International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2014): 5.611

The Impact of Distance on WLAN and LAN Network Performance

Islam Salem Al-Safe Abdullah[1], Amin Babiker A/Nabi Mustafa[2]

Department of Communication Engineering,Al-Neelain University

Abstract: ***Quality of Service (QoS) factors such as throughput and delay are important considerations for the users. Wireless fidelity (Wifi) is a certification mark for equipment based on a different set of IEEE standards from the 802.11 working group for wireless local area networks (WLAN). Fidelity Ethernet Local Area Connection (LAN) currently assumes one of the fastest data transfer rates in computer technology. By using LAN as a baseline, we will be able to accurately gauge all these technologies. In this project, we will use OPNET's simulation tool to compare the QoS factors mentioned. We will make comparisons between WLAN and LAN.***

Keyword: QOS, LAN, WLAN.

1. Introduction

The rapid development and growth of the Internet in recent decades has allowed the technology to be much more accessible. The Internet has become a major component of people's daily lives. This technology is becoming an integral part of people's daily activities such as email, work, and entertainment. Comparisons will be made between some current wireless technologies to determine their feasibility and performance capabilities in Quality of Service (QoS) factors such as network delay, and network throughput when paired up versus the superior standard wired local area network (LAN) Ethernet technology.

1.1 Wireless Fidelity (WiFi)

WiFi is a wireless local area network (WLAN) technology that belongs to the Institute of Electrical and Electronics Engineers (IEEE) 802.11 standards. This family of standards contains many different protocols with different specifications and performance standards that are coded as 802.11a, b, g, n, ac as shown below in Table 1. Devices with WiFi technology allows them to connect to the Internet wirelessly when it is within coverage range of a "WiFi hotspot", this coverage range depends on factors such as indoor/outdoor and frequency. WiFi networks have limited range, typically between 30 meters indoors to 100 meters outdoors, but this range may also vary due to frequency. Delivering signal to far places or providing high speed Internet connection, but it cannot do both. At long distances, the error bit rate also increases.

1.2 Ethernet Local Area Network (LAN)

Ethernet LAN or Ethernet is the standard wired networking technology introduced in 1980's. Ethernet was standardized by the IEEE 802.3 network protocol definition. Ethernet technology allows for immense speeds starting from 10 Mbps all the way up to 100 Gbps.

Table 1 below shows a general comparison in the technology between WiFi, and Ethernet LAN.

Table 1: Comparison between WiFi and Ethernet LAN.

Specification	Wifi	Ethernet
IEEE Standard	IEEE 802.11g	IEEE 802.3
Bandwidth	20MHz	
Data Rate	54Mbps	100Mbps
Indoor Range	38m	Limited by wire length

2. Methodology

In this paper, OPNET 14.5 was used to create the simulation models. The same scenario setup was used for the 2 different technologies. The same traffic model was used for the technologies as well.

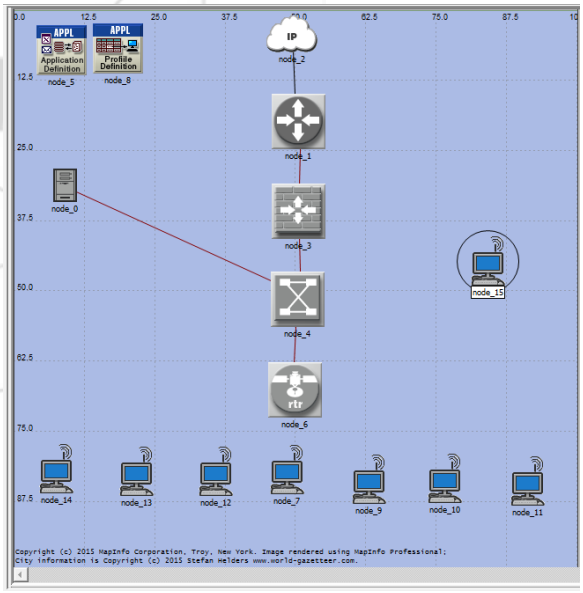

Figure 1: wlan model

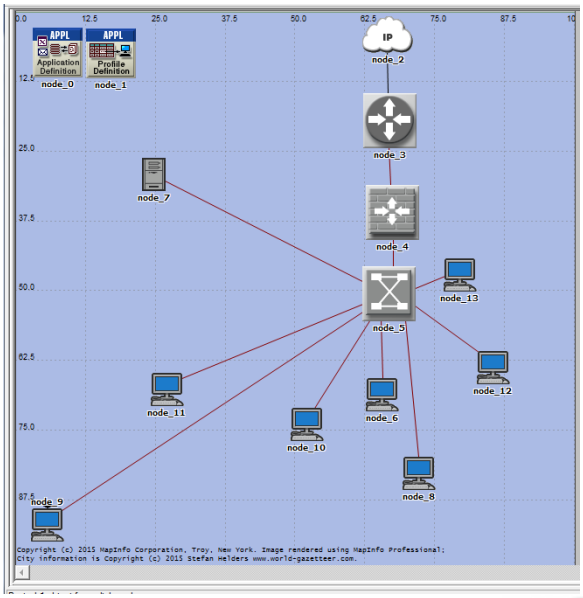

Figure 2: Ethernet model

3. Results and Discussions

3.1 Channel Efficiency

In a communication network, channel efficiency, also known as channel utilization or normalized throughput, is the ratio between the rate of successful packet delivery and the rate of total packet delivery. Throughput is the average rate of successful packet delivery through the channel, whereas the load is the rate of total packet deliveries. They are usually measured in bits per second (bps) or packets per second (p/s).

