A performance study on optical burst switching (OBS) rings

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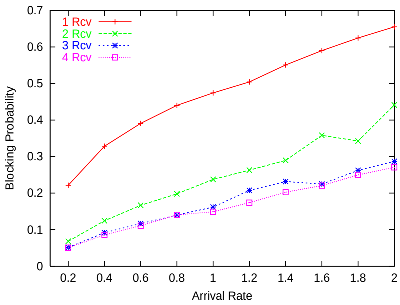
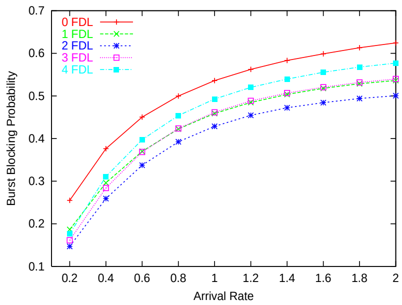
The majority of previous OBS network performance studies has focused on solutions to reduce the *channel blocking* (when there is no available wavelengths on some link(s) or switch output ports along the burst route for a burst) while ignoring the *receiver blocking* (when the receiver at a destination is serving another bursts when a burst arrives) with the assumption of unlimited number of receivers per destination. Xu *et al.* presented a simulation study on the receiver blocking for an OBS ring of special structure under different scheduling schemes.[1] In this paper, we propose to use multiple receivers or a FDL at the destination node to reduce the receiver blocking for a general bidirectional OBS ring with transmitter and receiver that both are fast tunable.

Assuming Poisson burst arrival, exponential burst duration and receiver tuning time, and K receivers, a destination node can be modeled as an $M/M/K/K$ queue. The receiver blocking probability p_r follows the *Erlang's loss formula* and decreases exponentially with the increment of K. Alternatively, using a FDL of fixed length as the optical buffer in front of the receiver may also reduce the burst receiver blocking probability. We have proposed a simple Earliest Arrival Burst First(EABF) scheduling algorithm for this approach.

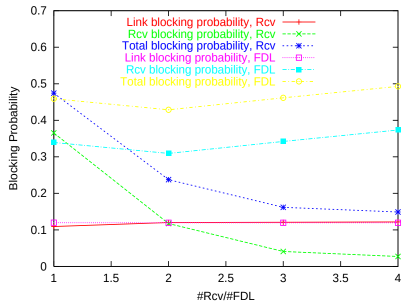
In the simulation study, we assume a size-threshold based burstification process with Poisson packet arrival, shortest-path routing, random-fit wavelength assignment, and the JIT control protocol .[2] Figure (a) and (b) shows the overall burst blocking probability p plotted as a function of packet arrival rate λ_p under different number K of receivers or FD L for a 16-node OBS ring with 12 wavelengths per link. By K FDL, we mean the FDL size is K times of the minimum burst size. As expected, p increases with λ_p in both figures. We also observed, as the number of receiver increases to 2, that p is reduced in about half. However, p almost stops decreasing after k reaches 3. This is because p_r is close to 0 and p is dominated by the channel blocking p_c. With the increment of the FDL size, p decreases first, but then increases after $K = 2$. This is because the receiver blocking decreases first, but begins to increase after K reaches 2. Above observations can be showed more clearly in Figure (c) where we fix the packet arrival rate to 1. The x-axis represents the number of receivers or the size of FDL and the y-axis represents the value of three types of burst blocking probability: p, p_r, and p_c. We observe that p_c is almost constant for various K in both cases. p_r is close to 0 after the number of receivers reaches 3. On the other hand, p_r hits the minimum when the size of FD L is 2. This shows that a small number of receivers would be sufficient to achieve very small p_r, but using FDL under the proposed scheduling has limited effect to reduce p_r. We also observe that p_r counts for a larger part of p when $K = 1$.



(a)



(b)



(c)

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1. Lisong Xu *et al.*, "A simulation Study of Optical Burst Switching Access Protocols for WDM Ring Networks," *Computer Networks*, **41(2)**, Jan. 2003.
2. I. Baldine *et al.*, "JumpStart: A Just-in-Time Signaling Architecture for WDM Burst-Switched Networks," *IEEE Communication Magazine*, **40**, Feb. 2002.