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Analysis on Energy Efficient Approaches for Routing In Mobile Adhoc Network

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Abstract
A Mobile Ad Hoc Network (MANET) is a self-organizing and dynamically configurable wireless network without having fixed infrastructures. Mobile ad hoc networks (MANET's) consist of nodes which move arbitrarily and form dynamic topologies. MANET's exhibit characteristics like limited bandwidth, energy constraints, mobility, scalability and limited security. The main issue is energy constraint of nodes in mobile adhoc network. The primary goal of a routing protocol is efficient route establishment between a pair of nodes. Because of limited battery of nodes links failure can be possible. So here the analysis of different techniques is done in this paper.The aim of this research is to check and compare the different approach to make the routing efficient in Mobile adhoc network. And one method is proposed for energy efficient communication in mobile adhoc network which use the remaining energy and number of nodes for selection of route.
Keywords- Manet, Energy efficient, routing protocol.

I. INTRODUCTION

Mobile adhoc network is a wireless network which has no fixed infrastructure. A (MANET) is a dynamic wireless network that can be formed without the need for any pre-existing infrastructure in which each node can act as a router. If two nodes are not within the transmission range of each other, other nodes will work as intermediate routers for the communication between the two nodes. Mobile ad hoc network (MANET) is an autonomous system of mobile nodes connected by wireless links. Mobile nodes in Ad hoc network are typically powered by batteries. Normally when nodes are run out of energy they will stop working, which influences the total performance of the Ad hoc network, and then the network will be in critical situation. So it is extremely important to conserve the energy. [1]

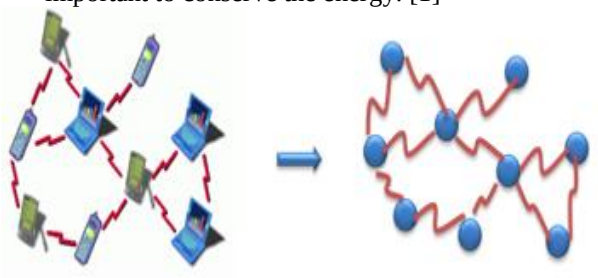

Fig 1. Mobile Adhoc Network

1.1. Manet Applications

Tactical networks: Manet is used in Military Communication automated Battle fields**.**

With satellite-based information delivery, MANET can be used for fire/ safety/rescue operations or other scenariosrequiring rapidly–deployable communications with survivable, efficient dynamic networking. Location Aware Services: Automatic Call forwarding, advertise location specific services, Location–dependent travel guide.
Sensor Network:Earth activities, Remote weathers for sensorsEmergency Services: Earthquakes,Disaster recovery, crowd control and commando operationsEducational Applications: Setup virtual class & conference rooms.

Entertainment: Robotics pets. Multi-user games.

Future military networking for robust, IP-compliant data services within mobile wireless communication networks consisting of highly – dynamic autonomous topology.

1.2. Characteristics of Manet

- Manet is not depending on any fix infrastructure for its operations.
- Speed of deployment
- Dynamic Changing Topology of nodes
- Multi-hop network

1.3. Current research challenges in mobile adhoc network

- Energy Saving
- Limited wireless transmission range
- Broadcast nature of the wireless medium

- Packet losses due to transmission errors
- Mobility-induced route changes
- Mobility-induced packet losses
- Battery constraints
- Potentially frequent network partitions
- Ease of snooping on wireless transmissions (security hazard)
- Limited Power Supply

II. ROUTING PROTOCOLS

Routing Protocol is used to find suitable routes between communicating nodes. Routing is very important point in mobile adhoc network. There is no fixed infrastructure and nodes have mobility so efficient routing of packets is very difficult. Routing protocols can be generally classified into 3 categories: and Proactive, Reactive and Hybrid.

2.1. Proactive Protocols

Proactive protocols are called table driven protocols in which, the route to all the nodes is maintained in routing table. In this type of protocol packets are transferred on the predefined route specified in the direction-finding table. In this scheme, the packet forwarding is done faster but the routing overhead is greater because all the routes have to be distinct before transferring the packets. The routes are maintained at all the times so proactive protocols have lower latency. For Example: DSDV.

