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# ALTERNATE REROUTING ALGORITHM FOR LINK FAILURE IN WDM OPTICAL NETWORKS

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**Abstract:** *The optical network is a fast growing technology assist to improve the performances of all-inclusive networks within formation dispensation to every node on the network domain. The domain consists of either inter-domain, intra domain networks. The inter-domain network locally carry the information to everyone whereas the intra domain does not kept the information locally, it broadcast the information globally. The information invariably store on the node but the node information hoard on the routing tables. The routing table has always been important in any network architecture. The fibre channel attaches on different nodes of the domain network and the broadcast information distributed over the multiple networks. The inter-domain examines the localized traffic if the single link break then it reroute the data to another freed link. This paper explored to distribute resource among the clients not only to backbone networks (like switch, router) and to achieve the throughput of the domain network with keeping proposed algorithm.*

## I. INTRODUCTION

Institute of Electrical and Electronics Engineers (IEEE) developed number of standards and these standards further used in number of complex technologies. The expert panel of IEEE defined rules, concept that makes them communication simpler in user perspective. In this paper, we uses both wired and wireless standard to start communication between client, host and servers. The SONET model is not well adapted to fulfill the existent Internet data traffic demands, such as bandwidth and low end-to-end latency, and its dynamic model [1]. Wavelength Division Multiplexing (WDM) refers to the technology of combining multiple wavelengths onto the same optical fiber [2]. Each wavelength is a different channel. The proposed scenario will be able to make connection throughout wireless and wired clients that share information to each other. WDM optical networks are the future network, because Link protection reduces the communication requirement as compared to path protection, so providing fast recovery [3]. Due to the high speed nature of optical networks, a component failure can lead to a huge amount of data loss. To minimize data loss, it is important that the failed component can be immediately localized and bypassed. Survivability becomes essential in such networks. Therefore, it is vital to design networks that can quickly and efficiently recover from failures. Most research till date in survivable optical network design and operation focuses on single link failures, however, the occurrence of multiple-link failures are general in a network topology. Multi-link failure scenarios can occur out of two common situations. First, an arbitrary link may fail in the network, and before that link can be restored, another link fails, thus creating a multi-link failure sequence [4].

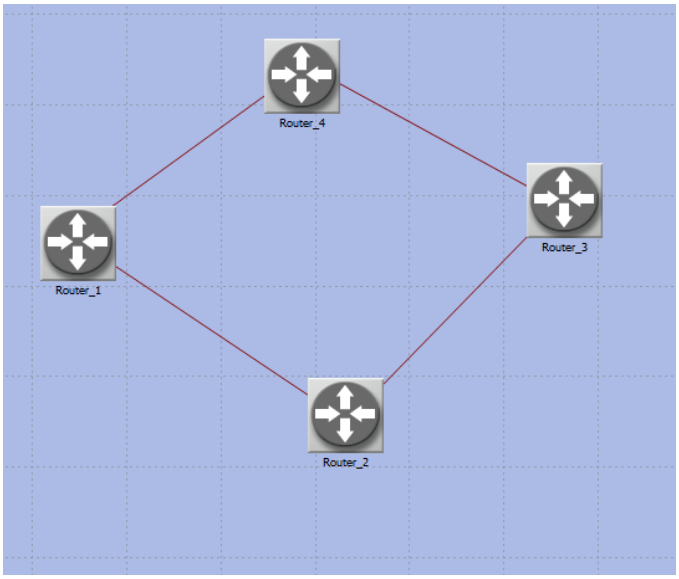


**Fig.1:** Router based backbone network

The figure1 represented the backbone networks where the Layer 3 devices link with each other for communicating with each other. The devices operated on the OSI model (layer-3), which is called the network layer, is responsible for packet routing. In order to enable network nodes to forward incoming packets to other nodes, each packet gets a source and destination address on this layer. If the message transfer from one device to another then the data routed from the packet format and these packets contains source and destination logical IP addresses. The other information in the packet contains header, trailer and packet data unit (PDU). The architecture link with number of client together and groups of clients are allowed to communicate with the routers. Usually all clients are allowed to communicate with a router. Only under certain conditions will the router choose to temporarily restrict access to parts of the network for some clients. This facility has been used in many of applications such as malls, cinemas, traffic handling etc. without restriction the application accessibility increases resultant overhead increases [5]. Depending on the size of the transmitted IP frames, header compression can substantially increase the transmission speed. Small frames in particular benefit from this as the IP header requires a proportionally oversized part of the frame.

