Power Awareness on Demand Routing Protocol for MANET

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ABSTRACT

Mobile ad hoc networks (MANETs) are autonomously self-organized networks without infrastructure support. Nowadays mobile devices in MANET are battery operated. Power is an important factor in MANET. In a mobile ad hoc network, nodes move arbitrarily; every node may be required to perform routing in order to achieve end-to-end communication among nodes. These networks are energy constrained as most ad hoc mobile nodes today operate with limited battery power. Hence, it is important to minimize the energy consumption of the entire network in order to maximize the lifetime of ad hoc networks. On Demand –driven reactive Protocols used for MANET. The variant of power aware AODV and DSR protocols are available in reactive protocol. So it will focus on any one variant of that and it will incorporate some new mechanism which will select energy efficient route based on link stability, residual energy level.

Keywords

MANET, Power Aware, AODV, DSR, Residual Energy

1. INTRODUCTION

MANET is a temporary wireless network formed by a group of mobile nodes which may not be within the transmission range of each other. The nodes in MANET are self-organizing, self-configuring, self-maintaining and characterized by multi-hop wireless connectivity and frequently changing topology [1].MANET usually consists of battery-operated computing devices which cooperate with each other to transmit packet from a source node to a destination node. The availability of each node is important for the enforcement of such cooperation. The failure of a single node can greatly affect the network performance. Since mobile nodes are usually battery operated, one of the major reasons of node failure is battery exhaustion. In order to maximize the life-time of a mobile node, it is important to reduce the energy consumption of a node while transmitting packet.[2]

Limited battery life is a very critical issue in MANET. So energy efficient protocol must to increase the lifetime of nodes and networks. Main purpose of power aware routing protocols is to maximize the lifetime of network. It's nearly impossible to recharge or replace node batteries in network. So reducing power consumption is only way to extend lifetime of network.

Routing protocols are usually classified as table driven or on-demand routing protocols. Table driven routing protocols also called proactive protocols which maintain continuous view of the full topology of the network in each node. On demand protocols also called reactive protocols which search for a route between source and destination.[3]

2. CLASSIFICATION OF ROUTING PROTOCOLS FOR MANET

MANET routing protocols could be broadly classified into two major categories: Proactive and Reactive.

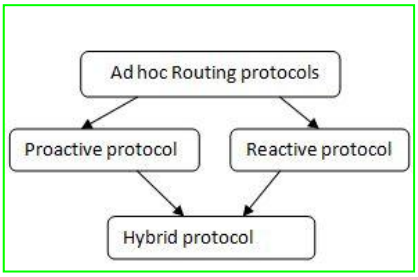

Fig 1: Classification of Routing Protocols

2.1 Proactive Routing Protocols

Proactive routing protocols are also called as table driven routing protocols. Here every node maintains routing table which contains information about the network topology even without requiring it. The routing tables are updated periodically whenever the network topology changes. Proactive protocols continuously learn the topology of the network by exchanging topological information among the network nodes. Thus, when there is a need for a route to a destination, such route information is available immediately. If the network topology changes too frequently, the cost of maintaining the network might be very high. If the network activity is low, the information about actual topology might even not be used. Proactive protocols are not suitable for large networks as they need to maintain node entries for each and every node in the routing table of every node [4]. These protocols maintain different number of routing tables varying from protocol to protocol. The well known proactive routing protocols. are DSDV, OLSR, WRP etc.

2.2 Reactive Routing Protocols

Reactive routing protocol is also known as on demand routing protocol. Here route is discovered whenever it is needed Nodes initiate route discovery on demand basis. Source node sees its route cache for the available route from source to destination if the route is not available then it initiates route discovery process. The reactive routing protocols are based on some sort of query-reply dialog. The on- demand routing protocols have two major components [5]: They are route discovery and route maintenance.

2.3 Hybrid Routing Protocols

Often reactive or proactive feature of a particular routing protocol might not be enough; instead a mixture might yield better solution. Hence, in the recent days, several hybrid protocols are also proposed. Based on the method of delivery of data packets from the source to destination, classification of MANET routing protocols could be done as follows:

- Unicast Routing Protocols: The routing protocols that consider sending information packets to a single destination from a single source.

