International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2013): 4.438

Performance Evaluation and Comparisons for FTP Protocol over WLAN IEEE 802.11 n and Ethernet Technologies IEEE 802.3

Salah El-din El-Hafiz Farah[1], Dr. Amin Babiker A/Nabi Mustafa[2]

[1, 2]Department of Communication engineering, Al-Neelain University, Khartoum, Sudan

Abstract: ***Network parameters are vital ingredients of today's data communication scenario especially Media access delay, download/upload response time and traffic sent/received .This Paper has taken into consideration the modeling and implementation of Wireless Local Area Network (WLAN) and wired Ethernet network (LAN) based on OPNET simulator 17.5 and evaluated the performance of the WLAN and LAN in a campus/university and office environment. Our model has been tested for one type of protocol (heavy file transfer protocol FTP) in two different sites each comprising of 28 users and found that among a set of other parameters Media Access Delay and traffic received/sent and upload/download response time by application server were highly affected by the number of users per application with LAN and WLAN technologies. Simulation performed shows the behavior of the Data transfer on wire-line and wireless network for both application scenarios.***

Keywords: WLAN, LAN, upload/download response time, traffic sent/received by server, OPNET

1. Introduction

Wireless access points are now common place on many university campuses. Technologies such as IEEE 802.11n wireless LANs (WLANs) have revolutionized the way people think about networks, by offering users freedom from the constraints of physical wires. Mobile users are interested in exploiting the full functionality of the technology at their fingertips, as wireless networks bring closer the "anything, anytime, anywhere" promise of mobile networking. For this paper we have focused on IEEE 802.11n. Due to its limited bandwidth, wireless LAN performance is a hot research topic. The literature available showed that the performance of IEEE 802.11 a, b, and g based on wireless networks can be improved in different ways; such as tuning the physical layer related parameters, some IEEE 802.11 parameters, or using an enhanced link layer (media access control) protocol. Our paper uses simulation to study a campus/university area network scenario. We use the OPNET 17.5 simulation environment, with its detailed models of IEEE 802.11n, TCP/IP, Heavy Files transfer by FTP (File Transfer Protocol) and . OPNET is a tool used to simulate the way networks run. We have chosen simulative tool- OPNET for our research because of the several benefits it offers over the other contemporary tools available. We parameterize the simulation model based on campus measurements, and validate the model against LAN performance metrics using simple Files and EMAIL workload models. We then build a model of browsing behavior for a Web client and use this model in a simulation study addressing the performance of the campus area network. Our experiments focus on the Media access delay, download/upload response time and traffic sent/received in the wired and wireless network environment.

The comparative investigation on various performance metrics in wireless and wire-line LAN for parameter has been presented.

1.1 The 802.11 Amendments:

The original 802.11 standard was release in 1997, and utilized direct sequence spread spectrum (DSSS) to modulate data onto an RF signal. The standard operated in the 2.4 GHz frequency range, and had a maximum throughput of 2 Mbps. The original 802.11 standard never saw widespread adoption, and was quickly supplanted by the 802.11a and 802.11b amendments, which were developed concurrently and released in 1999. 802.11 wireless amendments that are currently in deployment include:

- 802.11a
- 802.11b
- 802.11g
- 802.11n

a) 802.11a

The 802.11a amendment was released in 1999, and utilizes orthogonal frequency-division multiplexing (OFDM) for modulation. 802.11a operates in the 5.0-GHz frequency band, and has a maximum throughput of 54 Mbps. Specifically, 802.11a supports data rates of 6, 9, 12, 18, 24, 36, 48 and 54 Mbps, though the higher throughput is only available in close proximity to the wireless access point (WAP)/transmitter.

b) 802.11b:

The 802.11b amendment was also released in 1999, and utilizes complementary code keying (CCK) for modulation. 802.11b operates in the 2.4-GHz frequency band, and has a maximum throughput of 11 Mbps. specifically, 802.11b supports data rates of 1, 2, 5.5, and 11 Mbps

c) 802.11g:

The 802.11g amendment was released in 2003, and utilizes orthogonal frequency-division multiplexing (OFDM) for modulation. 802.11g operates in the 2.4-GHz frequency band, and has a maximum throughput of 54 Mbps.

Specifically, 802.11g supports data rates of 6, 9, 12, 18, 24, 36, 48, and 54 Mbps.

d) 802.11n:
The 802.11n amendment was officially released in 2009, though pre-release (or draft) equipment has been available since 2007. 802.11n supports significantly higher data rates than previous 802.11 amendments, through the use of wider channels (40MHz channels instead of 20MHz) and Multiple-Input Multiple-Output (MIMO).

2. Model Outline

The IEEE 802.11WLAN architecture is built around a Basic Service Set (BSS). A BSS is a set of stations that communicate with one another. Figure 1 & 2 shows an outline to the model and is followed by the tow wireless LAN sites and the specification's shows in Figure 3.

