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# Enhancing DSR Power Awareness Using ACO

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***Abstract- A power awareness routing protocol for dynamic source routing (DSR) is introduced using ant colony optimization (ACO) technique. The goal is to increase the lifetime of network using different technique. To achieve this ACO is applied to DSR protocol to increase the efficiency of network. The best available path from source to destination is selected (based upon the number of nodes and residual energy of nodes) using ACO. It has been found that ACO gives better result as it is based upon the technique of Swarm Intelligence (SI) which is capable for finding the adaptive routing for such type of network.ACO is a natured inspired algorithm.***

***Keywords- Dynamic source routing, Mobile ad-hoc networks, Ant colony optimization, Quality of service, Energy efficient routing***

## I. INTRODUCTION

Mobile ad-hoc networks (MANETs) are special kind of networks in which the mobility of the nodes is quite high. No des can join or leave the network at any time as there is no fixed infrastructure and centralized control in MANETs. All nodes are supposed to be equal in processing power. The network is required to have self configuration by means of the cooperation among the mobile devices: all nodes operate as routers and are capable of discovering and maintaining routes to propagate packets to their destinations. The movement of mobile nodes requires the aid of quite complex routing algorithms, as routes are not stable and need to be updated continuously. Due to the dynamic nature of MANETs, route maintenance is quite difficult task. Basically, Routing is the process of choosing paths in a network along which the source can send data packets towards destination. Routing is an important aspect of network communication because the characteristics like throughput, reliability and congestion depends upon the routing information. An ideal routing algorithm is one which is able to deliver the packet to its destination with minimum amount of delay and network overhead. The nodes update the routing tables by exchanging routing information between the other nodes in the network. In contrast with infrastructure networks, MANETs do not need centralized infrastructures, such as base stations. MANETs should be self-built, self-configured, and adaptive to dynamic changes. In a conventional routing algorithm, which is unaware of energy budget, connections between two nodes are established between nodes through the shortest path routes. The battery power of mobile nodes is a limited resource, and there is no way to allow a device to live forever, hence techniques to maximize battery life are relevant. It however results in a quick depletion of the battery energy of the nodes along the most heavily used routes in the network. A power-aware routing protocol is the one that balances the traffic load inside the network so as to increase the battery lifetime of the nodes and hence the overall useful life of the ad hoc network.

## II. ROUTING

The Dynamic Source Routing (DSR) protocol is a simple and robust routing protocol designed specifically for use in multi-hop wireless ad-hoc networks of mobile nodes. The Dynamic Source Routing protocol (DSR) is based on source routing, which means that the originator of each packet determines an ordered list of nodes through which the packet must pass while travelling to the destination. The DSR protocol consists of two basic mechanisms: Route Discovery and Route Maintenance.

*I. Route Discovery*:

Route discovery is used only when a source node attempts to send a packet to a destination node and does not already know a route to it. To initiate the Route Discovery, the source node transmits a "Route Request" with a unique ID as a single local broadcast packet. When some intermediate node receives this Route Request, at first it determines whether it has seen the Route Request or not. If the node has already seen the Route Request earlier, it will discard the packet; otherwise it will check its Route Cache whether there is a route to the destination of the packet.

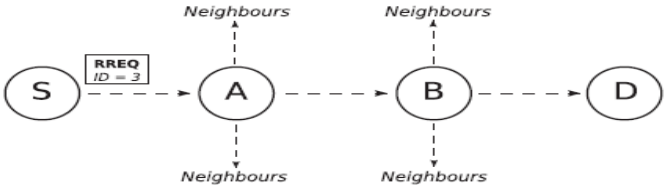


Fig. 1 Path discovery with RREQ

 

If it has the route to target in its routing cache, it returns a "Route Reply" to the initiator of the Route Discovery, giving a copy of the accumulated route record from the Route Request; otherwise it transmits the Route Request until the Route Request is received by the target .

