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Survey on Link Adaptation Techniques for Video Traffic in MANETs

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ABSTRACT: Modulation is used to change one or more parameters of a communication signal such as amplitude, frequency, phase or angle of the signal. It is also defined as process of encoding information into signal for the purpose of transmission. It is done at the physical layer. In this paper we presented literature of modulation techniques such as BPSK, QPSK, 16-QAM and 64-QAM and also adaptive modulation and coding. It also gives detailed description of Evalvid-2.7 tool in ns-2.35 for video transmission over MANETs and used in wireless network to evaluate quality of video received at receiver.

KEYWORDS: AMC, BSPK, QPSK, 16-QAM, 64-QAM, Evalvid 2.7, NS-2.35, Video Traffic.

I. INTRODUCTION

Adaptive Modulation and Coding (AMC) is used in wireless networks to indicate the pairing of modulation, coding with other signal and protocol features based on requirements of radio connection (For example: path loss and interference). For example, WiMAX uses a step by step rate adaption procedure, which adapts the Modulation and Coding Scheme (MCS). Different order of modulation techniques allow you to send more bits per symbol and thus accomplish good throughput. However when using a 64-QAM modulation technique, should have better SNRs to deal with interference and bit error rate. Selection of modulation techniques in a network depends on the quality of channel. As you increase in communication range, shift back to lower level modulations (such as BPSK), but as you are near then you can make use of upper level modulations such as QAM for great throughput. AMC also permits the system to eliminate fading and interference.

Link Adaptation Approaches are presented in Section 2. In Section 3 Modulation Techniques. Section 4 Evalvid Tool and Requirements. Performance Parameters is presented in Section 5. Conclusion and future works are highlighted in Section 6.

II. LINK ADAPTATION APPROACHES

In [1], the performance of cross-layer protocol solutions for real-time video transmission over three types of networks, i.e., single-hop, multi-hop, and cooperative wireless networks are investigated. The joint optimization of the video coding parameters of an H.264 codec at the application layer and the transmission parameters at lower layers in a cross-layer are considered. From the end users perspective, the end-to-end video quality evaluation is the objective function for video streaming. Hence the “recursive optimal per-pixel estimate” (ROPE) method in the H.264 video codec is used to determine the expected received video distortion under the video transmission delay constraints. The several cross-layer optimization frameworks for wireless multimedia networking are proposed:

- Video communications in single-hop wireless networks by exploring the transmission of video summaries, where a good content coverage is achieved by the link adaptation schemes
- For real-time video communication over multi-hop wireless networks, routing issue is considered because the path selection in video transmission majorly affects the end to end video quality of user

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- Video summary transmission over cooperative wireless networks to exploit the spatial diversity of cooperative communications and enhance the network resource utilization are investigated.

In [2][3][4], adaptive modulation and coding at the physical layer, and an ARQ at the data link layer considered for a single hop networks to maximize efficiency under delay and error prone performance constraints.

In [5], AMC techniques used in WiMAX based wireless networks to improve the network performance in case of non-line-of-sight communications in urban environments. In [6], AMC scheme is used for IEEE 802.11n MIMO OFDM systems with convolution coding.

In [6], this paper presents a cross-layer approach to jointly design adaptive modulation and coding (AMC) at the physical layer and cooperative truncated ARQ protocol at the data link layer.

In [7], this paper presents an adaptive modulation scheme in an OFDM based multi-hop network.

In [8], this paper introduces a novel framework by incorporating AMC with layered transmission through Superposition Coding (SPC).

III. MODULATION TECHNIQUES

In this paper mainly concentrating on BPSK, QPSK, 16-QAM and 64-QAM Modulations [9] [10] [11] over wireless network. **BPSK** is uses 0 and 180° phases and is known as two-PSK. It is only able to transmit at one bit/symbol. It is equivalent to 2-QAM modulation. The general form of transmitted BPSK signal is as given below

$$S_{BPSK}(t) = \sqrt{\frac{2E_b}{T_b}} \cos[2\pi f_c t + (1-n)] \quad n = 0,1 \quad 0 \leq t \leq T_b \quad (1)$$

Where E_b is the Energy per bit, T_b is the bit duration and f_c is the carrier frequency. The probability of BER of BPSK can be calculated as

$$P_b = Q\left(\sqrt{\frac{2E_b}{N_0}}\right) \quad (2)$$

QPSK [12] is called as quadrature phase-PSK, four-PSK, or four-QAM. It can encode two bits per symbol and at the same BER, its data rate is two time better than BPSK. The general form of QPSK Signal is as follows:

$$S_{QPSK}(t) = \sqrt{\frac{2E_s}{T_s}} \cos\left[2\pi f_c t + (n-1)\frac{\pi}{2}\right] \quad n = 1,2,3,4 \quad 0 \leq t \leq T_s \quad (3)$$

Where T_s is the symbol duration.

QPSK has in-phase component of the signal uses the even (or odd) bits for modulating signal and quadrature component of the signal uses odd (or even) bits for modulating signal. BPSK is used on both carriers and so they can be separately demodulated. Hence, the probability of BER for QPSK and BPSK is same.

QAM [13] is unite of two amplitude-modulated signals into a single channel, therefore bandwidth will be increased. It is a signal in which two carriers having the same frequency changed by 90 degrees are adjusted and the resultant contains both amplitude and phase variations.

It can be a combination of amplitude and phase modulation. Mathematically, signals are represented by a sine and cosine wave respectively. At the source, the two adjusted carriers are combined for transmission. The advantage of shifting to the higher order modulation is to send more bits per symbol.

