International Journal Of Core Engineering & Management
Volume-4, Issue-3, June-2017, ISSN No: 2348-9510

SOLUTION FOR THE ROUTING PROBLEM PRESENT IN COMMUNICATION NETWORK USING AN ENHANCED OPTIMIZATION TECHNIQUE

Anu,
Assistant Professor (Resource Person)
University Institute of Engineering and Technology
Mahrishi Dayanand University
Rohtak-124001, India
anukadyan01@gmail.com

Abstract

Ant colony optimization is an optimization technique mostly used for the optimizing the solution of problems such as the routing problem in communication networks. This technique is a population-based meta-heuristic in nature. This paper presents an enhanced ant colony optimizing method, which focuses on a method which brings up to date increase in pheromone amount and a mutation operation to find solution for routing problem. A comparison is made between the results of a standard problem and the results of ant colony optimizing technique.

I. INTRODUCTION

Communication networks are mainly divided into two categories: circuit switch and packet switch. Circuit switch networks is a network which constant from the start up to the breakdown of the connection. It completely depends on a connection from start to end nodes. A popularly known example of circuit switch network is telephone network. In Packet switch network, the data which is to be transferred is segregated into tiny packets and transmitted as data packets. In a packet switched networks, these data packets are received in an random order through different paths taken through different nodes. The examples of packet switch networks are internet and office LAN. To optimize the movement of traffic through a network, various techniques were employed[1]. The paper converges on the thought of network routing and routing tables. These tables carry data which is to be used by a routing algorithm. M.Reddy et al. [7] implemented ACO based heuristic approach for Location Routing Problem (LRP) in bill delivery services for the telecommunication company in Hong Kong.

Adaptability is the major issue in the network routing mainly in the vast networks for example internet. By removing old nodes and adding new ones the structure of the networks can be altered which results into unpredictably high traffic. Hence one cannot determine the possible combination of constant elements. In these kind of situation packet switch networks proved to be quite useful.

Each node in the network is given a graph which represents the connectivity in the network. This is achieved through link state algorithm. These graph represents which nodes are directly linked to one other. These graph also contains the values for the connected nodes which represents the

shortest possible path to other nodes.
Dijkstra algorithm is example of the link state algorithms. Whenever a new path is found between the two nodes, its weightage gets updated. A short path could be found by replacing the old values by new weight values in the table. By connecting minimum possible number of node, the algorithm allows messages to be channelized around the network [3,6]. This system works but it doesn't take into consideration the influx of traffic and balancing of load.
Because of the above mentioned problems in Dijkstra's algorithm, it is replaced by the generic algorithm. In this algorithm the calls took that path which is shortest in length. In this manner they would perform badly if they were caught on a engaged network. In the real time this would allow the routing system to acclimatize while the packets are been transferred. To solve this problem, ant colony optimizing algorithms are used [2]. These algorithms works on the same principle which ants use to find the path having smallest possible length to reach to their food from home. The ants drop the chemical called pheromone on their way to food. The path which contain maximum amount of pheromone deposit becomes the optimal path. Ant colony optimizing algorithms use virtual pheromones tables.
In Ant colony optimizing algorithm, the number of wait on (hops) and communication delay decide the quality of a path. A path having minimum number of wait on spots and delay gets more pheromones deposit and this path gets selected for data packets transfer with high probability. The main problem with the ant colony optimizing algorithms is that the pheromones gets updated after some time before it is used to send packets. Because of the node movements the link breakage occurs frequently. Due to the link disconnections a path having minimum hops and communication delay becomes unavailable.
To counter such problem, an enhanced ant colony optimizing method is proposed in this paper. This new improved technique has a new rule to update pheromone.

II. ENHANCED ANT COLONY OPTIMIZING TECHNIQUE FOR THE NETWORK ROUTING PROBLEM

Generation of solutions
In ant colony algorithm, a colony scale is decided and after that an ant imitates the starting node and its path is fabricated by choosing an end node until all nodes are covered. Those nodes which have profaned the constraints are deposited in the impracticable node list.

A probabilistic rule becomes a basis for decision making regarding combining customers. This rule considers both unobstructed view and the pheromone data for the decision making. A following probabilistic formula is used for determining the new customer [4].

$$p_{ij}(k) = \begin{cases} \dfrac{\tau_{ij}^{\alpha} \times \eta_{ij}^{\beta}}{\sum\limits_{h \notin \mathrm{tabu}_k} \tau_{ih}^{\alpha} \times \eta_{ih}^{\beta}} & j \notin \mathrm{tabu}_k \\ 0 & \text{otherwise} \end{cases}$$

Where Pij(k) is the chances of selecting nodes i and j on the path,
Ʈij is the pheromone density,
ηij is the visibility
α and β are the pertinent effect of the pheromone and the visibility values, respectively,
tabuk is the infeasible nodes for the kth ant.

Local search

The two opt exchange method is used to test all the possible pair wise combination exchanges of node locations only to see if any improvement can be achieved in the objective function.

Equation for pheromone updating

The main element in the adaptive learning technique is to continuously keep the pheromone data up to date and the improvement of future solution [5]. To maintain the similarity with the disappearance of the pheromone, before updating the amount of pheromone is reduced.