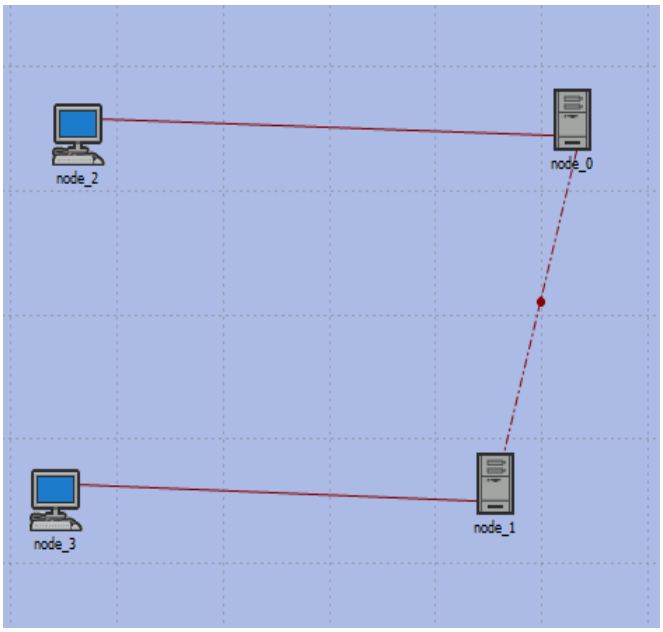


**Fig.2:** Sharing of data

The node_0 and node_1 act as a server while the node_2 and node_3 mark as wired node that communicates to each other. The two servers (node_0, node_1) link with each one that sharing the information, where the interface e1, e2 attach on node_3-→ node_1, node_2→ node_0. The survivability meaning to survive the network if one of server will be failed then the information stores by the back-up server. These devices aware of physical, MAC (medium access control) and network layer properties. The packet are forwarded to the MAC Layer and encapsulated by the data link layer, the medium access control layer includes additional information in the header to inform the physical layer which transport format it should select for transmission of the frames. The frame protocol is also used for the synchronization of the user data connection between the server and the Node.

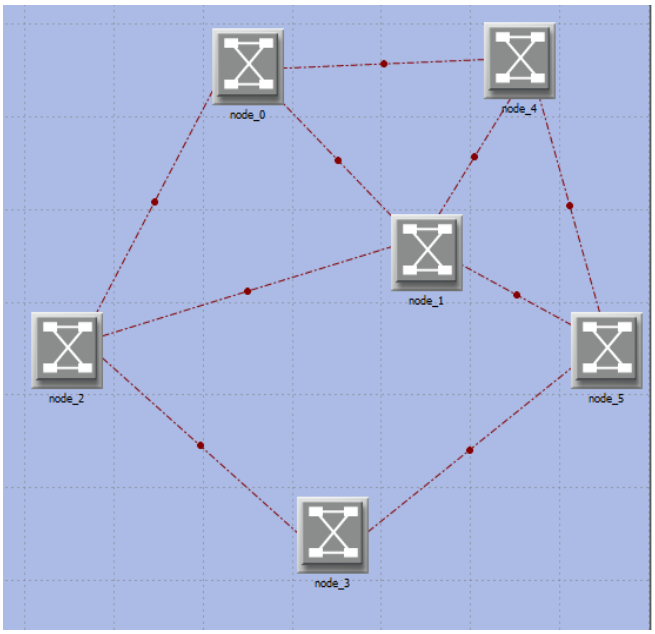


**Fig.3:** Light-Path connections of WDM Based Networks

The light-path connections make the WDM links [6] strong to traverse the data from one end to another of the networks. The exact path becomes lower the overhead and high throughput, thus the packets received in exact form as the send by the source node. Link failure typically brings down all connections traversing that link. The switch work on the layer 2 of the open system Interconnection (OSI) layer model, these intelligent devices bring the packet from the source node and to exact location of the destination node unicast. The unicast feature provides one to one path and other node does not receive any packet.

*A. Proactive Protocol*

[1] This protocol maintains the information to each and every node while they had configuring on the light-path else configuring on the IP based network where each node communicates via logical IP addressing. The advantage of this protocol is that it updates the information from beginning of the first packet sent. The protocol also preserves the bandwidth of the total network. The protocol used in Link State, Distributed Bellman-Ford, Global State Routing, Optimized Link State Routing, Fisheye State Routing and Hazy Sighted Link State [7].

