# Ant Colony Optimization Based Compact Routing for Networks

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***Abstract-****Network is an amalgamation of PCs and differed equipment gadgets that are joined by method for a channel of correspondence which empower the trading of data and assets. The methodology of selecting a way for exchanging is known as routing. There are numerous routing calculations which have been effectively executed. One variation of routing is compact routing wherein the point is to perform system minimizing so as to route the extent of the routing table. Compact Routing puts cutoff points on routing versatility. Routing list that can likewise be termed as the Routing Information base (RIB) is fundamentally an information table that is put away inside of a switch or a PC that is arranged that gives the rundown of courses to a particular destination system alongside a couple cases and separations related with these courses. The routing list additionally comprises of the system topology around it. This work obtains ideas of swarm knowledge in view of Ant colony optimization to plan a Compact routing calculation that store a little measure of data in a routing list at every hub in a system, and give a bound on the stretch of informing courses.*

**Keywords:** *swarm intelligence, collective intelligence algorithm, compact routing. (Key words)*

## I.INTRODUCTION

Routing is the process of establishing a path through which message packets can pass through to reach the destination from a sender. Each node in an network makes use of an routing table which keeps tracks of details like next node connectivity distance, time to reach next node, nearby connected nodes etc.

These routing tables that helps in establishment of a path to the nearby nodes. The selection of the nodes takes place through the choice of the routing algorithm followed. Routing is classified as Proactive, reactive, and hybrid routing, Distributed and centralized routing, single path and multipath routing.

In proactive directing new arrangements of destinations and their courses is kept up by intermittent distribution tables of routing all through the system. Separate measure of information for maintenance is required to be taken care of and there is moderate response on rebuilding and disappointments. This procedure is additionally alluded to as table driven routing. In reactive routing which is likewise approached as demand routing so as to direct, we discover a course on flooding the system with Route Request bundles. Here the inertness time in course finding is high. The benefits of proactive and reactive routing are conglomerated in hybrid routing. The routing is at first settled with some proactively prospected courses and afterward carries out the request from nodes that are activated additionally. The decision for one or the other strategy involves the predetermination of cases that are not common [1].

In the model for Centralized routing a routing is primarily done with the help of a database that is centralized. It can be understood as the routing table is placed at a central node singularly whose consent is not to be taken with regard to the making a decision on routing. A view of the global network is possessed by the centralized database. On the other hand in the distributed routing model a distinct routing table is maintained by every node. The distributing routing is the one that is optimum for the domains that can be recognized as completely opaque. If there is a case of failure (where it is required to restore quickly) the distributed routing systems can be trusted upon for bearing the responsibilities pertaining to the on demand computations of the course of recovery for every of the light course that have disappointed (also at the point of failure that is expected and detection) [4].

During the course of single-path routing structure there is a single path that is present among different two networks of an internetwork. Although it might simplify routing tables and courses of packet flow these networks are non-tolerant of faults. Single path protocol understands about the routes and then selects the only route to the destination. Only a single path shall be inserted into the destination in the table of IP routing. Whereas in multi-path routing varied paths are present among the networks in internetwork. These are fault tolerant when there is the use of dynamic routing and few routing protocols such as OSPF can be used for balancing the load of the network traffic at multiple paths along with similar metric value. It can comprehend about the routes and can also select more than a single course to destination. As the size of the network grows, the size of the routing table also increases. The routing list also be termed as the routing information base (RIB) is basically a data table that is storedwithin a router or a computer that is networked that provides the list of routes to a specific destination networks along with a few cases and distances related with these routes. The routing list also consists of the network topology around it. There are several paths that are connecting every node in the network. The size of this routing list grows while one aims to select a single path from source to destination.

In this work I make use of swarm intelligence to divide the flow of message packets among various paths rather than utilizing the single path which results in the good balancing of the load in the entire network. A Compact Routing Algorithm is made use of for the purpose of balancing the loads of every node that supports the optimizing the network entirely also Swarm Intelligence Algorithm is utilized for the selection of minimum path among the two nodes.

## II.BACKGROUND

### A. Ant Colony optimization

Marco Dorigo[12] and partners presented the first ACO calculations in the mid 1990's.The advancement of these calculations was roused by the perception of ants. Ants are social creepy crawlies. They live in states and their conduct is represented by the objective of state survival instead of being centered on the survival of people.