2.2. Reactive (On-Demand) Routing Protocols

In this group of protocol there is an initialization of a route discovery mechanism by the source node to find the route to the destination node when the source node has data packets to send. When a route is found, the route preservation is initiated to maintain this route until it is no longer required or the destination is not reachable. The benefit of these protocols is that overhead messaging is reduced. One of the disadvantages of these protocols is the delay in discovering a new route. The different types of reactive routing protocols are Dynamic Source Routing (DSR), Ad-hoc On-Demand Distance Vector routing (AODV).

2.3. Hybrid Routing Protocols

A hybrid protocol means the combinations of reactive and proactive protocols and takes advantages of these two protocols and as a result, routes are found quickly in the routing zone. Example Protocol: ZRP.

III. NEED OF ENERGY EFFICIENCY

In wireless networks, the devices are operating on battery power. So to get the energy efficiency the approaches like reduce energy consumed is used. The power consumption is not only the factor to decide energy efficiency. Energy efficiency can bemeasured by the duration of the time over which thenetwork can maintain a certain performance level, which iscalled the network lifetime. Sorouting tomaximize the lifetime of the network is different frommminimum energy routing. It is obvious that node failure is also possible in wireless network due to less battery power. So saving energy at the time of broadcasting torecover from the node failure or to re-routing is necessary.

The critical and important issue in the design of wireless network is limited availability of the resources. The resources are limited in wireless network than wired network. Energy efficient communication is difficult in wireless network. Each of the mobile nodes in the network is operated by a limitedenergy battery power and it is impossible toreplaceor rechargethe batteries during the operation. So limited battery constraints affect the network performance. Energyefficient operations are critical to enhance the network lifetime. Even some amount of power is lost during the idle mode of the node.During the past few years, there hasbeen increasing interest in the design of energy efficientprotocols for wireless ad hoc networks. The limited power is interferenceto network performance. So energy is precious resource that has to be carefully used. Therefore energy efficiency is most important factor in design of mobile adhoc network.

IV. ENERGY EFFICIENT ROUTING METHODS

4.1. A Power Efficient Technique to Avoid Packet Loss[2]:

Here in thistechnique the threshold value is defined.

In this method the idea is to propose a technique with thethreshold and cut-off value to avoid the packet loss during transmission. The technique works as follows:

Here Threshold and cut off value is defined for energy of the node. So in the route if any node has less value than threshold value then warning message will be sending to the source to change the route.

But if route is not changed and the value of energy decreased and reached to the cut off value then error message will be send to the source. It is simple and very efficient method to decrease the packet loss in the Manet. But it has some drawbacks like it is only theoretical concept not practically implemented till. It's not considering other factors like node's energy, no of nodes in route etc. It's only selected the shortest path then after the logic is applied.

4.2. Energy AOMDV routing protocol [3]

Here one energy efficient approachfor routing in mobile adhoc network is used. As we

know that Mobile Adhoc Networks having self-organizing and self-configuring network without the need of any centralized base station and physical connections of mobile devices. In this paper the existing algorithm is modified and compare to other routing protocols. This modified energy efficient protocol gives better performance.

Here there is a survey of routing protocols and descriptions of all the protocols are given. Then the modification is done in AOMDV. After that packet delivery measurement and end to end delay is compared to other protocols in scenario. The comparison of modified algorithm is done to DSR, AODV, TORA and DSDV.The concept behind the modified protocol is to find the residual energy of each route in the procedure. Then select the route of selecting path and select the path with minimum nodal residual energy and sort all the routes based on the descending order of nodal residual energy. Once upon a time a new route with greater nodal residual energy is rising; it is again chosen to forward rest of the data packets. This strategy is good because it improves the lifetime of the network.It has better result than other protocols in defined scenario.Buthere other factors are not considered like no of nodes in the route.

4.3.PowerAware and Signal Strength Based Routing[4]

This is an energy aware technique for routing the packets in the mobile adhoc network. As we know that manet is free infrastructure and nodes can move freely from one place to another. Issue of the energy constraint and nodes mobility is very critical. So many researchers are working on that. Here in this paper the concept of signal strength and battery of nodes is used. According to both parameters packets will be delivered to the destination. Here for the first factor we consider energy; the concept of residual battery power of the nodes is calculated. Then the signal strength is defined. On that basis the routing is performed in this proposed model. The proposed model has simulated with the help of network simulator and has compared with the algorithms namely, MTPR and CMMBCR.

