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Performance Analysis for All- Optical Networks Using Wavelength Routing Methods in Different Topologies

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ABSTRACT: The problem of routing and wavelength assignment (RWA) is critically important for increasing the efficiency of wavelength-routed all optical networking. So performance analysis of RWA algorithm is required for different topologies so that we use topologies for specific application example: (two way video communications). To increase the link utilizations and to reduce call blockage, the topology comparison is important. Topologies used in this paper for checking the performance of RWA are random, ring, star, and tree. In this paper we used First-fit algorithm for assigning wavelength and Dijkstra'srouting algorithm for shortest path for different topologies. It is shown that, under dynamic arising of calls the star topology performs the best on blocking probability, and also call blocking ratio (CBR) is 7% and CPU time 0.5sec.Comparative analysis has been done for different topologies. Performance analysis has been done by considering various topologies for a dedicated network.

KEYWORDS: *CBR, RWA and CPU, different topologies.*

I. INTRODUCTION

Wavelength-Division Multiplexing (WDM) in optical fiber networks has been rapidly gaining acceptance as a means to handle the ever-increasing bandwidth demands of network users. In a wavelength-routed WDM network, end users communicate with one another via all-optical WDM channels, which are referred to as light paths. A light path is used to support a connection in a wavelength-routed WDM network, and it may span multiple fiber links. In the absence wavelength on all the fiber links through which it traverses. RWA needs to find a path and assign the same wavelength to every link along the path. This is known as the wavelength continuity constraint. This means there are cases in which connections cannot be established even if every link along the path has wavelengths available.
A new technology is needed to support for the huge bandwidth needs. Optical fiber offers much higher bandwidth than conventional copper cables. A single fiber has a potential bandwidth on the order of 50THz. Blocking probability has been one of the key performance indexes in the design of wavelength-routed all-optical WDM networks. Existing research has demonstrated that an effective Routing and Wavelength Assignment (RWA) algorithm and wavelength conversion are two primary vehicles for improving the blocking performance. A wavelength-routed all-optical WDM network comprises optical wavelength routing nodes (i.e., wavelength routers) interconnected by optical fiber links. A lightpath has to be established before the communication between any two wavelength routers. Lightpath connection requests arrive over time and each lightpath may have a random holding period. These lightpaths need to be set up dynamically by determining a route across the network connecting the source to the destination, and allocating a free wavelength channel on each fiber

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link along the chosen route. Wavelength conversion can eliminate the wavelength continuity constraint and thus improve the blocking performance.

II. LITERATURE SURVEY

Chunyong Yang, Shaoping[2] shows that performance analysis of four classical topologies networks from the perspective of blocking probability, average hop count, average packet delay and link utilization has been carried out depending on wavelength conversion factor. In general, though the star topology performs the best on blocking probability, average hop count and average packet delay, it is unfavorable on link utilization. Furthermore, wavelength conversion is not ideal for the star topology. So it is turned out to be an expensive topology. However, the ring topology network is the cost-optimal one if the appropriate wavelength conversion capability in network is to be considered.

Randhawa, Rajneesh; Kaler, R. S.; Singal, Anuj[4]gives the performance evaluation of first-fit, random, most-used and wavelength conversion algorithms in WDM optical ring network are being proposed. The blocking probability of various algorithms has been compared. The blocking probability is maximum for first fit algorithm and least for wavelength conversion algorithm nearer to 0.01 and 0.0025 respectively. So the performance of the wavelength conversion algorithms is best but there is burden of using expensive hardware. Without the need of wavelength-convertor, the most-used algorithm performs better than the random and first-fit algorithms. These approaches are very effective for the minimization of blocking probability of optical WDM networks.

