ISSN: 2278 - 1323
International Journal of Advanced Research in Computer Engineering and Technology (IJARCET)
Volume 2, Issue 6, June 2013

Throughput Maximization for Optical Burst Switching Networks

Mrs. Kavitha.A
PG Student/Department of ECE
Sethu Institute of Technology, Kariapatti, India.
Ph No: 9962730817

Mrs. Helina Rajini J.
Professor/ Department Of ECE
Sethu Institute of Technology, Kariappatti, India.
Ph No: 9486927217

Abstract– **Optical burst switching is a one-way reservation technique that provides connectionless transmission services. In OBS Data Traffic Discarded at immediate nodes is retransmitted by the sources. In this project work an attempt is made to improve the performance of Optical Burst Switching (OBS) in situation where OBS performance degrades when the control processing time increases. Three feasible methods to improve OBS performance without significantly increasing the implementation complexity. There are Addition of simple Fiber Delay Lines (FDLs), Random Extra Offset time and Window Based Channel Scheduling (WBS). Additional FDLs can eliminate the negative impact cause by the variation of the offset time between control packets and data bursts. The Random Extra Offset time approach does not require any additional hardware and computational complexity in the nodes. If higher computational capability is available WBS in general can provide better throughput improvement than that of Random Extra Offset time when FDLs are used in the nodes to compensate the processing time.**

Index Terms– Control overhead, Offset time,Optical Burst Switching

I.INTRODUCTION

Recently, many in academic circles argued that, due to the lack of sophisticated optical hardware such as optical buffers, one-way reservation techniques such as optical burst switching (OBS) are likely candidates for the transmission of bursty traffic in optical networks in the near future. OBS can provide connectionless transmission services in optical networks without sophisticated optical hardware. Data traffic discarded at immediate nodes is retransmitted by the sources. Thus the one-way resource reservation of OBS effectively reduces the hardware complexity and signal processing requirement.

Since the duration of transmission for bursty traffic is typically short, two-way or centralized resource reservation approaches will be inefficient if the data transmission time is not much larger than the Propagation delay time between nodes. The performance of a one-way resource reservation scheme such as OBS, however, is not sensitive to the propagation delay between nodes.

Many approaches have been proposed to improve the performance of OBS, for example, adding optical buffers (switchable fiber delay lines) to OBS nodes, burst segmentation, centralized resource reservation, and dynamic routing. However, many of these proposals are not practical because they inevitably require much more sophisticated implementation than the original OBS scheme. In order to improve OBS performance without significantly increasing the implementation complexity, it is necessary to delineate the relationship among control processing time, one-way resource reservation, and OBS such that the merits of different improvement approaches can be fully understood. With this understanding, different performance improvement methods can be combined to further improve the OBS performance.

Our main contributions include the following:

1) The performance model has been derived to explain the phenomenon of OBS throughput degradation when the control packet processing time Tcp increases.

2) The compensation factor β in the fiber delay line (FDL) overcompensation approach is critical to OBS performance improvement, but the proper value of β is not easy to determine. We propose to use FDLs only for Tcp compensation. Further improvement in OBS performance is to be achieved by other methods.

3) The performance improvement mechanism of the random extra offset time approach can also improve system performance even if the OBS has zero Tcp or Tcp is fully compensated by FDLs.

4) The first window-based channel scheduling (WBS) that is suitable for OBS with both window time Twd and Tcp compensated by FDLs. In traditional WBS, only Twd is compensated. The proposed WBS can provide better performance improvement for OBS, with and without FDL compensation, than that of traditional WBS.

5) The performance of OBS can be significantly improved by combining different methods such as FDL compensation plus random extra offset time and FDL compensation plus WBS.

II. RELATED WORK

For improving the optical network performance and achieving the QOS parameters we definitely improve the performance of throughput in the networks.

The Author in [1] has proposed the performance model of optical burst switching (OBS) that can explain the degradation of OBS throughput performance when the control packet processing time increases was developed. To improve OBS performance without significantly increasing the implementation complexity three methods was employed: addition of simple fiber delay lines (FDLs), random extra offset time, and window-based channel scheduling (WBS).

The Authors in [12] has proposed the method based on Just-Enough-Time (JET), is described, along with the applicability of OBS protocols to IP over WDM. Specific issues such as the use of fiber delay lines (FDL) for accommodating processing delay and/or resolving conflicts are also discussed. JET-based OBS protocols can achieve good bandwidth utilization by using delayed reservation, and improve fairness by assigning an additional offset time (which is equivalent to a higher priority) to bursts travelling through more hops. OBS can be used to efficiently support multicasting at the optical layer to take advantage of the inherent multicasting capability of some optical switches as well as the knowledge of the physical topology of the WDM layer.

The Authors in [18] has proposed the JIT-OBS paradigm is designed for ultra-low-latency unidirectional transport of data-bursts across an optical network. Just-Enough-Time (JET) is the another signaling scheme, which attempts to utilize additional knowledge concerning the duration of burst transmission in order to schedule the cross-connect settings in each intermediate switches. Due to the reduced channel hold time made possible by forward scheduling, JET may deliver better resource utilization than JIT Signal scheme.

