Service Level Analysis of Video Conferencing over Wireless Local Area Network

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ABSTRACT

This paper modelled an effective video conferencing application over an existing wireless network. The topology of an existing wireless network was obtained and simulated using the Riverbed Modeler 17.5 software with a view to determining if the existing wireless network was capable of running a video conferencing application. The Riverbed Modeler 17.5 software was used to model and simulates the behavior of network in a wireless environment. The Result analysis showed that, the modeled network has highest delay of 0.1225 bytes and lowest delay of 0.01, which resulted to severe throughput degradation. The throughput result was just 80 (Mbps), which is below the required throughput of 100 (Mbps) for an efficient Video Conferencing application over wireless network. From the results obtained from this simulation work in comparison with the requirement, it showed that the modeled network does not provide sufficient requirements for video conferencing application.

General Terms: Delay, Traffic, Throughput

Keywords: Wireless LAN IEEE 802.11, Riverbed

1. INTRODUCTION

A wireless local area network (WLAN) is a moderate high-speed flexible data communication system implemented as an extension to, or an alternative for a wired local area network (LAN). WLANs also implements shared access technology in their communication network. [1] With the advent of mobile portable computing devices like laptops and PDAs and the Internet revolution have made wireless networks so wide spread in common places. Many people also use wireless networking frequently called Wi-Fi at home to share printers and provide Internet access anywhere within the house. Benefitting from the mobility of broadband internet services of wireless network, the wide spread reliance on networking in every sector of the economy and the rapid growth of the internet and online services are strong indication of shared data and resources. Base on social impact of multimedia sharing, People are growing in demanding to access internet for transferring and receiving multimedia messages over wireless networks. [2]

Wireless Local Area Networks (WLAN’s) became widespread, especially IEEE 802.11 standard, which is a standard network equipment in every domestic or establishing premises [3]. 802.11 standards are mostly used as an extension to Ethernet (IEEE 802.3) [4], which is used as a backbone part of local area network (LAN). However, WLAN can also be used as an alternative to wired LAN in cases were physical interconnection is not possible. With introduction of new multimedia contents, including streaming of high quality audio/video signal over WLAN networks and the emergence of internet TV services have put huge demands on bandwidth, that is to be provided to end user for efficient data delivery.

2. RELATED WORKS

Some of the related works on transmission of multimedia content over wireless local area networks are as follows: The authors [5] presented a research work where a new system that reinstalls the relation between the QoS elements (e.g. routing protocol, sender, and receiver) during the multimedia transmission was proposed. An alternative path was created in case of original multimedia path failure.
The suggested system considers the resulting problems that may be faced within and after the creation of rerouting path. Finally, the proposed system was simulated using OPNET 11.5 simulation package. Simulation results showed that the proposed system outperforms the existing one in terms of QoS parameters like packet loss and delay jitter. The authors [6] presented a paper on multimedia traffic, which was implemented using Real Time Protocol (RTP) and an implementation using Transmission Control Protocol (TCP). The findings was that, the RTP packet encapsulation scheme resulted in on average smaller network packets, which entails some overhead in network efficiency. This overhead is dependent on the encapsulation efficiency of the streams. For TCP this overhead is considerably smaller. The authors [7] showed that a high level of QoS is required for multimedia transmission over wireless networks.

Riverbed Modeler was used to measure various network data such as end-to-end delay between packet sending and arrival times, throughput of traffic sent, jitter of packets received, and packet loss that occurs in the network. The authors [8] presented an MPEG-4 video transfer, over IEEE 802.11 WLAN which explores the possibilities of using existing IEEE 802.11b and 802.11g networks to stream video content. The objective was to evaluate Wi-Fi network as a means of transporting video services. Experiment performed on the private network showed some issues that manifest as breaks in transmission and unstable throughput and quality of a streamed video. Due to the shortcomings of the reviewed literatures, there is a need to design an effective video conferencing application over wireless local area network with the view to reducing delay, packet loss, and jittering.

3. METHODOLOGY

The methodology adopted for the research is itemized as follows

i. Obtaining the network topology that will run the video conferencing application
ii. Create and configure the topology in the Riverbed Modeler software project editor.
iii. Run the simulation
iv. Collect the output result of this simulation
v. Validation

The work flow model is shown in Figure 3.1. The workflow model is a representation of how the overall results are obtained.

