SIMULATION OF MODIFIED PUSHOUT MECHANISM WITH ELASTIC AND DETERMINISTIC TRAFFIC SOURCES WITH PRIORITIES

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Keywords: ATM, Data Performance, Pushout mechanism,and Simulations

The aim of this paper is to present data performance analyses in Asynchronous Transfer Mode (ATM) network. Cells generated by different type of traffic sources face different priority schema entering the ATM switch. That is because of the different nature of the service used. Real-time services like telephone and video obtain higher priority. Elastic traffic, or data services are considered to be non-delay sensitive and obtain lower priority.

1. INTRODUCTION

In the literature, the ATM switch is approximated usually as a single server queue with different priority disciplines [4]. Our ATM switch also differentiates many types of traffic sources. Queue length is assumed 76 waiting places. Cell serving rate is 2.7 us (155 Mbps). Serving discipline is FIFO (First Input First Output) with and without priorities. It is shown the main structure of the simulation model. For elastic traffic the servicing discipline is without priorities the queue acts as pure FIFO. In other case I apply priority schema the queue is FIFO for different types of priority classes due to the nature of the pushout mechanism. High-level priority cells overcome all low level priority cells.

The mechanism proposed here with aims at overcoming the unfairness with respect to data traffic during dynamic share of ATM links within a real time traffic. Two thresholds are used, and reaching the high one – R_H, cells are serviced in the following manner (Fig. 1):

(1) On arrival of a high-priority cell and with a high threshold (R_H) reached, all cells between R_L and R_H are checked (from R_L to R_H *or* from R_H to R_L) and if a low-priority cell is found, it is discarded, thus it is created free place in buffer for the high-priority cell.

(2) If no low-priority cell is found between R_L and R_H, and buffer end K is not reached, a high-priority cell is inserted in the buffer.

(3) On overfilled of buffer capacity, cells are discarded following a PPD policy[1].

(4) The start and end cells of packets are serviced with priority (as VBR cells). Thus, proposed pushout mechanism keeps shortest packets (Today, approx. 60% of Internet traffic has length one or two cells.), and avoids phenomena of packets merging[3], which dramaticly reduce data perfomance.

The aim of the introduction of threshold R_L is to guarantee some fairness for the sources of low-priority traffic: considering that the mechanisms of buffer management are intended to cope with short-term overloads, it is expected that some amount of the low-priority traffic would be successfully transmitted, even for very high intensity of the high-priority traffic.

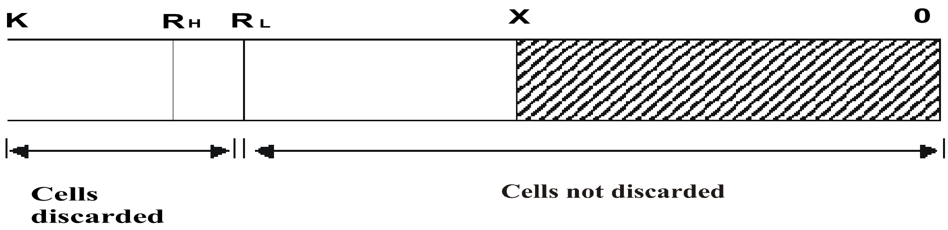

Fig. 1. Modified Push- out Mechanism.

Essentially, the above set up represents a conceptual model of the mechanism discussed and used for buffer management. The formalization is carried out by using an appropriate Q-scheme [1].

2. SIMULATION MODEL

The approach of building the algorithm uses the capabilities of GPSS language for indirect addressing and description in the blocks [3]. Thus, regardless of the number of simulated ATM links, the algorithm always contains one basic body per each of the two traffic types (high- and low-priority traffics).