The Authors in [15] has proposed the Burst segmentation is the process of dropping only those parts of a burst which overlap with another burst. Burst assembly is the process of aggregating and assembling IP packets into a burst at the edge of the network. The most common burst-assembly approaches are timer-based and threshold-based An analytical model for prioritized burst segmentation was developed to calculate the packet loss probabilities for a two-priority network. The high-priority bursts have significantly lower losses and delay then the low-priority bursts. And also the concept of composite burst assembly to handle the differentiated service requirements of the IP packets at edge nodes of the optical burst-switched network was described. We considered four different burst assembly approaches and evaluated their performance in terms of loss. But combination of these methods will increase the overall transmission delay.

The Authors in [10] has proposed the analytical model was introduced to evaluate the performance of optical burst switch (OBS) architectures employing fiber delay lines (FDLs) as optical buffers to reduce burst-loss probability. In OBS, a fundamental problem is how to handle burst contentions that occur when two or more incoming bursts are directed simultaneously to a common output line. Two basic contention resolution approaches that have been considered involve the use of multiple wavelengths and/or fiber delay lines (FDLs). There are some limitations in this method. An FDL can only provide a deterministic delay to an incoming burst. Moreover, the burst must be dropped if the maximum delay provided by the FDL is not sufficient. And also the complexity of the Analytical model makes it infeasible for solving problems of practical interest.

The Authors in [7] has proposed the method for the increasing bandwidth demands and reduce costs, Optical Burst Switching paradigm was proposed. The performance of a large set of scheduling algorithms, called best-effort online scheduling algorithms, for OBS networks was analyzed and number of interesting upper and lower bounds on the performance of such algorithms was established. Our analysis shows that the performance of any best-effort online algorithm is closely related to a few factors, such as the range of offset time, burst length ratio, scheduling algorithm, and number of data channels. Consider a large set of scheduling algorithms, called best effort online scheduling algorithms, which includes most of the well-known burst scheduling algorithms such as Latest Available Unused Channel with Void Filling (LAUC-VF), First Fit with Void Filling and Round Robin with Void Filling algorithm.

SWITCHING TECHNIQUES FOR OPTICAL NETWORKS:

Three switching techniques that are well studied to carry IP traffic over WDM networks are optical circuit switching, optical packet switching and optical burst switching.

A. Optical Circuit Switching:

In Optical Circuit Switching (OCS), the network is configured to establish circuits, from an entry to an exit node, by adjusting the optical cross connect circuits in the core routers in a manner that the data signal, in an optical form, can travel in an all-optical manner from the entry to the exit node. This approach suffers from all the disadvantages known to circuit switching - the circuits require time to set up and destroy, and while the circuit is established, there sources will not be efficiently used to the unpredictable nature of traffic.

B. Optical Packet Switching:

In Optical packet switching is suitable for supporting bursty traffic since it allows statistical sharing of the channel bandwidth among packets belonging to different source and destination pairs. In optical packet switching, the payload (i.e. data) will remain in the optic form, while its header may be processed electronically or optically. In packet switching, in order to facilitate implementation, headers can be transmitted on a separate wavelength or a subcarrier channel. Specifically, using a separate control wavelength or subcarrier channel makes it possible for a node to process the header (and set the local switch) before the payload is fully stored (in FDLs). In packet switched networks, IP traffic is processed at every router on a packet by packet basis. So, it takes more transmission time. To overcome this limitation, we go for optical burst switching (OBS).

C. OPTICAL BURST SWITCHING

In Optical burst switching (OBS) is the new switching technique for next generation optical networks. OBS combines the advantages of both circuit and packet switching while overcoming their limitations. In optical burst switching, the term burst is a variable length data packet, assembled at an edge router by aggregating a number of IP packets, which may be received from a single host or from multiple hosts belonging to the same or different access networks. A burst has two components: control and payload. The control packet carries the header information. Thus, the control component incurs an overhead, referred to as control overhead. Payload is the actual data transmitted. Control packet is sent first followed by the payload on a separate wavelength channel after an offset time equal to the processing time of control packet at intermediate node. Control packet is processed electronically at each intermediate node and reserves resources for a period starting from the time the payload/data burst is expected to arrive at the node until the transmission is completed.

A one-way reservation scheme is used to reserve wavelength channels dynamically for the DB on a link-by-link basis. If reservation is successful the control packet is transmitted to the next node on the path, else it is dropped at the node. For a successful reservation, switches are configured by the time payload/data burst arrive at the node. Hence the data burst remains in optical domain from source to destination.

Switching Techniques	Circuit	Packet	OBS
Bandwidth utilization	Low	High	High
Latency	High	Low	Low
Optical Buffering	Not Required	Required	Not Required
Overhead	Low	High	High
Adaptively	Low	High	High

Table 2.1 Comparison of various switching techniques

ARCHITECTURE OF OBS:

Architecture of OBS network is shown in Figure 2.1. OBS network consists of two types of nodes: edge node and core node. Edge nodes are at the interface between electronic and optical domain. Edge nodes can be an ingress or egress node. Packets are assembled into bursts at ingress edge node, which are then routed through the OBS network and disassembled back into packets at egress edge node. A core node is mainly composed of an optical switching matrix and a switch control unit which are responsible to forward data burst.

