Routing and Bandwidth Allocation for Wireless Mesh Network Levels

M. Ilakkiya
M.E-II(Communication Systems)
Jayaram College Of Engineering and Technology
Trichy, India.

Mr. R. Dhanagopal
M.E., Ph.D,
Assistant Professor, Dept of ECE,
Jayaram College Of Engineering and Technology
Trichy, India.

Abstract— The paper presents routing and spectrum allocation in networks by using wireless mesh topology. Compared with traditional Wavelength Division 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 needed 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. 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≤q≤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 ≥ 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

<table>
<thead>
<tr>
<th>S.NO</th>
<th>Number Of Paths</th>
<th>Capacity Per Path</th>
<th>Total Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>0.8B</td>
<td>1.6B</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>0.4B</td>
<td>1.2B</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>0.267B</td>
<td>1.068B</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>0.2B</td>
<td>B</td>
</tr>
</tbody>
</table>

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 fail, 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.

### III. MESH NETWORK

![Mesh network](Fig 1: Mesh network)

### 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
V. SIMULATION RESULTS

![Graphs showing simulation results](image)

<table>
<thead>
<tr>
<th>Table 2: Access Point Throughput (bits/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throughput levels</td>
</tr>
<tr>
<td>Access point</td>
</tr>
</tbody>
</table>
Table 3: AccesspointThroughput (packets/sec)

<table>
<thead>
<tr>
<th>Throughput levels</th>
<th>Source to destination (bits/sec)</th>
<th>Destination to source (bits/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access point</td>
<td>20,000</td>
<td>120,000</td>
</tr>
</tbody>
</table>

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.

ACKNOWLEDGEMENT

First and foremost I thank God, the almighty who stands behind and strengthens me to complete the project successfully. I would like to express my respect and gratitude towards my supervisor Mr. R. Dhanagopal, M.E., (PhD). His wide knowledge, research attitude and enthusiasm in work deeply impressed me and taught what a true scientific research should be. Words are inadequate to express the gratitude to my beloved parents and friends for their excellent and never ending co-operation.

REFERENCES