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Mobility Based High Reliable Low Energy Cost Routing in Mobile Ad hoc Network (MANET)

V Srividhya[1], J Faritha Banu[2], R Senthamizhselvan[3], K Revanth [4]

[1] *M.E Student, Department of Computer Science and Engineering*
R.M.K Engineering College, Kavaraipettai, Thiruvallur, TamilNadu.
[2] *Associate Professor of Computer Science and Engineering*
R.M.K Engineering College, Kavaraipettai, Thiruvallur, TamilNadu.
[1] *npssripriya@gmail.com*

Abstract

High Reliable Low Energy Cost Routing (HRLECR) selects the routes which needs less energy for packet transfer in mobile ad hoc network. In High Reliable Low Energy Cost Routing route selection is based upon the residual energy of the node and mobility of the node. Mobile nodes are battery limited. So considering residual energy will reduces the number of retransmission. Energy cost includes the energy required to transfer/receive the data packet, transfer/receive the acknowledgement and retransmission when data packet and acknowledgement was lost. Furthermore, it provides high reliability, in which selected route gives the less number of retransmission and it also reduces the delay of the packet delivery. It provides an efficient way to increase the operational lifetime of Mobile ad hoc network.

Keywords: Energy-aware routing, End-to-end transmission, hop-by-hop transmission, HRLECR, Mobile ad hoc network, Mobility, Reliability.

1. Introduction

Mobile Ad Hoc Network (MANET) is a self-configurable network establishes the route for data forwarding whenever there is a necessity. In MANET mobile nodes can move freely in any direction and any speed and will therefore change it links to other device frequently. The main challenge in MANET is maintain the information required to route traffic. So routing protocol is used to route the packet to the correct destination with high reliable. This routing protocol is classified as Proactive routing protocol and Reactive routing protocol. In proactive routing each node in the MANET has routing table to transfer the data packets. Reactive protocol searches the route in an on-demand and set the link in order to send out and accept the packet from a source node to destination node. DSR is a one of the On demand protocols. It selects the shortest path for data transfer and does not consider the residual energy of the node. So the same nodes can be overused, many times. To avoid the overusing of the same node, to increase the reliability and decrease the energy cost and delay HRLECR algorithm is implemented. It considers both residual energy of nodes and mobility of the nodes to achieve high reliability and low energy cost and delay.

2. Related work

We can classify them into three categories. The first category considers the reliability of the link to, select the reliable route. De Couto et al [1] introduced the notion of the ETX (Expected Transmission Count) to select routes which require less number of retransmissions for lost packet recovery. Although such routes may consume less energy, they do not necessarily minimize the energy cost for E2E packet traversal. Furthermore, it provides high priority for the reliability of the routes. So some nodes can be overused. If the reliability of the route is high, then that link will be used frequently to forward packets. So nodes along these links will fail quickly.

The second category includes algorithms that aim at finding energy-efficient routes [2]-[7]. These algorithms do not consider the remaining battery energy of nodes to avoid overuse of nodes, even though some of them[4]-[7] address reliability and energy efficiency together. Apart from this, many routing algorithms – including energy-efficient algorithms proposed [2]-[7] in has a major drawback. It does not consider the energy consumption of nodes. It only considers the transmission power of nodes and neglecting the energy consumed by processing elements of transmitters and receivers. Energy cost of nodes for transmission along a path is only considered as an energy cost of the path. This negatively affects reliability, energy efficiency and the operational lifetime of the network altogether.

The third category includes algorithms that try to prolong the network lifetime, reduce the energy cost as well as increase the reliability by finding routes [7]-[15] consisting of nodes with a higher level of battery energy and less mobility. The proposed algorithms in Thus, the network lifetime may even be reduced. Our in-depth work in this paper considers reliability, energy efficiency and prolonging the network lifetime in mobile ad hoc networks holistically. High Reliable Low Energy Cost Routing (HRLECR) finds energy efficient and reliable routes that increase the operational lifetime of the network.

3. Methodology

3.1 Network Topology

We design topology of a wireless ad hoc networks by a G (V, E), where V and E are the set of nodes (vertices) and set of links (edges), respectively. Each node is assigned a unique integer identifier between 1 and N=|V|. Nodes are assumed to be battery powered. The remaining battery energy of node $u \in V$ is represented by C_u. If the battery energy of a node falls below a threshold C_{th}, the node is considered to be dead.

