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REVIEW ON CAPACITY IMPROVEMENT TECHNIQUE FOR OPTICAL SWITCHING NETWORKS

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Abstract: In this paper, the performance of optical burst switching (OBS) network has been analyzed with the proposed capacity improvement scheme. In proposed scheme, an ingress edge node has multiple buffers where IP packets are stored depending on their egress edge nodes and bursts are assembled at the buffers in round-robin manner. The results are evaluated in terms of burst (packet) loss rate and compared with conventional assembly schemes. It is observed that the proposed scheme dramatically decreases the overall burst (packet) loss rate while keeping the end to-end delay in a feasible range. Further, through burst throughput simulation result it is shown that proposed scheme is quite useful for an OBS network with large number of input and output links.

Keywords: Optical Burst Switching, burst assembly, scheduling, congestion.

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INTRODUCTION

To meet the increasing bandwidth demands and reduce costs, several optical network paradigms have been under intensive research. Of all these paradigms, optical circuit switching (e.g. wavelength routing) is relatively easy to implement but lacks flexibility to cope with the fluctuating traffic and the changing link state; optical packet switching (OPS) is conceptually ideal, but the required optical technologies such as optical buffer and optical logic are too immature for it to happen anytime soon. A new approach called optical burst switching (OBS) that combines the best of optical circuit switching and optical packet switching was proposed by researchers [1-3] and has received increasing amount of attention from both academia and industry worldwide. Within an OBS network, an ingress

In order to reduce signaling delay, a source node starts burst transmission without receiving any acknowledgement from its egress edge node (one-way reservation). For the one-way reservation, several signaling protocols have been proposed with regard to the reservation period of a wavelength for the burst transmission [4]. In Just-Enough-Time

OBS node assembles IP packets into bursts and sends out a corresponding control packet for each data burst. This control packet is delivered out-of-band and leads the data burst by an offset time. The control packet reserves necessary resources all the way from the ingress node to the egress node where the data burst will be disassembled.

(JET) signaling protocol, a source node sends a control packet and then sends the corresponding burst after some offset time [4-5]. Using extra information to better predict the start and end of the burst, a wavelength is reserved efficiently to transmit the burst. Therefore, the JET protocol will achieve a better performance than other signaling protocols. There are many interesting topics in OBS, such as burst scheduling, burst assembly, offset time setting and contention resolution.

2. Proposed Technique:

The focus of the current work is to analyze the proposed scheme at an edge OBS node (without FDLs) in order to enhance the performance capacity of OBS system. In the proposed scheme, a burst is assembled in a round robin manner and with the JET signaling protocol, assembled bursts are transmitted into the OBS network at multiples of some fixed interval. It is also assumed that the ingress node has one dedicated burst assembly queue for each egress node. All incoming packets will be forwarded to the corresponding queue according to their destinations. When the queue size reaches a threshold or the waiting time of the packets in the

queue reaches a threshold, the packets in this queue are sent out as a burst. In the proposed scheme, data bursts that are too small are not sent out in order to reduce the overhead. Rather, a control packet is generated, when a burst exceeds a minimum burst length or when the assembly period times out, whichever comes first. These two parameters are set in a way such that the minimum burst length is smaller than the average burst length. The aim is to vary burst sizes based on the link congestion levels with the help of size and time threshold values while keeping end-to-end transmission delay in a feasible range. Depending on the congestion level, which is represented by loss rate, on the related outgoing optical link, the threshold values are determined for each virtual queue in order to utilize network resources more efficiently.

The pseudo code of the proposed scheme (based on the above mentioned considerations) is as follows:

- Assemble the packet to corresponding queue
- Determine traffic congestion level
- Select minimum burst length
- Generate a burst control packet
- Fill in and send out a control packet on a control channel
- Schedule the data burst to be sent out on a data channel after an offset time
- Stop the assembling timer

Further, it is also assumed that IP.

3. Simulation:

The simulation software used is Ns-2. The network topology used is composed of 5 nodes: Two edge nodes, one core-node and two destination nodes. It is assumed that there are 8 wavelengths on each fiber. Two fibers, one for each direction, are used to form an optical connection. Line rate of 10Gbps is taken per wavelength. Each node in the topology employs source routing based on Dijkstra's shortest path algorithm. 8 µs of average processing time and a 1 µs of average switching time are assumed. Poisson and self-similar traffic with Hurst parameter (H) = 0.9. In order to schedule bursts, the horizon scheduling algorithm is employed in the OBS network. The minimum burst size is also taken as 1 µs and 95% confidence interval

1. Results:

Outperforms the conventional assembly schemes in terms of burst (packet) loss rate as the offered load gets higher. At low loads, since the network is lightly loaded the loss rate is also too low. Therefore the proposed scheme also allows the burst generators to generate longer bursts. As the offered load gets higher, the number of contending bursts increases, increasing the burst (packet) loss rate. This information is obtained by the burst generator and the burst generator is forced to form shorter bursts.

Load (Erlang)

Burst (packet) loss rate (*0.01)

Conventional Schemes

Proposed Scheme

Load (Erlang)

Delay (microseconds)

Proposed scheme end-to-end delay

Conventional scheme end-to-end delay

Conventional scheme Queuing delay

Proposed scheme queuing delay conventional assembly and the proposed scheme. The queuing delay of the proposed scheme seems to coincide.

Since proposed scheme increase the average burst size by allowing long bursts at some points, longer bursts cause longer transmission time through the fiber so end-to-end delay increases. There is a slight increase in end-to-end delay when proposed scheme is employed. The proposed scheme re-queue the packets that cause the burst to exceed any size threshold level in order to generate bursts of predetermined sizes.

The burst throughput is sensitive to the assembly processing time. The decrease of the burst throughput implies the increase of the burst transmission delay. From Fig.3, it is observed that the proposed scheme improves the average throughput performance as compared with the conventional ones.

Offered Load Throughput

5. CONCLUSION:

In this paper, in order to enhance the OBS system capacity utilization, a novel scheme based on packet (burst) assembly scheme has been proposed. The performance of the proposed scheme has been evaluated in terms of burst (packet) loss rate and average end-to-end delay. The results obtained are compared with those of the conventional assembly schemes. It is shown that the proposed scheme outperforms the conventional assembly schemes with respect to burst (packet) loss rate and thus enhances the OBS network performance. However, the proposed scheme experiences delays for some load values since it allows longer bursts to be generated in order to utilize network resources efficiently. As a future work, the proposed scheme performance will be carried out under heterogeneous traffic supporting QoS. International Journal of Information Technology and Trends

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