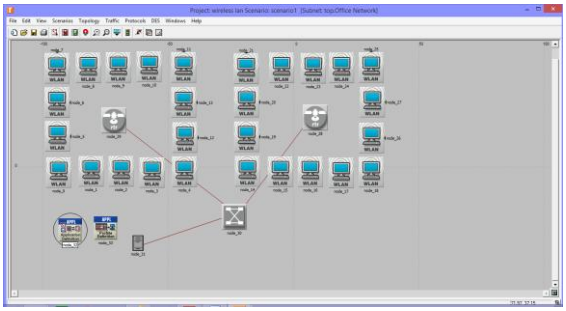

Figure 1: OPNET Model WIFI IEEE 802.11 n Network topology implemented Scenario 1

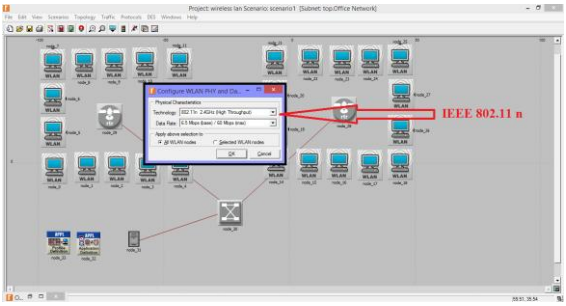

Figure 2: Type of WIFI 802.11 n used in scenario 1

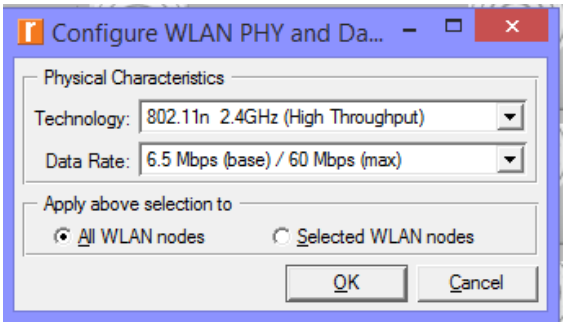

Figure 3: 802.11 n and max data rate 60 Mbps

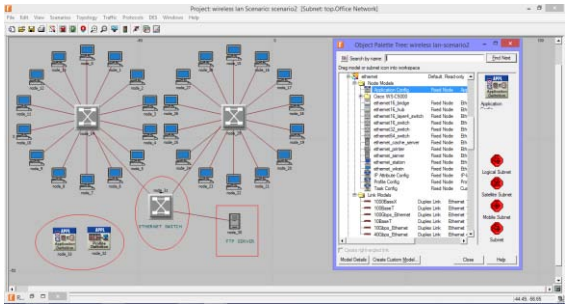

Figure 4: Ethernet IEEE 802.3 Network topology implemented Scenario 2

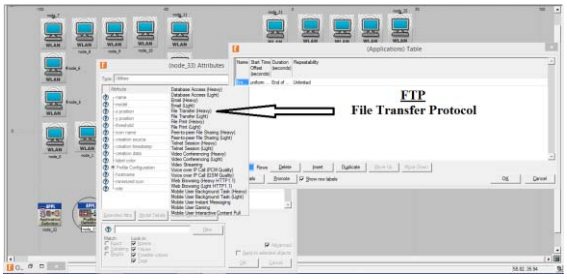

Figure 5: FTP used in scenario 1 and 2

In our research we considered installing two access points in a campus/university environment where mix of files and applications transfer to clients was present. Simulations have been carried out for our model to determine the optimal performance metrics and compare the results with the same network component with other technologies that we used (Ethernet 802.3).

3. Simulation Scenario

A simulation model was developed using OPNET 17.5. OPNET 802.11 n module was used as a standard with maximum data rate up to 56 Mb/s. IEEE 802.11b Direct Sequence was used with data rate of 5.5 Mbps in which slot time was 50µs. In this section, we consider the case of two scenarios.

Scenario 1: 2 WLAN Sites each with 14 Users through 1 access points using normal FTP (7 users), and Heavy FTP (7 users) connected with outside wire-line network.

Scenario 2: Ethernet LAN switches each with 14 Users through 1 switch using normal FTP (7 users), and EMAIL (10 users) and Heavy FTP (7 users) connected with outside wire-line network.

4. Results Analysis

Five graphs were selected after simulating our model (Figures 6 through 10). All graphs show a combination of the 2 scenarios. From figure 6 it has been observed that the WLAN Delay (sec) is more in comparison with CSMA/CD Ethernet network scenario. From figure 7, 8 we have also observed that the WLAN load on the node (FTP Server) in sites with the lower data traffic sent and received comparison with the CSMA/CD Ethernet network scenario the same thing in case of result of download/upload response time. After 1 hour of simulation time, which indicate the

performance improvement in case of Ethernet on the nodes.

