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TM ALGORITHM TO IMPROVE PERFORMANCE OF OPTICAL BURST SWITCHING (OBS) NETWORKS

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Abstract: - Optical Burst Switching (OBS) networks are new networks in the optical field to pass the heavy traffic of the Internet. These networks have optical links so they can provide high bandwidth in the backbone of the Internet. These networks have a bufferless nature as a result we have two types of packet drops in the network, one due to congestion and the other one due to burst contentions. Burst contention causes the misunderstanding for TCP Vegas in the network. Sometimes the network is not congested but there is a contention in the network so TCP reduces the sending rate by mistake and it leads to a reduction in the performance.
In this paper an algorithm based on burst making timeout and maximum size of the burst was proposed. I tried to make a balance between these two parameters to prevent the performance reduction in the network.

Keywords: BP Algorithm, Optical Burst Switching, TCP Vegas, Transport Control Protocol (TCP).

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1. INTRODUCTION

One of the new fields in the communication world is an optical network called Optical Burst Switching (OBS) networks. OBS Networks provide an environment to pass the heavy traffic of the Internet throughout its optical links. In these networks each link has a high bandwidth for carrying the packets. Because of this high bandwidth a large amount of it is wasted in the network so each link is divided two several separated links that can carry the packet individually. Dividing the links to more than one link is called Wavelength Division Multiplexing (WDM). WDM technique helps us to prevent the bandwidth wasting in the network.

OBS networks include two types of nodes, Edge nodes and Core nodes. The duty of edge nodes is sending and receiving the packets. Core nodes make the backbone of the network and they carry the heavy traffic of the network. We have two kinds of edge nodes, ingrees and egress nodes. Ingress nodes are the senders; when packets arrive to the ingress nodes they start to accumulate the packets and make a burst, a burst contains a lot of packets. We have two algorithms to make a burst in the network, one of them is based on the timeout, it means we have a timeout to make a burst and when it is finished the burstification stops. The other one is based on the maximum burst size, it means when the burst size gets to a certain size, burstification stops. We can use both of the algorithms to make more useful one. In this paper I want to make a balance between the timeout and maximum burst size to improve the performance of the network. The egress nodes disassemble the receiving burst and make the packets. Before sending the burst in the network, the ingress node sends a control packet in the network to reserve the resource that is needed. The control packet contains some information like the length of the burst or the offset time. The offset is the delay time between sending the control packet and the burst. Offset time is necessary for the control packet because it needs some time to reserve the resource in the network.

One of the major problems in OBS networks is burst contention. It means, sometimes we do not have heavy traffic in the network, but because of the bufferless nature of the network there is a probability that there will be contentions between the bursts so we have two types of contentions in the network, one of them due to heavy traffic and the other one due to burst contention. When the traffic is low in the network and a contention happens, TCP assumes that the packet drop is because of the traffic and reduces the congestion window size (cwnd) and it leads to a reduction in the performance [1-9].

In this paper I want to obtain a balance between the burstification timeout and maximum burst size to get the best performance for the network. The algorithm is called Timeout-Maxsize (TM).

2. RELATED WORKS

Researchers have done tremendous amount of studies to find a solution to prevent the performance reduction in OBS networks. One of the solutions to deal with false congestion problem in OBS networks is explicit signaling [10]. This scheme is used in OBS layers to solve the congestion detection problem. The most important drawback of this approach is making a random signal for each burst increases overhead of the network.

One of the other schemes to cope with this problem is burst retransmission and deflection scheme at the OBS layers [11-13]. By using this approach in the network, we can hide some of the burst losses from the upper TCP layers, so we can increase performance of the network.

A threshold-based TCP Vegas is proposed in [9]. This scheme adjusts size of congestion window based on round trip times (RTTs) of packets received at TCP senders. If the number of RTTs that are longer than minimum RTTs exceeds the threshold, it means congestion happens in the network, otherwise there is no congestion in the network.

Three different variants of TCP that are TCP Tahoe, TCP Reno and TCP New Reno have been studied in [14]. This paper represents throughput results from an experimental study of TCP source variants, Tahoe, Reno and New Reno.

