Enhancing the Performance of Wireless Ad hoc Network with AOLB Geographic Routing Technique

E.Padma
Assistant Professor, Department of Computer Science and Engineering,
Nandha Engineering College, Erode, Tamil Nadu, India.

Dr.N.Shanthi
Professor and Dean, Department of Computer Science and Engineering,
Nandha Engineering College, Erode, Tamil Nadu, India.

Abstract- A wireless ad hoc network is a decentralized type of wireless network. The network is ad hoc because it does not rely on a pre existing infrastructure, such as routers in wired networks or access points in managed (infrastructure) wireless networks. Instead, each node participates in routing by forwarding data for other nodes, so the determination of which nodes forward data is made dynamically on the basis of network connectivity. To support multimedia applications, it is desirable that an ad hoc network has a provision of Quality of Service (QoS). However, the provision of QoS Routing in a mobile ad hoc network is a challenging task. However, in the last decade, much research attention has focused on providing QoS Routing assurances in MANET protocols. This paper presents a review of the current research related to the provision of QoS in an ad hoc environment and provides the techniques to improve some of the QoS Routing metric using Geographic Routing.

Keywords- Mobile ad hoc Network, Ant colony optimization, routing protocol, geographic routing.

I. INTRODUCTION

MANET Stands for "Mobile Ad Hoc Network." A MANET is a type of ad hoc network that can change locations and configure itself on the fly. This can be a standard Wi-Fi connection, or another medium, such as a cellular or satellite transmission. Some MANETs are restricted to a local area of wireless devices (such as a group of laptop computers), while others may be connected to the Internet. It can be used for facilitating the collection of sensor data for data mining for a variety of applications such as air pollution monitoring and different types of architectures can be used for such applications. It should be noted that a key characteristic of such applications is that nearby sensor nodes monitoring an environmental feature typically register similar values. This kind of data redundancy due to the spatial correlation between sensor observations inspires the techniques for in-network data aggregation and mining. By measuring the spatial correlation between data sampled by different sensors, a wide class of specialized algorithms can be developed to develop more efficient spatial data mining algorithms as well as more efficient routing strategies.

In this paper, we address the problem of routing in large-scale mobile ad-hoc networks (MANETs), both in terms of number of nodes and coverage area. Our approach aims at abstracting from the dynamic, irregular topology of a MANET to obtain a topology with “logical routers” and “logical links”, where logical router and logical links are just a collection of nodes and (multi-hop) paths between them, respectively. To “build” these logical routers, nodes geographically close to each other are grouped together. Logical links are established between selected logical routers. On top of this abstract topology, we propose to run a routing protocol based on mobile agents and inspired from social insects behavior.

The Ant Colony Optimization algorithm (ACO) is a probabilistic technique for solving computational problems which can be reduced to finding good paths through graphs. Thus, when one ant finds a good (i.e., short) path from the colony to a food source, other ants are more likely to follow that path, and positive feedback eventually leads to all the ants' following a single path.

The idea of the ant colony algorithm is to mimic this behavior with "simulated ants" walking around the graph representing the problem to solve.

An ad hoc network is the cooperative engagement of a collection of mobile nodes without the required intervention of any centralized access point or existing infrastructure. Ad hoc On Demand Distance Vector Routing (AODV) a novel algorithm for the operation of such ad hoc networks. Each Mobile Host operates as a specialized router and routes are obtained as needed i.e. on demand with little or no reliance on periodic advertisements. Our new routing algorithm is quite suitable for a dynamic self starting network as required by users wishing to utilize ad hoc networks. AODV provides loop free routes even while repairing broken links. Because the protocol does not require global periodic routing advertisements the demand on the overall bandwidth available to the mobile nodes is substantially less than in those protocols that do necessitate such advertisements. Nevertheless we can still maintain most of the advantages of basic distance vector routing mechanisms.

Dynamic Source Routing (DSR) is a routing protocol for wireless mesh networks. It is similar to AODV in that it forms a route on-demand when a transmitting computer requests one. However, it uses source routing instead of relying on the routing table at each intermediate device.

