Energy-Efficient Routing Mechanisms for Ad hoc Network Optimization and Analysis

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ABSTRACT: Ad hoc Networks are dynamic in nature and used to communicate in a region where infrastructure cannot be used and are deployed in remote and left untouched areas. These networks consist of sensor nodes with some constraints like low energy, less memory, computation power, and communication range. The power utilization rate at each node must be uniformly distributed, and the overall power for connection request should be minimized, to maximize the lifetime of mobile ad hoc networks. The focus of this paper is to give a comprehensive assessment of energy-efficient routing protocols using Ns2 simulator.

Keywords- Ad hoc, Energy, Routing, QoS

I. INTRODUCTION

The Mobile Adhoc Network (MANET), an infrastructure-free network in which nodes swap automatically at different speeds, is gaining popularity in today's digital environment [1]. Fixed routers will not be present on these kind of networks. Nodes move at random and can be dynamically joined in any way. MANET's and Vehicular Networks are two prevalent types of Wireless networks (WSN). MANET and WSN's display dynamic topology changes based on the node mobility. They have unreplenishable power limits. As a result, topology management, QoS routing, and energy management are becoming difficult problems in mobile ad hoc networks. Certain nodes [2] are unable to connect directly with one another, hence it is necessary to route these messages to their intended recipients. The node in the network acts as a router, identifying and maintaining routes to other stations. The nodes [3] can be installed on planes, ships, automobiles, and other vehicles, as well as small devices. Communication in ad hoc networks is usually multicast and broadcast in nature. Broadcast is a method of communication in which all nodes in the network must interpret the broadcast message. Multicasting is a communication method in which a single user commences packet transmission and the message is received by two or many nodes in the network.

II STRATEGIES **FOR POWER MANAGED ROUTE SELECTION**

In MANET energy efficiency is a key concern [4]. Existing energy-efficient routing protocols frequently select an ideal path based on residual- energy, transmission power, or link distance. The focus of this part is on MANET energy efficiency and route selection rules using unique measures to improve MANET path survivability. If the path breaks are

not frequent, energy of the nodes can maintained for longer times which enhances the life of network. As a result of the new measures, network connectivity is more stable, and additional route finding processes are reduced. Low-energy protocols should use less energy than other standard protocols. This implies that such a protocol that considers the nodes remaining energy level and selects routes to maximize the network's lifetime is referred to as a low energy protocol.

III EXISTING METHODS

Traditional table based methods are prominently used for unicasting; however, reactive approaches are little bit time consuming but forms the basis for many approaches. The combinational methodology has also gained prominence in current applications. In F3TM [5] perpetrator nodes are identified using a “true flooding approach” based on finding trust value. The route finding technique used the “Grey Wolf algorithm” for verifying network nodes to find an efficient and safe path for data transfer. The determined delivery path is optimized using enhanced-multi-swarm optimization. In MLSMR [6] median contention count is used to determine link stability (LSF). LSF for each link is found and it considers the link with the highest LSF to be the most stable. In IPMRM [7] node power is managed by pruning concept to ensure the proper power management in network. In PN-SEMRP [8], energy of nodes is minimized. The cluster head is chosen using a modified-firefly algorithm. Taking into account QoS considerations such as increased energy and bandwidth, multipath route calculation is done to reach various destination nodes. Using a Cuckoo-based optimised “multilayer feed forward neural network”, the reliability pair factor (rpf) is estimated between the neighboring nodes engaged in the many routes, and pruning of nodes with rpf less than a predefined threshold is performed. In EMRP-AIPUR [9] cluster head is selected considering modified Ant colony method of optimization and energy consumption of nodes is maintained by changing the cluster head for each iteration. Here every node gets a chance to be head node [12] depending on its place and level of energy, thus the probability distributed black hole problem is one of the severe problems in networks [10]. When attack was manifested culprit node will drain the power of motes [11], thus it is very much needed to identify them and pull out of the network. Thus its very essential to incorporate security measures in the network [13].