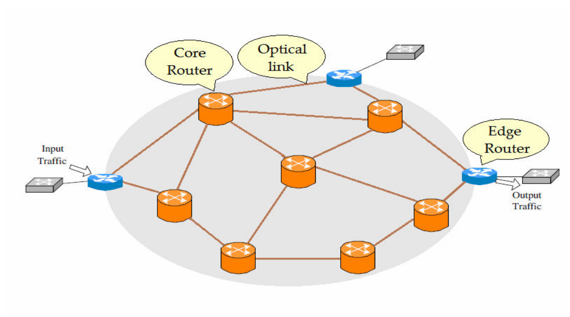

Figure 2.1 Architecture of OBS

A node in OBS network consists of both optical and electronic components. The optical components are multiplexers (Mux), demultiplexers (Demux) and an optical switching network (OSN). The electronic components are input modules (IM), output module (OM), a control burst router (CBRT), and a scheduler. An optical burst switch control unit transfers an incoming data burst from an input port to its destination output port. When an edge node intends to transmit a data burst, it sends a control packet on the control wavelength to a core node. At core node, the control packet on the control channel is input to the corresponding IM, which converts the control packet into electronic form. The control fields are extracted from the control packet. The CBRT uses these control fields to determine the next outgoing fiber for the corresponding payload by consulting a routing table maintained locally. The control packet is scheduled for transmission onto the selected outgoing link by the scheduler and the control packet is buffered until the scheduled time. The scheduler maintains a control packet queue. The scheduler also reserves wavelength on the determined links for the upcoming payload. The control packet is then forwarded on the OM, which updates its control fields and transmits it to the selected outgoing fiber using the optical transmitter. Just before the payload arrives, the switching element in the node is configured to connect the input port to the corresponding output port for the entire duration of the burst transmission. If the control packet is unable to reserve the wavelength then the control packet as well as payload is dropped.

III. OBJECTIVES AND OVERVIEW OF THE PROPOSED MECHANISM

APPROACHES TO IMPROVE THE OBS THROUGHPUT

In spite of the importance of higher throughput, any throughput improvement methods should not require network wide signaling or sophisticated optical hardware. The required computations for resource reservation should also increase only moderately. With these constraints, a single method is usually insufficient to provide the required throughput improvement. By combining methods that are based on different solution strategies, it may be possible to improve the OBS throughput performance without significantly increasing the OBS implementation complexity if all these methods require low additional implementation overhead. The three feasible methods include adding FDLs, random extra offset time, and window-based channel scheduling. We investigate the nature of each method and how they improve the throughput performance.

A.FIBER DELAY LINE METHOD:

We know that data bursts with different values of H will have the same probability to block each other if the offset time Toff is a constant. Under such conditions, we can eliminate the transmission bandwidth wastage caused by the offset time priority effect. Thus we should install FDLs at the node inputs to delay the incoming data bursts' Tcp time. It has been reported in that JET OBS will have better performance if the same numbers of FDLs are used as optical buffer like FDL delay units in JET OBS. The implementation of optical buffers to date, however, is still difficult. In contrast, only a single simple FDL (as shown in Fig.2.2) is required per node input to compensate the Tcp of all incoming data bursts in all wavelength channels. It may not be easy to use FDLs to exactly compensate the control packet processing time Tcp because Tcp can vary with the system loading and nodes. We observe that one solution is to set the delay time TFDL of FDLs to the maximum of Tcp and delay the forwarding of the control packet to the next node, if necessary, to keep the offset time Toff to be a constant. When the offset time Toff is constant, data bursts with different path lengths will have the same channel reservation success probability at an intermediate node. Therefore, data bursts with larger hop count paths will suffer from larger loss rate. We observe that the solution requiring minimum extra effort is to overcompensate the control packet processing time by setting the length of the FDLs to slightly larger than that required for the compensation of Tcp. We define , where $\beta \geq$ - Tcp is the compensation factor. The cases of $\beta < 0$ and $\beta > 0$ respectively represent when FDLs under compensate and overcompensate the control packet processing time Tcp.

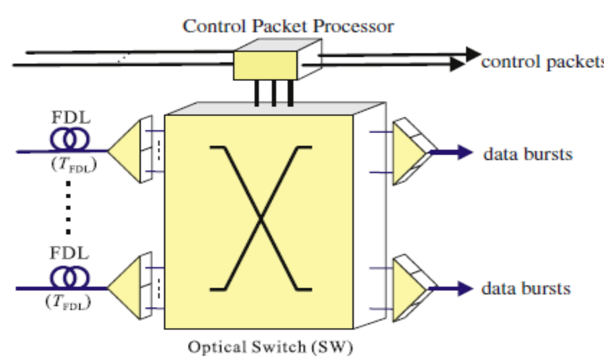

Figure 3.1 An OBS node with FDLs

Under compensation of Tcp will surely degrade OBS system performance, whereas overcompensation can often improve the throughput performance. Overcompensation of Tcp will increase the offset time between the control packet and the data burst when they pass the nodes along the path. Data bursts that have passed more nodes will therefore have a greater chance to reserve an output channel at an intermediate node because of the larger offset time. Though β is critical to the system performance, the proper value of β is not easy to determine because it varies with network topology and traffic. From implementation consideration, it may be better to first use FDLs to compensate the control packet processing time Tcp and then use other methods to further improve the throughput performance.

