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A Survey on: Strom Problem and Energy Efficiency in DSR Protocol in Mobile Ad-hoc Network

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Abstract

This paper presents a survey on energy efficient routing protocols and storm problem for Dynamic routing protocol. The Dynamic Source Routing protocol (DSR) is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. DSR allows the network to be completely self-organizing and self-configuring, without the need for any existing network infrastructure or administration. The protocol is composed of the two main mechanisms of "Route Discovery" and "Route Maintenance", which work together to allow nodes to discover and maintain routes to arbitrary destinations in the ad hoc network. This Survey focus on recent development, modifications, energy saving in this widely used field. Although establishing correct and efficient routes is an important design issue in mobile ad hoc networks (MANETs), a more challenging goal is to provide energy efficient routes because mobile nodes operation time is the most critical limiting factor .This article survey define the how to provide energy efficient routing and how to occur storm problem in DSR protocol in MANET.

Keywords:- *MANET, DSR protocol, Energy Efficiency and storm problem.*

I .Introduction

Mobile networking is one of the most important technologies supporting pervasive computing. During the last decade, advances in both hardware and software techniques have resulted in mobile and wireless networking. Generally there are two distinct approaches for enabling wireless mobile units to communicate with each other:

Infrastructure: Wireless mobile networks have traditionally been based on the cellular concept and relied on good infrastructure support, in which mobile devices communicate with access points like base stations connected to the fixed network infrastructure. Typical examples of this kind of wireless networks are GSM, WLL, WLAN, etc.

Infrastructure less: In infrastructure less approach, the mobile wireless network is commonly known as a mobile ad hoc network (MANET). A MANET is a collection of wireless nodes that can dynamically form

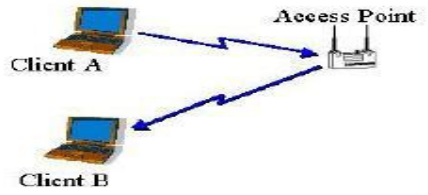

Figure: 1. Infrastructure base network

a network to exchange information without using any pre-existing fixed network infrastructure. This is very important part of communication technology that supports truly pervasive computing, because in many contexts information exchange between mobile units

cannot rely on any fixed network infrastructure, but on rapid configuration of wireless connections on the fly. Wireless ad hoc networks themselves are an independent, wide area of research and applications, instead of being only just a complement of the cellular system.[1]

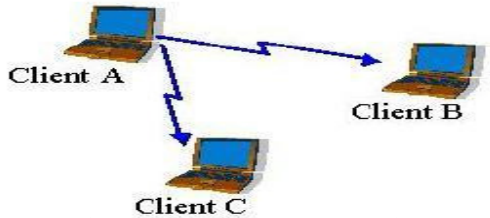

Figure: 2. Infrastructure less Adhoc network

II. Characteristics of MANET

Some of the major characteristics of mobile ad hoc routing protocols are:

Dynamic Network topology: As the nodes move, the

topology may change rapidly and the connectivity within the network varies with time.

Limited Bandwidth: The bandwidth available is limited than that of wired networks. The power is limited and the computation should be energy efficient

Distributed Operation: Nodes collaborate them to implement functions and not a single node is solely responsible for the overall operation.

Security: The wireless links lack defence against threats. Various attacks such as denial of services, eavesdropping, replay attacks are possible.

MANETs are resource constrained, bandwidth constrained and as the nodes are mobile, the network topology changes dynamically effectively. Therefore routing must be done and hence the need of efficient routing protocols. In MANETs, the protocols for routing are grouped into three categories based on the way how they work.[7]

III. Routing Protocol

Routing protocols tells the way how a message is sent from source to the destination. These protocols are categorized as shown in figure 3 Taxonomy of routing protocols

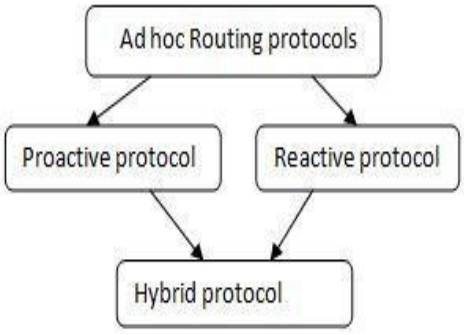

Figure 3: Taxonomy of Ad-Hoc Routing Protocols

1. Reactive Routing Protocols

In Reactive routing protocols or demand routing protocols, nodes are set up when needed Nodes. When a node wants to send a packet to another node, it initiates communication with that node, if no node is present earlier. The reactive routing protocols have two major components.

