A Novel Proposal to Optimize Energy Consumption of Nodes in DSR Protocol

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Abstract— A Mobile Ad-hoc Networks (MANETs) which is composed of a group of mobile and wireless nodes and completely infrastructure less. There are several issues needed to be addressed for smooth and effective functioning of MANET e.g. security, energy conservation, quality of service etc. One such issue for almost all kinds of mobile nodes supported by battery powers is energy conservation. Energy is a limited resource; hence, how to extend the lifetime of batteries is an important issue, particularly for MANET, Which is completely supported by batteries. This paper focuses on the extension of network lifetime. We propose a novel energy efficient DSR (Dynamic Source Routing) routing protocol which will be modified to improve the networks lifetime in MANET.

Key words: Mobile Ad-hoc Networks; Dynamic Source Routing; Energy Efficient; Dynamic Energy Threshold

I. INTRODUCTION

Mobile devices with wireless network interfaces become an important part of future computing environment consisting of infra-structured and infrastructure-less mobile networks. In wireless local area network based on IEEE 802.11 technology a mobile node always communicates with a fixed base station, and therefore a wireless link is restricted to at least one hop between the node and its neighbor base station, where Mobile ad hoc network (MANET) is a multi-hop infrastructure-less network where a node communicates with other nodes directly or indirectly through intermediate nodes. [1]

All nodes in a MANET function as routers participating in some routing protocol which are required for creating and then maintaining the routes. Since MANET are infrastructure-less networks, they are extremely used for applications such as military operations, special outdoor events, communications in infrastructure-less regions, emergencies and natural disasters. Routes between the nodes of an ad hoc network may include more than a single hop, hence, we call such networks ”multi-hop” wireless ad hoc networks. Due to the highly dynamic nature routing is the key issues in MANET [2]. Since mobile nodes are powered by batteries with limited capacity, energy efficient routing is one of the most important design criteria for MANET.

Failure of a mobile node due to power not only affect the node itself but also its ability to forward packets and it also affect the lifetime of a network. When a mobile node is actively sends or receives packets it means it is in active mode, and when it is listening to the wireless medium for any possible communication requests from other nodes this mode is known as idle mode. A mobile node consumes its battery energy not only when it is in active mode, but also when it is in idle mode [3]. So, energy-efficient routing protocols minimize this battery consumption by minimizing active communication energy required to transmit and receive data packets.

In this paper, we aim to provide a mechanism that is used to increase network lifetime. In Section II, DSR protocol is discussed. In Section III, focus is on current state of analysis work done for energy related problems in MANET. Section IV presents our proposed scheme in detail. With conclusions in section V follows references at the end.

II. BACKGROUND THEORY

A. Dynamic Source Routing (DSR) Protocol:

The Dynamic Source Routing protocol (DSR) is designed specifically for use in multi-hop mobile ad hoc networks it’s very simple and efficient routing protocol. Here sender itself knows the complete route of nodes to the destination. One advantage of using DSR is that no need of sending periodic router updates and advertisements [4]. DSR uses source routing algorithm every information packet in DSR consists total routing information from source to destination. Each node in DSR maintains a cache which has route information from source to destination.

1) Route Discovery:

When node S is to send message to the destination node D, it first queries if there exists route from S to D in the routing buffer. If so, then source node S sends message according to the route, otherwise route discovery program is launched, meanwhile source node S floods route request packet RREQ, When intermediate nodes receive the RREQ message, they test RREQ for the repetition of message. If repetition of request message is found, they are abandoned, otherwise attach their address to the route record in the head part of packet, and then send this packet to all the adjacent nodes. When the destination node finally receives RREQ packet, it copies and reverses the route record of the RREQ packet and sends the route reply message RREP to the source nodes, and returns route response message RREP to source node S. Source node buffers the route information locally for future use when receives the RREP packet [5].

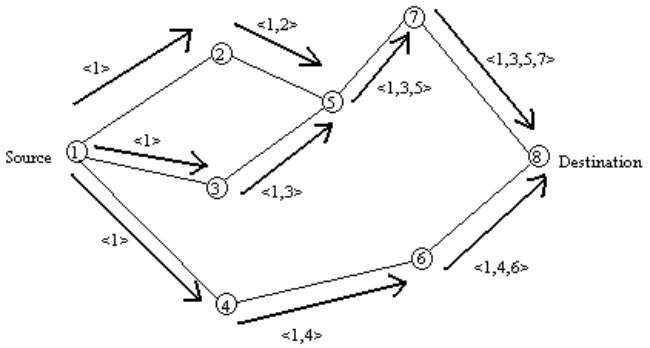

Fig. 1: Building record Route during route discovery

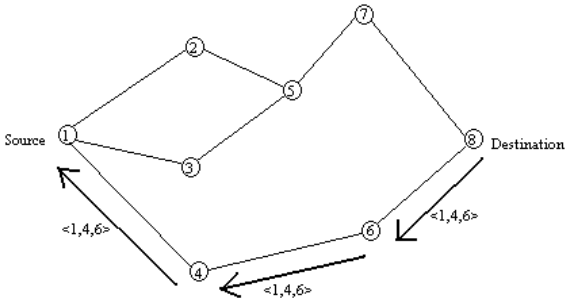

Fig. 2: Propagation of route reply with the route record

2) Route Maintenance:

Once some nodes find the neighboring link that data is to be sent by is disconnected, they immediately send a route error message RERR to source node S. When the source node receives the error packet, it deletes all the routes that use the invalid link from the buffer, and starts a new route discovery process if necessary. The nodes that forward the error packet along the way delete all the route in the broken link from their own routing table [6].

