International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 02 Issue: 08 | Nov-2015 www.irjet.net p-ISSN: 2395-0072

An Accessible Energy Efficient Routing Protocols for Mobile Ad Hoc Networks: A Contemporary Investigation

Nitesh Yadav[1], Sunita Chaudhary[2]

[1]M.Tech Scholar, Department of Computer Science & Engineering, MEC,Bikaner, Rajasthan, India
[2] Asst. Prof., Department of Computer Science & Engineering, MEC, Bikaner,Rajasthan, India

---

Abstract – ***Over the past years, with tremendous growth of mobile device and wireless networks the arena of Mobile Ad-hoc Networks (MANETs) has attain huge consideration of researchers and has become one of the most vibrant and active field of research. MANET is a Self-organized, energetically reconfigurable wireless Ad hoc network which does not rely on any fixed infrastructure. To keep the network connected each node act as router as well as performing function of source or destination node. Since the nodes are mobile in MANETs and have some unique personality such as limited battery power, tiny communication range and high mobility. Therefore network faces many challenges. Among of several an energy aware routing is one of the most important issues in MANET. However, a number of approaches have been proposed by number of researchers to trim down such issues in MANETs environment but each and every approach has its own limitation and not suitable for every circumstances. This paper presents the state of affairs on energy efficient routing approaches for MANETs with their merits & shortcomings, which can be used for further enhancement of existing protocol or development of new efficient and more reliable protocols for most of the applications in MANET.***

Key Words: *MANETs; Routing, Routing Protocols, Energy aware routing*

1. INTRODUCTION

With the recent advancement of wireless communication arena the mobile ad hoc networks (MANETs) are among the most popularly studied network communication technologies. MANETs is a dynamically self-organized, infrastructure less network where mobile devices are associated by wireless links and travels at dissimilar speed and directions without any restraint [1-4]. Each and every node of the network behaves like a router with performing the functionality of source as well as destination node. The nodes are consist with the limited communication range therefore only the nodes which are comes in the communication range of each other can communicate directly else the source node use the multipath communication where it passes the information by using several of intermediate nodes. The Figure 1 shows a mobile ad hoc network of 10 & 20 nodes.

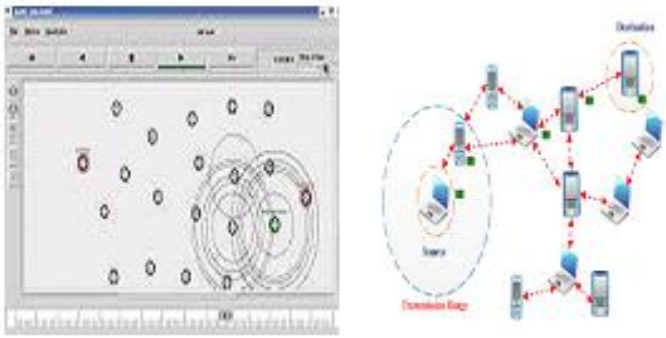

Fig. 1 Mobile Ad-hoc Network

MANETs are widely used in the area where fixed and traditional network establishment are not feasible. Nodes within such ad-hoc network generally rely on batteries power for performing the action of receiving / sending packets and to reconnect the path by using new pathway cause to trim down the network life time. Additionally the high mobility of nodes amends the network topology frequently [5-7]. However, a number of approaches have been presented and a lot of works are going on in direction to trim down such issues of efficient routing in MANETs but still the field face problem. No one single routing algorithm is efficient to work in all atmospheres of MANETs. Among of several efficient powers aware routing is the main and current hot topic of research in the field of MANET which can extend life time and connectivity of such network [8].

This paper present up to date investigation on current energy efficient routing approaches in MANETs and is organized as follows. The mechanisms of routing and routing protocols of MANETs are elaborate in section 2. A number of accessible energy efficient routing approaches have been presented in section 3 and modern issues are present in section 4. Finally section 5 concludes the paper.

2. ROUTING & ROUTING PROTOCOLS IN MANETS

Since the age of MANETs routing is a challenging task and the hot topic for the researchers. Typically routing refers the process of set up and retains routes between nodes in a dynamic environment with minimum resources. The routing protocols for the MANETs are broadly categorized into three types [9-11] as present in figure 2.

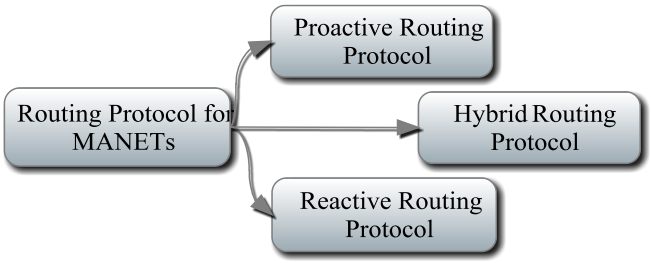

Fig. 2 Routing Protocols **for** MANETs

Proactive routing protocols are mostly based on shortest path algorithms and also known as table driven routing protocol because they store the information of all connected nodes in form of tables. Whenever any change present in network the node shared the information with their neighbors. The advantage of proactive routing protocol is that there is no route discovery since the destination route is stored in the background, but the disadvantage of this protocol is that it provides low latency for real time application.

Reactive routing protocol developed to overcome the overhead of proactive routing protocol. The Reactive routing protocol also called on-demand routing protocol because these protocol establish the route only when it is necessary and only for those nodes that are currently being used to send data packets from source to destination. The reactive routing protocol can be further classified as source routing or hop-by-hop routing. The data packet contain the whole routing information in the source routing and the nodes between the sources and destination which perform as intermediate node for communication can takes route information from the data packet and stores it in the header of data packet. As a result, each intermediate node does not need to update all route information in order to send packet to the particular destination.

