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ANT BASED INTELLIGENT ROUTING PROTOCOL FOR MANET

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Abstract- A group of mobile nodes that communicate with each other without any supporting infrastructure is a Mobile ad hoc network(MANET).The routing challenges faced is MANET are limited bandwidth, power energy and dynamic features. Bypursuing energy efficiency the energy consumed by the nodes that operate on the battery is very minimal.MANETs use a good technique for developing routing algorithms, Nature-inspired(swarm intelligence) such as Ant Colony Optimization(ACO).A discipline that includes natural and artificial systems, which include many individuals that work together in coordination using centralized control and self-organization in finding an optimal solution to a problem.To prolong the life span of overall communication network and minimizing the consumption of energy by the nodes in ACO we have proposed an energy efficient routing for MANETs.We have compared our proposed algorithm with the performance of the existing algorithm and network tool NS2 will be used for the simulation of the same.

I. INTRODUCTION

The important challenge faced in mobile networking is minimizing energy consumption. A significant amount of progress has been made by designing low-power hardware design for mobile devices that the wireless network interface uses, which is the single largest consumer of power. Power saving techniques could be by turning the radio off when the network is not in use. Practically a node must be turned on not to just receive packets addressed to it, but also participate in control and high level routing protocol. In a multi-hop ad hoc wireless network the basic requirement is cooperation between routing protocol and power must be acute so the nodes must forward packets to each other.

Following are the requirements that are required for a good power saving coordination technique for wireless ad-hoc networks. Compared to an active transmitter even an idle receiver circuit consumes the same amount of energy. Packets must be delivered from the source to the target with minimal delay is the nodes were to be awake.

The requirements mentioned above are fulfilled in our proposed algorithm. Each running node in the network makes periodic and local decisions, whether to stay awake or sleep as a regular node or coordinator to participate in the forwarding backbone topology. If a certain node realizes that two of itneighbouring nodes cannot communicate with each other with the existing coordinator it decides to volunteer to preserve the capacity. Taking the following two factors into account each node delays its willingness with a random delay:the number of neighbouring pairs it connects together and the remaining amount of battery level. The is all done by only using the local information.

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A. Contributions

In order to improve the network lifetime in this paper we present an Energy Efficient routing protocol for mobile Ad-hoc networks. The key aspects of our work are as follows:

B. Energy Consumption

Energy efficiency is an important consideration in such an environment. The nodes present in a MANET entirely rely on limited battery power for their energy. Maximizing the multicast energy-saving techniques and life span aimed at minimizing total power consumption of all the nodes in the multicast group should be considered.

II. RELATED WORK

Ant-E[1] inspired by Ant Colony Optimization utilizes a collection of mobile agents as 'ants' to perform the optical activities. This method also enhances the efficiency of MANET routing protocol.

SPAN[2] proposed a protocol for maximizing the lifetime of an Ad-hoc network by powering off the nodes as long as possible called Span. Decisions in Span can be made locally and produce a network without considerable decrease in capacity or increase in latency. The author of this paper believed that a power-save protocol should be able to send packets between any pair of nodes in the network with minimally more delays compared to every node being awake and also have nearly as much of the total capacity as the original network.

ARA [3] The Ant Colony Based Routing Algorithm for MANETs. A new on-demand routing algorithm for mobile, multi-hop ad-hoc networks is presented in thispaper. The introduced routing protocol which is based on swarm intelligence and ant colony optimization is highly efficient, adaptive and scalable. The main goal was to reduce the overhead for routing.

ACO[4] The rapidly changing and unpredictable nature of Mobile Ad-hoc networks. its wide range of challenges like load congestion avoidance, efficient routing, energy Consumption.

BECA/AFECA[5] This algorithm with the involvement of application – level –informationturns off the radio to reduce the energy consumption.

III.PROPOSED WORK

A) Span Design

From the available nodes coordinators are elected into the span network. Within this network these coordinators are constantly awake and perform multi-hop packet routing. While the rest of the nodes stay in power-saving mode and timely check if they need to wake up and become coordinator.

The span achieves the following goals :

- Makes sure that there sufficient coordinators are elected so that every node is in the range of at least a minimum of one coordinator.
- A rotation is carried out to ensure all the nodes share the task of providing global connectivity equally.
- It tries to minimize the number of elected nodes as coordinators, without incurring a significant loos of capacity or an increase in latency, which leads to the increase in network lifetime.
- In the election process each node consults state stored in local routing tables and in a decentralized manner the coordinators are elected using the local information.

