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# PROPOSE FIBER OPTIC LAN/MAN ARCHITECTURES

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# Propose Fiber Optic Lan/Man Architectures

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***Abstract* – *Fiber optic network architectures can be classified into two broad categories: broadcast and select, and wavelength routing architectures. In broadcast and select architectures, different nodes broadcast messages on different WDM channels, typically, over passive star, linear bus, or tree topologies. Access nodes in these networks route the messages. In contrast, wavelength routing networks employ active switches to route messages based on the wavelengths and thus messages carried in optical domain "as far as possible". Today, broadcast topologies are used for LAN/MAN solutions because they are simple to construct and cost effective. Networking has become an integral part of computing. Computing applications in all sectors are now dependent upon computer networks to routinely, accurately and rapidly convey data from one to another. Similarly, networking is the heart of audio and video communications.***

***Keywords: Communications, Fiber, Networking, Lan/Man, Computing, Messages, etc.***

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## INTRODUCTION

Today, Local Area Networks (LANs) with transfer rates of l0Mbps to 100 Mbps are commonplace. Networks with few hundred Mbps transfer rates are already replacing the existing 10Mbps networks and networks supporting a few Gbps per node are emerging. This development towards higher speed has been a push and pull between users and suppliers which is fuelled by the technological developments in optical communication and the opportunities provided by the new applications (multimedia web applications, virtual environments, distributed computing). The first generation fiber optic LANs/MANs was developed on the principle of the traditional networks wherein all the nodes share the single communication channel. Examples of this generation include Express net [1], CRMA [2], DQDB [3], and FDDI [4]. The speeds of these networks are limited to the peak electronic processing speeds (2-5 Gbps) [5]. The dependency of nodes' transmission capacities on the network throughput and hence on number of nodes in these networks is a limiting factor for bandwidth hungry applications listed in recommendation 1.121 - such as video telephony, high-definition image transfer, high-speed data transfer, multimedia mail, video on demand and high-fidelity audio. To overcome this problem, next generation networks aim to utilize the tremendous bandwidth of optical fibers. This became possible by recent advances in photonic technology to multiplex and demultiplex hundreds of wavelengths on a single optical fiber.

## REVIEW OF LITERATURE:

This class of networks, the bandwidth of optical fiber is divided into a number of channels with each channel operating closer to the maximum speeds of the electronic interface units, i.e., of the order of Gbps. By using these channels for parallel transmission among various nodes, each node processes only that part of network traffic available on the channels allocated to it. Thus, the network capacity can be increased up to the bandwidth of optical fiber or beyond [6-8]. A brief discussion on multichannel networks is presented in the following section.

### 1. Multichannel Fiber Optic Networks:

The communication among the nodes, in optical networks with multiple channels realized in a single fiber optic cable, can be established either by switching the channels using tunable transmitters/receivers or by switching the information (packets) across various nodes. Networks based on the former approach are called as single-hop networks while those of latter approach are networks [9]. In a single-hop network, the transmitted information remains in optical form up to its destination. Since the number of transmitters and receivers associated with each node is much less than the number of channels available in the network due to electronic bottleneck, significant amount of coordination among nodes is required. For a packet transmission to occur, one of the transmitters of the sending node and one of the receivers of the destination node must be tuned to the same wavelength and/or code for the duration of the packet's transmission. Moreover, the transmitters and receivers should be able to tune to different channels quickly, so that packets may be sent or received in quick succession. In addition, single-hop networks should take into account different propagation delays among different pairs of nodes and dispersion of optical signal (i.e., signals of different wavelength propagate at different speeds). Single-hop networks need wavelength-agile components, as they require dynamic coordination between the nodes for the packet transmission duration. Given that the tuning times of current optical transceivers are significantly long (compared to the packet transmission duration), the challenge is to develop protocols for performing the proper transmission coordination in an efficient fashion. Conversely, in multichip networks, a packet is routed to its destination according to a relatively static connectivity (logical topology) among transmitters and receivers of all nodes. Hence, multichip networks provide guaranteed packet delivery. The logical topology of multichip networks needs to be changed only when there is a change in the network (failure or addition or in traffic. Hence, multichip networks can be developed with existing (relatively) slow tunable transceivers. The following section briefly discusses multichannel multichip fiber optic LANs/MANs.

