Enhanced Power aware Multipath Routing Protocol for MANETs

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***Abstract* – The tremendous developments in wireless technology made Mobile Ad hoc Networks(MANETs) inevitable in our day to day life.MANET is a set of mobile nodes or devices with dynamically varying topology which does depend on any pre-existing infrastrure.These mobile nodes are run by batteries with limited capacity. Power failure of nodes and unnecessary energy consumption are the critical issues in energy efficient routing of MANETs.So more efficient power aware routing is required. The Enhanced Power aware Multipath Routing (EPMR) protocol efficiently utilizes the energy of nodes and resources .Thus increases reliability and the lifetime of the network . The simulation tool used is NS2.Simulation results show that the energy consumption of the network is less after applying EPMR protocol and shows better throughput and packet delivery ratio.**

Index Terms – MANETs, quality of service, multipath routing**.**

I INTRODUCTION

Mobile ad hoc networks (MANETs) are a type of ad hoc networks.As the nodes are mobile, the topology of MANETs may change any time. The nodes in MANETs communicate with each other only if they are within the transmission range of each other.So the nodes can sometimes transfer data directly or need to depend on intermediate nodes .so such networks are also named as multi-hop networks. In MANET, each node participates in routing by forwarding data for other nodes, and so the determination of which nodes forward data is made dynamically based on the network connectivity. Hence the routing protocol plays a major role in MANET. Mobile ad hoc networks find its application in many areas and are useful for many cases.

Routing in MANET is challenging because of node mobility, limitations for transmission bandwidth, battery power. In MANET nodes work together to route the packets to destination. The distance between source and destination may be at multiple hopes. Death of few or even single node due to energy depletion will cause the breakdown in communication of the entire network.

The routing protocols are mainly classified into two. They are proactive (table driven) protocols and reactive (on demand)protocols.The proactive protocols usually find routes constantly and maintain routing tables for all source-destination pairs .Because of maintaining routing table for all possible routes,there will be large number of routing tables.Only few routes will be used among them.This results in high routing overhead due to unnecessary routing tables which are never used in the entire life time of the network.On the other hand reactive protocols creates routing table on demand only.So whenever there is a need for a route from a particular source to destination ,then only the routes will be established.The routing table created for such paths will be dropped automatically when such route is not active for long time.This will reduce the overhead due to routing table to some extend and utilize less bandwidth and energy as compared to proactive protocols. So on demand protocols are preferred for MANETs.

As the mobile nodes have limited battery life time, mobile networks should use battery power more efficiently to increase the network life. The purpose of a power aware routing protocol for MANETs is to route packets from a source to all the destinations by using the available bandwidth efficiently in the presence of continuous topology changes.But power aware routing is a difficult and challenging task in MANETs.

The typical routing protocols of MANETs are mainly the shortest path routing protocols and do not consider the energy aware issue. If the one path in normal energy based routing is break that causes the heavy packet loss because that kind of link breaks are occur suddenly or without any information and also neighbor are not aware about this kind of condition .Efficient minimum energy routing schemes can greatly reduce energy consumption and lead to a longer battery life of the mobile node.So Enhanced Power aware Multipath Routing (EPMR) protocol

[1]describes improvement of the conventional routing protocol by utilizing high energy paths in the network**.**EPMR protocol is an on demand multipath protocol which finds multiple paths for a source destination pair.Due to the unreliable links links may break at any time or node may dead due to energy loss.In such situations the EPMR protocol selects multiple paths and in case of link or node failure source switch to the next optimal path.Thus EPMR protocol provides reliable packet transmission in case of route break up or link failures.

II RELATED WORKS

A mobile node consumes its battery power not only when it active but also when it stays idle.When a node is idle ,the node may be listening to the wireless medium for any possible communication requests from other nodes in the network. Thus, energy efficient routing protocols minimize either the active communication energy required to transmit and receive data packets or the energy during inactive periods. Power failure of a mobile node affect the node itself and also its ability to forward packets in the presence of other nodes and thus the overall lifetime of the network. For this reason, many research efforts have been devoted to developing energy aware routing protocols.[2],[3].There are so many approaches for power aware routing in MANETs.

Rupali Mahajan, Rupali Jagtap proposed an energy efficient routing protocol for MANETs[4].The authors make AODV[5] protocol energy efficient by doing some modification in the route discovery process. Expanding ring search (ERS) technique is introduced in route discovery process. The redundant rebroadcasting of RREQ are avoided .Thus the energy of the nodes in the network are saved.

In on demand energy efficient routing for MANETS [6] uses minimum energy routing approach. The energy consumption of the nodes are reduced by routing the packets on selected routes which consumes only less amount of energy to route packets to its destination. The minimum energy route information are stored on cache. Also uses energy aware link cache for this purpose.

