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An Access Point-Based FEC Mechanism for Video Transmission over Wireless LANs

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ABSTRACT: Video transmission over the wireless network faces many challenges. The most critical challenge is related to packet loss. To overcome the problem of packet loss, Forward Error Correction is used by adding extra packets known as redundant packet or parity packet. Currently, FEC mechanisms have been adopted together with Automatic Repeat request (ARQ) mechanism to overcome packet losses and avoid network congestion in various wireless network conditions. In the current work An Enhanced Random Early Detection Forward Error Correction (ERED-FEC) mechanism is implemented to improve the quality of video transmissions over Wireless Local Area Networks (WLANs). The aim is to improve recovery performance on the current Adaptive FEC mechanism by injecting FEC packets dynamically based on varying wireless network conditions. Based on the findings, the optimal amount of FEC generated by Enface mechanism can recover high packet loss and produce good video quality

KEYWORDS: Forward error correction, Video transmission, Wireless network, Packet loss, Video quality.

I. INTRODUCTION

As Technology is attaining vast growth, numbers of users prefer to connect to the Internet through wireless devices. A variety of multimedia services like video conferencing, On-demand learning, mobile learning are in high demand and thus face diverse challenges such as attenuation, fading, interference from active sources during transmission in wireless network environments. Such challenges lead to packet losses which are recovered by two techniques: Automatic Repeat Request (ARQ) and Forward Error Correction (FEC). ARQ recovers packets by retransmitting the lost packets during timeouts or responding to the explicit requests from the receiver whereas FEC [9], [10] acts in advance by sending redundant packets along with original packets to recover successfully at the receiver in case of packet losses. Out of the two approaches, FEC guarantees the low retransmission delay and variation in delay (also known as 'jitter') and thus suitable for real-time data transmission. Multimedia data finds the way difficult to transmit through wireless network because of low bandwidth, packet losses and delay. With the rapid increase of data transmission including data, voice, video and mobility supported by a common IP platform, quality-of-service provisioning has grabbed primary focus from the problem of congestion control. Since various types of traffic are carried through the Internet, multimedia flow requires differentiated services from other network services. The Active Queue Management (AQM) mechanisms are helpful for providing differentiated services to reduce delay variation or jitter, packet loss and bandwidth depending on mutually agreed upon service level agreements (SLA). Real-time applications require QoS guarantees such as high throughput, bandwidth [1]-[3], low delay and jitter to transmit the audio or video with better quality. A guarantee, in the sense, fixes a maximum threshold above which degradation in quality must not increase. In the multimedia transmission used in applications such as Learning-on-Demand, packet delay variation is not acceptable. Jitter is defined as an end-to-end delay between the selected packets in a particular flow. The inter-packet arrival time plays an important role in providing QoS for real-time applications. The differentiated services are needed to reduce packet delay and variation to improve multimedia quality. Congestion control is again a big challenge in wireless networks. Congestion affects the QoS characteristics and so it should be effectively managed by the queue management mechanisms. Tail drop is one such mechanism to control congestion [4]. It drops the packets at the tail of the queue during buffer overflow. It is not suitable for real-time data transmission. AQM [5]-[7] is proposed to control end-to-end congestion by adapting Random Early Detection (RED) [8] which drops the packets earlier to avoid congestion to eliminate buffer overflow. Thus it achieves high system utilization and low Packet delay and suits for real-time applications.

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II. RELATED WORK

In [1] authors used Forward Error Correction (FEC) which is one of the most common means of performing packet error recovery in data transmissions. FEC schemes typically tune the FEC rate in accordance with feedback information provided by the receiver. However, the feedback and FEC rate calculation processes unavoidably have a finite duration, and thus the FEC rate implemented at the sender may not accurately reflect the current state of the network. The authors proposes an Enhanced Random Early Detection Forward Error Correction (ERED-FEC) mechanism to improve the quality of video transmissions over Wireless Local Area Networks (WLANs). In contrast to most FEC schemes, the FEC redundancy rate is calculated directly at the Access Point (AP). The experimental results show that the proposed ERED-FEC mechanism achieves a significant improvement in the video quality compared to existing FEC schemes without introducing an excessive number of redundant packets into the network.[1]

