Performance Analysis of IPTV over Fixed Wimax

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***Abstract*— IEEE defines various modulation schemes for WiMAX i.e. QPSK, BPSK, 16 QAM and 64 QAM. This model will examine Internet Protocol Television (IPTV) performance over Fixed WiMAX system taking many combinations of digital modulation. The performance will involve many key system parameters, which will involve the variation in the path loss, video coding, different rated codes, scheduling service classes in FEC channel coding. The performance study will be carried on by using OPNET modeller. The performance will be analysed by taking several performance parameters i.end to end delay,. packet jitter delay, packet lost and network throughput. By using simulation results the performance will be evaluated and examined.**

Keywords: WiMAX, IPTV, QAM, OPNET, FEC, QoS, VoD.

I. Introduction

Global operability for Microwave Access (WiMAX) technology is best solution of next generation (4G) wireless network, which gives high data rates for IP networks that is able of providing high Quality of Service (QoS). The QoS assurance and high data rate offered by this standard has made it commercially feasible to support multimedia applications i.e. mobile TV broadcasting, video gaming and video telephony. WiMAX base station (BS) can offer broadband wireless access in a range upto 3 to 10 miles (5 to 15 km) for mobile stations and 30 miles (50 km) for fixed stations with a maximum data rate of 70 Mbps. The WiMAX standard product is particularly for Nomadic and fixed services. It was re-examined to deal with full mobility applications. Therefore, Mobile WiMAX provides suppport to full mobility for fixed and nomadic systems. It addresses the following characteristics: provides high data rates; supports nomadic, fixed and mobile applications thus converging the mobile and Fixed networks; and has compromising network architectures; in summation to its easy to deploy and cost efficient. furthermore, it can provide support to point to multipoint and point to point connection, also provide support to IP based architecture; and has optimal handover which provide support to full mobility application i.e. Voice over Internet Protocol (VoIP). It also possess the power saving process, which enhances the battery life period of handheld devices. Internet Protocol Television (IPTV) offers digital television services over IP for business and residential users at a lower cost. Furthermore, IPTV is a system able of getting and showing a video stream by using Internet Protocol. Users can obtain IPTV services anytime and anywhere to mobile devices. IPTV services can be categorised as follows according to their type of services and content:

• **Video-on-Demand content:** In this type of IPTV service a user is permitted to surf an online movie book, to see trailers, and to choose a movie of interest. A user can request or cease the video content any time and is not restricted by a specific TV schedule, unlike the case of live video. The selected movie begins play nearly immediately on the user's PC or TV.

• **Live content:** In this type of IPTV service a user is needed to access a specific channel for the content at a particular time, like to accessing a formal TV channel. A user cannot request to see the content from the starting if he or she watches the channel late.

• **Managed services:** It enables video content to be provided by the phone companies who control the IPTV business or received from syndicated content suppliers, in which the content is generally well-handled in terms of the play out quality and coding, as well as in choosing of video titles. Bandwidth for delivery and customer equipment are managed cautiously for providing the best quality and play out performance to the customers.

• **Unmanaged services:** In this type of service, IPTV itself enables play out of any on-demand or live video content from any third party over the Internet. Thus, nothing ceases a user from accessing video content directly i.e. YouTube (or Google Video), an organization or individuals. With a broad range of options for content selection, clearly these services have a benefit at the cost of non-guaranteed play out performance and quality.

There are many factors that influence the quality of a signal obtained by a user device in wireless communication systems. These factors are the distance between the interfering base stations and desired user, log-normal shadowing, path loss exponent, short term Rayleigh noise and fading. In order to enhance system capability, high coverage reliability and data rate, the signal transmitted by and to a specific user is changed to consider the signal quality variation by a process usually known as link adaptation. Adaptive Modulation and Coding (AMC) has become a standard technique in latest growing

ISSN: 2278 – 7798

wireless standards i.e. WiMAX. However, the concept behind AMC is to dynamically adjust the coding and modulation technique to the channel conditions so as to obtain the maximum spectral efficiency at all times.

