

A Survey on Improving the Lifetime of the Network in Mobile Adhoc Network

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Abstract – Mobile Ad-hoc Network (MANET) is a wireless network established without any pre-determined topology. The mobile node in the network operates not only as a host but also as a router in forwarding packets to other mobile nodes in the network. Each node contains a limited resource constraint such as battery power, bandwidth, etc. Since nodes are dynamic, energy drains quickly. Energy consumption and selecting an efficient path are major challenges in this type of network. Lots of approaches have been proposed in developing an energy efficient route. This paper presents some latest approaches that provide the energy efficient route in delivering the packets from source to destination and also enhance the lifetime of the network.

Key Words – MANET, Energy Efficient route survey, Network Lifetime

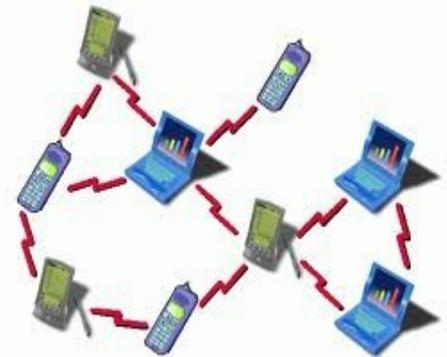


Figure 1 Mobile Ad hoc Network [3]

I. INTRODUCTION

Mobile Adhoc NETWORK (MANET) is an autonomous network formed by connecting mobile routers through wireless links [1]. The routers are dynamic and hence the network topology changes frequently. The routers in the network communicate wirelessly in a self-organised manner. This type of network is widely used in the area where there is no other wireless communication infrastructure present or where such infrastructure cannot be used. All nodes in such networks are mobile, so energy is one of the most important and vital issues for those ones.

Many approaches have been developed in consuming the energy and also in improving the lifetime of the network [2]. But routing algorithm plays an important role in finding an energy efficient route because routing algorithm decides which node has to be selected for communication. An example of MANET is shown in figure 1.

The nodes in the network depend on their battery power during transmission of packets. The energy drain of a particular node depends upon the transmission energy of a node, data packet size send through the particular node and queue status of a node. Queue status of a node overcomes the congestion problem which wastes the network energy unnecessarily.

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The rest of the paper is organized as follows. Section 2 presents the challenges in MANET. Section 3 briefly describes routing protocols in MANET. Section 4 presents related work involved in MANET. Section 5 describes and classifies energy efficient algorithms for MANET. Section 6 provides conclusion.

II. CHALLENGES IN MANET

Since there are limited resources available in MANET, there are lots of challenges [4] [5] faces by this architecture and are categorized as follows:

- 1) Limited bandwidth:** Wireless links usually have lower capacity compared to wired networks.
- 2) Dynamic topology:** Nodes in the network moves freely, thus the network changes dynamically and changes rapidly at unpredictable times.
- 3) Routing Overhead:** Since nodes in the network are movable routes to the destination changes often. So, some stale routes are formed which leads to unnecessary routing overhead.
- 4) Battery constraints:** Since the devices are portable, charging at work place are not possible. So all devices are fitted with battery power
- 5) Security threats:** The nodes in the network are connected through wireless links, so security for the data is quite a challenge in this type of network.

III. ROUTING PROTOCOLS IN MANET

Routing protocols are the set of standards or rules. Routing is the process of selecting the paths in the

network to send the network traffic. There are three types of routing protocols: Proactive protocol, Reactive protocol and Hybrid protocol. The protocols are selected depend upon the network capability.

A. PROACTIVE PROTOCOL

In proactive protocol, each node in a network maintains routing information about the entire network topology. The routing tables are updated periodically [6]. Each node broadcast the messages to the entire network whenever there is a change in the network topology. Hence, additional overhead cost occurs due to the updation of routing table periodically. Finally this leads to degradation of throughput in the network. Destination Sequenced Distance Vector (DSDV), Optimized Link State Routing protocol (OLSR) are some of the examples of proactive routing protocol [7].

B. REACTIVE PROTOCOL

In reactive protocol, the routing process is initiated whenever there is a demand. If the source wants to send message to destination, first it will broadcast the Route Request (RREQ) packet to all other neighbors. An intermediate node then checks whether it has route to destination or not in its routing table. If it has a route then the RREQ packet is send to the destination through that route and Route Reply (RREP) is send to the destination else an intermediate node will broadcast the RREQ to its neighbors and the process continues until RREQ packet reaches the destination [8]. Dynamic Source Routing (DSR), Ad-hoc On Demand Routing (AODV) and Associativity Based Routing (ABR) protocols are some of the examples of reactive routing protocol. In DSR, the entire routing information is maintained in the packet header [9] whereas in AODV source routing is not present.

C. HYBRID PROTOCOL

Hybrid protocol invokes the advantages of both proactive protocol and reactive protocol [10]. Zone routing protocol is an example of hybrid protocol. In this protocol, the inter zone network uses proactive protocol and the intra zone network uses reactive protocol.

