

Performance analysis of dual ring WDM network with outer/inner ring failure

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Abstract

In large WDM network, failure can disturb the functioning of multiple devices, so continuous working of WDM network is required. This problem is identified as survivability of WDM network. This paper presents the concept of survivable of WDM network by implementing the proposed Dual ring Dual connection topology. We proposed a dual ring dual connection topology for the availability of WDM network and analysis the different link failure. Routing and re-routing schemes will be analyzed for assigning routes.

Keywords

WDM, RWA, Dual ring, Backup path.

1.Introduction

Wavelength Division Multiplexing (WDM) allows single optical fiber to carry traffic on multiple optical channels by assigning to each channel a unique wavelength in which the corresponding traffic is transmitted. Each node in a WDM network is capable of optically switching traffic on any of the wavelengths supported by the network. This allows the creation of clear end - to - end optical channels that span multiple physical fiber hops but retain all the advantages of optical transmission over a continuous span of fiber [1]. There are two types of routing, static routing and dynamic routing. As one of the important problem of WDM optical network is RWA (Routing and Wavelength assignment) which is nothing but for finding route between source and destination nodes, an algorithm is used for route selection and wavelength assignment to that route. Such an algorithm called as a Routing and Wavelength Assignment algorithm in which a Heuristic algorithm is used.

2.Literature review

MatPlanWDM tool, an educational network planning tool for wavelength-routing WDM networks has mentioned. It includes a set of heuristic algorithms for solving the virtual topology design, and the routing and grooming of traffic flows on top of it.

In addition, an implementation of the linear programming problem to obtain the optimal solution of the complete design is included for comparison [2]. WDM optical networks are high capacity networks based on optical technologies in which RWA (Routing Wavelength Assignment) is a main issue [3]. We have given overview on different rerouting schemes and also the survivability concept in case of failure occurs in network. That means most of the attention devoted on use of routing and wavelength assignment (coloring) scheme in first phase and rerouting in later phase. Wavelength Division Multiplexing (WDM) network, for a given connection request, a route has to be found, and a dedicated wavelength has to be assigned along that route. This problem of assigning route and wavelength to the connection request, using minimum network resources, is called Routing and Wavelength Assignment (RWA) Problem [4]. We focuses on the analysis of proposed RWA algorithms in large WDM networks. We use simulations and analysis of randomly generated large networks under dynamic traffic and static traffic, with and without protection of the connection request. The protection of the primary route between source and destination is considered by setting up a dedicated backup path in case of failures [5, 6].

3.Design of dual ring heading

A WDM network topology of 8-node Dual ring with dual attachment is designed and analysis of the topology is to be done for Single link failure to multiple link failure. The proposed dual ring with dual attachment is shown in Figure 1.

On this proposed dual ring topology load analysis is to perform on various parameters, with the proposed routing and re-routing algorithms. Figures 2,3,4 and 5 show cases from single link failure to multiple links failure respectively. On all these failures, performance analysis on the various parameters will carried out to check the survivability of the Dual Ring with Dual Attachment.

4.Simulation results & discussion

MatPlanWDM.061 is used as a simulation tool. It accepts 8-node Dual Ring Dual Attachment physical topology and 8-node Uniform traffic as inputs. We have taken various network topologies like single link failure, two links failure, four random links failures, inner ring failures and outer ring failures.

As we compare Carried Traffic / Offered Traffic vs. Traffic Demand, we have observed that traffic demand with respect to carried traffic / offered traffic metric carried channel traffic is decreases when traffic demand increases. We conclude that for inner ring failures and outer ring failures decrement is maximum. As in case of both these failures the maximum number of failed link is equal to 4 links. But in case of four random links failure the decrement is average. This suggest that ring failures have higher impact on network.

As we compare Number of Virtual Hops vs. Traffic Demand, we have observed that number of virtual hops increases with increase in traffic demand. We have also observed overlapping of numbers of virtual hops for all the cases of failure. We conclude that links failures have similar effect on network.

We observed that the single hop traffic initially increases for all topologies but with increase in traffic demand it start decreasing and maximum for outer and inner ring failure.

We observed that number of lighthpaths increases with increase in traffic demand, but comparatively there is a decrease in light path with increase in number of failure links. It is also observed that for ring failures number of lighthpaths decreases more in compare to same numbers of links failure.

