternative Radio City can be used to provide digital subscriber line (DSL), cable, or country. Better than multiple antennas, WiMAX 256 sub-carriers use scalable orthogonal frequency division multiple access (SOFDMA) range and better power support. WiMAX uses the media access control (MAC) layer to the network scheduling algorithm for the first entry in the subscriber station (SS), then the BS allocates an access slot to SS and other subscribers cannot use that slot . And used this algorithm control parameters for bandwidth efficiency, and change the quality of service (QoS) required time slots based on the application of the SS. A series of criteria for using the criteria as defined in the wireless communications sector since 2007, WiMAX equipment, WiMAX technology recognizes the IMT-2000 IMT-2000, which included the International Telecommunication Union (ITU R) results [12]. Theoretically, WiMAX is a broadband wireless access (BWA) offers mobile and fixed stations can be 5-15 km, 50 km.

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It is more effective than long-haul bandwidth usage data interference to minimize almost interference avoids issues like. First of all, the standard 10-66 GHz band transmission possible.

The system of WiMAX comprises of two parts:

• 802.16 WiMAX base station (BS) - IEEE according to the range of standard WiMAX base stations from the RADIUS (50 km).

• WiMAX receiver - Receiver and antenna are small box or personal computer memory card International Association (PCMCIA) cards, or they way WiFi access, could be incorporated into today's laptops.

IV. WiFi SIMULATION SETUP

OPNET modeller 14.5 is used to simulate WiFi scenarios [10]. OPNET is according to the effective operation of the network and computer systems a complete modelling tool is carefully. Easy to use and supports a wide range of network protocols and applications, master, especially debutant. Better modelling tools, it gives comprehensive technical and maintenance support. WiFi scenarios parameters can be shown in Table 3.

Table 3: WiFi Test Parameters

WiFi 802.11g		
	AP (Access Point)	Mobile Node
Tx Power	0.1W	0.1W
Data Rate	11Mbps	11Mbps
Receiver Power Threshold	-95dBm	-95dBm
Buffer Size	1024000 bits	256000 bits
Short Retry Limit	7	7
Long Retry Limit	4	9
Large Packet Processing	Fragment	Fragment
Access Point Functionality	Enabled	Disabled

The proposed scenarios are based on three OPNET models for WiFi and fixed local area networks to estimate their performance. OPNET solutions communication devices, protocols, technologies, and architectures to observe, simulate the performance in a dynamic virtual network environment. A network of three subnets is connected during the work, subnet one, a server connected to the Internet cloud, for streaming video and voice. Subnet 2, video and audio streaming data to receive, that around of subscriber station (SS) a different subnet from the BS delivers content. Distributed via the WiFi link to all subnets of the SS a different computer and, receive data from WiFi routers and WiFi enabled. Subnet 3 is 1 and 2 combined.

4.1. Baseline WiFi Scenario

The Baseline Scenario of 802.11g model can be produced using a standard models of the OPNET 14.5 WLAN deployment scenario. The action of a single infrastructure 802.11g WLAN has been tested to obtain a configuration of an existing network within the framework of an executed WAN. An Internet Protocol- IP cloud-supposed as a backbone, Internet, is connected with a serial link Point-to-Point T1 (1.544Mbps). The three subnets are standing on the three sides of this IP cloud via an IP gateway connected by PPP T1 link -Point-to-Point Protocol- as well as two servers connected over a central switch using 100 BaseT, the three subnets can be shown in Fig. 3.

