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Performance simulation of broadband multimedia wireless networks simulation based on OPNET

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ABSTRACT

As the rapid growth of multimedia application over the Internet, it is essential to preserve the Quality of Service (QoS), which is certifying the guaranteed service through the Internet and representing the biggest challenges for the current IP based services. Multimedia traffic usage has been increased in relation to the streaming media such as video conferencing using OPNET, the performance can be simulated based on heavy and light scenarios for video conferencing including web traffic. The overall WLAN load data are obtained for such scenarios, also the performance of simulated overall Delay in the three scenario networks is measured.

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1. INTRODUCTION

Wireless networking can now be considered as the backbone of the modern telecommunication system. A request for fast transmitting of the high-speed data without appreciable loss had been guided to the technology evolutions such as WLAN or WiMAX. Despite the fact that these technologies have enhancement level that reached for confronting demand from the customers, there is still ample scope for increasing quality of service (QoS) and data rate beyond the present level [1].

The utilizing of wireless networks may be for providing a network connectivity nearly everywhere, such networks equipping big companies with a choice of connecting the wired networks with a modern wireless network unaccompanied by any problems in addition to select any group of applications for users nevertheless of suppliers or sources. The forthcoming WLAN permit users for moving to anyone communication, everyplace at whatever time with a variety services in multimedia. Such applications of wireless communication systems have expanded from simple voice services to integrate data services [2].

The network revolutions, that happening with a technology of broadbands, give a possibility of a wide diversity of applications and facilities. Beyond a market relaxation, an innovative possibility initiates modern applications and requirements. The networks with High-speed permit the conception of original applications, that may cause multiple challenges and big problems. Currently, a commonly using of Wireless networks, but the mobility of users, the management of networks, besides the current protocols increase important network issues, that should take into consideration the next-generation in the telecommunication network [3, 4].

The wireless networks have multi-services that can transmit data, voices, multimedia, and video traffics [5]. The integration of wireless access and broadband networks in their architecture in order to be convenient for applications of mobile and multimedia with bankrupt traffic [6, 7]. In multimedia networks at high-speed with mobile applications, new challenges have been confused by bankrupt traffic. Actually, the applications of data, multimedia, voice and video network services shared with the challenges in both high-speed and wireless networks need recently developed solutions for synchronization problems in multimedia schemes, dynamic channel function in cellular mobile networks, incoming technologies, QoS and requirements of performance associated with the services and applications proposed [8, 9].

The wireless networking approval is driven by spreading of portable mobile devices, along with an appropriateness of release communications. With growing multimedia content deployment on the Internet along with the deployment of time-sensitive critical applications, there is a strong motivation to develop QoS features to meet the most stringent performance requirements [10]. The term QoS refers to the guarantees on the ability of a network to deliver predictable results and a more deterministic performance, so data can be transferred with a minimum delay, packet loss, jitter and maximum throughput. The QoS does not take into account the user's perception of the quality [11, 12].

The main Internet applications in the wireless network like file transfer or email can be considered elastic applications, that's mean they are not requirements limited by strict performances, and consequently well corresponding with the delivery mode of Internet's datagram which provides network-layer connectionless service [13, 14]. A world of the modern Internet, that is a full capable of multimedia applications, needs guarantees of QoS that users must arise for assuming from the world of telecommunications network. Therefore, for supporting applications of multimedia and other collaborative performances, a support is a needed for QoS features over QoS supplying that delivers resource confirmation along with service distinction [15, 16].

The core topical of this work offered in this paper can be focuses in evaluating the WLAN performance, particularly end to end delay, load, media access delay, and the received and sent traffics. Network's multimedia traffic in a video conferencing mode is employed with various scenarios so as to compare between them. The simulation of networks is set up by OPNET 14.5 modeler. Each scenario varies from the others with physical layer technology and transmission rate.