The following equation is used for updating pheromone:

$$\tau_{ij}^{new} = \rho \times \tau_{ij}^{old} + \sum_{k}^{K} \Delta\tau_{ij}^{k} \quad \rho \in (0,1)$$

Where

τ_{ij}^{new} is the new amount of pheromone on the node (i,j)

$\tau_{ij}^{old}$is the previous amount of pheromone on the node (i,j)

ρ the constant,

k is the number of a route,

K is the total number of the routes in the results, with K > 0,

$\Delta\tau_{ij}^{k}$ is the incremented amount of pheromone on node (i,j) of route k.

Problem solving procedure

The flowchart of the proposed algorithm for the computer network routing problem is shown in Fig. 1.

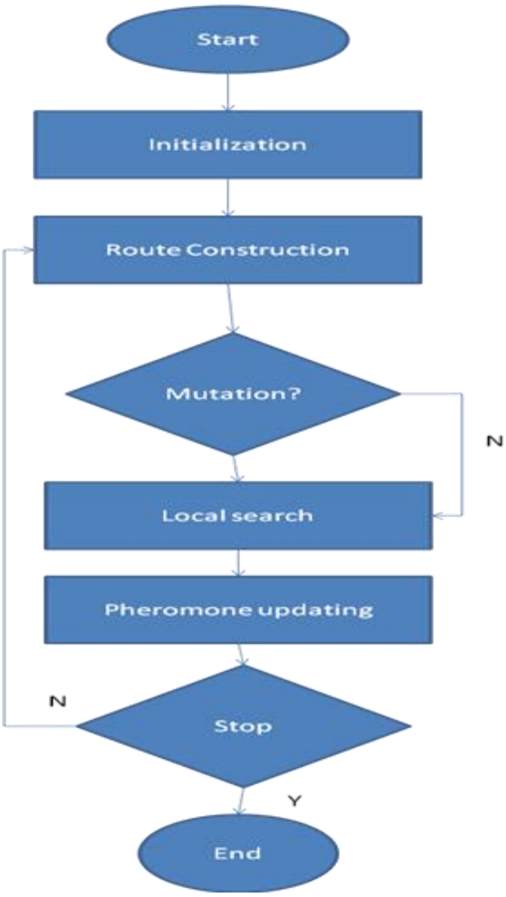

Fig 1: The flowchart for IOCA Procedure [5].

III. SIMULATION RESULTS

From the simulation results, it is showed that the enhanced algorithm can perform better with low communication cost. Routing of a communication network is improved by using the improved ant colony optimization algorithm. To show this number of simulations is done. A network system is chosen which contains 30 nodes. Values of Basic parameters are given below [3]:
Speed of simulation: 1100 tick/sec
Number of calls to be made: 4000
Maximum number of converging calls: 50
Total capacity of a Node: 30
Time period of call: 150 (in ticks)
IACO versus simple ACO

From the fig 2 concludes that by the time first 400 calls were completed the number of wait on spots i.e. hops have reduced by approx. 1.7 nodes. At the end of the simulation it can be seen that the enhanced Ant colony optimizing improves the network performance by 3 hops.

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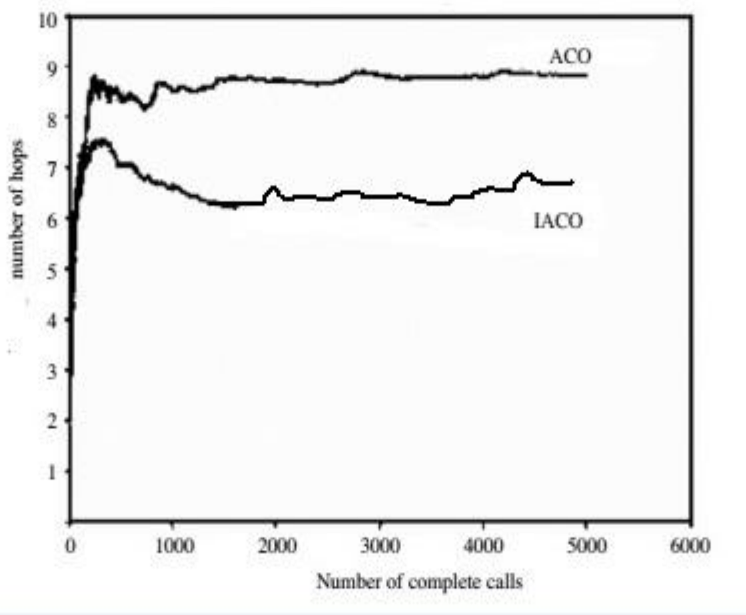

Fig: 2 Comparisons of Results Of Simple And Improved Ant Colony Algorithm.

IV. CONCLUSION

A new algorithm for solving communication network problems is proposed in this paper. According to this algorithm the path chosen by the ants depends upon its quality. For evaluating the quality of the path, ant uses its pheromone. The results from the simulation show that higher ratio of packet delivery with low communication cost is obtained from improved ant colony optimizing algorithm than with simple ant colony optimizing algorithm.

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