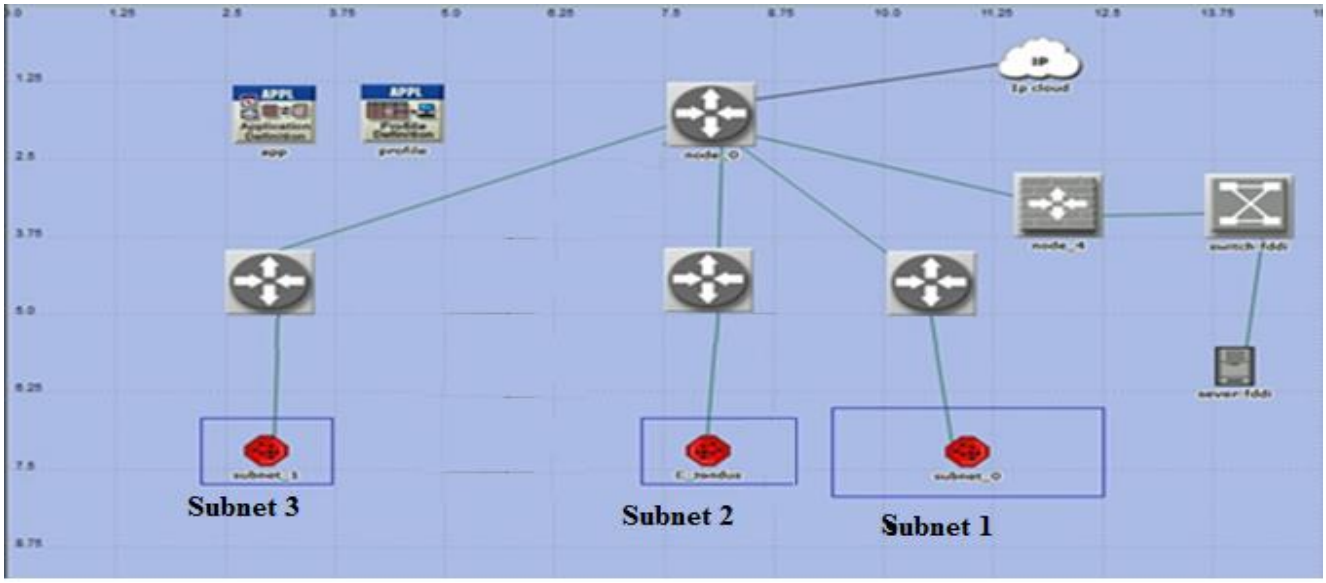

Figure 3 Simulated Wire Server with three subnets

4.2. WiMAX simulation setup

WiMAX scenarios are based on the following parameters shown in table 4.

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Table 4: parameters of WiMAX simulation

WiMAX		
	BS (Base Station)	SS (Subscriber Station)
Tx Power	20W	0.5W
Antenna Gain	15dBi	15dBi
Path Loss	Free Space	Free Space
Bandwidth	20MHz	20MHz

4.3. WiMAX scenario

In WIMAX scenario, all links are configured with the same setting and configuration for making a simple performance analyses so far comprehensive and universal. However, in functional applications, different setting and several configuration exist for each link and node with a view to maximize the efficiency of the system. But while simulating a network in providing and considering various conditions as different and extreme as possible to make it appropriate and more comprehensive to study and research. For testing how each of the QoS parameters behave, a large number of simulations were proceeded, using each QoS parameter separately and with others, including all possible combinations and network conditions.

WiMAX scenario comprise three WiMAX –BS-Ethernet connected to router and WiMAX workstation SS Ethernet. Each WiMAX base station are connected with the IP cloud by (PPP-link). The base station used to transmit the WiMAX wave to the WiMAX work station with 30 km WiMAX BS coverage. WiMAX scenario shown in fig.4.