2. MECHANISM OF RTS/CTS

The base station in wireless network is well prepared for transmitting and made sending a short frame of Request To Send (RTS) before transmission of each data frame. An RTS frame impact is less potential than impact of the real data frame owing to the size differences. When the base station at the receiver is ready for receiving, the RTS frame is acknowledged with a send frame of Clear To Send (CTS) for sender, hence all traffic are blocked from another station [17]. Furthermore, if the source is received CTS frame, then a data frame is sent in case channel is reserved for a full transmission length. Finally, the ACK frame is sent by receiver to the sender based on frame receiving [18]. Thus, a significant efficiency evaluation of optional mechanism of RTS/CTS handshake on the performance for analyzing the IEEE 802.11 based WLANs [19].

3. OPNET IMPLEMENTATION & SIMULATION

3.1. OPNET Modulator

OPNET Company (Optimized Network Engineering Tool) was initiated in MIT (Massachusetts Institute of Technology), and its establishment in 1986. A year later, 1987, first simulation software of commercial network performances was released by OPNET company which could providing an optimization tool of important network performances that made a revolutionized network simulation [20]. Creation the management of analytical network performances is powerful with simulation and thus it becomes possible. The development of other products at OPNET besides Modeler is done, it also comprises a Kit of OPNET Development, WDM Guru etc [21, 22].

The model of simulation is considered a progressively popular approach for studying the performances and functionalities of the suggested models in various scenarios. Simulation is a testing procedure of a designed prototypical on a platform that duplicates the real environment and offers the opportunity for studying, creating, and modifying the performance of design proposing with the purpose of strengthens and weakness the expectation before the model implementation in a real environment [23, 24].

A flow chart of simulation of any system started with the steps that is taken in the simulation process. For each scenario, the network traffic, configurations are modified and the simulation is run [25]. A flowchart is used to illustrate the key steps taken to assess the performances of a WLAN is seen in Figure 1.

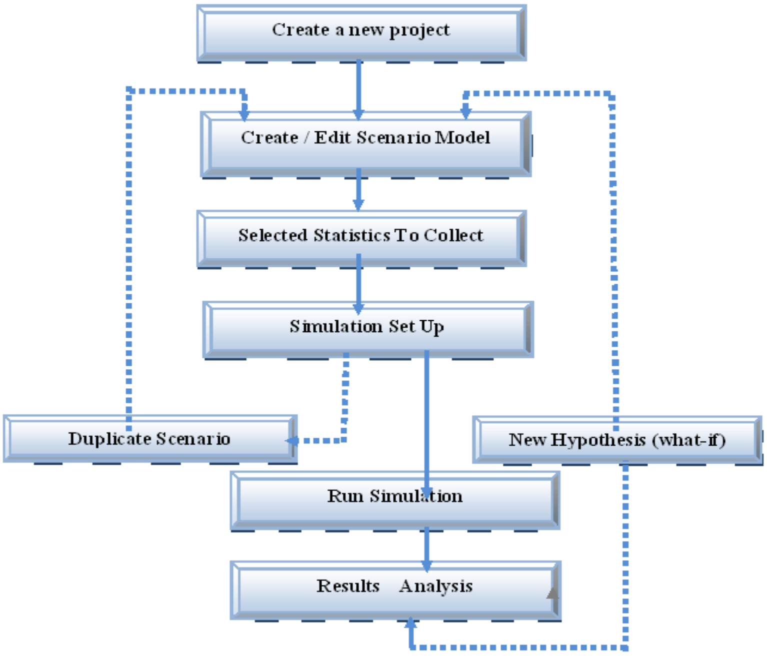

Figure 1. Flow chart to evaluate the performance of WLAN

3.2. Baseline Scenario

The Baseline 802.11g model scenario is formed utilizing a standard model's variation of the OPNET 14.5 WLAN arrangement scenario. Within such scenario, a single infrastructure 802.11g WLAN behavior can be inspected in the organized WLAN framework for better emulating the actual network conformation as shown in Figure 2. An Internet Protocol IP cloud van be using to signify the Internet backbone is connected with a serial link of Point-to-Point T1 (1.544Mbps) [19]. The three subnets are positioned at each side of IP cloud through an IP gateway connecting by Point-to-Point Protocol T1 link and two servers are connecting via a central switch utilizing a link of 100BaseT, as seen in Figure 2, and wireless as seen in Figure 3 respectively.