IV SIMULATION RESULTS

Simulations are done in Network Simulator 2.35 (Ns2.35) and the simulation parameters used are given below:

S. No	**Parameter**	**Value**
1.	Protocols	IPMRM, MLSMR, F3TM,EMRP-AIPUR, PN-SEMRP
2.	Deployment of	Random

	nodes	
3.	Area of network	100 mt * 100 mt
4.	Number of Nodes	Varied from 100 to 400
5.	Packet size	1500
6.	Initial Energy of node	100j
7.	Traffic type	(CBR) Constant Bit Rate
8.	Simulation time	100 sec
9	MAC type and Bandwidth	Mac/802_11 and 1MB
10.	Radio Propagation Antenna Model	Two Ray Ground Omni Antenna
11	NS2 Version	NS-2.35
12	Operating System	Ubuntu 19.1

Table 1: Simulation Metrics

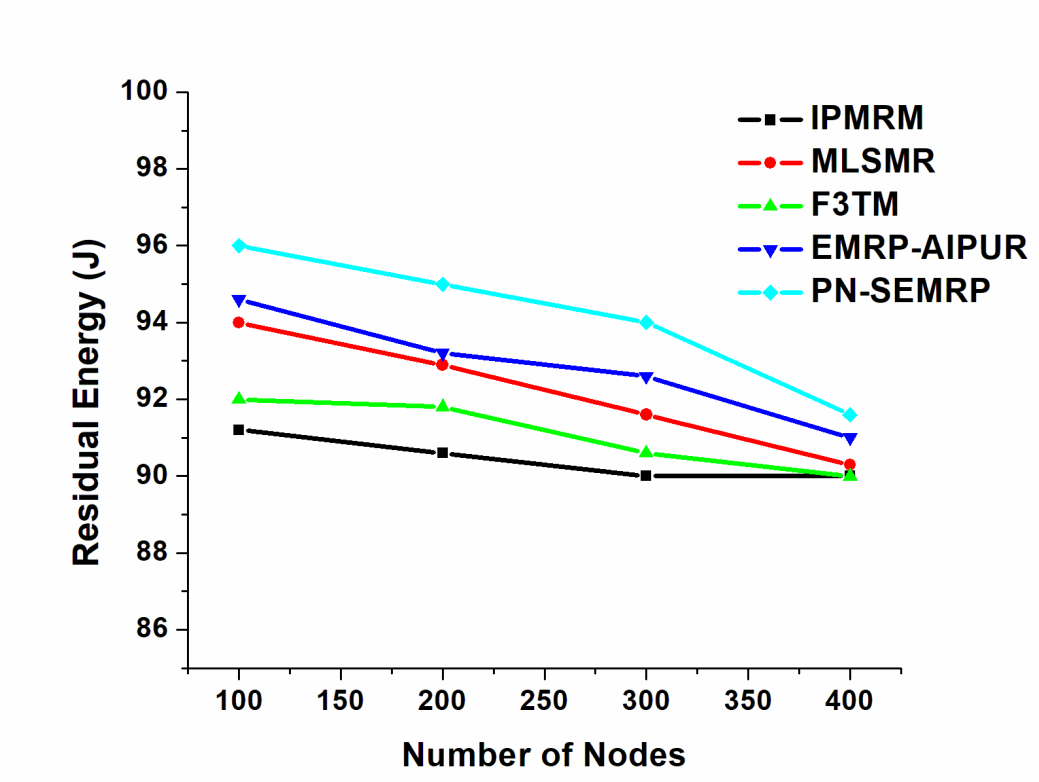

Figure1. Residual Energy as a function of Nodes

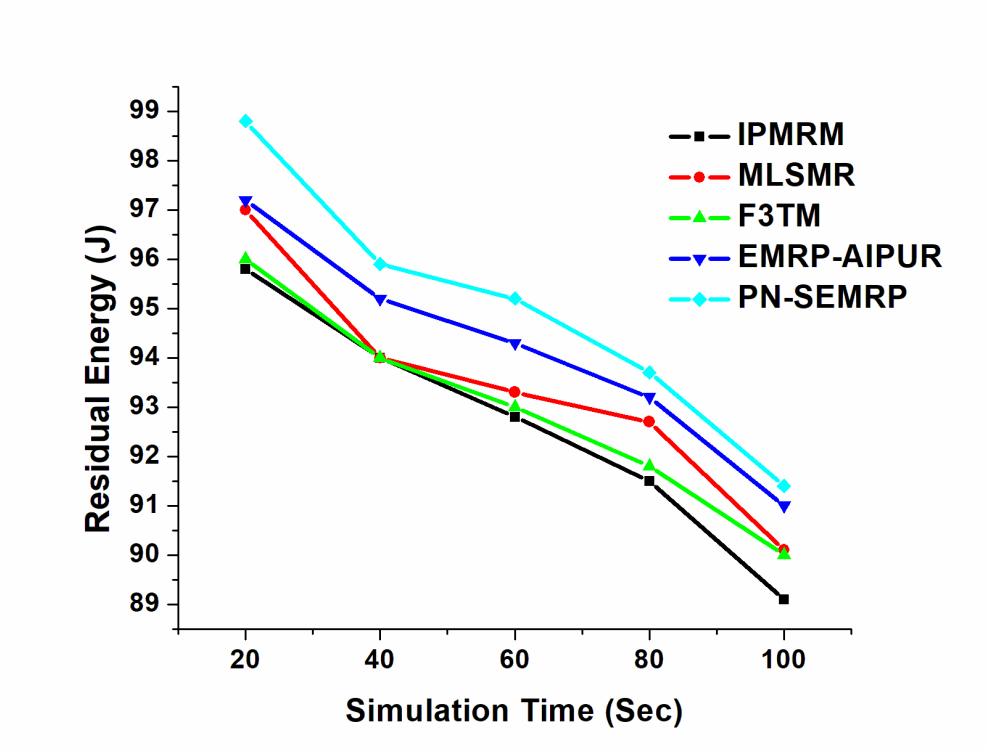

Figure 2. Residual Energy versus Simulation Time

The difference between the node's original and used energy is the node's residual energy. When seen in Figure 1, as the number of nodes increase, the node's residual energy drops due to an increase in computations. When number of nodes is varied from 100 to 400, residual energy in PN-SEMRP varies between 96 to 93J. Figure 1 and 2 shows that the residual energy of the PN-SEMRP protocol is higher than other existing protocols, implying that the network's lifetime will be extended when that routing technique is used.

V CONCLUSION

Every protocol has got its own applications and merits, in this paper, we present a thorough examination of residual –energy of various protocols in Ad- hoc networks that have been built and designed by the authors. These mechanisms are usually flat, hierarchical and cluster based. PN-SEMRP shows lesser energy consumption because of its design and well-organized power management scheme. In future the performance can be evaluated for above protocols under various attacks.

REFERENCES

1. Joshua Reginald Pullagura and Dr.D.Venkata Rao, “An efficient and cooperative multicast routing based on hop tree in adhoc networks”. IEEE International Conference on Advanced Computing and Communication Systems, Coimbatore, India, 2016, pp.1-5, DOI: 10.1109/ICACCS.2016.7586365.
2. Yasaroglu Pinar, Abdul-Jabbar,” Wireless Sensor Networks (WSNs)” IEEE long island system, application and technology conference (LISAT) 20 June 2016
