International Journal of Engineering Applied Sciences and Technology, 2016
Vol. 1, Issue 8, ISSN No. 2455-2143, Pages 83-86
Published Online June - July 2016 in IJEAST (http://www.ijeast.com)

PERFORMANCE COMPARISON OF ENERGY EFFICIENT ROUTING PROTOCOL IN WIRELESS AD HOC NETWORKS

Priyanka R. More
Dept of E&TC Engineering
D.Y.Patil college of Engg. And Technology
Kolhapur, India

Prof. Dr. Swati. V. Sankpal
Dept of Electronics Engineering
D. Y. Patil college of Engg. And Technology
Kolhapur, India

***Abstract*- This paper proposes two energy aware routing algorithms for wireless Ad Hoc network called Reliable Minimum Energy routing (RMER) and Reliable Minimum Energy Cost Routing (RMECR). RMER is an energy efficient routing algorithm which finds routes minimizing total energy required for end-to-end packet traversal on the other hand RMECR considers the energy consumption and remaining battery energy of nodes as well as quality of links to find energy efficient and reliable routes that increase operational lifetime of network. Simulation result for normalized control overhead and Packet delivery using RMER and RMECR algorithm are obtained in this paper.**

***Index terms*- Wireless Ad Hoc Network, Energy efficient routing, network lifetime, Energy aware routing, End to End transmission, Retransmission, Reliable routes.**

I. INTRODUCTION

In a world of increasing mobility, there is a growing need for people to communicate with each other and have timely access to information regardless of location of individuals or information. Wireless communication serves the purpose and plays a vital role. In Ad Hoc network devices can directly communicate with each other. It consists of multiple nodes connected to each other by links. Path is series of links connecting two nodes. In Ad Hoc network nodes are working only with battery power. Limited battery power imposes a severe constraint on the network lifetime. As nodes are battery powered, energy is a precious resource which has to be carefully used by the nodes in order to avoid an early termination of their activity.

Energy efficient routing is an effective mechanism for reducing energy cost of data communication in wireless ad hoc networks. Generally, routes are discovered considering the energy consumed for end-to-end (E2E) packet traversal. Nevertheless, this should not result in finding less reliable routes or overusing a specific set of nodes in the network. Energy-efficient routing in ad hoc networks is neither complete nor efficient without the consideration of reliability of links and residual energy of nodes. Finding reliable routes can enhance quality of the service. Whereas, considering the residual energy of nodes in routing can avoid nodes from being overused and can

Eventually lead to an increase in the operational lifetime of the network. Packet Delivery Ratio (PDR) and normalized control overhead are important Quality of service (Qos) parameter on which this work is focused.

The rest of the paper is organized as follows: In section 2 we present some previous work. In section 3 end to end retransmission system is given. In section 4 energy aware reliable routing is mentioned. In section 5 RMECR algorithms is explained. In section 6 we go through some practical issues that need to be considered. In section 7 simulation results are been showing of the proposed work. And finally in section 8 we conclude.

II. PREVIOUS WORK

Many routing algorithms have been proposed. They can be grouped as follows: A group of algorithms that consider reliability of links to find reliable routes. D. Aguayo mentioned notion of expected transmission count (ETX) to find reliable routes. It consists of links that require less number of retransmissions for lost packet recovery. Although such routes may consume less energy since they require less number of retransmissions, they do not necessarily minimize the energy consumption for E2E packet traversal. If there are some links more reliable than others, these links will frequently be used to forward packets. Nodes along these links will fail.

The next group includes algorithms that aim at finding energy-efficient routes. Jinhua Zhu developed minimum energy routing scheme. It do not consider actual energy consumption of nodes to discover energy-efficient routes. They only consider the transmission power of nodes neglecting the

International Journal of Engineering Applied Sciences and Technology, 2016
Vol. 1, Issue 8, ISSN No. 2455-2143, Pages 83-86
Published Online June - July 2016 in IJEAST (http://www.ijeast.com)

energy consumed by processing elements of transmitters and receivers.
The other group includes algorithms that try to prolong the network lifetime. Archan Mishra and Suman Banerjee proposed MRPC, a new power-aware routing algorithm for energy-efficient routing that increases the operational lifetime of multi-hop wireless networks. This algorithm does not consider reliability and energy efficiency.
The algorithm mentioned in this paper that is RMER considers energy efficiency for reliable routes while RMECR increases the network lifetime as well as it considers the residual battery power.

