International Conference on Network Applications, Protocols and Services 2008 (NetApps2008)
21 - 22 November 2008
Executive Development Center, Universiti Utara Malaysia

Effects of Packet Size on FEC Performance

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Abstract- **Packet loss can have a destructive effect on the reconstructed video which makes the presentation displeasing to human eyes. with the availability of Forward Error Correction (FEC), the error of packet losses in streaming applications for both video and audio data can be better managed and controlled.. Different FEC packet sizes can cause variation in packet loss and packet loss ratio. Selecting appropriate packet size is important. In this paper we examine how the FEC packet size effects on the packet loss and packet loss ratio. Ns2 simulator is used to evaluate FEC packet size and find optimal FEC packet size.**

Keywords: **FEC, Packet size, Packet loss Ratio, Ns2**

I. Introduction

FEC is a mechanism for error control correction. It functions by sending redundant data to original data which enables the receiver to correct errors once detected. FEC does not require channel feedback. FEC has been proposed to recover packets losses in multimedia applications such as audio and video [1, 2]. FEC sends original and redundant data as block of FEC (n, k). k is the number of data packets in a FEC block, and n is the number of all the packets in the FEC block or called FEC block size (Block length).

There are two approaches of FEC design to recover data packets from losses [2]. Namely, these are the: *Media dependent*, or *Media-specific media,* and *Media independent*. Figure 1.1 shows how Media-dependent, or Media-specific media FEC is being used. Media dependent FEC prevents packet loss by transmitting each packet more than once. When a packet is lost, one of its extra packets is able to restore the lost as shown in figure 1.1. The first packet transmitted of audio or video packet is the primary encoding because it has the best quality. Duplicate of this packet is the minor or secondary encoding. The sender is able to decide if the quality or bandwidth of this packet should be The same or lower than the main encoding packet.

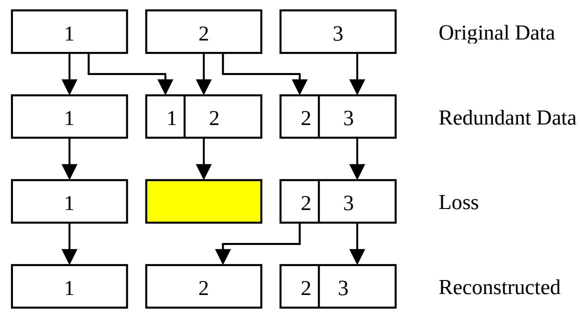

Figure 1.1 Media-Dependants, or, Media-Specific FEC.

Figure1.2 shows Media-independent FEC. Media independent FEC does not need to know what is inside the contents of the stream. Block or algebraic codes are transmitted to help repair what was lost. The k data packets is codeword, and n-k extra packets are transmitted for n packets that needs to be sent over the Internet.

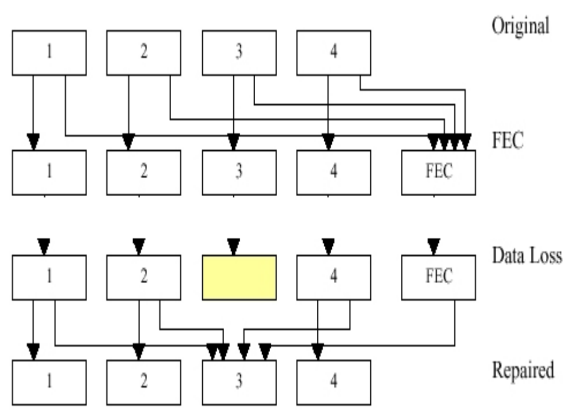

Figure 1.2 Media-Independent FEC.

In this paper, we investigate the effect of different FEC packet size on the FEC performance for video streaming over Internet with respect to packet loss and packet loss ratio. The rest of the paper is organized as follows; Section 2 discusses the introduction of video streaming; Section 3 is about the forward error correction (FEC); Section 4 explains the experimental design, Section 5 details all the simulation results, and Section 6 concludes the paper.

II. Video Streaming

Video streaming applications need a continuous stream of video data sent over the Internet. Such as: Internet broadcasting, Education (distance learning), Video-on-demand (VOD), and many more. There are two modes of transmission video over Internet, download and streaming [3]. In the download mode applications such as file transport protocol (FTP), the users have to downloading the complete file before starting view. While the streaming mode enables user to view the received part of the file and other is still transmitting. Figure 2.1 illustrates the architecture for video streaming.