Determining source routes requires accumulating the address of each device between the source and destination during route discovery. The accumulated path information is cached by nodes processing the route discovery packets. The learned paths are used to route packets. To accomplish source routing, the routed packets contain the address of each device the packet will traverse. This may result in high overhead for long paths or large addresses, like IPv6. To avoid using source routing, DSR optionally defines a flow id option that allows packets to be forwarded on a hop-by-hop basis.

This protocol is truly based on source routing whereby all the routing information is maintained (continually updated) at mobile nodes. It has only two major phases, which are Route Discovery and Route Maintenance. Route Reply would only be generated if the message has reached the intended destination node (route record which is initially contained in Route Request would be inserted into the Route Reply).

To return the Route Reply, the destination node must have a route to the source node. If the route is in the Destination Node's route cache, the route would be used. Otherwise, the node will reverse the route based on the route record in the Route Request message header (this requires that all links are symmetric). In the event of fatal transmission, the Route Maintenance Phase is initiated whereby the Route Error packets are generated at a node. The erroneous hop will be removed from the node's route cache; all routes containing the hop are truncated at that point. Again, the Route Discovery Phase is initiated to determine the most viable route.

II.RELATED WORK

In [1] Bellman- Ford routing mechanisms, An ad-hoc network is the cooperative engagement of a collection of Mobile Hosts without the required intervention of any centralized Access Point. In this paper we present an innovative design for the operation of such ad-hoc networks. The basic idea of the design is to operate each Mobile Host as a specialized router, which periodically advertises its view of the interconnection topology with other Mobile Hosts within the network. This amounts to a new sort of routing protocol. We have investigated modifications to the basic Bellman- Ford routing mechanisms, as specified by RIP, to make it suitable for a dynamic and self-starting network mechanism as is required by users wishing to utilize ad hoc networks. Our modifications address some of the previous objections to the use of Bellman-Ford, related to the poor looping properties of such algorithms in the face of broken links and the resulting time dependent nature of the interconnection topology describing the links between the Mobile Hosts. Finally, we describe the ways in which the basic network-layer routing can be modified to provide MAC-layer support for ad-hoc networks.

In Ad hoc On Demand Distance Vector Routing AODV [2], the author describes An ad hoc network is the cooperative engagement of a collection of mobile nodes without the required intervention of any centralized access point or existing infrastructure. In this paper we present Ad hoc On Demand Distance Vector Routing AODV a novel algorithm for the operation of such ad hoc networks. Each Mobile Host operates as a specialized router and routes are obtained as needed on demand_ with little or no reliance on periodic advertisements. Our new routing algorithm is quite suitable for a dynamic self starting network as required by users wishing to utilize ad hoc networks. AODV provides loop free routes even while repairing broken links. Because the protocol does not require global periodic routing advertisements the demand on the overall bandwidth available to the mobile nodes is substantially less than in those protocols that do necessitate such advertisements. Nevertheless we can still maintain most of the advantages of basic distance vector routing mechanisms. We show that our algorithm scales to large populations of mobile nodes wishing to form ad hoc networks. We also include an evaluation methodology and simulation results to verify the operation of our algorithm.

In The Dynamic Source Routing protocol (DSR) [3], is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. DSR allows the network to be completely self organizing and self-configuring, without the need for any existing network infrastructure or administration. The protocol is composed of the two mechanisms of Route Discovery and Route Maintenance, which work together to allow nodes to discover and maintain source routes to arbitrary destinations in the ad hoc network. The use of source routing allows packet routing to be trivially loop-free, avoids the need for up-to-date routing information in the intermediate nodes through which packets are forwarded, and allows nodes forwarding or overhearing packets to cache the routing information in them for their own future use. All aspects of the protocol operate entirely on-demand, allowing the routing packet overhead of DSR to scale automatically to only that needed to react to changes in the routes currently in use.

