Routing and Bandwidth Allocation for Wireless Mesh Network Levels

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***Abstract*— The paper presents routing and spectrum allocation in networks by using wireless mesh topology. Compared with traditional Wavelength Divison Multiplexing networks, orthogonal frequency-division multiplexing (OFDM)-based flexible optical networks are able to provide better spectral efficiency due to their flexible allocation of requests on fine granularity subcarriers. The Dynamic Survivable Multipath Routing and Spectrum Allocation problem, which aims to accommodate a given set of demands with minimum utilized spectrum. Orthogonal frequency-division multiplexing (OFDM), a modulation technique used extensively in broadband wired and wireless communication systems, is also a promising technology for optical communications, because of its good spectral efficiency, flexibility. An OFDM-based optical transport network architecture called a spectrum-sliced elastic optical path network (SLICE) algorithm is proposed. In this paper, we present a survivable multipath provisioning scheme that provides efficient throughput for spectrum allocation in OFDM-based flexible optical networks. Our simulation results show that the proposed multipath provisioning scheme achieves higher spectral efficiency than the traditional single-path provisioning scheme.**

Index Terms-Flexible optical networks, multipath provisioning, optical OFDM, Routing and Spectrum allocation.

I. INTRODUCTION

In conventional WDM optical networks, a connection is supported by a light path with full wavelength capacity. This rigid and coarse granularity leads to a waste of capacity when the traffic between the end nodes is less than the capacity of a wavelength. To address this issue, flexible optical networks with fine granularity are need for better spectral efficiency. The Orthogonal frequency-division multiplexing (OFDM), a modulation technique used extensively in broadband wired and wireless communication systems, is also a promising technology for optical communications, because of its good spectral efficiency, flexibility. In optical OFDM, a data stream is split into multiple lower rate data streams, each modulated onto a separate subcarrier. By allocating an appropriate number of subcarriers, optical OFDM can provide fine granularity capacity, as opposed to wavelength capacity, to connections. An OFDM-based optical transport network architecture called a spectrum-sliced elastic optical path network (SLICE) is proposed in this work.

In SLICE networks, just enough of the spectral resource is allocated to an end-to-end optical path according to the user demand, leading to efficient accommodation of sub wavelength and super-wavelength traffic. An important problem in the design and operation of OFDM-based flexible networks is the routing and spectrum allocation. The goal is to select a path and allocate a set of contiguous subcarriers for a demand while minimizing utilized spectrum. Dynamic RSA algorithms are proposed in this work it is used to efficiently accommodate connection requests as they arrive at the network.

Multipath provisioning (MPP) is able to support full and partial protection with higher efficiency than SPP. In MPP,a data stream is split into multiple lower rate streams, each of which is routed on a separate path. Multipath provisioning naturally provides partial protection, because when a failure occurs on one of the connection’s paths, traffic carried on the other paths is not affected. Multipath provisioning schemes providing full protection and partial protection in next-generation synchronous optical network.

In this paper, we propose a survivable MPP scheme for OFDM-based flexible optical networks. To the best of our knowledge, there is no prior work on survivable MPP in OFDM-based optical networks. We define the dynamic Survivable Multipath Routing and Spectrum Allocation (SM-RSA) problem. The aim of this problem is to accommodate a given set of demands using MPP such that the utilized spectrum is minimized.

II. SURVIVABLE MULTIPATH PROVISIONING METHOD

OFDM-based optical networks are able to provide better throughput levels due to their flexible bandwidth allocation capability. we assume a connection request has both a bandwidth requirement and a protection level requirement. Here , a request is represented by r =(s; d; B;

q), where s is the source and d is the destination nodes, B is the bandwidth requirement, and q ($0 \le q \le 1$)is the protection level requirement, indicating qB bandwidth must be available after any single link failure. Note that q=0 indicates no protection, q =1 denotes full protection, and ($0<q<1$) indicates partial protection. To accommodate a connection request r =(s; d; B; q) using MPP, we find N = 2 link-disjoint paths between s and d and allocate capacity on each of the N paths such that the total capacity on the N paths is at least B, and the total capacity on any group of N - 1 paths is at least qB. To minimize the total capacity allocated on all paths of r, we allocate the same amount of capacity on each path as follows. If $N \ge 1/(1 - q)$, we allocate B/N capacity on each path. In this case, the total allocated capacity is B; no backup capacity needs to be allocated, because each path carries no more than $(1 - q)B$ capacity. If N<(1/_1 – q), we allocate $qB/(N - 1)$ capacity on each path. This ensures that any group of N - 1 paths has total capacity qB.