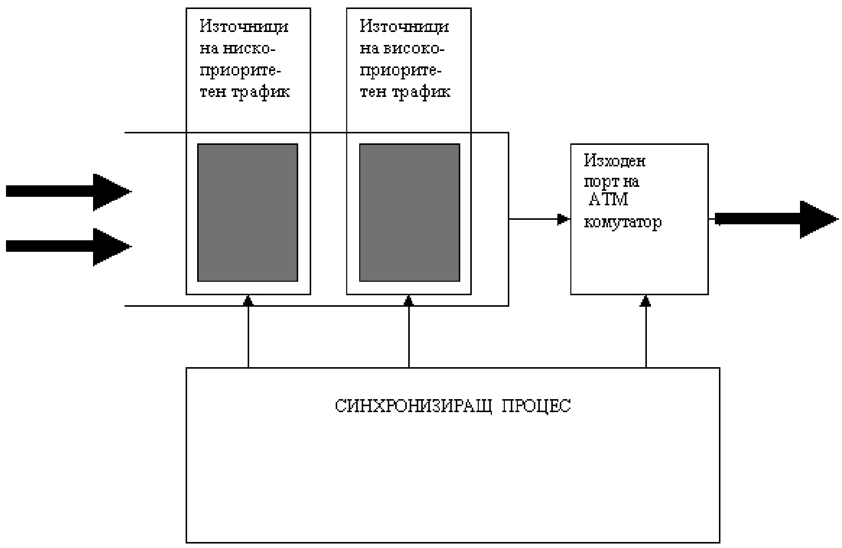

Fig. 2

The model is based on queuing system, dealing with service realized when a push-out mechanism is in action. A simulation program to evaluate push-out efficiency is created in GPSS (General Purpose Simulation System). Since processes that take place in ATM switches during packet discard are servicing ones, it seems felicitous for one to characterize them by Q-scheme (fig.2). Notations used in the present paper are as follows: G – traffic sources, F - device, Q – buffer, RL and RH – buffer thresholds, X – current length of the buffer queue.

Cells, being processes according to the control mechanisms strategy and having entered the corresponding output buffer Q of the ATM switch, wait to be serviced by device F, i.e. to be transmitted through the switch output port. Finally, cells that have been serviced in device F, are discarded.

The ATM output port- Line is adopted as a device in the model designed, since two states (occupied and released) are defined for it during the time of ATM-switch performance. On the other hand, this enables one to use the built-in capabilities of the GPSS interpreter to collect various statistical data for the devices.

In order to correctly reflect the final buffer capacity, buffer is presented as a group of K-number of fragments with one flag per each fragment (0 –vacant fragment, 1-occupied fragment). The value of parameter /P1/ is further used to access flags and variables (of K- number, too) describing buffer state (0 –vacant fragment, 1 – fragment occupied by a high-priority cell and 2 - fragment occupied by a low-priority cell). Parameter P1 is also used for transact transmission through various model blocks. Initially, M-number of transacts are generated and they enter next blocks where transact parameters P4 successively adopt corresponding values N, N-1, …N-M+1. Note that using those values, indirect addressing and description in the GPSS blocks are carried out in the model outlined below. Intensity of cell generation and the distribution law are determined by the algorithm (the ON – OFF period is given by the time of gate opening/closure).

3. SIMULATION RESULTS

The simulation model is encoded on GPSS (General Purpose Simulation System). Load of the queue system varies among 0.7 and 1.5 ATM link capacity. All types of traffic sources in the model have different representation and weight during the simulation. Ratio of high- to low priority cells varies among 3:1, 1:1 and 1:3. The ATM line interface serves only one cell at given moment. New cell arriving at the same moment waits in the queue or is lost in case of full queue.

The rest of the paper represents part of the results obtained after simulation. On figures 3-8 are depicted the dependence of waiting times and cell loss can be seen as a function of intensity of traffic sources (load), ratio of high- to low priority and buffer capacity. The servicing discipline is pure FIFO with priorities. Due to the deterministic nature of the traffic sources the effect of statistical multiplexing is almost not seen.

