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A Review Article on Energy Efficient Routing Algorithm in MANETs

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Abstract
With the rapid evolution in the mobile computing field, the new alternatives are derived in which mobile devices form a self-creating, self-administering and self-organising wireless networks. Mobile Ad Hoc Network (MANET) is one such arbitrary network in which all the nodes are mobile and consists of limited battery power and channel bandwidth. These Ad Hoc networks are often used in emergency situations. The frequent change in topology leads to more consumption of energy, therefore saving power in such situations is of prime importance. In this paper, we will try to make some improvements in the already exciting energy efficient routing protocols in order to get better results. We will find minimum distance from source to destination by changing the route request phase. In this way, the energy of nodes with not suffers from inefficiency.
Keywords: AODV, Mobile Ad hoc Networks, Energy Efficiency and Routing.

1. INTRODUCTION:

MANET is one of the most emerging field research and development of wireless network. It has now become one of the most vibrant and active field of communication in wireless technology due to the increased popularity of mobile devices and wireless networks over the past-years. MANET is a self-configuring and infrastructure-less network. The devices and nodes are free to move independently and thus can change their links with other devices in any direction frequently. The primary challenge in the creation of MANET environment is to continuously maintain the required information to route the traffic properly. Routing is one of the main issues in the MANETs due to their highly dynamic and distributed nature. Such networks can operate by themselves or by connecting themselves to the larger internet and may contain more than one transceiver. This results in a highly dynamic and autonomous topology. Figure 1 shows the mobile ad hoc network consisting of various mobile nodes each having a particular route to another node.

In particular, the most important design criteria for MANETs is energy efficient routing, since mobile nodes will be powered by batteries with limited capacity. The main objectives of MANET routing protocols are to maximize network throughput, maximize energy efficiency, and maximize network lifeline and minimum delay. The current routing protocols in MANET for an ad hoc mobile wireless networks are classified into three categories based on routing strategy which are as follows:

Reactive Routing Protocol: It is an on demand routing protocol. Reactive protocol maintains no predetermined paths for communication instead find a path between source destination pair only when it is required. This protocol searches for the route in an on demand manner and establishes the connection in order to transmit and receive the packet. AODV and DSR are on demand routing protocols.

Proactive Routing Protocol: It is a table-driven protocol. Proactive routing protocol each node sends a broadcast message to the entire network if there is a change in the network topology. It maintains the routing information even before it is needed. Routes information is generally kept in the routing table and updated in a periodic manner.

Hybrid Routing Protocol: This Protocol is a combination of Reactive and Proactive routing protocol. It is hybrid routing protocol that combines the best features from the reactive and proactive protocol.

Advantages of MANET

The following are some of the important application related to MANET:

- Business application,
- Military application,
- Emergency operations,
- Home, office, and educational applications,
- VANET,
- Wireless sensor networks, mesh networks, etc.

Overview of AODV

AODV is a very simple, efficient and effective routing protocol in Mobile Ad hoc networks that do not have fixed topology. It is intended for networks that may contain thousands of nodes. The source, destination and the next hop are addressed using the IP addressing. It was an improvement to the algorithms DSDV and DSR.

AODV is very useful and desired algorithm as it obtains the routes purely on-demand. The protocol contains two type of phases for the operation to take place. These two phases are: Route Request Phase (RREQ) and Route Reply Phase (RREP). The nodes in the network contain the routing table that contains the information about the destination node. Routing table contains the fields like Destination IP address, Destination Sequence number, Network interface, Next hop. In the figure 2, the dotted line shows the route request phase from one node to the other and while route reply phase follows the reverse path. The figure shows the working of AODV routing protocol.

Working of AODV

Each node in the network act as a special router and find routes as per requirement. When a packet is to be sent from source node to destination node and there is no specific route present for it, then a route discovery process is initiated to locate the destination. A node broadcast a RREQ (Route Request) packet to their neighbours, which forwards the request to their neighbours and so on. This process is carried out until the destination is located. When RREQ packet is forwarded, the intermediate nodes record in their routing tables the address of neighbours from which RREQ was received, thereby establishing the reverse path. When the RREQ reaches the destination node, it replies back with a RREP back to its neighbour from which it first arrived at the RREQ. RREP is routed along the reverse path and nodes along this path set the forward entries in their route tables that point to the node from which RREP came. In this way a source can send its packet to the destination via established path.

2. LITERATURE SURVEY

Many researchers have done work in this field and everyone has used different idea and different mechanisms. Thamizhmaran Krishnamoorthy in his research has used the concept of residual energy. It has proposed an enhanced AODV routing protocol. This system aims at maximising the lifetime of mobile ad hoc networks by delivering sensed data across multiple hopes with different energy levels. The model performed the route discovery process similar to AODV protocol but in addition considered the residual energy of the node and hop count along the path towards the sink. Min-RE (Minimum Residual energy) field is added to the RREQ message and set with a default value when a source node broadcasts a new RREQ message for route discovery process. With every node receiving the RREQ packet, MIN-RE is updated. [10]