III. ROUTING AND WAVELENGTH ASSIGNMENT ALGORITHM

RWA is a fundamental problem in the engineering, control, and design of All-Optical Networks, and arises in most network design applications, including traffic grooming, survivability design, and traffic scheduling. Internet is formed by collection of topologies. Different topologies exhibit different performance parameters like traffic congestion, delay, packet loss and cost. Traffic congestion is an important parameter which has to be reduced for All-Optical Network in different topologies.RWA of lightpaths in optical networks is usually done in two steps. The first step tries to find a route between the node pair, and the second assigns wavelengths for links of the route. The literature suggests different solutions, with separate or simultaneous handling of these steps. One approach is to route all connections first, and then assign wavelengths to them as a separate step. Another approach is to combine the steps so that routing is tied to a particular wavelength. This latter approach is typically accomplished by starting with a particular wavelength and reducing the network topology to only those links on which this wavelength is available.

*3.1*Routing algorithm

For the routing algorithm, there are three basic approaches that can be found in the literature: fixed routing, fixed-alternate routing and adaptive routing. Among these approaches, fixed routing is the simplest while adaptive routing yields the best performance. Alternate routing offers a trade-off between complexity and performance. We briefly discuss fixed routing approaches later in this work.

3.1.1 Fixed routing

The most straightforward approach to routing a connection is to always choose the same fixed route for a given source-destination pair. One example of such an approach is fixed shortest-path routing. The shortest-path route for each source-destination pair is calculated off-line using standard shortest-path algorithms, such as Dijkstra's algorithm and any connection between the specified pair of nodes is established using the pre-determined route. This approach to routing connections is very simple. However, the disadvantage of such an approach is that, if resources (wavelengths) along the path are tied up, it can potentially lead to high blocking probabilities in the dynamic case, or may result in a large number of wavelengths being used in the static case. Also, fixed routing may be unable to handle fault situations in which one or more links in the network fail. To handle link faults, the routing scheme must either consider alternate paths to the destination, or must be able to find the route dynamically.

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3.1.2 Static RWA models

All the light paths that are to be set up in the network are known. The objective is typically to accommodate the demand while minimizing the number of wavelengths used on all links.

3.1.3 Dynamic setting

The light path requests between source destination pairs arrive one by one. A typical objective is to minimize the call blocking probability or the total number of blocked calls over a given period of time. On the contrary, dynamic routing algorithms are good candidates for traffic engineering and generally they can improve the blocking performance significantly.

***.3.2*. Goal of routing and wavelength assignment algorithm**

- To analyze the performance of same algorithm in different topologies, so we can use it for specific application.
- Satisfying the bandwidth, delay and throughput requirement for every admitted connection.
- Reduce call blocking ratio.

IV. FIRST FIT ALGORITHM

Choose the lowest indexed wavelength from list of free wavelength and assign it to the connection request. When the request is completed the wavelength is added back to the free wavelength set.

4.1 First-Fit wavelength assignment

First-fit does not require global knowledge about the network. No storage is needed to keep the network states and no communication overhead is needed. The computational overhead is small and the complexity is low. Moreover, the performance in terms of blocking probability and fairness is among the best.

Therefore, first-fit is preferred in practice although the performance analysis of optical WDM networks is studied extensively that there is less work for analyzing the blocking performance of first-fit scheme. In this scheme, all wavelengths are numbered. When searching for available wavelengths, a lower numbered wavelength is considered before a higher-numbered wavelength.

The first available wavelength is then selected. This scheme requires no global information. Compared to Random wavelength assignment, the computation cost of this scheme is lower because there is no need to search the entire wavelength space for each route.

V. TOPOLOGIES USED FOR COMPARING BLOCKING PROBABILITY

1. Random
2. Star
3. Ring
4. Tree

5.1 Network stimulation

We present stimulation scenario and results to illustrate the performance of topologies. The topology scenario random, star ring, tree presented in fig 1, 2, 3, and 4 respectively.

