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يناير 2023م

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Investigate the Effect of Video Conferencing Traffic on the Performance of WiMAX Technology

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Abstract: in recent years, WiMAX technology has been wildly used to provide broadband connections to end users. Many modern applications, such as Video conferencing, can be run over this network. Running application soverthe WiMAX platform may decrease its performance. This paper evaluates the influence of Video conference traffic on WiMAX. OPNET is used to carry out the experiment part. Three different types of Video conferencing traffic were simulated. WiMAX delay, load and throughput were measured. The outcome of this research shows that the lowest performance of WiMAX was in the case of Virtual Conference Room traffic, and the best WiMAX performance was under low video traffic.
Keywords:*WiMAX, VideoConference, OPNET.*

I. Introduction

IEEE has released the 802.16 standards to systematize the Worldwide Interoperability for Microwave Access (*WiMAX*) technology [1]. It is a type of wireless broadband communication technology. It offers a connection with data rates near 70 Mbps, approximately, and an extensive coverage range of up to 50 km in line of sight implementation. Since 2001, the IEEE has released many updates to its original 802.16 standards. For Fixed wireless access 802.16d was released, and the new IEEE 802.16e standard with mobility capability. Many WiMAX service classes were present and started using them from 2000 until data. Table 1 provides an overview of the various WiMAX standards and their characteristics.[2].Nonetheless, regardless of the advantages of WiMAX in data rate and coverage, the high charge of WiMAX implementation struggles customers to use the technology in a large geographical area[3].

Table 1: Comparison of Service Classes in WiMAX

Service Class	Data delivery service	Typical applications	QoS Specifications
Unsolicited grant service (UGC)	Real-time Fixed-rate service	Voice (VoIP) without silence suppression	Maximum sustained rate, Maximum latency tolerance, Jitter tolerance
Extended real-time Polling service (ertps)	Extended real-time variable-rate service	Voice (VoIP) with silence suppression	Maximum sustained rate, Maximum reserved rate, Maximum latency tolerance, Jitter tolerance, Traffic priority
Real-time Polling service ((etrp)	Real-time variable- rate service	Streaming Audio or video	Maximum sustained rate, Maximum reserved rate, Maximum latency tolerance, Traffic priority
Non-real-time polling Service (rtps)	Non-real-timevariable- rate service	File transfers	Maximum sustained rate, Minimum reserved rate, Traffic priority
Best-effort Services (BE)	Best-effort service	Web browsing email	Maximum sustained rate, Traffic priority

In the past, People must travel long distances to attend meetings; however, videoconferencing solved this problem. Through this, one person can use their camera to speak with another person while remaining in the same place. He can travel easily to the meetings. It saves both money and time. During theCOVID-19 pandemic, millions of individuals worked remotely, and the number of people using video conferencing is growing exponentially[4]. Research claims that in March 2020 download for video conferencing platforms exceeded 62 million. Applications for video conferencing have recently become indispensable for both those who work and those who do online interviews. There are advantages and disadvantages to the unexpected rise in traffic for these applications [5].

II. Related Study

In evaluating VoIP and Video streaming performance over a fixed WiMAX network. Multiple computing traffic sources and calculating the capacity of their WiMAX equipment to handle [5]. In [6], the parameters of video quality refresh rate and pixel resolutions were selected to fulfil the various demands of streamed video traffic over WiMAX networks. The second goal of this study was to determine whether WiMAX access technology could deliver equivalent network performance to ADSL for streaming video applications. In this study, specific circumstances and parameter values were taken into account[7]. The current study's data suggest that 30 frames per second, or roughly 20 MHz bandwidth, is required for video traffic communication.However, the WiMAX network did not support video conferencing traffic at 30 frames per second based on the results of simulations and observations.Although, as stated in the approach, the acquired findings show the best statistics of video conferencing traffic at a frame rate of 15 fps and a pixel size taken as 128*120 in the simulated situation.Additionally, it was discovered that transmission of choppy video occurs if the rate is fewer thanten frames per second .in [8] the performance of IPTV over WiMAX was analysed under different rain environments ,namely free space, outdoor to indoor and pedestrian .OPNET was used to evaluate the performance of IPTV over WiMAX. The results show that the free space path loss model is a primary path loss model with all other parameters related to terrain and building density .Modeling and resource allocation for mobile video over WiMAX broadband wireless networks was conducted in [9]. They compare the performance of three different scheduling methods for video over WiMAX networks: Earliest Deadline First (EDF), Deficit Round Robin (DRR) and a combination of the two. The study concluded that under overload, EDF introduces unfairness[10]. DRR, with a deadline, is fair and gives the best performance.