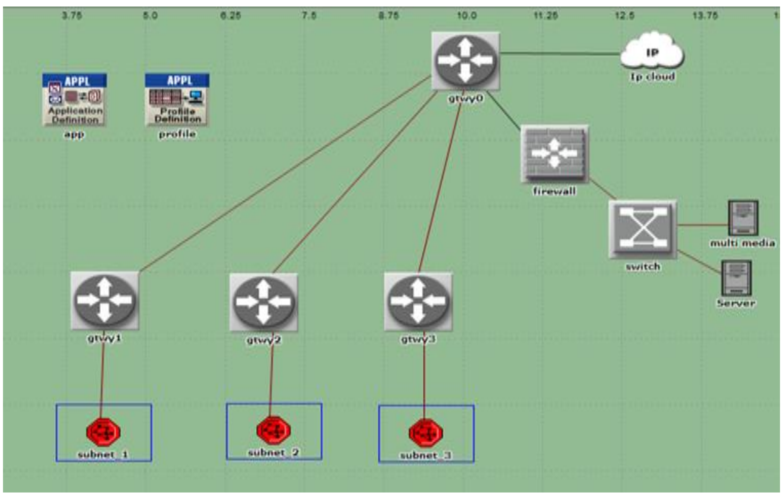

Figure 2. Simulated wire server frameworks

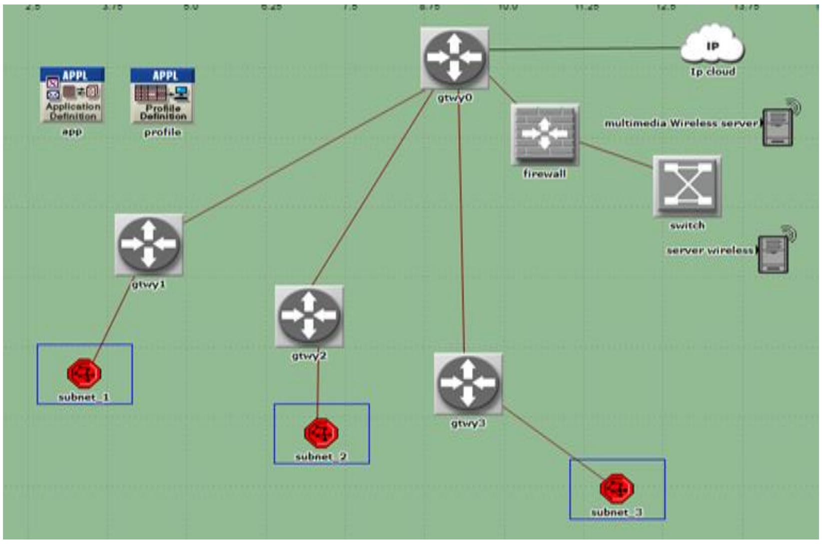

Figure 3. Simulated wireless server frameworks

The location of subnet one is at the right side of the Internet Protocol (IP) cloud and the servers of the traffic network are connected by 100BaseT Ethernet, the servers is connecting to the firewall by 100BaseT Ethernet link and can be using in place of sources and destinations at all applications: video conferencing, Hypertext Transfer Protocol (HTTP), File Transfer protocol (FTP), voice applications, Electronic Mail (E-mail) and Database simulation on the completed network characterizing the traffic which exchanges with the 802.11g WLAN mobile nodes through simulations, as shown in Figure 4.

The subnet two denotes the office of remoting branch that comprising five workstations in the office_LAN connecting by a link of 100BaseT. This LAN office is connecting by a central switch with a link 100Base Ethernet wiring to compete with a real-time office situation which uses Fast Ethernet LAN standards. The IP gateway connects the LAN to an IP cloud, this gateway is connected to the LAN office by 100BaseT Ethernet link whereas the serial link P2P T1 is connect the IP cloud and the IP gateway, as seen in Figure 5.

