

Analysis of Effective Energy Routing in MANETs

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Abstract

Wireless ad-hoc network is a wireless infrastructure fewer networks designed for internet access regardless of geographical location. . However this network contains constrained resources with absence of central coordinator. Path selection between communicating nodes is most challenging task. Moreover, effective energy routing is powerful factor due to constrained energy and its application mission In particular, effective energy and reliable routing is the societal design factor for MANETs since devices has to be powered by constrained batteries. Failure of any one of the node directly affect the overall communication performance of network, as communication in network rely on intermediate nodes coordination with each other in the network. In the paper we proposed a new routing protocol (RMEC) for MANETs compare it with efficient energy routing protocols of MANETs and provide the path for future research regarding efficient energy routing protocol design.

Keywords: - MANET, energy, performance, network life time.

INTRODUCTION

Wireless communication concept becomes a reality by the advancement in technology of past years. Enhancement of chip development brought in the reduction size of batteries and makes the wireless devices portable. These enhancements allow the node mobility and access ability to the network anytime & anywhere. If user wants to access the network, regardless of geographical location, which in turn require the implementation of mobile devices equipped with network intelligence and autonomous status. This requirement is fulfilled by mobile ad-hoc network in short MANETs [1]. Application of this network includes critical area and disaster recovery. One of the important challenging issue in MANETs is routing, i.e., efficient paths selection, between sources and destinations. Nodes in a network are communicating directly if both communicating nodes with in a communication range else they have to rely on intermediate nodes, as MANETs is characterized by infrastructure less and absence of central coordinator. Thus devices in network work as peer to peer and work as host as well as router. Whenever node behave as router then its resource utilize for sending packets of other nodes, and it is considerable problem due to resource constraint Manet's environment [2, 3].

Energy [9] is one of the most considerable resources in MANETs, as applications of MANETs include the area, where one can't recharge/replace the batteries during the application. In this work we are discussing the energy-aware routing protocols of MANETs and analyzing their performances with respect to consumption of energy, lifetime and reliability of route [10].

The paper is organized in separate section , one section discuss about the energy-efficient routing protocols of MANETs and performance analysis discussed in further section, the paper end with results and conclusion.

Energy-Efficient Routing Protocols of MANET

Routing protocols of MANET proposed for energy recourses can be categorized in following three major types to enhance the network life time, route reliability and energy efficiency [11]

1. Reliability of routing path by considering link reliability.
2. Effective energy routing path.
3. Routing path with nodes of maximum remaining energy nodes [12].

Protocol routing path selection based on link reliability may consume least energy by reducing the retransmission count but did not take account the consumption of energy for end to end packet communication. Routing path based on high priority reliable link cause the extra burden on specific nodes and specific links for forwarding packets and thus energy of those nodes quickly exhaust [13]. Routing Algorithms path selection is based on energy efficiency to enhance the reliability of route but do not concentrate on remaining energy of nodes and actual consumption of energy of nodes [4, 5]. Major route finding criteria is transmission power of devices neglecting the energy consumption by processing elements of receivers and transmitters. However, this causes bad impact on performance such as energy efficiency, reliability and lifetime of network. Routing algorithm path selection metric is based on nodes of

maximum remaining energy nodes enhance the network lifetime by forwarding the packets via the higher energy of nodes but do not consider the reliability & energy-efficiency. Moreover, this algorithm causes the increment in overall network energy consumption [6, 7].

Apart from above three concepts to find the effective energy routing path selection between source to destination, holistically consider energy efficiency, reliability and network lifetime of MANETs for routing protocols known as reliable minimum energy cost routing RMECR selects the route based on energy efficiency as well as link reliability to enhance the lifetime of network. RMER is selects the path which takes less energy for packet communication in order to get energy efficiency. These algorithms consider the impact of ACK packets on energy cost for host to host and end to end communication packets in network. Consumption of energy of processing elements of transceivers is considered. The protocols [4] which we are being considered in our paper are Traditional minimum energy routing (TMER), Minimum Expected transmission count (min ETX), Reliable minimum energy routing (RMER) and Reliable minimum energy cost routing (RMECR).