III. Experiment Setup

A. WiMAX Deployment Scenario

Due to its ability to transmit high data rates across great distances wirelessly, WiMAX is beneficial in situations where it is impossible to lay down physical wires. Figure 1 depicts a typical WiMAX network implementation scenario[11]. It demonstrates how the WiMAX Base Station (BS) in a remote location connects mobile users to the core network via an Internet hotspot, an office network, and a LAN segment.[12]

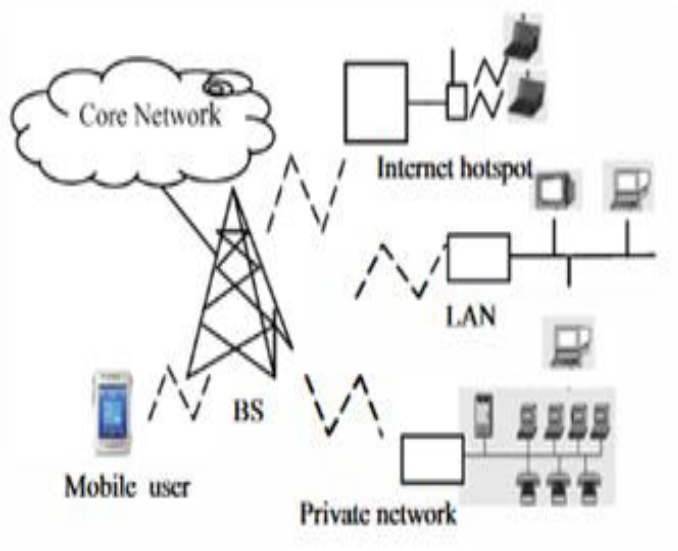


Figure 1: WiMAX Deployment Scenario

B. WiMAX Modeling

As shown in figure 2, the simulated WiMAX network consists of one WiMAX cell, with one base station (BS) in the cell and four subscriber stations (SS).The cell radius is fixed at 5.00 Km[13]. Application definitions was used to generate Video conferencing traffic. Three types of video traffic were simulated[14]. The simulation was run three times for (Low Video traffic, High Video traffic and VCR Video traffic). The duration of the simulation run was 5 minutes.

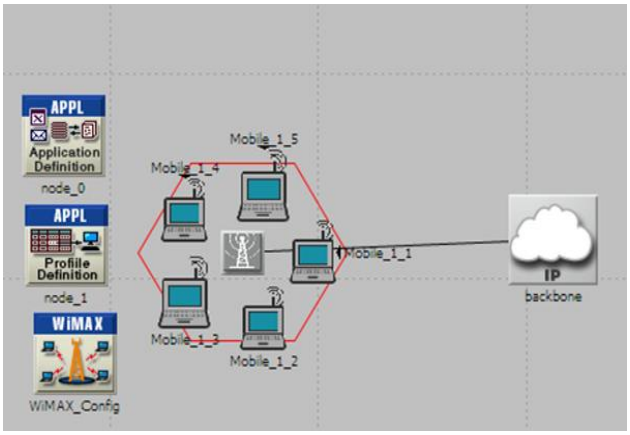


Figure 2: WiMAX Experiment Setup

C. Performance Metrics of WiMAX

A. Throughput

The rate at which data can be transferred over the network is known as throughput[15]. The WiMAX forum gives a recommended throughput range of 4-384 Kbps.

Throughput =(Number of delivered packets * Packet size * 8 bit) / Total duration of simulation [16]

B. Load

Load shows when the network is experiencing too much traffic to handle. Bits/second (b/s) is used to measure the overall load[17].

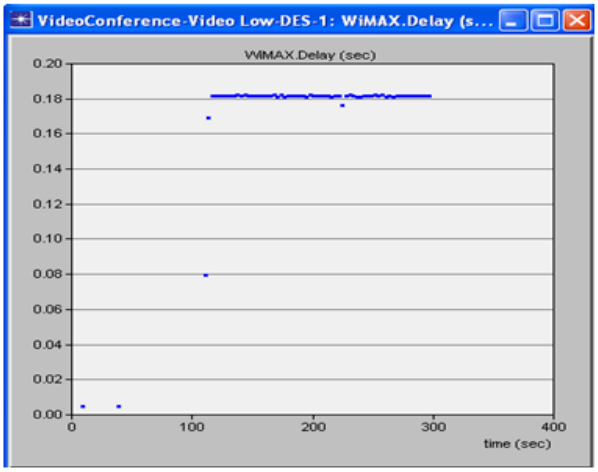
C. Delay(Latency)

Delay indicates the time a packet takes to arrive at the destination. Based on the WiMA Xforum, the delay should be less than 150 ms[18].

