Drone for live video multicasting: *Understanding how reliability* parameters affect playback delay

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Introduction

The popularity of drones has increased in recent years due to their applicability in a broad spectrum of scenarios in different fields. Particularly, live video streaming has shown to be of interest in search and rescue, law enforcement, military operations and for industrial uses and entertainment. In some cases a reliable multicast scheme is needed if multiple users require the video. We examine how adaptation of video, transmission and erasure coding rate can improve reliability of multicast while also considering video playback delay.

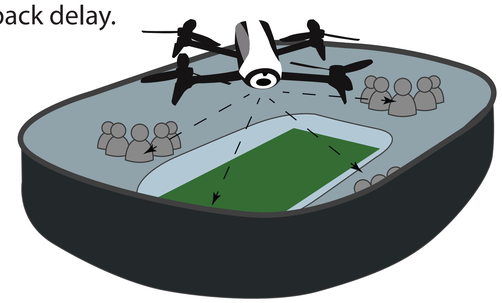

Figure 1

System components

Video rate: Is the average bitrate of the video.

RLNC: Random linear network coding is an erasure code that adds resilience against packet losses.

TxR : Transmission rate is the physical data rate. Lower rates provide resilience against noise, while higher rates are more sensitive against noise, but offer higher throughput.

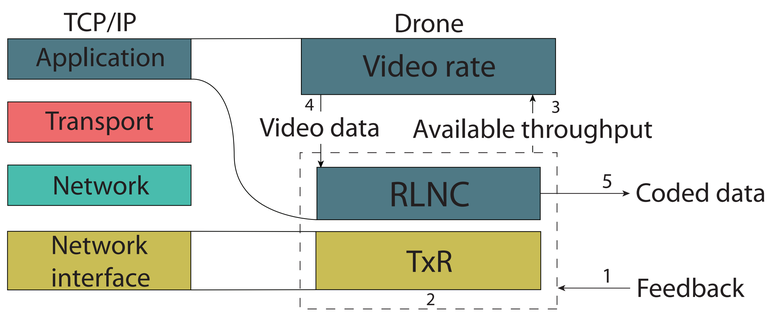

Figure 2

Results

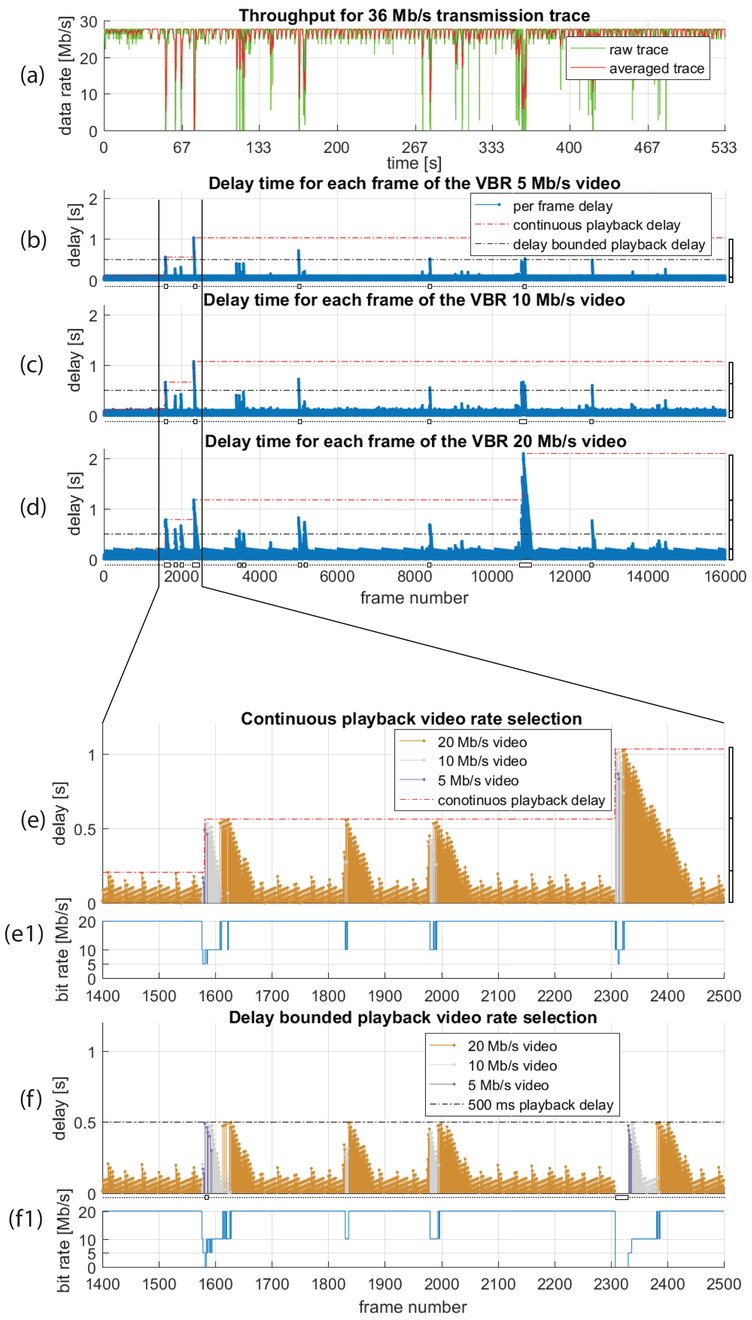

Figure 3

Discussion

We analyze two video playback methods:

Continuous playback is playing every frame of the video in chronological order. Whenever a frame is delayed more than the previous frame the playback delay is increased and a playback freeze occurs. The strength is that every frame of the video is present, the weakness is that there is no upper bound on either the playback delay or the buffer size.

Delay bounded sets a strict delay requirement and this is the exact amount of time before the receiver will play the video. Frames delayed beyond this threshold are discarded. Thereby strict delay and buffers sizes on the sender and receivers are guaranteed. The strength of this method is that the video has a constant playback delay, but the down side is freezes occur in the video whenever frames are not delivered fast enough.

The results are shown in the Table below.

	Video Rates	5 Mb/s	10 Mb/s	20 Mb/s
Continuous playback	Playback freezes	3	3	4
	Total freeze time	1.032 s	1.074 s	2.102 s
	Accumulated playback delay	1.032 s	1.074 s	2.102 s
Delay bounded playback	Playback freezes	5	6	11
	Total freeze time	1.133 s	2.533 s	15.833 s
	Accumulated playback delay	0.5 s	0.5 s	0.5 s

Our analysis resulted in two policies:

Continuous playback policy is when a frame is delayed beyond the initial delay we switch to the video rate, which causes the lowest additional delay. If delay decrease we switch to the highest video rate that does not introduce further delay. An illustration of this policy is seen in Figure 3(e).

Delay bounded policy is when frames from the 20 Mb/s video are delayed less than 500 ms they are played. If the delay is exceeded a lower video rate that still fulfil the requirements is used. If none of the video rates are able to fulfil the 500 ms delay requirement we experience playback freeze. Figure 3(f) illustrates the switching done to fulfil the 500.

Scan the QR code to see a video test demonstration