Route discovery: When a node or the source wants to send a packet to another node or the destination node, it first scans its cache to find the route to the destination, if route not present, it initiates route discovery process containing through a packet having the destination address and the address of intermediate nodes to the destination.

Route maintenance: Due to mobility of nodes, the nodes change their topology and hence route maintenance is done. Route maintenance is achieved through the use of acknowledgement.

2. Proactive routing protocols

Proactive routing protocols are also knows as table driven protocol. In these protocols, each node maintains a routing table consisting of routing information to every other node in the network. Since the nodes are mobile, they keep on changing their location. So the routing tables maintained by different nodes are periodic or whenever a change occurs, are updated. There are a number of proactive routing protocols. They differ in various areas like number of routing table maintained and how the changes are propagated in the network

3. Hybrid routing protocols

Hybrid routing protocols are both proactive and reactive in nature. There protocols work on the merits of these protocols to increase scalability and to decrease the routing overhead.[7]

IV. DYNAMIC SOURCE ROUTING (DSR)

It uses the concept of [5] source routing in which the creates routes only when source requires [6]. It is based on link state algorithm [4]. As it is on demand routing protocol, the routing overhead is less [14] This Protocol is composed of two essential parts of route discovery and route maintenance.

Route Discovery: When a source node S wants to send a packet to the destination D, it first checks its route cache. If there is an entry for the destination node, then the source uses the available route in cache. If route not found or the the route cache has an expired route, then it initiate the route discovery process. Route cache contains the recently discovered routes. Route discovery requires 7 fields during this process such as sourceid, destid, ReqID,Addresslist, Hoplimit,NetworkInterf---aceList, Acknowledgment list. Then source node broadcasts the message to its neighbour. Moreover, source node also maintains a replica of messages sent in its send buffer. Packets can be dropped if send buffer is full or the time limit for route discovery is over. When a nodes destination or the intermediate node having route to destination receives the route request message, it generates route reply [6]

Route Maintenance: Route maintenance includes monitoring the routes against failure through route error messages and route cache [5]. There is no need of keeping routing table in DSR [3] protocol. Route cache can further decrease route discovery overhead. DSR reduces overhead of route maintenance. However DSR is not scalable to large networks and packet Size grows with length of the route due to source routing.[7]

Benefits and Limitation

As the entire route is contained in the packet header, there is no need of having routing table to keep route for a given packets. The caching of any initiated or overheard routing data can significantly reduced the number of control message being sent, reducing

overhead.

But DSR is not scalable to large networks. The internet draft acknowledges that the protocol assumes that the diameter of the network is not greater than10 hops. Additionally DSR requires significantly more processing resources than most of other protocols. The other drawback of DSR is selecting the path for routing on the basis of minimum hop counts from the source to the destination. As it selects the path of having minimum hops count, lesser will be the number of intermediate nodes, more will be the distance between each pair of nodes. As the distance is more we need to have more transmission power to communicate between any pair of nodes and hence it consumes more battery power as it is one of the limited resources.

V. Energy Efficient Routing Protocol

The energy efficient routing protocols [8, 9] play a significant role in mobile ad hoc networks as the nodes are dynamic in nature and each node can participate in routing the data packets. In such scenario, efficient routing protocols are needed for Ad Hoc networks, especially when there are no routers, no base stations and no fixed infrastructure. So establishing the correct and efficient routes between the a source and destination is not the ultimate aim of any routing protocols, rather to keep the networks functioning as much as possible with less battery consumption at each node, should also be the objective of any routing protocols.

