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USING ERED-FEC MECHANISM TO IMPROVING VIDEO QUALITY TRANSMISSION ON WiMAX

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ABSTRACT *:* Forward Error Correction (FEC) 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 inevitably have a finite duration, and thus the FEC rate implemented at the sender may not accurately reflect the current state of the network. Thus, this project proposes an Enhanced Random Early Detection Forward Error Correction (ERED-FEC) mechanism to improve the quality of video transmissions over Worldwide Interoperability for Microwave Access(WiMAX).It is a broadband wireless technology that allows rapid deployment of video streaming services. In contrast to most FEC schemes, the FEC redundancy rate is calculated directly at the Access Point (AP). Moreover, the redundancy rate is tuned in accordance with both the wireless channel condition (as indicated by the number of packet retransmissions) and the network traffic load (as indicated by the AP queue length).

KEYWORDS—FEC,videoquality,access point.

I INTRODUCTION

The use of wireless devices such as laptop computers and PDAs to connect to Internet services is becoming increasingly common nowadays. However, wireless communication channels are prone to serious transmission errors due to attenuation, fading, scattering or interference. Packet losses in wireless environments are generally recovered using either Automatic Repeat reQuest (ARQ) or Forward Error Correction FEC) methods. ARQ schemes automatically retransmit the lost packets during timeouts, or in response to explicit receiver requests. By contrast, in FEC schemes, the effects of potential packet losses are mitigated in advance by transmitting redundant packets together with the source packets such that a block of packets can be successfully reconstructed at the receiver end even if some of the packets within the block are lost during transmission. Of the two approaches, FEC schemes result in a lower retransmission latency, and are therefore widely preferred for the delivery of video streams over WiMAX.Conventional FEC mechanisms are sender-based, the redundant packets are generated and encoded at the sender end. Broadly speaking, sender-based FEC schemes can be categorized as either Static FEC (SFEC) or Dynamic FEC (DFEC). In SFEC schemes, the number of redundant packets added to the source packets remains constant irrespective of changes in the network condition.

The recovery performance of SFEC schemes is therefore somewhat unpredictable because they fail to capture the real-time network conditions and adjust the FEC redundancy rate accordingly. In most DFEC schemes, the FEC rate is tuned at the sender based on information provided by the receiver. The packet error rate is measured periodically at the receiver side and fed back to the sender, which then calculates the FEC rate required to maintain a constant packet error rate at the receiver end. In the FEC rate is adjusted incrementally in such a way as to preserve a pre-determined value of the Peak Signal-to-Noise Ratio (PSNR) at the receiver end. Meanwhile, the FEC scheme modifies the FEC rate in accordance with changes in the network delay.The FEC redundancy rate is traditionally calculated at the application layer based on feedback information such as that pro-vided by acknowledgement messages (ACKs). However, the feedback and FEC rate calculation processes have a finite du-ration, and thus there is no guarantee that the FEC rate implemented at the sender end accurately reflects the current network condition.

II.RELATED WORK

A. Forward Error Correction (FEC*)*

The basic principle of FEC entails injecting redundant packets (h) into the video stream together with the source transmission packets (k) such that packet losses can be recov-ered at the receiver end without the need for retransmission. In other words, as shown in Fig. 1, the original block is encoded as (nk) packets, where n is the summation of source packets (k) and redundant packets (h). Thus, provided that no more than h packets are lost in transmission, the source transmission packets can be successfully recovered at the receiver. Since FEC schemes enable the recovery of source packets which would otherwise be lost, the effective loss rate in the transmission network is lower than the actual loss rate.
In FEC codec, redundant packets are derived from the original packet using conventional coding theory techniques. Of the various traditional error correcting codes available for this purpose, Reed-Solomon (RS) code has attracted particular interest. RS code provides an ideal error protection capability against packet losses since it is a maximum distance separable code, i.e., no other coding scheme exists capable of recovering lost source data symbols from a lesser number of received code symbols.

