Performance Evaluation of IPTV over WiMAX

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ABSTRACT

In telecommunications, Triple Play service is a business term for providing the high-speed Internet access and television, two bandwidth-intensive services, and a less bandwidth-demanding (but more latency-sensible) telephone service, throughout a single broadband connection. In this paper, the impact of mobility of mobile WiMAX subscribers on video on demand (VOD) over WiMAX is examined by taking into consideration the SVC codes (scalable video coding) for video streaming. OPNET simulator 14.5 is used for this experiment. For comparing the performance of Internet Protocol television (IPTV) over WiMAX, different performance matrices i.e. packet end to end delay, packet delay variation, delay and load matrices are used. The simulation result indicates that the load increases and delay decreases after a certain speed and there is no change in the packet end to end delay and packet delay variation.

Keywords: WiMAX, SVC, OPNET, IEEE 802.16, wireless networks, IPTV

I. INTRODUCTION

Internet Protocol Television (IPTV) is a method of providing digital audio and video data through an IP broadband network, marketing deployments of IPTV services by telecommunication organization all around the world continue to enhance, and becomes a host of unique functional challenges for cable, telecom, and satellite TV suppliers [1]. Global ability for Microwave Access (WiMAX) technology is one of the future communication which is capable for providing high Quality of Service (QoS) at high data rates for IP networks. The Quality of Service (QoS) and high data rate assurance offered by this technology has built it commercially feasible to support multi-media applications i.e. video gaming, video telephony, and mobile TV broadcasting. System architecture to support high definition video broadcasting (i.e. H.264/AVC, MPEG-X and SVC) that offers a mobility of 30 km/h in an urban and sub-urban environment has been formulated [2], [3]. The International Telecommunication Union focus group on IPTV (ITU-T FG IPTV) defined IPTV as multimedia services i.e. video/ television/ text/audio/graphics content delivered across IP based networks (which also sometimes triple play services) The range of service suppliers which are involved in deploying IPTV services is from satellite and cable TV carriers to the private network operators and big telephone companies in various parts of the world. IPTV has large number of characteristics [1] including: Support for interactive TV, interactive means the two-way abilities of IPTV systems which permits service suppliers to deliver a complete list of interactive TV applications

II. Literature Review

Y. Zhang *et al*., [3] studied the basics of Quadruple Play and Triple Play services, and a few popular and common applications for the Triple Play architecture. They also studied the pricing model adapted for supporting Triple Play services followed by a simulation study on OPNET 11.5 to understand and analyze QoS parameters such as jitter and end to end delay created by video, voice and data traffic as they traverse routers assembled with many scheduling mechanisms.

C. Hellberg *et al*., in 2010 [8] showed an experimental network infrastructure giving E2E QoS, using a combination DiffServ and MPLS technologies in the core network and WiMAX technology for high priority services (VoIP, High Quality Video Streaming) transmission as the wireless access medium

G. Galitzine *et al*., [12] analysed the performance of common packet scheduling methods which are used in DiffServ Triple Play architecture. The performance of WFQ, WFQ-LLQ and PQ schemes was evaluated, in order to find out the most suitable solution for the fundamental network.

C. A. Papagianni *et al*., [14] talked about the architecture of network system in which the 802.16e which is operating in PMP mode was utilized for last mile access and the authors examined some of the Triple Play applications which include Infotainment and e-Education. A study of the delivery of Triple Play service over 802.16e was described and the evaluation of performance for a typical emerging market scenario showed that 6-8 simultaneous video sessions can be endorsed for over an 802.16e network operating in PMP mode of operation.

N. Zotos et al; [17] studied how to obtain Network Utility Maximization (NUM) in NGN running Triple Play services. By examining the features of most of its traffic classes, they explicitly showed their usage as the function of allocated bandwidth. They also further developed the NUM objective

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as a non linear programming problem with both equality and inequality constraints. Many useful results are indicated on the new characteristics of the NUM-based scheduling.

K. Ozdemir *et al*., [18] observed user capacity of mobile WiMAX systems for these three services (Triple Play services) by taking into consideration different link interference scenarios, link characteristics, modulations, QoE requirements and QoE Classes. He also examined the effect of header compression and suppression methods and their impact on capacity.

III. WIRELESS IPTV OVER WIMAX ARCHITECTURE

This section describes the architecture of IPTV over Mobile WiMAX for providing the better IPTV services to end users. IPTV service providers must have an suitable IP network to ensure QoS (Quality of Service) at the ser-vices level. The QoS for providing IPTV services depends specially on network bandwidth and performance. The general network architecture of the IPTV application over WiMAX is shown in Figure 1.

