Performance Evaluation Internet Protocol Television (IPTV) by taking Various Modulation Schemes

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***Abstract*— IEEE describes various modulation mechanisms for WiMAX i.e. QPSK, BPSK, 16 QAM and 64 QAM. This paper measures the performance of Internet Protocol Television (IPTV) over Fixed WiMAX system taking various combinations of digital modulation. The performance is analyzed considering a number of main system parameters which involve the variation in the path-loss, video coding, scheduling service classes, various rated codes in FEC channel coding. The performance evaluation was carried out by utilizing OPNET simulator. The performance is measured with respect of packet jitter delay, packet lost, network throughput and end-to-end delay. Simulation results indicate that higher order modulation and coding techniques (namely, 16 QAM and 64 QAM) have better performance as compared to QPSK.**

Keywords: IPTV, QoS, modulation and coding, WiMAX, OPNET, performance study.

I. INTRODUCTION

Internet Protocol Television (IPTV) offers digital television services over IP for residential and business users at a low cost. Moreover, IPTV is a system able of obtaining and showing a video stream utilizing Internet Protocol [5]. Users can obtain IPTV services anytime and anywhere to mobile devices. IPTV services can be categorized by their kind of services and content to [6]:

Video-on-Demand content: In this IPTV service a user is permitted to surf an online movie book, to see trailers, and to choose a movie of interest

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 traditional TV channel.

Managed services: It enables video data to be provided by the phone companies who operate the IPTV business or received from syndicated content suppliers, in which the data is generally well-maintained in terms of the playout and coding quality, as well as in the selection of video titles.

Unmanaged services: In this type of service the technique of IPTV itself enables playout of any on-demand or live video content from any third party across the Internet.

This work is done towards analysing the performance study of IPTV (VoD) over Static WiMAX networks when taking various coding and modulation techniques utilizing simulation software OPNET Simulator.

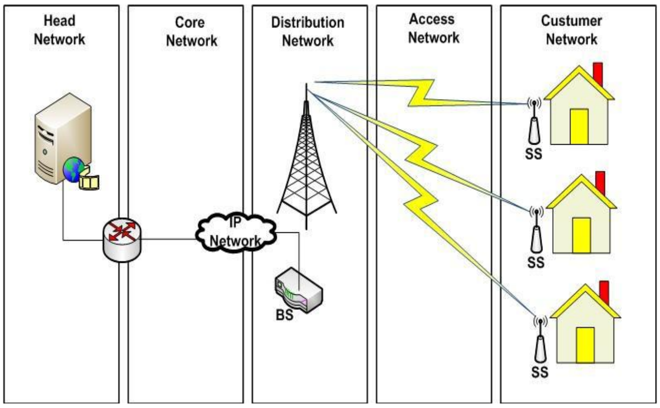

Figure: 1 IPTV Model

II. LITERATURE REVIEW

Lately, there has been some research based on performance analysis of video streaming over WiMAX networks. Many research workers have worked on WiMAX in the context of stored video and real-time applications. For instance,

Pandey et al. [5] formulated a model to resize the network for IPTV service suppliers that provide VoD services to their users in heterogeneous surrounding. The suggested modeling and simulation mechanism permits us to find the optimal deployment conditions for a specified number of potential IPTV customers while fulfilling pre-specified QoE measures.

Shehu et al. [10] talked about issues related challenges for providing IPTV over WiMAX. These issues involve the challenges of QoS needs.

Bhunia et al. [16] introduced an in-depth performance of mobile WiMAX is deployed by utilizing adaptive modulation and coding under the real-time simulation environment of OPNET. They have measured the performance metrics of mobile WiMAX with respect to various coding and modulation schemes.

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III. SIMULATION MODEL

This section explains the simulation model employed for measuring the impact of Video on Demand (VoD) over the Fixed WiMAX Networks. The simulation was executed to measure the performance of VoD over the static WiMAX networks under various parameters: path-loss models, video codecs, and class's services under static kinds of modulation and coding mechanisms in order to examine and measure the performance and behavior of these models. At first, topology described in Figure 2 was considered. This configuration has a server with a video encoder which is able of transmitting video to the subscriber station (SS). It is also considered that there are n WiMAX cells (BS) associated to the wired networks. An SS of every cell links to the server and request the video stream in real-time. It is considered that every SS at various distances from every BS so that every BS allocates various modulation and coding for SS. For instance: QPSK ½ allocate to SS in BS1, 16 QAM ¾ allocate to SS in BS 2, and 64 QAM 2/3 allocate to SS in BS n.

