A Dynamic Wavelength and Bandwidth Allocation Algorithm with Dynamic Framing under Ring-based EPON Architecture

Hakjeon Bang, Chang-Soo Park
Department of Information and Communications
Gwangju Institute of Science and Technology (GIST). Gwangju 500-712, Korea
starm021@gist.ac.kr

Abstract—To reduce delay for high priority packets in the ring-based EPON, the EPON packet classifier groups services as their priorities and frames for services are dynamically framed as their priorities. Since dynamic framing for a packet priority dynamically changes assignment spaces in the maximum framing packet size as network traffics, it makes services with high priority to improve quality of services with relative low threshold time for transmitting.

Ⅰ. DWBA with Dynamic Framing under the Ring-based EPON Architecture

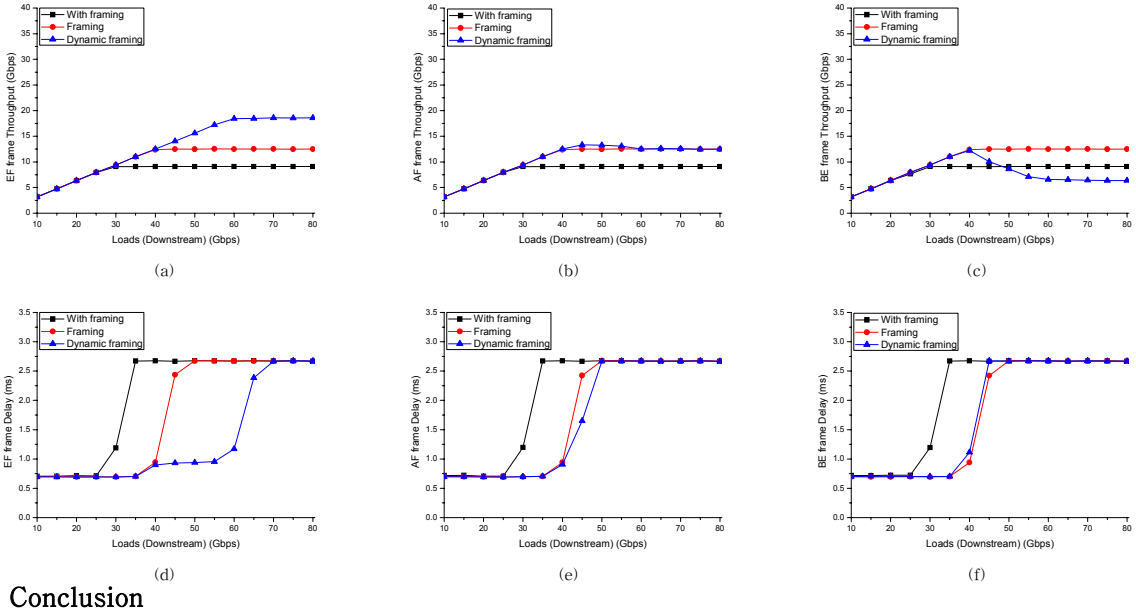
A framing technique improves throughput by reducing overheads related to preambles for packets and guard bands. However, since packets for services have own priorities and threshold times for service providing, packets should be classified as classes of service (CoS) to several queues and be dynamically framed for their service due-time. For example, packets for network control must get there. Services of voice have threshold delay of 10 ms and delay of video services should be less than 100 ms.

A dynamic framing technique determines how many frames will be contained in a packet by framing as CoS. For example, if average delay for transmitting packets with high priority is over the maximum threshold time, spaces for frames with high priority will be increased in a packet. If average delay is less than the minimum threshold, spaces for frames will be decreased. However, the maximum frame space for high priority cannot be over maximum transmission window and the minimum frame space should be larger than guaranteed spaces for services. But, high priority frames firstly checked for framing and then next priority frames will be occupied in a packet if size of high priority frames is less than service-guaranteed spaces. The maximum and minimum threshold time should be calculated with consideration about the time for guaranteeing services and propagation delay. Because these values are for improving QoS for high priority frames, the value roughly calculated is acceptable if it satisfies requirement about maximum allowed delay time.

Ⅱ. Simulation

A simulation model for dynamic framing in the ring-based EPON architecture, which is consisted of an optical line terminal (OLT) and several optical networking units (ONUs), is developed in C++. First, in this architecture, tunable transmitters and receivers at the OLT are shared by all the ONUs. Second, ONUs have no local DWDM light source. ONUs modulate optical continuous wave (CW) bursts transmitted by the OLT

for upstream transmissions. Therefore, the status of all shared resources has to be kept track for a scheduling algorithm and be arranged properly in both time and wavelength for upstream and downstream transmissions. 8 ONUs are placed from the OLT at 20 Km and use 4 wavelengths from λ_1 to λ_4. The transmission line speeds for both upstream and downstream are set to 10 Gb/s. The maximum grant size and the guard band are set to 30 Kb and 0.05 μs, respectively. IP packets are assumed that they have constant size of Ethernet frame of the 1518 bytes and generate constant bit rate. Downstream packets for ONUs are uniform destination distribution. Each generated IP packet is encapsulated into an Ethernet frame, put into a FIFO queue and then encapsulated. The size of queue is set to 3 Mb. Packets with QoS information are classified as their services to EF(Expedited Forwarding), AF(Assured Forwarding), BE(Best Effort) packets. Frames stored in queue will be discarded when they have scheduling delay of more than 2 ms.



Ⅲ. Conclusion

To guarantee quality of services for EF and AF packets with high priorities, spaces for high priority frames should be adjusted as their threshold time and network loads. Dynamic framing makes services with high priority to transmit more quickly in framing for frames transmitted from traffic queues. So, to improve throughput and delay for service priorities, size of the maximum transmission packet should be differently adjusted by dynamic framing.

Reference

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