Another energy efficient routing scheme [7] introduces an energy aware path selection mechanism and rediness concept in MANETs.These mechanisms increases the network life time and energy efficiency of nodes in the network.Rediness means the capacity of a node to act as an intermediate node. Each node calculates its own energetic status and declares an appropriate readiness. The readiness selection is based on battery capacity and predicted lifetime of a node.

In power aware routing with power control method [8] uses a four way handshake mechanism. A source node that wishes to send a packet first transmits an RTS (Request To Send) control packet to its destination. When the destination node receives the RTS it replies with a CTS (Clear To Send). This RTS-CTS handshake reserves the channel for the duration of DATA and ACK transmission. Thus, upon receiving the CTS the source can transmit DATA packets. When the destination receives DATA packets successfully it replies with an ACK.

III THE ENHANCED POWER AWARE MULTIPATH ROUTING (EPMR) PROTOCOL

The EPMR protocol combines the concepts of multipath as well as power aware routing. When a source need to send packets to one destination, using this protocol multiple paths are selected with minimum hop count and maximum lowest energy level. According to this criterion the route information will be stored and the best path which satisfies the above criteria will be considered as the optimal path, next best path will be the secondary path and so on. So whenever there occurs any link or node failure, then the source node switches to the next optimal path. This reduces the need of re- route discovery process which is a time consuming process. The paths are node disjoint paths which also make the network more reliable and avoid the condition of over utilization of the same node for different routes.

To discover multiple paths between a pair of source to destination the basic route discovery mechanisms used in AODV protocols. The paths selected based on highest average energy of the nodes in the route and the route containing highest minimum energy level in the route. Thus by selecting such energy aware paths, the network life time can also be increased.

Figure 1.depicts one scenario. Suppose there are two possible paths from a source to destination.Then active or primary path will be selected based on minimum hop count and maximum average energy and high minimum energy level of node in the path.So the first path in the figure consists of 4 intermediate nodes and the average energy level of the path is 30 and highest minimum node energy is 41.Second path have 2 intermediate nodes,60 as the average node energy in the path and high minimum

energy is 40.Here number of minimum hop have high priority among the constraints.Maximum average energy of the path and highest minimum node energy have second and third priority.So second path satisfies most of the constraints .As a result second path will be selected as primary and the first path will be selected as the secondary path.Here energy represents residual energy of nodes.

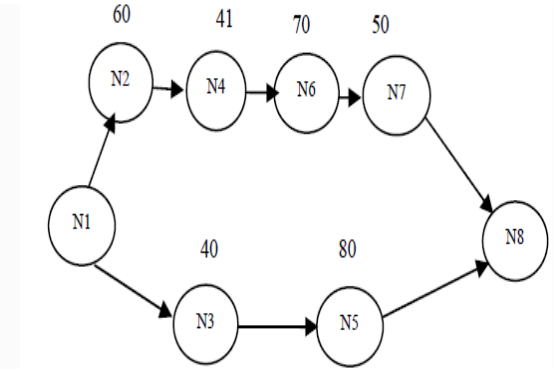

Fig.1. Scenario 1

Figure 2 depicts the second scenario.There are three available paths from source to destination.According to priority based minimum number of hops path 2 have minimum number of hops.Average energy of nodes in the path are 30,60 and 80 for each path .Based on high minimum node energy paths have values 41,40,60 respectively.Finally path two will be selected as the primary route and path 1 as secondary ,path 3 as territiary route as per the conditions.

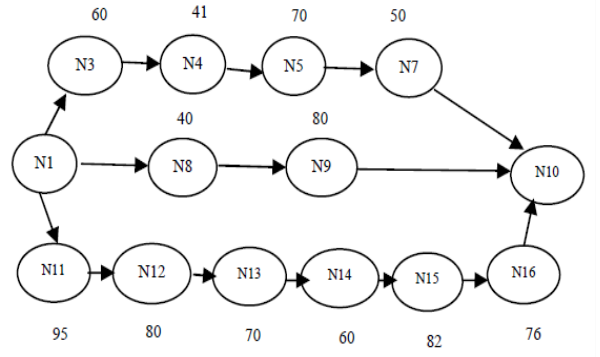

Fig.2. Scenario 2

The multipath routing helps significantly in providing QoS by reducing the end-to-end delay for packet delivery. The reduction in the end to- end delay is not that intuitive and is attributed to multiple factors. Notice that the end-to-end delay is the latency between a packet sent at the source and received at the destination. Thus the EPMR protocol indirectly provides Quality of Service (QoS)to MANETs.

IV SIMULATION RESULTS

The simulation tool used is NS.34[9].Simulation of 50 nodes are done and multiple paths are represented using different colors.The optimal path or active path with minimum hop count is marked as blue. Secondary path is marked as violet ,third path as black ,fourth path as maroon etc.Figure 3 represents the starting of simulation .the source destination pair will be selected.Figure 4 shows theprimary,secondary paths etc.