**2. Multichannel Multichip Fiber Optic LAN/Mans:**

Multichannel multichip fiber optic LAN/MANs uses broadcast and select architectures, wherein different nodes broadcast messages on WDM channels, typically, over passive star, linear bus, or tree topologies. Access nodes in these networks receive messages routed by making use of the logical topology. Logical topologies are embedded on to the physical topologies such as passive star, linear bus and tree topologies by tuning the transmitters and receivers of the access nodes. Multichannel multichip networks are classified as regular and irregular topology networks based on the regularity of the topology [10].

**3. Irregular Topologies:**

Irregular topologies are, usually, designed based on some criterion. Generally, the optimization function is selected to minimize, the maximum flow among all logical channels. This is done by properly assigning the wavelengths to node pairs based on traffic between them and hence the optimization problem is widely known as flow and wavelength assignment (FWA) problem. The problem is setup as a mixed integer optimization problem [11]. Since the search space of this problem rapidly increases with the size of the network, sub-optimal solutions are proposed in [10]. Alternatively, the optimization function is selected to minimize the average delay of a packet. The work [10] reports that algorithms based on simulated annealing can be employed to solve the delay based optimization problem. Examples of networks based on irregular topologies include [12]. Most of these topologies are proposed for wide area networks. But, in [13], irregular topologies are also demonstrated for local area networks.

**4. Regular Topologies:**

Regular topologies are usually designed with an emphasis on the relationship among nodes. Several regular topologies have been extensively studied as interconnection networks for parallel computers. Regular topologies can be further divided as basic and hierarchical topologies. While the basic topologies define simple structures, the hierarchical topologies are constructed by considering such basic topologies as building blocks at different levels. A topology is called as topology if the topology is constructed by treating nodes of the structure at level / > 1 as regular structures such as Hypercube, Ring and deBruijn graph. [14] Proposed two-level hierarchical networks for optical communication. As the node degree, in simple (basic) regular topologies such as Hypercube, increases with the size of topology, hierarchical topologies are aimed at constructing the topologies with fixed node degree or aimed at reducing the rate of change of node degree with the size of network. For example, in the Hierarchical Hypercube (HHC) proposed in [13], the node degree is (log log k), compared to the node degree of (log k) for Hypercube of size k. Similarly, the maximum degree of a node in Cube Connected Cycles (CCC) is three [10]. However, the smaller node degree in hierarchical networks is achieved at cost of the average internode distance and/or diameter.

**5. Motivation:**

The huge bandwidth potential of single mode optical fiber and electro-optic bottleneck made the researchers to design novel architectures, by invoking some form of concurrency to utilize the entire bandwidth of optical fiber, to satisfy the needs of bandwidth-hungry applications such as virtual environments and distributed computing. Several attempts have been made and a few test-beds were developed by industry giants to study the feasibility of the architectures that are intended to exploit the complete bandwidth of optical fiber [15]. Thus, the demands for high-speed networks and technical feasibility to develop practicable systems are the prime motivations for this research on fiber optic networks.

## CONCLUSION:

We have designed a packet-switched LAN/MAN. The network is fault-tolerant in that it can switch to a reserved wavelength channel in the event of a failure in the control (header) channel or a channel at which a node is transmitting. We have also dealt with the problem of dispersion, which is a dominant factor in such types of networks. Our node architecture enables multicasting in the optical domain. The tristate switch has to be fast enough to achieve high bit-rates. The payload is always kept in the optical domain. This is important in achieving bit-rate transparencies. In order to design dynamically reconfigurable regular logical topologies for tolerating changes in the network, reconfiguration is treated as a design issue. Before developing such logical topologies, I will study how various properties such as diameter, average internode distance, node degree and reconfiguration affect the network performance parameters such as throughput, packet delays, reliability and expandability.

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