3. TM ALGORITHM TO GAIN THE BEST PERFORMANCE

This section explains the scheme and the changes which we use to reduce the effect of the false congestion detection on the performance when TCP Vegas is deployed in the network. Figure 1 shows the topology that is used for our OBS networks. The OBS network contains 12 edge nodes and 3 core nodes. In this network each edge node is connected to the core nodes with a 1ms propagation delay. These links use 100 wavelength channels for transferring data and data rate of each channel is 1Mbps it means each edge node is connected to the core node with a 100Mbps optical link and each link contains 8 wavelength channels for transferring control packets. The link between core nodes has 100 wavelength channels and data rate of each channel is 100Mbps it means core nodes are connected to each other with 10Gbps bandwidth and the links have 8 wavelength channels for transferring control packets. Data rate of each wavelength channel is 1Mbps.

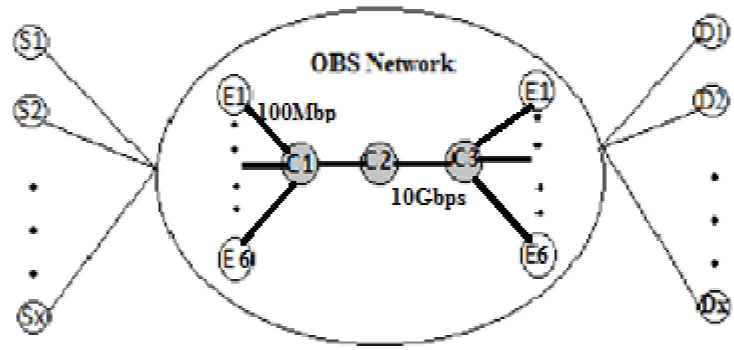

Figure 1: The network topology adopted in the simulation

Because we have burst contention in the network, burstification timeout and the maximum size for making a burst can have an important role in the performance of the network. A slight change in the value of one of them can have a noticeable effect on the performance of the network.

I am going to use a linear reduction for burstification time (formula (1)), it means if our burstification timeout is X_n and our burstification timeout was $Xn - 1$ we will have:

$$X_n = X_{n-1} \times 2 \qquad (1)$$

The other linear formula (formula (2)) is for obtaining the maximum burstification size, it means if our maximum burstification size is Y_n and our previous one was $Yn - 1$ we will have:

$$Y_n = \frac{Yn-1}{2} \qquad (1)$$

The way that this method wants to deal with performance reduction is to keep a balance between the timeout and maximum burstification size. The timeout value and maximum burst size are:

Table1. Timeout and maximum burstification size

	1	2	3	4
Burstification timeout	0.1(s)	0.2(s)	0.4(s)	0.8(s)
Maximum Burst Size	200(Kb)	100(Kb)	50(Kb)	25(Kb)

By increasing in the value of maximum burst size, a reduction in the timeout can prevent the performance reduction.

For simulation and comparing the different results, we have run a lot of tests in NS-2. By using this method we can obtain the best performance for OBS networks. Figure 2 shows the performance of the network when packet lost probability is $10^{-5.}$