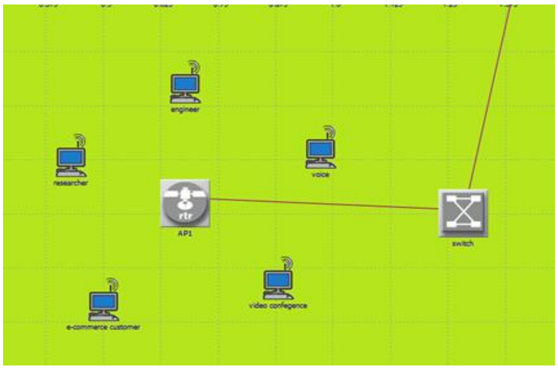

Figure 4. Subnet 1 802.11g WLAN

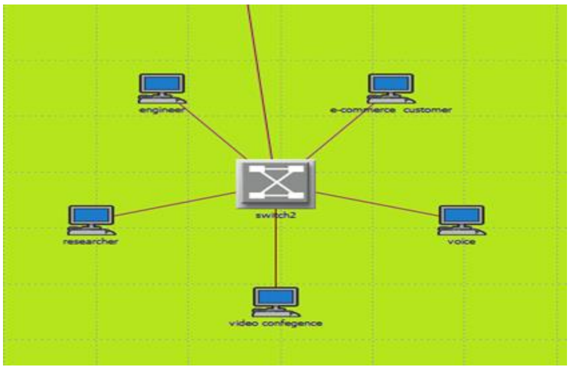

Figure 5. Subnet 2 802.11g WLAN

Finally, the subnet three located on the other side of the Internet Protocol cloud, a connection of WLAN is done within access point AP to LAN office by a central switch utilizing Ethernet wiring to emulate an environment of real-time office within Fast Ethernet LAN standards that has extension of a WLAN to a zone of wiring difficulty or demanding aesthetics like a media (voice or video) room or conference, as shown in Figure 6. The office_LAN are divided equally amongst the profiles, with each profile having one workstation. Here the main objective is to analyses the performances of operator perceived usefulness belong to WLAN users, An WLAN sub network with five mobile nodes are assigned to different profiles as shown in Table 1.

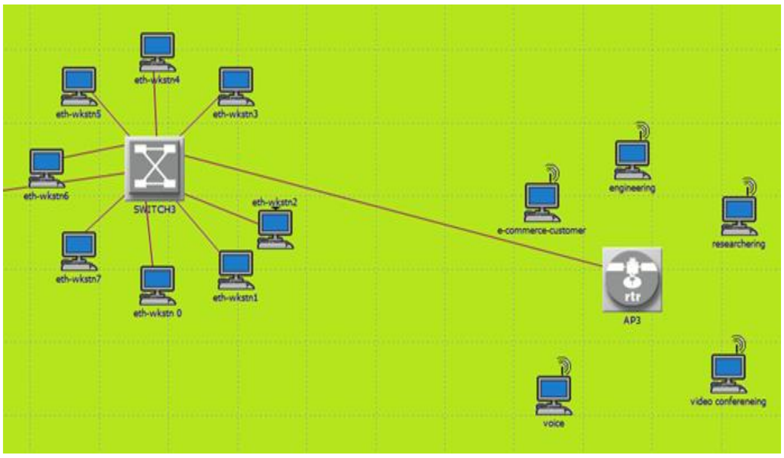

Figure 6. Subnet 3 Offices WLAN

Table 1. Assigned Profiles of Mobile Nodes in the WLAN Sub Network

MOBILE NODE	USER PROFILE
Station_1	Engineer
Station_2	Researcher
Station_3	E-commerce Customer
Station_4	Sales Person

3.3. Multimedia Load Scenarios

The multimedia traffic can be represented as a video conferencing form in the network. This form of conferencing involves images, data, and voice, and definitive multimedia traffic representation. While the video server is presented for assisting the application of video conferencing towards the details of network, Figure 7 shows the configuration for multimedia employer profile applications at the scenarios of multimedia load.

