International Journal of Engineering Applied Sciences and Technology, 2020
Vol. 5, Issue 1, ISSN No. 2455-2143, Pages 47-51
Published Online May 2020 in IJEAST (http://www.ijeast.com)

NETWORK MODEL ANALYSIS IN OPNET SIMULATION

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***Abstract*— Electronic transfer of data and or information in a particular area requires techniques of telecommunication which is the process of communication between two or among multiple communication systems. The routing of data or information of concern would be dependent of the acceptable communication link of either wired or wireless means, and this must be connected to the already configured server. As there is a need to know which of either local area network (LAN) or wireless local area network (WLAN) would attract demand of the consumer in terms of the flexibility, speed and rate of traffic received; the work in this paper therefore looked keenly to the modeling analysis of both local area network (LAN) and wireless local area network (WLAN) using simulation approach to verify and establish the state of art in the available gap. Parameters of consideration include: Ethernet delay in (sec), Traffic sent (packets/sec) and Traffic received (packets/sec). File transfer protocol (FTP) was used as a traffic application and it was configured for a comprehensive study using Optimized Network Engineering Tools (OPNET) simulator. These parameters were compared in both scenarios, and it was observed that the local area network remained the fastest means of communication over the wireless local area network, as there was no delay in the formal compare to some seconds delay in the later, as the same traffic application was sent in both scenarios. Furthermore, more traffics were considerably received in the case of the LAN over simulated time. According to the simulated results, it has therefore been established that if mobility is not of priority, the local area network is the best. Although, the generated results are OPNET based and there could be little or no different when other network simulators are considered.**

Keywords— **Delay, OPNE, Traffic, Telecommunication**

I. INTRODUCTION

In a communications networks, peripherals, servers, nodes/workstations, network devices, and other devices are joined together to permit data communication. However, with the collection of these components for resource sharing, good benefits are derived from the system. This includes; easy file sharing, great flexibility, low-cost system, more suitable resource sharing, boosts storage space, and deeply enhances communication and availability of information [1]. Furthermore, the drawback of this system according to [1], includes; high initial set-up cost, highly technical skills and expertise, user's undesirable behavior or illicit practices, computer malware and viruses presence, lack of robustness, poses security difficulties and lack of independence. [2] Divides a computer network designed into three to operate over the area they cover. This includes the LAN (Local Area Network: connects a group of a computer with a switch or stack of a switch using a private address scheme). The MAN (Metropolitan Area Network: connects two or more computers that are distant, but located in the same or different cities). The WAN (Wide Area Network: involves LAN to LAN's connection over a telephone line, and satellite, or radio waves). This researched work was based on a comparative analysis of LAN network systems that cover a smaller geographical areas as office building using twisted pair cable (wired local area network: for highest speed and security) and wireless connection (wireless local area network). LAN involves connecting few computers and other devices such as server, hub/switches, and network interface card (NIC) over a transmission media such as twisted-pair cables (transmitting at 100Mbps or 1000Mbps) or coaxial cables. This network is not difficult to design, manage, and maintain, it has little noise, and error because it only covers shorter distance, has high fault tolerance, great data transmission rate, good reliability, less congestion, and very short propagation delay [2]. According to [3], [4], LAN topologies are classified into four, which includes; bus (all devices connected using a single cable), star (using central device to connect all nodes), ring (connects all nodes point-to-point) and mesh (every node on network are connected to each other) topologies. Star topology was used for the comparative analysis of this research work because it has a high tolerance, easy to reconfigure, and fault on any device/cable will not affect the network. On the other hand, WLAN links two or more nodes on a network using radiofrequency. This technology is based on IEEE 802.11standards [5], [6]. The network is flexible and allows for mobility [7], [8]. It uses access point as a central coordinator (infrastructure-based) for deployment or deployed infrastructure less (ad hoc) [9]. The deployment of WLAN in this researched work involves adding access point (router) and wireless workstations to make difference for comparison with

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the traditional LAN. Different simulation tools are available for network systems to reduce the cost of prediction and evaluation; such as NS-2, NS- 3, NetSim, OMNet++, GlomoSim and OPNET [10], [11]. However, OPNET was used in this work because it presents graphical editors that indicate the actual structure of the network and its components [12]. Network parameters, which also refers to as quality of service (QoS) that guarantee delivery of data over the network [13] was used to carry out the comparative analysis