Figure 1.

Three operations are involved for designing a Span[9]:

1) Coordinator Election

Packets from each flow need to continuously send and receive packets by the source and destination nodes. And they do not operate in power saving mode. Thus they routinely become coordinators.

The coordinators Selection Scheme takes such following factor

a) To ensure the stronger node the remaining battery capacity of the node and utility of the node into consideration the remaining battery capacity is used.

b) The radio range of a node is a measurement that if that node is selected how much more number of node connected the network would be and it is measured in how many more pairs of neighbor nodes that would be connected if the node was chosen as a coordinator.

2) Coordinator Announcement

The following coordinator eligibility rule in span ensures that the entire network is covered with enough coordinators:

Coordinator Eligibility rule: the node should become a coordinator if two neighbors of a non coordinator node cannot reach each other either directly or via one or two coordinators.

This election algorithm forms a network that roughly contains a coordinator in every populated radio range in the entire network topology and also does not provide the least number of coordinators vital to merely maintain connectedness. The packets are routed through coordinators to yield good capacity.

Before announcing itself as a new coordinator the Coordinator choice implemented is by manipulating a randomized back-off delay that a standard nodes uses. The issues in the delay is the effectiveness and remaining energy .

3) Coordinator Withdrawal

Each coordinator from time to time examines if it should extract as a coordinator. A node should extract if every pairs of its neighbors can reach each other either directly or via some other coordinators. However, in order to also make sure fairness, after a node has been a coordinator for some period of time, it withdraws if every pair of neighbor’s nodes can reach each other via some other neighbors, even if those neighbors are not presently coordinators. This rule gives other neighbors a chance to turn out to be coordinators.

Mobile ad-hoc networking has brought up much research in the area of competent routing protocols.

Sleep/awake approaches

In this Sleep/awake power save mode approach[2][8] focuses on motionless time of communication. When all the nodes in a MANET sleep and do not pay attention, data packets cannot be delivered to a destination node.
SPAN to chooses a Coordinator node, and lets it coordinate the communication on behalf of its neighboring as non-coordinator nodes. Now, non-coordinator nodes can carefully sleep most of time saving battery energy. Each non-coordinator node occasionally wakes up and communicates with the coordinator node to find out if it has data to obtain. In a multihop MANET, more than one coordinator node would be necessary because a single Coordinator cannot wrap the entire MANET, So Multiple Coordinators are selected.

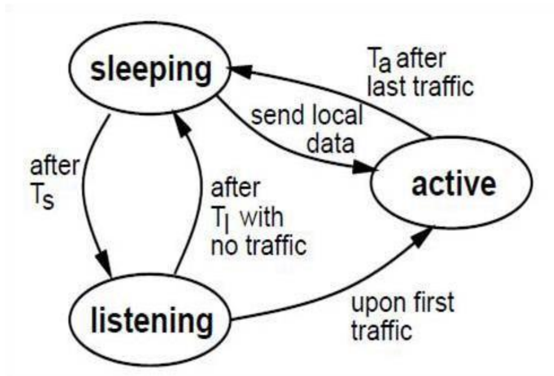

Figure 2

One of three states are nodes as shown in Fig. 2 as active, sleeping and listening. The node in theactive state is the coordinator node. All non coordinator nodes are in the sleep state and at regular intervals goes to listening state and the nodes including discovery messages are exchanged. To find a particular destination IDs are provided. If a node doesn't consider discovery messages it becomes a coordinator node. If there are more then one node, the node with the longest expected lifetime in the listening state becomes a coordinator.

B. Ant Colony Optimization

ACO routing algorithms take inspiration from the behavior of ants in nature and from the related field of ACO to solve the problem of routing in communication networks. The main source of inspiration is found in the ability of certain types of ants (e.g. the family of Argentine ants LinepithemaHumile) to find the shortest path between their nest and a food source using a volatile chemical substance called pheromone between the nest and the food source leave traces of pheromone as they move. They also preferentially go in the direction of high pheromone intensities. Since shorter paths can be completed faster, they receive higher levels of pheromone earlier, attracting more ants, which in turn leads to more pheromone. This positive reinforcement process allows the colony as a whole to converge on the shortest path. It forms the basis of most of the work in the field of ACO.