These goals can be accomplished by minimizing mobile node's energy during both the active as well as inactive communications. Active communication is when all the nodes of the route are participating in receiving and forwarding of data. Minimizing the energy during active communication is possible through two different approaches:

- Transmission power Control
- Load distribution

In an inactive communication the nodes are idle i.e. neither forwarding any data packets nor receiving any data packets. In such situation, to minimize the energy consumption Sleep/Power-down approach is used. We will not discuss about the power consumption during inactive communication in the network. There are many energy matrices used for calculating the power consumption caused by different reasons. The energy few energy related metrics are used. These metrics are helpful while determining energy efficient routing path instead of considering shortest path like in the traditional DSR protocol use. These metrics are:

- Energy consumed per packet
- Time to network partition
- Variation in node power level
- Cost per packet
- Maximum node cost

By using these metrics we can determine the overall energy consumption for delivering a packet, which is known as Link cost. In other word, link cost is the transmission energy over the link. Basically the efficient energy protocol selects the minimal power path depends which minimizes the sum of the link cost along the path.

1. Transmission Power Control Approach

We assume that a node's radio transmission power [10, 11] is controllable, if its direct communication range as well as the number of its intermediate neighbours is also adjustable. As the transmission power increases, the transmission range also increases and it reduces the number of hop count to the destination. Weaker transmission makes topology sparse and it may result more network partition and high end to end delay.

So it is desirable to have perfect transmission range between any pairs of nodes, so that less power consumption will occur. And it is possible when the transmission power can be adjustable according to the requirement of the receiver. So, instead of having high or low transmission power between the pair of nodes let the transmission power be set in such a way that any pair of nodes just reachable to each other. It will not only save the energy of battery but also reduces the interference and congestion in the networks.

2. Load Distribution Approach

The main objective of load distribution approach [12] is to select a route in such a way that the underutilized nodes will come in play rather than the shortest route. Due to the proper load distribution among the node, there is high balance in energy usage of all nodes. This approach certainly do not provide lowest energy route but surely prevent certain nodes from being overloaded and contributes towards longer network life time of the node.

3. Sleep/Power-down Approach

This approach is used during inactive communication. When any node is not receiving or transmitting any packets to other node, then it is desirable to put the subsystem/hardware into the sleep state or simply turn it off to save energy.

4. Related Work

Since last 10 years many energy efficient routing protocols have been proposed and wondering the best solution out of all. As it is very difficult to restrict technologies and research digging for optimal solution, many noticeable enhancement and modifications have been done to convert DSR as an energy efficient routing protocol and serve it as efficient routing protocols like other protocols. So in the next session here are few important routing protocols which are made after doing some modification in traditional DSR protocol.

4.1 Global Energy Aware Routing (GEAR) Protocol

We have discussed that the Route Request is propagated towards the destination via multiple intermediate nodes. In Global Energy Aware (GEAR), along with the route request it piggybacks the remaining battery power as well as its identity and broadcast it to its neighbour nodes. When the destination nodes receive these different route request (RREQ) from the same source, then it selects the best route on the basis of high remaining/residual battery power out of the all received RREQ. But it does not guarantee the selected path is the best path always. Because it may happen that few routing paths with a better metric may not be considered, if it is arrived some time later than the specified time duration.

Apart from the above problem GEAR is associated with two major problems, one is incapable o utilizing the route cache and the other one is blocking property. Because the individual node is not having any power related information in its route cache which induces traffic surge due to the flood of the RREQ. Whereas the other problem is to manipulate the waiting time of the various RREQ from the same source node in order to select the best route by the destination node. Because prior to select the best route it waits until it receives all RREQ messages along all possible routing paths. So while specifying the time duration, it should be taken into consideration that too short time may not select the best path always. On the other hand too long time may affect the average response time. However local energy routing protocol comes as the remedy for the problems discussed above

4.2 Local Energy Aware Routing (LEAR) Protocol

Localized Power Aware Routing (LEAR) Protocol [11] is based on DSR routing mechanism. The basic idea of LEAR is to consider only those nodes for the communication which are willing to participate in the routing path. This "Willingness" is the special type of parameter used in the modified DSR to find the route from source to destination. The new parameter can be determined by the Remaining Battery Power (E_r). If it is higher than a "threshold Value (th_r)", then the node will be considered for the route path and 'Route Request' is forwarded, otherwise the packet is dropped. It means only when the intermediate nodes will have good battery levels then only the destination will receive route request message. So the first message that arrives at the destination will be considered to follow an energy efficient as well as reasonably shortest path.

An interesting situation arises when a single intermediate node of a total route has lower battery power level than its threshold value(Er<Thr), a route request is simply dropped. If it is occurred for every possible path then the source will never receive a single route reply message even there exist a path between a source to destination. To avoid this situation, the source will resend the same route with an increased sequence number. When any intermediate node receives this same route request message, again with larger sequence number it adjusts (lower) threshold value to continue forwarding.