[2] The optimized link state routing protocol has been used in this paper, usually OLSR (Optimized Link State Routing protocol). The OLSR protocol group the number of nodes where the node selects the neighbor nodes and these nodes has responsible for forwarding the packets. The protocol maintains to up-to-date information and information could be exchanged on the regular basis. When any node has to share the data or information to any node, then routes will be available, the availability of the routes always on the request. The OLSR protocol defines three control messages i.e.: HELLO, Topology Control (TC), and Multiple Interface Declaration (MID).

[3] *Hello Message:* The OLSR protocol used hello message to sensing the nodes in the domain or inter-domain networks. Control message is to mark the nodes and update routing tables. These control messages helps to calculate the shortest path and calculating distance between the forwarding nodes.

[4] Topology Control (TC): The topology control set by true when OLSR functioning on the communicating domain network. The control information flow in between the topology, if any changes on the topology then the message has been passed to each node.

[5] Multiple Interface Declaration (MID): This information stores on the routing table (RT), when node uses multiple interfaces and each interface assign individual logical Internet Protocol (IP) address. The messages transmitted from interfaces and each information flow on the interface stores on the routing table.

The rest of the paper is organized as follows: In section II, the Algorithm approaches are explained. The related work has been presented in Section III. Section IV shows the proposed algorithm and Section V conclude the paper.

*B. Primary Path and Backup Path*

To route the packet from source to destination there is necessity of light-path through number of packets can be send but there exist multiple paths from every sender to receiver, sometime path should be longer and due to congestion and interference packet will not able to reach the destination. If it is not the source node, the beginning token will be delivered to the source node [8].

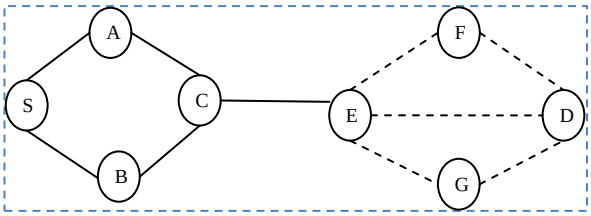


**Fig.4:** Light-Path in WDM Networks

Figure 4 shows the light-path which consists of static link allocation as well as dynamic link allocation. Every node connected to its neighbor node peer to peer, solid line show the static link and dashed line show the dynamic link. nodes S,A,C,B connected with static links or node assigned a fixed interfaces and on the other hand node C and E act as router which communicate with other nodes and nodes E,F,G,D are connected through dynamic links and routes are changeable. In this one network consists of both static and dynamic allocation schemes for better performance of network.

## II. LITERATURE SURVEY

Marco D. D. Bicudo, et.al. [1] detailed discussion about the WDM networks and to reduce the interference between communicating high end devices. The various technologies described in this paper such as ATM, SONET and Ethernet that supportive this network. The paper implements the scenario that created the backup path only if a failure affects its primary path. This backup method called Protection that proposed in the paper. The algorithm determines whether the establishing backup path and share the resources. The connection holding time is exponentially distributed, and its mean is varied to get the different network loads. The source and destination pair is randomly chosen among all nodes in the network.

Daniele Arci et.al.[9] explained common protection schemes in WDM optical networks and spare resources that were planned. The protection was achieved by a standby redundancy strategy. The functional elements should comprise all the transmission and switching equipment crossed by each light path. The advantages of survivability to multiple failures should be compared keeping the cost of the resource consuming protection techniques into account.

F. Xu, et. al. [10], explained domain level diversity. The domain level diversity distinguishes into two types i.e. primary and backup. This primary and backup diversity maintains the routes for forwarding traffic from source to receiver end. The optical fibre provides the link to each node. The nodes locally and globally communicate with the domain level scenario. The TE based algorithm

has been used for path pair selection process for recovery of link failures.

The OSPF [11],stands for open shortest path first that distinguish from other proactive based protocol. The routing table information traversed to each node and also sent updated information. This includes when link or path had been failure then this information recorded on the routing tables. The OSPF protocol [12] version 2 also updated the information to every node but this information mapping to OSI model.

Yonggang Wen et. al. [13], proposed fault-diagnosis algorithms that exploit the optical wavelength-division multiplexing (WDM) networks, where optical signals are not usually detected at intermediate nodes along lightpaths optical signals will be sequentially sent along a set of light paths over an all-optical network to probe its state of health. The greedy based algorithm introduced in this paper and this algorithm is equivalent to the binary decision tree that already discussed in the paper (sections). It evaluated the probability of reached node in the set of inner nodes. The information distributed on the inner node in the sense of bits stream. From the analysis of this paper author concluded that they managed the complexity of all optical networks.