In [2] authors used Forward Error Correction (FEC) techniques to overcome packet losses and improve the quality of video delivery. The authors propose an Adaptive Cross-Layer FEC mechanism (ACFEC) to enhance the quality of video streaming over 802.11 Wireless Local Area Networks (WLANs). Under the conventional FEC approaches, FEC functions are implemented on the application layer, which require feedback to calculate the redundancy rate. The proposed ACFEC mechanism, however, leverages the functionalities of different network layers. The Automatic Repeat request (ARQ) function on the MAC layer can detect packet losses. The experiment results demonstrate that our ACFEC mechanism is able to adaptively adjust and control the redundancy rates and, thereby, to overcome both of short-term and persistent channel fluctuations. Consequently, model under various network conditions, performs better in recovery than the conventional methods, while generating a much less volume of redundant traffic.[2]

In [3] authors presents a survey on the solutions that are developed to improve the Quality of Service characteristics of video delivery and streaming over the WLANs based on the implementation layer of the solutions. These solutions mainly concentrate on the three major layers namely, Application layer (APP), Physical layer (PHY) and the Medium Access Control layer (MAC). Also, some major issues like security and energy are being discussed in this work. We conclude that the technologies and application of video over WLANs will attain a new peak in the near future.[3]
In [4] authors explore the dynamics of Forward Error Correction (FEC) schemes in multi-rate wireless local area networks. The authors study the fundamental behavior of a 802.11gnetwork which already has embedded error correction in physical layer, under unicast and broadcast modes in a real outdoor environment and then explore the effectiveness of packet level FEC over wireless networks with multi-rate capability. [4]

III. SENDER-BASED FEC MECHANISMS

A. *Constant Error Rate FEC (CER-FEC):*

Proposed a sender-based Constant Error Rate FEC (CER-FEC) scheme for enabling the dynamic QoS control of real-time multimedia streams over heterogeneous environments comprising wired and wireless connections. As in the proposed scheme, the packet error rate is periodically observed at the receiver side and any change in the error rate is fed back to the sender. Upon receiving this information, the sender calculates the number of redundant packets required to restore the error rate to its original value. In other words, the FEC redundancy rate is dynamically controlled in such a way as to maintain a constant packet error rate at the receiver end.

B. *Cross-Layer FEC (CL-FEC):*

Proposed an efficient Cross-Layer FEC (CL-FEC) scheme for wireless video multicasting designed to maintain the received video quality for all the users above a certain pre-specified level. In the proposed scheme, each user periodically reports the number of packets received out of the previously transmitted packets. The sender then calculates the number of packets which each user has lost and determines the maximum number of packets which can be decoded by all the users (i.e. the number of decodable packets for the user with the greatest number of packet losses).

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C. *Basic Concept of ERED-FEC Mechanism:*

Enhanced Random Early Detection Forward Error Correction (ERED-FEC) mechanism is implemented for improving the quality of video transmissions over wireless LANs (WLANs). In the proposed approach, redundant FEC packets are generated dynamically at the AP in accordance with both the condition of the wireless channel and the current network traffic load. The channel condition is evaluated by monitoring the number of packet retransmissions. As the number of retransmissions Increases (i.e., the condition of the wireless channel deteriorates), a greater number of redundant FEC packets are generated. Conversely, as the channel condition improves, the number of FEC packets is reduced. The network traffic load is evaluated by monitoring the queue length at the wireless AP. If the queue is almost empty, i.e., the network is only lightly loaded, the number of redundant FEC packets is increased. By contrast, if the queue is nearly full, i.e., the network is heavily loaded; the number of FEC packets is reduced. By adopting this approach, the ERED-FEC algorithm significantly improves the video quality without overloading the network with an excessive number of redundant packets. An analytical model is proposed for predicting the quality of MPEG-4 video streams delivered over WLANs with FEC protection in terms of the effective packet loss rate and the Decodable Frame Rate (DFR) [22], [23]. It is shown that the model provides the ERED-FEC mechanism with the means to determine the FEC redundancy rate required to guarantee the QoS requirements of video transmissions over lossy wireless networks. Fig. 1 illustrates the basic architecture of the AP-based ERED-FEC mechanism proposed in this study. (Note that an assumption is made that the wired segment of the video delivery path is loss free.) As shown, the ERED-FEC mechanism consists of five components, namely (1) a packet type classifier (2)a packet loss monitor (3) a video quality model (4) a network load monitor and (5) a FEC packet generator. During video streaming, the streaming server encapsulates the video data in Real-time Transport Protocol (RTP) packets and delivers them to the receiver through the wireless AP. When packets arrives at the AP, the ERED-FEC controller retrieves the packet header from the UDP, and identifies the packet type by checking the RTP header. Once a complete block of video packets has arrived, the packet loss monitor estimates the packet loss rate by examining the number of packet retransmissions associated with the block. An appropriate FEC redundancy rate is then determined via the video quality model (i.e., the DFR). Finally, the ERED-FEC mechanism checks the queue length at the AP in order to evaluate the current network traffic load, and then uses this information to adjust the FEC redundancy rate (if required).

