MAXIMIZING NETWORK LIFETIME IN MANETS THROUGH LOAD BALANCING

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ABSTRACT

Mobile ad hoc networks are self-organizing topology of mobile nodes. Node mobility causes topologies to change dynamically over time, which complicated important tasks such as routing. Various Routing protocol are proposed to increase overall lifetime of MANETS.We are devising a novel technique that take into consideration energy aware route which tries to maximize network lifetime by load balancing.

Keywords: Energy aware, load balancing, MANET, Network lifetime

I. INTRODUCTION

Mobile ad hoc networks (MANETs) are collections of various wireless mobile devices, which can communicate with each other in the transmission range without any infrastructure support. It is a self-configured and self-maintained network with no central controller. Adhoc Networks are dynamic changing topologies so link stability becomes important criteria. Link stability indicates how stable the link is and how long it can support communications between two nodes. Stability of links can be estimated using many parameters like - signal strength , pilot signals , relative speed between two nodes forming the link , link duration distributions and remaining battery power of the nodes etc. Network lifetime is affected by stability of link duration between two nodes.

Routing protocol in MANET is based on the routing information maintenance and stored, which can be classified as the table-driven or proactive such as DSDV, OLSR and reactive or On-demand routing protocol such as AODV, DSR. ZRP is hybrid structure combining advantages of both proactive and reactive routing protocols.

II. RELATED WORK

In [8] the authors further extend the Dynamic Source Routing (DSR) protocol with the load balancing function. When the source node wants to send packets to the destination node, it will use the DSR protocol to find all possible paths to the destination. It will also measure the number of congested packet on each path based on the information sent by the

destination node in the Route Reply (REP) packets. The source node then distributes the data packets on all paths in the way that the total number of congested packets on each path is equal. From time to time the destination node will update the number of congested packet by sending the Load Packet (LP) to the source node and the load balancing decision in the source node is made accordingly with this updated information.

In [9], the authors proposed the Multipath Source Routing (MSR) algorithm also based on the DSR to find all routes from the source node to the destination node. Real-time information on each path is monitored using a feedback control mechanism. It requires the source node to send probe packets periodically on all paths and wait for these packet returned by the destination. It then measures the Round Trip Time (RTT) of these probe packets. From there, path delay will be calculated using Karn algorithm [10]. If the path has longer delay, it will receive less data packet and vice versa.

Lee et. al. presented in [11] workload-based adaptive load balancing technique that is based on the idea that by dropping route request packets (RREQ) according to the load status of each nodes, nodes can be excluded from route paths. This algorithm uses the length of the message queue in nodes and the outstanding workload which is defined as the combination of the queue length and residence time

of packets in the queue. At the beginning of simulation, the minimum and maximum lengths of message queue and workload threshold are initialized. When a node receives RREQ packets, it checks the length of queue and calculates the average of two thresholds values. And then, a node calculates outstanding workload. If queue length is greater than the average threshold value and outstanding workload is greater than workload threshold, it drops RREQ packets.

III. CALCULATION OF ENERGY METRIC IN SELECTING A ROUTE

All wireless nodes come with residual power detection device. The energy required to transmit a packet (Etx) can be computed as

$$Etx = (Psize * Ptx)/ BW \qquad (1)$$

where Psize is the packet size, Ptx is the packet transmitting power and BW is the bandwidth of the link. The transmitting energy is directly proportional to the distance between nodes. The source application layer communicates n value to the network layer, for selecting nodes that meet the energy requirement. It avoids link breakages due to energy depletion. The total energy required (REQe) for data packet transmission is given by

$$REQe = n * (Etx + Eproc) \qquad (2)$$

where Eproc is the energy required for packet processing and n is the number of packet . The energy metric (EM) of the path is given by

$$EM (Pi) = \prod (Ri / Fi) \qquad (3)$$

where Ri is remaining battery capacity and Fi is full battery capacity of intermediate node i,at time t. The goal of this metric is to maximize EM. It takes the product of the residual battery of the intermediate nodes to select a path that has nodes with maximum residual energy among the path that just meet the basic energy requirement REQe.