Bin Wu et. al. [14], described an optical layer mechanism to achieve fast link failure detection and localization using only a small set of monitors. Link failure due to fiber-cut is a common failure in optical networks. The authors assume a single link failure in the network. Since a link failure disrupts all the lightpaths passing through the failed link, it is more critical than a channel-based failure or optical signal degradation.

Nazbanoo Farzaneh,et. al. [16], mentioned that network to adapt to real-time traffic changes or ensures network survivability during equipment failures. If an error occurs in the network, the traffic loss is stopped by changing the path from the primary to the backups. The network traffic flows are continuously observed and the updates to the virtual topology are made when necessary. For each request of a new lightpath, the shortest path is selected as the route. The proposed algorithm finds shortest path and the wavelength availability in each fiber. It also creates conflict list and the relation that calculates from the authors, it decides the new virtual topology.

Jane M. Simmons [17], said link failure typically brings down all connections traversing that link. This disruptive effect is magnified when a network suffers multiple concurrent link failures. Data traffic transmitted using Fiber Channel or Ethernet protocols and Wave Division Multiplexing (WDM) enables multiple data. The streams of varying wavelengths to be combined in to single fiber [18], significantly increase the overall capacity of the fiber. The WDM optical network discussed by this reference book to calculated the wired network and how to increase the survivability of the overall networks. Shaveta Rani et. al. [19] ,Resources for backup lightpath can be reserved in three ways: primary backup multiplexing, backup multiplexing and dedicated backup lightpath. Degree of survivability is the ratio of traffic affected that has been restored by the amount of the total traffic affected.

## III. RESEARCH GAP

The mesh networks creates backup path and if any failure affects in the primary path [1]. This protection mechanism does allocate it in advance when any network was setup. The number of re-routing schemes introduced by the authors [2] that partially divides the traffic in upstream and downstream. The dual link failure strategy had applied on the current scenario but it affects the accuracy of the total nodes and increases the complexity of the network. There are number of multi-domain protection schemes introduced in the coming years to increase the survivability of the network. The network should be treated as wired and wireless networks that expand according to the requirement of the users. The protection scheme mentioned by the authors is inter-domain protection scheme [10]. This scheme computes the link disjoint light path pair and reduced the ratio of link failures.

Above said problems related to link and path failures and this includes restoration of the whole network must be designed. Link protection helps fast recovery from link failures. Existing schemes either pre-reserve two backup paths for each demand or compute new backup paths for unprotected demands after the first link failure occurs. A light path routing with high Min Cross Layer Cut value implies that the network remains connected even after a large number of physical failures. To further verify the survivability performance of the lightpath routings from a different perspective, for each lightpath routing. The packet switching require for the proposed to carry the same amount of traffic and increase the efficiency of the bandwidth. The backup connectivity also provide on the previous approach but lack of efficiency when scale the large networks. This way, we adopt effectively traffic engineering by building the servers and routers together and working on inter-domain network. The OLSR protocol is better than other proactive protocols when obtaining the minimum delay around optical network connectivity. When a node in the network receives the request to establish a new route, the node creates an appropriate

working path. Each node in the network is required to maintain a routing table that contains an ordered list of a number of fixed shortest routes to each destination node. The link shares the frequency band so that sending and receiving nodes transmitted/receiving the packets. The packets are placed on each link and every node was responsible for maintaining the queue. Queues are served in order. A queue is inspected before an actual frequency switch; if the queue is empty the next queue in turn will be inspected.

## IV. CONCLUSION

We concluded that light-path based connection make the WDM network stronger. The light-path make stronger the connection between each node, these nodes are server node, client node, workstation or Ethernet node etc. It also helps to improve the network performance by increasing network throughput and decreasing the delay in the network. The proposed algorithm defined on the WDM based network and to manage the information cycle on every node. The backup connectivity shares the resources in distributed manner and protected against loss of large data. The restoration also helps towards path or link failures and route traverse over another path. The multiplexing only be used when backup light paths utilizes. If the distributed based technique has been used on the inter-domain network, intra-domain network then increase the overhead ratio, resultant affects the overall performance. The proactive protocol i.e. OLSR protocol is the better idea to use it and reduce the overall overhead when distributed technique using on two-domain networks.

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