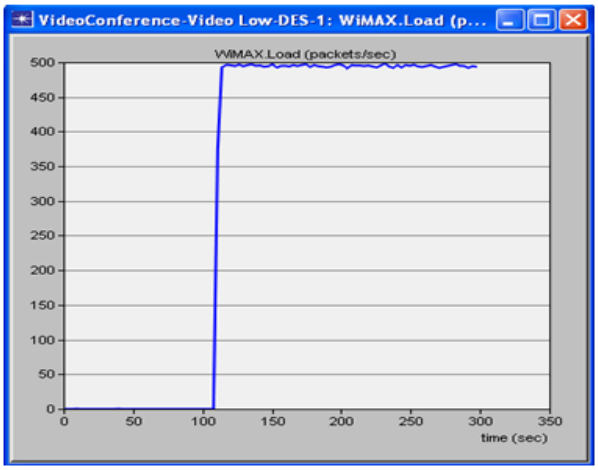
Delay= Propagation time + transmission time + queuing time+ processing delay[19].

IV. Simulation Results

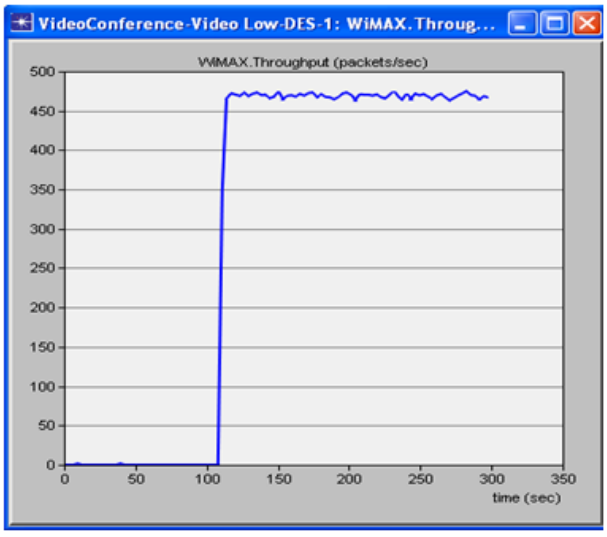
1. Scenario 1. In this run, Low Videoconferencing was generated in the modelled network. WiMAX delay, Load and throughout were measured. Videoconferencing traffic sent was calculated[20]. The simulation was run for 5 minutes. The figure shows in figure **3.**