The conduct that gave the motivation to ACO is the ants' searching conduct, and specifically, how ants can find most brief ways between sustenance sources and their home. At the point when looking for nourishment, ants at first investigate the region encompassing their home in an irregular way. While moving, ants leave a synthetic pheromone trail on the ground [12].

Ants can notice pheromone. At the point when picking their direction, they have a tendency to pick, in likelihood, ways stamped by solid pheromone focuses. When a burrowing little creature discovers a nourishment source, it assesses the amount and the nature of the sustenance what's more, conveys some of it back to the home. Amid the arrival outing, the amount of pheromone that a burrowing little creature leaves on the ground may rely on upon the amount and nature of the nourishment. The pheromone trails will control different ants to the sustenance source. It has been indicated that the aberrant correspondence between the ants by means of pheromone trails—known as stigmergy empowers them to discover most limited ways between their home and sustenance sources.

The ant walk begins by first ant wanders keep looking for food source walk randomly until it finds the food source (F), then it returns to the nest (N), laying a pheromone trail. Other ants uses the laying pheromone as a trail and follow one of the paths at random, also laying pheromone trails. Since the ants on the shortest path lay pheromone trails faster, this path gets reinforced with more pheromone, making it more appealing to future ants. The ants become increasingly likely to follow the shortest path since it is constantly reinforced with a larger amount of pheromones. The pheromone trails of the longer paths evaporate. Paradigm for optimization problems that can be expressed as finding short paths in a graph for any given problem.

Working of ant colony optimization algorithm:

- Construct ant solutions.
- Define attractiveness $\tau$, based on experience from previous solutions.
- Define specific visibility function, $\eta$, for a given problem (e.g. distance).

- Initialize ants and nodes (states).
- Choose next edge probabilistically according to the attractiveness and visibility.
- Each ant maintains a table list of infeasible transitions for that iteration.
- Update attractiveness of an edge according to the number of ants that pass through.
- Update pheromones.

Figure 1 explains the working of ant colony optimization heuristics.

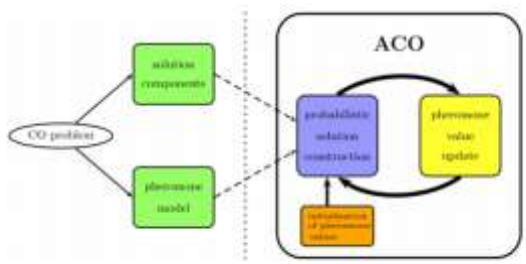


Figure 1: Working of ANT COLONY OPTIMIZATION Algorithm

### B. Compact Routing

A routing plan is a Compact routing that permits any source hub to course messages to any destination hub, given the destination's system identifier. In the routing system every hub contains a directing table which determines a yield port for every destination [11]. Conservative directing is essentially utilized for minimizing the measure of the routing rundown.

Smaller directing issue:

Information: a system G (a weighted associated diagram)

Ouput: a routing plan for G

A routing plan is a disseminated calculation that permits any source hub to course messages to any destination hub, given the destination's system identifier.

Objective: to minimize the measure of the steering tables.

## III. WORKING METHODOLOGY

Assuming the following (*Figure 2*) network type, and we need to find the shortest path. In such a problem, you have a network with link weight on the edges and two special nodes: a start node (White) and a finish node (Green).

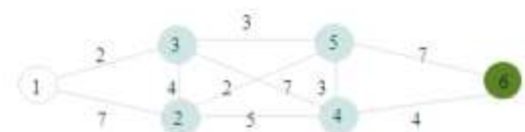


Figure 2: Network with Weights

Ant colony optimization is used to either maximize or minimize and objective function by updating the velocity (cost, weight, link) in every iteration. We willmap (consider) all paths from Start (Origin) to Finish (Destination) as particles.

***APSO–CR Simple Algorithm to Optimize Network Routing***

1. Calculate *pbest* and position of corresponding particle.
2. for (i=0; i<no_of_iteration; i++);
3. for(x=0; x<particle_count; x++);
4. Change weight of each link along the path of each particle randomly.
5. Calculate fitness and find *pbest*of $n^{th}$iteration.
6. Find best *pbest* or *gbest* with the corresponding particle, which gives the shortest-path in terms of the weight associated with the links on the path (or particle).