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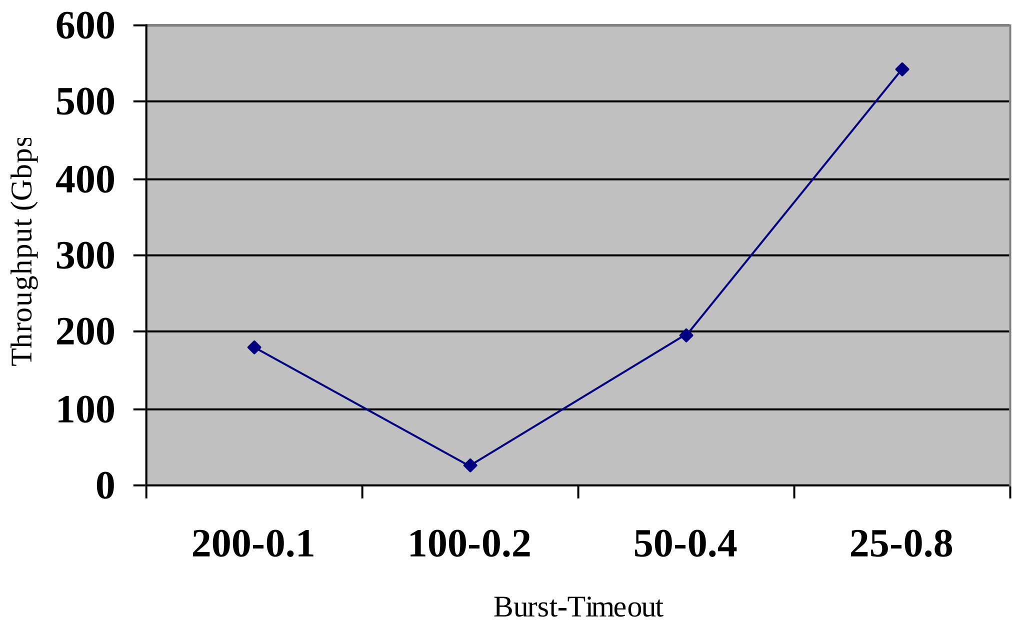

Figure 2: TM algorithm effect on the performance of the network when contention probability is 10^{-5}

The figure shows when we have a balance between the burstification timeout and maximum burst size, we can increase the performance. The reason behind this scheme is the packets number. Packets number is a proper value all the time, it is not so high or low, so when we have a contention in the network we do not loss a lot of packets and we always send a suitable packets number.

Figure 3 shows the performance of the network when packet lost probability is 10^{-4}.

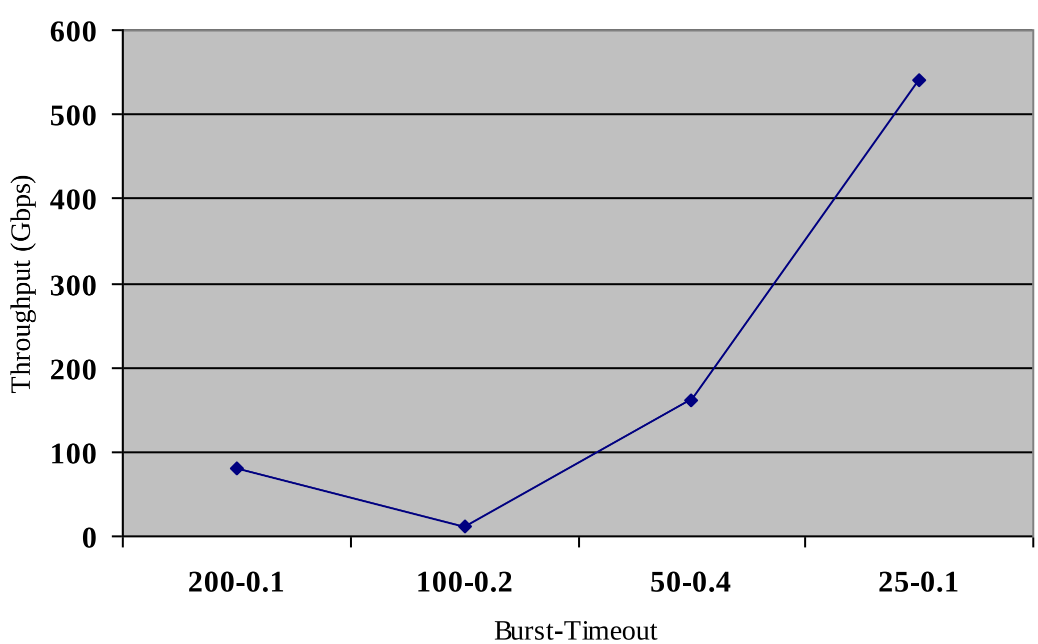

Figure 3: TM algorithm effect on the performance of the network when contention probability is 10^{-4}

Figure 4 shows the performance of the network when packet lost probability is 10^{-3}.