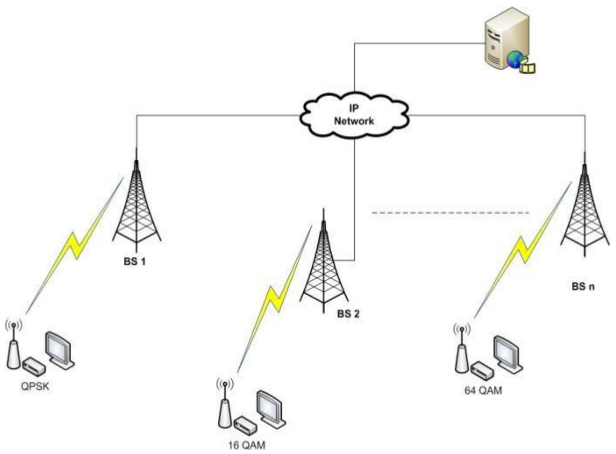

Figure 2: Topology of IPTV (VOD) over WiMAX

IV. Results and Discussion

Sixty six scenarios were modeled, and the results are gathered and summed in three scenarios based on various video codec of video application and varying path loss models, and for various kinds of service classes. For every scenario, the kinds of coding and modulation mechanisms are selecting one at a time to receive one set of simulation results for the various performance measures of packet delay, packet loss, traffic load throughput and packet jitter..

Scenario 1: Different video codec of video application

This subsection describes the simulation results of three scenarios under this category. Every scenario utilized various video codec under various coding and modulation scheme in every cell.

The mean packet jitter, and mean E2E delay with several coding and modulation schemes are indicated in Figures 3. Figure 3 describes the mean variation of packet delay variation for audio/video IPTV over Fixed WiMAX networks. For various coding, video quality is best if the jitter is zero. As described in Figure mean audio/video jitter is nearly zero for higher modulation and coding scheme (MCS) (16 QAM, and 64 QAM) while QPSK has a bad mean variation of jitter for Movie coded through AVC codec. From the results in Figure 4(a), it is realized that WiMAX utilizing higher MCS (16 QAM, 64 QAM) as a modulation scheme indicates better jitter as compared to other MCS (QPSK). It is also realized that video coded through SVC, and MPEG-4 has a better mean jitter as compared to AVC codec. Thus, video codec by SVC is best choice for deploying IPTV.