However, if all the nodes in a given path have remaining battery capacity higher than the threshold value (ɵ), then chooses a path, which has more signal strength, otherwise a path with the maximum remaining battery capacity. Advantage of this model is that the simulation results are shown that the proposed model has kept at top position as compared to MTPR and CMMBCR models. Limitation**is** that it has taken more number of hops to reach destination because the packets are routed through the strong links. Here packet lost is not considered but in real situation, there will be a packet lost over the network.

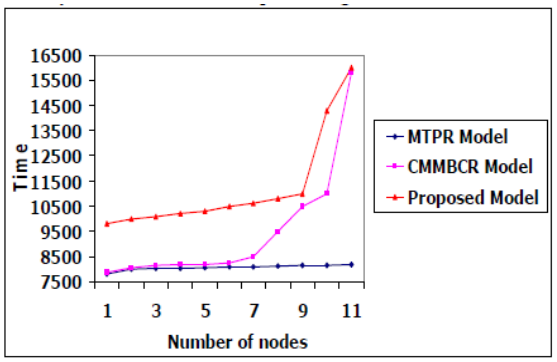

Fig 2 Number of nodes versus time

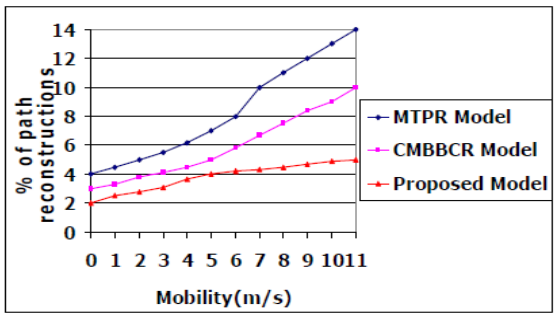

Fig.3 Mobility against percentage of path reconstructions.

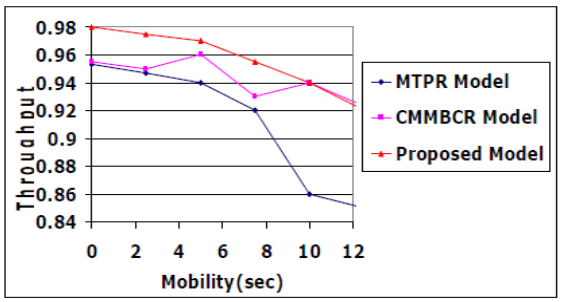

Fig.4Mobility versus network throughput

From the Figure2, it can be conclude that in MTPR model, 7th node dies around 25.96% earlier than the proposed model and 4.95% before CMMBCR model. In MTPR algorithm, 11th node will die around 96.32% prior to the proposed model and 93% against to CMMBCR model. Remaining lifetime of a node is directly derived from the output voltage of the node. The reconstruction of paths is consistently low at the proposed model as compared to MTPR model and CMBCR model as shown in Figure 3.

In Figure 4 the network throughput decreases as the node mobility increases. However, increasing the number of nodes in the network, the throughput does not change substantially.

4.4. Energy aware AODV (EA-AODV) and Optimized Energy Aware Routing (OEAR) scheme, under various mobility models[5]:

Here this isthe routing scheme in which it finds an energy efficient route by varying the transmission range of the nodes. Each node sets its transmission range to the most nearest node present after receiving the route replies from all the nodes having path to destination. The route request RREQ is sent at common transmission range of 250m.An advantage of this methodis Mobility models play an important role in emulating real life scenarios. So here proposed scheme is analyzed with mobility models.Buthere only the transmission range is varying, other important factors like node's energy, no of nodes in route etc. are not considered.

4.5. Number of times nodes send Constraint Energy DSR (NCE-DSR)[6]:

Thistechnique proposes a novel method of energy-conserving route protocol called NCE-DSR(Number of times nodes send Constraint Energy DSR).Here Based on DSR protocol, mark related to the number of times of sending message is added to the datagram for routing protocol. And the nodes with relatively more number of times of sending message are protected**.**Here the value N is defined as number of times message is send by the particular node. So the node which has highest value has lowest energy because we know that in sending state the energy is consumed more.Here Route discovery is same as DSR, but only the difference is that it RREQ contain the value of N_i for node i.This improved method is simple and energy saving routing protocol.It has better result than DSR.

