International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Impact Factor (2012): 3.358

Performance Evaluation of QoS in WLAN-UMTS Network Using OPNET Modeller

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Abstract: ***Seamless connectivity is need of next generation wireless network (NGWN). WLAN, WiMAX and UMTS are the main components of wireless network connected in integrated manner. These networks, each with its own characteristics, connected to a common IP-based core network to provide mobile user with seamless connectivity. One of the major issues for the converged heterogeneous networks is to provide seamless connectivity with QoS support. In this paper we integrated WLAN and UMTS network and evaluated QoS parameters for Video Conferencing and FTP applications.***

Keywords: WLAN, WiMAX, UMTS, QoS, NGWN

1. Introduction

In these days, telecommunication services such as video on demand, music download, video streaming, video conferencing and VoIP are becoming part of user's daily activities. These applications demand high quality service, particularly for voice and real time sessions. So it is very important to increase the quality of data for telecommunication as well as the seamless connectivity between the users. One of the major issues for the converged heterogeneous networks is providing a seamless vertical handover (VHO) with QoS support. In this paper we have simulated integration of WLAN and UMTS networks using OPNET Modeler for video conferencing and FTP applications. Rest of the paper is organized as follows: Section II represents the contribution of researchers in this field. Section III presents the simulation setup for WLAN and UMTS integrated network. Section IV provides the results of simulation and section V represents the conclusion and future work.

2. Related Work

The main motive of successful vertical handover is always best connected (ABC) [1]. In [2] a method was introduced to facilitate seamless vertical handover between wide area cellular data networks such as UMTS and WLANs using the Stream Control Transmission Protocol (SCTP). Architecture for interworking between a WLAN and the UMTS was presented in [3] and the uniqueness of that architecture was that the IP multimedia subsystem proposed by the 3GPP had been used as an arbitrator for network coupling and real-time session management. HSUPA transport network flow control algorithm was introduced in [4] that handles congestion situations efficiently and supports Quality of Service differentiation. The need of vertical handover was End-to-End Vertical Handover (E2EVH). The performance of the system was found out to greatly differ with the use of different jamming signals [5] [6]. The different integration mechanism of UMTS and WLAN gives the different results for jitter, MOS value, delay, throughput etc [7]. In [8], authors introduced vertical handover in multi-homed mobile node that relies on received signal strength and threshold along with quality of services factors. The main issue was the lower signal strength while moving between heterogeneous access network technologies [9]. In [10], authors implemented several projects with different types of networks and simulated in different case studies offered by OPNET simulation to make Intra-technology handover (horizontal handover) switched in each network and Inter-technology handover (vertical handover) by interworked between two HWNs. But the main problem in heterogeneous networks was the unsuccessful connection between WiMAX and UMTS [11]. In paper [12], the authors simulated WiMAX and UMTS successfully and also all three wireless technologies such as WLAN, WiMAX and UMTS were successfully integrated.

3. Simulation Setup

In this paper we have integrated WLAN and UMTS network using OPNET Modeller. Fig.1 shows the scenario of WLAN-UMTS heterogeneous network. In this scenario, we used 5 cells in which two cells consist of WLAN, each having 5 mobile nodes and three cells of UMTS network, each having 2 mobile nodes.