The route discovery procedure of DSR protocol often discovers many routes from source node to destination node. And route with minimal hop is more possible chosen for data transmission than others, the nodes frequently chosen are more likely to consume more energy, which results in short usage of battery.

III. Related Work

In 2006, Yuhong Luo, Jianxin Wang and Songqiao Chen, at el. [7] Proposed An E-DSR routing protocol, which combined with the new route selection mechanisms and mobility prediction to reduce energy cost.

In 2007, Yang Tao and Wei Luo, at el. [8] Proposed a method to optimize the routing energy and set dynamic priority weight to select the routing to aim at saving energy.

In 2010, Linyang Sheng, Jingbo Shao, Jinfeng Ding, at el. [9] Proposed an improved scheme of DSR as NCE-DSR for routing protocol, the improved method is simple and energy saving routing protocol. Moreover, hardware overhead related to obtaining electricity parameter is also reduced, and the system is more compatible

In 2012, Mehdi Barati , Kayvan Atefi, Farshad Khosravi,Yashar Azab Dafial, at el. [10] compared DSR and AODV routing protocols for mobile Ad hoc network on the basis of energy performance.

In 2013, Sheetal Sisodia, Sandeep Raghwanshi, at el. [11] Compared the performance of DSDV and DSR. All the results conclude that DSR protocol is efficient in mobile ad-hoc network and also provide energy saving and energy aware mechanism of the nodes and destination location information so that the overhead is minimized.

In 2013, Kok-Poh Ng, Charalampos Tsimenidis at el. [12] proposed a multipath Energy-balanced Dynamic Source Routing (EB-DSR) protocol that is fully distributed and computationally efficient. The results from simulations have shown that without sacrificing packet delivery performance, EB-DSR can effectively prolong the network lifetime by routing the data away from low-energy nodes

IV. Proposed Work

We proposed an approach for extending the network lifetime when using DSR routing protocol in MANET.

A. Flowchart of Proposed Method:

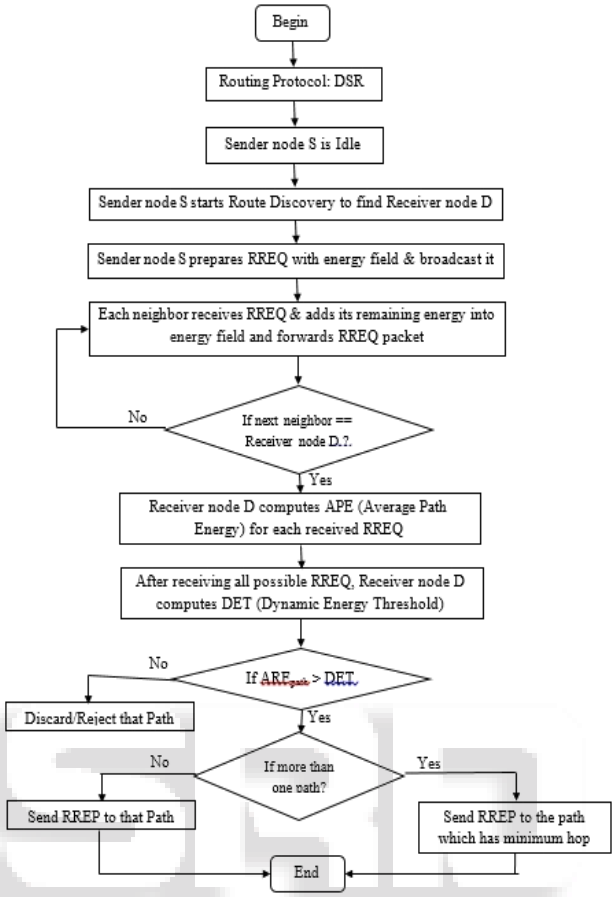

Fig. 3: Flowchart of Proposal Work

B. Implementation Steps of Proposed Method:

1) Routing Protocol: DSR (Dynamic Source Routing)
2) Sender node S is Idle.
3) Sender node S starts Route Discovery to find Receiver node D.
4) Sender node S prepares RREQ with energy field & broadcast it. Let's assume that energy field value as $E_p = 0$ for each individual path p.
5) Each neighbor receives RREQ & adds its remaining energy into energy field and forwards RREQ packet.

$$E_p = E_p + E_{int}$$

6) Where E_{int} is energy of an intermediate node i and E_p is total energy of a path p.
7) If (neighbor node is not equal to Receiver node D) {Goto step 5.}
8) Receiver node D computes APE (Average Path Energy) for each received RREQ.

$$APEpath = \frac{Ep}{no.ofhops}$$

Where E_p is total energy of a path p and no.of hops is the total number of hop counts in path p.

9) After receiving all possible RREQ, Receiver node D computes DET (Dynamic Energy Threshold)

$$DET = \frac{\sum_{i=1}^{p} Ei}{\sum_{i=1}^{p} Hi}$$

Where Ei is total energy of a path p and Hi is the total number of hop counts in path p.

10) If (AREpath > DET) {
If (more than one path)
{
Send RREP to the path which has minimum hop
}
Else
{
Send RREP to that Path
}
}
Else
{
Discard/Reject that Route
}

V. CONCLUSION

There are several issues needed to be addressed for smooth and effective functioning of MANET e.g. security, energy conservation, quality of service etc. One such issue for almost all kinds of mobile nodes supported by battery powers is energy conservation. Energy is a limited resource; hence, how to extend the lifetime of batteries is an important issue, especially for MANET, which is totally supported by batteries. In this paper, we proposed a solution based on considering the energy of each node in DSR routing protocol, as because each node's energy state has a huge influence on the entire network lifetime; would be a great solution for energy-efficient routing protocols. In future, we are going to implement proposed method for DSR routing protocol in Network Simulator 2.

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