So the data will not be transferred to that node. Without loss of generality, we assume C_{th}=0. We represent a path in the network with h hops between two nodes as a set of nodes $\dot{P}$ (n_1, n_{h+1})={n_1, n_2,.., n_h, n_{h+1}}, where $n_k \epsilon$ V is the identifier of the *k*th node (k=1,..h+1) of the path. Here, n_1 is the source node, n_{h+1} is the destination node, and the rest are intermediate nodes which relay packets from the source to the destination hop by hop.

3.2 Energy saving for packet sending over wireless links

Let x[bit] represent the size of a packet transmitted over the physical link and let $\varepsilon_{u, v}$ (x) represent the energy saving by a transmitted node u to transmit a packet of length x to a receiving node v through the physical link (u.v). $\omega_{u, v}$ (x) denote the energy saved by the receiving node v to receive and process the packet of length x transmitted by u. The energy consumed by nodes during packet transmission could be abstracted into two distinct parts. The first part represents the energy saved by the transmission circuit excluding the power amplifier of the transmitter. The second part represents the energy saved by the power amplifier to generate the required output power for data transmission over the air. The energy saving by the receiving circuit including the low noise amplifier (LNA) of the receiver.

3.3 Hop-by-hop and End-to-end Retransmission Systems

Wireless links in ad hoc networks are usually prone to transmission errors. This necessitates the use of retransmission schemes to ensure the reliability. We can use either HBH or E2E retransmissions. In the HBH system, a lost packet in each hop is retransmitted by the sender to ensure link level reliability. An acknowledgment (ACK) is transmitted by the receiver to the sender when the receiver receives the packet correctly. If the sender does not receive the ACK (because either the packet or its ACK is lost or corrupted), the sender retransmits the packet. This continues until the sender receives an ACK or the maximum allowed number of transmission attempts is reached. If each link is reliable, the E2E path between nodes will also be reliable. In the E2E system, the ACKs are generated only at the destination and retransmissions happen only between the end nodes. The destination node sends an E2E ACK to the source node when it receives the packet correctly. If the source node does not receive an ACK for the sent packet, it retransmits the packet. This may happen either because the packet or the ACK is lost. In either case, the source retransmits the packet until it receives an ACK for the packet.

3.4 High Reliable Low Energy Cost Routing (HRLECR)

Our goal is to find reliable routes minimize the energy for E2E packet Traversal. By route selection to considered the mobility and energy cost of routes. The main key point is that mobility of a node is related to its reliability. If nodes have high mobility, the probability of packet retransmission increases. A larger amount of energy will be consumed per packet due to retransmissions of the packet. Mobility and energy cost of routes must be considered in route selection. The key point is that energy cost of a route is related to its mobility. If routes are less reliable, the probability of packet retransmission increases. Thus, a larger amount of energy will be consumed per packet due to retransmissions of the packet. By defining ways of computing the energy cost of routes, design sets of energy-aware reliable routing algorithms for HBH and E2E systems. They are called High Reliable Low Energy Cost Routing (HRLECR). In HRLECR, energy cost of a path for E2E packet traversal is the expected amount of energy consumed by all nodes to transfer the packet to the destination. In HRLECR, the energy cost of a path is the expected battery cost of nodes along the path to transfer a packet from the source to the destination.

4. System Implementation
4.1 Network Creation
Nodes registered in the database with its name, Internet protocol Address & Port number and status and registered in the database. Each node can log in to the network through port number and its name. Each node maintain the on or off status this process is to identify whether the node is logged in or not. All node details are maintained in Main server the main server permits means the node can send the data. The Main server not in ON status means the node unable to send the data. We create the topology construction (path construction) to send the data. We send the data via intermediate nodes. For the Topology construction the user have to give weight to the source and the destination to n number of nodes. This process is to communicate via intermediate nodes.

4.2 Gathering Information about the Nodes
As an essential requirement for energy-efficient routing, we assume nodes support adjustable transmission power. The transmission power from source node *to* destination node *is* denoted by a finite set of allowable transmission powers for source node s (*u)* specified by *S* (*u*)…, *D* (*u*) [mu] where *mu* is the number of allowable transmission powers of node s (*u)*. The discrete set is due to the practical considerations that all the commercially available devices are pre-programmed with a set of power settings. Regarding the power adjustment by nodes, we assume: (a) *Pu, v*is the minimum transmission power from *S* (*u*) that satisfies the targeted link error probability. (b) By adjusting the transmission power, the data rate of the Physical link does not change.

Nodes transfer the mobility to the other nodes to select the high reliable nodes with less energy cost. Mobility of the each node is denoted by M_k. Where k=1, 2….N.