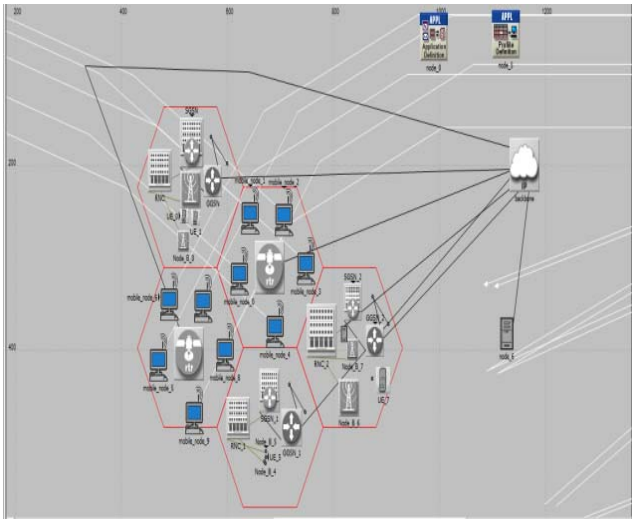

Figure 1: WLAN-UMTS NETWORK

The simulation is done for two applications, one is video conferencing application and the other is FTP application. The setup for both the applications is same as shown in Fig.1 The performance of these two networks has been evaluated on the basis of load, delay and throughput as quality of service (QoS) parameters.

4. Results for WLAN-UMTS Integrated Network

In the first scenario for video conferencing application, the simulation was done for 10 minutes. The same setup was run with FTP application for 10 minutes. Fig. 2-8 presents QoS parameters for the two scenarios used in this paper.

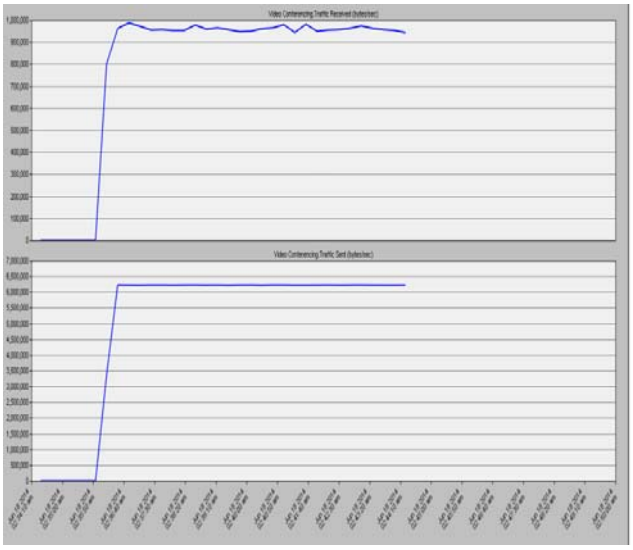

Figure 2: Video Conferencing Traffic Sent and Received

Fig. 2 shows the Video conferencing traffic sent and received. It is cleared from the above figure that the sent signal was 6,250,000 bps whereas the received signal was around 1,000,000 bps.

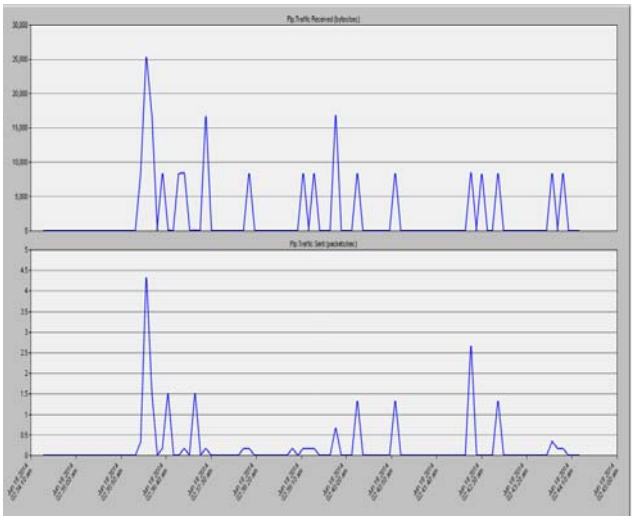

Figure 3: FTP Traffic Sent and Received

Fig. 3 shows the FTP signal send and received. As shown in the Fig.3, the data drop was very less in the case of FTP.