As the LEAR is mean to estimate the energy consumption and the balance across all mobile nodes, the result from the simulation shows that it has achieved the balanced energy consumption across all nodes successfully which is 35% more than that of DSR. Where as in the traditional DSR, energy consumption at different layer are uninformed, some nodes consume less energy and some nodes consume more energy. And hence the LEAR provides longer transmission time compared to DSR.

LEAR routing protocol not only achieves balanced energy consumption based only on local information but also removes the blocking property of GAER. Other than that it has also an advantage of being its simplicity characteristic and being integrated easily into existing ad hoc routing algorithm without affecting the other

layers of protocol stack. This was the first work to explore the balanced energy consumption in the realistic environment taking DSR as its base protocol where mobility, radio propagation, routing algorithm are concerned. From the simulation it was shown that in LEAR there was better distribution of energy then the traditional DSR routing protocol.

4.3 Energy Saving Dynamic Source Routing (ESDSR) Protocol

Energy Saving Dynamic Source Routing (ESDSR) protocol [13] is another modified DSR protocol which is aimed to prolong the network life time by using basic two approaches of power consumption, one is transmission power control approach and the second one is load balancing approach. In the first phase it decides the route based on the load balancing approach and in the second phase it dynamically adjusts the transmitting power at every node before it transmits packet.

The idea came from the traditional routing mechanism which is basically based on minimum hop count. Instead o having minimum hop count approach while selecting the path and having fixed transmitting power, it introduces two new parameters. One is the current energy level and the other one is the current transmitting power level o individual node. Because it assumes that the ration of the current power level and the current transmitting power is nothing but the depletion rate o the battery. When the following cost is maximize then only a source node finds the route R(t):

$$C(R,t) = \max (Rj (t)) \ldots\ldots\ldots (1)$$

$$Rj (t) = \min (Ei / Pti) \ldots\ldots\ldots (2)$$

Where Rj (t) is called the minimum expected lift time at time
"t" or the path j. So while selecting the path it selects the path which is having maximum of minimum expected life time among different possible path. Then each node calculates the minimum transmitting power in order to send the packet to it's next neighbor node. This minimum transmitting power is calculated in the following way:

$$Pmin = Ptx + Precv + Pthreshold \ldots (3)$$

Where Ptx is the transmitting power to send the packet, Precv is the receiving power of the node at which it receives the packet, required threshold power of the receiving node for successful reception of data. Each node maintains a power table where the required transmitting power of that node and it transmits the packet at that power.

ESDSR is implemented by considering various parameters like total numbers of data packets reached at the destination, energy consumption per packet, number of dead nodes and outperforms better than DSR routing protocol irrespective these different parameters.

4.4 Energy Dependent DSR Routing (EEDSR) Protocol

Energy Dependent DSR (EEDSR) [12] is also an energy efficient routing protocol which is based on traditional DSR mechanism. It is almost similar to the LEAR approach but the only difference is that the willingness factor depends upon some other parameters. These parameters decide whether a node should participate in forwarding the packets or not which in turn it prevents nodes from a sharp drop of battery power.

The concept behind this algorithm is to compute the residual battery power (RBPi) of each node (ni) periodically. If the node has enough residual battery then it can participate in the network activities behaving exactly as DSR nodes. But when it's residual power becomes less than the specific threshold, the node delays broadcasting of a RREQ. As the delays in the node increases the **predicted lifetime** decreases**.**

4.4.1 Predicted lifetime

The predicted lifetime simply denotes when the remaining battery of the node (ni) is exhausted. Predicted life time of node (ni) can be calculated by taking the ratio of Residual battery Power of the node and drain rate. Drain rate examines how much energy is consumed per second.

So with these above metrics, EEDSR attempts to discourage node which are having low residual power and high drain rate. So the node with small predicted life time will be rejected and cannot participate in forwarding the data. When energy of a node along an active route falls below a critical threshold, then it will immediately inform the source sending RREP packet. The source will try to find another route to the same destination by using Route Discovery Process.

In LEAR as the mechanism is based on residual battery power, much traffic load are injected through node if the node had high value of remaining power.