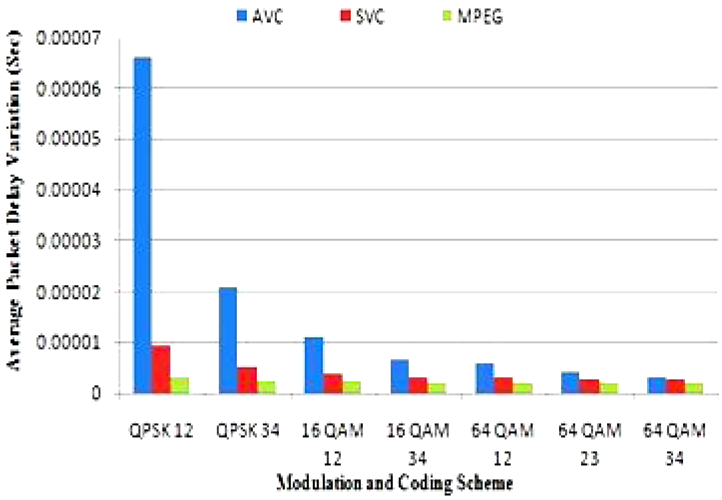

Figure 3: Average packet delay variation

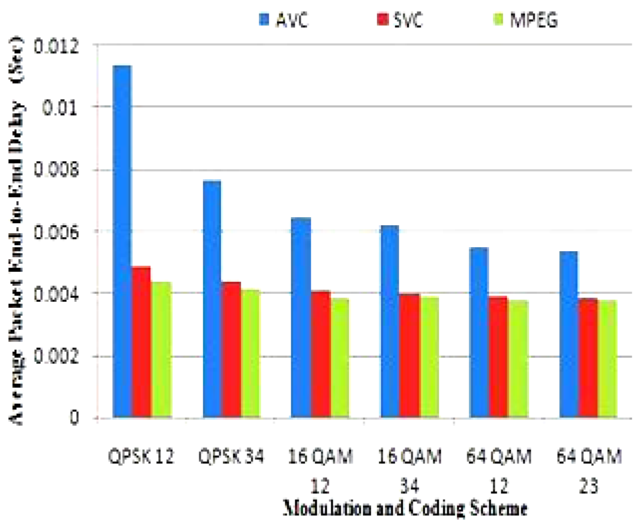

Figure:4 Average Packet End to End Delay

As depicted in Figure 5, the mean data loss is importantly higher when video codec through AVC codec. The impact of data drop naturally reduces the mean WiMAX throughput as depicted in Figure 6.

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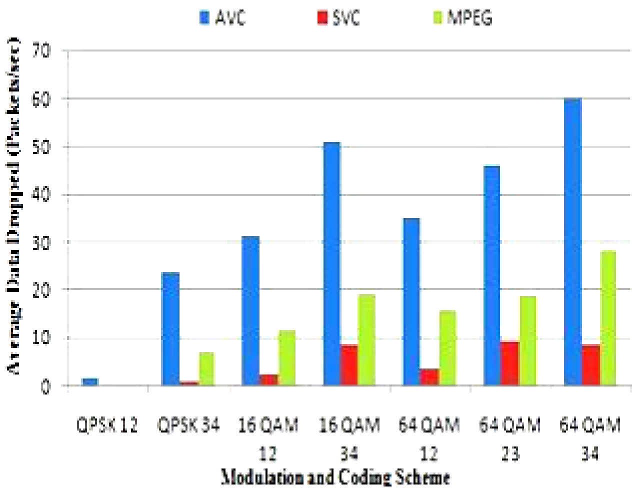

Figure 5: **Average packet data dropped from SS node**

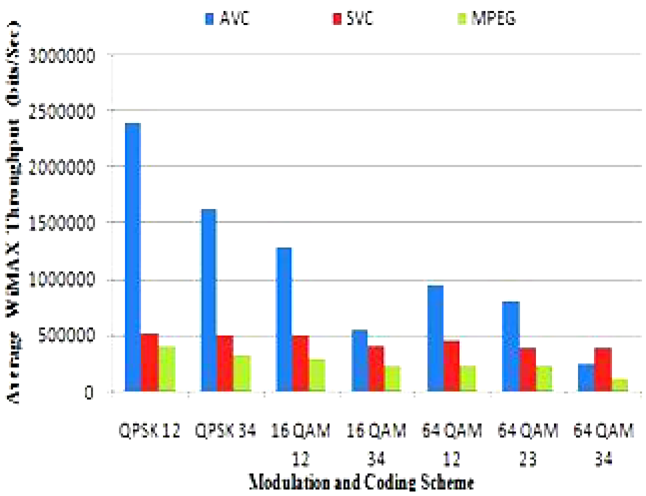

Figure 6: Average WiMAX throughput for SS node

Scenario 2: Mobile node with different path loss

This subsection talks about the simulation results of twenty eight scenarios, performance parameters of every scenario realized for several modulation and coding schemes related to several path-loss models. It is assumed in this category holding the video codec with SVC codec and scheduling service classes as rtPS.