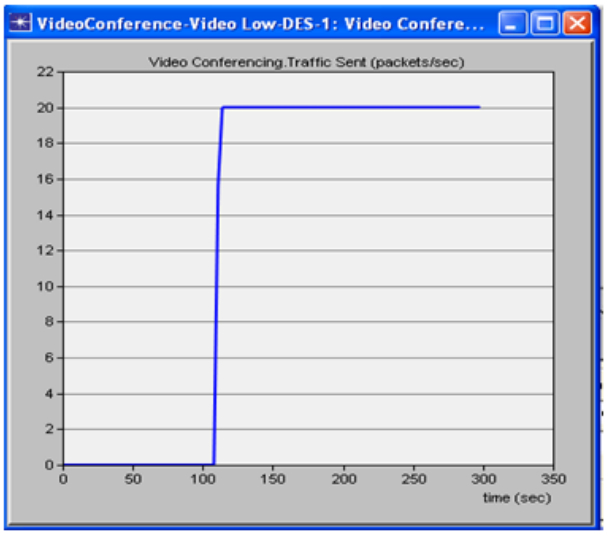
A: WiMAX Delay



B: WiMAX Load

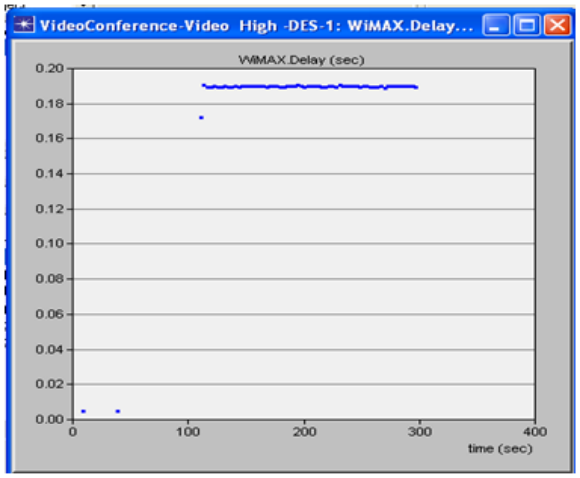


C: WiMAX Throughput

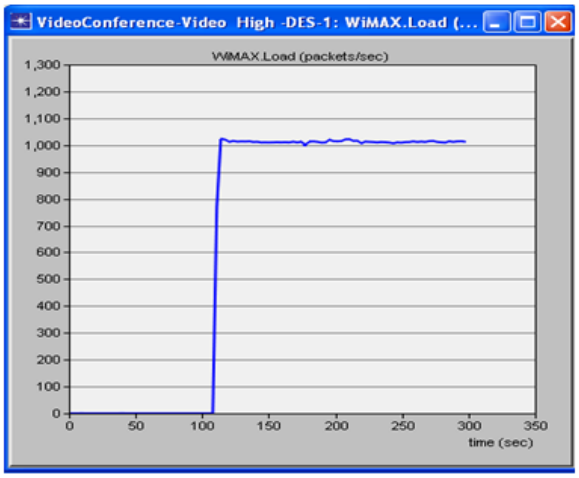


D: Video Conference Traffic Sent

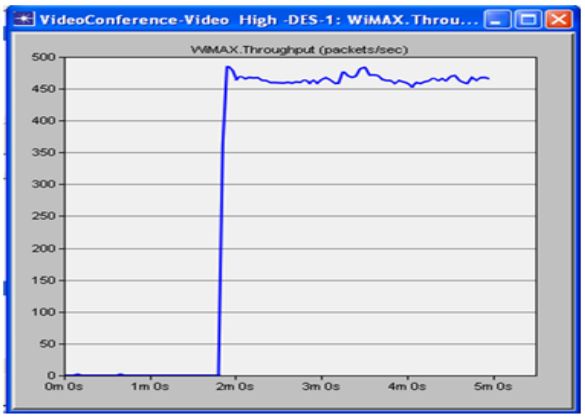
2. Scenario 2: High video conferencing traffic was generated in the modelled network. WiMAX delay, Load and throughout were evaluated[21]. Videoconferencing traffic sent was calculated. The simulation was run for 5 minutes.Figure4 presents the result from this part.