In Fig 5 NCE-DSR achieves better performance than DSR. Moreover, it can be inferred that the proposed method have more remaining energy than DSR on the whole. Therefore the proposed method NCE-DSR obtains advantageous performance of network lifetime and consumes less energy under the same conditions over method DSR.The numbers of death nodes are less in NCE-DSR than DSR.

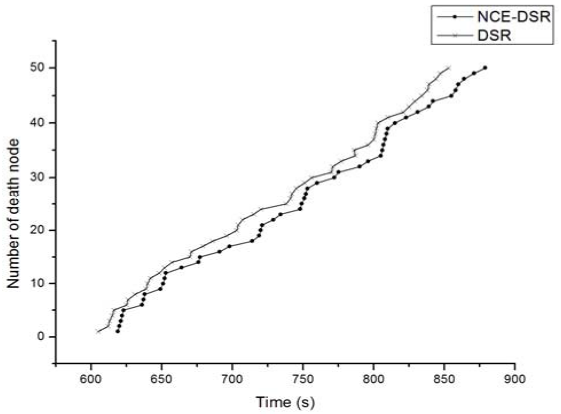

Fig5.The number of dead nodes for each node in different time

4.6. Reverse AODV protocol [7]:

This protocol is modifiedAODV protocol. The logic is added in the AODV protocol. They create reverse adov protocol.In MANET, mobile devices uses of wireless links and dynamically varying network topology. AODV (Ad-hoc on-demand Distance vector routing) is an on-demand ad hoc routing protocols. AODV and most of the on demand ad hoc routing protocols use single route reply along reverse path. Rapid change of topology causes that the route reply could not arrive to the source node, i.e. after a source node sends several route request messages; the node obtains a reply message, especially on high speed mobility. This increases both in communication delay and power consumption as well as decrease in packet delivery ratio. To avoid these problems, they propose a reverse AODV which tries multiple route replies. The extended AODV is called reverse AODV (R-AODV).

In R-aodv the same process of route discovery is apply to root reply. It reduces path fail correction messages and obtains better performance than the AODV and other protocols have. We design the R-AODV protocol and implement simulation models using NS-2. Simulation results show that the reverse AODV provides good experimental results on packet delivery ratio, power consumption and communication delay.Here packet loss can be decreased.Retransmission is also decreased so energy of nodes will be saved.But there are also some limitations. The energy of the nodes not considered.We can apply the concept of energy of the nodes. Means select the node which has minimum energy or maximum residual energy and concept of the stability can also apply.

4.7.LLR(Log-Likelihood ratios) based routing protocol [8]:

On the basis of received LLR, the intermediate nodes decide whether or not to take part in communication. This significantly reduces the power consumption. With the larger transmission range, number of intermediate hops are significantly reduced which reduces the end-to-end time delay. Here random waypoint mobility model is used. Hence the nodes deciding against taking part in transmission save lot of energy. Here this method is applied to AODV protocol.

4.8. Low overhead stability-aware multipath routing protocol (LOSAM) in Manet [9]:

This method is reliable multipath routing protocol that finds stable paths from a source node to a destination node. It is Low overhead stability-aware multipath routing protocol that find stable route. Instability of the links is a very important issue for the routing protocols. Here source node initiate route discovery process. It creates RREQ packet and puts its own location and movement information, then broadcasts it.Each neighbor node that receives the RREQ packet calculates probable life time of the link among itself and the source node using its own location and movement information and the information of the RREQ packet. Then, this node determines appropriate threshold, and compares calculated link life time with that. If the link life time is less than the threshold, the RREQ packet will be discarded and the route discovery process through this node will be blocked and ended. If Current node is the destination the node creates a Route Reply (RREP) packet and unicasts it to the source node. Current node is an intermediate node and has an active route to the destination then the node creates a RREP packet and unicasts it to the source node. Current node is an intermediate node and has no active route to the destination. In this case, the node replaces existing location and movement information in the RREQ packet with its own information and broadcasts the RREQ packet with the new information. This approach has caused optimizing the energy consumption and improving the performance.