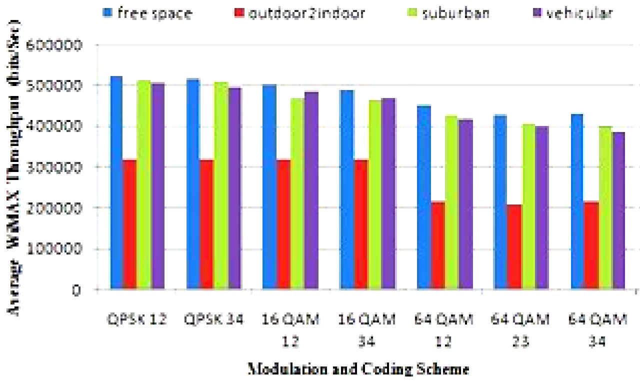

Figure 7: Average Throughput

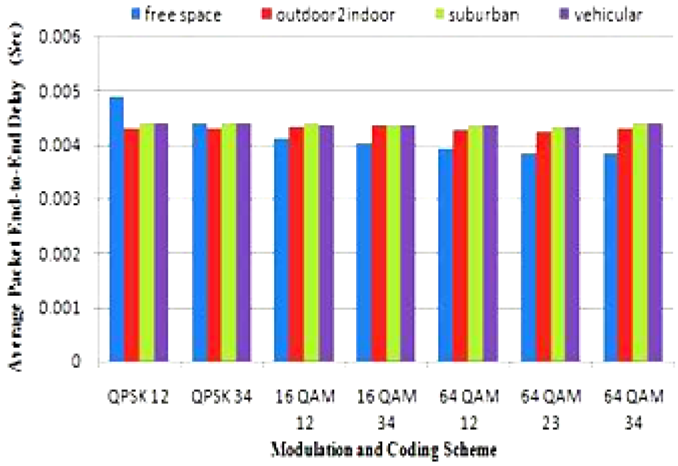

Figure 8: Average packet end to end delay

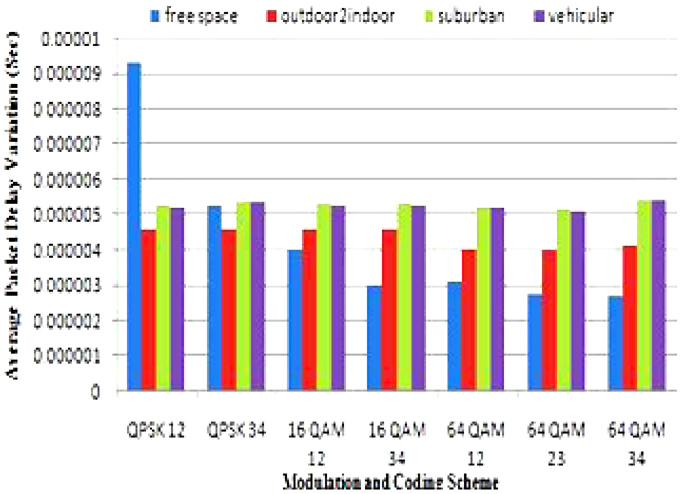

Figure 9: Average packet data dropped from SS node

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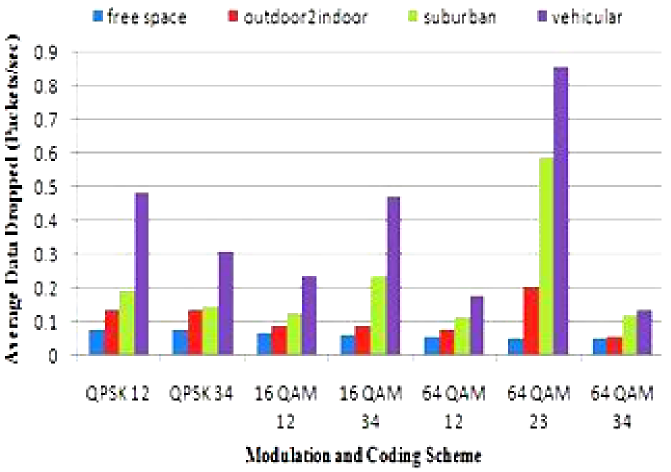

Figure: 10 Average WiMAX throughput for SS node

Scenario 3: Mobile node with different classes

This subsection contains the simulation results of 35 scenarios under this class where path loss and video codec kept constant.