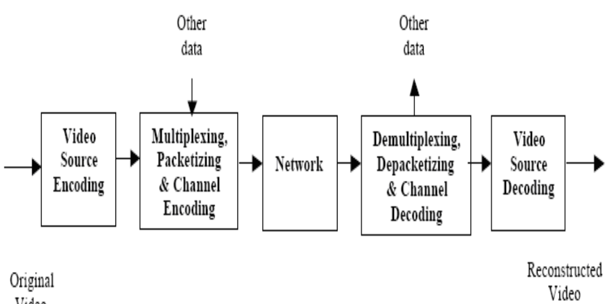

Figure 2.1 Video streaming System

III. Forward Error Correction

The aim of FEC is to add specialized redundancy that can be used to recover data from packet loss errors. A number of forward error correction techniques have been developed to repair losses of data during transmission [4-9]. The basic idea of FEC is to add redundant packets on compressed source packet to enable error detection and correction. Redundant packets are transmitted so that the original message can be reconstructed in case the packets are lost. If there are K data packets, FEC will add $N - K$ redundant packets and the FEC overhead is N/K [6]. Where N is he blocks size. If the losses are less than redundant packets, then the transmitted data can be perfectly recovered loss data at the received. However, if the losses are greater than the redundant packets, then only a portion of the data can be recovered.

IV. Experiment Design

In this simulation experiment, we examine the effects of different FEC packet size against number of packet loss, and packet loss ratio to show how the FEC packets size effect on the FEC performance for video streaming over Internet with respect to packet loss and packet loss ratio using Ns2 simulator [10] . Figure 4.1 shows our simulation topology. We took different FEC packet size (300, 500, 700, 900, 1100, 1300, and 1500) and run simulation for each packet size 50 times and we used RNG to

We generate two sets of competing traffics pattern (FTP, CBR) since TCP is the most used Internet traffic. We attached the FTP to TCP source, and CBR to FEC source. Routers are configured using *DropTail* management policy. The table.1 shows simulation parameters:

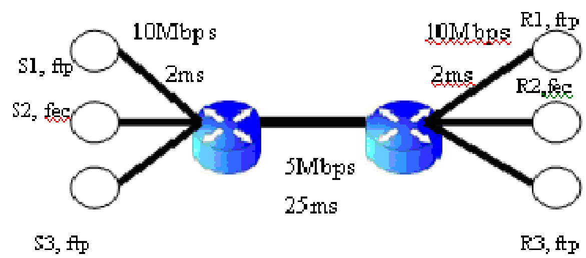

Figure 4.1 Simulation topology

Table 1. Simulation parameters

Parameter	Value
Packet size (ftp)	1000 bytes
FEC Packet Size	300,500,700,900,1100, 1300,1500
Bottleneck bandwidth	5 Mbps
Bottleneck delay	25ms
Sidelink bandwidth	10Mbps
Sideline delay	2ms
FEC block number	50
FEC block size	255 packets
Redundant packet	10 packets
Management policy	DropTail
Queue limit	25 bytes
Simulation Time	200 second

The effects of FEC packet size simulated by calculating the lost packets at R1, and packets number of successfully received at FEC receiver. PLR is computed based on the following formula:

$$PLR = \frac{LostPacket}{lostpacket + receivedpacket} \quad (4)$$

V. Result Discussion

Table 2 presents the result of the simulation experiment. The table presents the FEC packet size, the total number of received packets, number of lost packets, and packet loss ratio.

Table. 2 Simulation result

Packet size	Packet loss	Received packet	PLS
300	178	12572	0.013992157
500	112	12638	0.008778039
700	106	12644	0.008346667
900	156	12594	0.012258824
1100	86	12664	0.006713725
1300	117	12633	0.009157647
1500	211	12539	0.016536471

We obtain the total received packets by simulating the received packet at FEC receiver, from analysis the trace file that was received by running the simulation for many times, we use AWK [11] to analysis the trace file. We obtain the packet loss by simulating the drop packet at the first router. We compute the Packet Loss Ratio (PLR) based on formula No.4:

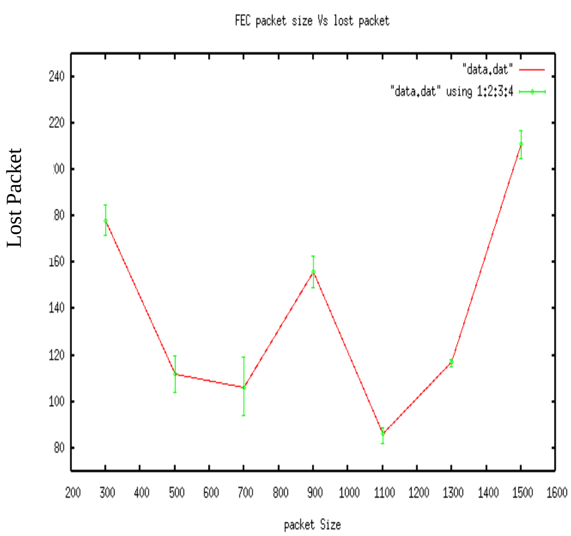

Figure 4.1 lost Packet Vs Packet size

In figure 4.1 we plot the FEC packet Size Vs number of packets loss. Evidently, packet loss is varies for different packet size, we can see from the plot graph, when FEC packet size is 1100 it has the minimum packet loss. When FEC packet size is 1500 it has the maximum packet loss. So when the FEC packet size is 1100 bytes can improve the performance of FEC for improving the video streaming quality.

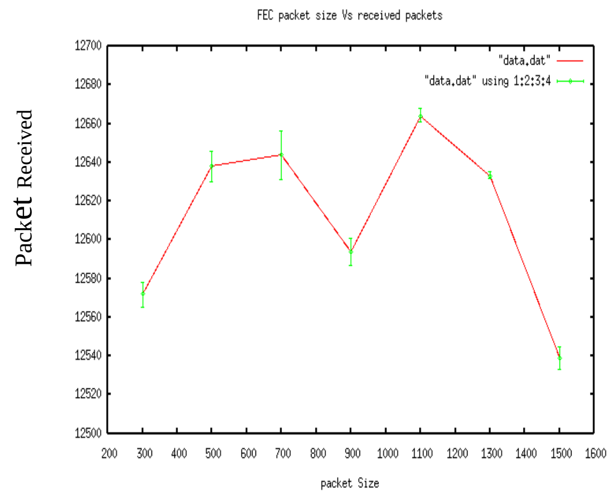

Figure 4.2 Packet Received Vs Packet size

In figure 4.2 we plot the FEC packet Size Vs number of packet received. Evidently, packet received is varies for different packet size, we can see from the plot graph, when FEC packet size is 1100 it has the maximum number of packet received. When FEC packet size is 1500 it has the minimum number of packet received. So when the FEC packet size is 1100 bytes can improve the performance of FEC for improving the video streaming quality.

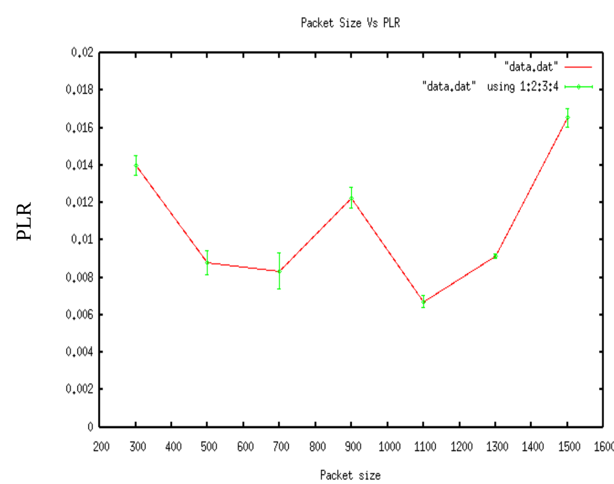

Figure 4.3 PLR Vs Packet size

In figure 4.3 we plot the FEC packet Size Vs PLR. Evidently, PLR is varies for different packet size, we can see from the plot graph, when FEC packet size is 1100 it has the minimum PLR. When FEC packet size is 1500 it has the maximum number of packet received. So when the FEC packet size is 1100 bytes can improve the performance of FEC for improving the video streaming quality.

Finally. We can conclude that FEC packet size of 1100 bytes is the suitable FEC packet size to improve the performance of FEC for improving the video streaming quality.

VI. Conclusion

This paper investigated the effects of different FEC packet size on FEC performance. The results had shown how the FEC packet size effect on the packet loss, and packet loss ratio. The simulation results elicited that the best FEC packet size is 1100 bytes. Consequently, since the packet size of 1100 bytes have PLR is low the efficiency of network utilization high. Therefore, 1100 FEC packet size provides good efficiency of network utilization. The results presented here can be used as basis for future research on FEC performance.

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