- Multicast Routing Protocols: Multicast is the delivery of information to a group of destinations simultaneously, using the most efficient strategy to deliver the messages over each link of the network only once, creating copies only when the links to the destinations split. Multicast routing protocols for MANET use both multicast and unicast for data transmission.

Multicast routing protocols for MANET can be classified again into two categories: Tree-based multicast protocol and Mesh-based multicast protocol. Mesh-based routing protocols use several routes to reach a destination while the tree-based protocols maintain only one path.[5]

Table 1: On-Demand Routing Protocols

Protocol	Advantage	Disadvantage
Proactive	Latency is reduced. Information is always available.	Routing information is flooded in the network. Overhead is high.
Reactive	Path available when needed overhead is low and free from loops.	Latency is increased in the network.
Hybrid	Suitable for large networks and up to date information available.	Complexity increases

3. OVERVIEW OF ON -DEMAND ROUTING PROTOCOLS

Our power-aware source routing algorithm belongs to reactive routing protocols. So in this section, we start with a general review of two on -demand routing protocols, Dynamic Source Routing (DSR) and Ad -hoc on -demand Distance Vector (AODV), in MANETs. These protocols initiate route discovery only when a route is needed and maintains active routes only while they are in use.

3.1 Dynamic Source Routing (DSR)

Dynamic Source Routing (DSR) is a reactive protocol based on the source route approach [6]. In *Dynamic Source Routing (DSR)*, the protocol is based on the link state algorithm in which source initiates route discovery on demand basis. The sender determines the route from source to destination and it includes the address of intermediate nodes to the route record in the packet. DSR was designed for multi hop networks for small Diameters. It is a beaconless protocol in which no HELLO messages are exchanged between nodes to notify them of their neighbours in the network[7].

3.2 Ad Hoc On-Demand Distance Vector Routing (AODV)

AODV is basically an improvement of DSDV. But, AODV is a reactive routing protocol instead of proactive. It minimizes the number of broadcasts by creating routes based on demand, which is not the case for DSDV. When any source node wants to send a packet to a destination, it broadcasts a route request (RREQ) packet. The neighboring nodes in turn broadcast the packet to their neighbors and the process continues until the packet reaches the destination. During the process of forwarding the route request, intermediate nodes record the address of the neighbor from which the first copy of the broadcast packet is received. This record is stored in their route tables, which helps for establishing a reverse path. If additional copies of the same RREQ are later received, these packets are discarded. The reply is sent using the reverse path. For route maintenance, when a source node moves, it can reinitiate a route discovery process. If any intermediate node moves within a particular route, the neighbor of the drifted node can detect the link failure and sends a link failure notification to its upstream neighbor. This process continues until the failure notification reaches the source node. Based on the received information, the source might decide to re-initiate the route discovery phase.

4. OTHER RECENT WORKS ON MANET ROUTING

Network performance is key issue in MANET research. There has been some study on power aware routing protocols for MANET. Presented below is a brief review of them. In [8, 9], a node holds the RREQ packet for some time, inversely proportional to its residual energy. Hence, paths with nodes that are poor in energy will have minimal chance to be chosen. In [10], the Residual Energy-aware Probability Model of Node (REPMN) is proposed. In this, on receiving a RREQ, if the residual energy *Er* of the current node is superior to a certain threshold THr than the RREQ is forwarded with a probability 1, else it's forwarded with a probability $\mu \times (Er/THr)$ where μ is a variable coefficient that should increase as the average energy of the network decreases. In [9], a routing algorithm based on minimizing the amount of power required to get a packet from source to destination is proposed. The main disadvantage of [9] algorithm is that it always select the least-power cost routes. So as a result because of the battery energy exhaustion, nodes die soon. So it will be better to use a higher power cost route. The previous observation rise to number of battery cost aware routing algorithms as described below.

1. Minimum battery cost routing algorithm which minimizes the total cost of the route by provides minimizing the summation of inverse of remaining battery capacity for all nodes on the routing path [10].

2. Min-Max battery cost routing algorithm is a modification of the minimum battery cost routing which attempts to avoid the route with nodes having the least battery capacity among all nodes in all possible routes. So it results in better use of the battery of each node [9] [10].

