6.1 Introduction

Optical networks are high-capacity telecommunication networks that provide routing and restoration at the wavelength level as well as wavelength-based services. Optical Fibre is playing a major role in communication, because of its higher transmission rate and lower attenuation. In addition, a Fibre cable can carry many channels simultaneously using wavelength-division multiplexing (WDM). Which makes it possible to establish many virtual topology on top of the physical topology.

Dynamic programming is a method for solving complex problems by breaking them down into simpler sub problems. It is applicable to problems exhibiting the properties of overlapping sub problems which are slightly smaller and optimal sub structure when applicable, the method takes far less time than naive methods. Using dynamic programming to find the shortest path in optimal each source to different destination, and to implement stage wise in optimal route.

6.2 Conclusions

- Implementation of Dynamic programming to produce effective traffic matrix and to find the shortest path.
- Dynamic programming model has been developed to produce different sets of traffic matrices for finding the shortest path from each source to different destinations
- The various heuristics are implemented on the traffic matrix generated through Dynamic Programming approach and its heuristics namely Dynamic Programming Heuristic approach (DP-H), Dynamic Programming Source based Approach (DP-S), and Dynamic Programming Destination Approach (DP-D) is implemented to find the shortest path for formation of Virtual Topology.
- To show optimality in network another way of approach is Dynamic Value approach. The heuristics implemented are named as Dynamic Value Heuristic approach (DVH), Dynamic Value Source Based approach (DVS), and Dynamic Value Destination Based approach (DVD).
- An experimental study has been made on 4-Node, standard 14-Node (NSFNET) traffic matrices and comparative study has been done.
Chapter 6: Conclusions and Future Scope

The entire theme of the thesis is presented in six chapters. The first chapter deals with the Introduction. The idea behind this chapter is to carry out an optical communication system and the need of Optical Interconnects and Optical Networking. The major role of Optical Fiber in Optical Communication is explained by describing the Nature of light, the functionality of light, as electromagnetic waves. Characteristics of a glass, Transmission Capacity of Optical Fiber and its operational principles are explained. In addition, the contrast between single mode and multimode Fiber is also studied. The usage of Optical Transmitters, Laser Functioning Mechanism, Optical Receivers and Filters and the characteristics of Optical amplifiers is also explained. Brief introduction of Wavelength Division Multiplexing, contrast between Physical and Virtual Topology and Dynamic programing are explained at the end of the chapter.

The main emphasis in second chapter is Review of literature on Dynamic programming and virtual topology. A literature review of virtual topology on optical networks is presented. A study has been done an optical components like couplers, multiplexers, optical amplifiers, transmitter’s detectors, and switches. An emphasis is also made on WDM technology and its classifications and Routing and Wavelength assignment. Further a major study is made on Dynamic programming characteristics, Dynamic programming problems and advantages and disadvantages its presented. Comparison of Dynamic programing with other paradigms and is also shortest path is presented several researchers recently.

The third chapter presents Routing approaches through Dynamic programming algorithms. The significance of virtual topology design problem has been presented. It briefly review the good solutions for efficient utilization of network resources such as wavelengths, optical transmitters, and receivers so as to optimize network. There are several sub problems in the designing of Virtual Topology followed by certain objective Functions in performance maximization and certain Constraints are described in the design of Virtual Topology and the Virtual Topology Problem formulation. Virtual Topology Design is computed by using the existing Heuristics HLDA approach is presented. The implication of Dynamic programming of Dynamic programming and its functionality is presented .the problem from single pair shortest path to all pair shortest path problems is presented.
The fourth chapter proposed the **Implementation of Dynamic programming formation of virtual topology.** This Chapter deals with the simulated designing of virtual topology on fiber optic networks. Input of a traffic matrix for virtual topology is one of the major criteria. In Dynamic Programming the concept of stage wise traffic matrix is used to implement the proposed heuristics namely DP-H, DP-S and DP-D. The input traffic matrix depends on the existing nodes of the Network. The experimental work is done for formation of Virtual Topology on 4-Node and 14-Node NSFNET. For optimal Virtual Topology, it took 5-stages for complete network. To observe the effectiveness of virtual topology on fibre optic networks one more method is also adapted named as Dynamic value approach. The randomly generated stage wise traffic matrices are considered as Dynamic value traffic matrices, on which the heuristic DVH, DVS and DVD are implemented. Total results are tabulated, showing the objective functions of each approach, that is effective utilization of light paths, wavelength’s, Physical hops, Total hops weights, Average weighted hop, maximum and minimum congestion.

The fifth chapter **Performance Evaluation** aims on the comparative study on objective functions that are taken to show the effectiveness of the network. The results obtained through Dynamic programming heuristics and Dynamic value heuristics on 4-Node and 14-Node (NSFNET) network is compared with their objective functions like utilisation of light path, wavelength, physical hops and maximum and minimum congestion. Results are effectively presented in this chapter to discuss about the performance of all the heuristics that are implemented in the proposed approaches. The 14-Node (NSFNET) network efficiency is emphasised with some of the performance of objective functions explained as below.

a) It is noticed that the utility of light paths is optimised in both the Dynamic programming approach and Dynamic value approach its heuristics.

b) It is observed that the utilisation of physical hops is optimal in the network with the proposed heuristics and marginally difference is observed at DVD and DP-D.

c) It is perceived that the total hop weight is slightly minimum at the DVD in all other cases it is equivalent.
d) Noticeable changes has been observed in case of formation of congestion in both the approaches after implementation its heuristics.

From all the above observations that are performed in the simulation, it is clear that the generated objective functions like Light paths, Wavelengths, physical hops, hop weight, Total hop weight, Average hop weight, and maximum and minimum congestion obtained are relatively showing the difference from one approach to other. The contrast is clearly observed in the graphical representations presented in the fourth and fifth chapter. On practical implementation the proposed heuristics belongs to its approaches may enhance the efficiency of the Fiber Optic Network.

6.3 Future Scope of the Work

- Rapid development of Fibre Optic Networks is taking place in the World by keeping this into consideration a simulative study has been made.
- On simulation the proposed models and heuristics are showing various performances are discussed.
- Some proposed model may be useful for further development, routing technologies on Optical Fibre Communication.
- The research on Dynamic Programming may be implemented on various fields.
- The research may also extended on Virtual topology Reconfiguration and on Link Failure mechanism.
- Dynamic Programming model may applied on Coins, the longest increasing subsequence, to fix Sensors, Tele Communication, Bio-Medical and Road maps, and bridges.