Simulation of Burst Aggregation and Signalling schemes for Optical Burst Switched Networks

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Abstract – In this paper the model of IP-packet aggregation in the ingress node for OBS networks proposed. The main difference of this model is packet loss probability accounting due to block sizes distribution. Simulation results determined that proposed algorithm 10 times reduces the IP-packet losses, providing the same throughput.

Key words – IP, Optical Burst Switching, Burst Header Packet, Intermediate Node Initiation.

I. Introduction

Nowadays in optical networks the state-of-the-art switching techniques and new physical solutions implements due to increasing the network efficiency [1-3]. These new solutions causes demanding of new conception IPoDWDM. The next generation of IPoDWDM networks is Optical Burst Switching technology (OBS) [4,5]. OBS allows to increase efficiency of throughput utilization by static bursts multiplexing. Herewith, OBS does not require strict synchronization because of special structure of control burst header packet (BHP).

In modern optical transport networks three main difference of OBS from circuit and packed switched networks.

- burst positioned as intermediate (in terms of duration) solution between connection session and packet;
- burts can be transmitted without confirmation, therefore, necessary bandwidth established for burst more quickly than for circuit switched networks;
- optical burst switching assumes transmission without buffering, in difference to packet transmission for which buffering is necessary.

Incoming IP packets from access networks assemblies into different sizes optical bursts by ingress node [6,7]. Before burst transmission ingress node sends the BHP to destination node for establishing virtual channel with confirmation or without it depends on transport layer protocols. Signaling and users' data division allows to eliminate necessity of expensive optical buffers. At destination node bursts disassemble onto separate IP packets. The architecture of OBS networks presented in Fig.1. Optical burst switching network consist of two main types of functional elements: ingress node and transparent edge node [8,9]. Ingress nodes responsible for aggregation of low rate streams from access network and forming of bursts traffic.

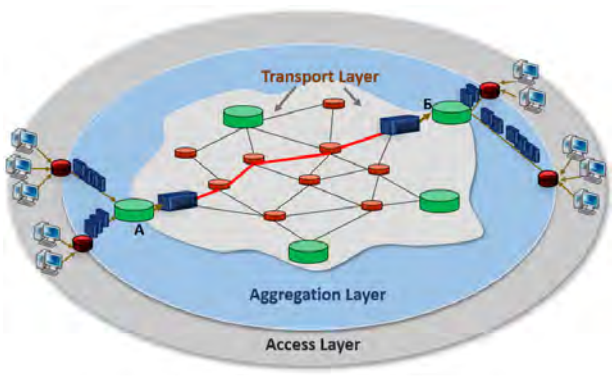

Fig. 1. Architecture of optical burst switching network

II. Simulation of Burst Assembly Ingress node

Ingress node of optical burst switching network developed for optical bursts assemblying from IP packets which arrives in electrical representation. The functional scheme of OBS network ingress node shown in Fig.2.

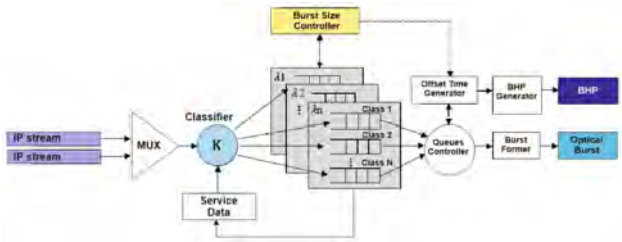

Fig. 2. Model of OBS network ingress node

Model, presented in Fig.2 describes sequence of burst assembly process and BHP generation. The first stage is an aggregation of IP traffic from access network to one stream of optical bursts according to packets priority. In IPv4 the Type of Service (ToS) field contains information about one of possible class of service: low latency, high throughput, high security, etc. Thus, 8 possible class of service defined for IPv4. Because of IPv6 implementation, ToS field was exchanged by field Priority, which define 16 priority values for datagrams. 16 possible values of this field divides onto two different categories. From 0 to 7 used for datagrams, which may not be transmitted while network is overloaded, such as TCP, e-mail, FTP, NFS, TELNET, X-interactive. From 8 to 15 – for packets which must be transmitted surely.

Stage of burst assembly from incoming IP-packets on ingress nodes is one of most important task of optical burst switching networks. The significant factor is burst size distribution which influence for network traffic properties. We provide simulation of three different burst aggregation alghorithms.

