Implementation of Aco Algorithm in Rwa

R.Hemalatha, G.Karthikeyan, R.Mahalakshmi

Abstract: ***The major problem in the optical mesh network is routing and wavelength assignment (RWA) and this trouble arises due to more number of tracks present in the network. When huge networks are used for transmission of information from source to destination, there will be a need for wavelength assignment to the track in that network. Solution for Routing and wavelength assignment problem has been done using various optimization algorithms such as Genetic Algorithm, Simulated Annealing, Particle Swarming Optimization, Memetic Algorithms, etc. It is found that the mean execution time and mean blocking probability are more while using these algorithms in the optical mesh networks. Here the RWA problem is solved using Ant Colony Optimization Algorithm and it noticed that it is better than the other optimization algorithms. The standard mesh network NSFNET network (14node) is considered for the simulation. The performance metrics such as mean execution time and mean blocking probability using first-fit & random wavelength assignment techniques are considered. The results obtained for mean execution time is lesser compared to the other optimization algorithms and mean blocking probability using first-fit, random, wavelength ordering and round robin wavelength assignment techniques are compared to each other.***

Key Words: Ant Colony Optimization (ACO), Routing and Wavelength assignment (RWA), Wavelength Division Multiplexing (WDM), Time Division Multiplexing (TDM)

I. INTRODUCTION

In Advanced telecommunication systems, optical network plays a vital role. The main objective of the optical communication is to transfer the vast data in an easy manner to the receiver system. In optical communication there are two different techniques has been used such as time division multiplexing (TDM) and wavelength division multiplexing (WDM). Nowadays WDM technique has been widely used for the data transmission because WDM meets with heights bandwidth demand. One of the major problems in WDM technique is routing and wavelength assignment, traffic grooming, survivability etc.[1]. In optical communication all source are transmitted with the aid of light path to other node for transfer of data for that we need wavelength to be assigned to individual track this leash to more computational time[2]. In this proposed method Ant Colony Optimization (ACO) algorithm is used to solve this crisis. Similar algorithms such as Genetic algorithm, simulated annealing, Memetic algorithm

Particle swarming optimization are simple but leash to poor functioning by introducing drawbacks like high blockage time, high performance time etc.,[3]

In this research report the Ant Colony Optimization algorithm is used for describing the above routing and wavelength assignment (RWA) problems. The discussion includes simulation results, analysis, determination of the study, and possible future work.

II. PROBLEM DEFINITION

In WDM mesh network, there is a close conjugation between routing and wavelength assigning. A track of connectedness between the beginning and finish nodes is selected and a particular wavelength on each of these links is reserved for the light track[3]. Thus for launching an optical connection it randomly select a suitable track and allocate an available wavelength for that path hence this leads a problem called as RWA problem hence the difficulties of the RWA raised based on the below constraint and requirements[4]:

1. Wavelength Distinct Constraint: On a given link two light paths should not involve a same wavelength.

2. Wavelength coherence requirement: On the entire fibre connection a lightpath should involve the same wavelength.

The major prob arising in the field of network is communication through routing and wavelength assignment[5]. When the number of necessity increases it leash to lack of wavelength to the route and when more number of routes use the same wavelength it leash to Call blocking in the network, Huge processing time, More delay to transmit the data from the source to destination, Less quality of service (QOS)[6].

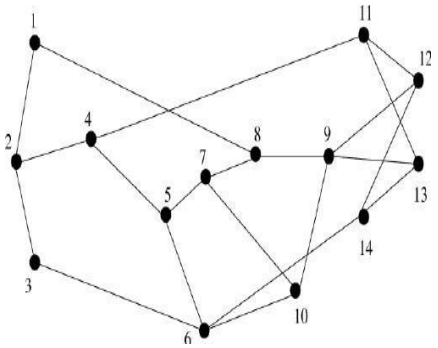

Fig1: NSFNET network model

Here the network is modelled with 14nodes.A graph is modelled as G (V, E). Hence V - set of nodes with routers and switches, E - edges which are used for the connectivity between the nodes[7]. The links are bidirectional in nature[17]. The fig 1 which describes the basic NSFNET structure.