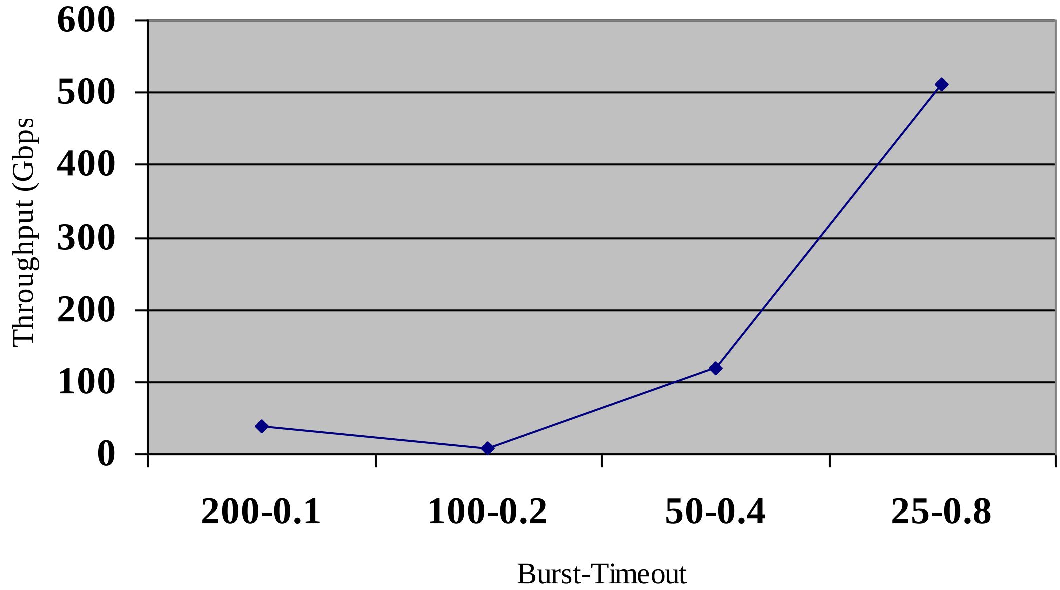

Figure 4: TM algorithm effect on the performance of the network when contention probability is 10^{-3}

Figure 5 shows the performance of the network when packet lost probability is 10^{-2}.