3.1 Initializing Network Setup

The main objective of this design is to use Riverbed simulation to model the behavior of video packets over WLAN with respect to different performance matrices i.e. General Statistics: packet delay variation, packet End-to-End delay(sec), Traffic Received (Packets/sec), Data Dropped(bits/sec) and Objects Statistics which include: Delay (Sec), throughput (bits/sec) according to the network design. The structure of the network is shown in Figure 3.2.

The network topology obtained consists of the ground floor, first floor and the second floor. The simulated diagram of the connection of the floors are shown in Figures 3.3, 3.4 and 3.5.
3.2 Choosing Individual Statics

Individual statistics needs to be chosen with respect to the performance metrics. However, Riverbed modeler does not automatically collect all the statistics in the system. Before running the simulation using Riverbed modeler, the individual statistics dialogue box is used to specify the parameters that constitutes the performance metrics. Figure 3.6 shows the individual parameters selected in the case of this paper.

![Figure 3.6 Selection of Performance Metrics](image)

3.3 Run Simulation

The final stage of the setup was configuring the parameters of Discrete Event Simulation (DES) and running them. Although there are two types of results that can be obtained using the Riverbed Modeler which are the DES graphs and the flow analysis. But the DES graphs was chosen in this work because it does thorough analysis than the flow analysis. Also Before running the simulation, configuration needs to be made to the attributes which is, specifying the length of simulation and the values per statistics.

4. RESULT AND DISCUSSIONS

This paper is limited to the General Statistics of the network which includes wireless LAN Delay (sec), packet End-to-End delay (sec), wireless LAN Media Access Delay (sec), Data Dropped (bits/sec), Traffic Received (Packets/sec), Traffic sent (Packets/sec), and Objects Statistics such as wireless LAN Delay (Sec), throughput (bits/sec) graphs and description of the network are presented in the following sub-section.
4.1 Performance Delay

Delay is an essential metric to characterize the QoS of any network, especially for Video Conferencing application. The delay is defined as the time taken by the system for data to reach the destination after it leaves the source [5]. The delay for any network can be measured at three layers, end-to-end delay, wireless LAN delay and MAC (media access control) delay. Wireless LAN delay depends on used frequency band and media access delay on media access technique and physical characteristic of the standard, while end-to-end delay includes both wireless LAN delay and MAC delay [7]. Figures 3.7, 3.8 & 3.9 showed the results of wireless delay test and MAC delay test, end-to-end delay test.

Figure 3.7 Average (in wireless LAN Delay (sec))

Figure 3.8 Average (in wireless LAN media Access Delay (sec))

The graphs showed that video conferencing application over this network will undergo an amount of delay of 0.1225 bytes per sec. The delay presumes duration for this simulation. The summary of delay performance of the network is shown in Figure 3.10

Figure 3.10 Delay Graph

4.2 Traffic Performance

One of the parameters that can influence the overall performance of the Wireless Local Area Networks (WLANs) is traffic analysis. Traffic analysis includes traffic sent, traffic dropped and traffic received. Traffic sent determines the capability of the system to transmit amount of data from the source point, while traffic received determines the amount of the data received at the destination.
The traffic drop in applications such as video conferencing is often caused by the buffer overflow and the amount of data dropped can be determined from the amount of data transmitted and received. Various tests for traffic performance of the modeled network have been conducted and the result is presented in Figure 3.11.

4.3 Throughput Performance

Throughput is defined as the average rate of successful message delivery over a communication channel. Figure 3.12 showed the graph of the throughput of the entire network.

5. CONCLUSION

The motivation behind the paper presented was to investigate the performance of an existing Wireless LAN, strictly for an application which have high bandwidth requirements such as video conferencing application. Consequently, various tests were performed using Riverbed 17.5 simulator. Performance tests conducted were Delay Performance, Traffic Performance and Throughput Performance. In Delay Performance test, the results were observed for three cases: End-To-End Delay, Wireless LAN Delay and MAC Delay, which indicate that the network under test has high delay. Traffic performance test included three cases: Traffic sent, Traffic Received and Data Dropped.

The results of this test showed that the network has huge amount of data drop, which consequently leads to low amount of data received. Throughput test shows that under heavy loads such as video conferencing, the network data throughput is lagging the required throughput which is 100(Mbits/sec) [9]. It has been observed from the overall obtained results of this simulation that the wireless LAN under consideration is not a better choice, especially for the applications requiring high bandwidth. This can be due to the fact that there exists many access points on the network.
REFERENCE