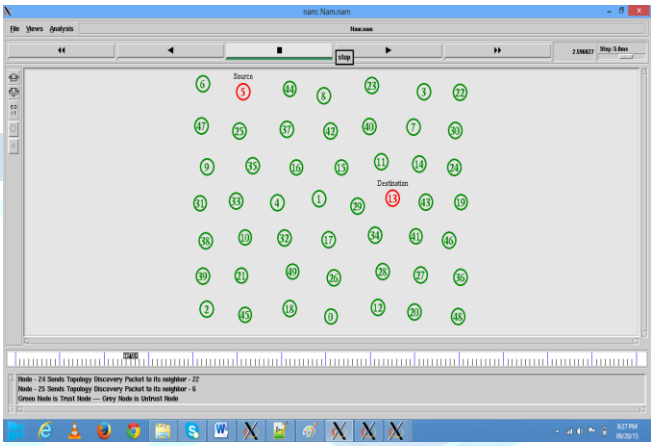

Fig.3. Initial stage

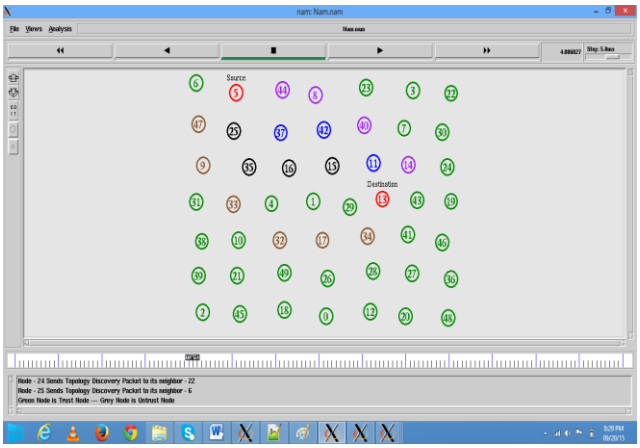

Fig.4. Selected paths as per consraints.

Figure 4 shows graph of the average energy consumption rate of nodes in the network.Figure 5 shows the thoughput of EPMR protocol.

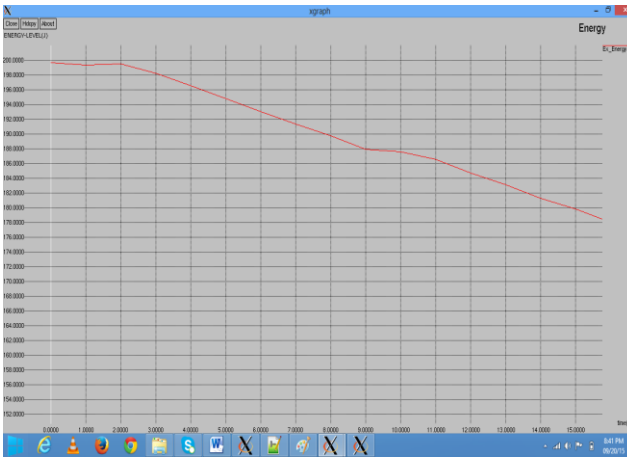

Fig.5. Energy consumption rate of nodes ,

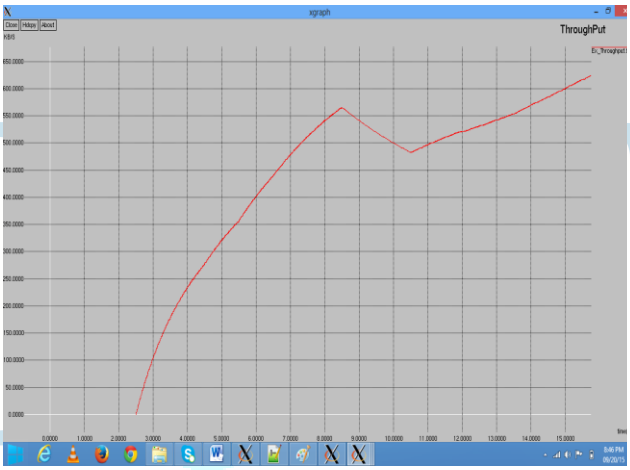

Fig.6. Throughput of EPMR protocol.

V CONCLUSION AND FUTURE SCOPE

The power is a major constraint in ad hoc networks since the nodes operate with limited battery life. Hence, the routing protocols in such type of networks must be developed to consider power aware as a primary objective. Power aware routing is a major a challenge due to the dynamic nature of MANETs. In this paper we proposed a new routing protocol for MANETs. EPMR protocol does not consider only the battery power as a major challenge, but it also satisfy QoS requirements like cost and delay indirectly. The simulation results show that the EPMR protocol significantly performs better in terms of throughput, end-to-end delay and and energy consumption.

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