3. S. Mirza and S. Z. Bakshi, “Introduction to MANET,” International Research Journal of

Engineering and Technology, vol. 5, no. 1.

4. Joshua Reginald Pullagura and Dr.D.Venkata Rao, “Attacks on Mobile Ad hoc Networks A Survey”, International Journal of Computer Applications (IJCA), 2016, ISSN: 0975-8887.
5. Ahmed, Malik N., Abdul Hanan Abdullah, Hassan Chizari, and Omprakash Kaiwartya. "F3TM: Flooding Factor based Trust Management Framework for secure data transmission in MANETs." Journal of King Saud University-Computer and Information Sciences 29, no. 3, 2017, pp. 269-280
6. Singal, Gaurav, Vijay Laxmi, Manoj Singh Gaur, Swati Todi, Vijay Rao, MeenakshiTripathi, and RitiKushwaha. "Multi-constraints link stable multicast routing protocol in MANETs." Ad Hoc Networks 63 ,2017, pp. 115-128..
7. Raja shekhar C. Biradar, Sunil kumar S. Manvi “Information Priority based Multicast routing in MANET” International Journal of Wireless and Mobile Networks(IJWMN)Vol 3, June 2011
8. Joshua Reginald Pullagura and Dr.D.Venkata Rao, “Analysis of multicast routing protocols for health care monitoring system” in journal of IT in Industry, ISSN (Online): 2203-1731 Vol. 9, No.2, 2021
9. Joshua Reginald Pullagura and Dr.D.Venkata Rao “ Performance analysis of Efficient Multicast Routing techniques in Ad hoc Networks” in Journal of Critical Reviews Vol 6, 2019.
10. Detecting and Isolating Black-Hole Attacks in MANET Using Timer Based Baited Technique Hindawi Wireless Communications and Mobile Computing Volume 2018. Research Article.
11. Mitigating Black Hole Attacks in MANETs Using a Trust-Based Threshold Mechanism International Journal of Applied Engineering Research ISSN 0973-4562 Volume 13, Number 7 (2018).
12. Joshua Reginald Pullagura and Dr.D.Venkata Rao “ACO based routing protocols for Mobile ad hoc networks” in International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-9 Issue-1S5, December, 2019.
13. Ming-yang su; kun-lin chiang “Mitigation of black-hole nodes in mobile ad-hoc networks,” international symposium on parallel and distributed processing with application IEEEconference, 11th nov 2010.