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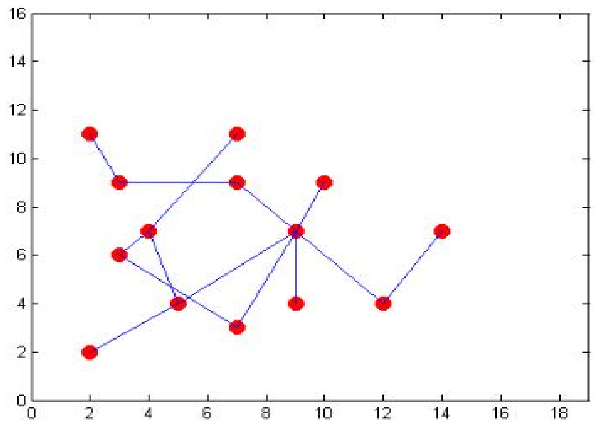

Figure 1.Scenario of Random network topology

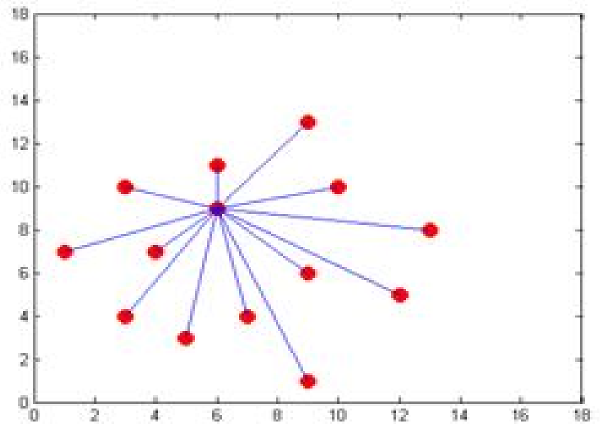

Figure 2 Scenario of Star network topology

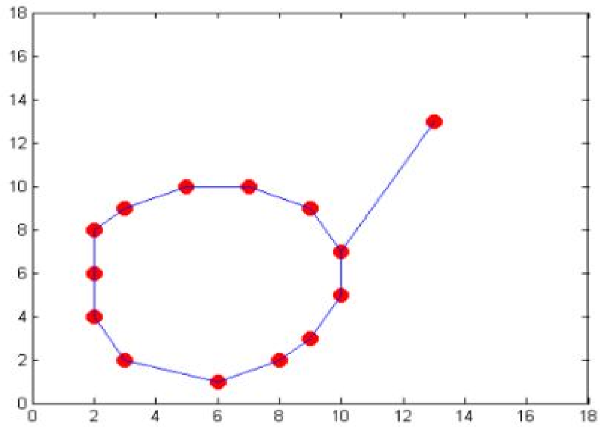

Figure 2Scenario of Ring network topology

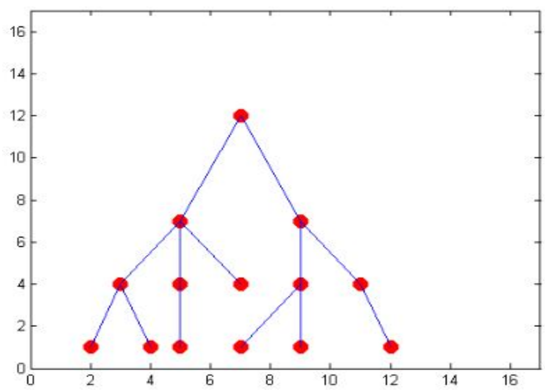

Figure 4 Scenario of Tree network topology

VI.PROBLEM FORMATION

As the WDM technology matures and the demand for bandwidth increases, dynamic provisioning of lightpaths at the WDM layer becomes an important and challenging problem. Any distributed algorithm for routing dynamic traffic should be simple, efficient, and also scalable. Most of the multimedia and real-time application requires specific quality of service (QoS), hence it is important that the routing algorithm should provide lightpaths which satisfy the required QoS. Our proposed algorithm also measures the performance evaluation considering call blocking ratio and simulation time.