Illustrationofhowitworks

Note: pbest (priority) is not the weight Figure

| Node | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Pbest (priority) | 2 | 6 | 4 | 9 | 5 | 7 |

$i^0$ $i=0,\ V_p^k=(1)$

| Node | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Pbest (priority) | ● | 6 | ● | 9 | 5 | 7 |

$i^1$ $i=1,\ V_p^k=(1,3)$

| Node | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Pbest (priority) | ● | ● | ● | 9 | 5 | 7 |

$i^2$ $i=2,\ V_p^k=(1,3,2)$

| Node | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Pbest (priority) | ● | ● | ● | 9 | ● | 7 |

$i^3$ $i=3,\ V_p^k=(1,3,2,5)$

| Node | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Pbest (priority) | ● | ● | ● | ● | ● | 7 |

$i^4$ $i=4,\ V_p^k=(1,3,2,5,4)$

| Node | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Pbest (priority) | ● | ● | ● | ● | ● | ● |

$i^5$ $i=5,\ V_p^k=(1,3,2,5,4,6)$

Particle priority vector updating to construct the path {1, 3, 2,
5, 4, 6}.

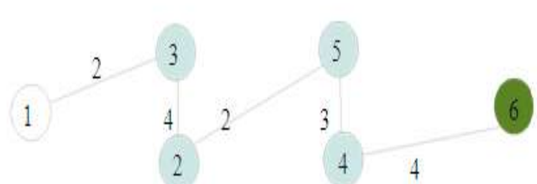


Figure 3: Final output of network

This example corresponds to the priority (particle position) vector to create a valid path from the same position vector and the corresponding final path is {1, 3, 2, 5, 4, 6}, where forces the algorithm to choose a valid node (although it has the highest priority)there by avoiding an invalid path creation.

This operation reduces the number of invalid paths (thereby, the computation time).

## IV. RESULTS

The validation of the proposed algorithm is carried out using MATLAB

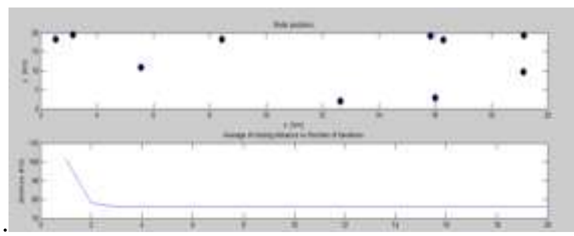

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Figure 4: The sample node position and their average Distance

After computing the proposed algorithm for the given nodes following figure is obtained.

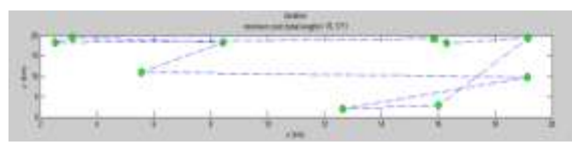

Figure 5: Final output

The Total cost length is 76 sec.

## V. CONCLUSION

Networks comprise of extensive arrangements of asset obliged hubs. The outline of viable, strong, and adaptable steering algorithm in these systems is a testing errand. Then again, the generally novel area of swarm intelligence offers algorithmic configuration standards, enlivened by complex versatile organic frameworks that well match the requirements and the difficulties of systems. This is the reason, in the most recent years various routing algorithms for systems have been created in light of Swarm Intelligence standards, and, all the more particularly, taking motivation from searching practices of subterranean insect and honey bee settlements [3]. In this paper, we have displayed a fairly broad overview of these SI-based algorithms for routing in systems. At long last, we have illustrated a general approach which is logically solid in assessing enhanced separation between two hubs with minimized routing rundown.

In view of PSO algorithm, a versatile particle swarm streamlining Algorithm to comprehend multi-QoS limitations any cast problem of routing (APSO-CR) is proposed in this paper. This algorithm has couple of parameters to conform and simple to figure it out. The test results demonstrate that the APSO-CR calculation is powerful and accessible. It can fulfill the obliged state of various QoS, parity system stack reasonably, and enhance the nature of system administration. It has a superior capacity to escape from a nearby ideal and its joining velocity is speedier than the Dijkstra's algorithms.

To close, I need to portray some future bearings for the field as opposed to highlighting methodological issues. I emphatically trust that we will witness a huge dissemination of Swarm Intelligence-based answers for genuine systems whether it is wired or remote.

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