3. In [10], Conditional Max-Min battery capacity routing algorithm was proposed. In this algorithm the route with minimal total transmission power is selected if all nodes in the route have remaining battery capacities higher than a threshold; otherwise, routes that consist of nodes with the lowest remaining battery capacities are avoided. Some experiments have been performed

in [10] to compare different battery cost aware routing. As per result of reports, the minimum battery cost routing exhibited superior results compared to the Min-Max battery cost routing. Results of Min-Max routing are depending on how threshold value was selected.

5. In [11], Power aware source routing (PSR) is proposed which uses state of the charge of battery to maximize the lifetime of MANET. This protocol adds a power aware routing metric into DSR. PSR try to find a route π such that properly defined route cost functions are minimized.

5. SCOPE FOR RESEARCH

Our main goal is to improve the performance of existing on demand routing protocols. The basic idea behind our work is to find nodes with dynamic route to the destination, having energy level above than threshold value.

The two common on-demand routing protocols are dynamic source routing (DSR) protocol and ad-hoc on demand distance vector routing (AODV) protocol. We select AODV protocol to implement our proposed scheme because AODV is an efficient routing protocol which removes unnecessary and outmoded information quickly, and does not create traffic unless necessary. Also AODV can react to topological changes that have an effect on active routes rapidly. AODV performs better in scenarios with extra load and/or higher node mobility; as a result it's more scalable than DSR.

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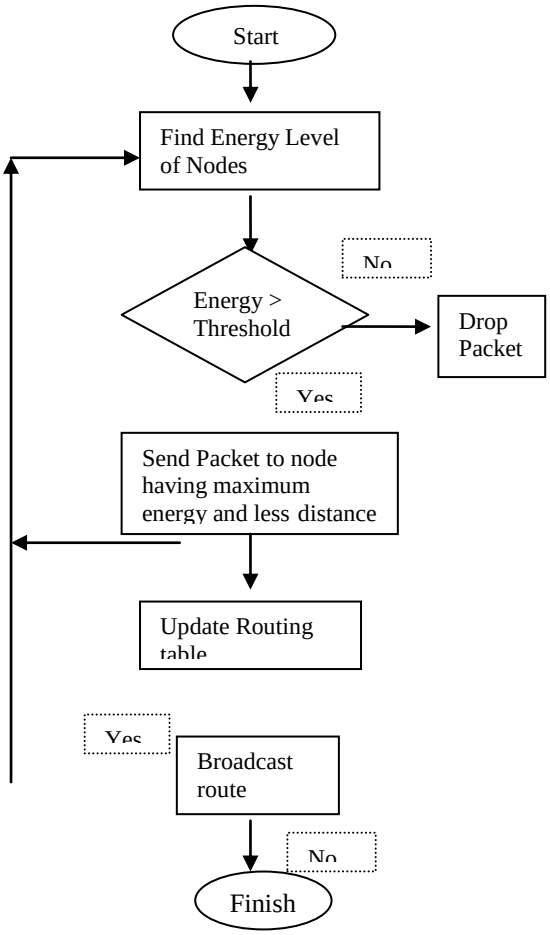

Fig 2: Effective Node Discovery

In the proposed work, the main goal is to find neighboring nodes with an active route to the destination. As shown in fig.2, energy status of all nodes in the network are found

Any node in the network wants to communicate with another node then source node broadcast message to know status of energy level of all other nodes. Based on threshold value which defines by default, energy levels of nodes are compared with threshold. Only those neighboring nodes that have energy levels higher than the threshold are eligible to participate in route discovery. Nodes having Energy level above than threshold are picked, from that node having maximum energy and less distance is selected and packet will send to that node. As the scheme has both distance and energy metrics, Local repair of the active path is automatically built-in the scheme.

6. CONCLUSION

Energy management born out of limited battery capacity of wireless nodes is a challenge to be tackled in MANETs. In this paper, a mechanism is proposed for MANETs using on demand routing protocols in order to maximize the lifetime of the network. The main goal is to improve the performance of existing on demand routing protocols. The proposed scheme to AODV works on a reactive approach and make use of alternate paths by satisfying a set of energy and distance based threshold area. It achieves improvement in the lifetime of the entire network

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