B.RANDOM EXTRA OFFSET TIME:

Throughput improvement has been observed with an extra random offset time and this is attributed to the traffic shaping effect of the data bursts at OBS source nodes. However, we find that the random extra offset time also significantly weakens the connection between the number of hops to destination H and the offset time, and hence reduces blocking. We observe that random extra offset time can further improve the throughput performance even if the offset time priority effect of OBS is reduced by FDL compensation. Random extra offset time can reduce the loss rate of data bursts with large hop count paths and improve the throughput performance.

We first consider the cases of OBS without control packet processing time compensation. When a random extra offset time is added to Eq. (4.4), the offset time becomes

$$T_{off} = H \times T_{cp} + T_{sw} + T_{ex}$$

Where Tex is the random extra offset time. The difference of the two offset times Tfx and Tf1 is

$$T_{fx} - T_{f1} = (H_x - H_1)T_{cp} + T_{diff}$$

Where Tdiff is the difference between the two random extra offset times.

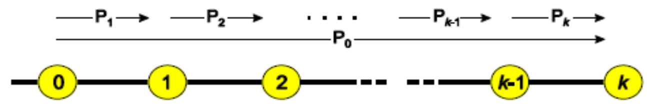

Figure 3.2 A network with one k-hop path & k one-hop path

For the performance of OBS with FDL compensation being improved by random extra offset time, we use a simplified model to illustrate the principle. Figure 5.2 shows an OBS network with constant offset time. There is one k-hop path (P0) and k one-hop paths (P1 to Pk).Without the random extra offset time, all data bursts have the same channel reservation success probability s at any node, e.g., s = 0.5. The average loss rate of a P0 data burst will therefore be, and that of Pj is, for 1 ≤ j ≤ k. After an extra offset time Tex has been randomly added/subtracted to/from each pair of control packet and data burst of P0, we assume that the channel reservation success probability of a data burst will become one of the two values s - sex and s + sex at random, where sex (≤ s) is a random reservation probability caused by Tex. We assume sex to be a constant for ease of illustration. Although the average channel reservation success probability of a data burst is still s, the average loss rate of P0 and Pj become

$$B_0 = 1 - \frac{[(s - s_{ex})^k + (s + s_{ex})^k]}{2}$$

$$B_j = \frac{[(s - s_{ex})^j + (s + s_{ex})^j]}{2}$$

For 1 ≤ j ≤ k.

Data bursts with larger hop count paths will have higher loss rate. The reduction of loss of data bursts with larger hop count paths is achieved at the expense of the increase of loss of data bursts with smaller hop count paths. Similar to the case of FDL overcompensation, larger values of random extra offset time Tex do not guarantee increased system throughput. However, JET OBS can have throughput improvement with a large range of Tex and the selection of a suitable value of Tex becomes easy.

C.WINDOW BASED CHANNEL SCHEDULING:

Window-based channel scheduling schemes delay the channel routing assignment an additional Twd time after reading the information of a control packet. It enables us to predict the impact of a channel assignment to the channel requests (control packets) arriving in the future Twd time interval. We can therefore make better channel/routing assignment decisions than the FCFS approach. To illustrate, Fig.2.3 shows four control packets and their associated data bursts arriving at a node. Assuming that all data bursts are routed to the same output port Ox of the node, we may need three output channels if the channel assignment uses FCFS according to the arrival of control packets, e.g.,

$DB1 \rightarrow Ox,1, DB2 \rightarrow Ox,2, DB3 \rightarrow Ox,2,$ and

$DB4 \rightarrow Ox,3.$ and where Oxy is the yth channel of output port Ox. With the additional Twd delay time; however, we need to use only two for the channel assignment, e.g. $DB1 \rightarrow Ox,1, DB2 \rightarrow Ox,2,$ $DB3 \rightarrow Ox,1,$ and $DB4 \rightarrow Ox,2$.

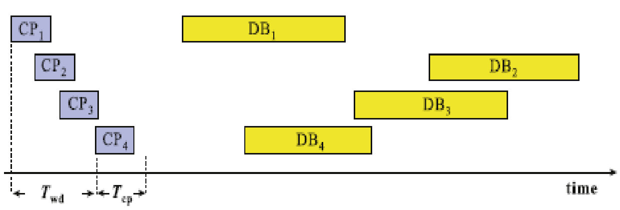

Figure 3.3 Transmission of data bursts in OBS

There are two major concerns with WBS OBS schemes. First, the additional Twd time delay of the control packet in OBS will increase the equivalent control packet processing time to Tcp + Twd. Note that a normal JET system with control packet processing time Tcp + Twd will have larger blocking probability than that with control packet processing time Tcp unless Tcp is much larger than the average data burst transmission time L. Similarly, a WBS OBS scheme can have even lower throughput if Tcp is not much larger than L. Therefore, for the WBS OBS schemes, we can assume that Tcp is much larger than L or the Twd delay time is compensated. WBS OBS assuming large Tcp does not require any additional hardware and only needs to extend the initial offset time at the source.

$$T_{off} = H \times ((T)_{cp} + T_{wd}) + T_{sw}$$

Since the value of Tcp should not be restricted, delay compensation seems to be a more attractive approach. At the moment, adding FDLs at the node inputs is the only practical way to compensate the delay of the control packet in a node. We believe that adding FDLs only for Twd compensation is not reasonable. Hence, unlike traditional WBS schemes, we assume that WBS OBS with FDLs for delay compensation will always have constant offset time between control packets and data bursts, i.e., both Twd and Tcp are compensated.