Another research by Ashlyn Antoo has created a protocol known as E-HDS Enhanced hybrid drive scheme for power saving. This model combined the features of PSM as well as RTS-CTS scheme. PSM (Power Saving Mechanism) was provided by IEEE 802.11 which reduced the power consumption by the transition of mobile stations between the awake state and doze state. In PSM, time is divided into beacon interval, beacon frames are transmitted for synchronizing all nodes. When a source node has a data packet to send, RTS frame is being sent to the destination and the destination node responds with the CTS frame. In this scheme, a single beacon frame is transmitted per beacon interval instead of transmitting beacon frame after each data transmission. This reduces the wastage of energy. [6]

Divya Sharma, Manish Yadav, Hari Kumar in 2015 formed a routing algorithm referred to as MAODV. They modified the route reply by dividing it into two phases. In the first phase, the destination node will send route reply packet to one of the intermediate nodes having the minimum distance. In the second phase, a threshold is being set to compare the energy level of nodes. The node having the energy level less than the threshold will not acknowledge the route reply packet. In this way it could find the path with minimum distance and maximum energy level. [1]

AL-Gabri Maleka, Chunlin LIb, Zhiyong Yang, Naji Hasan.A.Hd,Xiaoqing Zhang in 2012 proposed simple but efficient balance energy consumption among all Participating nodes. They have proposed a LEA-AODV that reduces energy consumption, and leads to prolong battery life at the terminals. LEA-AODV is based on one of the most important routing protocols Ad hoc On-Demand Distance Vector (AODV). Each node uses the local information about its own battery during the searching of a route to decide whether if to take part in the route selection process or not. It is implemented in the process of route discovery. When a RREQ message is flooded in the network, not every intermediate node, which receives the message, will broadcast it [14].

3. NEW TECHNIQUE

In normal AODV, the destination node upon receiving the route request message, reply back to source node via paths from which the route request came. The source node chooses the path having lowest hop count to forward the data to destination. In the study done by Divya Sharma et al. the authors have modified the route reply phase for the ad hoc on demand distance vector routing protocol. Therefore in modified AODV, the authors have divided the route reply in two phases. In First phase, destination node will reply to one of the intermediate nodes with minimum distance. In Second phase, threshold is being set for all the nodes and if any node suffers from inefficient power than it will not acknowledge the RREP packet, and the packet will be forwarded through

different route with second lowest minimum distance. In this way not only energy is being conserved but also minimal distance is also selected for communication.

This approach has a drawback that the reply phase depends upon acknowledgement procedure to confirm if the node has energy greater than threshold value. Secondly, the route request phase also causes redundant broadcasting of request packets. For example, a node might receive multiple request packets from the different nodes. This process leads to delay and more energy being consumed in the network. So here again arises the issue of energy wastage which can be solved using a new modified technique.

4. CONCLUSION

In the proposed work we aim at reducing the energy consumption in the route request process while the packets are being forwarded in search of path for destination node. The nodes in the proposed route request phase will forward their energy levels and location of the destination to the neighbour nodes along with route request packets. We are using destination's location to make intelligent route request forwarding. Every node will find the neighbours to which the route request needs to be broadcasted. Then it will compare the location of the neighbours with the location of the destination node. If any neighbour node is lying in the quadrant that is towards the destination node only then it will be considered for forwarding the packets. Also if any node is receiving multiple route request packets then it will not accept the redundant request packets. This modified route request forwarding phase will save energy and will lead to increase in lifetime of the network.

When the route request will reach the destination node, the destination node will calculate the energy value of the nodes received. It will choose the path having highest energy instead of following the ACK procedure. According to the proposed scheme we aim at finding the route to destination from source node using modified route request phase and the scheme is named as MAODV. Using this method, Further we will compare the performance of the network on the basis of parameters like energy consumption, delay and throughput.

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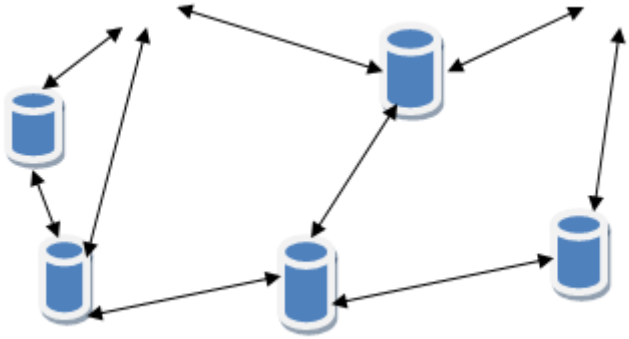

Figure: 1 shows the mobile ad hoc network consisting of various mobile nodes

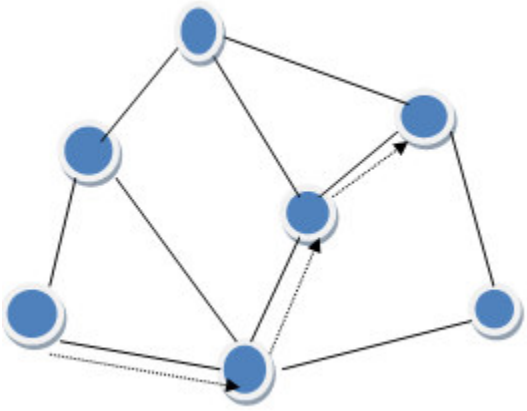

Figure 2: route request phase from one node to the other