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Design And Implementation of Shortest Path For Wavelength Routed Networks

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***Abstract*-According to a quick growth of the bandwidth capacity of WDM network, traffic damage due to a failure of network components is becoming unacceptable. To overawe this problem, a protection method that prepares backup light paths for each working path is now considered to improve reliability of networks. In this paper, it proposes an energy efficient routing in WDM passive optical networks. Routing means to provide a connection between source and destination node. Optimal Routing can increase efficiency of wavelength routed optical networks. Provisioning a connection in such a network includes defining a time-slot assignment, in addition to route and wavelength. Then their effect on performance parameters like energy has been calculated. The results show that it reduces the energy consumption. The simulations have been done with MATLAB tool and Its GUI.**

***Keywords*- Shortest Routing, path in Networks, WDM Networks, Efficient Routing.**

I. INTRODUCTION

Communication may be defined as the transmission of information from one point to another. When info is to be sent from one place to another a communication system is required. In a general communication system an electromagnetic wave acts as the information signal which is changed in a particular form after modulation or conditioning. In an optical communication system a light wave acts as the information carrier. Therefore optical communication simply means communication with the aid of light carrier's i.e. optical fibers [1].

An optical network joins computers (or any other device which can generate or store data in electronic form) using optical fibers. According to the physical technology employed, one can classify three generations of networks, Networks built before the emergence of optical fiber technology are the first generation networks (i.e. networks based on copper wire or radio). The second generation systems employ fibers in traditional architectures. The selection of fiber is due to its large bandwidth, low error rate, dependability, availability, and maintainability. Although some routine improvements can be achieved by employing fibers, the performance for this generation is limited by the maximum speed of electronics (a few gigabits per second) employed in switches and end-nodes. This phenomenon is named an electronics bottleneck. In order to gratify the increasing bandwidth requirements of emerging applications, totally new approaches are working to exploit vast bandwidth (approximately 30THz in the low loss region of single mode fiber in the neighbourhood of 1500nm obtainable in fibers. Therefore, the third generation networks are designed as all-optical to avoid the electronics bottleneck [2].

In all-optical networks, there might be different types of wavelength continuity constraints. First, network might lack wavelength conversion capabilities altogether. In this case, a light path must occupy the same wavelength on all the links it travels across. Second, network might have full conversion capability at all of its nodes. In this case, wavelength assignment will not have a material effect on the network and problem boils down to routing. Alternatively, network might have wavelength conversion capabilities on only a portion of its nodes [3].

The problem of providing routes to light-path requests and assigns a wavelength on each of the links along it. WDM (Wavelength Division Multiplexing) has a capability of providing a large transmission capacity by multiplexing wavelengths on fiber. Recently, an IP (Internet Protocol) over WDM network where IP packets are directly carried over WDM network is expected to offer an infrastructure for next generation Internet. A currently available product for IP over WDM networks only provides the large bandwidth on point to point link. That is, each wavelength on fiber is treated as a physical link between conventional IP routers. In this way, link capacity is certainly increased by number of wavelengths multiplexed on the fiber, but it is insufficient to resolve the network bottleneck against an explosion of traffic demands since it only results in that bottleneck is shifted to an electronic router [6].

According to a large transmission capacity of WDM network, traffic loss due to a failure of network components is also becoming large .Determining route and wavelength of primary/backup light paths is called a logical topology design method. Routing protocols use metrics to evaluate what path will be best for a packet to travel. A metric is a measurement standard; such as path bandwidth, reliability, delay, load on that path etc.; that is used by routing algorithms to define optimal path to a destination. To aid process of path determination, routing algorithms adjust and maintain routing tables, which comprise route information. Route information varies depending on routing algorithm used [8].

The paper is planned as follows. In section II, we discuss related work with the routing scheme. In Section III, It describes system architecture to implement WDM networks. Section IV explains the design and

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implementation method of system. In section V, it contains the all results of the system. At last, conclusion is specified in Section VI.

II. RELATED WORK

In literature, severalsuggested a medium access control (MAC) framework personalized for frequency-division multiple contact passive optical networks is defined which allows exploiting both subcarrier and time domains in a dynamic and flexible way. A dynamic carrier assignment procedure that compliments quality of service by offering decreased average delay is proposed. Moreover, effective methods to progress its performance and reduce its complication are provided. Additionally, suggested PON MAC framework for first time leverages on a cross-layer optimization via adaptive quadrature amplitude modulation (QAM) per optical network unit (ONU). The performance of all schemes is measured using computer simulations [4].