The remaining part of this research work is structured as follows: Section II. Presents the simulation environment in OPNET modeler where two network systems were modelled with different network components and the modeling was based on three global statistics. File application protocol was configured on each node as application traffic. Section III. Presents results obtained from the simulation using tables and graphs prepared in OPNET environment. Section IV concludes the work, as remarks was specified in this section

II. METHODOLOGY AND PROCEDURES

This work modeled and deployed network systems using simulation approaches that lessen the cost of prediction, valuation, and implementation before implemented. OPNET modeler 17.5 academic edition was employed to implement the network systems. Two network scenarios were set-up, which is a local area network (LAN) and wireless local area network (WLAN) with each scenario having 20 workstations respectively. The two scenarios were modeled based on global statistics such as Ethernet delay (sec), traffic sent (packets/sec), and traffic received (packets/sec). The application traffic configured on each node of the network was a file transfer protocol. This was used to examine the behavior of each metric on the network. The following networking components were deployed in the first scenario of figure 1. Here, the application definition was configured to use only file transfer protocol as the traffic application for the network system. The Profile definition was configured to establish a user profile. This was further detailed on each node to generate application traffic. Ethernet server running over TCP/IP was configured to use FTP server applications. Ethernet32 switch was considered for the network, which was connected to both the Ethernet server and the Ethernet workstations using a 100base-T duplex link operating at 100Mbps. The second scenario of figure 2, contained all the configured components of scenario one with additional wireless features technology to differentiate it from the first scenario which includes wireless router representing access point with one Ethernet interface and wireless workstations (fixed nodes). The 20 nodes wireless workstations were further configured to maintain 11Mbps. Figure 1-2 below present modeling and analysis of network systems for both LAN and WLAN using OPNET modeler.

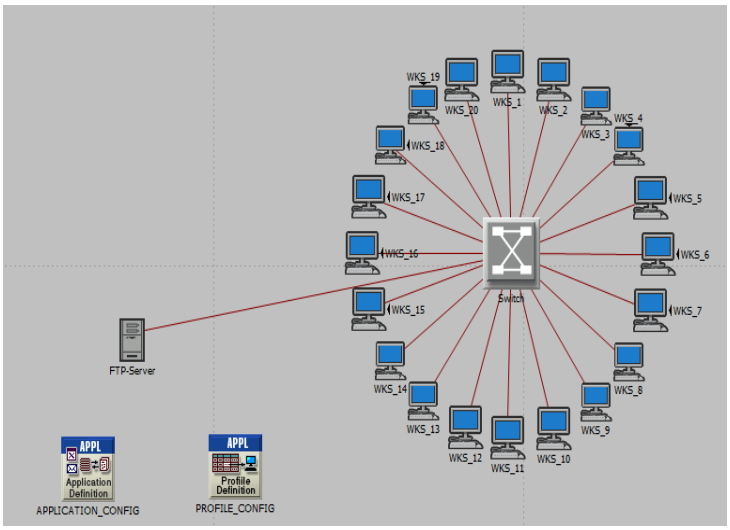

Fig. 1. Modeling of Local Area Network (LAN) with 20 Workstations

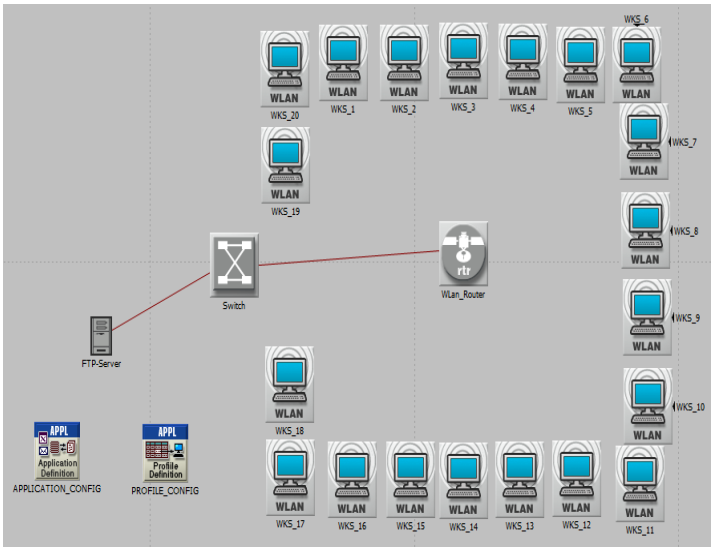

Fig. 2. Modeling of Wireless Local Area Network (WLAN) with 20 Workstations

III. RESULTS AND DISCUSSIONS

The results for this work are presented in table 1-4 and figure 3-5. The two scenarios were simulated for 1hour based on the chosen global statistics for both LAN and WLAN respectively. The results obtained were further analyzed for comparisons discussion, of which both are represented in stacked.