And so drain rate becomes high in such nodes. but in EEDSR, the as route is obtained considering both the factors, the remaining battery power as well as the drain rate of the nodes, overcomes the problem of high traffic on the channel.

From the simulation it is found that EEDSR performs better than DSR as well as LEAR. In a dense networks scenario, EEDSR obtained a high number of survived nodes and improves Drain Rate in term of average node life time. Whereas the LEAR suffered from flooding problem caused by Drop_Route_Request packet sent in broadcast manner.

4.5 Energy Efficient DSR Protocol (E2DSR)

The Energy efficient DSR (E2DSR) [14] is one of the splendid efforts made so far in order to make DSR as an efficient routing protocol. Because It has introduced many significant parameters as performance matrices which helps in calculating energy consumption in MANET. Even though it has the same objective like other protocols, but it has left a broad scope or the research activities. It is one of the latest energy aware routing protocols designed to reduce power consumption in battery effectively by doing some modifications in DSR. E2DSR has proposed some new structure for the control packets to change the behavior of the nodes implements a new Energy table and creates a new algorithm for route cache and route selection.

4.5.1 Structure of the Control Packets in E2DSR

A new field is inserted in the RREQ message in the called Energy Field by using the data structure as an array. The
energy field contains the remaining energy power of each node that is forwarded with the RREQ. This energy represented by some bits. If the number of bits are 4 then there can have 0 to 15 different energy level of the battery. The level 0 indicates the battery is empty and level 15 indicates the battery is full.

The structure of the RREP has also modified like the RREQ message. It appends the array of the energy level with the RREQ message which has to be received by the destination.

4.5.2 Routing Behaviour of Nodes in E2DSR:

4.5.2.1 Intermediate nodes

When first RREQ arrives from source to any intermediate node, it stores the RREQ in the request table. Then extract the energy array of the every RREQ and calculates the energy parameters of the path. If the energy parameter of the first RREQ is E1 then it is added with the threshold value (E).

If the second RREQ, the value of E2 is less than e1, then that RREQ will be dropped. Note that, every intermediate node forwards and replies to a maximum of K RREQ from source to destination. The intermediate node will not forward request that have arrived after the T inter_wait Time expires.

4.5.2.2 Destination Node:

The destination node has to play very simple role by replying the first received RREQ and also to the subsequent K-1 received RREQ which have the highest energy.

4.5.2.3 Source Node:

In E2DSR, the source will select the best route for a specific destination by using a new function called Route priority Function. This route priority function will select the route with higher energy level. The process of selecting the route using Route priority Function is a background process which calculates the best route when any new RREQ is arrived at destination. The best route is chosen depending upon some new parameters like delay, jitter, and packet delivery ratio.

The route Priority function is basically depends upon three input parameters.

- Length
- Freshness
- Energy of path

Length Parameter: It is considered that the more will be the length of the link the higher probability of link breakage. So it is one of the important metric while evaluating energy saving in the networks. It can be calculated by the following method.

L(i)=Length of Route(i)/ Max_length of the route

Freshness Parameter: This parameter is somehow difficult to calculate due to dynamic nature of the ad Hoc Networks. Because sometimes the node's movement may change the validity of a route. So it must be required to know that which node is the fresh/latest and it is possible by keeping the
future studies and research works because all these metrics described above, have not been implemented yet for a large scenario. So we may get many

interesting results while carry out any experiment with a larger scenario with all these new performance matrices.

4.6 Topology Control Based Power-Aware and Battery Life-aware DSR (TPBDSR) Protocol

It is realized later that the topology control has serious effects on the system performance in various ways. It can affect the traffic carrying capacity as well as can have the contention for the medium. Topology Control Based Power-aware Battery Life-aware DSR (TPBDSR) [15] uses simple pure distributed control where each node adjust its transmitting power through certain range of neighbor that are given with some number. If the node find it's neighbor within or beyond certain range then the transmitting power is getting adjusted. In other word, we can say that the transmitting power gets adjusted according to their neighbor node's position in the network topology which may change dynamically. This strategy also limit the power adjustment period which is denoted by h second, where the value of h may vary with mobility character of the networks.

4.6.1 The Operation in Intermediate nodes:

As TPBDDSR has to adjust the transmitting power, it requires Transmitting Power Value Field (TTP) and Least Battery Value field (LBP) which have to be attached with the Route request Packet. Every time the node k receives the route request packet (RREQ) ,then the new value of TTP has to be updated.