Authorsproposed End-to-end real-time optical orthogonal frequency-division multiple-access (OOFDMA) passive optical networks (PONs) with adaptive dynamic bandwidth allocation (DBA) and colourless optical network units (ONUs), for first time, at combined 10.375 Gb/s over 26.4 km standard single-mode fibers based on intensity modulation and direct detection. The colourless ONU operation for several illustrative wavelengths across C-band is successfully achieved by utilizing cost-effective reflective semiconductor optical amplifier strength modulators, whose contracted signal modulation bandwidths are fully exploited through adaptability of OOFDM transceivers and adaptive DBA [5].

Another suggested design and management themes in routing a mixture of OC-192 and OC-768 streams in wavelength-routed optical systems. They assumed that fiber links in network are heterogeneous with respect to their transmission capability (i.e., links are intended to handle a given maximum bit-rate forced by regenerator spacing). They investigated issues of routing connection demands of various bit-rate requirements in such heterogeneous networks. In this environment, we introduce routing of multi rate traffic (RMT) problem. The RMT problem is easily defined as process of finding best routing which maximizes total bandwidth carried in network, for a set of sessions, within a given TDM equipment budget. They proposed a two-phase optimization arrangement (two-phase RMT). This scheme obtains a basis solution used in routing 40-Gb/s traffic only on OC-768 capable relations without the use of TDM equipment [7].

Some proposed that next generation multimedia applications such as video conferencing and HDTV have raised tremendous challenges on network design, both in bandwidth and service. As wavelength-division-multiplexing (WDM) networks have occurred as a promising candidate for future networks with huge bandwidth, supporting efficient multicast in WDM networks becomes renowned. Different from IP layer, the cost of multicast at WDM layer includes not only bandwidth (wavelength) cost, but also wavelength alteration cost and light excruciating cost. It is well known that optimal multicast problem in WDM networks is NP-hard. In this paper, they will develop an efficient approximation algorithm consisting of two separate but integrated steps: multicast routing and wavelength assignment [10].

III. SYSTEM ARCHITECTURE

In WDM networks, links on same light path must use same wavelength, otherwise wavelength converters are required to convert signals from one wavelength to another. The use of wavelength conversion has a profound impact on cost of multicast in WDM networks. Wavelength routed networks have been most commonly used in WDM networks and it is considered to be potential candidate for next generation of wide-area network. It is composed of some form of wavelength-selective elements at nodes of the network. Such node makes its routing decision based on the input port and the wavelength of the signal passing through it [8]. Wavelength routing is achieved by de-multiplexing the different wavelengths from each input port and then multiplexing signals at each output port [9].

In optical networks, wavelength division multiplexing technology which multiples a number of optical carrier signals into a single optical fiber using different wavelengths (colours) of a signal. Using this technique, we can join signals at the transmitter side referred as multiplexer and it splits signals at receiver side referred as de-multiplexer as shown in fig 1.Frequency Division Multiplexing PON, or FDM-PON, is a non-standard type of passive optical networking, being developed by some companies. The multiple wavelengths of a FDM-PON can be used to separate Optical Network Units (ONUs) into several virtual PONs co-existing on the same physical infrastructure [11].

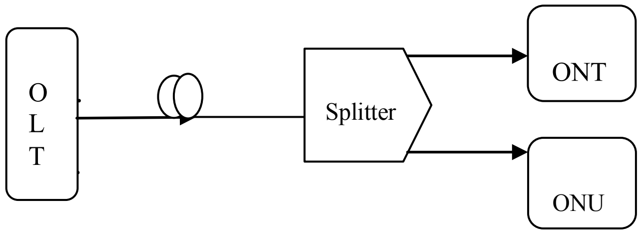

Figure 1: Proposed System Architecture of a System

By monitoring bandwidth utilization, it is possible to define the users, applications and hosts taking up precarious bandwidth, as well as in identifying access of unauthorized applications. Optical devices should be especially focused on bandwidth monitoring, since unauthorized usage can be identified by simply reading historical trends. Again, with viruses and malware consuming out-of-the ordinary amounts of bandwidth, monitoring bandwidth consumption can be invaluable in identifying security anomalies [13].

The active modules in the network consist of an optical line terminal (OLT) situated at the central office, either an optical network terminal (ONT) or an optical network unit (ONU) at the far end of the network and optical amplifiers for amplification purposes [11].The OLT is located in a central office and controls the bidirectional flow of information across the ODN. An OLT must be able to support transmission distances across the ODN of up to 20 km. In the downstream direction the function of an OL T

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is to take in voice, data, and video traffic from a long-haul or metro network and broadcast it to all the ONT modules on the ODN. In the reverse direction (upstream), an OLT accepts and distributes multiple types of voice and data traffic from the network users [15].

ONT is located directly at the customer's premises. There its purpose is to provide an optical connection to the PON on the upstream side and to interface electrically to the customer equipment on the other side. At the high-performance end, an ONT can aggregate, groom and transport various types of information traffic coming from the user site and send it upstream over a single fiber PON infrastructure.