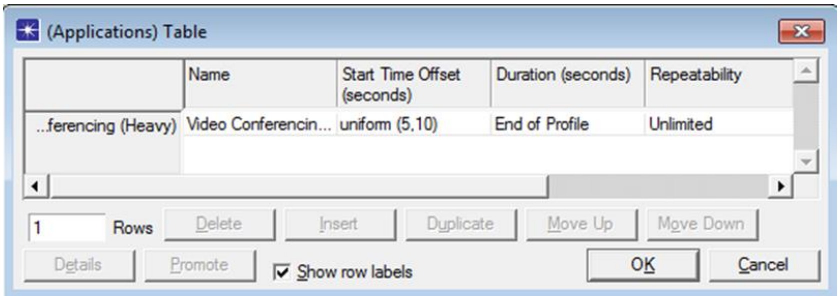

Figure 7. Application Configurations for Multimedia User Profile

4. SIMULATION RESULTS AND DISCUSSIONS

4.1. Load

A load is the first parameter which effects the total performance of the wireless efficiency. The assessment of the load is concerned with the reception of the transmitted data in spite of don't consider the network overhead opposed to the load. A total WLAN load with respect to the time function as the advanced simulation can be considered as a greater extent significant results, Data have overall WLAN load with an approximate average value of scenario heavy is (430.7407) Kbps on the 5 minute mark and the average value of scenario light WLAN is (3622787) Kbps on the 5 minute mark and Figure 8 shows the results belong to the first scenario. A simulation scenario (heavy) was built and run in order to obtain the desired results for individual load as shown in Figure 9.

Figure 8. Total Loads on the Simulated Wireless LAN

Figure 9. Individual load values

A simulation scenario (Light) was built and run in order to obtain the results for Individual Load Values for a subnet, as shown in Figure 10. In order to obtain the desired results of the load and the access point are illustrated approximate average peak values stations to achieve the objective, A simulation scenario (heavy) with a simulation scenario (Light) can be represented in Table 2.