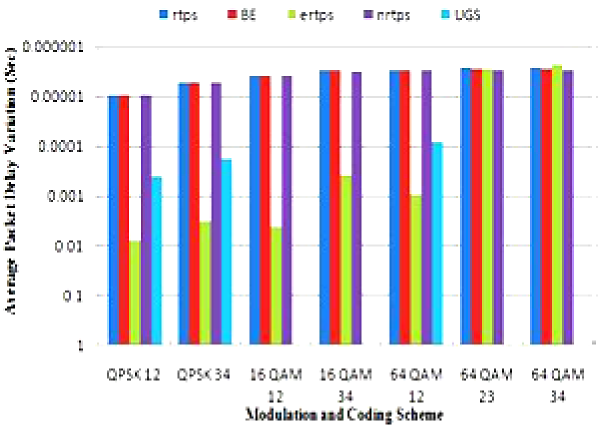

Figure: 11 Average video jitter

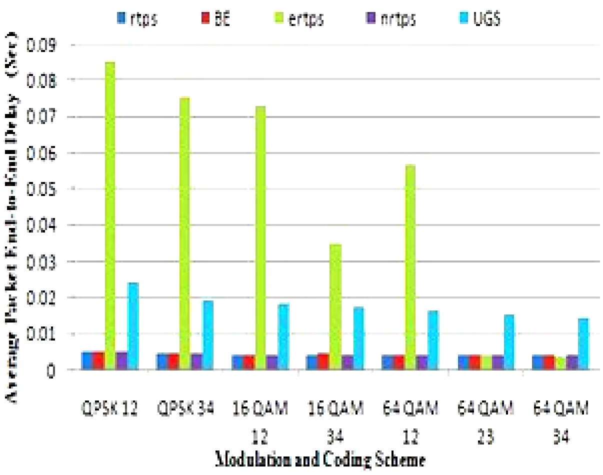

Figure: 12 Average packet End-to-End delay

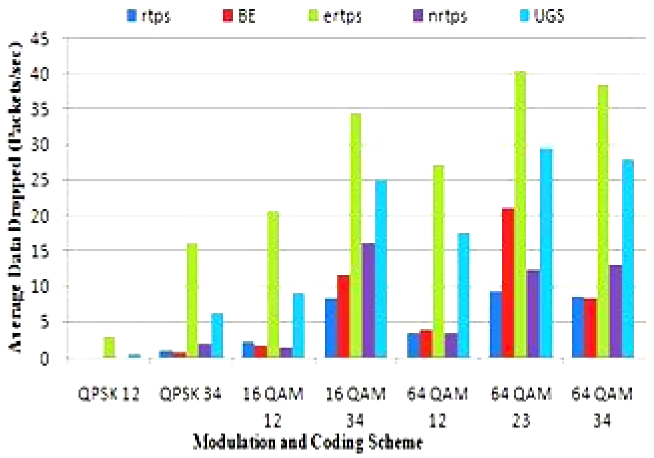

Figure: 13 Average packet data dropped from SS node

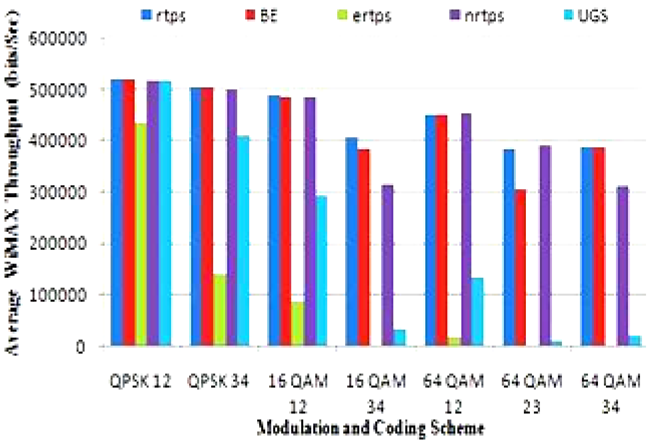

Figure: 14 Average WiMAX throughput for SS nosde

CONCLUSION

In this work, study of IPTV performance over static WiMAX network taking various modulation and coding schemes have been introduced under various key system parameters involving path-loss models, video coding, and MAC service classes. The performance has been measured with respect to average packet jitter, average packet E2E delay, average throughput, and average data-dropped. OPNET simulation results describe that SVC has better performance as compared to other video codec strategies. Also results describe that the free space route loss is the excellent propagation model for distributing A/V video application over various static mobile node whereas vehicular model shows the worst performance providing the maximum packet drop rate. Furthermore, simulation results describe that rtPS scheduling service class is the most suitable scheduling service for A/V video application. The future scope will be to study the effect of mobility on video quality, and also the effect of utilizing multicast SVC multilayer adaptation strategy on improving the performance of video streaming over mobile WiMAX.

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