Next Generation WDM based Network basically focuses on the Routing and Wavelength Assignment (RWA) problem in wavelength-routed optical WDM networks. Most of the attention is devoted to such networks operating under the Wavelength- continuity constraints, in which light paths are set up for connection request between node pairs, and a single light path must occupy the same Wavelength on all of the links that it spans.

In Different topologies exhibit different performance parameters like traffic congestion, delay, packet loss and cost. Traffic congestion is an important parameter which has to be reduced for All-Optical Network in different topologies. Setting up a

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light path, a route must be selected and a Wavelength must be assigned to the light path. If no Wavelength is available for this light path on the selected route, then the connection request is blocked. In our proposed work Wavelength is assigned dynamically depending on the bandwidth factor.
We examine the RWA problem and review various routing approaches and Wavelength assignment approaches proposed in the literature. Finally we have proposed a new RWA algorithm, which works well under dynamic traffic by checking the performance of call blocking ratio at constant number of calls. And we demonstrated its performance through simulation.

VII. PROBLEM STATEMENT

The difference in blocking probabilities among random, Ring, star, tree topology is depicted. By observing the performance evaluation parameter such as blocking probability ratio and stimulation time star topology performs best on blocking Probability and takes less simulation time as compared to other topologies.
Performance evaluation parameter:
Blocking probability ratio = (total calls – successful calls) /total calls
Simulation time = CPU time
Wavelength chosen is 50 per link
Number of calls = 100

VIII. SIMULATION RESULTS

Below figures 5,7,9 and 11 shows the performance blocking probability and figures 6,8,10 and 12 shows the performance of simulation time in random, ring, star, tree topology respectively.

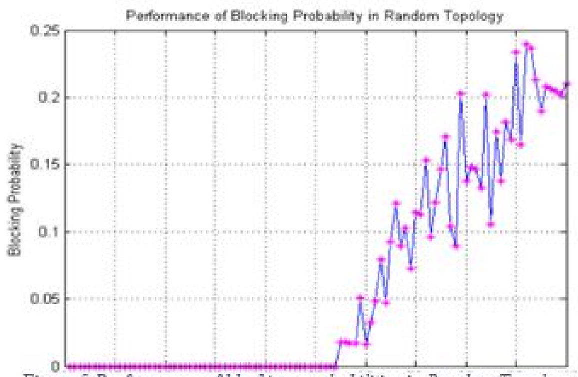

Figure 5 Performance of blocking probabilities in Random Topology

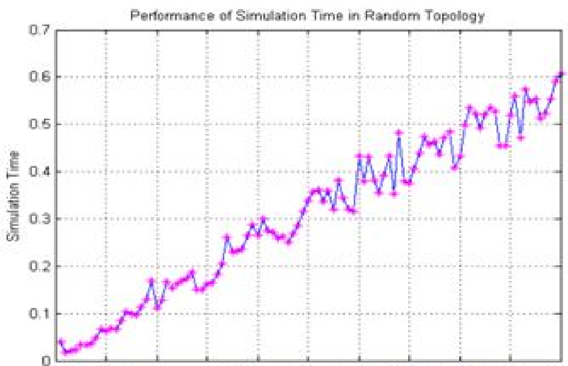

Figure 6 Performance of Simulation Time in Random Topology

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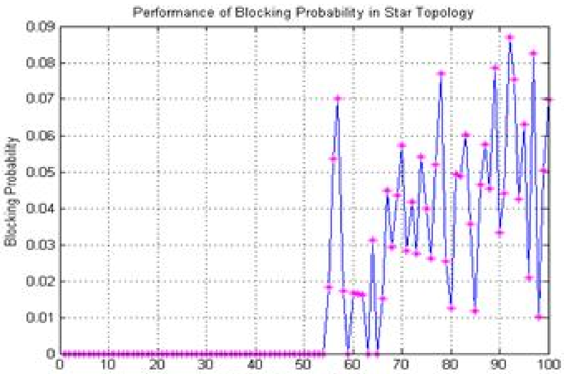