III. ROUTING & WAVELENGTH ASSIGNMENT

A path required to send the data from source to goal to set up the lightpaths is called routing[8]. Different protocols are

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used for sending the data in WDM mesh network are fixed routing, fixed alternate routing, Adaptive routing, and least congested path routing, then the Path is found by the free wavelengths available, length of the lightpath and number of transformation required from source to destination[9]. Let the high speed data will route through the available wavelength those high speed data will take less handling time and low speed data will take more time to process the data. Allotting the wavelength to the track is called wavelength assignment[10]. Let Assignment of wavelength to the path is the tedious processes because when the number of users and lightpath are high then it leads to call blocking, delay, traffic grooming, survivability etc., to overcome this problem the backup lightpaths are used but it lead huge processing time to process the data[11].

IV. ANT COLONY OPTIMIZATION ALGORITHM

It is one of the probabilistic techniques for solving computational problems which can be reduced to determine the good route through graphical record by using the swarming intelligence method the ACO process is done [16]. This algorithm is similar to the act of ant's behaviour for getting food with the help of Fremont smell[12]. This algorithm helps in determining an optimal path for the data transmission between the source and destination by finding a shortest path. The paths which are found have a minimum processing time in the transmission[13]. Here the ants work concurrently and independently & collects data via indirect communication which led to good solutions. The major disadvantages in ACO are slower convergence than other [18] Heuristics algorithm, Performed poorly for Travelling Salesman Problems larger than 75 cities. The applications of ACO are Traveling Salesman Problem with less number of cities, Quadratic Assignment Problem, Network Model Problem, Vehicle routing[3]

In Ant Colony Optimization the steering inclination depends on the pheromone fixation, trade of the directing data depends on the piggybacked in information parcels[14], adjusting to topology change is incessant to transmission of ants, In ACO the directing overhead process is low contrasted with typical conventional figuring, steering refresh is free in pheromone table[15]. Fig 2 represents the flow process of the ACO algorithm

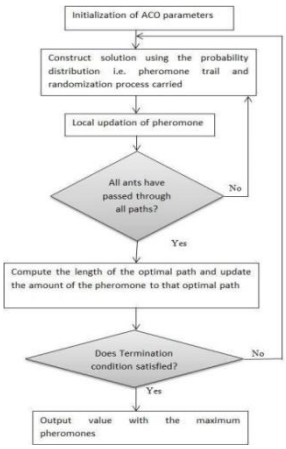

Fig 2: Flow diagram of ACO

Steps for Ant Colony Optimization algorithm in MATLAB 2017a

- Model creation – initialization of parameters
- Fitness implementation
- Wavelength assignment techniques
- Plot solution[16]

V. SIMULATION RESULTS

Let the fig 3 and 4 shows the general path formation with the help of ACO to the NSFNET network. The fig 3 shows nodes defined for source and destination in order to find the path for source and destination node here the path formed is the shortest path between the nodes 4 to 13 according to the weight values

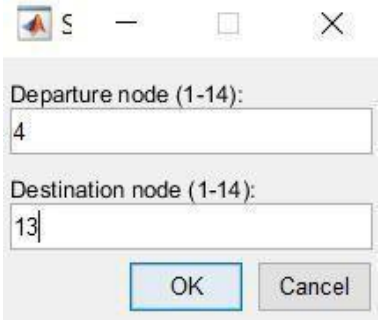

Fig 3: Defining Source And Destination Node

The darker line in fig 4 shows the path formed between the nodes 4 to 13. The path is found between the nodes 4-5-6-13. Similarly multiple numbers of paths are achieved but the weights values mentioned are high compared to the above mentioned paths.

The other paths are 4-9-12-13, 4- 9-14-13, 4-5-7-8-10-12-13, and 4-5-6-11-10-12-13.

Here the path found has less weight value as 14 but the other paths have the values of weight 26,27,48,61 these values leash to more processing time. The processing time found is at the limit of microseconds only. In this algorithm ant performance is based on the pheromone value only, because the major work done in this algorithm is movement of ants, updation pheromones, evaporation, the path formation is found by ferments smell produce by ant.