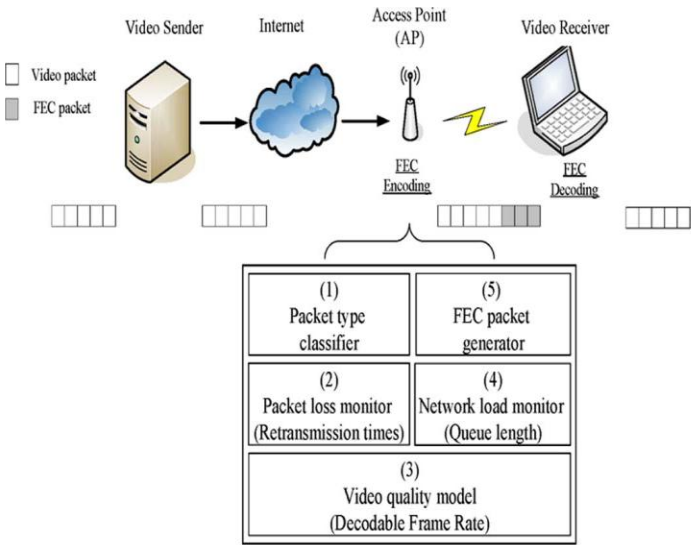

Fig. 1. Architecture of ERED-FEC controller

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IV. IMPLEMENTATION

The work is to implement FEC mechanism for the video transmission over the WLAN. It is based upon GUI (graphical user interface) in MATLAB. It is an effort to further grasp the fundamentals of MATLAB and validate it as a powerful application tool. There are basically different files. These are the programmable files containing the information about different The FEC scheme has been adopted to overcome packet errors/losses and to improve the quality of video delivery. This functionality gets realized by adding error-correcting information to the original data. The FEC is usually performed at the byte level and at the packet level. The byte-level FEC recovers bit errors in one packet, and functions on the physical layer of WLANs. This study focuses on the packet-level FEC mechanism, which mainly deals with packet losses. The source data stream is divided into separate blocks, with each block consisting of *K* source packets. By accurately detecting packet losses and adjusting the redundancy rates accordingly, the number of FEC packets increases or decreases to meet the need of the receiver and to overcome the packet losses. No FEC packets are generated, when the all-video data packets of one block arrive in the receiver successfully.

For (every arriving packet**)**
If (the packets is the video packet**) then**
Save the packet into the buffer
Trace the transmission result
If (the transmission failed**) then**
Increase failure_counter
End If
If (a block is transmitted**) then**
If (failure_counter > 0**) then**
Generate _FEC(failure_counter)
End If
Clear the buffer memory
failure_counter = 0
End If
End If

End For

V. RESULT

The proposed FEC mechanism is implemented with MATLAB. The result and discussion display the different snap shots for the FEC mechanism. In this chapter the video is transmitted from source to destination.