We have observed that number of used wavelength channels increases with increase in traffic demand. It is also observed that number of used wavelength channel in minimum for inner and outer ring failure. It is due to the high utilization of channels with the increase in traffic of each channel.

We have observed the number of lighthpaths increases with increase in traffic demand and in case inner and outer ring failure, lighthpaths requirement is highest at the initial traffic demand as compare to other topologies.

We have observed that message propagation delay is maximum for four random links failure and inner

ring failure where as it is minimum for outer ring failure.

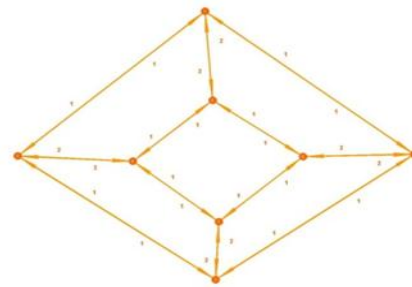


Figure 1 Dual Ring with dual attachment

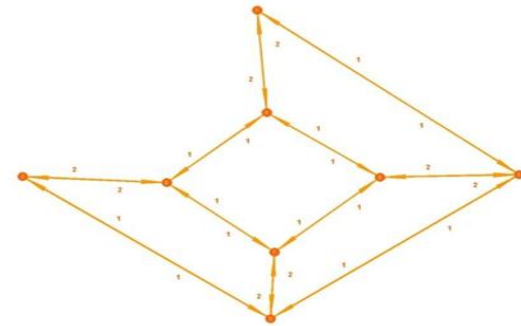


Figure 2 Single link failure-dual ring with dual attachment

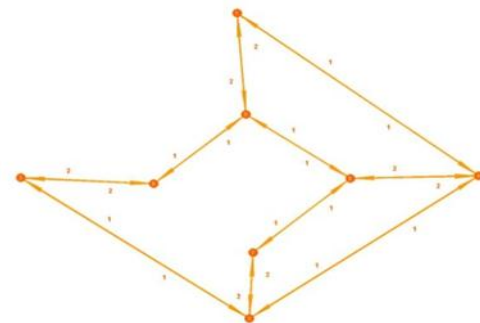


Figure 3 Two links failure

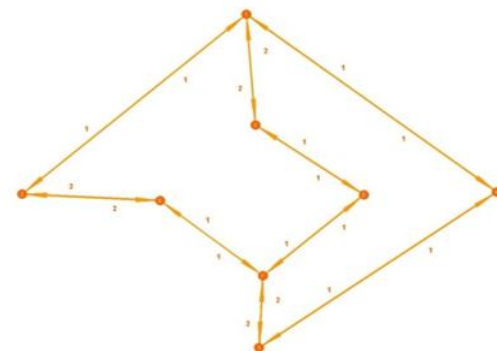


Figure 4 Four random links failure

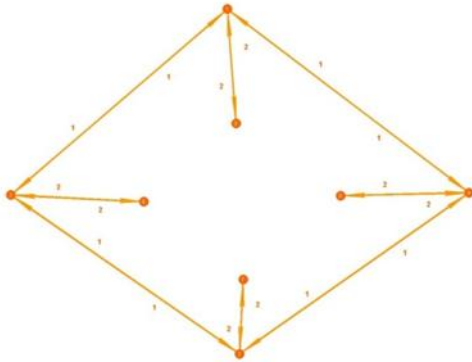


Figure 5 Inner ring failures

5. Conclusion and future scope

We have observed that traffic demand with respect to carried traffic / offered traffic metric carried channel traffic is decreases when traffic demand increases. We conclude that for inner ring failures and outer ring failures decrement is maximum. As in case of both these failures the maximum number of failed link is equal to 4 links. Here we have discussed about the WDM network and compare the performance of 8-node Dual Ring Dual Attachment topology with the five failure cases with respect to traffic demand, lightpath capacity and wavelengths. On the basis of performance matrices we can plan better network and improve on capacity planning with fail safe networks. MatplanWDM0.61 is freely available simulation tool for network designing and planning, is a good simulation tool to simulate various network topologies with performance matrices. 8-node Dual Ring Dual Attachment can be further investigated for cross-connect architecture, so the impact of ring failure can be minimized.

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