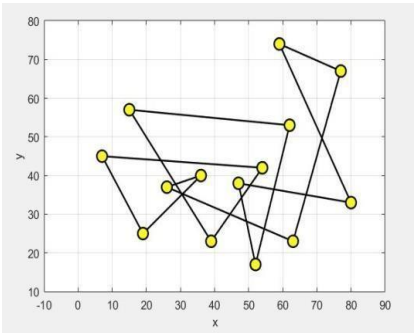

Fig 4: Processing Time For 7 Iteration

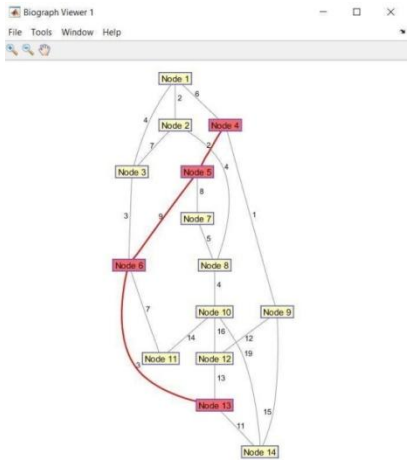

Fig5: Path formed between nodes 2 to 13

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Iteration 1: Best Cost = 77.6531
Iteration 2: Best Cost = 79.8339
Iteration 3: Best Cost = 294.8485
Iteration 4: Best Cost = 341.4624
Iteration 5: Best Cost = 382.3726
Iteration 6: Best Cost = 382.3726
Iteration 7: Best Cost = 382.3726
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Fig 6: path by ACO program

The above figure shows the path formed between the nodes 4 to 13 by ACO algorithm.

Similarly ACO algorithm is implemented for another 14 node NSFNET network there source and destination node is from node 1 to 14 here it form many paths for 1 to 14 node for communication, the difference occurred will be at microseconds only. Let the figure 5 shows the path formed between the nodes 1 to 14.

The above figure shows the path formed between the nodes 1 to 14 in NSFNET network. There will be numerous paths obtained but they are different to each other hence there will be a change in the execution time for those paths. For the fig 6 the execution time for that network is shown

Let those iterated values are graphically represented in the figure 7 they shows that there is decrease in time compared with all iterations. Here the x domain is taken as number of iteration and y domain as fitness value for the Ant Colony Optimization.

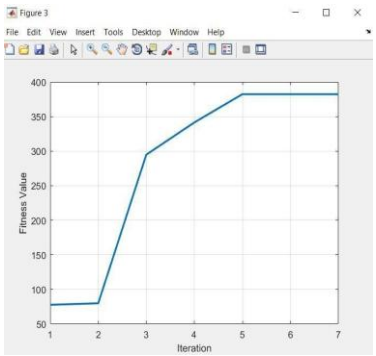

Fig 7: processing time (execution time)

While we use wavelength to assign for the lightpath it is quite difficult to proceed because when the users get large there will be lack in assigning the lightpaths to the user for that different wavelength assigning techniques has been proceeded here, in this paper first-fit, random, wavelength ordering, round-robin wavelength assignment techniques has been used. From the figure 8 the mean blocking probability for those wavelength assignment techniques is found in that it is clearly shows that wavelength ordering technique gives less blocking compared to rest of the technique mentioned above.

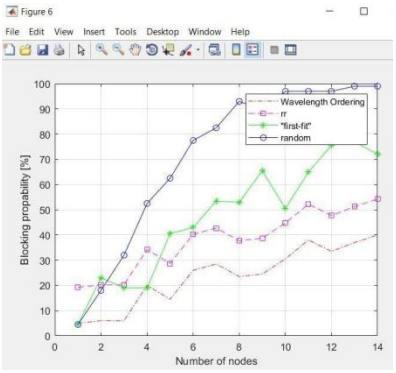

Fig 8: Mean Blocking Probability By Wavelength Assignment Techniques

VI. CONCLUSION

RWA is the major threat in optical networks domain. In this proposed work, the ACO algorithm is used to overcome those complex optimization problems. Here the Ant Colony Optimization algorithm is used in the NSFNET network model and the mean execution time and mean blocking probability for first-fit and random wavelength assignment techniques are found. The shortest path between those nodes is found with the help of corresponding weights of the path. From the results obtained, it is studied that applying ACO to the NSFNET network leads to lesser execution time for the data transmission. The peak blocking probability is found to be 97% for random wavelength assignment technique, 72% for first-fit technique, 52% for round-robin technique while it is only about 40% for wavelength ordering technique.

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