Journal of High Speed Networks 16 (2007) 123–131
IOS Press

ROBS: A novel architecture of Reliable Optical Burst Switching with congestion control

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Received 6 March 2007

Abstract. In this paper, we propose a novel improved architecture of Optical Burst-Switched Networks, called *Reliable Optical Burst Switching* (ROBS), which introduces congestion control and retransmission mechanisms of TCP to OBS layer. Design issues of edge and core nodes for ROBS networks are both demonstrated. Part of its function has been implemented on *ns*-2 platform and its performance are evaluated by simulation.

Keywords: Optical burst switching, congestion control, transmission control protocol, reliable OBS

1. Introduction

IP over Wavelength Division Multiplexing (WDM) has been regarded as the framework of future optical Internet. Optical Burst Switching (OBS), which combines the advantages of wavelength routing and optical packet switching while avoiding their difficulties, is considered as one of the most promising approaches to implement IP over WDM. In OBS networks, several client packets with common destination are assembled to form a burst at the ingress of an OBS network, then, a control packet or Burst Header Packet (BHP) is generated for it and sent first to reserve an appropriate amount of bandwidth and configure the switches along its routing path; then the burst is sent without waiting for an acknowledgment for the bandwidth assignment. With control information transmitted on dedicated channels, bursts can be transparently transmitted through the OBS network. Given enough resource, the switching path has been configured well just before the burst arrives such that the burst can cut through the core switches. At the egress, bursts are disassembled to packets which are forwarded on in client networks.

Contention resolution is the first issue to be addressed in OBS networks based on one-way reservation. Four approaches have been proposed up to now. First is *buffering*. It solves the contention in time domain. Since no optical random memory is available, Fiber Delay Lines (FDLs) are the exclusive selection, but they are so clumsy, inflexible and need complex configuration. Second is *Wavelength Conversion*. It solves the contention in wavelength domain. This method can sufficiently utilize the giant bandwidth supplied by WDM links, but all-optical wavelength conversion technology is not mature until now. Third is *Deflection Routing*. It solves the contention in space. Although local blocking is avoided, traffic burden is imposed on other nodes and delay is increased simultaneously. For OBS using Just-Enough-Time (JET) signaling scheme, offset time deficiency easily happens which results that bursts arrive earlier than their corresponding BHPs. The last is *Segmentation*, specific for OBS,

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