Research Issues in Wireless

Communications and Networking

Farhat Anwar
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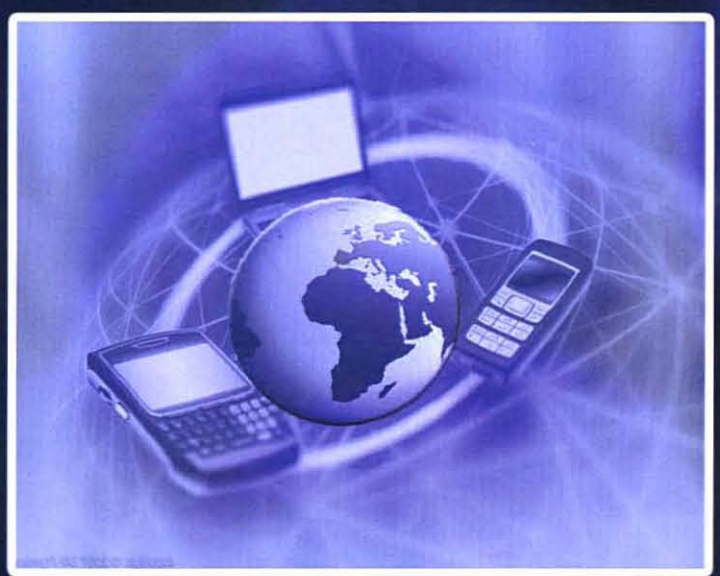

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CHAPTER 32

FINE-GRANULATED FEC CODE FOR IPTV I-FRAMES OVER WIRELESS DVB-T CHANNELS

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32.1 INTRODUCTION

Powerful Forward Error Correction (FEC) codes are usually used over digital video broadcast (DVB) networks. IPTV uses a base video layer and enhancement layer. In IPTV, the Intra-frame (I-frame) has the highest dependency where corruption of an I-frame will result in error propagation through all the frames in the Group of Pictures (GOP). This phenomena motivates the development of frame-selective fine - granulated FEC schemes in the application layer at the frame level (e.g., GOP) rather than the PHY layer packet level. The objective of this letter is to confirm this hypothesis by investigating the GOP peak signal to noise ratio (*PSNR)* and the bit energy to the noise energy (E_b/N_0) performance for different bit error rate (*BER)* levels using such fine-granuled Reed-Solomon (*RS*) FEC coding and Interleaving at the video source before being passed down to the PHY layer. Recent research works have considered the effect of using FEC coding at the application layer for the whole GOP stream in conjunction with the PHY layer [1, 2 among others] but, to the best of the authors' knowledge, none has opted to study the effect of FEC coding to the individual I-frames that forms the base video at the video source before streaming it, in the open literature. Such I-frame protection reduces the required processing time and coding overhead that is most useful when streaming IPTV over satellite links, WiMAX, and other wireless channels.

32.2 SYSTEM MODEL AND PROPOSED AL-FEC/INTERLEAVING

A Digital Video Broadcasting – Terrestrial (DVB-T) system simulator, that performs the baseband TV signals adaptation from the output of the MPEG- 4 transport to the terrestrial channel characteristics based on [3] and [4], is used. Before the passing an MPEG-4 stream to the DVB-T LINK/PHY blocks, the data is processed at the application layer video source itself. An application layer frame isolator is used for the MPEG-4 transport video frame to separate the I-frame and P-frame streams in Macro Blocks extracted using the Mindego Analyzer [5]. The Macro block bit distributions are used for getting information about each frame separately. This process facilitates the encoding for any separate IPTV frame stream alone in order to test the performance of the FEC code on the overall system performance. It is then followed by a AL-FEC Reed-Solomon encoder that uses block length of 192 and a payload of 180 bytes where the number of correctable symbol errors t = 8. The encoded stream is processed using a convolutional Interleaver of rate i =1/2 block. The source stream video is made of a GOP that consists of 1 I-frame and 9 predictive frames (P-frames) sequence. Frames are extracted individually from each GOP in a hexadecimal format. Two scenarios were devised for the simulation in order to evaluate the extra protection proposed for the base video layer that produces the IPTV frames . In the first scenario, the proposed AL-FEC is applied to the I-frame stream only before being combined with the P-frame stream to form the GOP, and then forwarded to the standard DVB-T simulator. The GOP is assembled back together into a *IPPPPPPPPP* format only after being applied to the *RS*