Review of Various Techniques for Energy Aware Routing Protocol for MANET

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Abstract—MANET is mobile adhoc network which is relay on power of network. Battery is important factor in MANET. MANET is collection of nodes which are move freely and changing the topology of network. AODV is on demand protocol. Energy of nodes is effect of network lifetime. Blind flooding in aodv which are improving contention in network also it increased higher number retransmission. In the proposed algorithm which modifies the conventional aodv which find more stable path improve the performance better than conventional AODV.

Key words: AODV Routing Protocol, MANET

I. INTRODUCTION

A mobile ad hoc network (MANET) is one subsist of a set of mobile hosts which can operate separately with-out infrastructure base stations[1].Due to no need for any fixed infrastructures, MANET can help communications in the situations that it is hard to deploy base stations, such as battlefields, disaster areas, and etc. It is also a prospective candidate to solve the "last-mile" problem for broadband Internet service providers. With these characteristics, MANET has attracted a lot of attention recently [2]. The Ad hoc On Demand Distance Vector (AODV) routing algorithm is a routing protocol designed for ad hoc mobile networks. AODV is capable of both unicast and multicast routing. It is an on demand algorithm, meaning that it builds routes between nodes only as desired by source nodes. It maintains these routes as long as they are needed by the sources. Additionally, AODV forms trees which connect multicast group members. The trees are composed of the group members and the nodes needed to connect the members. AODV uses sequence numbers to ensure the freshness of routes. It is loop-free, self-starting, and scales to large numbers of mobile nodes. To find a route to a particular destination node, the source node broadcasts a RREQ to its immediate neighbours. If one of these neighbours has a route to the destination, then it replies back with a RREP. Otherwise the neighbours in turn rebroadcast the request. This continues until the RREQ hits the final destination or a node with a route to the destination. At that point a chain of RREP messages is sent back and the original source node finally has a route to the destination.

II. ENHANCED AODV PROTOCOL APPLIED TO ENERGY MEAN VALUE

AODV Protocol and DSR protocol use similar algorithms in a Route Discovery process by using RREQ and RREP control message in the route searching process, when a flooding is initiated. Mobile nodes create a Reverse path based on neighbouring nodes that send the RREQ message. And when RREQ message reaches to destination node, a Forward path is generated.

When AODV activates a flooding RREQ message, AODV sets a Reverse Path towards the node which sent the RREQ message to each mobile node's routing Table of its own. When the RREQ message arrives at its destination node. A RREP Message is transmitted through the created Reverse Path for the construction of a Forward Path.

This paper explains our research to find out how to extend the entire network lifetime by efficiently consuming the limited battery power in mobile nodes, which is one of the biggest constraints in establishing an AODV (On - demand routing. protocol) platform Ad-hoc network.

Traditional AODV constructs a route path by using basic route discovery algorithms regardless of a node's energy status. In that case, energy consumption rises dramatically if a node holds many paths, which will force the node to fail to participate in the network. In order to extend the entire network lifetime by reducing the energy concentration on a certain node in the network and distributing it to the whole network, the energy state of each node & the entire network should be considered. Based on this observation, the following experiment is made to increase the entire network lifetime through the delaying method of RREQ flooding by considering the node's energy state & the entire node's Energy Mean Value [3].

III. SIGNAL STRENGTH BASED ROUTE SELECTION IN MANET

In the MANET, one of the major concerns is how to reduce the link failure due to the mobile node in the network, for this stable route is required which is more flexible in mobile networks. Stable route in MANETs is a route that is established for an acceptable period for transmission. For this purpose in this paper, we propose a new method for routing in MANETs that created routes have more stability. In this method we use signal strength metric to route the data to the destination. The following cases are used to forward the data over the network.

A. *Route Discovery*

When the route is needed, the source sends the RREQ packet to his entire neighbour after that intermediate node does following steps:

First it checks the signal strength of the packet if it is greater than SIGNAL THRESHOLD value then it process the request the otherwise it discard this RREQ packet then intermediate node checks its routing table for the desired destination. If it found then send a reply to the source otherwise it forwards the RREQ to his neighbour.