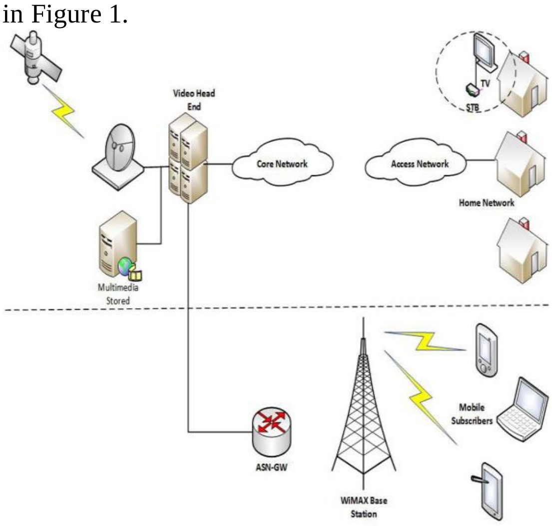

Figure 1. Deploying IPTV Services to both Fixed and Mobile Subscribers

On the other hand, the Access Service Network- Gateway (ASN-GW) which is managed by a Network Access Provider (NAP), consists one or more ASN gateway and one or more base stations that make the radio access network. The ASN gateway does the following functions [7]: Network discovery and selection of the subscriber's preferred CSN/NSP; user and service credentials to selected NSP; IEEE 802.16e-based layer 2 connectivity with the Mobile Station (MS); Relay functionality for establishing IP connectivity between the Connectivity Service Network (CSN) and mobile station; Mobility-related functions i.e. location management, handover and paging with the ASN, including sup-port for mobile IP with foreign agent functionality; AAA proxy: transfer of device, Radio Resource Management (RRM) and allocation based on the QoS policy and/or request from the Application Service Provider (ASP) or the NSP;

IV. EXPERIMENTAL SETUP

In our simulation we had taken the effect of velocity of mobile WiMAX Mobile Nodes over Mobile WiMAX is evaluated by using OPNET simulator. For simulation we have taken 4 different scenarios with name WiMAX6, WiMAX7, WiMAX8 and WiMAX9. In all simulation scenarios mobile nodes are moving with different velocity. In WiMAX 6 Mobile Nodes have 60 km/h velocity, in WiMAX 7 has 70 km/h, in WiMAX 8 is 80 km/h and in WiMAX 9 nodes have 90 km/h velocity. In each scenario three hexagonal cells are taken. Each cell has a radius of 25 Km, in each cell consist of 1base station and 8 mobile nodes. These nodes are circularly placed. The BS connected to the IP backbone via a OC3 WAN link. The node 0 is connected to backbone through ppp_sonet_oct1 link. The node 2 is also connected to video server through ppp_sonet-oc12.

No. of Wimax Station	WiMAX6, WiMAX7, WiMAX8
Cell Radius	25 km
No. of Mobile Nodes Stations per BS	8
No. of Mobile nodes in the network	8
Speed of the mobile nodes	60, 70, 80, 90 km/hr
Simulation time	600 sec
Base Station Model	wimax_bs_ethernet4_slip4_router
Mobile Nodes Station Model	wimax_ss_wkstn
ASN Gateway Model	ethernet4_slip8_gtwy
IP Backbone Model	ip32_cloud
Voice Server Model	ppp_server
Link Model (BS-Backbone)	PPP_DS3
Link Model (ASN - Backbone)	PPP_SONET_OC1
Physical Layer Model	OFDMA 20Mhz
MAC Protocol	IEEE 802.16e
Multipath Channel Model	ITU Vehicular A
Scheduling Type	ertPS, nrtPS
Application	FTP
Voice Codec	G 711
FTP Load	High

V. RESULTS

Here various simulation result of VOD over WiMAX is analyzed by varying velocity of nodes. Figures 4.5 to represent the result of packet end to end delay, delay and load.

A. Packet end to end delay

It is the time taken to send a video application packet to a destination node application layer. This statistic records data from all the nodes in the network. Figure that as speed is increasing, the packet end to end delay is decreasing. From Figure 5.1, for 60 km/h, the highest value of packet end to end delay is 0.315 and for 70 and 80 km/h it is 0.33 and for 90 km/h it is 0.2811.

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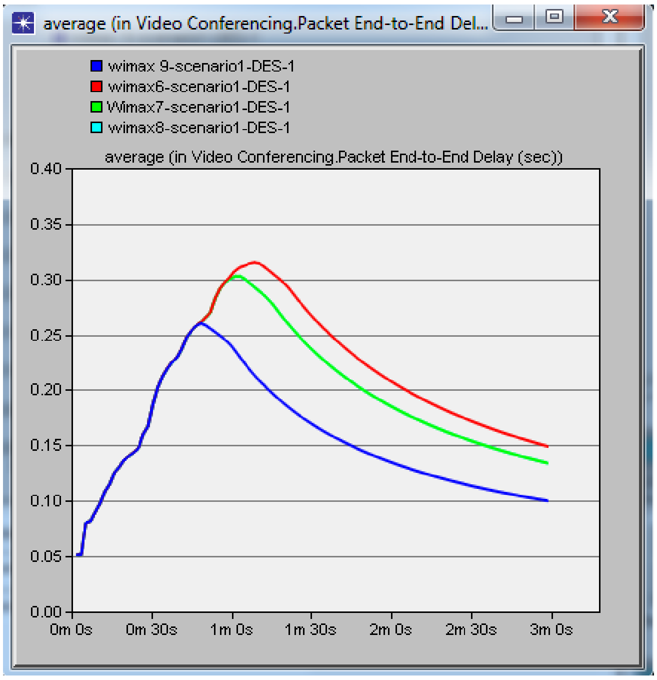

Figure 5.1 Packet end to end delay.