II. WIMAX Overview

In this Section, a short summary of WiMAX technique is described. Global operability for Microwave Access (WiMAX) is presently one of the best technique in wireless. has published a set of standards that describe WiMAX has been published by The Institute of Electrical and Electronics Engineers (IEEE) 802 committee. IEEE 802.16-2004d was issued in 2004 for fixed applications; 802.16e is issued in July 2005 for mobility. WiMAX is a standard-based wireless technique that offers high throughput broadband connections over large distance. WiMAX can be employed for a number of applications, involving "last mile" broadband connections, high-speed connectivity for business subscribers, hotspots and It offers wireless metropolitan area network (MAN) connectivity at speeds about 70 Mbps. WiMAX works in the 10–66 GHz band with line of sight (LOS) communications by utilizing the single carrier (SC) air interface. The IEEE 802.16a standard defined non line of sight (NLOS) communications in the 2 – 11 GHz band by utilizing one of three air interfaces: Orthogonal Frequency Division Multiplex (OFDM), SC, and Orthogonal Frequency Division Multiple Access (OFDMA). OFDMA and OFDM make capable carriers to enhance their data capacity and bandwidth. Spacing subcarriers very nearly together without disturbance attain this enhanced efficiency because subcarriers are statistically unrelated to each other. Within a allocated channel bandwidth, subcarriers are categorized as: data subcarriers, null subcarriers, DC subcarriers, and pilot subcarriers. Subcarriers are then adjusted by employing conventional digital modulation technique with different inner code rates: Quadrature Phase Shift Keying (QPSK), Binary Phase Shift Keying (BPSK), and Quadrature Amplitude Modulation (QAM) (16-QAM, 64-QAM, and optional 256-QAM). Therefore, WiMAX data rates between 1.5 to 75 Mbps are obtainable.

III. Related Work

In this project, the performance study of IPTV (VoD) over Fixed WiMAX networks is investigated by considering various coding and modulation techniques by utilizing OPNET simulator. This model also involves generation and disegregation of a streaming audio component, also offers a comparative study of performance of IPTV (VoD) over Fixed WiMAX by using varying video coding and by using various service classes and path-loss models under fixed modulation schemes in order to analyze and examine the performance and behavior of these models. OPNET offers broad development of network models involving all the significant parameters that required to be reflected in the design method of MAC and/or PHY layers. A number of simulation scenarios by using OPNET for broadband wireless communication is formulated. This project objectives to demonstrate a comparative study of performance of IPTV (VoD) over Fixed WiMAX.

IV. Result

The simulation results will be talked out in this section. The snapshots of OPNET simulation results for deploying VoD services with various codes over WiMAX model was demonstrated in this section. The aim of our simulation was to test the deployment, and to examine the performance metrics of IPTV (VoD) over WiMAX networks.

Parameters	SVC
Throughput	1.25 mbps
End to End Delay	2.7 milliseconds
Jitter Delay	5.6 microseconds
PSNR	47.89 db

Table: Performance metrics of SVC Video Codec

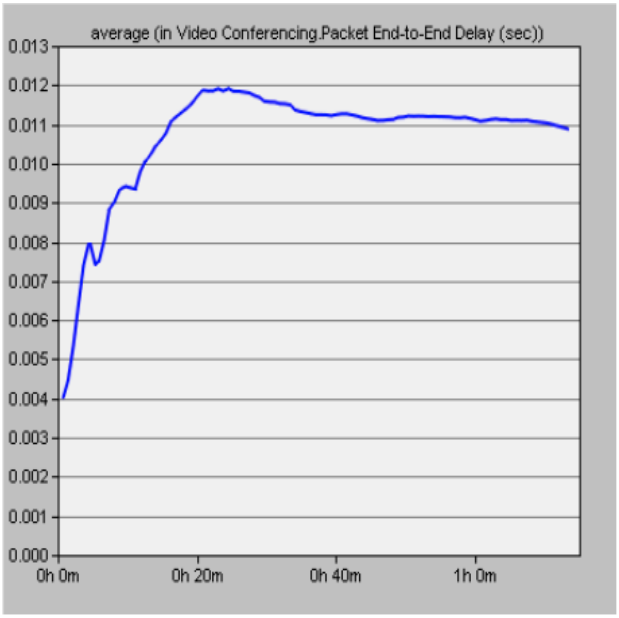

Figure 1. Average End-to-End packet delay.

