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Title: On the characterization of the cell loss process of VBR MPEG on ATM
Purpose: Information and discussion
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1. Summary

This contribution presents some recent statistics on the cell loss process of variable bit-rate (VBR) MPEG-1 video for ATM applications. A simulation model that uses TES [1] source models of MPEG VBR video, derived from empirical data obtained by encoding five test sequences (over 3000 frames), in the 5-10 Mbps regime (average bit-rate = 5.4 Mbps, average peak-to-average ratio = 4, average SNR = 31 dB) was used to study the cell loss process at different network utilization levels. The discrete event simulation samples the status of the multiplexer buffer (of size 10*N cells) every $(30*N)^{-1}$ seconds, where N is the number of video users. Thus the aggregate bit-rate changes only at the beginning of the sample interval. If at the end of the interval the buffer overflows the aggregate number of cells lost is distributed among users proportional to the corresponding user's incoming cells. The results are helpful as a starting point for the understanding of the cell loss process in statistically multiplexed VBR MPEG. This understanding is necessary to formulate ATM channel models for performance evaluation of end-to-end VBR MPEG video systems.

2. Simulation Results

In Table 1 a summary of the cell loss process given by the aggregate cell loss rate (CLR), average burst length and inter burst length for a wide range of utilizations is presented. It is observed that for MPEG-1 video in the bit-rate regime considered and without any form of traffic shaping, the average burst length is in the order of tens of msec and tens to lower hundreds of cells for a wide range of network utilization. The range of the inter-burst length has a larger variance going from seconds and tens of thousands of cells, for low utilizations to tens of msec and hundreds of cells for congested scenarios. Note that although the absolute results shown for burst and inter-burst lengths are averages accurate only for lengths >> than the sampling interval used in the simulation (ranging from 2 to 1 msec), the relative impact of network loading in the cell loss process is independent of the sampling interval. Figures 1 and 2 show the effect of throughput on the distribution of burst and inter-burst length, respectively.

3. Conclusions

The results show large burst lengths in the open loop, i.e without traffic shaping, case. Future contributions will report on the effect of different levels of traffic shaping on the statistics of the cell loss process.

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[1] TES is a non-linear model based on AR-1 in modulo 1 arithmetic. TES models guarantee a match on the marginal distributions of the model and the empirical data while allowing a large set of possible autocorrelations.

Utilization, ρ (Users)	CLR	Av. Burst Length		Av. Inter Burst Length	
		(cells)	(msec)	(cells)	(msec)
0.618 (16)	9.0 e-04	26	11.6	22927	1618
0.706 (18)	3.0 e-03	27	14.0	9352	660
0.782 (20)	9.0 e-03	32	15.3	3337	227
0.810 (21)	1.6 e-02	36	15.6	2692	190
0.878 (23)	2.5 e-02	47	20.6	1204	85
0.902 (24)	4.0 e-02	53	22.6	963	68
0.924 (25)	5.5 e-02	65	25.6	751	53
0.938 (26)	7.3 e-02	72	30.1	652	46
0.967 (28)	1.0 e-02	103	41.6	453	32
0.979 (30)	1.3 e-02	145	57.2	341	24

Table1 Cell loss statistics at different network throughputs

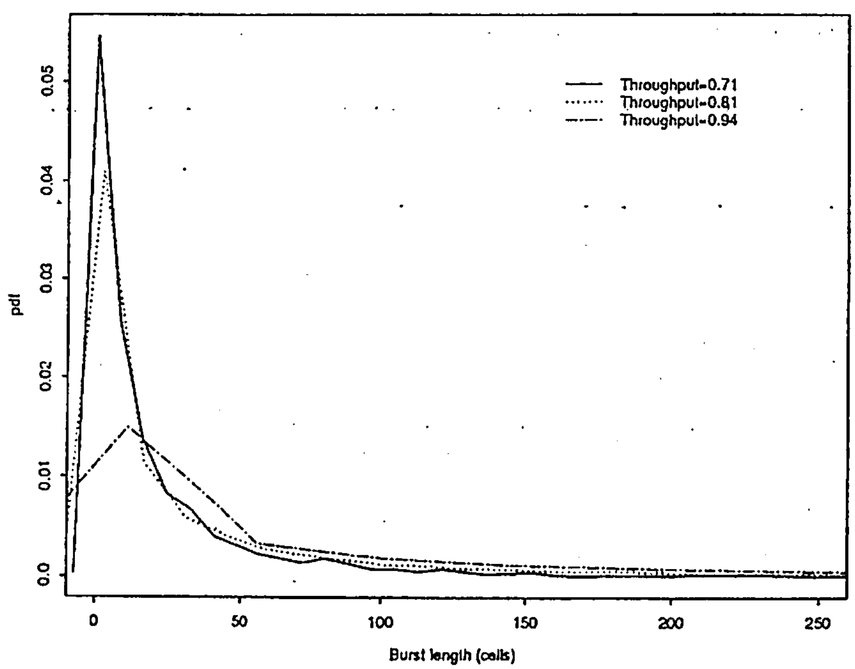

Figure 1: Burst length distribution for unshaped VBR MPEG video

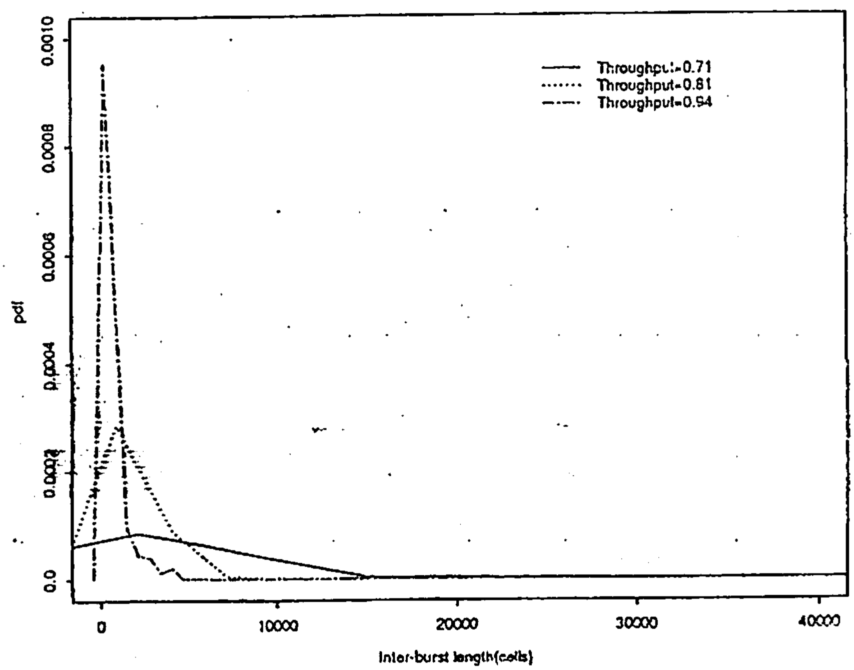

Figure 2: Inter-burst length distribution for unshaped VBR MPEG video