V. PROPOSED METHDOLOGY

A Mobile Ad Hoc Network (MANET) is a self-organizing and dynamically configurable wireless network without having fixed infrastructures. Mobile ad hoc networks (MANET's) consist of nodes which move arbitrarily and form dynamic topologies. MANET's exhibit characteristics like limited bandwidth, energy constraints, mobility, scalability and limited security. The main issue is energy constraint of nodes in mobile adhoc network. The primary goal of a routing protocol is efficient route establishment between a pair of nodes. Because of limited battery of nodes links failure can be possible. So Here we don't consider the total energy of route, means which route use less energy will select, This concept is not applied here.

Here we consider the remaining batter power of the nodes. So the route which has more remaining energy is better. The number of intermediate nodes or hopes in the path is also considered. On the basis of that concept ranks are given to the routes. Route is selected according to given rank.

This concept is applied to the AODV, DSR. And another important protocol is reverse aodv is also taken for this technique. Then after compare the performance of those protocols. Here to take the mobility factor we use the mobility models to these protocols.

Here in Fig the first step is given that source will send the RREQ to establish the connection to the destination. Now the neighbor nodes will receive and forward to next node. At that time remaining energy of nodes are added to the packet. Then at last the destination will receive the RREQ. Here destination save all the routes and according to the rank of the route will be selected and RREP will send back to the source.

Here rank is calculated using the values like total remaining energy of route is considered.
Another factor is number of the nodes in the defined routes.
Here the ration W=E/N is considered. Here the E=remaining energy and N= Total number of nodes. So which route has value of W is greater is better route.
Now the ranks can be given on basis of ratio W.

Then routes are sorted and which route has highest rank will be select for the transmission.The method can be applied to the DSR, AODV Reverse AODV protocol.

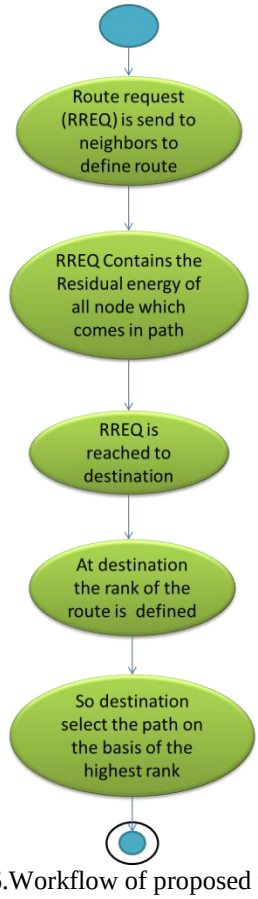

Fig 6.Workflow of proposed work

Define the route which is efficient

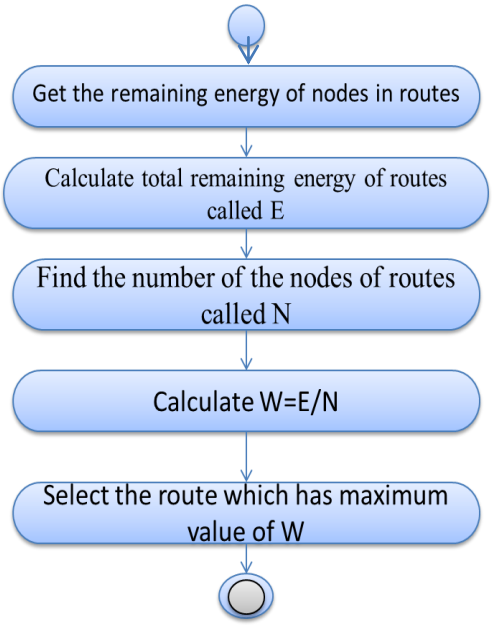

Fig 7.Steps of to find efficient route

We can apply the whole logic or concept in different mobility models like random waypoint model, random walk mobility model. Then comparison of result will be done.

VI. CONCLUSION

From the above study, we see thatthere are different methods and approach to find efficient route in Manet. But there is not a particular one methodwhich cangive the bestperformance in ad hoc network. Some techniques concentrate on remaining energy or total energy which gives better performance in energy efficiency concept. One method is work according to the number of messages sent by node which give better throughput and network lifetime is increased. But short path is not considered so end to end delay may be increased. Performance of the technique varies according to the variation in the network parameters and ad hoc network properties which constantlyvary. So the selection of the approach or method is depends on type of the network and needs. Proposed method find the energy efficient and short route in network.Further research isneeded toidentify the energy efficient routing protocols formultiple environments.

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