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The drawback is that the link is more susceptible to noise when the constellation points are closer together. Since, QAM are only used when there is a SNR is high. In this project 16-QAM and 64-QAM is used. At the destination, the signals are separated, the data is drawn from each, and then the data is merged into the single unit of information. Table 2.1 as shown below.

Table 2.1 Details of Bit rates for modulation Techniques

Modulation	Bits per symbol	Symbol Rate (bit rate)
BPSK	1	1
QPSK	2	1/2
16QAM	4	1/4
64QAM	6	1/6

IV. EVALVID TOOL AND REQUIREMENTS

“EvalVid is a framework and tool-set for evaluation of the quality of video transmitted over a real or simulated communication networks[14]”. It measures the QoS parameters of simulation networks like delay, jitter and loss rates and video quality by using PSNR metric. It supports MPEG-4, H.263 and H.264 codecs and also supports AAC makes use of PESQ or PEAQ for perceptual quality evaluation. The system model for video communication over mobile ad hoc networks in NS2 using Evalvid tool as shown in figure 3.1

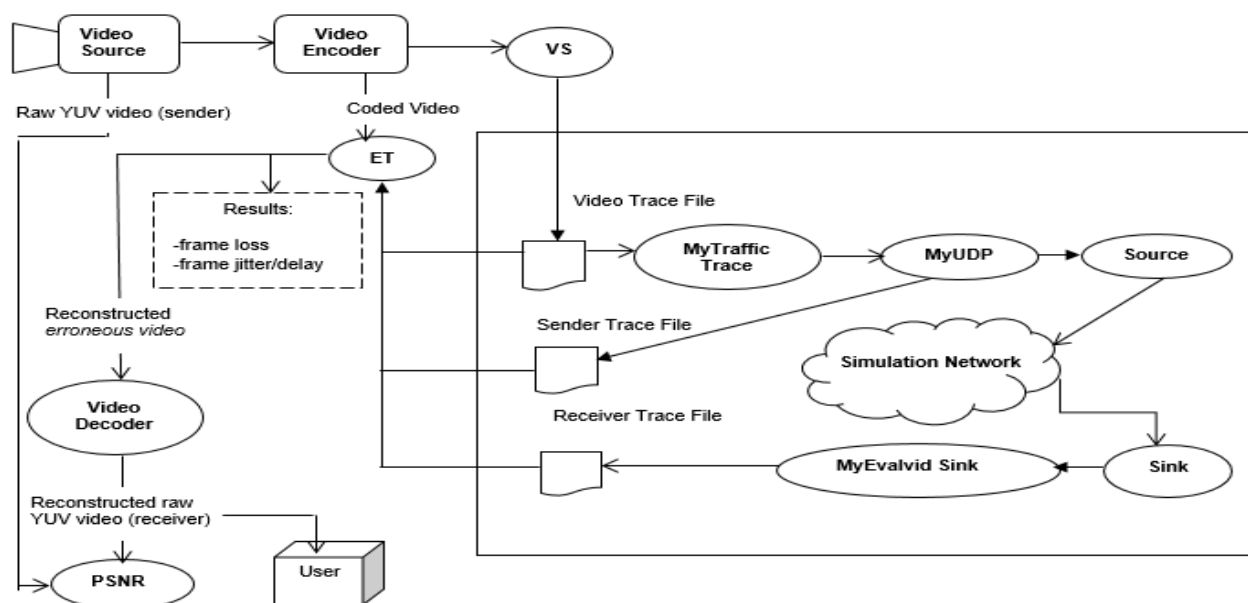


Figure 3.1 System model for integrated evalvid tool in NS2 [15].

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Evalvid tool Requirements:

EvalVid-2.7 version for linux contains binary files eg, etmp4, hist, miv, mos, mp4trace, psnr, vsgen. It also require ffmpeg and MP4Box to be downloaded separately. The whole package can be used to evaluate media over a simulated network using NS-2.35. To run it successfully ffmpeg, mp4box, mp4trace, etmp4 and psnr is required.

ffmpeg: ffmpeg is a very fast video and audio converter that can also grab from a live audio/video source.

mp4box: it is a multi-purpose command oriented tool which is used to create and edit presentation of MPEG-4 systems and to manipulate ISO media files such as MP4, 3GP.

mp4trace: mp4trace generates the trace file of video is used to send over the simulated network.

etmp4: This is used to reconstruct the video file at the receiver end which would be probably corrupted where all the lost frame would be deleted.

PSNR: This calculates the signal to noise ratio between the transmit file and receiver file.

Install the packages before installing evalvid-2.7 [16] [17] [18] [19].

V. PERFORMANCE PARAMETERS

Packet Delivery Ratio (PDR): It is the ratio of number of received packets and number of packets sent.

Throughput: It is the number of packets received within a given time.

% loss of frame/packet: It is a percentage of overall loss of I, P and B frames in a video.

Peak Signal Noise Ratio: It measures the difference between the original video file and reconstructed video file.

Received Signal Power: is amount of power present in a received radio signal at a particular distance.

These parameters to be considered when communicate over MANETs, to ensure reliability of data.

VI. CONCLUSION

In this paper we presented survey about different modulation techniques such as BSPK, QPSK and QAM (16 and 64) and adaptive modulation technique. Evalvid-2.7 Tool is used in NS-2.35 for video transmission over mobile ad hoc network, since we need to study about tool and what are all the requirements to install packages in network simulator. This tool is used to evaluate quality of video received at a receiver. The future work is to simulate mobile ad hoc network for video transmission by using evalvid tool which integrated in ns2 and measure and analyse the performance parameters for the modulation techniques and then adapt Adaptive modulation and coding for video transmission.

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