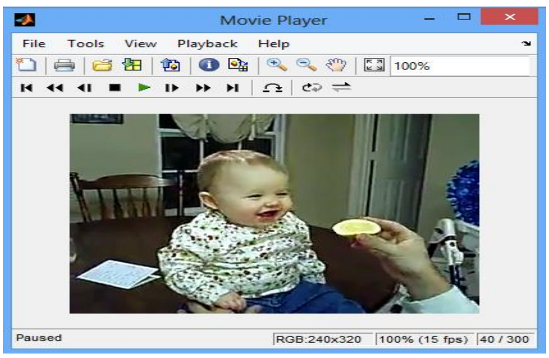

Figure 2: video transmission

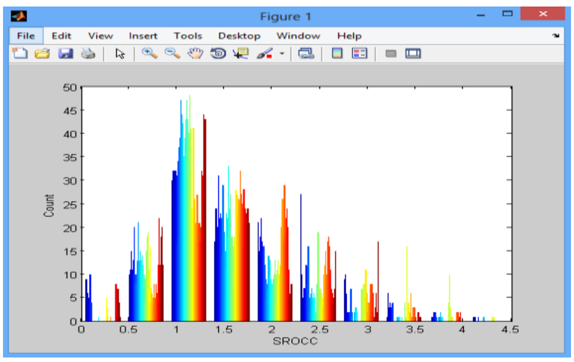

Figure 3: frame count vs. SROCC

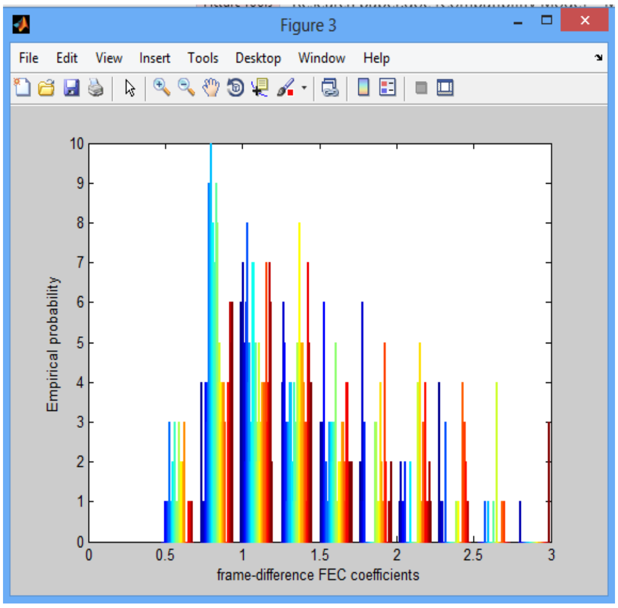

Figure 4: empirical probability vs. frame difference of the video

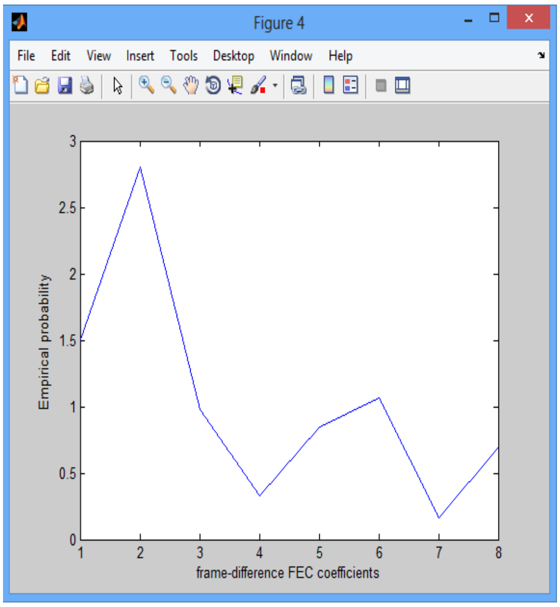

Figure 5: empirical probability vs. frame difference of the video

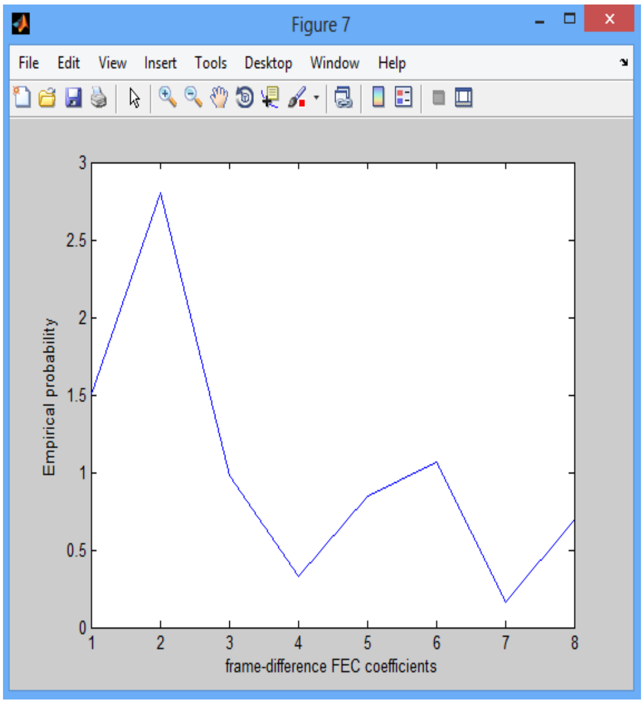

Figure 6: Empirical probability vs. Number of Frames L3

```
>> working_model

features =

    1.5040    1.3528    1.3023
    2.7997    2.4331    2.3799
    0.9742    1.0493    1.0864
    0.3328    0.3570    0.3636
    0.8454    0.8152    0.7963
    1.0624    1.2599    1.1417
    0.1649    0.1190    0.1038
    0.6974    0.4685    0.3881
```

Figure 7: Different frame values for layer L1,L2,L3 level

VI. CONCLUSION AND FUTURE WORK

This paper has presented an AP-based FEC mechanism for improving the quality of video transmissions over WLANs. In contrast to many FEC schemes, in which the FEC rate is determined at the sender end on the basis of information provided by the receiver, in the FEC mechanism proposed in this study, the FEC redundancy rate is

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determined at the wireless access point (AP).Moreover, the FEC redundancy rate is calculated in accordance with both the wireless channel condition and the network traffic load. As a result, the FEC mechanism significantly improves the video quality without overloading the network with redundant packets. Our future work will include further evaluation of the hybrid approaches.

REFERENCES

[1]. Ce-Kuen Shieh ; Wen-Shyang Hwang" An Access Point-Based FEC Mechanism for Video Transmission Over Wireless LANs" Multimedia, IEEE Transactions on_ (Volume:15 , Issue: 1), 12 December 2012.
[2]. Longzhe Han, Sungjun Park "An Adaptive Cross-Layer FEC Mechanismfor Video Transmission over 802.11 WLANs" KSII The first International Conference on Internet (ICONI) 2009, December 2009.