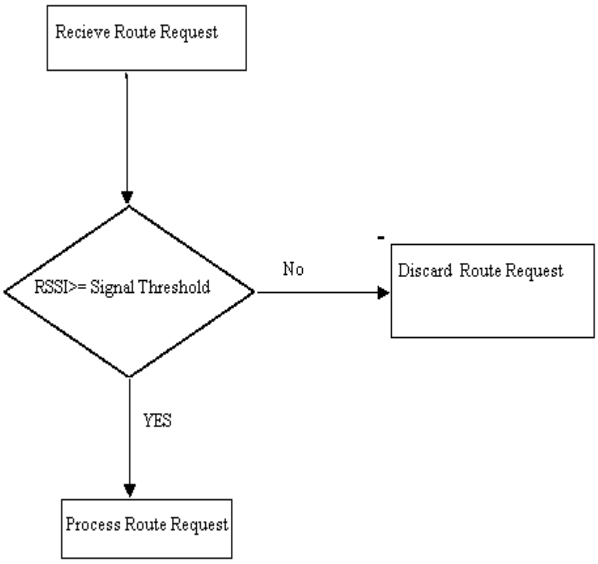

Fig. 1: Processing of Route Requesting SSAODV

B. *Route Selection by source node*

When several RREPs receive to the source node, it can select the best RREP based on minimum hop count and start sending data.

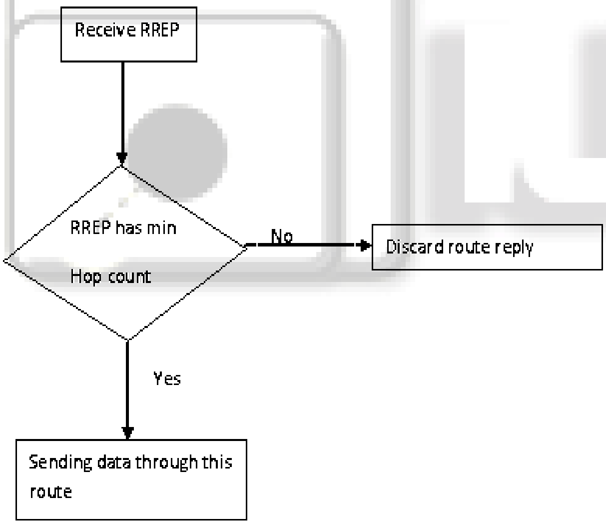

Fig. 2: Route selection in SSAODV

$$P_r = \frac{P_t \cdot G_t \cdot G_r \cdot {h_t}^2 {h_r}^2}{d^4 \cdot L}$$

P_r: Power received at distance d
P_t: Transmitted signal power
G_t: Transmitter gain (1.0 for all antennas) Gr: Receiver gain (1.0 for all antennas)
d: Distance from the transmitter
L: Path loss (1.0 for all antennas)
h_t: Transmitter antenna height (1.5 m for all antennas)
h_r: Receiver antenna height (1.5 m for all antennas)

C. *Simulation parameters*

The RSSI value is calculated with the help of two ray ground model Request otherwise it discards this RREQ packet then intermediate node checks its routing table for the desired destination. If it found then send a reply to the source otherwise it forwards the RREQ to his neighbour [4].

IV. POWER CONSERVATION

Power Saving Techniques in Mobile Device, There are many techniques for the optimization of power consumption. Some of these include the following

Disk Scheduling- One method of energy conservation is to spin down a disk in its idle time. The spin down delay is the amount of time the disk is idle before it spins down. Two parameters which are used to decide powers saving of disc are:

1) Frequency of sleep and
2) Length of sleep

   They claim that, with shorter delays, the disk gets to sleep for a longer time and hence save more power. The drawback of spinning down a disk after such short delays is the time and energy needed to spin up the disk, which results in user delay.
3) CPU Scheduling-The power consumed by a processor is directly proportional to the supply voltage, the switching capacitance of the various devices and the frequency of the clock. The power required by the CPU is given by:

   CPU Required Power=CV2 F

   Where, C is the total capacitance of the wires, V is the supply voltage and F is the operating frequency.

   There are various algorithms proposed for adjusting the clock frequency in idle time. The main idea behind it to balance the CPU usage between bursts of utilization and idle times. Task or process scheduling can be an effective way of accomplishing this.
4) Memory Allocation- In mobile devices, one of the highest consumers of power are memory instructions. Since many small devices do not have a secondary storage, the power consumed by memory is very crucial and needs to be optimized.
5) There are two types of hardware policies for determining the states of the memory chip:
6) Static: Every power-aware DRAM chip is in the same power mode when there are no outstanding requests for that device.
7) Dynamic: In this strategy, the OS tries to predict the requests based on the access patterns and access times to power down the chips to a lower state [5].