A. Media Access Delay

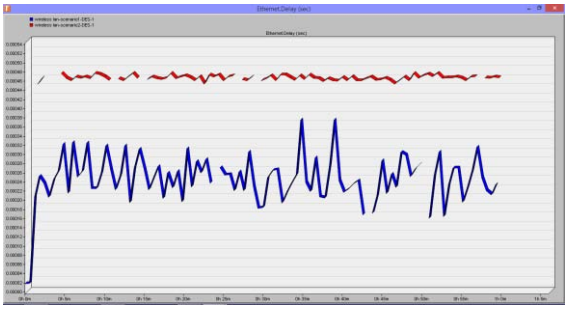

Figure 6: Media Access Delay

B. Traffic sent by Server

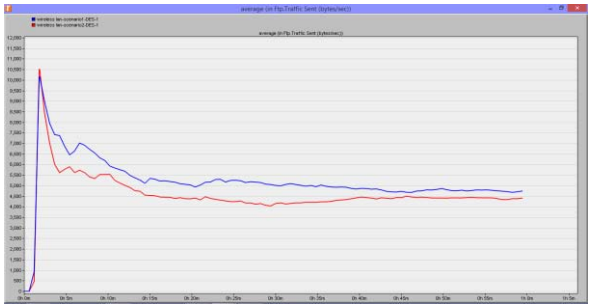

Figure 7: Traffic sent by server

C. Traffic received by server :

Figure 8 below shows the comparison of FTP traffic received (bits/sec) and shows 2 values of theoretical have equal state and stable because the traffic generated by simulator does not change. Also the small change of values dose not affected quality of service in this case.

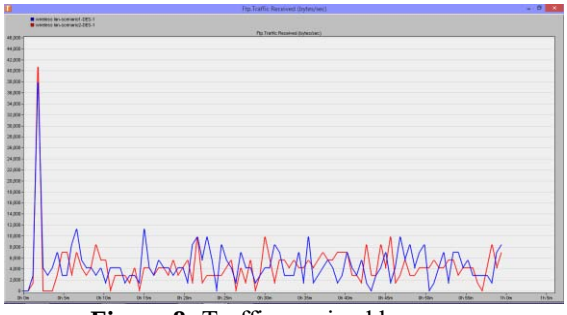

Figure 8: Traffic received by server

D. Upload Response Time

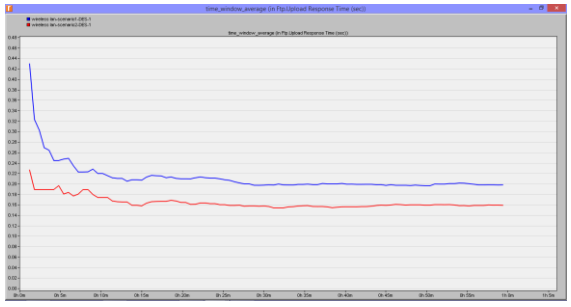

Figure 9: Upload response time

E. Download Response Time

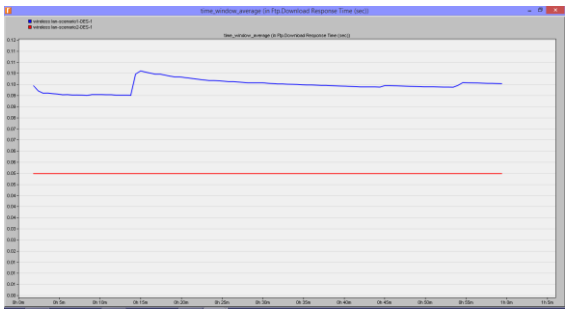

Figure 10: Download response time

5. Conclusion

The main advantage of Wireless LAN network over the CDMA/CD Ethernet based LAN network is the freedom mobility and flexibility. Another advantage is WLAN can be applied when the installation and maintenance cost of wired LAN infrastructure rises significantly, to provide the need of LAN extension to other building. However, there are five issues that decrease the attractiveness of wireless LANs, such as the transmission medium degradation due to multipath fading which in turn leads to hidden terminal problem, the security of the transmission medium, which is open to anyone within the geographical range of transmitter, and leads to the need of the encryption, the lower transmission rate of around 1 to 10Mbps and the need of the licensed when applying wireless over radio technology. However, some countries, USA, European countries and Japan have stated that the use of ISM not required the license to operate at the ISM (industrial, scientific and medicine) frequency.

In this paper we have observed that WLAN Delay (sec) and other parameter shows in figures with is more in comparison with Ethernet network .the difference is quite less of the order of 0.000045 seconds but on the other hand load on the nodes (workstations) has been decreased in case of Ethernet scenario which shows the improvement in the network while using with the CSMA/CD Ethernet.

References

[1] http://www.cisco.com/warp/public/102/wwan/quick-ref.pdf)
[2] http://en.wikipedia.org/wiki/List_of_WLAN_channels
[3] http://www.cisco.com/en/US/docs/wireless/access_point/1200/vxworks/configuration/guide/bkscgaxa.html
[4] http://www.cisco.com/en/US/docs/voice_ip_comm/cuipph/7920/5_0/english/design/guide/wrlqos.html#wp1041341
[5] http://en.wikipedia.org/wiki/IEEE_802.11g-2003)
[6] http://en.wikipedia.org/wiki/IEEE_802.11n-2009;
[7] http://www.airmagnet.com/assets/whitepaper/WP-802.11nPrimer.pdf
[8] http://www.ciscosystems.sc/en/US/prod/collateral/wireless/ps5678/ps6973/ps8382/prod_white_paper0900aecd806b8ce7_ns767_Netw orking_Solutions_White_Paper.html