In a new distributed routing protocol [4], the author describes a new distributed routing protocol for mobile, multihop, wireless networks. The protocol is one of a family of protocols which we term "link reversal" algorithms. The protocol's reaction is structured as a temporally-ordered sequence of diffusing computations; each computation consisting of a sequence of directed link reversals. The protocol is highly adaptive, efficient and scalable; being best-suited for use in large, dense, mobile networks. In these networks, the protocol's reaction to link failures typically involves only a localized "single pass" of the distributed algorithm. This capability is unique among protocols which are stable in the face of network partitions, and results in the protocol's high degree of adaptivity . This desirable behavior is achieved through the novel use of a "physical or logical clock" to establish the "temporal order" of topological change events which is used to structure (or order) the algorithm's reaction to topological changes. We refer to the protocol as the Temporally-Ordered Routing Algorithm (TORA).

In Location-Aided Routing (LAR) [5], the author describes A mobile ad hoc network consists of wireless hosts that may move often. Movement of hosts results in a change in routes, requiring some mechanism for determining new routes. Several routing protocols have already been proposed for ad hoc networks. This paper suggests an approach to utilize location information (for instance, obtained using the global positioning system) to improve performance of routing protocols for ad hoc networks. By using location information, the proposed Location-Aided Routing (LAR) protocols limit the search for a new route to a smaller "request zone" of the ad hoc network. This results in a significant reduction in the number of routing messages. We present two algorithms to determine the request zone, and also suggest potential optimizations to our algorithms. As the route request is propagated to various nodes, the path followed by the request is included in the route request packet. Using the above flooding algorithm, provided that the intended destination is reachable from the sender, the destination should eventually receive a route request message. On receiving the route request, the destination responds by sending a route reply message to the sender the route reply message follows a path that is obtained by reversing the path followed by the route request received by D (the route request message includes the path traversed by the request). It is possible that the destination will not receive a route request message.

In Greedy Perimeter Stateless Routing (GPSR) [6], the author describes Greedy Perimeter Stateless Routing (GPSR), a novel routing protocol for wireless datagram networks that uses the positions of routers and a packet's destination to make packet forwarding decisions. GPSR makes greedy forwarding decisions using only information about a router's immediate neighbors in the network topology. When a packet reaches a region where greedy forwarding is impossible, the algorithm recovers by routing around the perimeter of the region. GPSR scales better in per-router state than shortest-path and ad-hoc routing protocols as the number of network destinations increases. Under mobility's frequent topology changes, GPSR can use local topology information to find correct new routes quickly. We describe the GPSR protocol, and use extensive simulation of mobile wireless networks to compare its performance with that of dynamic Source Routing. Our simulations demonstrate GPSR's scalability on densely deployed wireless networks.

The two dominant factors in the scaling of a routing algorithm are the rate of change of the topology and the number of routers in the routing domain. Both factors affect the message complexity of DV and LS routing algorithms: intuitively, pushing current state globally costs packets proportional to the product of the rate of state change and number of destinations for the updated state. Hierarchy is the most widely deployed approach to scale routing as the number of network destinations increases. Without hierarchy, Internet routing could not scale to support today's number of Internet leaf networks.

In geographical routing algorithm (GRA) [7], the author presents a new type of distributed, adaptive and asynchronous routing algorithm for ad-hoc networks. It routes based on partial information. It does not rely on any address hierarchy but instead relies on information about node positions, and hence, is called the geographical routing algorithm (GRA). We assume each node knows its own position, and can acquire the position of the packet destination by some means.

Since ad-hoc networks change topology frequently, routing under partial information is of interest for ad-hoc networks. The Zone Routing Protocol is one well known example of an algorithm based on partial information. A node is expected to know the topology in its own zone accurately, and that in other zones only approximately. It is hoped that this will reduce the inter-node communication required to track a changing network topology. Of course, the reduction in the information used for routing may impose other costs. For example, the routes may not be shortest paths.

In Grid Location Systems [8], the author describes GLS is a new distributed location service which tracks mobile node locations. GLS combined with geographic forwarding allows the construction of ad hoc mobile networks that scale to a larger number of nodes than possible with previous work. GLS is decentralized and runs on the mobile nodes themselves, requiring no fixed infrastructure. Each mobile node periodically updates a small set of other nodes (its location servers) with its current location. A node sends its position updates to its location servers without knowing their actual identities, assisted by a predefined ordering of node identifiers and a predefined geographic hierarchy. Queries for a mobile node's location also use the predefined identifier ordering and spatial hierarchy to find a location server for that node. Experiments using the ns simulator for up to 600 mobile nodes show that the storage and bandwidth requirements of GLS grow slowly with the size of the network. Furthermore, GLS tolerates node failures well: each failure has only a limited effect and query performance degrades gracefully as nodes fail and restart. The query performance of GLS is also relatively insensitive to node speeds. Simple geographic forwarding combined with GLS compares favorably with Dynamic Source Routing (DSR): in larger networks (over 200 nodes) our approach delivers more packets, but consumes fewer network resources.