Table-1 Capacity Allocation For Multipath Provisioning With Different N Values

S.NO	Number Of Paths	Capacity Per Path	Total Capacity
1	**2**	**0.8B**	**1.6B**
2	**3**	**0.4B**	**1.2B**
3	**4**	**0.267B**	**1.068B**
4	**5**	**0.2B**	**B**

The Dynamic SM-RSA problem requires that the following Constraints be satisfied.

• **Capacity allocation constraint**: For each request r =(s; d; B; q), the total capacity allocated on N paths is at least B and the total capacity allocated on any group of $|N_r - 1|$ paths is at least qB, where N_r denotes the number of paths used to satisfy the request.

•**Spectrum contiguity constraint**: A set of adjacent subcarriers must allocate to a spectrum paths.

• **Non-overlapping bandwidth constraint:** A subcarrier on a link can be allocated to at most one spectrum path routed over the links.

•**Guard subcarrier constraint**: Two adjacent spectrum paths shared a link, they must be separated by G guard subcarriers.

III. MESH NETWORK

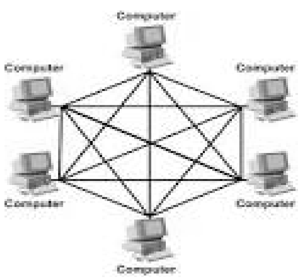

Fig 1: Mesh network

A network setup where each computer and network device is interconnected with one to another, allowing for most transmissions to be distributed, even if one of the connections go downstairs. This topology is not commonly used for more computer networks as it is difficult and expensive to have redundant connection to each computer. However, this topology is commonly used for wireless networks.

A. Wireless Mesh Network

A wireless mesh network is made up of three or more wireless access points, working in consonance with each other while sharing every other routing protocol, in a collection of cross-connect links to create an interconnected electronic pathway for the transmission between two or more computer networks. When a wireless mesh is form it produce a single name identifier for access and the signals between wireless access points are used with each other to clearly distinguishable from another network. The organization of distribute access points working in harmony is known as the mesh topology. The defined mesh topology of a particular area defined by the access points is known as mesh cloud. Access to this mesh cloud is reliant on the network created by the access points.

Wireless Mesh topology every node has a connection to every other node in the network domain. There are two types of mesh topologies: full mesh and partial mesh. Full wireless mesh topology arise when every node in a realm is connected to every other node in a network. Full mesh is yields the important amount of redundancy, so in the occasion that one of those nodes fails, network traffic can be control to any of the other nodes. Full wireless mesh is hard to achieve on a large scale using Mesh; however, small-scale area like offices or small campus may be ideal. One should note that it is hard to deploy a full mesh topology.

Wireless allows for devices to be shared without networking cable which increases mobility but decreases range. Two main types of wireless networking; peer to peer or ad-hoc and infrastructure. An ad-hoc or peer-to-peer wireless network consists of a number of computers each equipped with a wireless networking interface card. Each computer can exchange information directly with all of the other wireless authorize computers. They can share files and printers this way, but may not be able to entry wired LAN resources and one of the computers acts as a bridge to the wired LAN using special software. An infrastructure wireless network consists of an access point or a base station. This type of network the access point acts like a hub, providing connection for the wireless computers. Wireless networks are reliable, but when interfered with it can minimize the range and the quality of the signal.

IV. ROUTING AND SPECTRUM ALLOCATION IN SLICE NETWORKS

In SLICE networks, a spectrum path (SP) is an all-optical trail established between the source and sink nodes by using one or multiple consecutive sub-carriers. The fundamental issue in the SLICE network is to route and set up spectrum paths to accommodate the traffic demands, which is called as the routing and spectrum allocation (RSA) problem. Although both RSA and RWA have to consider the allocation of spectrum resources and the spectrum continuity for any spectrum path (or light path), the RSA problem is different from and more challenging than the traditional RWA problem. First, for a spectrum path with multiple sub-carriers, the allocated sub-carriers have to be consecutive in spectrum domain to be effectively modulated at the OFDM transponders, which is referred to as the sub-carrier consecutiveness constraint. Second, although multiple sub-carriers within one spectrum path can be partially overlapped, various spectrum paths have to be separated in the spectrum domain by guard frequencies when two spectrum paths share at least one common fiber. These guard frequencies are used to facilitate the physical frequency filtering and are referred to as one or multiple sub-carrier. In the frequency domain, one sub-carrier normally corresponds to several Giga hertz, and the capacity of one sub-carrier is in the order of Giga bits per second.

Assuming that each fiber consists of W sub-carriers (with index 1, 2... W), for a given traffic demand, the request can be translated into a number of subcarriers, and accommodated through the establishment of a spectrum path. To form spectrum paths, the SLICE network needs to deploy bandwidth-variable (BV) transponders at the network edge and bandwidth-variable WXCs in the network core, which can be built based on the continuous BV wavelength-selective switch (WSS). In the following, we formally define the routing and spectrum allocation (RSA) problem in the case with off-line or static traffic.