An ONU normally is housed in an outdoor equipment shelter. These installations include shelters located at a curb or in a centralized place within an office park. Thus, the ONU equipment must be environmentally rugged to withstand large temperature variations. An alternative approach is to allow ONUs to adjust their transmitter powers such that power levels received by OLT from all ONUs become the same [12].For optical communication, which is generally meant for long distant communication, the possibility for signal degradation is high which reduces the signal strength as it reaches the receiver side. Hence regeneration of the light signal becomes essential especially over large distances for several thousand km. Optical amplifiers are introduced in the system to solve this problem. An optical amplifier is a device which amplifies the optical signal directly without optical to electrical conversion i.e., all functions occurs in optical domain. In optical fiber, the light pulse itself is amplified. Optical amplifiers provide high gain and low noise for the optical signal; it has importance in the overall bandwidth provided by WDM system [14].

IV. DESIGN AND IMPLEMENTATION

The routing and wavelength assignment problem is an optical networking problem with the goal of maximizing the number of optical connections. The general objective of routing problem is to maximize the number of recognized connections.

A. Routing in Networks

Routing involves two basic activities: determining optimal routing paths and transporting information groups (typically called packets) through an internetwork. For the shortest path selection in the proposed algorithm Dijkstra algorithm is used and the implementation of the algorithm is given below. Dijkstra's algorithm is called the single-source shortest path. It is also known as single source shortest path problem. It computes length of shortest path from the source to each of the remaining vertices in the graph.

The main issue is how the routers that constitute the network layer of a network cooperate to find the best routes between all pairs of stations. Routing algorithm at a router decides which output line an incoming packet should go, i.e. making a routing decision. It should practice properties, like correctness, simplicity, toughness, stability, fairness, and optimality. Routing protocols use metrics to evaluate what path will be the best for a packet to travel. A metric is a measurement standard, such as path bandwidth, that is used by routing algorithms to determine the optimal path to a destination. To aid process of path determination, routing algorithms modify and maintain routing tables, which comprise route information. Route information varies depending on routing algorithm used [11].

Routers communicate with one another and maintain their routing tables through the transmission of a variety of messages. The routing message is one such message that generally consists of all or a portion of a routing table. By analyzing routing updates from all additional routers, a router can build a detailed picture of net topology. A link-state advertisement, another example of a message sent between routers, informs other routers of the state of sender's links. Link info also can be used to build a complete picture of network topology to enable routers to determine optimal routes to network destinations [13].

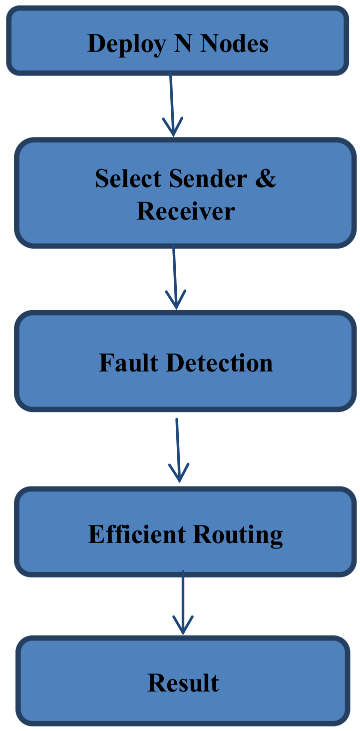

Figure 2: Proposed Steps of a System

V. RESULTS AND DISCUSSION

Since the ultimate goal of this work is to assess the performance of routing algorithm, it is essential that it comes up with tests that are fair measures of the performance of these algorithms.

A. Simulation Tool: MATLAB

MATLAB is one of a number of commercially available, refined mathematical computation tools. Each permits you to perform basic mathematical computations. They vary in way they handle symbolic calculations and more complicated mathematical procedures, such as matrix manipulation. For example, MATLAB (short for Matrix Laboratory) excels at computations involving matrices,

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whereas Maple excels at symbolic calculations. It is given by fig 3.

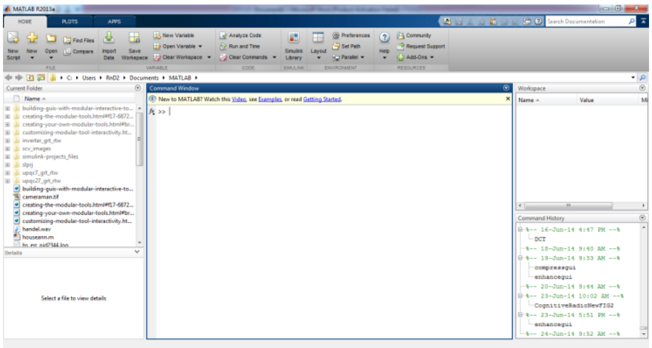

Figure 3: MATLAB Tool

B. *Routing in Networks*

The figure 4, displays how the nodes are being deployed in an area. Nodes are randomly spread over the area. Each node has a sensor ID shown along with it. It will be used to address any sensor throughout the process.