[3]. Dr.N.Saravanaselvam" Layered Implementation Solutions for Video Transmission over Wireless LANs" International Journal of Advanced Research in Computer Science and Software Engineering, Volume 3, Issue 11, November 2013 ISSN: 2277 128X.
[4]. Thanasis Korakis, Yao Wang, and Shivendra Panwar "Is Physical Layer Error Correction sufficient forVideo Multicast over IEEE 802.11g Networks?" 978-1-4244-2309-5/09/$25.00 ©2009 IEEE.
[5]. Cheng-Han Lin, Ce-KuenShieh, and Wen-ShyangHwang,"An Access Point-Based FEC Mechanism for Video Transmission Over Wireless LANs", IEEE Trans. Multimedia, vol. 15, pp. 195- 206, Jan 2013
[6]. H. Zhihai and X. Hongkai, "Transmission distortion analysis for real-time video encoding and streaming over wireless networks," IEEE Trans. Circuits Syst. Video Technol., vol. 16, pp. 1051–1062, 2006.
[7]. A. Nafaa, Y. Hadjadj-Aoul, and A. Mehaoua, "On interaction between loss characterization and forward error correction in wireless multimedia communication," in Proc. IEEE Int. Conf. Communications, ICC 2005, 2005, pp. 1390–1394.
[8]. J. Dan, F. Pascal, and J. Aleksandar, "Forward error correction for multipath media streaming," IEEE Trans. Circuits Syst. Video Technol., vol. 19, pp. 1315–1326, 2009.
[9]. K. Takahata, N. Uchida, and Y. Shibata, "Packet error and frame rate controls for real time video stream over wireless LANs," in Proc. Int.Conf. Distributed Computing Systems Workshops, ICDCSW2003, May 2003, pp. 594–599.
[10]. I. V. Bajic, "Efficient cross-layer error control for wireless video multicast," IEEE Trans. Broadcast., vol. 53, pp. 276–285, 2007.
[11]. K. Park and W. Wang, "AFEC: An adaptive forward error correction protocol for end-to-end transport of real-time traffic," in Proc. Int. Conf. Computer Communications and Networks, ICCCN1998, Oct. 1998, pp. 196–205.
[12]. C. H. Lin, C. H. Ke, C. K. Shieh, and N. Chilamkurti, "An enhanced adaptive FEC mechanism for video delivery over wireless networks," in Proc. Int. Conf. Networking and Services, ICNS2006, 2006.

BIOGRAPHY

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