IV. RELATED WORK

Many works have been done in MANET to provide a robust and secure communication. Since mobile nodes are portable, security for data packets are not clear [11]. Since MANETs are mainly used in the battle field, recovery areas etc., data send through the network should not be known to the attackers. So the number of approaches and algorithms has been developed in providing a secure and reliable communication. The energy consumption of the mobile nodes is also high due to the dynamic nature of the network. Since nodes in the network have limited resource constraints energy drains quickly in case of high dynamic, network overload etc. Hence improving the lifetime of the network becomes a major challenge in today's network.

V. LITERATURE REVIEW

Maximum Energy Level Ad Hoc Distance Vector (MEL-AODV) protocol selects the energy efficient route using residual energy of each node involved in the path. The source wishes to send data packets to destination initiate the route request process. A new field known as accumulated energy is added into the RREQ. When the intermediate node receives the RREQ packet, it updates the accumulated energy field by its residual energy. At the destination the total energy of each route is calculated. Then the accumulated energy field of all the routes are compared. The route having the highest accumulated energy is selected as the best route and the RREP is send along the particular path. Then the source sends the data packets through that path [12].

Energy Efficient Maximum Lifetime Ad-hoc Routing (EEMLAR) [13] protocol also calculates the residual energy of each node but at the destination the optimization function is used to calculate the energy efficient path instead of comparing with other routes.

Initially threshold value for both signal strength and residual energy is set. At each intermediate node, the signal strength and residual energy are compared with threshold value. Based on the comparison reliability count value is incremented. In destination, by calculating and comparing the reliability factor for each path the best route to the destination is selected. The protocol used is signal strength and energy aware routing [14].

The method AODV-Sleep [15] changes the mode of the node to sleep if its energy level reaches the minimum threshold value. Before going to the sleep mode, it checks the remaining energy of the neighboring node. If the energy of neighbor node is greater than 50 then the routing table updation is performed on the node and the new route is established through that node.

Energy Efficient Enhanced AODV Routing protocol selects the path based upon the residual energy, traffic density and the stability of the node until the time T. The route reply is send along the corresponding paths. Source node calculates the power loss level by subtracting the received energy from the transmitting energy of the particular path. Then the data packet is send along the path having low power loss level [16].

Efficient Power Aware Routing Protocol (EPAR) [17] identifies the best path using Mini-Max formulation. Destination node selects the path with maximum lowest hop energy. But the mobility prediction of the node is not considered. In Efficient Power and Life Aware Routing (EPLAR) protocol [18], the mobility prediction of the route is also considered and finds an efficient path to destination.

The Transmission Energy (TE) of each node is also used to calculate the energy efficient path. Each node checks whether the residual energy of the node is less than the transmission energy or not. If it is less than TE then the node will broadcast the request to neighboring nodes and change the mode to sleep. Otherwise it is involved in the route to destination. At destination the total transmission energy of the route is calculated. The energy efficient route is selected on the basis of minimum total transmission energy of the path [19].

The Intelligent energy efficient routing protocol [20] proposes a SPAN algorithm. SPAN algorithm selects “coordinators” from the network. The coordinators are selected based upon the remaining energy level. Only the coordinators are combined to form a route to the destination. The remaining non-coordinators nodes are put to sleep mode. The network is selected with high coordinator node to ensure better communication. The algorithm is analyzed for both heterogeneous and homogeneous network. If the network doesn't contain as many coordinator nodes as possible then this algorithm will not suits. The ant colony optimization algorithm [21] is used to find the shortest path from source to destination.

Many routing algorithms have been developed to provide an energy efficient route. To make a congested free network an Energy Efficient Routing (EER) algorithm [22] considers queue occupancy as one parameter. The queue status of a node ensures efficient delivery of the data packets. The node does not provide service to only one source destination pair; it may deliver data packets from many sources. So if the queue status of the node is high it will simply discard the route request message.

The lifetime prediction of a node can also be used to improve the lifetime of the network. The lifetime of a particular node is selected based upon the last N values of residual energy. The lifetime of the nodes except source and destination are calculated using the formula in [23]. The route request message with minimum cost is accepted by an intermediate node and then forwards to neighboring nodes. At destination, the route having minimum total cost is selected as energy efficient route.

VI. CONCLUSION

A Mobile Ad-Hoc network is a network of mobile devices which does not require any wired infrastructure for intercommunication. A node can move in any direction & it acts as a router. Thus energy consumption is a major issue. In this paper, the various methods for conserving energy is discussed. To conserve energy, the transmission power control and load balancing approaches are used. The sleep/power-down mode approach focuses on reducing the energy during the idle state. So the main concern for conserving power of nodes in MANET and increasing the lifetime of network is to consider the remaining energy of node before sending the data through it.

VII. REFERENCES

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