V. LINK STABILITY AND ENERGY AWARE ROUTING PROTOCOL (LSEA)

In this technique, our focus is mainly in showing how to improve the route discovery process whenever a source node attempts to communicate with another node for which it has no routing information.

$$LET = \frac{-(a+b) + \sqrt{(a^2+c^2) + c^2 - (ad-bc)}}{(a^2+c^2)}$$

We get the link lifetime between any two nodes using equation. When the link lifetime between any two nodes equal, that imply after 1 second the link between those two nodes will breaks. In LSEA, when there is data to transmit, the source node broadcast a RREQ, the neighbouring nodes decides whether to forward the RREQ based on its remaining battery as well as the expiration time of the link with the RREQ sender. In essence, simplicity, together with effectiveness, is one of the major goals of our work. Our LSEA is different from all previous work in a way that on receiving a RREQ at any node, it can decides immediately whether to forward the RREQ or not based on its remaining battery as well as the expiration time of the link with the RREQ sender, rather than all nodes forward any RREQ and give the destination a chance to select one RREQ that contain nodes having a good link lifetime among them in case of link lifetime used as metric or that contain nodes having a good power level in case of power used as metric. Hence in LSEA the question rose up, why the node forward a RREQ while the link lifetime with the RREQ sender going to break and can't reach the RREQ sender to send back a RREP or the node energy level is very low and this node going to die soon. In addition, sending any RREQ will incur more overhead and at the end only one RREQ will select to create a path through it.

For instance in Fig. when S tries to sends data to D with no data available for D in S routing table. S broadcast a RREQ packet and all its neighbours will receive this packet. In conventional AODV, nodes 1, 2, 3 and 4 will rebroadcast the RREQ if they don't have a valid route to D.LSEA node 1 will check the link lifetime with S. Node 1 find out that a link lifetime is good (more than 3second). Then it will go to check the second condition which is the energy level. Node 1 finds out that it has very low energy level. Simply according to our scheme it decides to discard the received RREQ. The same thing will happen with node 3, as it has a good energy level (more than 3) but the link lifetime with node S is very weak and likely will broke after 0.3 second. So, node 3 will decides to discards the RREQ. In this example the only node allow to rebroadcast the RREQ is node 2 as it satisfied our requirement for energy level and the link lifetime [6].

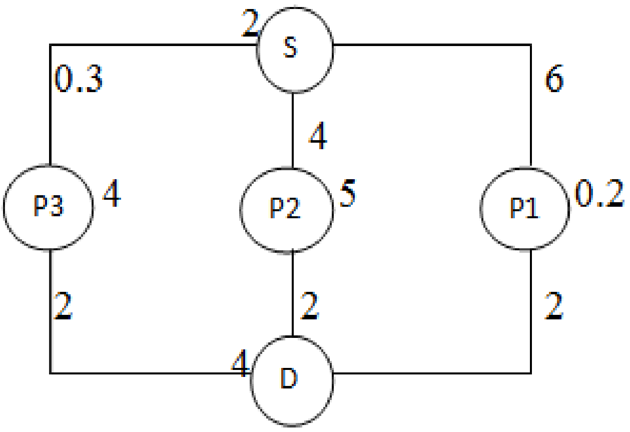

Fig. 3: Link Lifetime + Energy

VI. AODV+SIBA

The proposed AODV with Sufficient Intermediary Bandwidth Aware (AODV+SIBA) routing protocol is the extension to the well-known AODV routing protocol that add CFT constraint to the route establishment phase for performance improvement and network stability. It is a reactive single path routing protocol comprising the following three divisions.