Obtained results shows that using algorithms based on buffer loading criteria, packet losses in network are absent(Fig.3). However, number of bursts exceeded 2000, because of small size of bursts, which decreases network throughput. Using latency based alghorithm burst size was large and network throughpup was maximal. But for large traffic intensity this algorithm allows 30 % packet loss (Fig.4).

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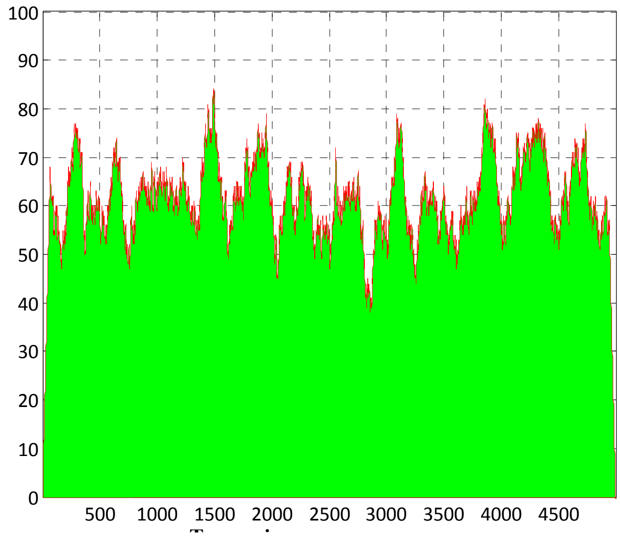

Fig. 3. Buffer loading for loading criteria algorithm

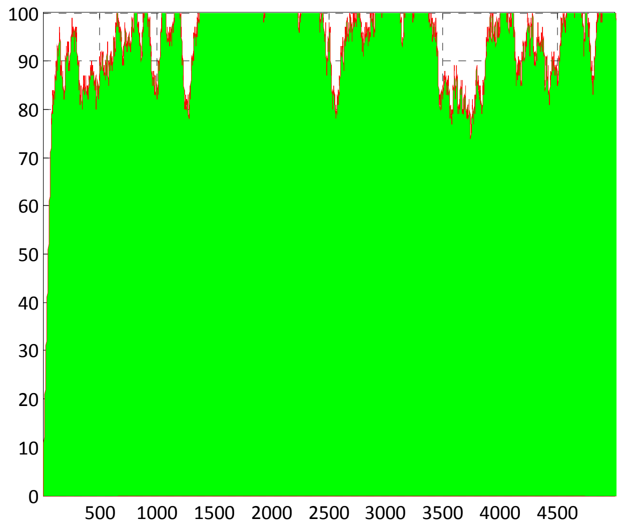

Fig. 4. Buffer loading for latency criteria algorithm

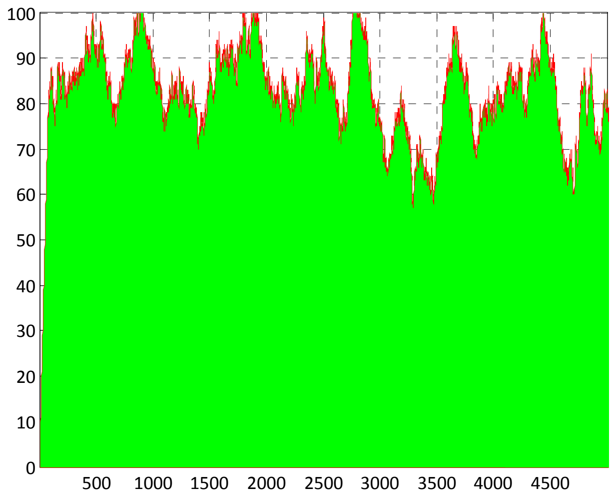

Fig. 5. Buffer loading for adaptive algorithm

For adaptive criteria algorithm optimal balance between throughput and packet loss provbability achieves. For example, packet loss probability for adaptive algorithm, as shown in Fig.5, is 3 %, which is 10 times less than for latency criteria algorithm.

Conclusion

In this paper we suggest using new algorithm for burst aggregation in optical burst switching networks. The difference of this algorithm is adaptive choosing of limitation criteria for burst size. We provide simulation for three different algorithms: buffer loading criteria, latency criteria and adaptive algorithm. Simulation results, shows that adaptive algioritthm is able to achive throughput, which equal to latency criteria algorithm, providing 3 % of packet losses, which is 10 times less than for latency criteria algorithm.

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