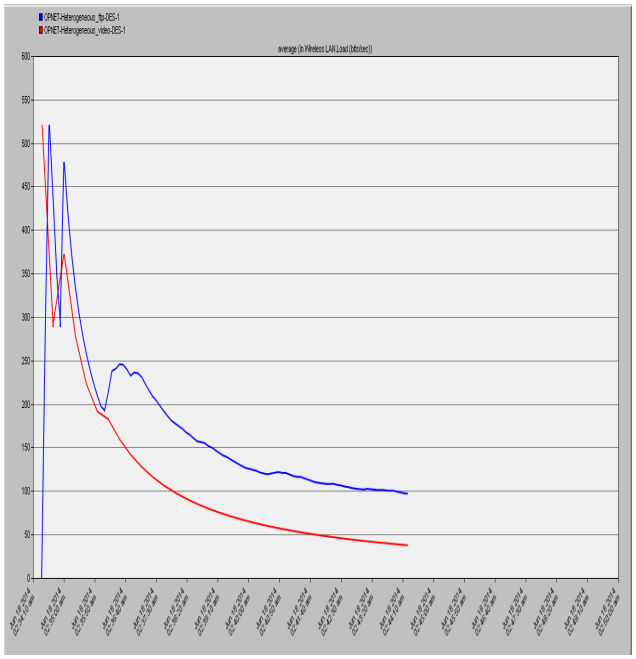

Figure 4: LOAD ON WLANs

The fig. 4 shows the load in both the scenarios. It is clear from the figure that the load of ftp is higher than that of video conferencing application. The maximum value of load in video conferencing as well as ftp is 520bps approximately. The minimum value for ftp is around 100b/s and for video conferencing its value is 50b/s.

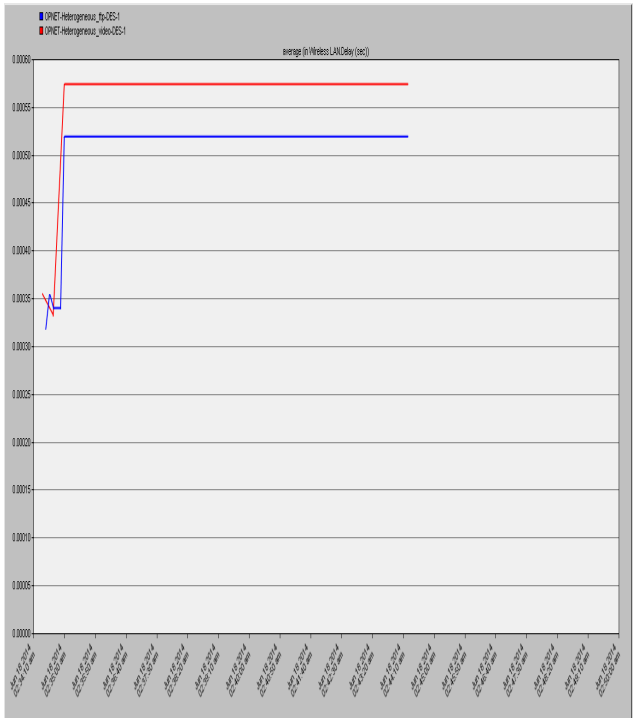

Figure 5: DELAY IN WLANs

Fig. 5 shows the delay in the WLAN networks. The delay in the video is higher than the ftp, as shown in the above figure.

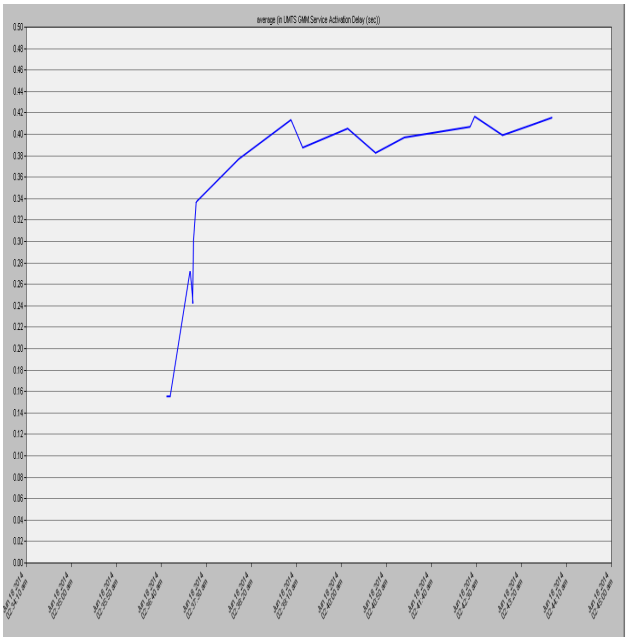

Figure 6: Service Activation Delay in UMTS Networks

Fig.6 shows the service activation delay of UMTS networks. The maximum value of this delay is around 0.42 sec. and minimum value is around 0.15 sec.