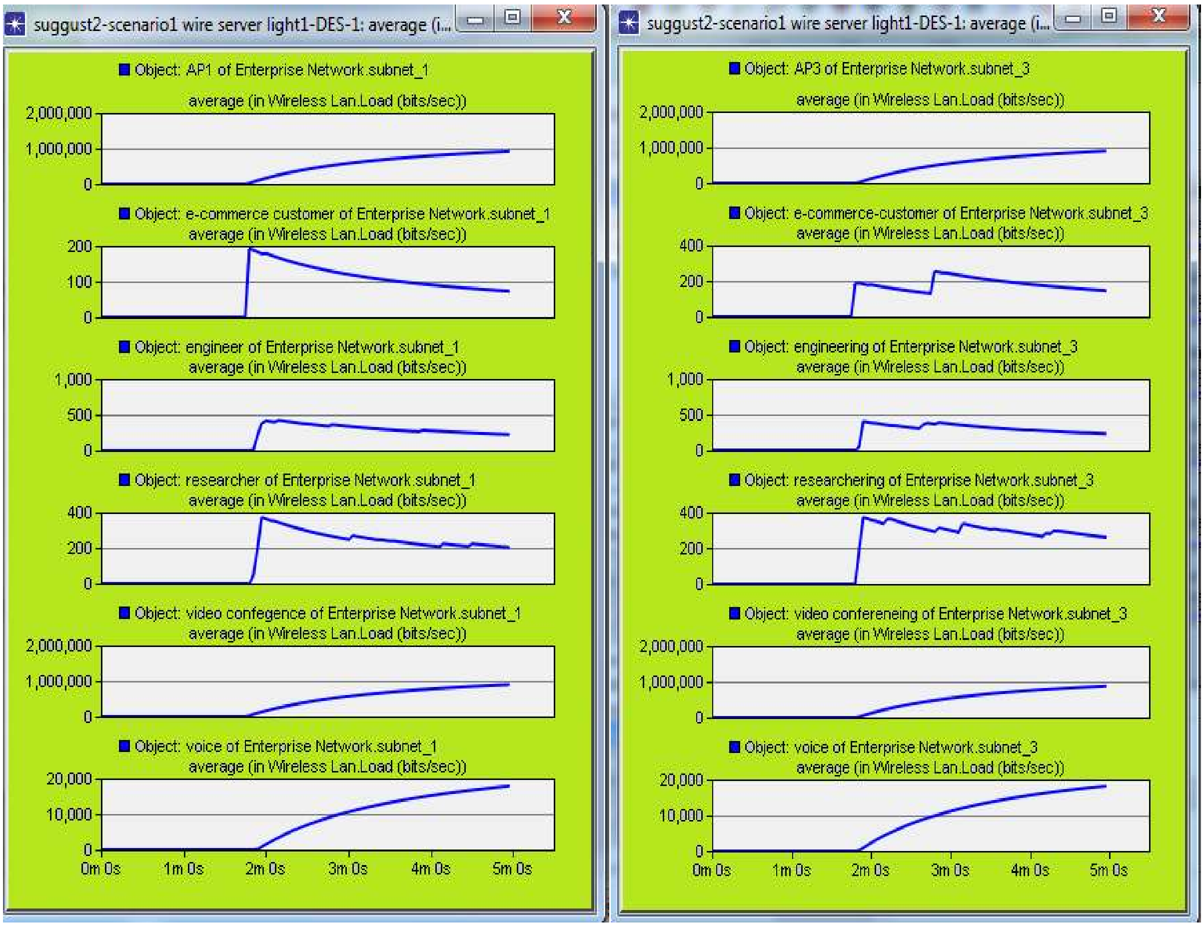

Figure 10. Individual load values for scenario (light) subnet one, subnet three

Table 2 The Individual load values scenario 1(light) and scenario 2(heavy)

Type Of Node	WLAN Load (Heavy) (Kbps) subnet one	WLAN Load (Heavy) (Kbps) subnet three	WLAN Load (Light) (Kbps) subnet one	WLAN Load (Light) (Kbps) subnet three
Access point	(AP2) 42.07	(AP1) 200.2	(AP1) 916124	(AP3) 899128
E-commerce costumer	0	188.4	73	146
Engineer	0	0	223	232
Researcher	0	0	202	260
Video conferencing	0	0	893783	87652
Voice	0	0	17878	18201
Sub Value	42.07	388.6	1828285	1794502
Sum total	430.7407407		3622787.467	

4.2. Delay

Delay can consider fundamental metric for describing any network's QoS, specifically a real time. In application of multimedia, delay may perform a central parameter for choosing the MAC layer effective operation, its operation time, and the mechanism of Required To Send/ Clear To Send (RTS/CTS). Delay has two main kinds, they are a medium access delay and overall packet transmission delay statistics, Figure 11 shows a results of average overall WLAN delay peaks at 0.0125s, these values are distinctive of an efficient WLAN under normal traffic loads, while the average (in the Video conferencing packet End-to-End Delay (sec)) delay peaks at (0.055s) as seen in Figure 12.

It can be seen that an WLAN Delay which characterizes the end to end delay of all the packets received by the wireless LAN MACs by all nodes of WLAN network then higher layer forwarded. This delay comprises medium access delay at the source MAC, reception of all the fragments individually. An indication that WLAN Delay can be considered very high throughout those resends. The average (in the

Voice packet End-to-End Delay (sec)) delay peaks at (0.093s) as shown in Figure 13. A simulation different WLAN Delay of applications are used and simulation scenario 1 (Light) Wire Server (0.0103(sec)) vs Wireless Server (0.0125(sec)) as shown in Figure 14**.** The delay and the access point are illustrated approximate average peak values as shown in Table 3.