Next, it is necessary to determine the procedure for assigning the output channel to a control packet, say CPx, after the Twd time delay. A common approach is to virtually assign output channels to CPx and other control packets that have arrived in the Twd time period according to the arrival sequence of their associated data bursts. The data burst DBx of CPx will get the channel that is assigned to DBx in the virtual channel assignment. DBx will be rejected if it fails to get a channel in the virtual channel assignment. This approach is effective, e.g., we will need only two output channels in Fig.2.3. However, it assumes no compensation for the control packet processing time Tcp and only the window time Twd is compensated. It will not be useful if both Tcp and Twd are compensated, i.e., no further throughput improvement can be obtained. In such a situation, the data burst arrival sequence is the same as that of the control packets. We need a WBS OBS channel assignment procedure for all circumstances. We propose to use a basic principle: reject a data burst if it will cause the blocking of subsequent data bursts and decrease the system throughput. Thus we assign the output channel based on the impact of the control packet on other control packets (their associated data bursts) arriving in the Twd delay time interval. Consequently, we weigh the data burst DBk of a control packet CPk with a value wk. To assign a channel to a control packet CPx (data burst DBx), we first compute two control packet sets S and R, where S(R) is the set of control packets that arrive in the Twd delay time interval and their associated data bursts will be accepted if DBx has (has not) been assigned a channel. The latest available unused channel with the void filling (LAUC-VF) scheme is used in Fig 5.3. assuming two output channels Ox,1 and Ox,2 only, we will have S={CP2(DB2 Ox,1),CP3(DB3 Ox,2)} and R ={CP2(DB2 Ox,1),CP3(DB3 Ox,2),CP4(DB4 Ox,1)} according to the arrival sequence of CP2, CP3, and CP4. LAUC-VF chooses the idle time gap in the channels. The weighing of the data burst is important for WBS OBS performance.

We have tested the wx setting of (1) a nonzero constant c; (2) the data burst length Lx; (3) the number of passed hops from source hx. This simple wx setting provides slightly better system throughput performance than that from the common approach of channel assignment when WBS OBS is without FDL compensation. Note that the common channel assignment procedure approach does not improve the throughput of WBS OBS with FDL compensation.

The table represents the average value of the computational time of our methods oriented active appearance model and integrated graph cut oriented active appearance model will be implemented and calculated the results as early as possible. However, the proposed channel assignment procedure can further improve the system throughput in such cases.

Proposed Burst Delay Feedback Scheduling Algorithm

Our aim is to schedule as many bursts as possible with reduced burst loss. Therefore we propose a new Burst scheduling algorithm named Burst Delay Feedback Scheduler for scheduling the burst with minimum loss. In a feedback-based network, the ingress nodes have knowledge of the network state and they can respond to changes in the network load. This mechanism support quality of service (QoS) for different class of bursts. In feedback scheduling the core node senses the data traffic and sends feedback to the previous core/edge node for delay the incoming burst in order to minimize contention. This feedback contains information that how much time the data burst must delayed to reduce contention.

Performance parameters for each burst flow are exchanged by a feedback message to the ingress nodes. According to the information contained in the message, the edge nodes dynamically adjust its parameters needed to achieve a defined QoS parameter such as bandwidth, throughput and delay. The adjusted parameters are the offset time parameter or the burstification rate. Feedback control approach computes accurate burstification rate (i.e., rate by which the bursts are injected into the network) for each class of bursts. Based on the computed burstification rates, the maximum delay is calculated and guaranteed to the deterministic level.

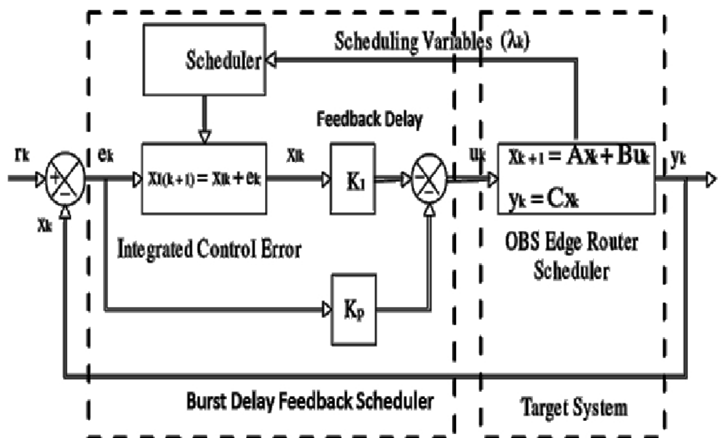

Figure 3.4. A linear control system with feedback control mechanism using burst delay feedback scheduler.

General diagram for a linear control system implementing closed loop feedback control mechanism is shown in Fig. 3. At first edge node generates bursts by aggregating a number of IP packets directed towards the same core node. The burst manager controller (BMC) controls the Burstification rate which resides at every edge node of the network. Every core node sends a feedback to the edge nodes containing a reduction request of the burstification rate. The reference Delay is a reference value that the controlled output parameter should be restrained in the network. The error is the difference between the reference Delay and the measured Delay.

The burst manager controller (BMC) takes the error value as an input and generates a burstification rate accordingly based on a control law. This approach guarantees quality of service in terms of throughput and latency for each class of burst.