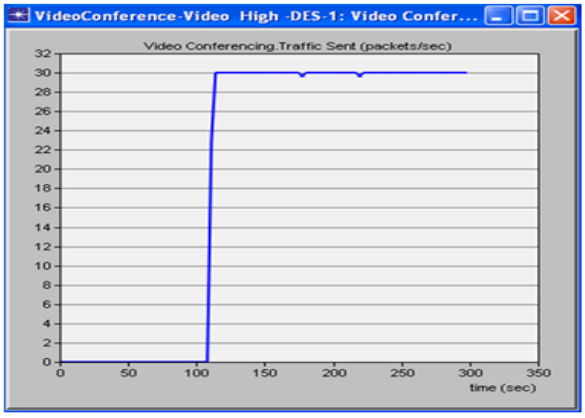
A: WiMAX Delay



B: WiMAX Load

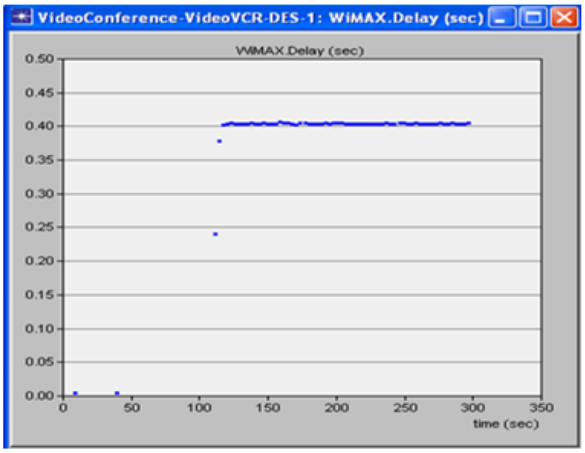


C: WiMAX Throughput

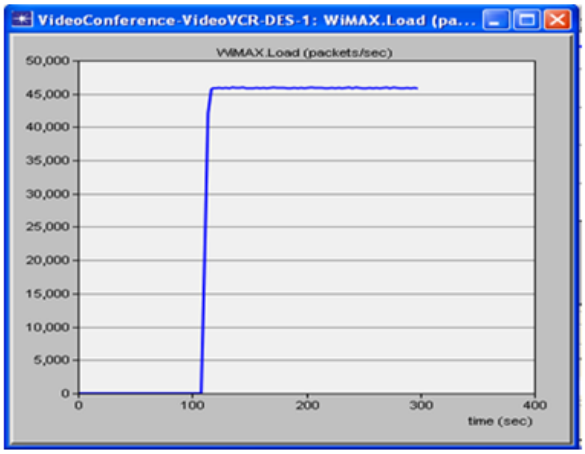


D: Video Conference Traffic Sent

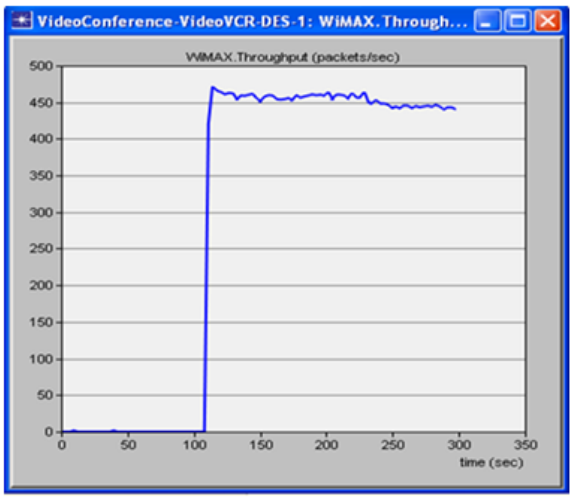
Scenario 3: Virtual Conference Room (VCR) was created in the WiMAX network in this set-up. WiMAX delay, Load and throughout were measured. Videoconferencing traffic sent was calculated. The simulation was run for 5 minutes.