So, $TTP_{New} = TTP_{old} + TTP_k$ and if Bk < LBPold then LBPnew = Bk

Where Bk = Fk/ Rk(t),

Fk = Full battery Capacity of the node, Rk = remaining Battery capacity of the node k at time t.

4.6.2 The Operation in the Destination Node:

DSR basically accepts the first packet that has come through the shortest path and hence it discards other subsequent request packets. But TPBDSR accepts multiple route requests. It does that with some additional rules. The moment first route request arrives at the destination; it sets a timer and wait for a more route request packets containing other path's information. And selects the best path among all the paths it has in list.

Simulation result shows that the TPBDDSR have much longer life time of nodes than the traditional DSR and EEDSR. As

the scenarios of the experiment changes the result may vary, hence it's still difficult to say which one is best between

TPBDDSR and EEDSR. But certainly TPBDSR gives better results than DSR.

4.7 Minimum Energy Dynamic Source Routing Protocol (MEDSR)

Minimum Energy Dynamic Source Routing Protocol (MEDSR) [19] has done one of the finest attempts to make DSR more as an energy aware routing protocol. The whole MEDSR approach is based on two mechanisms:

- Route Discovery
- Link Power Adjustment

The route Discovery process itself is classified into two sub processes.

- Route Discovery mechanism using low power level
- Route discovery mechanism using high power level

4.7.1 Route Discovery mechanism using low power level:

In this process of route discovery when source node S has some packets to send, then it sets a minimum level transmitting power for all the nodes. So the route packet will be broadcasted to only re within the range of the minimum level of transmitting power. Once the route request arrives at the destination, the destination node copies the power level information from the route request packet into the route reply. The route reply is sent back to the nodes that are within the small range of transmitting power level from the destination node. The moment, the intermediate node will receive the route reply, it will calculate the minimum power for itself. The minimum transmitting power level for any node can be calculated as

Pmin =Ptx-Prec +Pth

Where Ptx=Transmitting Power of Destination

Prec=Receiving Power of the node that has received th route reply

Pth= Threshold receive power for successful reception of the packet. And it will keep continuing at each node until the route reply is received by the source. Once the route reply reaches at the source, the source sets the transmitting power. And start sending with that transmitting power on the route that is been selected for data transmission.

4.7.2 Route Discovery mechanism using High Power Level:

High power route discovery is just same as the low power route discovery. The only difference is that instead of setting up the low transmitting power, it sets high transmitting power while sending route request. This process is highly needed for

route discovery, especially when no path is found due to unreachability by setting the transmitting power low. So to overcome this problem high power routing is also mandatory.

MEDSR uses two levels of powers; the network connectivity is highly maintained and results less network partition. The result also depicts that when the network size is small the energy saving per data is maximum in MEDSR as compared to DSR, almost 55% high which indeed turning out to be an efficient routing protocol.

4.8 Modified DSR Routing (MDSR) Protocol

As the name suggests Modified DSR (MDSR) [20] has been designed after making some modification in DSR routing protocol. Because, due to source routing nature of DSR, the overhead increases when the network size gets increased. Apart from that, the energy consumption of nodes also increases as the nodes act as intermediate nodes for multiple sources destination pairs. So MDSR protocol has aimed to reduce overhead by reducing the number of routing reply packets and a fixed header size for the data packets and acts itself as one of the energy efficient routing protocol.

The main drawback of DSR protocol is the generation of redundant route replies. These RREP travels through the path in which RREQ's bearing same Ids were received. This causes not only congestion but also wastage of battery power.

So it's whole operation consists of two basic mechanisms:

- Overhead reduction mechanism
- Efficient energy management mechanism

4.8.1 Overhead Reduction Mechanism:

4.8.1.1 Control Packet Reduction:

In MDSR, the destination alone initiates a RREP only for the first received RREQ rather than for every RREQ bearing the same id which is reached via different routes.

