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Power Aware Routing Protocol for Manet: A Review

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***Abstract* - This paper presents a detailed analysis of recent work in power aware routing protocols in Mobile Ad hoc Networks (MANETs). Ad hoc wireless networks are power constrained i.e. the nodes in the MANET have limited battery. Thus power conservation in Ad hoc network is a major challenging issue. To conserve the power of mobile nodes various power aware routing protocols have been proposed.The purpose of a routing protocol for MANETs is to support the transmission of packet from a source to all the destinations along with trying to minimize the consumption of power in transmission. The Study of this paper will not only help us to get an overview of the existing protocols but also suggest which protocol may perform better with respect to varying network scenarios.**

Keywords: Wireless Ad Hoc Networks; MANET; Power Consumption; Power Aware Routing Protocols.

1. INTRODUCTION

MANETs stands for Mobile Ad hoc Networks. Mobile implies "mobility". Ad hoc is a Latin word and it means "for this only". A Mobile ad hoc Network (MANET) are group of wireless mobile nodes connected with each other via radio waves without any central access point. The mobile nodes in ad hoc networks can move arbitrarily thus the topology of network changes dynamically. Each node operates not only as a node, but also as a router to forward the packets. The nodes can directly communicate only when the participating nodes are located within each other radio range. If the destination node is outside the radio range of sender node, then message is not sent through a hope node between the two. These networks are self configurable (i.e. the mobile nodes in the MANET dynamically establish routes among themselves to form their own network in an ad hoc fashion so that user can move at anywhere at any time) and autonomous (i.e. no central access point) systems consisting of routers and hosts. MANET communication between mobile users is becoming more popular than ever before. This is due to recent technological advances in laptop computers and wireless data communication devices, such as wireless LAN s and wireless modems.

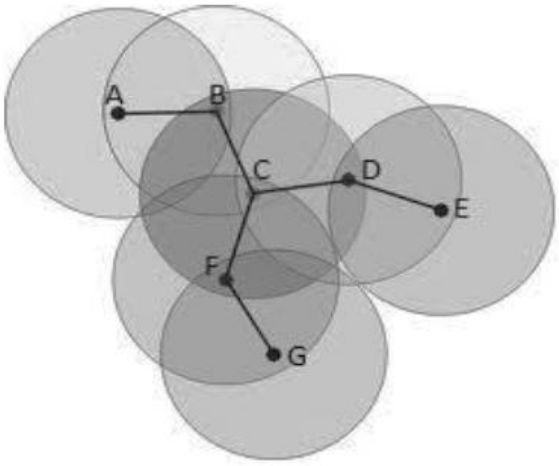

Fig. 1. A Mobile ad hoc network

According to dynamic topology of Ad hoc networks, routing and communication between the nodes in these networks have been challenging missions. To overcome this challenge, many protocols for routing in MANET have been presented. For Ad hoc network protocols may be classified as Table-driven (proactive) routing protocol and reactive (On-Demand) routing protocols.

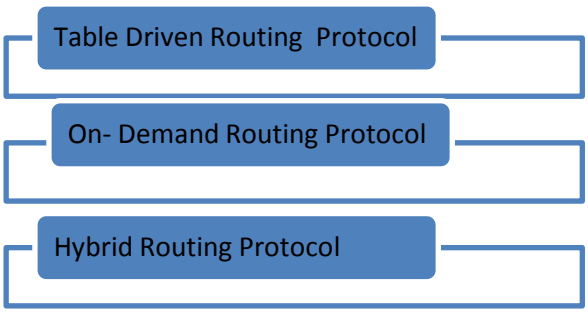

Fig 2. Routing Protocols

I. Table-driven (proactive) routing

In Table-driven (proactive) routing Protocols each node maintains one or more tables containing routing information to every other node in the network. All nodes update this table so as to maintain consistent update view of the network. The examples of table driven protocols are – Destination Sequence Distance Vector (DSDV), Cluster Head Gateway Routing Protocol (CGRP) and Wireless Routing Protocol (WRP) etc.

II. Reactive (On-Demand) routing

It is also called on demand routing. It is more efficient than proactive routing. In reactive (On-Demand) routing Protocols It is more efficient than proactive routing protocol. The concept use in this type of routing is to find a route between a source and destination whenever that route is needed while in proactive routing protocol we were maintaining all routes without regarding its state of use. Discovering the route on demand avoids the cost of maintaining routes that are not being used and also controls the traffic of the network because it doesn't send excessive control messages. E.g. of Reactive protocols are Ad-hoc On Demand Distance Vector (AODV), Dynamic Source Routing (DSR).

Iii. Hybrid Routing
Hybrid protocols are the combinations of reactive and proactive protocols and take advantages of previous two protocols. In this protocol routes are found quickly in routing zone. E.g. Zone Routing Protocol.

Table 1. Comparison

Routing protocol	**Advantage**	**Limitation**
1.Table-driven (proactive)	Information is always available.	1. Complexity increases when the network size increases. 2. Overhead in maintaining Routing tables.
2. reactive (On-Demand)	1. Over head is low. 2. Path is available when needed.	1. Network is congested on excessive flooding of packets.
3.Hybrid Routing	Suitable for large networks and up to date information available.	Complexity increases

Paper Outline The rest of the paper is organized as follows: Section 2 presents power issue in MANETs. Sections 3 present the detailed analysis of various categories ofad hoc routing protocols and Section 4 presents the overall comparison based on the review presented. Finally Section 5 concludes the reference papers.