Tables 1-2 represent tables of Ethernet delay (sec) for LAN and WLAN. Figure 3 presents a graph of Ethernet delay (sec) in stacked for the two scenarios.

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Table - 1 Ethernet Delay (sec) in LAN

Packets	Delay (sec)
0.50	0
0.40	0
0.30	0
0.20	0
0.10	0
0.00	0

Table - 2 Ethernet Delay (sec) in WLAN

Packets	Delay (sec)
0.00018	160
0.00015	140
0.00010	120
0.00005	60
0.00000	0

Delay (sec) of 160 seconds was observed when a packets of 0.0018 (packets/sec) was sent in WLAN while no delay occurred in LAN even with higher packets as indicated in table 1 and table 2 above. Figure 3 below presents a graph of Ethernet delay (sec) of both scenarios in stacked

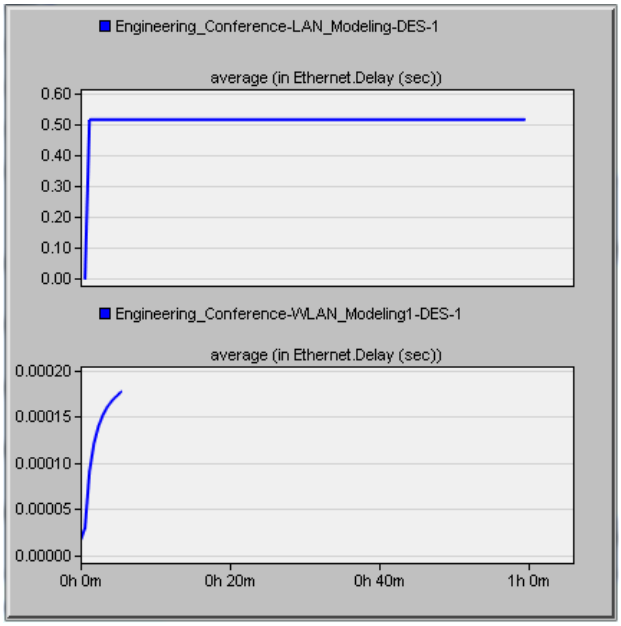

Fig. 3. Comparison of Ethernet Delay (Sec) in LAN and WLAN Scenarios Displayed in Stacked Statistics

Table 3 below represents table of traffic sent (packets/sec) of both LAN and WLAN with time (sec)

Table – 3 Traffic Sent (packets/sec) of Both LAN and WLAN with Time (sec)

Time (sec)	LAN: Traffic Sent (packets/sec)	WLAN: Traffic Sent (packets/sec)
0	350	350
120	250	250
240	200	200
360	150	150
480	100	100
600	80	0
720	70	0
840	60	0
960	40	0

As indicated in table 3 above, the packets experienced decrease with increases in time for both LAN and WLAN, but the packet was more visible with time in LAN than WLAN because no packets was sent in WLAN as the time exceeding 480 seconds (say from 600 seconds above). Figure 4 below presents a graph of traffic sent (packets/sec) of both scenarios in stacked

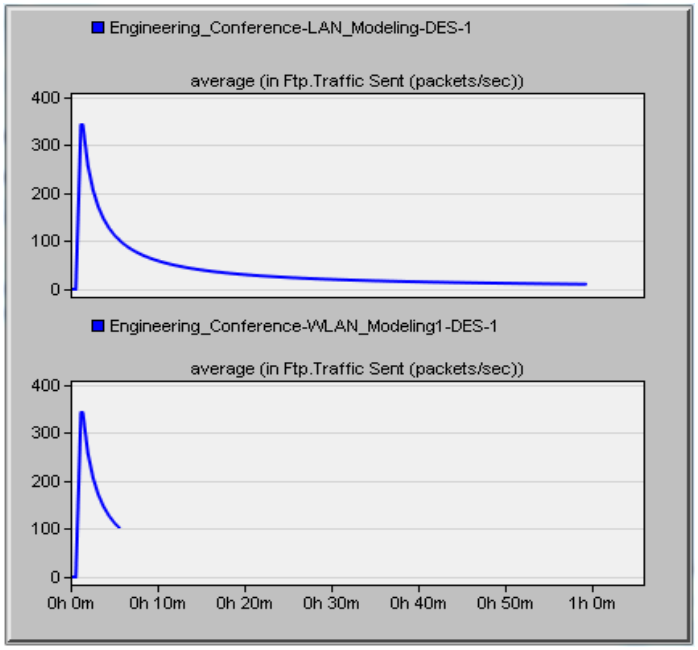

Fig. 4. Comparison of Traffic Sent (packets/sec) in LAN and WLAN Scenarios Displayed in Stacked Statistics