III. END- TO-END RETRANSMISSION SYSTEM

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 End –to-End (E2E) retransmissions. 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. Retransmission occurs after the expiration of a timer. We assume that the duration of this timer is long enough to prevent unnecessary retransmissions.

IV. ENERGY -AWARE RELIABLE ROUTING

The objective is to find reliable routes which minimize the energy cost for E2E packet traversal. To this end, reliability 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 reliability. 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.
In RMER, 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 RMECR, 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. Minimum Energy Cost Path (MECP) between a source and a destination node is a path which minimizes the expected energy cost for E2E traversal of a packet between the two nodes in a multihop network.

V. RMER AND RMECR ALGORITHM

First analyze the energy cost of a path for transferring a packet to its destination considering the impact of E2E ACK then secondly we concentrate on algorithm for finding MECP in end-to-end system thus lastly RMER and RMECR algorithms can be derived there in.
In the E2E system, the energy cost of a path depends on the number of times that the packet and its E2E ACK are transmitted. This, in turn, depends on the E2E reliability of the path.
Considering the impact of end-to-end ACK on energy cost and end-to-end reliability of path equal to 1, MECP can be found. According to the Dijkstra's algorithm as,

$$C(P(s,v)) = \frac{1}{P_{u,v}(L_d)\ P_{v,u(L_e)}} \times C\big(P(s,u)\big) + W(u,v)]$$

Where, $W(u,v)$ is link weight, L_d is data packet size , L_e is E2E ACK packet size.
Now when the equation for MECP is designed we concentrate on link weight. In RMECR the impact of remaining battery energy is considered while finding link weight and RMECR considers reliability of links in computing total energy cost. The general approach for RMER algorithm energy cost of link is defined as actual amount of energy consumed by two end nodes of links to exchange packet .In RMER the impact of remaining battery energy is not considered.

VI. PRACTICAL ISSUES

Complete image of network topology is required for MECP. This could be achieved by optimized link state routing protocol l (OLSR). OLSR optimizes classic link state routing algorithm in which each node declares all links with neighboring nodes and floods the entire network with routing messages. Each node periodically shares its view of the network topology with other nodes. This is done by the use of so-called topology control messages, which are flooded in the network. Nodes also use periodic beacons to detect their neighboring nodes.
For implementation of RMER and RMECR, PDR (packet delivery ratio) of a link, must be known to compute the energy cost of that link. PDR of a link could be estimated using a link quality estimation technique. It could be a packet-based technique in which periodic beacons, periodic unicast packets, or data traffic are used to estimate the packet delivery ratio of links. Topology control message are transmitted every Ttc seconds.

VII. SIMULATION RESULTS

The source-destination pairs are chosen randomly over the network. A square size area 350m*350m is chosen. In this paper we focus on Constant Bit Rate (CBR). The packet size is limited to 512 bytes. Each source-destination pair begins packet sending at a chosen time. Scenarios by varying number of nodes are obtained.

International Journal of Engineering Applied Sciences and Technology, 2016
Vol. 1, Issue 8, ISSN No. 2455-2143, Pages 83-86
Published Online June - July 2016 in IJEAST (http://www.ijeast.com)

A. SIMULATION PARAMETER

TABLE I
PARAMETERS USED IN SIMULATION

Parameter	Value
Initial battery energy of each node (B)	100 [J]
Network area	350*350 [m2]
Path-loss exponent (ŋ)	3
Data rate (r)	100 [Kbps]
Power consumption of transmitter circuit (Pt)	100 [mW]
Power consumption of receiver circuit (Pr)	100 [mW]
Maximum transmission power (Pmax)	150 [mW]
Minimum transmission power (Pmin)	15 [mW]
Maximum# of transmissions in HBH system(Qu)	7
Transmission range (dmax)	70 [m]
Data packet size (Ld) 512 [byte]	512 [byte]
MAC ACK packet size (Lh)	240 [bit]
E2E ACK packet size (Le)	96 [byte]
Hello packet size (Lhello)	96 [byte]
Battery death threshold (Bth)	0
Maximum collision probability (Pcmax)	0.3
channel sensing time (Tsense)	50 [µs]
Kidle	0.2
Ksense	0.4
Thello	10 [s]
Ttc	20 s]

B. RESULTS

Software used for obtaining results in this work is NS2.