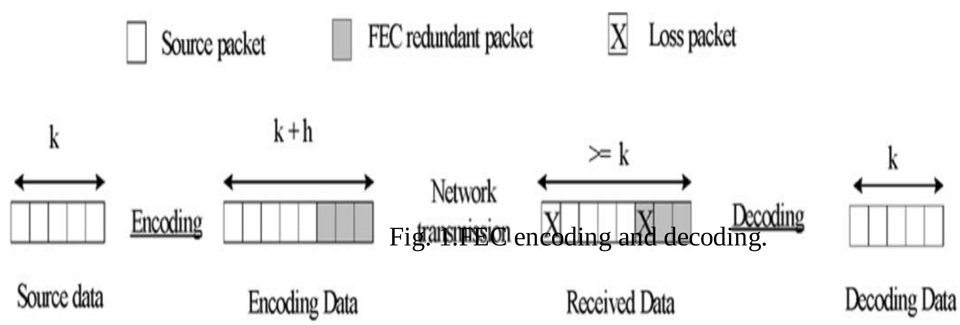

Fig. 1.FEC encoding and decoding.

B. Sender-Based FEC Mechanisms

1) Constant Error Rate FEC (CER-FEC):Takahata *et al.* 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 shown in Fig. 2 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.

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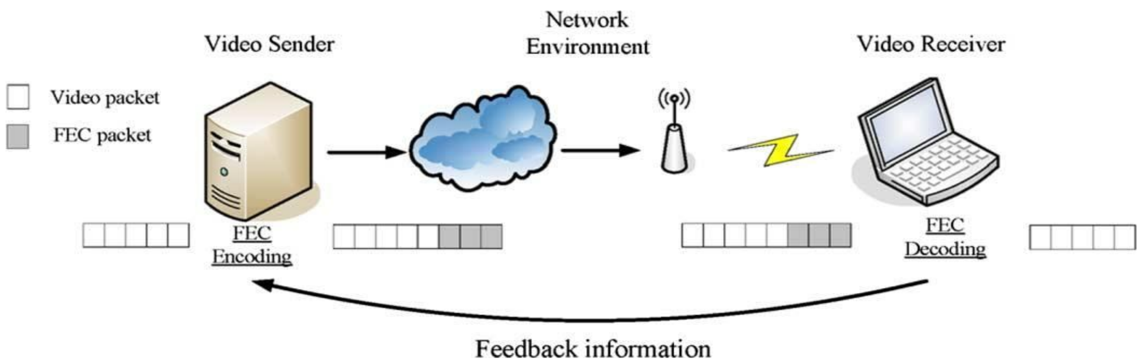

Fig. 2.Sender-based FEC scheme.

2)Cross-Layer FEC (CL-FEC):Bajic *et al.* [12] proposed anefficient 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 k 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.

3) Adaptive FEC (AFEC):Park *et al.* [13] presented an adaptive FEC (AFEC) protocol for facilitating the end-to-end trans-port of real-time traffic whose timing constraints rule out the use of retransmission-based congestion control or QoS provisioning schemes. In the proposed approach, the degree of FEC redundancy is tuned in accordance with the current network delay. Specifically, the number of redundant packets is increased as the network delay decreases, but is reduced as the delay increases.

C. AP-Based FEC Mechanisms

1) Random Early Detection FEC (RED-FEC)*:* Inheavily-congested networks, traditional FEC-based error recovery schemes increase the redundancy rate in order to compensate for the greater number of packet losses. However, the redundant packets worsen the network congestion, and therefore further degraded the network performance. To ad-dress this problem, Lin *et al.* [20] proposed a Random Early Detection FEC (RED-FEC) scheme in which the redundant FEC packets are generated dynamically at the wireless AP in accordance with the current network traffic load, as indicated by the AP queue length (see Fig. 3). Specifically, the number of redundant packets is increased as the queue length shortens, but is reduced as the queue length grows. Importantly, when the queue is near to full, no FEC packets are generated in order to avoid overloading the network. By adopting this approach, the RED-FEC mechanism improves the quality of the delivered video stream without injecting an excessive number of redundant packets into the network.

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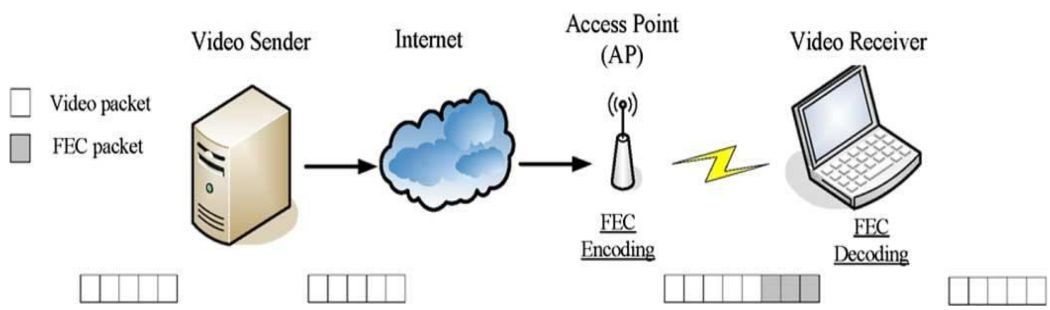

Fig. 3.AP-based FEC scheme.