4.8.1.2 Fixed header size in MDSR

Unlike DSR, MDSR makes the address part of the packet header to carry only the source and destination address. It offers to traverse through a correct path from source to destination even if the intermediate nodes are not added with the packet. It does it by creating a **routing table** which stores source and destination address instead of having **route cache.**

4.8.1.3 Efficient Energy management mechanism:

In the traditional DSR, the transmitting power is set same for all the nodes which are participating in packet forwarding process. But in MDSR, the transmission power varies between a pair of nodes depending upon the distance between them.

To calculate the Minimum required transmission power for each node, the two Ray Model is used.

$$Pt(min)=[(Pr(th)\times d^4)/(ht^2.hr^2.Gt.Gr)]+C$$

The RREP packets help the intermediate nodes to calculate the distance between itself and neighboring node; so that the required transmit power can be determined. And this required transmitting power is stored in the routing table along with the source address, destination address and precursor node address before the RREP is broadcasted. Upon receiving the route reply the source starts transmitting the packet with the required transmitting power.

The simulation results that MDSR has generated less number of control packets than the existing DSR. Here control packets are sum of all the RREQs, RREPs and Route Error Packet. MDSR has also high packet delivery ratio as compared to the existing DSR. Due to the reduction of number packets and dynamic variation of transmit power, provides high saving of energy than the traditional DSR.

4.9 Multi-path Energy Aware DSR Routing (MEADSR) protocol

By the time, energy efficient protocols were becoming the interest of all researchers in Mobile Ad Hoc

Network, at the same time some other issues were started evolving as major constraints of MANET. Due to self organizing and self configuring nature of MANET, it generates lot of control packets and because of wireless in nature, these all were the major cause for high traffic overhead and high bandwidth consumption. So multi path routing was introduced as one of the remedy of these problems. As multipath routing [16] reduce the number of route discovery and reduce the end to end delay time, bandwidth utilization became fair. But the multi path routing was highly involved in generating control messages. To make it more efficient one, both the multipath and energy aware techniques are integrated called as Multi– path Energy Aware DSR (MEADSR) [21] routing protocol. So the basic objective of this protocol is to have the best path for routing by computing multipath node disjoint where the best path is the high energy efficient. MEADSR performs its operation by two major steps:

- Node disjoint path discovery
- Update mechanism

4.9.1.1 Node disjoint path discovery:

Traditional DSR stores all paths that the RREP have travelled through. But in MEADSR, those paths are stored which are having node-disjoint routes. Because path-disjoint-ness inside multi-path DSR can increase data throughput by handling the greater resilience against the node mobility.

$$P1 - (s,d) \cap P2 - (s,d) = \emptyset$$

Where P1 and P2 are two different paths are considered disjoints whose intersection is empty. These paths are ordered not just by the path length but by an energetic metric. This energetic metric is calculated while the route reply comes across the intermediate nodes from destination to the source.

4.9.1.2 Update Mechanism:

Since the active node which are participating in the communication, continuously receive and transmit the packet, they consume their energy. This energy is calculated while RREP is travelled through these intermediate nodes. So the change in energy should be reflected at the source route cache which contains the information about the path length as well as the cost unction o the entire path <Path, Ci>. MEADR uses a special packet called RREQ-PROBE which is a uncast probe packet sent by all nodes. This packet is a kind of RREQ packet and the moment destination node will find the probe packet it will send the RREP-PROBE packet and the updated Ci values are stored here within the packet. The moment source will receive the RREP-Probe packet it just updates its route cache.

MEADSR results prove that there is evenly distribution of energy consumption among nodes by using their residual battery capacity. And it is considered as one of the best energy efficient routing protocol which is made by modifying the traditional DSR routing protocol.

VI. RELATED STUDY

Prashant Dewan and Partha Dasgupta, "*Trusting Routers and Relays in Ad hoc Networks*." Proceedings of the 2003 International Conference on Parallel Processing Workshops. [2].

This paper provides the mechanisms for trusting routers & relays. It enumerates the issues involved in using reputation in Adhoc networks. It protects the end to end by public key infrastructure. It discussed some designed goal on which the paper is basis. Like if a node is malicious then the collaborating node must not with them if it so then whole network will collapse. Node should not fake in the sense that it should of the same networks. Node should be punishing on bad reputation. It provides solution to the routes in trusting. A threshold mechanism is used for reputation in this paper.

Po-Wah Yau and Chris J. Mitchell, "*Reputation Methods for Routing Security for Mobile Ad Hoc Networks*"[3].