Routing is the process of selecting best paths in a network. In the past, the name routing was also used to also mean send network traffic among networks. Routing is performed for many kinds of networks, including the telephone network such as circuit switching networks, electronic data networks such as the Internet.

The routing process usually directs forwarding on the basis of routing tables which maintain a record of the routes to various network receivers. constructing routing tables, which be held in the router's memory, is very essential for economic routing. Most routing algorithms use only one network path at a time. Multipath routing techniques change the use of multiple alternative paths.

Throughput refers to how much data can be transferred from one location to another in a given amount of time. It is used to determine the performance of hard drives and RAM, equally rise up Internet and network connections. The system throughput or aggregate throughput is the sum of the data rates that are delivered to all terminals in a network.

In communication networks, such as Ethernet or packet radio, throughput is the average rate of successful message delivery over a communication channel. This data may be provide over a physical or logical link, or travel through a certain network node. The throughput is normally measured in bits per second bits per second, and sometimes in data packets per second or data packets per time slot.

V. SIMULATIONRESULTS

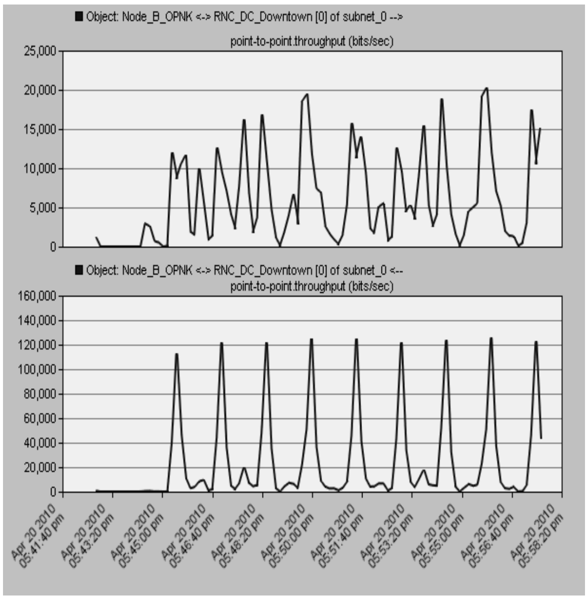

Fig-2:Point-to-Point throughput Analyze (bits/sec)

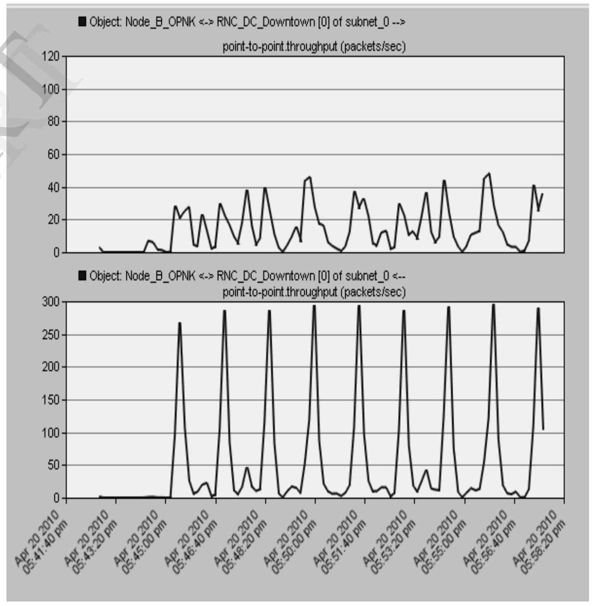

Fig-3:Point-to-Point throughput Analyze (Packets/sec)

VI. THROUGHPUT COMPARISON TABLE

Table2: AccesspointThroughput (bits/sec)

Throughput levels	**Source to destination (packets/sec)**	**Destination to source (packets/sec)**
Access point	50	300

Table3: AccesspointThroughput (packets/sec)

Throughput levels	Source to destination (bits/sec)	Destination to source (bits/sec)
Access point	20,000	120,000

VII. CONCLUSION

Initially 10 nodes are constructed in a wireless network using mesh network topology. Spectrum allocation for the wireless network is difficult. Here the spectrum is allocated for those 10 nodes. The resource allocation is done Dynamically that is the unused bandwidth is used by the other nodes as required by using the slice technology. Throughput is the data delivered per unit time. Hence in this project the throughput is achieved for this spectrum allocation. It shows how efficiently the resources are allocated dynamically.

Wireless mesh networks were originally developed for military applications. Mesh networks are type of wireless. Predicate the past decade, the surface, cost, and power requirements of radios has declined, modify multiple radios to be contained within a single device, i.e., mesh node, thus allowing for larger modularity; each can handle multiple frequency bands and support a variety of functions as needed such as client access, backhaul service, and scanning even customized sets of them.

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