Volume 6, Issue 5, May 2016 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

# An Algorithm to Find Optimal Route in MANET

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***Abstract: In Mobile Ad-hoc Network (MANET), routing is the most important issue for communication. A number of routing protocols are available for communication in MANET, but optimality is the key issue in routing to improve the performance of MANET. Reactive protocols do not preserve routing information at the network node level, if there is no communication between the nodes. Reverse Reactive protocol determines a route to a specific destination when a particular packet is intends to send. This paper proposed a combination of algorithm (ACO, and Genetic Algorithm) to find optimal route in MANET.***

***Keywords: MANET, ACO, Genetic Algorithm, routing protocol, optimal route.***

## I. INTRODUCTION

A MANET [2] is a wireless network operated entirely by mobile nodes that cooperate to setup a communication service with no support from wired networks required. Nodes in the wireless range of each other may communicate directly, while those far apart must rely on other nodes to route their messages for them. Routing in a MANET has been a challenging issue since the network topology may constantly change due to mobility, and the efficiency of routing is a major concern as energy and bandwidth in a MANET are premium resources. Many routing protocols for MANETs have been proposed, which may be categorized into two general types:

i) Proactive
ii) Reactive

Proactive protocols attempt to maintain up-to-date information about the path from each node to every other node in the network through regular exchange of topology updates. Reactive protocols [6, 7] in contrast, are based on the on demand philosophy that protocols discover and maintain paths to only destinations to which data packets must be sent. Thus, it is of interest to ask if the process of generating route replies can be also optimized so that the existing efficiency can be enhanced. For example, if a node processing a query has advance knowledge that its route to be returned is not optimal, e.g. in terms of hop count, then it may choose to not reply, even if the query is received for the first time. As an optimum solution for routing in MANET, ad hoc routing protocols must be designed focusing on the performance metrics for best output like maximum data throughput, minimum end-to-end delay, minimum Route Acquisition time, minimum number of hops (shortest path), minimum overhead, energy efficiency, bandwidth efficiency, Load balancing (least congested path). A fundamental issue arising in mobile ad hoc networks (MANETs) is the selection of the optimal path between any two nodes. A method that has been advocated to improve routing efficiency is to select the most stable path so as to reduce the latency and the overhead due to route reconstruction. Here, we study both the availability and the duration probability of a routing path that is subject to link failures caused by node mobility. In particular, the work focuses on the case where the network nodes move according to the Random Direction model, and we derive both exact and approximate (but simple) expressions of these probabilities.

The issue of this work is to design and develop a set of routing protocols that address the following issue and then evaluates the performance in comparison to others.

1. Mobility induced route reconfiguration, packet losses, unstable multicast network structure and network wide flooding of control packets
2. Inefficient utilization of bandwidth and energy resource and excessive Control overheads
3. Non-adaptability to different network environments
4. Scalability issue in MANET multicasting
5. Efficiency and robustness problem in multicasting

## II. APPLICATIONS OF MANET

The set of applications for MANETs is diverse, ranging from small, static networks that are constrained by power sources, to large-scale, mobile, highly dynamic networks. The design of network protocols for these networks is a complex issue. Regardless of the application, MANETs need efficient distributed algorithms to determine network organization, link scheduling, and routing. Some of the main application areas of MANET's are:

**1. Military battlefield**– soldiers, tanks, planes, Ad- hoc networking would allow the military to take advantage of commonplace network technology to maintain an information network between the soldiers, vehicles, and military information headquarters.

**2. Sensor networks** – to monitor environmental conditions over a large area.
**3. Local level** – Ad hoc networks can autonomously link an instant and temporary. Multimedia network using notebook computers or palmtop computers, spread and share information among participants in conference or classroom. Another appropriate local level application might be in home networks where devices can communicate directly to exchange information.
**4. Personal Area Network (PAN)** – pervasive computing i.e. to provide flexibility and connectivity between personal electronic devices or home appliances. Short-range MANET can simplify the intercommunication between various mobile devices (such as a PDA, a laptop, and a cellular phone). Tedious wired cables are replaced with wireless connections. Such an ad hoc network can also extend the access to the Internet or other networks by mechanisms e.g. Wireless LAN (WLAN), GPRS, and UMTS.
**5. Vehicular Ad hoc Networks** – intelligent transportation i.e. to enable real time vehicle. Monitoring and adaptive traffic control Civilian environments like taxi cab network, meeting rooms, sports stadiums, boats.

## III. PREVIOUS ALGORITHMS

### *A. Ant Colony Optimization*

This technique allows an adaptive routing system which is updated and a more optimal path is found or an obstruction placed across an existing pathway. A number of techniques can be employed to optimize the flow of traffic around a network. Such techniques include flow and congestion control, where nodes send packet acknowledgements from destination nodes to either ramp-up or decrease packet transmission speed. The area of interest in this report concentrates on the idea of network routing and routing tables. These tables hold information used by a routing algorithm to make a local forwarding decision for the packet on the next node it will visit in order to reach its final destination. One of the issues with network routing (especially in very large networks such as the internet) is adaptability. Not only can traffic be unpredictably high, but the structure of a network can change as old nodes are removed and new nodes added. This perhaps makes it almost impossible to find a combination of constant parameters to route a network optimally. Packet-switched networks dynamically guide packets to their destination via routing tables stored in a link state and are selected via a link state algorithm.
A link state algorithm works by giving every node in the network a connectivity graph of the network. This graph depicts which nodes are directly connected. Values are stored for connected nodes in a map which represents the shortest path to other nodes. One such link state algorithm used in network routing is Dijkstra's algorithm. When a path between two nodes is found, its weight is updated in the table. Should a shorter path be found, the new optimal weight will be updated to the table, replacing the old value. The algorithm allows traffic to be routed around the network whilst connecting to the least number of nodes as possible. The system works, but doesn't take into account influx of traffic and load balancing.