ISSN: 2278 – 7798

The Packet Delay Variation for the video traffic i.e. the ideal jitter is less than 10 m/s. The mean jitter value for various users is depicted in Fig 2 and it is nearly 60 μs.

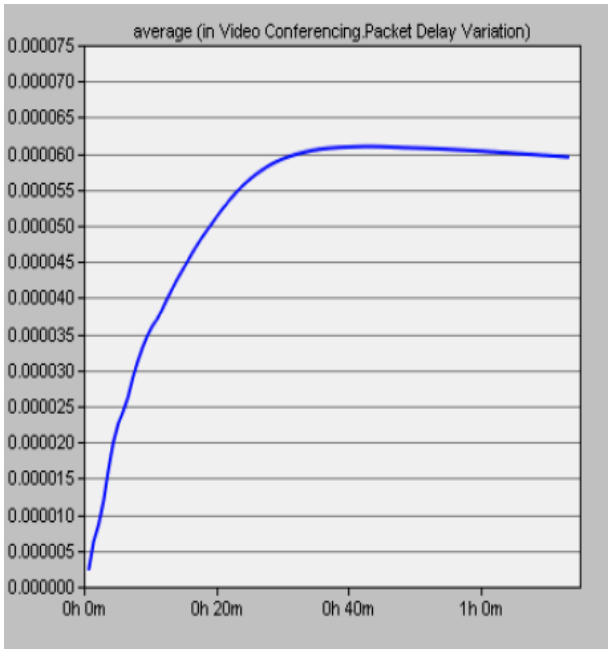

Figure 2. Jitter delay.

We can notice that the jitter value in our case is importantly less than the ideal value of 10ms, which is taken as a strong statistic. The throughput in our case in the range needed of 10 kbps – 5 Mbps. The mean throughput in our case is approx. 1.5 Mbps as depicted in Figure 3.

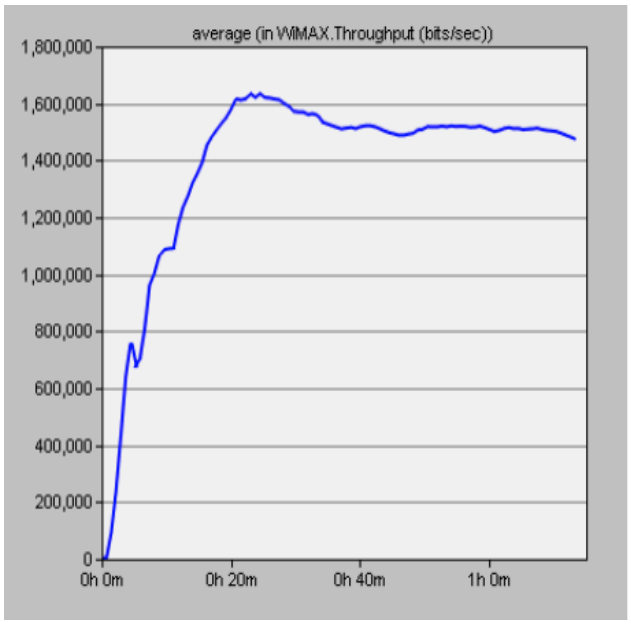

Figure 3. Average throughput.

This shows the throughput of our video codec is as required. The lost packet rates by the PHY layer for the WiMAX Subscriber Station are depicted in Figure 4, which possess a much higher loss rate.