2) Adaptive Cross-Layer FEC (ACFEC):Han *et al.* [21] pro-posed an Adaptive Cross-layer FEC (ACFEC) scheme for enhancing the quality of video transmissions over IEEE 802.11 WLANs. The cross-layer design enables the ACFEC mechanism to leverage the functionalities of the different network layers. For example, packet loss information is retrieved using the ARQ function of the MAC layer, while the FEC redundancy rate is controlled adaptively at the application layer utilizing the UDP protocol. Specifically, as the source packets are trans-mitted through the wireless AP, the ACFEC mechanism moni-tors the transmission performance continuously via the failure information from the MAC layer. After transmitting one block of video packets, the failure counter is used to adjust the FEC redundancy rate accordingly.

D. Contribution of Present Study

ENHANCED RANDOM EARLY DETECTION FEC (ERED-FEC) MECHANISM

The major contribution of the present study is to propose a new AP-based FEC mechanism (ERED-FEC) for improving the quality of video transmissions over WiMAXs (WLANs). The literature contains many proposals for sender-based FEC schemes [11]–[13], which have a finite duration to feedback in-formation from the receiver. Thus, the FEC rate determined at the sender end may not accurately reflect the current network condition. The proposed ERED-FEC mechanism is AP-based and the FEC rate is calculated at the AP directly without feed-back information from the receiver. Moreover, while the literature also contains various proposals for AP-based FEC schemes [20], [21], these schemes consider only single metric, such as the wireless error rate or only the traffic load to determine the FEC rate. By contrast, in the ERED-FEC mechanism proposed in this study, the FEC rate is controlled adaptively in accordance with both the wireless channel condition and the network traff c load. By adopting this approach, the ERED-FEC mechanism significantly improves the video quality and avoids overloading the network with an excessive number of redundant packets.In addition, this paper proposed an analytical model for predicting the performance of video transmissions over a WLAN with FEC protection. In fact, the video quality is determined not only by the loss effect of wireless network but also the coding dependency of MPEG-4 video frames. However, the analytical models in previous related works [22], [23], [26]–[28] did not take the FEC recovery performance and frame coding dependency aspects into consideration. In [26]–[28], the video quality cannot be directly evaluated using these models because these models did not include coding dependency of video frames. Moreover, the Decodable Frame Rate (DFR) which is proposed in [22], [23] is a performance metric to assess the video quality of streaming MPEG- 4 video. However, the loss effect of wire-less transmissions on video quality using DFR is measured by a simple parameter (such average packet loss rate in wireless net-work) without considering the actual behavior of the FEC recovery performance. Therefore, the advantage of the proposed model is to consider not only effects of FEC recovery

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performance but also the impact of the loss of specific MPEG-4 video frames.