3.1.1 Wlan Channel Efficiency

Figure 3 depicts the Wlan average throughput in bps

The results correspond to the differing distances between the gaming clients. The longer the distances from the client to the AP results in lower throughput.

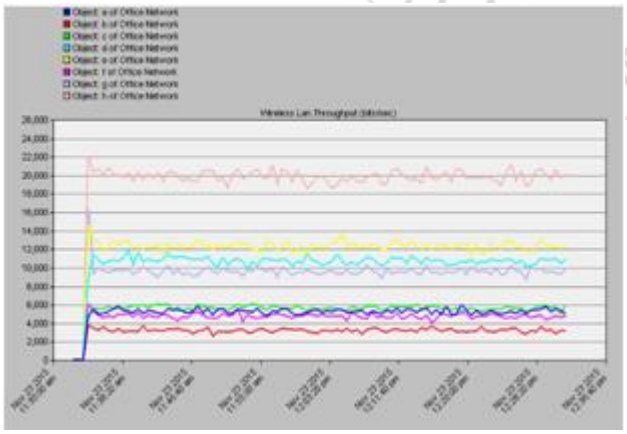

Figure 3: Wlan Average Throughput (bits/sec)

3.1.2 Ethernet LAN Channel Efficiency

The Ethernet average throughput simulated results is shown below in Figure 4, but OPNET 14.5 did not provide any results for Ethernet throughput., the average load is equal to the average throughput and has 100% channel efficiency

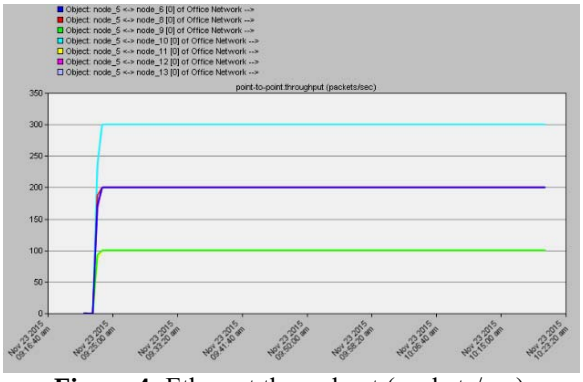

Figure 4: Ethernet throughput (packets/sec)

3.2 Delay

In communication networks end-to-end delay is the time it takes for a packet to transfer from the source to the destination. It is measured in sec (seconds) over a duration of 15 minutes for gaming simulation.

3.2.1 Wlan Delay

Figure 5 shows the measure Wlan delay between the gaming clients. All the gaming clients have a fairly constant steady state. We see that in longer distance, it results in smaller delay.

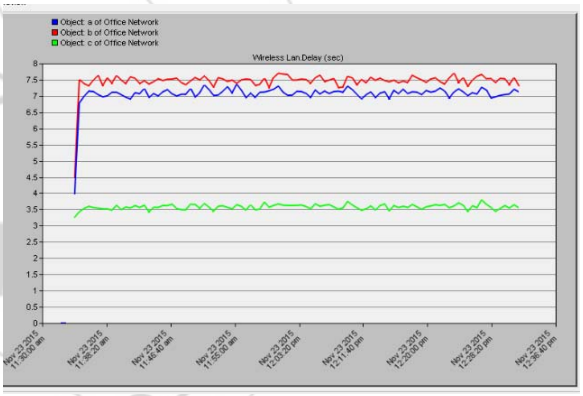

Figure 5: Wlan Delay (sec)

3.2.3 Ethernet LAN Delay

In Figure 6 Gamer1 is the shortest distance to the router. The longest Gamer has the longest distance All the gaming clients have a fairly constant steady state. The longer the distance from the router will result in a higher delay.

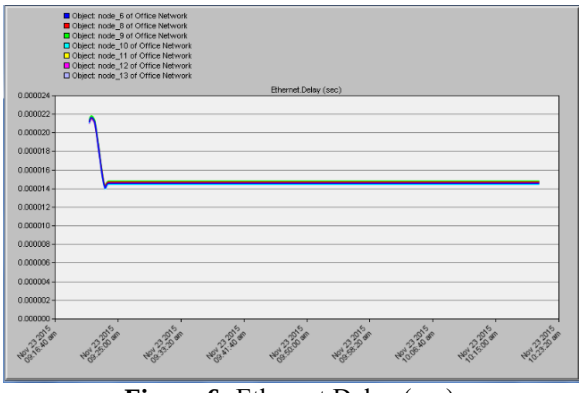

Figure 6: Ethernet Delay (sec)

4. Conclusion

A moderate study of lan and Wlan, allowed to provide a general topology of each network. Thus, QoS factors and performance can be analyzed using OPNET 14.5 modeler.

As a result, the simulation results provided with a deeper knowledge. From that, we confirmed that channel efficiency ranks the network topologies as Ethernet LAN being the most efficient at 100%, whereas WLAN has the lower channel efficiency percentage out of all two network topologies. Our presumption for this topology was that longer distances will result in higher load and lower throughput.

Simulation results showed that when the distance increases, the delay of the Wlan starts to decrease. We attribute this to the limited range of Wlan.

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