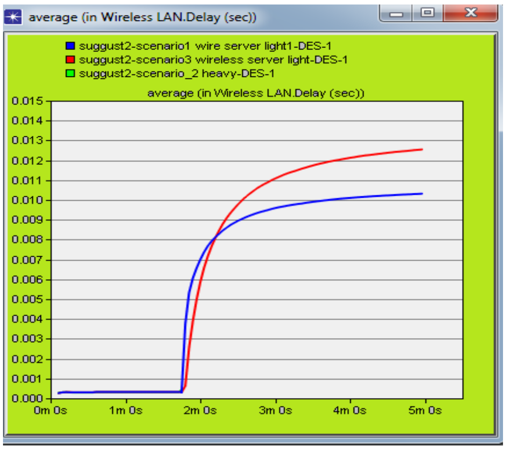

Figure 11. Simulated overall delay

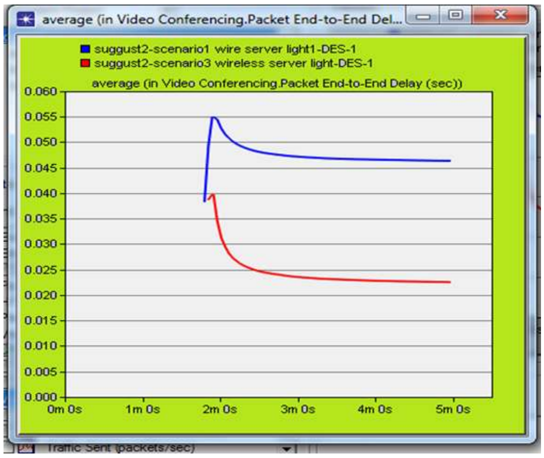

Figure 12. Simulated video conferencing wire

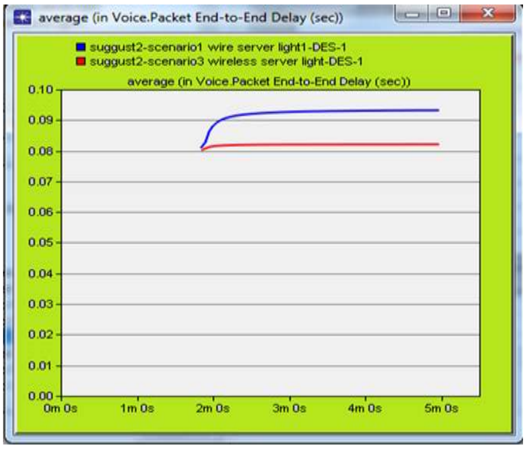

Figure 13. Simulated voice wire server delay vs wireless server delay

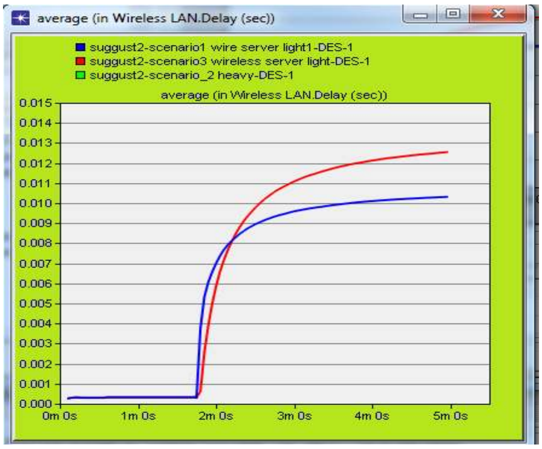

Figure 14. Simulated WLAN delay (sec) wireless servers vs wire server

Table 3. Wireless LAN delay (sec) Server of applications in WLAN

Application	Wireless server Delay (sec)	Wire server Delay (sec)
Video conferencing	0.039	0.055
Voice	0.082	0.093

5. CONCLUSION

The performances of Quality of Service QoS can apply in IP networks for employment of available network resources at greatest efficient method for minimizing delays in network traffic that have multiple forms of multimedia services which contains voice, video and database. Two network scenarios have been created, namely 1 heavy network, Scenario 2 (Medium Load) network and Scenario 3 (High Load) network. The Comparison was carried out between them. Performance assessments directed were both Loads and Delays Performances, in these Performance tests, we observed the results in two cases: heavy and light scenarios.

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