In on-demand routing algorithm [9], the author describes mobile ad-hoc network (MANET) is a collection of mobile nodes which communicate over radio. These kinds of networks are very flexible, thus they do not require any existing infrastructure or central administration. Therefore, mobile ad-hoc networks are suitable for temporary communication links. The biggest challenge in this kind of networks is to find a path between the communication end points, what is aggravated through the node mobility. In this paper we present a new on-demand routing algorithm for mobile, multi-hop ad-hoc networks. The protocol is based on swarm intelligence and especially on the ant colony based meta heuristic. These approaches try to map the solution capability of swarms to mathematical and engineering problems. The introduced routing protocol is highly adaptive, efficient and scalable. The main goal in the design of the protocol was to reduce the overhead for routing.

In ant-based control (ABC) [10], the author describes a novel method of achieving load balancing in telecommunications networks. A simulated network models a typical distribution of calls between nodes; nodes carrying an excess of traffic can become congested, causing calls to belost. In addition to calls, the network also supports a population of simple mobile agents with behaviors modeled on the trail laying abilities of ants. The ants move across the network between randomly chosen pairs of nodes; as they move they deposit simulated pheromones as a function of their distance from their source node, and the congestion encountered on their journey. They select their path at each intermediate node according the distribution of simulated pheromones at each node. Calls between nodes are routed as a function of the pheromone distributions at each intermediate node. The performance of the network is measured by the proportion of calls which are lost. The results of using the ant-based control (ABC) are compared with those achieved by using fixed shortest-path routes, and also by using an alternative algorithmically-based type of mobile agent previously proposed for use in network management.

III.ARICHITECTURE DIAGRAM OF ANT OPTIMIZED LOAD BALANCE GEOGRAPHIC ROUTING SCHEME FOR MANET

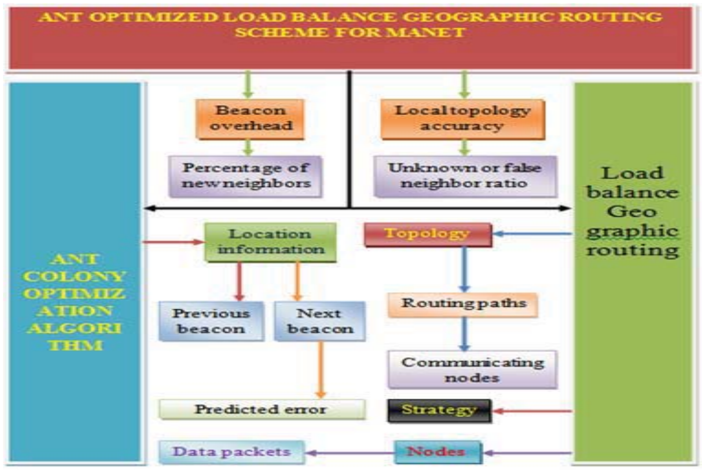

Figure1. Architecture diagram of Ant optimized load balancing technique

The phases involved in the proposed scheme are:

- On Demand Rule
- Ant Optimization for logical routers
- Load Balance with logical links

A. On demand Rule

The On demand rule maintains more accurate local topology in the regions of network where significant data forwarding activities are on-going. According to ODR rule whenever a node overhears a data transmission from a new neighbor it broadcasts a beacon as a response**.** By a new neighbor imply a neighbor who is not contained in neighbor list of this node. In reality a node waits for small random time interval before responding with beacon to prevent collisions with other beacons.

The data packet contains location of final destination any node overhears data packet also checks its current location**.** It determines if destination is within its transmission range**.** The destination node is added to list of neighboring nodes if it is not already present. In particular check incurs zero cost no beacons need to be transmitted.