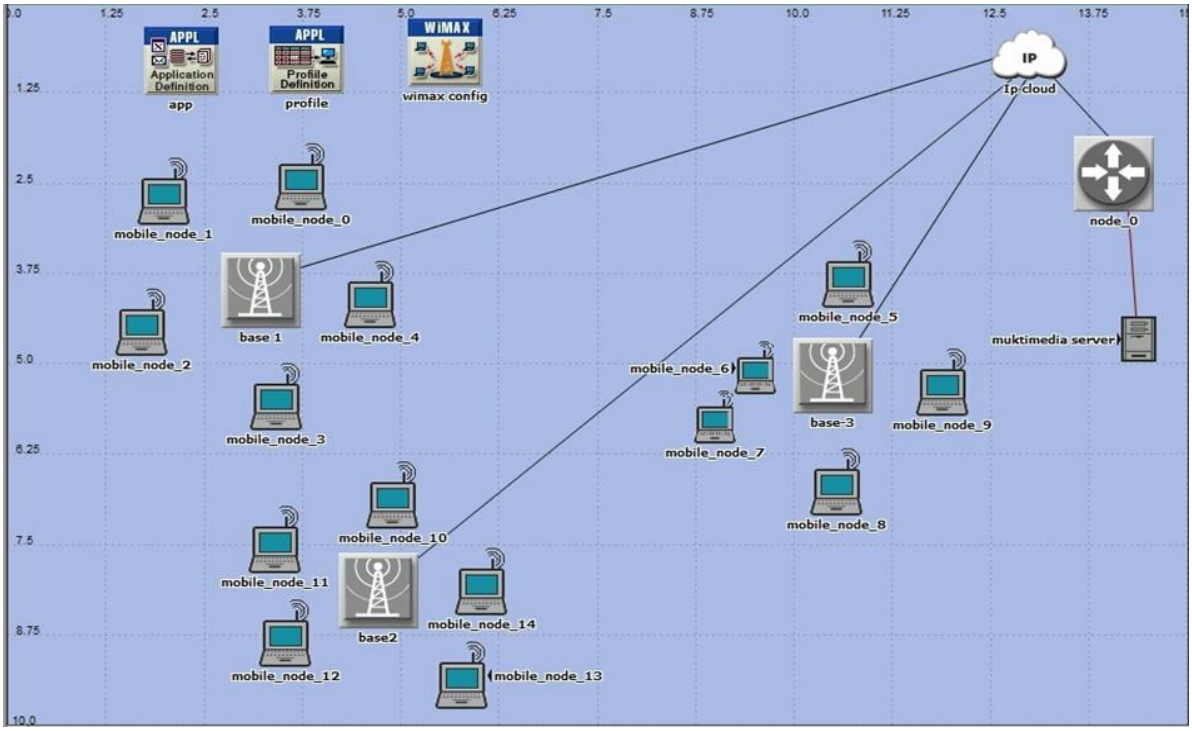

Figure 4: WiMAX scenario

In this WiMAX Scenario the parameters used to measure the network statistics represent video conferencing with low quality and voice with a GSM quality (light) and video conferencing as a heavy quality and the voice as PCM quality (heavy).

V. OPNET SIMULATION RESULTS AND DISCUSSION

The results and discussion of the WiMAX, WiFi base line for the parameters data transmission (voice, light and heavy video) will be demonstrated based time delay measurement for WiFi base line, WiFi-based line of voice packets end-to-end delay for voice packets and measuring end-to-end delay basic WiMAX network, light and heavy video for WiMAX network throughput measurements.

5.1. WiFi Delay

A significant and meaningful parameter in assigning the efficient operation of the data transmission, its timing operations and the Required To send/ receive mechanism are the MAC delay and overall packet transmission delay statistics. The latency of the network is considered as an important design of computer and communication networks as well as performance characteristics. Specifies how long to move over the network from a single node or endpoint to another data bits. Delay is usually measured with a bit of the second in doubles. Minimum period of packet transmission delay depends somewhat pair serial link communication experience are specific locations. You can add a level of network congestion delay variable. The MAC delay measured in the simulation of the WiFi base line connection shown in Fig. 5. From the simulation results of the video and voice across the 300s time, any connection not happened until 100 second, where the connection network established, and the communication system reach the steady state with maximum delay of more than 0.045 at the time of 200 second.

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Figure 5: wireless LAN delay based line connection

5.2. WiFi voice-packet end to end"delay

The analog signal from the phone is in pulse code modulation (PCM) signal was digitized speech coder-decoder (codec). Navigate to the compression algorithm to compress the voice packet format for transmission over WAN PCM samples. From the simulation results of WiFi base line, the voice-packet end to end delay without connection until 110 seconds where the connection network established, and the communication system reach the steady state with maximum delay 1 packet at the time of 200 second, this may be shown in Figure 6.

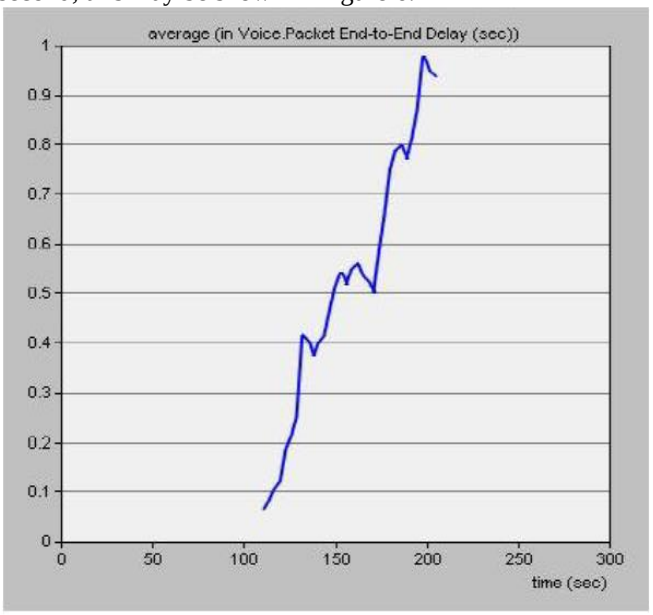

Figure 6: WiFi base line voice-packet end to end delay.

5.3. WiMAX voice-packet delay

WiMAX voice-packet end to end delay is simulated first for the PCM voice and a light video data transmission, it seen from the simulation, the connection is started at 110 second where the connection network established, and the communication system reach the steady state which can be considered as a straight line at the second 250 with maximum delay 115 ms, as shown in Figure 7.