PERFORMANCE ANALYSIS

MANET is a wireless infrastructure fewer networks designed for internet access regardless of geographical location. Application of this network is disaster recovery and critical operations. However this network contains constrained resources with absence of central coordinator [8]. Path selection between communicating nodes is most challenging task. Moreover, effective energy routing is powerful factor due to constrained energy and its application missions. In particular, effective energy and reliable routing is the much vital design issue for MANET since devices will be sourced by constrained batteries. Failure of any one of the node directly affect the overall communication performance of network, as communication in network rely on intermediate nodes coordination and peer to peer network characteristics. We compare the effective energy routing mechanisms of MANET and provide the path for future research regarding effective energy routing protocol design. Increasing the energy efficiency, reliability and network lifetime is the drawback in TMER and min-ETX (expected transmission count). RMECR and RMER are proposed to achieve the above requirements of MANETs. In the paper we are presenting the experimental outcomes and discussions on the simulated results and also compared the performance of the algorithms in wireless network.

PERFORMANCE ANALYSIS METRICS

Packet delivery fraction: It is a Ratio between packet received by receiver and packets send by sender.

Consumption of energy: It is defined as ratio of Energy utilized by node to process one packet.

Reliability of routes: It is the maximum packets successfully received at destination, the higher is the reliability of routes [14].

Lifetime of network: First node energy exhausts time.

NETWORK PARAMETERS FOR PERFORMANCE ANALYSIS

To evaluate the performance the implemented protocol is compared with the existing protocols. The trace files generated is used and using AWK scripts various parametric values are collected and graphs are plotted using GNU plot.

Table .1 Simulation parameters

Simulation parameters	Value
Simulator	NS2(2.34)
Topology area	350*350
Packet size	512bytes
Nodes	200
Pause time Simulation	0sec 200sec
Maximum connection	10flows
Packet rate Traffic type	1packet/sec CBR(constant bit rate)
Initial energy Transmission range Tx energy Rx energy	100 joules 70mts 0.1 0.1

The simulation parameters for the proposed protocol is been shown in Table 1. The facsimile step was brought down by using NS-2 simulator to access the achievement of the proposed protocol. The simulation scenario is carried out by placing 200 nodes in an area of 350*350. The packet size is 512 bytes at a packet rate of 1packet/sec.

RESULT AND DISCUSSION

Figure 1 shows the performance of proposed RMEC (Reliable minimum Energy cost routing) against existing TMER (Traditional minimum Energy routing),(minETX)Minimum Expected transmission count and RMER (Reliable minimum Energy routing). There is a comparison between Reliability of Routes and energy consumption of proposed protocol with the existing protocols; this is performed to test the energy efficiency of routing protocols. As seen from Figure1the performance of RMEC protocol is better as compared to other existing protocols just

because of limited number of transmission attempts on the energy cost of routes when host to host system is considered. thus increases the reliability of routes.

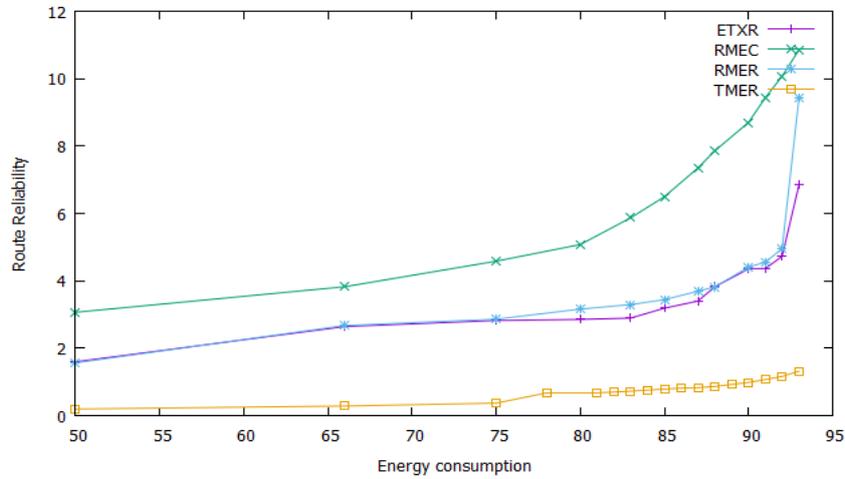


Figure 1. Performance comparison of Route reliability and energy consumption.