The Neighbor list developed at a node by initialization phase and MP rule has basic list. The list is updated in response to mobility of node and its neighbors. ODL rule allows active nodes involved in data forwarding to enrich local topology beyond basic set. The rich neighbor list is maintained at nodes located in regions of high traffic load. The rich list is maintained only at active nodes built reactively in response to network traffic. All inactive nodes simply maintain basic neighbor list. By maintaining a rich neighbor list along forwarding path. The ODL ensures situations where nodes involved in data forwarding are highly mobile alternate routes easily established without incurring additional delays.

B. Ant optimization for Logical Router

The Ant optimized logical router consists of a data structure. The routing table is organized as a table with a row for every outgoing logical link, column for every zone and entries represent probability to select logical router at other end of logical link as a logical next hop**.** If destination coordinates are located within zone. The link-costs of all incoming logical links are stored in the route table and information used to determine quality of followed path by ants.The Ants and data packets are marked in header fields with source and destination coordinates**.** It keep track of followed path by storing coordinates of each intermediate relaying node. In order to limit their size followed path approximated by a sequence of straight lines**.** The information used for routing and updating of the two tables**.** The data packets and ants are routed in the same way.The Logical router determines in which zone destination coordinates are located then selects an outgoing logical link for that zone with probability given in routing table. The Redundant routing over multiple paths is supported naturally traffic load is shared proportionally between existing logical links.

C. Load Balance with logical link

The Load balance with logical links work on two kinds of ants to update routing table It Forward ants are launched periodically from every logical routers to randomly chosen destination coordinates d. The Neighboring logical routers coordinate forward ants for distant destinations as ants follow approximately same paths anyway keep track of the followed path. At the destination d they turn into backward ants which travels back over recorded path in reverse direction.

Backward ant is able to determine quality of path followed by forward ant using appropriate data stored in the link cost tables. It's arriving at any logical router backward ant updates routing table according to logical link costs encountered marks entries corresponding to its followed path with artificial pheromones. The natural pheromones artificial pheromones will also decay. If a path doesn't encounter any reinforcement for a long time eventually not be marked anymore. The updating pheromone trails for load balancing. The last logical router k at which packet was routed in different direction is determined due to path recorded in packet result in a logical router. The multiple logical hops away packet is considered to have arrived over logical link. It matches best to previously determined logical router over incoming logical link l that originates in zone to which logical router belongs.

The Load balancer is applied for routing over a logical link routes packets along a straight line. The Probability in routing table corresponding to logical link l and to zone in which backward ant's source router d is located is increased depending on measured and summed up link costs. At the source of the forward ant backward ant will be deleted.

IV. EXPERIMENTAL RESULTS AND DISCUSSIONS

In this section we evaluate performance of Ant colony load balancing geographic routing through NS2 simulation. To confirm the analytical results, we implemented Ant colony optimization algorithm in the system networking simulator ns-2 and evaluated **Ant Optimized Load Balance Geographic Routing (**AOLBGR) the performance of technique. The performance of is evaluated by the following metrics.

- Packet delivery ratio
- Energy Consumption
- Average speed

Table 1.Packet delivery ratio

Number of Node	Packet delivery ratio in Existing System	Packet delivery ratio in Proposed System
10	86.45	95.87
20	90.56	98.45
30	93.87	100.09
40	98.89	105.43
50	100.90	112.87