4.3 Minimum Energy cost Routing
Mobility and energy cost of routes must be considered in route selection. The key point is that energy cost of a route is related to its mobility. If nodes have high mobility, the probability of packet retransmission increases. Thus, a larger amount of energy will be consumed per packet due to retransmissions of the packet. By defining ways of computing the energy cost of routes, design sets of energy-aware reliable routing algorithms for HBH and E2E systems. They are called High Reliable Low Energy Cost Routing (HRLECR).

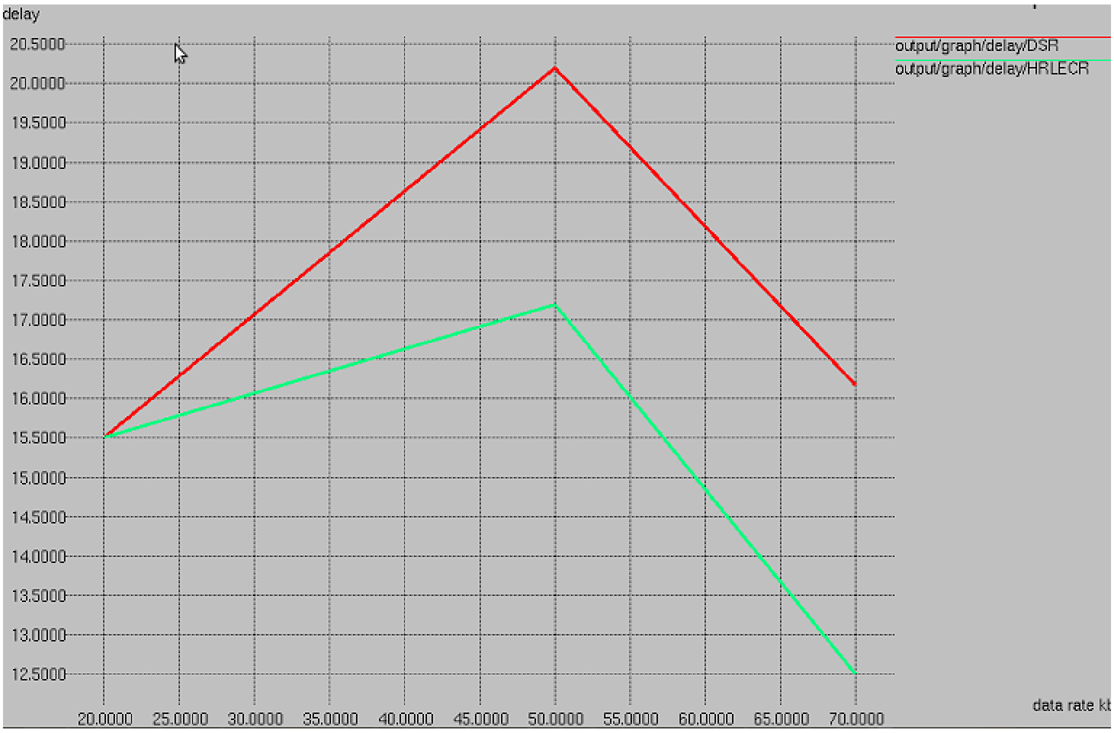

Figure 1. Delay in DSR and HRLECR comparison

4.4 Increase the Operational lifetime of the Network

High Reliable Low Energy Cost Routing (HRLECR) can increase the operational lifetime of the network using energy-efficient and reliable routes. In the design of HRLECR, we used a detailed energy consumption model for packet transfer in wireless ad hoc networks. RMECR was designed for two types of networks: those in which hop-by-hop retransmissions ensure reliability and those in which end-to end retransmissions ensure reliability. The general approach that we used in the design of HRLECR was used to also devise a state-of-the-art energy-efficient routing algorithm for mobile ad hoc networks. HRLECR finds routes minimizing the energy consumed for packet traversal. RMECR consider the remaining battery energy of nodes, and was used as a benchmark to study the energy-efficiency of the HRLECR algorithm. Extensive simulations showed that not only saves more energy compared to existing energy efficient routing algorithms, but also increases the reliability of wireless ad hoc networks.

5. Conclusion

This paper, introduce a HRLECR routing scheme to select the optimal path for data forwarding based on energy of the neighbor nodes in the network. This scheme increases the reliability and prolonging the network lifetime by selecting high energy nodes for transmission and increases the energy efficiency by selecting the shortest path with high energy node for transmission in mobile ad hoc network. Existing RMECR does not consider the mobility of the nodes to select the route. This proposed scheme will not transfer the data through the node which have the high mobility. Simulation results demonstrate the proposed scheme increases the reliability and energy efficiency of the network. In future work routing will be more energy efficient using HRLECR with traffic load consideration.

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