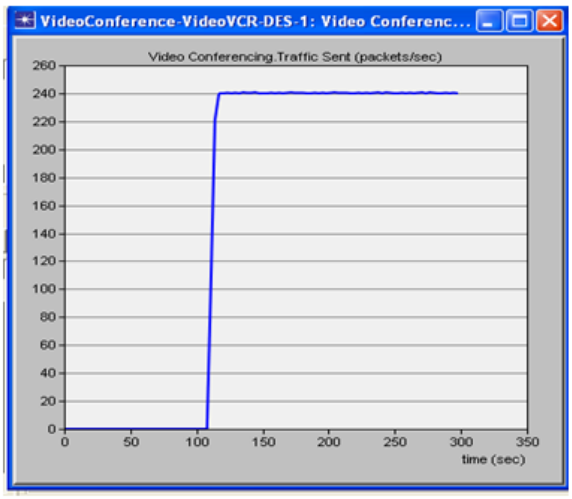
A: WiMAX Delay



B: WiMAX Load



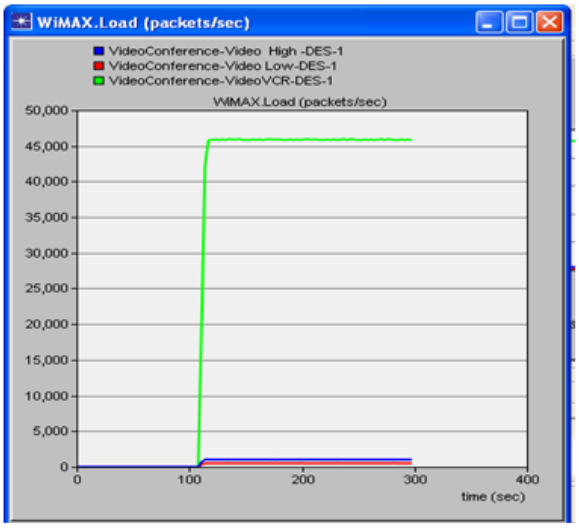
C: WiMAX Throughput



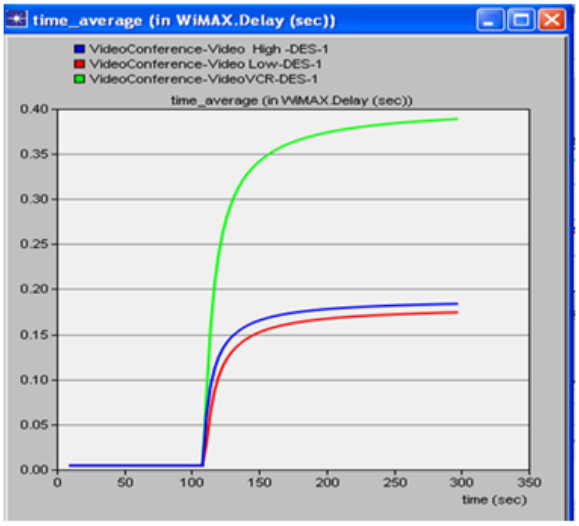
D: Video Conference Traffic Sent

Result Analysis

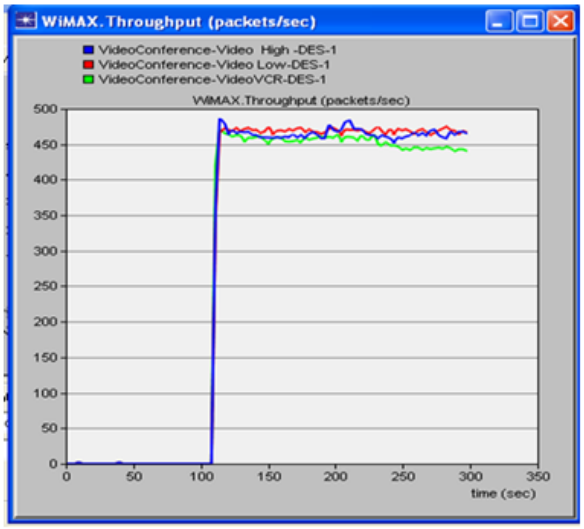
Toevaluate the impact of the three types of video traffic on the performance of WiMAX, theresults from each scenario was collected in one graph as shown in figure 5.According to the development, the highest WiMAX load was in the case of Video VCR traffic. It was slightly above 45.0000 packets/second. In addition, the load was approximately 1000 packets/second for low and high video traffic. In terms of delay, the highest delay was from VCR video traffic. It was near 0.4 seconds. The slightest hesitation was almost 0.16 seconds in case of low video traffic. Regarding the delay, the highest value was in VCR traffic. It was 0.38 seconds. High video traffic has introduced 0.18 seconds.The minor delay was from low video traffic at 0.16 seconds. Moreover, throughput was nearly equal for the three types of video traffic. It was nearly 480 packets/second. Finally, video traffic sent was at 240 packets/second when VCR traffic was generated in the network. In contrast, the traffic sent was 30 packets/second in high video traffic and 20 packets/second in low video traffic.



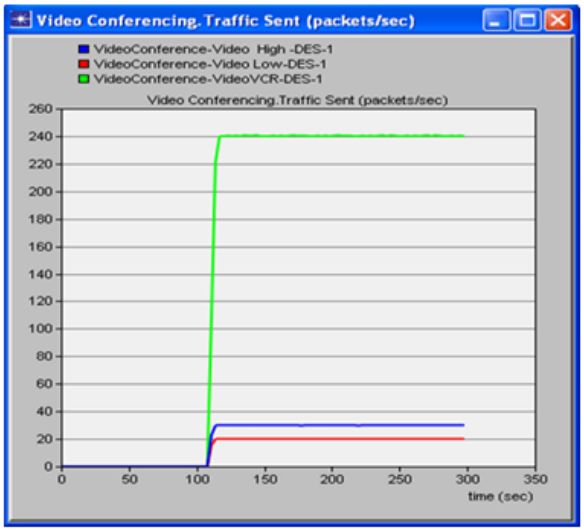
A: WiMAX Delay



B: WiMAX Load



C: WiMAX Throughput



D: Video Conference Traffic Sent

V. Conclusion

In this paper, the influenceof video conferencing traffic on theperformanceof the WiMAXnetwork was investigated.OPNET was used to simulate the WiMAX network. To approach a realistic environment, three levels of Video traffic were simulated—low, High and VCR video traffic.To assess the effect of video trafficWiMAX load, Delay and throughput were determined.The study concludedthat VCR traffic has the highest impact on WiMAX performance.in contrast, The best performance for WiMAX was in the case of low video traffic.

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