This paper discusses the effect of malicious node behavior & also provides a solution on the basis of reputation method. It first discuses the two reputation protocols & then compares both of them. On the basis of these it provides a solution for analyzing the reputation values. Calculating the reputation values. Detecting the misbehaviour of unwanted type provide a reputation Mechanism. Reputation system is also employed in the localized mechanism where both positive & negative behavior is severely affects the reputation values. It categorizes the nodes in to different scenarios a threat model for

Ad hoc routing protocols were described, classifying internal attacks into four categories — failed badly failed, selfish, and malicious nodes. Failed and selfish nodes are those which do not perform certain operations that the protocol specifies that they should, the former due to some unforeseen failure and the latter due to selfishness to conserve power.

P. Michiardi and R. Molva, "*CORE: A collaborative reputation mechanism to enforce node cooperation in mobile ad hoc networks*," Proceedings of the 6th Joint

Working Conference on Communications and Multimedia security, September 2002, pp. 107-121. [4]

CORE is another reputation-based solution. The authors regard a mobile ad hoc network as a community, in which only ones contributing own resources are entitled to use shared resources. In CORE, three types of reputations are employed. Subjective reputations values are obtained directly from a node's own observation of behavior of its neighbors. Contrary to CONFIDANT, more weight is assigned to past observations to prevent false detection caused by link breaks or collisions. Indirect reputation values are obtained from other nodes, and only positive values are considered to avoid denial of service attack (broadcasting negative ratings for legitimate nodes). Function reputation values are related to certain functions like routing and data forwarding. Global reputations are calculated in terms of subjective reputation and indirect reputation on different functions.

S. Marti, T. J. Giuli, K. Lai, and M. Baker, "*Mitigating routing misbehaviour in mobile ad hoc networks,*" Proceeding of MOBICOM, Aug 2000 pp 255-265. [5]

This paper provides solution to packet lost problem caused by misbehaving nodes in mobile ad hoc networks. Two extensions are introduced to DSR to mitigate the effects of misbehaving nodes. The watchdog is in charge of monitoring neighbours to identify misbehaving nodes, and the path rater tries to prevent packets being delivered through these nodes.

After a node forwards a packet, its watchdog checks whether the next node on the path forwards the packet cooperatively. The watchdog performs this operation by listening promiscuously to the next node's transmissions. If the number of packets a neighbouring node drops exceeds a threshold, that neighbour will be regarded as a misbehaving node. The watchdog needs to know the next two hops in order to monitor the next node's data forwarding behaviours. Therefore, watchdog is implemented based on DSR. The path rater in each node selects the most likely reliable route according to knowledge of misbehaving nodes and link reliability information. It calculates the route metric by averaging the rating of all nodes on a path and chooses the path with the highest metric. In this solution, the node rating is calculated in terms of link reliability rather than neighbor monitoring results.

International Journal of Computer applications (0975 – 888) Volume 47– No.4, June 2012. Reputation based Dynamic Source Routing Protocol for MANET[6]

This paper proposes a new reputation based routing protocol based on DSR (Dynamic Source Routing) and through simulation results proves that the proposed method performs well compared to normal DSR.

VII. ESDSR Energy Saving Mechanism

The objective of ESSDSR is to forward the packet through those nodes which are having higher level of energy at a given time. The DSR has been modified in such a way that if an energy of a node which is forwarding the data packet within a multi hop path reaches a level less than or equal to certain threshold percentage of its initial battery energy the node will ask the neighbour nodes to look for another location for such data. Since the node may die out of energy in sort of time if it continues sending or receiving packets. So the different – different algorithm has been introduced not only an energy saving feature but also introduces an energy survival characteristic for any low energy node. Here we can develop new routing algorithms for energy saving in DSR protocol.

VIII. Strom Problem

Storm problem is the problem of rebroadcast reply of the node because more than node is reply the request at the same time. In this time of situation lots of problems are arise such as traffic conjunction, Increasing node density, heightening node mobility and number of nodes perform route request peer to peer communication.

IX. Conclusion and future Work

This survey paper is based on the Dynamic source routing protocol which is describe all types of routing and features of energy efficiency routing protocol. Energy efficiency is a major concern in the field of Adhoc Network. In this paper we have describe an energy saving DSR routing protocol which is based on DSR, where we introduce energy saving algorithms.

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