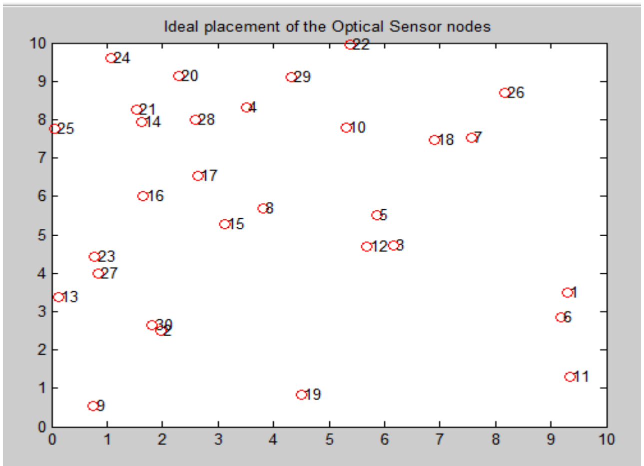

Figure 4: Placement of Input Nodes

After the deployment of the sensor nodes, the system will ask you to enter one sender id and one receiver id. That sender will become the master node and will send acknowledgement request to all the other nodes in the scenario.

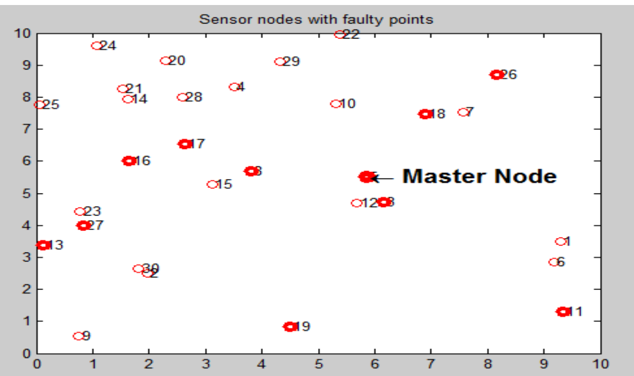

Figure 5: Detection of Fault Nodes

All the nodes are authentic and fault free. Information is securely transferred from sender to the receiver. It selected the shortest path from sender to receiver as shown in fig 6.

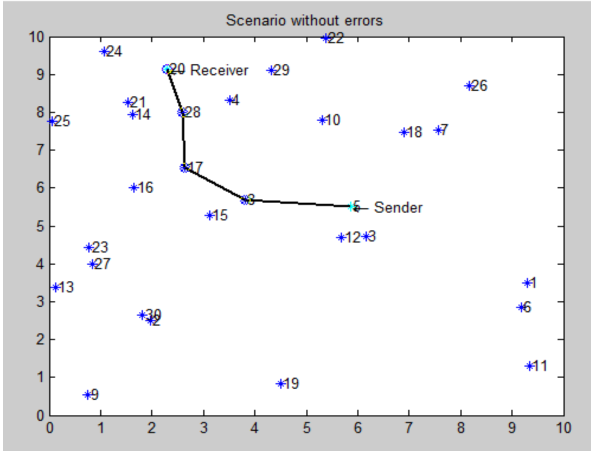

Figure 6: Routing in Network

The figure 7 shows how the energy is being depleted in the above scenarios when information is transferred from Sender node to Receiver node.

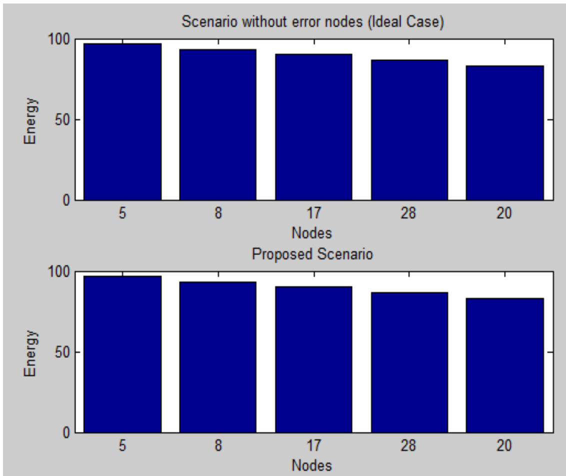

Figure 7: Energy Output

VI. CONCLUSION

This paper investigated the energy efficient routing in WDM networks. It is proved that the results for the transmission through the networks are successful with reduced energy depletion.As the deployment of Thousand Numbers of Sensor Nodes in Area needs Energy Performance And better Packet Delivery from the Sender to the Receiver, the new approach provides a methodology for the tracing of Path having good Packets with an Energy Efficiency and Accuracy. Results are simulated in MATLAB.

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