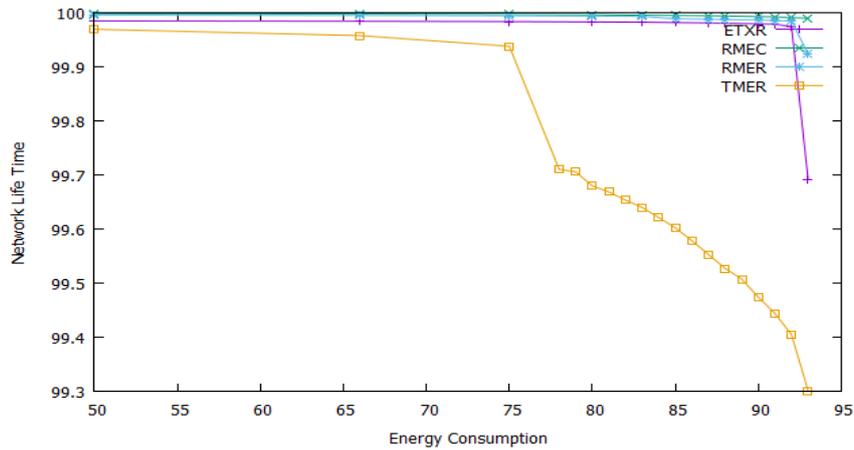


Figure 2. Performance comparison of Network life time and Energy consumption.

Figure 2 shows the performance of proposed (RMEC) against existing (RMER), (min ETX) and (TMER) protocols with respect to network lifetime. As seen from figure 2 Traditional minimum energy routing network lifetime is very less in comparison with all the other routing protocols as it only considers the residual energy for routing path calculation. RMEC routing protocol with respect to the Network life time which increases the reliability of routes shows a better result when compared to other protocols. There is a reduction in unnecessary packet transmission and reception in retransmission algorithm.

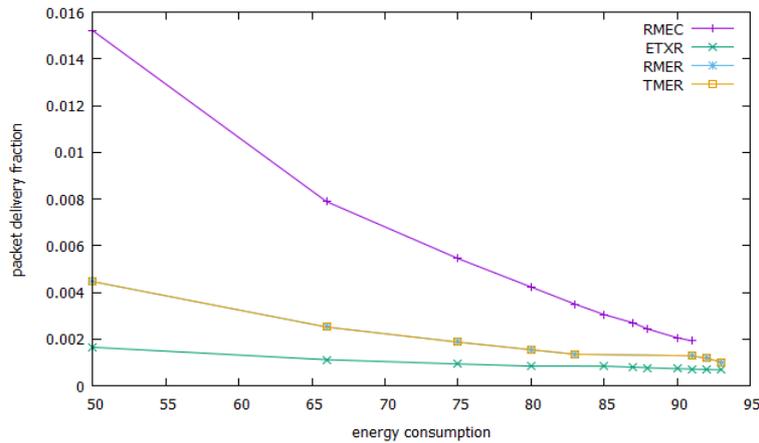


Figure 3. Performance comparison of energy consumption and Packet delivery fraction

Figure3 shows the performance of proposed (RMEC) protocol against existing (TMER), (min ETX) and (RMER) protocols with respect to packet delivery fraction and energy consumption. This comparison is very useful for testing the routing protocol energy efficiency. As RMEC is based on the residual energy of nodes, its performance for PDF is outstanding when compared with all other routing protocols, as it is cost efficient routing protocol and has minimum transmission count it always improves the performance of network.

CONCLUSION

In this paper the proposed system represents an in-depth study of energy-aware routing in ad-hoc networks, and proposed new routing protocol for wireless ad hoc networks, namely, RMECR(reliable minimum energy cost routing) comparing with the existing protocols (RMER), (TMER) and (min ETX).. In the design of RMECR, a detailed energy consumption model for packet transfer in wireless ad hoc networks is used. Thus its performance is good in comparison with all other routing protocols which we have discussed above. We conclude from our above discussion is that in order to achieve enhanced network performance with respect to energy, one should consider energy efficiency, reliability along with The impact of limited number of transmission attempts on the energy cost of routes. Moreover, impact of acknowledgment packets on energy cost of routes in both host to host and end to end systems is also considered. The proposed protocol increases the operational lifetime of the network using energy-efficient and reliable routes

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