### *B. Genetic algorithm*

To begin with, each possible path has an even likelihood of being chosen. An ant is placed on a network of 4 nodes, with the source node 1 and destination node 2. A chance mechanism is invoked and a path is chosen.

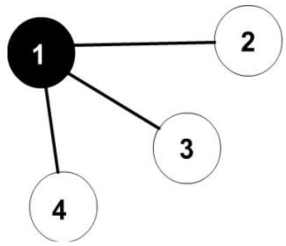


Fig 1 .The Network Graph

In this case, node 2 has been selected [Figure 1] and the ant arrives at its source destination.
The ant then moves and updates the pheromone tables for the visited nodes with a higher (and more mathematically biased) value. This would be calculated in the following way:

- Node 2 was the final destination
- It took 1 hop to get to its destination
- Divide 1 (hop) by 100: 100%
- Add 100 to the probability value of node 2 (currently 33.3333): 133.3333
- Add the values of the other nodes to 133.3333 (133.3333 + 33.3333 + 33.3333): 200 (approximately)
- Calculate the ratio: ratio = 100/200 0.5
- Set the probability of the node to its current value multiplied by the ratio
  Node 2: 133.3333 * ratio (0.5) = 66.6666%
  Node 3: 33.3333 * ratio (0.5) = 16.6666%
  Node 4: 33.3333 * ratio (0.5) = 16.6666%
- Node 2 (66.6666%) + Node 3 (16.6666%) + Node 4 (16.6666%) = 99.9999%

The system isn't 100% accurate as the total will never add up to exactly 100%, but it will be close enough to allow accuracy within the level required.

The following diagram depicts how the path and pheromone table after the update has taken place.

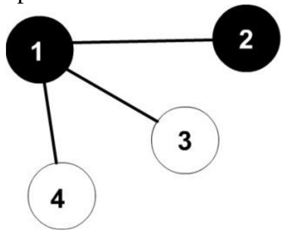


Fig 2 .The Network Graph after update

## IV. LITERATURE REVIEW

| **1. S. Prasad, Y.P.Singh, and C.S.Rai** [5] |
|---|
| • Proposed a novel proactive algorithm called Probabilistic Ant Routing in 2009, in mobile ad hoc networks, which is inspired by Ant Colony Optimization (ACO) framework and uses "ants" for route discovery, maintenance and improvement.<br>• The algorithm is based on a modification of the state transition rule of ACO routing algorithm that results in maintaining higher degree of exploration along with congestion awareness in the search space. This leads to reduced end-to-end delay and also lowers the overhead at high node density. |
| **2. Hamideh Shokrani and Sam Jabbehdari** [6] |
| • Presented that Mobile ad-hoc networks are infrastructure-less networks consisting of wireless, possibly mobile nodes which are organized in peer-to-peer fashion. The highly dynamic topology, limited bandwidth availability and energy constraints make the routing problem a challenging one.<br>• Recently a new family of algorithms emerged inspired by Swarm Intelligence, which provides a novel approach to distributed optimization problems. Initial studies have unveiled a great deal of matching properties between the routing requirements of ad-hoc networks and certain features of SI, such as the ability of ant colony to find a nearly optimal route between elements.<br>• In this paper author described a survey of ant-based routing algorithms for MANETs & categorization of algorithms and summarize their operation. |
| **3. Al-Dahoud Ali, Mohamed A. Belal and Moh'd Belal Al-Zoubi** [7] |
| • Represented Ant Colony Optimization (ACO) provides a meta heuristic optimization tool and collective intelligence model to several applications such as routing and load balancing. |

A lot of work found in the literature on using ACO in load balancing. However, as far as the knowledge, there was no work done relating load balancing in distributed systems with ACO.

## V. CONCLUSION AND FUTURE WORK

This paper aims at proposing a technique, which reduces the routing overhead ratio. The ad-hoc network when used in places affected by natural calamity or in cases of defense services where these resources are scarcely available there are even conditions where for days together the battery cannot be replaced or where the communication means required is fast reliable and optimal. The work hence aims at conserving the hop counts by reducing the search space for the node for searching the optimal route for a node to other nodes. These values are calculated by the artificial ants, generated by the node in the ant colony implementation on the ad-hoc network that is sent on the routes calculated above. Taking into account the above factors the probability for selecting next hop for a node to other node is calculated basing on the priority and the requirement for the route. The best route available is thus associated with the highest pheromone count. The future work may well be to research completely different strategies to any limit the traffic or load and compare the Emmet based mostly algorithmic program for different proactive and reactive routing protocols. Hybrid routing of projected algorithmic program is presently beneath investigation.

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