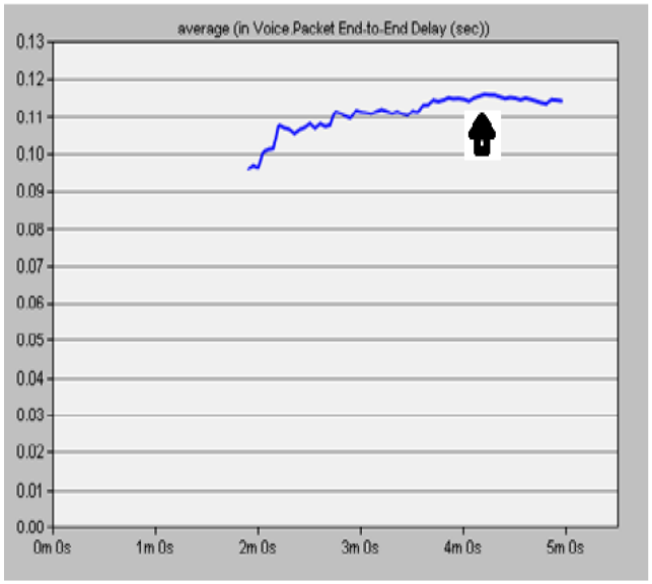

Figure 7: WiMAX voice packet end to end delay with Light video

Secondly, the simulation results of PCM audio with heavy data transmission of WiMAX voice packets end-to-end delay, also reaching steady state in the second considering the maximum delay of seconds 110 m 70 m second delay for 110 seconds connection without a communication system Figure 8 to 240.

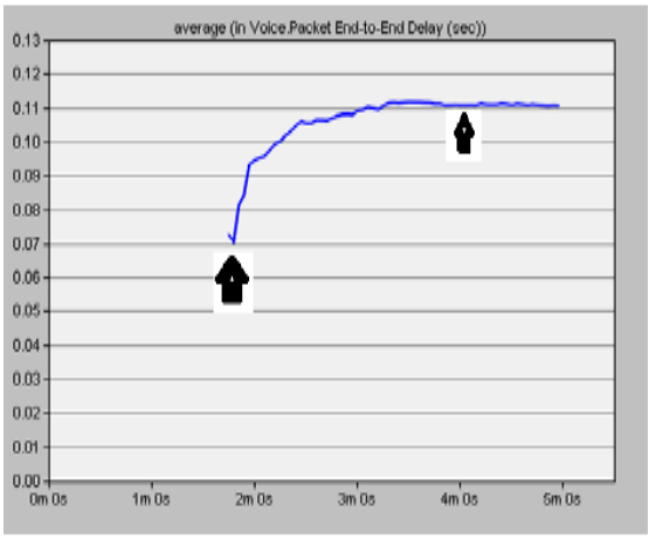

Figure 8: WiMAX voice packet end to end delay with heavy video

VI. CONCLUSIONS

In this work, comparison between simulations of scenarios have been studied WiFi and WiMAX networks and voice packets end-to-end delay. Performance of the two scenarios has been presented, and 300 years time comparison. Light and heavy video, WiMAX voice packets end-to-end delay was given. For WiFi the voice-packet end to end delay without connection until 110 seconds where the connection network established, while for WIMAX the connection starts at 110 seconds also.

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BIBLIOGRAPHY OF AUTHORS:

Dr. Adnan Hussein Ali, The Author is an assistance Lecturer in the Computer Engineering Department at Institute of Technology, Baghdad, IRAQ. He has been awarded a Doctor of Philosophy in Laser and Opto-Electronics Engineering from University of Technology, Baghdad, in 2007. He has studied Master of Science in Electronics Engineering, Cupper Vapor Laser's Power supply at University of Technology, Baghdad in 2000. He has gained Bachelor in Electrical and Electronic Engineering from University of Technology, Baghdad, in 1987. Currently he is lecturer at Institute of Technology, Baghdad, IRAQ. His research interests are Radio over Fiber, Wireless Network, Laser's Power supply and OPNET.

Dr.Ahmed R. Ajel, has been a full-time lecturer in the Institute of Technology Baghdad/Iraq, Ministry of higher education and scientific research/Iraq. Received his BSc. (1992), MSc. In control engineering, (1996) and PhD Degree in Electrical and Electronics engineering from the University of Technology (2006), Baghdad/Iraq, Head of Information and Communication Technology in Institute of Technology Baghdad/Iraq from 2012-2015, and head of the Consulting & the Scientific Bureau in Institute of Technology Baghdad/Iraq from 2016 to yet.

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