2. POWER AWARE ROUTING PROTOCOLS: A SURVEY

In multi-hop wireless mobile ad-hoc networks, Nodes are powered by batteries. When nodes send their data to another node then battery is consumed for each transmission. Thus in Ad hoc network a mobile node consumes power when it is active in the network or stays idle. So extending the battery lifetime and saving the battery or transmission power has become a challenging mission. So it wants a better routing protocol that considers more concentration on ad hoc network. To achieve this challenge various routing protocol have been designed by various researcher. All protocols have focused on the optimization of energy consumption of mobile nodes from different point of view. So it wants a better routing protocol that considers more situations on ad hoc network at the same time. A better routing protocol not only increase life time of networks but also speed up data delivery between mobile nodes and consider limited energy of nodes. Routing in MANETs has been an active area of research and in recent years numerous protocols have been introduced for addressing the problems of routing. Power aware routing protocols are just modification in the current ad hoc routing protocols like Dynamic Source Routing Protocol (DSR), TORA and Ad-hoc On-demand Distance Vector Routing Protocol (AODV) .There are various Power aware routing protocol such as Minimum total power routing protocol [1], minimum battery cost Routing protocol [3], Power aware source routing protocol [5]. These power routing protocol are used to maximize the battery power of mobile nodes.

3. POWER EFFICIENT ROUTING PROTOCOLS

3.1 Minimum Total Transmission Power (MTPR):
MTPR [1] tries to select a path that has minimum total transmission power. A node that requires a path to a distant node broadcast RREQ to all its neighbors. This process continues at each and every intermediate nodes till the packet reaches to a destination node.The destination node receives RREQs from various nodes but selects the path with minimum total transmission power. Since the transmission power is inversely proportional to the distance. So this protocol selects the more number of hopes to extend the distance.

Algorithm:

1. Calculate the total transmission power for all the routes in the network.

2. Select the route with minimum total transmission power among all the routes.

Limitations:

- The network will be congested as the packet has to routed from multiple nodes.
- More number of nodes are active.
- It will always select the nearest neighbor node. So battery is exhausted very quickly if all these nodes are used for every transmission.

3.2 Minimum Battery Cost Routing (MBCR):

MBCR [3] prevents nodes from being overused. In MBCR used battery cost function which is inversely proportional to the battery capacity. As the battery capacity decreases the value of the cost function increases. As a result the nodes which have little battery capacity still may be selected for transmission.If all nodes have similar battery capacity, it will select shorter hop route.

Algorithm:

1. Find the total battery cost for each route from source to destination.

2. Select the route for transmission which having minimum total cost among all routes.

Limitations:

- Some hosts may be overused because a route containing nodes with little remaining battery capacity may be selected again and again.

3.3 Min-Max Battery Cost Routing (MMBCR):

Min-max battery cost routing (MMBCR) [4][5] overcomes the limitation of remaining battery capacity of MBCR. It treats the node fairly. The nodes with smaller remaining battery capacity are avoided and ones with larger battery capacity are picked up for transmission.In this algorithm instead of summing the battery cost function of all nodes of the individual routes, select the battery cost which is maximum among all nodes of route.

Algorithm:

1. For each route, select battery cost function which having maximum value among all nodes in the route.

2. Now select the route with minimum battery cost among all routes.

Limitations:

- No guarantee that minimum total transmission power paths will be selected under all circumstances[5].
- Consume more power to transmit node traffic from a source to a destination, which will reduce the lifetime of all nodes [5].

3.3 Conditional Max-Min Battery Capacity Routing (CMMBR):

The CMMBCR [2] presents a hybrid method that selects a route favored by either the MTPR or the MMBCR by using a given threshold **γ**, which is a percentage value of hosts' initial energy between 0 and 100.CMMBCR considers both the total transmission energy consumption of routes and the remaining power of nodes.When all nodes in some possible routes have sufficient remaining battery capacity (i.e., above a threshold), a route with minimum total transmission power is chosen among these routes.If all routes have nodes with low battery capacity (i.e., below the threshold), a route including nodes with the lowest battery capacity must be avoided to extend the lifetime of these nodes.

Algorithm:

1. For each route 'j' find the minimum capacity ('Rj') among all nodes in that route.

2. If Rj>=Y is true for some or all routes between a source and destination.

- Apply Minimum Total Transmission Power Routing (MTPR) scheme to select path among all routes which satisfying above condition.

3. Else

- Select the route 'i' with the maximum battery capacity.

Limitation:

- How to select the value of Threshold (**γ**).

3.4 Power Aware Localized Routing Protocol (PLR):

This Protocol is Localized, fully distributed energy aware routing algorithm. It assumes that a source node has location information of its neighbors and destination. Therefore it knows the link cost from source node to its neighbors, all the way to the destination. Having all this information source node cannot find the optimal path but can choose next hop through which the transmission of packet consumed less power[4].

4. CONCLUSION

A mobile ad hoc network (MANET) consists of independent mobile nodes, each of which communicates directly with the nodes within its coverage range. An efficient routing protocol is required to facilitate reliable communication within a MANET. In this review paper we studied various energy efficient routing protocol with their certain limitation. Thus we conclude that each protocol have their own characteristic features and performance parameter which varies according to the variation in the network parameters.In other words, one routing protocol cannot be a solution for all energy efficient issues that are faced in MANETs. So research is still continued to design the protocol which could provide all the performance parameter.

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