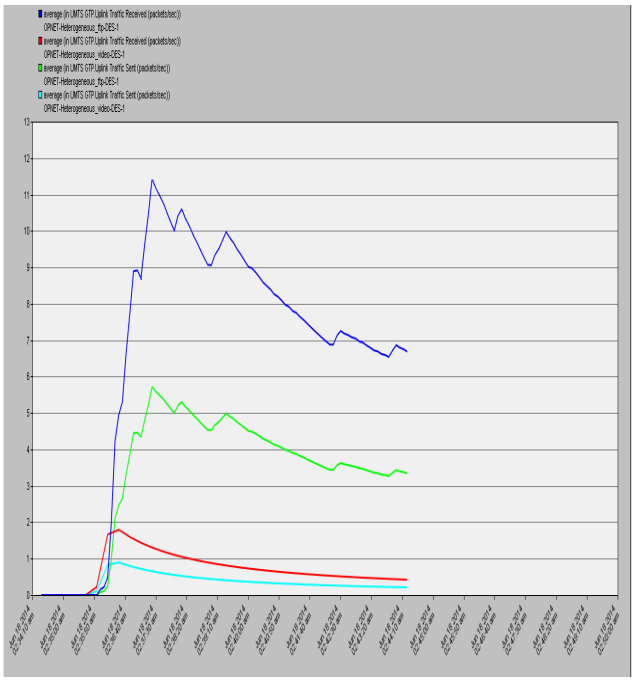

Figure 7: UMTS Networks UPLINK Traffic Sent and Received

Figure 7 shows the UMTS networks uplink traffic sends and received.

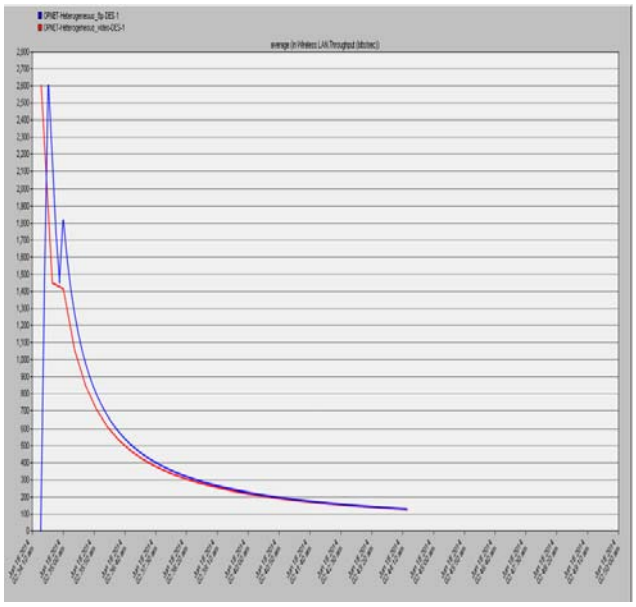

Figure 8: Throughput

Fig. 8 shows the throughput of the networks. The throughput of ftp is slightly better than the video, as shown in the above figure.

5. Conclusion and Future Work

In this paper, performance analysis of WLAN-UMTS heterogeneous network is done for video conferencing and FTP applications using OPNET Modeller. The simulation results show that the throughput of network with ftp application is good as compared to the network with video conferencing. But the delay in video network is higher than the ftp network. For future work number of networks in this structure can be increased and simulated with different applications. The simulation time can also be increased for performance evaluation.

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