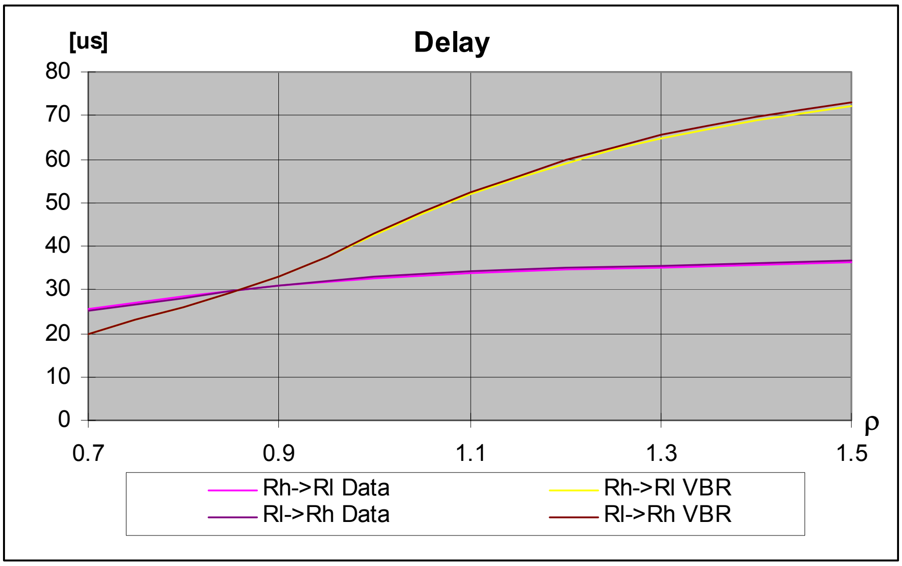

Fig. 3

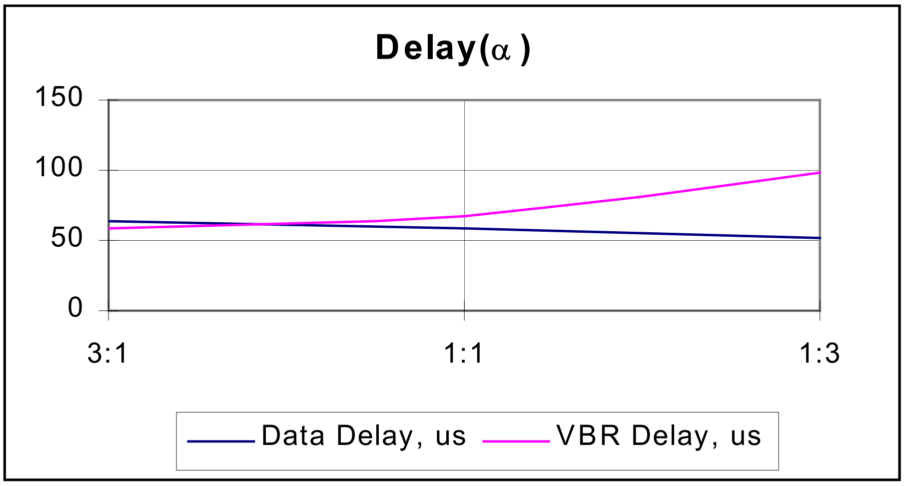

Fig. 4

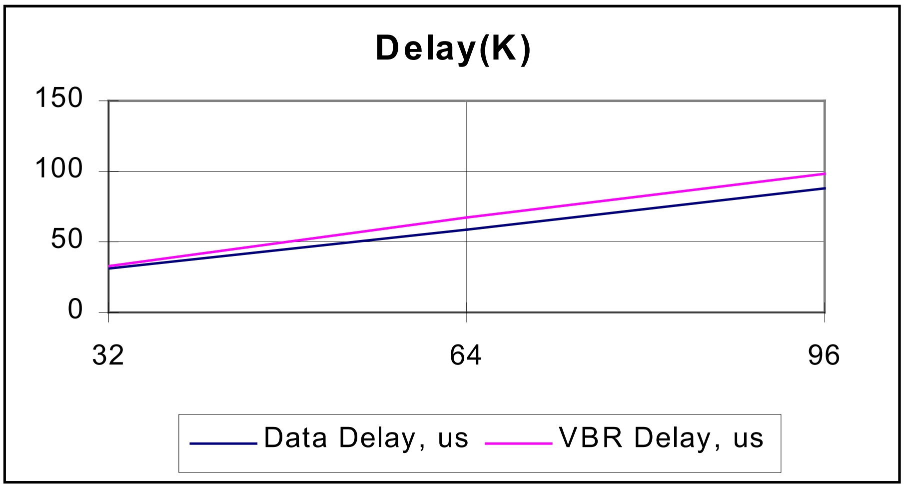

Fig. 5

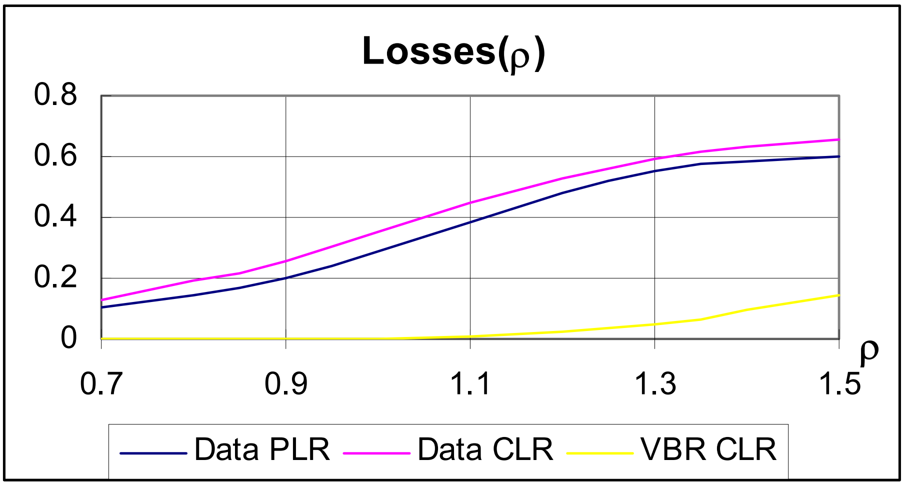

Fig. 6

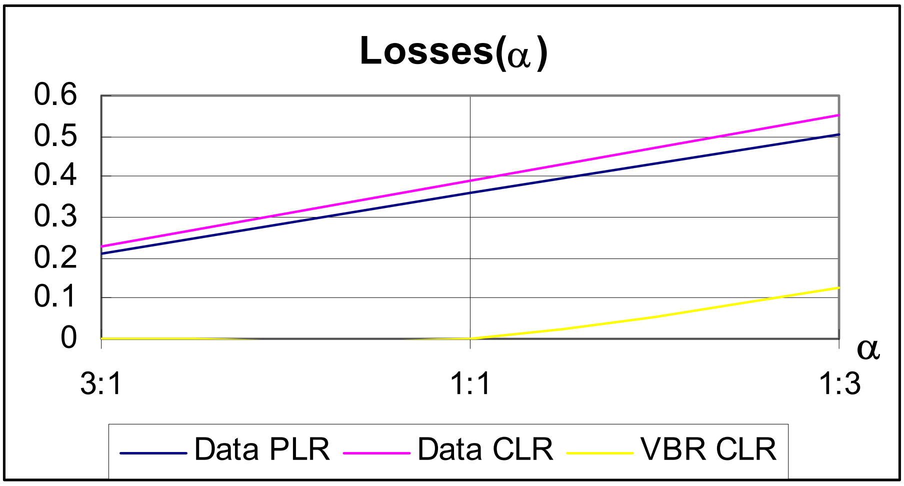

Fig. 7

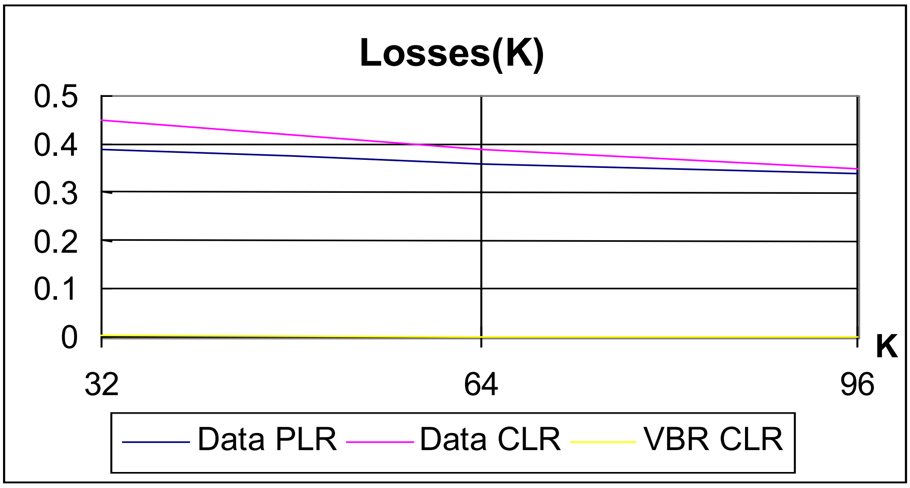

Fig. 8

High rate sources like videos occupy the queue. This assumption influences on end-to-end delay. Thus, the delay of the high priority cells is increased. I detect some specific thresholds of cell loss and cell delay that depend on specific thresholds of queue length, intensity of traffic sources (load) and the ratio between high and low-priority traffic.

4. CONCLUSION

The improved buffer management mechanism– modification of push-out, and an invariant simulation model for the investigation of its performance have been proposed. The model is used to study the effect of various factors on data performance of mechanism push-out, keeping shortest packets. Some numerical results, found by using the designed simulation model are given and analyzed.

5. REFERENCES

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