IV.PERFORMANCE EVALUATION

We use simulations to verify the throughput and transmission delay using the combinations of the methods discussed in Section III and IV on a 22-node 23-link NS2 topology network. We assume that all links are bidirectional. In the simulations, we assume that data bursts arriving at the nodes follow the Poisson process. When a new data burst arrives at a node, it randomly chooses a destination from the rest of the nodes in the network and uses shortest-path routing to determine the path. The maximum number of paths per link for the NS2 is 23. Therefore, the maximum throughput per node is 13/23 or around 0.565. This value is our maximum achievable throughput.

The node creation in OBS network and the NAM window is shown below

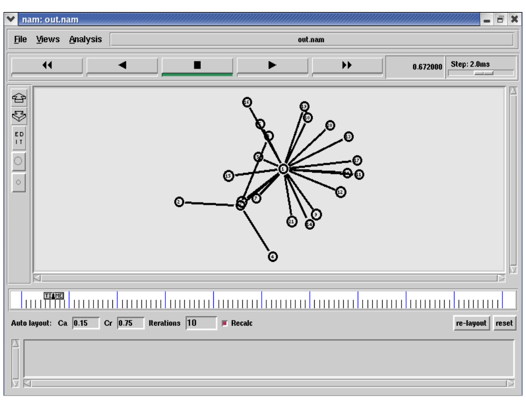

Figure 4.1 NAM output showing Node Creation in OBS Network

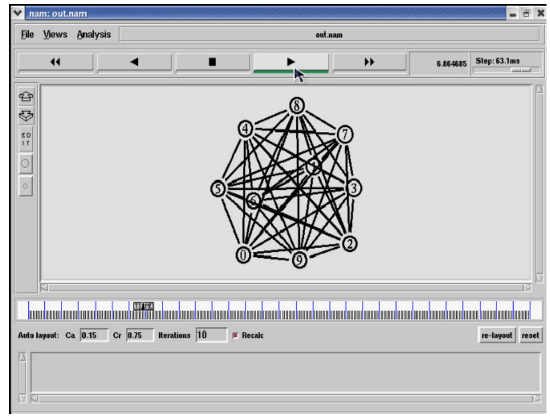

Figure 4.2 Creation of OBS Nodes

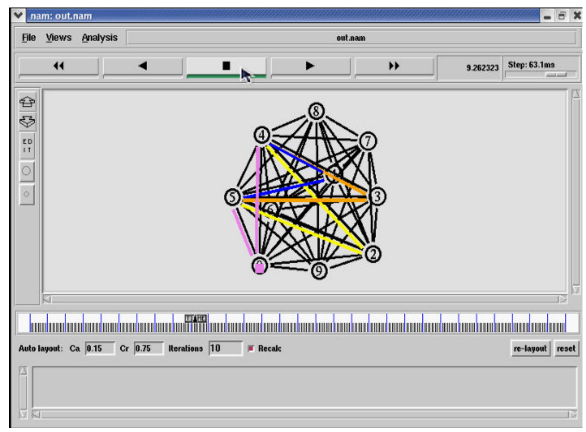

Figure 4.3 Data Burst Transmission between Nodes

In the above diagram 4.3 shows the OBS network is created and Data Burst is transmitted between the nodes. The coloured line indicates that burst transmission between different nodes.

Once a new data burst arrives at a node, a control packet is sent out immediately to reserve the required channels and resources on the path. The data burst is then transmitted after the offset time Toff according to one of the settings (a) Tcp + Tex, and (b) Tcp + Twd. Setting (a) is for OBS that also uses the random extra offset time approach, whereas setting (b) is for those that also use window-based channel scheduling. In the simulations, we assume negligible switch reconfiguration time in the OBS node (Tsw = 0). The traffic loading to a node is the number of data burst arrivals to the node per unit

ISSN: 2278 - 1323
International Journal of Advanced Research in Computer Engineering and Technology (IJARCET)
Volume 2, Issue 6, June 2013

time divided by the number of wavelength channels per link.

Throughput Performance of BDFS with WBS and FDL compensation

In the existing Window Based Channel Scheduling with FDLs for control packet processing time overcompensation, throughput performance was improved. To further improve the throughput and reduce delay, we may combine WBS plus FDL overcompensation with Burst Delay Feedback Scheduling.

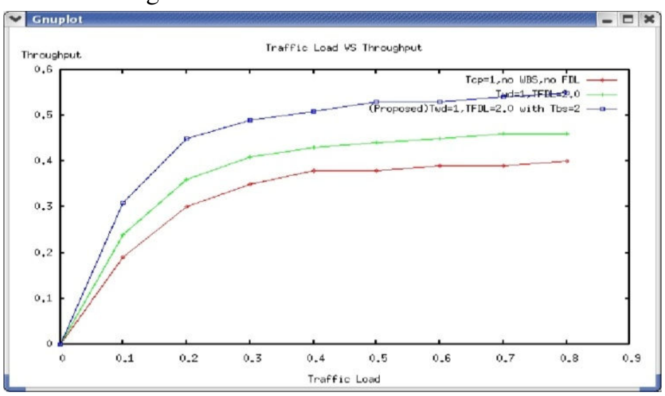

Figure 4.4 Throughput Maximization graph

The Throughput curves on NS2 with Tcp = 1 using WBS and FDL compensation with Burst Delay Feedback Scheduling.