B. End to End Delay:

It represents the end-to-end delay of all the packets received by the WiMAX MAC's of all WiMAX nodes in the network and forwarded to the higher layer. Figure 5.2 shows the result of Delay. In the Fig shows that when we increase the speed, the Delay will decreases. And fig also shows that at the end of simulation 60 km/hr have high delay which is 0.1121, the delay for 70 km/hr and 80 km/hr is 0.09553 and 90 km/hr has delay of 0.08567.

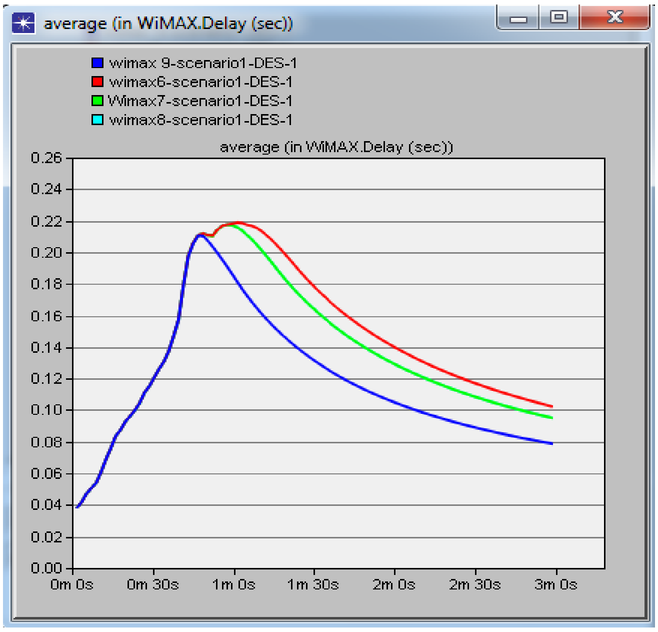

Figure 5.2 Delay

C. Network Load

It represents the total load submitted to WiMAX layers by all higher layers in all WiMAX nodes of the network. Figure 5.3 represents the result of Network Load. This figure shows that with increase in speed, the load also increases. From Figure, it has been observed that, 90 km/h having the highest load which is 6537896, 80 and 70 km/h having load of 6500657and 60 km/h having load of 63915538.

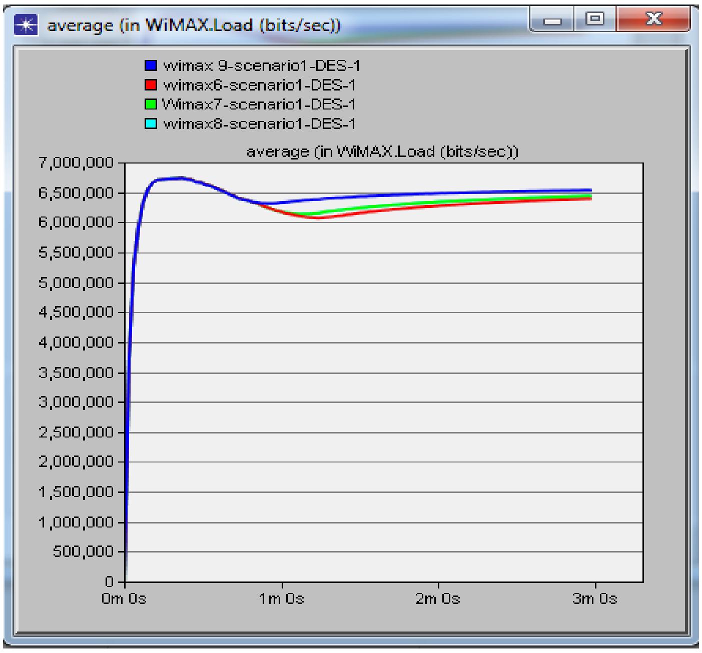

Figure 5.3 Load

CONCLUSION AND FUTURE SCOPE

In this paper we analysis that the performance of IPTV (VOD) over WiMAX by varying velocity of mobile WiMAX Mobile Nodes in terms of, packet end to end delay, load, and delay had been conducted. In our simulation the placement of mobile nodes are random within hexagonal cell of radius 25 km. Here the speed of each node is varying from 60 to 90 km/h. Simulation is carried out for 30 minutes. The simulation results show that when we increase in the velocity the load is increasing but packet end to end delay and delay are decreasing no doubt this increment of load is very little. The result also shows that for 70 and 80 km/h, packet end to end delay, delay and the load has same values. In future, one can analyze the IPTV (VOD) over integrated WiMAX and MPLS by varying different parameters like number of mobile WiMAX Mobile Nodes, network area, and power.

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