*I. Route Maintenance:*

DSR protocol implements the route maintenance mechanism while communicating the packets from source to destination. But when the communication link between the source and the destination is broken or else a change in network topology is noticed. It will lead to failure of the communication between source node and destination node. In this scenario DSR protocols uses the route mechanism, to detect any other possible known route towards the destination to transmit data. If the route maintenance fails to find an alternative known route to establish the communication then it will invoke the route discovery to find the new route to destination.

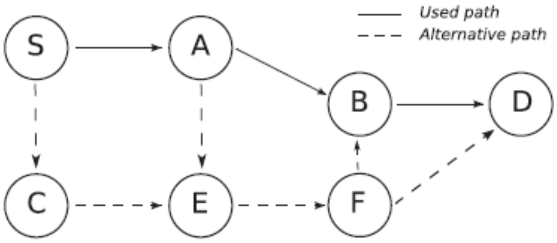


Fig. 2 Example path between source and destination

## III. ANT COLONY OPTIMIZATION

Ant colony optimization (ACO) takes inspiration from the foraging behavior of some ant species. These ants deposit pheromone on the ground in order to mark some favourable path that should be followed by other members of the colony. Ant colony optimization exploits a similar mechanism for solving optimization problems. Ant colony optimization (ACO) is a population-based meta- heuristic approach.

As the name suggests the technique was inspired by the behavior of ‘‘real" ants. Ant colonies are able to find the shortest path between their nest and a food source by depositing and reacting to the trail of pheromone which provide help to future ants towards optimal paths to food. Ants on reaching the destination; start a new route backward towards the source nest by following the same path and biases the path by depositing more pheromone on the shorter path. As time progresses, the pheromone on non-optimal paths evaporate while the pheromone on near-optimal paths is reinforced. The basic principle of ACO algorithms can also be applied to many other combinatorial optimization problems.

## IV. RELATED STUDY

Javad Vazifehdan et.al [1] proposes two novel energy-aware routing algorithms for wireless ad hoc networks, called Reliable Minimum Energy Cost Routing (RMECR) and Reliable Minimum Energy Routing (RMER). RMECR addresses three important requirements of ad hoc networks: energy-efficiency, reliability, and prolonging network lifetime. It considers the energy consumption and the remaining battery energy of nodes as well as quality of links to find energy-efficient and reliable routes that increase the operational lifetime of the network. RMER, on the other hand, is an energy-efficient routing algorithm which finds routes minimizing the total energy required for end-to-end packet traversal. RMER and RMECR are proposed for networks in which either hop-by-hop or end-to-end retransmissions ensure reliability. Simulation studies show that RMECR is able to find energy-efficient and reliable routes similar to RMER, while also extending the operational lifetime of the network. This makes RMECR an elegant solution to increase energy-efficiency, reliability, and lifetime of wireless ad hoc networks. In the design of RMECR, they consider minute details such as energy consumed by processing elements of transceivers, limited number of retransmissions allowed per packet, packet sizes and, the impact of acknowledgment packets. This adds to the novelty of this work compared to the existing studies.

Giampaolo Bella et.al [2] introduces a power-aware route maintenance protocol for Mobile Ad Hoc Networks (MANETs). Termed Dynamic Path Switching (DPS), the new protocol puts an overloaded node to sleep before a route link breaks because that node runs out of energy, and brings other suitable nodes into play instead. When the battery charge of a node reaches a stated level, the node can advance a request to change to a sleep state for a while. The request is honored unless survival of some path rests on the forwarding activity of that very node. All nodes are assumed to be collaborative. The DPS protocol is fully backward compatible, as it can be implemented within existing routing protocols such as Dynamic Source Routing (DSR). The new protocol has been extensively simulated with the established network simulator NS2. The findings indicate a much improved power awareness of the updated routing protocol with respect to the unadorned one. Power saving is particularly effective during long-lived sessions.

S. Soundararajan et.al [3] said that in mobile ad hoc networks, the on demand multi-path routing protocols addresses certain issues such as more message overheads, link failures and node's high mobility. More message overheads are caused due to increased flooding. Packets are dropped by intermediate nodes due to frequent link failures. Moreover the overall throughput and the packet delivery ratio are reduced in high mobility scenarios. In order to overcome the issues an efficient multi-path routing protocol ABMRLBCC (Ant Based Multi-path Routing for Load Balancing and Congestion

 

Control) based on Ant Colony Optimization is proposed. The best path for each ant is selected based upon the number of hops and travel time.