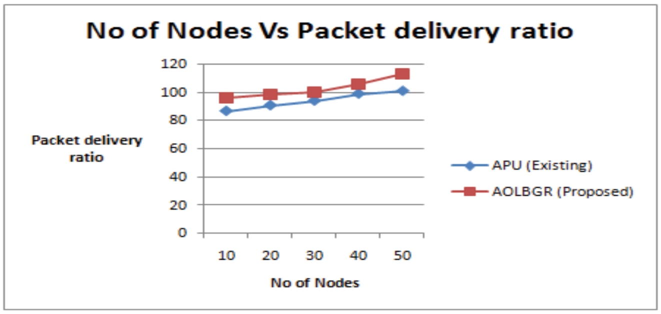

Figure 2. Packet delivery ratio

Figure 2 demonstrates the Packet delivery ratio. X axis represents the number of nodes whereas Y axis denotes the Packet delivery ratio using both the proposed Ant Optimized Load Balance Geographic Routing. When the number of nodes increased, Packet delivery ratio gets increases accordingly. The rate of Packet delivery ratio is illustrated using the existing APU and proposed AOLBGR. Figure 4.1. Shows better performance of proposed AOLBGR in terms of No of nodes density than existing and proposed Ant optimized load balance geographic routing method. Ant optimized load balance geographic routing 15 to 25% less Packet delivery ratio variation when compared with existing system

Table 2.Enegry consumption

Number of Node	Energy consumption in Existing System	Energy consumption in Proposed System
10	54	45
20	65	53
30	75	64
40	87	74
50	90	80

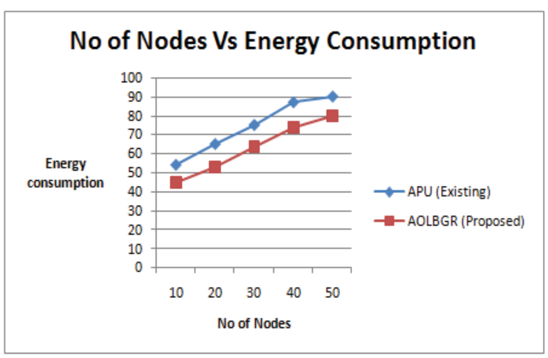

Figure 3. Energy Consumption

Figure 3 demonstrates the Energy consumption. X axis represents the number of nodes whereas Y axis denotes Energy consumption the using both the APU and our proposed Ant Optimized Load Balance Geographic Routing. When the number of nodes increased, Energy consumption also gets decreases accordingly. The Energy consumption is illustrated using the existing APU and our proposed Ant Optimized Load Balance Geographic Routing. Figure 4.2 shows better performance of Proposed Ant Optimized Load Balance Geographic Routing terms of nodes than existing APU and our proposed Ant Optimized Load Balance Geographic Routing. Ant Optimized

Load Balance Geographic Routing achieves 20 to 35% less Energy consumption variation when compared with existing system.

Table 3. Average Speed

Number of Node	Average in Existing System	Average in Proposed System
10	54	49
20	65	56
30	75	62
40	87	71
50	90	79

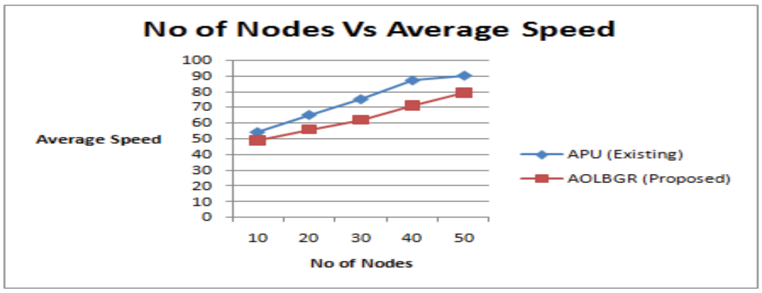

Figure 4. Average Speed

Figure 4 demonstrates the Average speed. X axis represents number of nodes whereas Y axis denotes the Average speed using both the APU and our proposed Ant Optimized Load Balance Geographic Routing. When the number of nodes increases the Average speed also gets increased. Figure 4 shows the effectiveness of Average speed over different number of nodes than existing APU and our proposed Ant Optimized Load Balance Geographic Routing Ant Optimized Load Balance Geographic Routing achieves 30% to 50% more Average speed when compared with existing schemes.

V. CONCLUSION

In this paper we performed a tradeoff analysis of energy consumption gain in reliability, timeliness, and security for nodes utilizing Ant Optimized Load Balance Geographic Routing to answer user queries. Finally, we applied our analysis results to the design of a Ant Optimized Load Balance Geographic Routing algorithm to identify and apply the best design parameter settings in Ns2. we implemented the proposed scheme, and conducted comprehensive performance analysis and evaluation, which showed its efficiency and advantages over existing schemes.

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