Table 4 below represents table of traffic received (packets/sec) of both LAN and WLAN with time (sec)

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Table – 4 Traffic Received (packets/sec) of Both LAN and WLAN with Time (sec)

Time (sec)	LAN: Traffic Received (packets/sec)	WLAN: Traffic Received (packets/sec)
0	**0.38**	**0.28**
120	**0.28**	**0.20**
240	**0.22**	**0.16**
360	**0.20**	**0.08**
480	**0.10**	**0**
600	**0.08**	**0**
720	**0.06**	**0**
840	**0.05**	**0**
960	**0.03**	**0**

As indicated in table 4 above, the packets received decreases with increases in time for both LAN and WLAN, but more packets were received in LAN when the packets received already dropped to zero in WLAN with more time Figure 5 presents a graph of traffic received (packets/sec) of both scenarios in stacked. Here more packets of 0.38 was observed in LAN as compared to 0.28 packets observed in WLAN. The packets was more received in LAN than WLAN as indicated in figure 5 below

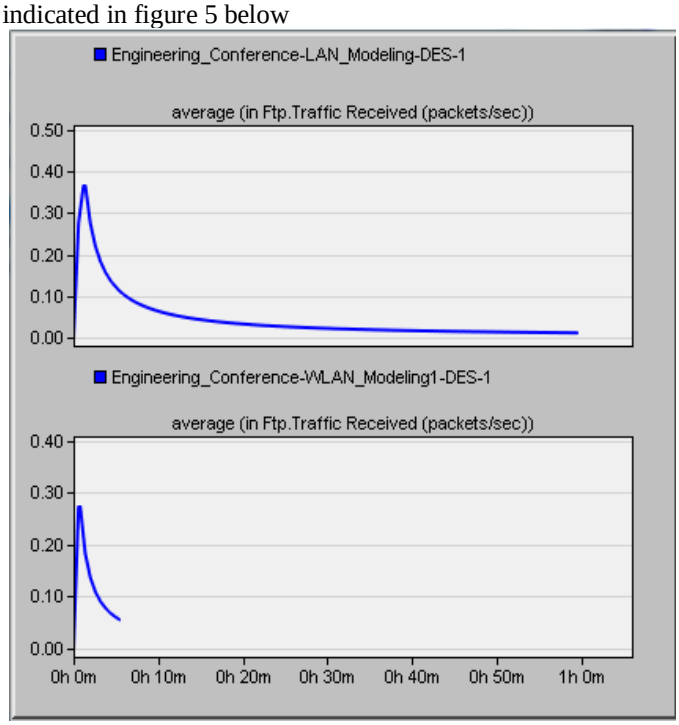

Fig. 5. Comparison of Traffic Received (packets/sec) in LAN and WLAN Scenarios Displayed in Stacked Statistics

IV. CONCLUSION

The performances of both LAN and WLAN had been analyzed in detailed. The modeled scenarios of both local area networks and wireless area networks were investigated for 1 hour using a simulation approach. In our results, no significance delay (sec) was observed in the local area network (LAN) whereas wireless local area network (WLAN) experiences more delay of traffic generated by the application. More application traffic (packets/sec) was received in the local area network than the wireless local area network with the same amount of traffic application sent in both scenarios. In conclusion, the results obtained on this researched work proved that the local area network performed better than the wireless local area network in terms of delay and traffic in an office set-up if flexibility and mobility are not of major preference. The challenges in WLAN performance could be a result of obvious factors such as distance between the wireless workstations and the access point, physical obstruction between access point and workstations, and or interference within the environment.

ACKNOWLEDGMENT

This work was carried out in the Department of Computer Engineering of the Federal Polytechnic Ilaro, Ogun State, Nigeria under the leadership of Engr. D.W.S Alausa. We kindly appreciate him for the support towards successful completion of the research work

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