Bibhash Roy et.al [4] introduces that the complexity increases due to various characteristics like dynamic topology, time varying QoS requirements, limited resources and energy etc. QoS routing plays an important role for providing QoS in wireless ad hoc networks. The biggest challenge in this kind of networks is to find a path between the communication end points satisfying user's QoS requirement. Nature-inspired algorithms (swarm intelligence) such as ant colony optimization (ACO) algorithms have shown to be a good technique for developing routing algorithms for MANETs. In this paper, a new QoS algorithm for mobile ad hoc network has been proposed.

N.Umapathi et.al [5] describes, AntHocNet an algorithm for routing in mobile ad-hoc networks. It is a hybrid algorithm which combines proactive and reactive behavior to compute packet delivery ratio, end to end delay and overhead by varying the speed of the mobile nodes. The algorithm is based on proposed nature inspired, self organized algorithm of ANT colony optimization (ACO). The bit error rate of ANT algorithm in accordance with other algorithms (AODV, DSDV, DSR, ……) is computed including power consumption, time delay and packet loss.

Young-Min Kim et.al [6] proposes an ant colony optimization (ACO) based energy saving routing, referred to as A-ESR, for energy efficient networks. The proposed A-ESR algorithm firstly re-formulates the energy-consumption minimized network (EMN) problem, which is NP-complete, into a simpler one by using the concept of traffic centrality. After that, it solves the re-formulated problem by 1) letting the flow to autonomously be aggregated on some specific heavy-loaded links and 2) switching off the other light-loaded links. Simulation results show that the A-ESR algorithm can get better performance than previous works in terms of energy efficiency.

Javad Vazifehdan et.al [7] proposes several energy-aware routing algorithms for such ad hoc networks. The proposed algorithms feature directing the traffic load dynamically towards mains-powered devices keeping the hop count of selected routes minimal. They unify these algorithms into a framework in which the route selection is formulated as a bi-criteria decision making problem. Minimizing the energy cost for end-to-end packet transfer and minimizing the hop count are the two criteria in this framework. Various algorithms that is proposed differ in the way they define the energy cost for end-to-end packet traversal or the way they solve the bi-criteria decision making problem. Some of them consider the energy consumed to transmit and receive packets, while others also consider the residual battery energy of battery enabled nodes. The proposed algorithms use either the weighted sum approach or the lexicographic method to solve the bi-criteria decision making problem. They evaluate the performance of algorithms in static and mobile ad hoc networks, and in networks with and without transmission power control.

Sarala.P et.al [8] uses the Multipath dynamic source routing protocol (MPDSR) to discover multipath route under MANET nodes. The MPDSR protocol uses the local link information for the route discovery process. The MPDSR protocol is enhanced with ant colony optimization method to provide multipath route information using global link information. EMPDSR provides QoS factors such as end to end reliability. Network traffic, bandwidth and battery power factors make an influence over the route discovery process. Cost enabled route discovery is one of the considerable routing methods that enable the cost estimation with different metrics. The multipath routing protocols concentrates on the route discovery with end to end reliability factors. The EMPDSR protocol is integrated with fuzzy cost estimations techniques. Distance, network traffic, bandwidth and battery power metrics are used in the fuzzy cost enabled multipath dynamic source routing protocol.

## V. CONCLUSION

Mobile ad-hoc network, Dynamic source routing protocol, and ant colony optimization technique has been studied. It has been noticed that DSR protocol which is used for finding the available route does not always gives the best path to send the packets from source to destination. So to find the best path, a technique called ACO can be used.ACO is used to find the multiple paths. By using ACO, the efficiency of network or lifetime of network can be increased. As the energy of node is also considered for computation of path, the network lifetime get automatically increased. It is not necessary that ACO always gives shortest path to send packet, it can be more than that of shortest path.

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