IV. LOAD BALANCED ROUTING

The load balancing is a technique in which the mobile nodes will forward the packets from various available multipaths which have enough capacity remaining. So the local network congestion can be moderated and it also increases the rate of transmitting with dynamically changing load in the network. Due to load balancing the overall network throughput can be increased and a better QoS can be provided. In the network if all paths have same bandwidth, load-balancing means, the router sends one packet to the destination over the first path, the

second packet to the same destination over the second path, and so on. Load balancing guarantees equal load across multiple paths [1].Though the load balancing in the network it is possible to distribute workload across multiple paths in order to achieve optimal resource utilization, minimize response time, maximize throughput, increase network life time and avoid overload. Applying the load balancing in the multiple paths it is possible to increase reliability through redundancy.

If the weight of load distribution in k-path is Wk, then , $Wk \propto Bk$ (k=1, 2, 3, ..., n). Bk is the available bandwidth in k-path. In addition,

BU= B1+B2+...+Bn

Wk= Bk / BU

Load distribution algorithm is as follow,

Wk=min ([Bk / BU],M) × R.

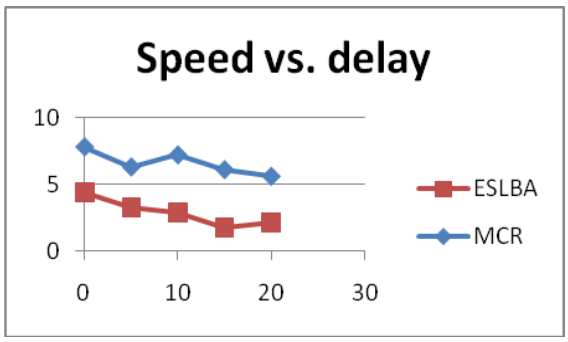
M is the maximum value of Wk, Its role is to limit Wk, if Wk is over the range, multipath would degenerate into single path. R is used to the granularity of load distribution on each path. When the load is distributed to the multipaths , Round Robin Scheduling Algorithm is used.

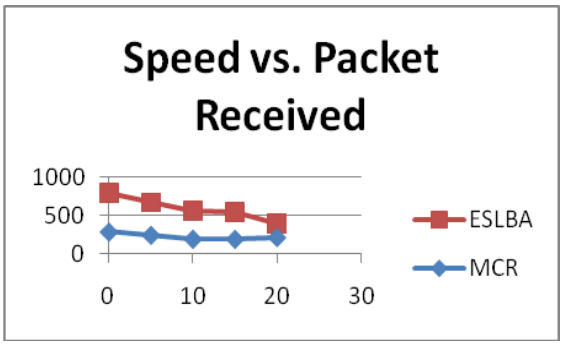
V. MATHEMATICAL MODEL OF NETWORK

We assume Topology of MANET is represented as the undirected graph G = (V , E) , wherein V is the collection of node ; E is the set of edges of the node connection. Let P(i,j) ={P0 , P1 , P2 ,..., Pn } , wherein each Pk is a feasible path between i and j considering the route stability and remaining energy, the problem of selecting the optimum path from the source to the destination node can be described as:

Path Pi=Max(EM(Pi),Wk)

If there are same B.W. in all the paths available from source to destination then load balancing will ensure sending one packet along first available path,second packet along second available path and so on.Using simulation on NS2 we have found that our proposed algorithm ESLBA(Energy Saving Load Balancing Algorithm)performs better in comparison to MCR (Mutipath Coding Routing) in case of end-to-end delay using CBR scenario.On X-axis we are varying the speed of mobile nodes as 10m/s,20m/s,and 30 m/s.





VI. CONCLUSION

Our algorithm ESLBA will ensure better utilization of bandwidth using load balancing technique. End to end delay is reduced upto 73% in case of CBR (constant bit rate)scenario.In future,Same work can be extended for video data also.

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