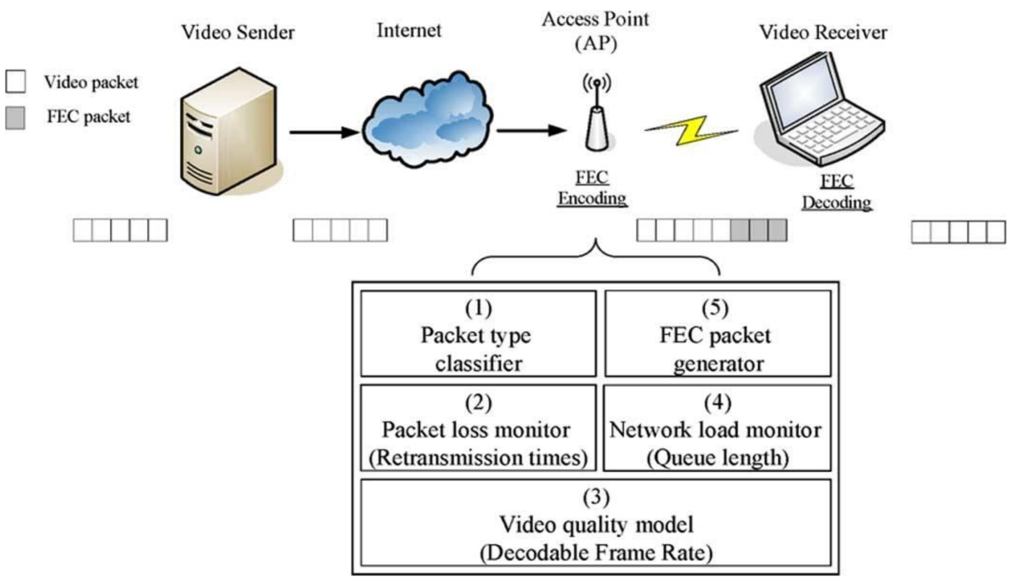

Fig. 4.Architecture of ERED-FEC controller.

Fig. 4 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 con-sists of fi ve 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 a packet 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).

III.CONCLUSION

This paper has presented an AP-based FEC mechanism **(ERED-FEC)** 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 informa-tion provided by the receiver, in the FEC mechanism proposed in this study, the FEC redundancy rate is determined at the wireless access point (AP). Moreover, the FEC redundancy rate is calculated in accordance with both the wireless channel con-dition and the network traffic load. As a result, the ERED-FEC mechanism significantly improves the video quality without overloading the network with redundant packets and also yields a higher Decodable Frame Rate (DFR) and Peak Signal-to-NoiseRatio (PSNR) than existing AP-based FEC mechanisms under both light and heavy network traffic loads.

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IV.FUTURE WORK

As the future work, the recovery performance of the ERED-FEC mechanism will be further enhanced by utilizing an FEC inter-leaving/de-interleaving strategy. In addition, the feasibility of extending the ERED-FEC scheme to IEEE 802.16 (WiMAX-WiMAX mobile devices) networks will also be addressed.

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REFERENCES

[1] E. Maani and A. Katsaggelos, “Unequal error protection for robust streaming of scalable video over packet lossy networks,” IEEE Trans.Circuits Syst. Video Technol., vol. 20, pp. 407–416, 2010.
[2] L. Han, S. Park, S. Kang, and H. P.In, “An adaptive cross-layer FEC mechanism for video transmission over 802.11 WLANs,” in Proc. Int.Conf. Internet, ICI 2009, Dec. 2009, pp. 209–215.
[3] J. Paavola, H. Himmanen, T. Joela, J. Poikonen, and V. Ipatov “End-to-End prediction model of quality and decodable frame rate for mpeg broadcasting services vol. 52, pp. 274–285, 2006
[4] A C. H. Lin, C. K. Shieh, N. Chilamkurti, C. H. Ke, and W. S. Hwang, “A RED-FEC mechanism for video transmission over WLANs,” IEEETrans. Broadcast., vol. 54, no. 3, pp. 517–524, Sep. 2008.
[5] S.-H. G. Chan, X. Zheng, Q. Zhang, W.-W. Zhu, and Y.-Q. Zhang,“Video loss recovery with FEC and stream replication,” IEEE Trans.Multimedia, vol. 8, pp. 370–381, Apr. 2006.
[6] I. V. Bajic, “Efficient cross-layer error control for wireless video multicast,”IEEE Trans. Broadcast., vol. 53, pp. 276–285, 2007.
[7] A. Nafaa, Y. Hadjadj-Aoul, and A. Mehaoua, “On interaction between loss characterization and forward error correction in wireless multi media communication,” in Proc. IEEE Int. Conf. Communications,ICC *2005*, 2005, pp. 1390–1394.
[8]kihwanchoi and sunghyunchoicross-layer product code for video multicast over IEE802.11,”IEEE Trans. Broadcast., vol. 53, pp. 276–285, 2007.
[9] LucaBaldantoni, HenrikLundqvist and Gunnar Karlsson “: Adaptive end-to- end FEC for improving TCP performance over wireless links,” in Proc. Int.Conf. Computer Communications and Networks, ICCCN2004, 2004, pp. 196–205
[10] Dan Jurca, Member, IEEE, Pascal Frossard, Senior Member, IEEE, and AleksandarJovanovicforward error correction for multipath media streaming VIDEO TECHNOLOGY, VOL. 19, NO. 9, SEPTEMBER 2009