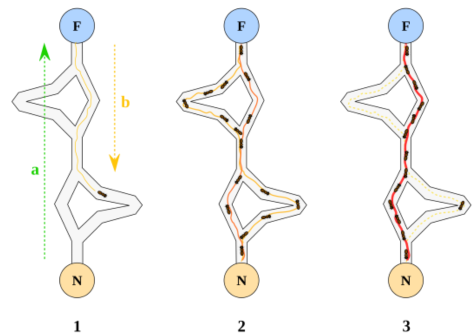

Figure-3

IV.ANT COLONY ALGORITHMS FOR MANET

A. ARA

Ant Colony Based Routing Algorithm (ARA) [6] which reduces overhead, because routing tables are not interchanged among nodes. It consist of three phases namely Route Discovery phase, Route Maintenance and Route Failure Handling. The Route Discovery phase consist of two mobile agents that is Forward Ant (FANT) for route request and other agent is Backward Ant (BANT) for route reply to create new routes. FANT packets have unique sequence number and source address is broadcasted by the sender and will be passing on by the neighbors of the sender. Node receiving the FANT for the first time generates a record with entries of destination address (Source address of FANT), next hop (address of previous node), and pheromone value (number of hops the FANT needed to reach this node). The destination node extracts information of FANT, destroys it and creates BANT which establish pheromone track to destination node.

B. AntNet

AntNet [7] which is based on two mobile agents traverse from source to destination d, to collect information regarding congestion, delay and path in network. These agents are Forward Ant (FA) and Backward Ants (BA). Source generates FA which uses routing table Tk which stores probability value Pnd for destination-neighbor pair, to find path to destination and record the route it has taken. When they reached at the destination FA dies and creates the BA which goes back to the source by moving along the same path followed by the FA but in opposite direction. During this traversal by BA, [8] it modifies routing table by increasing the routing probability of FA and decrease in probability of all other neighbor nodes, but this increase and decrease should be done at the total of all probabilities will remain 1.

C. AntHocNet

In AntHocNetduring reactive path setup, multiple routes are set on demand by broadcasting reactive FANT and gather information of about quality of path they followed. When node receives a number of ants in case of broadcasting, the node compares the path travelled by each new ant to that of former received ants of this generation and rebroadcast only if its number of hops and travel time are both within an acceptance factor of best forward ant. Once paths are setup, source starts sending proactive FANT to destination on the basis of pheromone values combine with small probability at each node of being broadcast. Hence route path discovered so far can be improved. During link failure node sends notification to its neighbors and updates routing table to give better packet delay and delivery ratio than AODV.

Table 1.Comparison between ARA, AntNet and AntHocNet

Parameters	ARA	AntNet	AntHocNet
Routing Overhead	Less	More	More
Routing Approach (Reactive or Proactive)	Reactive	Reactive	Both
Type of Information (collected by forward ants)	Cost of link	Congestion and delay	Quality of path
Ant Composition	Source IP address, dest IP address, sequence number and hop count	Source IP address, dest IP address, sequence number and memory	Source IP address, dest IP address, sequence number and next hop IP address, stack, hop count
Routing Table Composition	Destination address, next hop and pheromone value	Destination address, neighbor node and pheromone value	Destination address, next hop and goodness of next hop
Amount of Pheromone Deposit	Nondecreasing function of link costs	Constant	Function of total cost from source to destination

V. CONCLUSION

Ants-based routing algorithms have attracted the attention of researchers because they are more robust, reliable, and scalable than other conventional routing algorithms. Since they do not involve extra message exchanges to maintain paths when network topology changes, they are suitable for mobile ad-hoc networks where nodes move dynamically and topology changes frequently. From the above shown comparisson, for wired networks Antnet works best in maintaining the established paths as compared to other routing because Antnet chooses best paths based on probability. In ARA both forward and backward ants update pheromone value. AntHocNet algorithm improves the Energy efficiency, robustness and reliability. The efficiency of routing protocol AntHocNet is shown to better than other demand routing protocols.TheAntHocNet routing protocol uses a optimal path routing and fast route discovery. The Established paths provide reliable, Shorter and faster communication.

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