1. Packet delivery ratio: The fraction of data packets delivered to the destination node to those sent by source node.

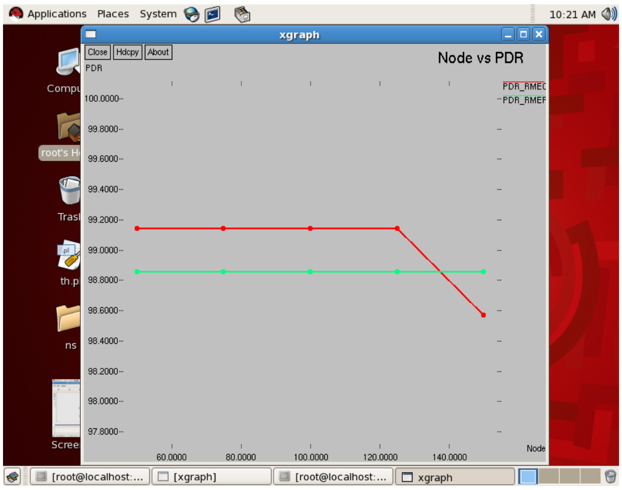

Fig. 1 PDR

2. Control overhead: the ratio of routing packets to delivered data packets.

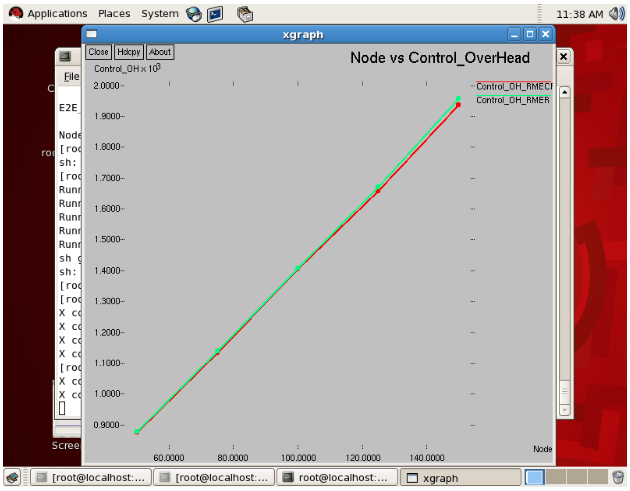

Fig. 2 Control overhead

VIII. CONCLUSION

In this paper we observed performance of RMER and RMECR algorithms. RMER does not consider remaining battery power of nodes. RMECR on the other hand considers the remaining battery energy of nodes while route selection. The simulation results for Packet delivery ratio, control overhead are obtained. from Fig.2 it seems that higher control packets are generated for RMER as compared to RMECR. From Fig. 1 delivery ratio of RMECR is considerably greater to that of RMER. Periodically OLSR protocol sends control packets that's why number of delivered packets decreases as traffic load increases.

IX. REFERENCES

[1] J. Vazifehdan, R. Prasad, and I. Niemegeers, —"Energy-Efficient Reliable Routing Considering Energy in Wireless Ad Hoc Networks", *IEEE transactions on mobile computing, vol. 13, No.2, Feb. 2014.*

[2] J. Vazifehdan, R. Prasad, and I. Niemegeers, "Minimum Battery Cost Reliable Routing in Ad Hoc Wireless Networks," Proc. Eighth IEEE Consumer Comm. and Networking Conf., Jan. 2011.

[3] Dr Chandra Shekar Reddy Putta *1,DrK.Bhanu Prasad*2

[4] X. Li, H. DilliRavilla,*3 MuraliNath R.S*4,M.L.Ravi Chandra-"Performance of Ad hoc Network Routing Protocols in IEEE 802.11", *Int'l Conf. on Computer & Communication Technology,2010*

[4]Chen, Y. Shu, X. Chu, and Y.-W. Wu, "Energy Efficient Routing with Unreliable Links in Wireless Networks," *Proc. IEEE Int'l Conf. Mobile Adhoc and Sensor Systems (MASS '06), pp. 160-169, 2006.*

[5] J.-H. Chang and L. Tassiulas, "Maximum Lifetime Routing in Wireless Sensor Networks," *IEEE/ACM Trans. Networking, vol. 12, no. 4, pp. 609-619, Aug. 2004.*

[6] J. Zhu, C. Qiao, and X. Wang, "On Accurate Energy Consumption Models for Wireless Ad Hoc Networks," *IEEE Trans. Wireless Comm., vol. 5, no. 11, pp. 3077-3086, Nov. 2006.*

[7] Misra and S. Banerjee, "MRPC: Maximizing Network Lifetime for Reliable Routing in Wireless Environments," *Proc. IEEE Wireless Comm. and Networking Conf. (WCNC '02), pp. 800-806, 2002*