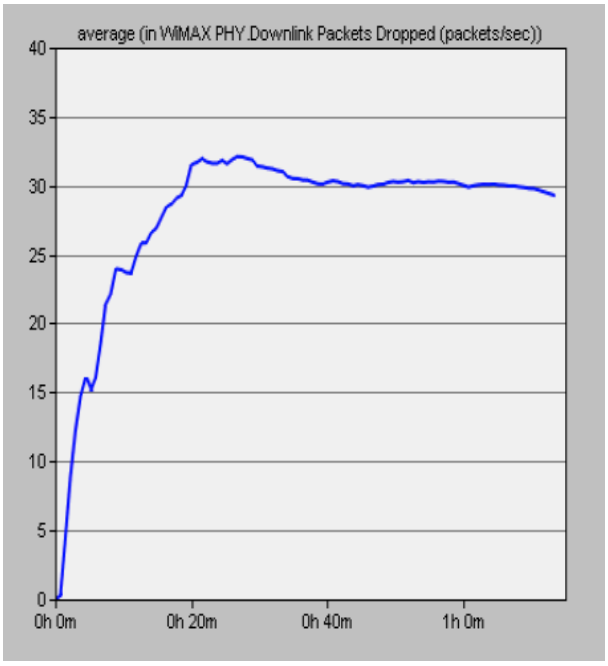

Figure 4 Dropped packet rates by PHY layer for WiMAX SS.

The downlink SNR for the Subscriber Station is depicted in Figure 5.

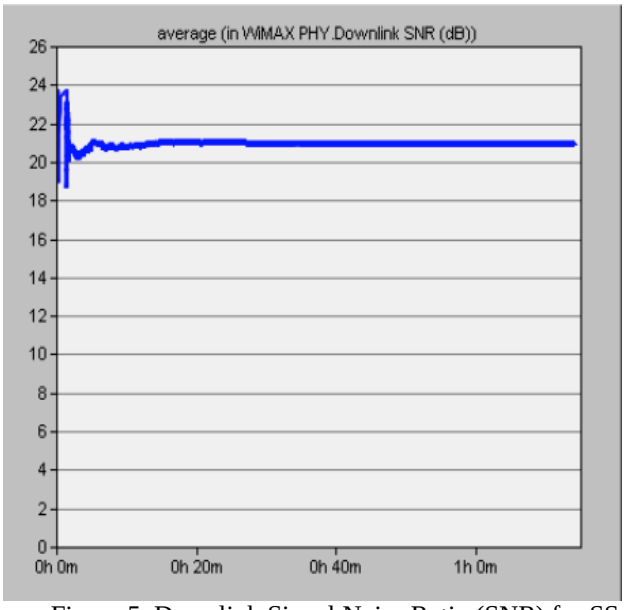

Figure 5. Downlink Signal Noise Ratio (SNR) for SS.

The subscriber station possess a downlink SNR that is under the essential minimum level for 64-QAM. Quality of Experience has been formulated by MOS. Mean Opinion 17 Score (MOS) is based on evaluating the Peak Signal Noise Ratio (PSNR). We utilized the PSNR ratio from Table 2. By that result, we can view all these codes have an excellent

ISSN: 2278 – 7798

MOS, and PSNR for SVC code is nearly 47.89, which signifies it has a good MOS. Clearly, the simulation results show that SVC offers the best quality of video in terms of throughput, MOS value, jitters and end-to-end delays. Thus, SVC is the most suitable video codec technique for providing IPTV services over WiMAX network.

V. Conclusion

This study explores the performance analysis and technical details of IPTV over WiMAX broadband access technique. Its objective is to deal with the performance metrics of QoS for video streaming when deploying over WiMAX access technology. The OPNET simulator is employed to characterize and design the performance metrics of Tokyo Olympics video streaming with various codes of H.264.x to WiMAX video customers by utilizing QoS performance parameters. The simulation results show that the SVC/H.264 video codec has been determined to provide enhanced visual quality and suitable codes for providing video as compared to the previous standards. Moreover, the streaming video content has been simulated as unicast traffic while better performance may have yielded by multicast video traffic. This work has some restrictions to some specified assumptions i.e. distance between base station and subscriber station, the station transmit power, subscriber station was set up as fixed, station antenna gain, not support mobility, carrier channel bandwidth and operating frequency.

Future Work

This model can be organized by using the feature of mobility. It can be organized by using other video codec scheme i.e. H264/AVC. The future scope can be, study the effect of mobility on video quality, and also the effect of using multicast SVC multilayer adaptation technique on improving the performance of video streaming over mobile WiMAX. The work can be carried out to deal with some restrictions i.e. distance between base station and subscriber station, the station transmit power, station antenna gain, subscriber station was organized as fixed not support mobility, carrier channel bandwidth and operating frequency.

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ISSN: 2278 – 7798