The traffic load-throughput performance of OBS with WBS of Twd = 1 plus FDL compensation of W2

Delay Performance of Burst Scheduling with WBS and FDL compensation

By combining BDFS and WBS with FDL compensation, reduced transmission delay was also achieved

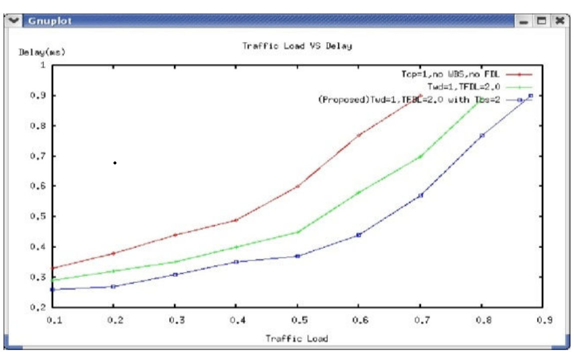

Figure 4.5 Traffic Load vs. Delay

The Transmission Delay curves on NS2 with Tcp = 1 using WBS and FDL compensation with BDFS.

Figure 4.4 is the traffic load-throughput performance of OBS with WBS of Twd = 1 plus FDL compensation of TFDL = 2.0 with and without proposed burst scheduling, when Tcp = 1. From the simulation results, the Delay reached nearly 1ms only when full load condition, in the Burst scheduling with WBS OBS plus FDL compensation (blue line) method. But, in the WBS OBS plus FDL compensation without BS (green line) method delay reached 1ms for 0.9 traffic load itself. So the proposed method can decrease the OBS delay.

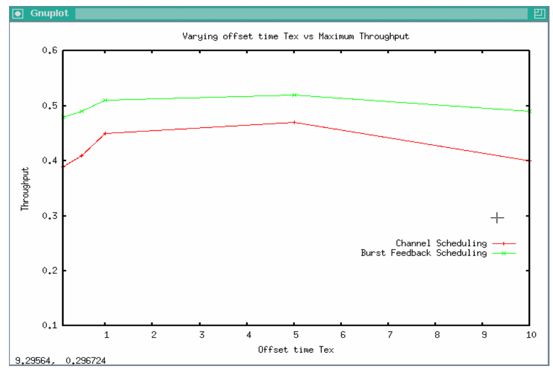

Figure 4.6 Offset Time vs. Throughput

Measurement of Average Loss Rate and Burst Size using Burst Feedback Scheduling:

Figure below shows, average loss rate performance of OBS by using burst delay feedback scheduling. When delay time is varied from 0.2 to 1, the average loss rate of the Burst scheduling is varied. When compared to window based channel scheduling with FDL, the performance of burst scheduling was improved. From the figure average loss rate vary from 0.11 to 0.13.

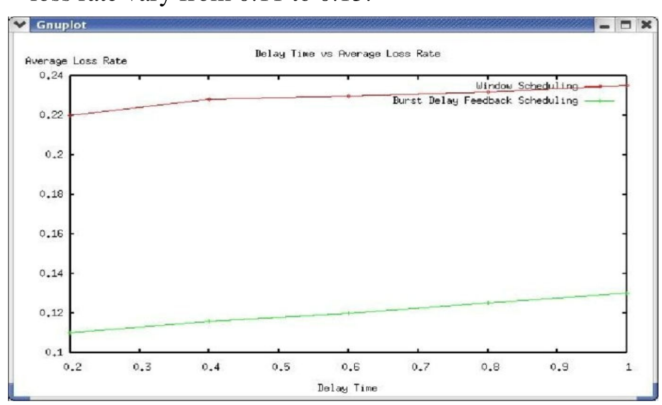

Figure 4.7 Delay time Vs Average loss rate.

Similarly figure shows burst size of OBS for various simulation times.

Measurement of Traffic Load and Burst Loss Rate Using Burst Feedback Scheduling:

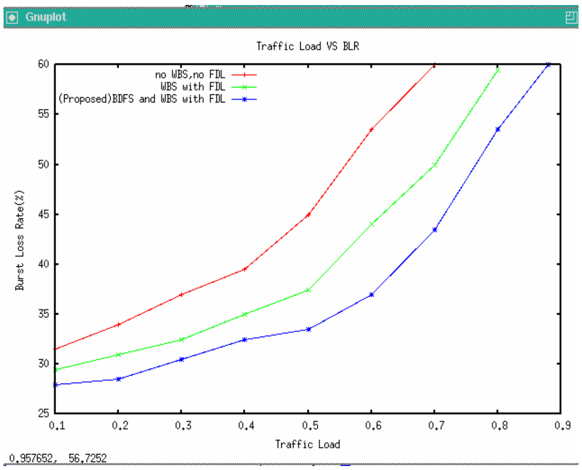

Figure 4.8 Traffic Load vs. BurstLosssRate

MEASUREMENT OF TRAFFIC LOAD VS THROUGHPUT USING BURST FEEDBACK SCHEDULING ALGORITHM

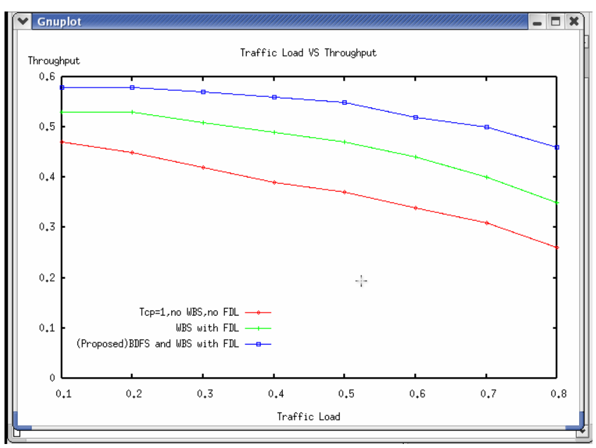

Figure 4.9 Traffic Load vs. Throughput

V.CONCLUSION

This paper proposes the method to improve the OBS performance without increasing the implementation complexity. By combining three methods that are based on different principles, OBS performance can be improved: adding simple FDLs, random extra offset time, and WBS. In some cases (two data bursts having same offset value), Window Based Channel Scheduling will reject a data burst if it will cause the blocking of subsequent data bursts and will decrease the system throughput. So, we have to assign the output channel based on the impact of the control packet on other control packets (their associated data bursts) arriving in the Twd delay time interval. For this purpose, we can use Burst scheduling algorithm in addition with those existing methods. Thus it will increase overall system throughput.

REFERENCES

1. C.Y Li, P.K.A. Wai, and Victor O.-K.Li, *"Performance Improvement Methods for Burst- Switched Networks"*, J. Opt. Commun. Network Vol. 3 No. 2 Feb. 2011

2. Barakat. N and Sargent. E.H (2005), *'Analytical modeling of offset-induced priority in multiclass OBS networks,'* IEEE Trans. Commun., vol. 53, pp. 1343–1352.

3. Duser. M and Bayvel. P (2002), *'Analysis of a dynamically wavelength routed optical burst switched network architecture,'* J. Lightwave Technol., vol. 20, pp. 574–585.

4. Hernandez. J.A, Aracil. J, Pedro. L, and Reviriego. P (2008), *'Analysis of blocking probability of data bursts with continuous-time variable offsets in single-wavelength OBS switches,'* J. Lightwave Technol., vol. 26, pp. 1559–1568.

5. Kim. B.C, Cho. Y.Z and Montgomery. D (2004), *'An efficient optical burst switching technique for multi-hop networks,'* IEICE Trans. Commun., vol. E87-B, pp. 1737–1740.

6. Li. C.Y, Wai. P.K.A, and Li. V.O.K (2011), *'Performance Improvement Methods for Burst-Switched Networks,'* J. OPT. COMMUN. NETW./VOL. 3, NO. 2

7. Li. C.Y, Li. G.M, Wai. P.K.A, and Li. V.O.K (2007), *'Optical burst switching with large switching overhead,'* IEEE J. Lightwave Technol., vol. 25, pp. 451–462.

8. Li. J, Qiao. C, Xu. J, and Xu. D (2007), *'Maximizing throughput for optical burst switching networks,'* IEEE/ACM Trans. Netw., vol. 15, pp. 1163–1176.

9. Li. H, Neo. H, and Ian. T.L.J (2003), *'Performance of the implementation of a pipeline buffering system in optical burst switching networks,'* in Proc. Global Communications Conf., pp. 2503–2507.

10. Lu. X and Mark. B.L (2004), *'Performance modeling of optical- burst switching with fiber delay lines,'* IEEE Trans. Commun., vol. 52, pp. 2175–2183.

11. Pedro. J, Monteiro. P, and Pires. J (2009), *'Traffic engineering in the wavelength domain for optical burst switched networks,'* J. Lightwave Technol., vol. 27, pp. 3075–3091.

12. Shalaby. H.M.H (2007), *'A simplified performance analysis of optical burst-switched networks,'* J. Lightwave Technol., vol. 25, pp. 986–995.

13. Vokkarane. V.M and Jue. J.P (2003), *'Prioritized burst segmentation and composite burst-assembly techniques for QoS support in optical burst-switched networks,'* IEEE J. Sel. Areas Commun., vol. 21, pp. 1198–1209.

14. Vazquez-Abad. F, White. J, Andrew. L, and Tucker. R (2004), *'Does header length affect performance in optical burst switched networks,'* J. Opt. Netw., vol. 3, pp. 342–353.

15. Verma. S, Chaskar. H, and Ravikanth. R (2000), *'Optical burst switching: a viable solution for terabit IP backbone,'* IEEE Network, vol. 14, pp. 48–53.

Authors Profile

A.Kavitha received her B.E degree in Electronics and Communication Engineering from Arignar Anna Institute of Science and Technology, Sriperumbudur, Kanchipuram Dist., Tamilnadu, India. Currently she is pursuing her M.E (Communication Systems) from Sethu Institute of Technology, Kariapatti, Virudhunagar Dist, and Tamilnadu, India.

Her research interests are Optical Networks, Optical Burst Switching Networks and Wireless Networks.

Helina Rajini.J received her B.E Electronics and Communication Engineering from Thiagarajar College of Engineering, Madurai and M.E (Applied Electronics) from Government College of Technology, Coimbatore in the year 1989 and 1991 respectively. She is currently pursuing her Ph.D from Anna University, Chennai. She is presently working as professor in Department of Electronics and Communication Engineering at Sethu Institute of Technology, India. She has published many research papers in the National and International Conferences and journals. Her research interests include Optical Burst Switching Networks, Passive Optical Networks and WDM optical networks