A. Channel Free Time Status Monitoring

The CFT is a metric evaluated from the MAC layer. It can be used to make routing decision that taking into account the status of local wireless medium, which helps to avoid choosing routes through the congested area of the network. This metric provides the node with a view of current status of the shared wireless medium. The instantaneous MAC layer utilization at the node is either 1 (busy) or 0 (idle). In our algorithm, we accumulate the time (Tbusy) when the medium is busy over a period of time (Tmac) to reflect the usage of the wireless medium around the node as follows

$$CFT = 1 - \frac{\sum T_{busy}}{T_{mac}}, T_{busy} \subseteq T_{mac}$$

The status of congestion (Cs) can be indicated by two levels: Forward and drop. The forward level mean the Route Request (RREQ) packet can be processed and broadcasted to the next neighbour. The drop level means there is no way to process and broadcast packet, just drop it.

- If CFT ≥ Threshold, Cs = forward level.
- If CFT < Threshold, Cs = drop level.

The threshold is a tuning parameter that helps to improve network performance and its value is in the range [0, 1]. If the threshold is equal to zero, AODV+SIBA routing protocol works the same as the original AODV routing protocol. Our preliminary simulation, the threshold used in AODV+SIBA is set to 0.1.

B. Route Discovery

When a source node wishes to send a packet to a destination node for which it has no routing information in its table, it initiates a route discovery process by creating and broadcasting a route request (RREQ) packet to its neighbour as in the original AODV routing protocol.

```
When RREQ packet received
If (It is not the destination node) and (Cs = drop level)
        {
            drop RREQ packet received;
        }
Else
{
            If (the first copy)
                {
                    create reversed route to the source;
                }
If (the destination node or any intermediary node has an up-to-date route)
        {
            send RREP packet to the source;
        }
Else
        {
            update RREQ packet and rebroadcast it to its neighbours;
        }
}
```

Algorithm illustrates the extension procedure the receive a RREQ packet. When each node receives a RREQ packet, except the destination node, it first checks the value of Cs to decide whether to drop or to continue the RREQ packet before proceeding to the next process. If the value of Cs is the drop level, the packet is dropped to reduce routing overhead and block data traffic that may traverse the congested area in the future. Otherwise, the node processes the RREQ packet in the same manner as the original AODV routing protocol. Each node responds to the first copy of the RREQ packet by creating the reverse route to the source. If neither the destination node nor any intermediary node has a fresh enough route to the destination, it rebroadcasts the RREQ packets to its next neighbour. Otherwise, the Route Reply (RREP) packet is generated and unicasted back to the source node along the reverse route. Similarly, the forward route to the destination is also updated on receiving a RREP packet. When the RREP finally reaches the source node, the discovery period is terminated and the newly established route can now be used to send the data packets waiting in the buffer.

C. Routing Maintenance

Routing maintenance phase is the same as the original AODV. To preserve connectivity information, each node executing AODV+SIBA can use link-layer feedback or periodic HELLO messages to detect link breakages to nodes that it considers as its immediate neighbours. If a node does not receive HELLO packets from its next neighbours within a certain time or receive link failure report from link-layer, the node will invalidate all the routes containing this link by marking the route failure and sending the Route Error (RERR) packet to all the upstream nodes that use this link. Once the source node receives the RERR packet, it re-initiates a route discovery process to search for a new route [7].

VII. MAKING MANET ENERGY EFFICIENT

In this scheme main aim is to provide an efficient, more stable and long lasting path from source to destination. This routing scheme is designed for mobile ad hoc networks with large number of nodes. It can handle low, moderate, and relatively high mobility rates. It can handle a variety of data traffic levels. This Protocol is designed for network topology in which the nodes can trust each other, and there are no malicious intruder nodes. In this section, we present the operation details of this scheme. Since the main aim is to improve the performance of existing on-demand protocols, this protocol description is based on AODV with modifications. There are three major operations in this scheme: RREQ (Route Request) phase, RERR (Route Error) phase and LRR (local repair phase). As a major change to all existing protocols, power related function starts only when RREP (Route Reply) phase occurs as in the start, when network is new, all nodes are fresh with adequate energy levels and can very well select shortest path for data transmission. This in turn reduces overhead and end to end delay. So LRR (Local Repair) and RERR phase uses this parameter in proposed scheme and not RREQ phase [8].

VIII. CONCLUSION

In this survey paper various energy aware techniques has been overviewed. There is also brief introduction about aodv and MANET. From this survey paper we can conclude that MANET is basically depend on battery. Enhancing the lifetime of an entire network is an major issue so to overcome that we have proposed a new energy aware routing algorithm which will outperforms over conventional energy aware routing algorithm.

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