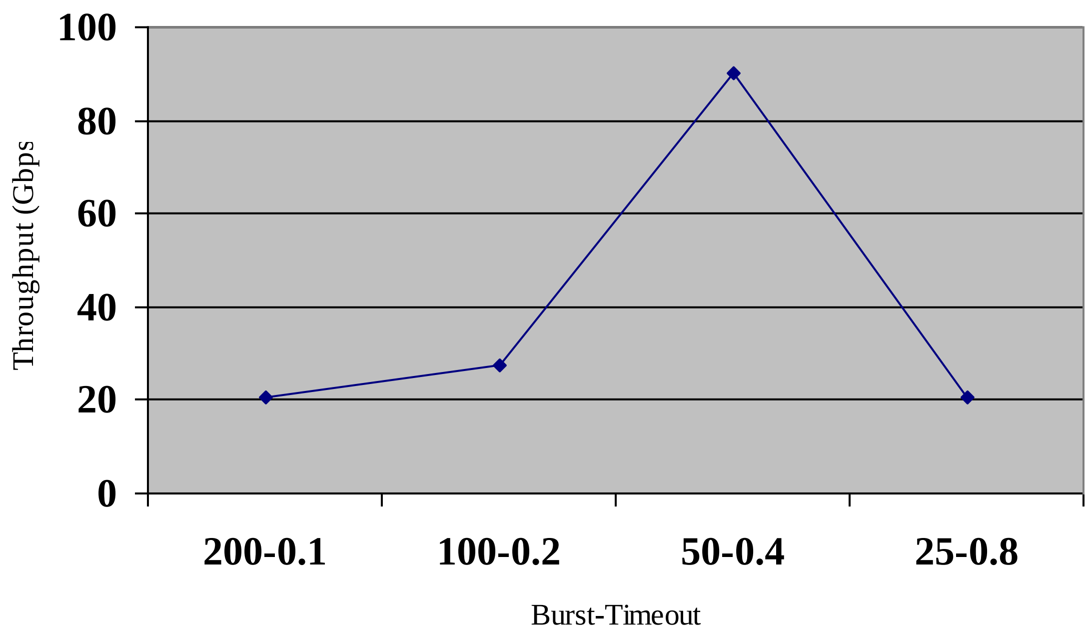

Figure 5: TM algorithm effect on the performance of the network when contention probability is 10^{-2}

All of the figures show having a balance between timeout and maximum burst size leads to a better performance.

4. CONCLUSION

False Congestion detection in OBS networks is one of the major problems in OBS networks and it can cause performance reduction in these networks. In this paper a new scheme was proposed base on the maximum burstification size and timeout for making a burst. For this purpose, I tried to make a balance between burstification timeout and maximum burst size in different contention probabilities, the results lead to a better performance. Simulation results in ns-2 environment approved this theory.

REFERENCES

[1] A.Jain, S. Floyd, M.Allman, P.Sarolan Quick-start for TCP and IP, ICSI, 2006.
[2] C. Jin, D. Wei, S. Low, FAST TCP: motivation, architecture, algorithms, performance, INFOCOM 2004. Twenty-third Annual Joint Conference of the IEEE Computer and Communications Societies (Volume:4) , March 2004.
[3] S. Hegde, et al., FAST TCP in high-speed networks: an experimental study, in: Proceedings, GridNets, Engineering & Applied Science, Caltech, The First International Workshop on Networks for Grid Applications, 2004.
[4] L. Xu, K. Harfoush, I. Rhee, Binary increase congestion control (BIC) for fast long-distance networks, in: Proceedings, INFOCOM 2004. Twenty-third Annual Joint Conference of the IEEE Computer and Communications Societies (Volume: 4), March 2004.
[5] W. Stevens, TCP slow start, congestion avoidance, fast re transmit, and fast recovery algorithms, RFC, 1997.
[6] M. Mathis, J. Mahdavi, S. Floyd, A. Romanow, TCP selective acknowledgement options, RFC, 1996.
[7] L. Brakmo, L. Peterson, TCP Vegas: end-to-end congestion avoidance on a global internet, IEEE Journal on Selected Areas in Communication, 1995.
[8] D. Katabi, M. Handley, C. Rohrs, Congestion control for high bandwidth-delay product networks, ACM SIGCOMM Computer Communication, PA, 2002.
[9] BasimShihada, Qiong Zhang, Pin-Han Ho, Jason P. Jue, A novel implementation of TCP Vegas for Optical Burst Switched networks, Optical Switching and Networking, 2010.
[10] X. Yu, C. Qiao, Y. Liu, TCP implementations and false time out detection in OBS networks, Infocom, 2004.
[11] Q. Zhang, V. Vokkarane, Y. Wang, J.P. Jue, Analysis of TCP over optical burst-switched networks with burst retransmission, in: Proceedings, IEEE GLOBECOM, St. Louis, MO, November 2005.
[12] Q. Zhang, V. Vokkarane, Y. Wang, J.P. Jue, Evaluation of burst retransmission in optical burst-switched networks, in: Proceedings, 2nd International Conference on Broadband Networks, BROADNETS, Boston, MA, 2005.
[13] C. Hsu, T. Liu, N. Huang, Performance analysis of deflection routing in optical burst-switched networks, INFOCOM 2002. Twenty-First Annual Joint Conferences of the IEEE Computer and Communications Societies. Proceedings. IEEE (Volume: 1), New York, NY, June 2002.
[14] Sodhatar, S.H., Patel, R.B. , Throughput Based Comparison of Different Variants of TCP in Optical Burst Switching (OBS) Network , Communication Systems and Network Technologies (CSNT), 2012 International Conference on 2012.
[15] Ns-2, Network Simulator, www.isi.edu.