Figure 7 Performance of blocking probabilities in Star Topology

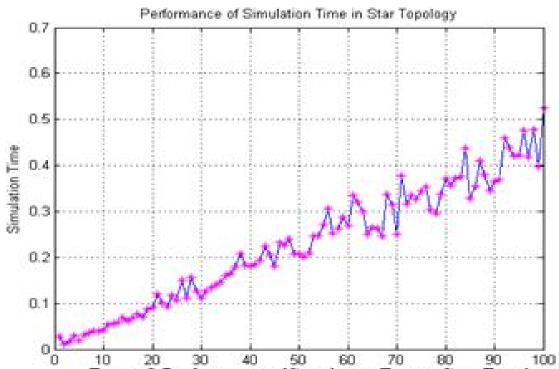

Figure 8 Performance of Simulation Time in Star Topology

IX. COMPARISON RESULT (NUMBER OF CALLS = 100)

Sl.No.	Parameters	Optical Links			
1	**Topology**	**Random**	**Star**	**Ring**	**Tree**
2	**CBR Call Blocking Ratio (%)**	0.24	0.07	0.47	0.5
3	**CPU Time(sec)**	0.6	0.5	0.65	0.7

Table 1 Comparison table based on call blocking ratio and CPU time

Table 1 shows the comparison between different parameters like CBR and Simulation time in sec for different topologies.

X. CONCLUSION

By comparing the values of different topologies on the basis of CALL BLOCKING RATIO and CPU time (sec), for Random topology CBR is 24% and CPU time is 0.6 sec, Star CBR is 7% and CPU time is 0.5sec, Ring 47% and CPU time is 0.65sec, Tree topology 50% and CPU time is 0.7 sec.It is observed that the star topology performs best on blocking Probability and takes less simulation time as compared to other topologies.

REFERENCE

[1] A Fast Path-Based ILP Formulation for Offline RWA in Mesh Optical Networks Zeyu Liu, George N. Rouskas Department of Computer Science, North Carolina State University, Raleigh, NC 27695-8206, USA

[2] Performance analysis of topologies for optical wavelength convertible networks Chunyong Yang Shaoping Chen College of Electronics Information Engineering, South-Central University for Nationalities, Wuhan 430074, China

[3] Blocking in wavelength-routedall-opticalWDM networks AmitWason,R.S.KalerElectronics &CommunicationEngineeringDepartment,ThaparUniversity,Patiala,Punjab,IndiaReceived 8June2008;accepted30September2008

[4] Randhawa, Rajneesh; Kaler, R. S.; Singal, Anuj, Performance evaluation of algorithms for wavelength assignment in optical ring network , Optik - International Journal for Light and Electron Optics, vol. 124, issue 1, pp. 78-81

[5] Virtual topology reconfiguration in IP/WDM optical ring networks G. Mohan*, P.H.H. Ernest, V. Bharadwaj Department of Electrical and Computer Engineering, National University of Singapore, Singapore, Singapore Received 27 November 2001; revised 18 March 2002; accepted 27 March 2002

[6] HUI ZANG, JASON P. JUE, BISWANATH MUKHERJEE, Review of Routing and Wavelength Assignment Approaches for Wavelength-Routed Optical WDM Networks, 2000 SPIE/Baltzer Science Publishers 1388 6916/2000

[7] Xuehong Sun', Yunheo Lit, IoannisLambadarist and Yiqiang Q. Zhao', Performance Analysis of First-Fit wavelength Assignment Algorithm in Optical Networks, 7th International Conference on Telecommunications - ConTEL 2003 ISBN: 953-184-0524. June 11-13,2003,Z agreb, Croatia

[8] Topology analysis of auto load-balancing RWA in optical burst-switched networks 15-16 April 2011 12048207 IEEE