Hybrid routing protocol combines characteristics of both reactive and proactive routing protocols and proposed to reduce the control overhead of proactive routing protocols with decreasing the initial route discovery delay in reactive routing protocols. Typically the hybrid routing protocols are area based; it means the number of nodes is divided into different zones to make route discovery and maintenance more reliable for MANETs or VANETs. The main advantage is that it requires less roadside infrastructure. However, one disadvantage is that network connectivity may not be guaranteed in scenarios with low density network.

3. AVAILABLE ENERGY PROFICIENT ROUTING PROTOCOLS FOR MANET

A good number of approaches have been presented by the different authors to trim down the energy consumption issues in the environment of MANETs. A two phase energy stable routing algorithm Q-PAR [12] has been presented by the author for satisfying energy stability and bandwidth constraint. The proposed approach discovers the finest route in its first phase by applying DSR route discovery mechanism. After establishment route nodes start the communication and whenever an event of route breakage occur in the network the second phase of the proposed algorithm start the maintenance by searching next energy stable path. However the approach enhances the QOS of the network but in high mobile network connections are break frequently and each and every time searching the alternate path required more energy of host. Therefore approach is not feasible for the environment of MANETs.

In same context another author has present a novel routing algorithm EEAODR [13]. The proposed approach selects the best path for packet transmission on the base of nodes energy levels. In proposed algorithm, if the path has one node with low energy level, the optimizer function will not choose it. If time is low, the route will be shorter and less energy will be consumed. but some nodes may die too quickly. Therefore optimizer function should do a tradeoff between time and network/node lifetime. In this protocol when the destination receives first RREQ, waits for a while and collects all the subsequent RREQs. After this time, the destination uses the optimizer function to choose the best path and inserts it in the RREP packet. The destination also chooses some backup routes to avoid wasting energy and time for re-calculation of paths.

A novel Energy Efficient Location Aided Routing (EELAR) algorithm has been proposed in [14] for reducing the nodes energy utilization. The proposed approach control the overhead packet generation by restrictive the searching area of next route. The approach produce significant result in comparison of other existing approaches such as AODV, LAR and DSR routing protocols but same as previous approaches the algorithm use the source routing strategy which can be improved.

To enhance the energy level a Load Aware Routing Protocol (ELB-MRP) [15] present by authors. The approach uses collision window size and queue size to calculate load at the node and its single hop neighboring nodes. Each node except source and destination, collects

information about the collision window size (ACW), power factor (EF) and queue factor (QF) for itself and its single hop neighbors. To discover Paths, intermediate nodes add their traffic and energy information to the RREQ packets. Hello packets also collect information about ACW, EF and QF values. Using the neighbor information obtained from hello packets, intermediate nodes calculates the cumulative cost using relation and adds it to the RREQ packet. If a node i, has neighbors j and k, the cumulative cost of CC(i) is obtained using the relation. When the first RREQ reaches the destination, destination waits for more RREQs. Then destination, selects two paths with least cost as primary and backup path.

To improve the reliability of the discovered path with taking into account both signal strength and remaining energy of nodes a novel reliable energy and signal strength aware routing protocol (SEA-DSR) [16] presents by researchers. The approach enhance the network life time by shrinking the link failure, route discovery and routing control overhead issues. To achieve aim the approach attach a extra field called trust count (RELCOUNT) to the RREQ packet header of DSR protocol. After receiving first RREQ packet, the destination sets a timer and stores all RREQ in its route cache. After the timer, chooses the path with high reliability factor and sends a RREP packet for that. Reliability factor for the path is calculated using relation. In same context by shrinking broadcasting power of beacon messages an adaptive topology control protocol has been present in [17]. The approach has consent to each node to decide whether to support energy-efficient routing to conserve its own energy. It employs the information partially received from nearby nodes to confine the broadcasting radiuses of subsequent beacons. Every time interval each node broadcasts a beacon at a certain radius to nearby nodes. This protocol can significantly decrease the total energy consumption for successfully transmitted data, and the lifetimes of nodes, especially in high mobility environments.

To achieve energy conservation in heterogeneous mobile ad hoc networks authors has present a new scheme device-energy-load aware relaying framework DELAR [18]. The proposed algorithm exploits device heterogeneity and the features of cross-layer protocol design methodology. They show that DELAR can significantly reduce the energy consumption and thus prolong the network lifetime even with just a few P-nodes placed in the network. There various energy conservation techniques such as power saving modes. Transmission power control and power aware routing can be integrated to jointly achieve better energy conservation. More importantly, in this the framework provides a platform to address other challenging issues such as quality of service provisioning and security support as well.

A new approach ETARP [19] has been proposed in direction to reduce overheads. The proposed approach has been designed with energy management capabilities that consider variations in the availability of the environmental energy. The approach can adjust the duty cycle of each node adaptively in order to exploit the available energy resources efficiently in comparison to other opportunistic routing protocols. But geographical information is required, which make it unsuitable for an each environment of MANETs.

The paper [20] has discussed the issues of single routing protocol inefficiency to satisfy all requirements. i.e., one routing protocol cannot be a solution for all energy efficient protocol that designed to provide the maximum possible requirements, according to certain required scenarios. Additionally the paper has presents the implementation of Adaptive HELLO messaging scheme to determine the local link connectivity information for monitoring the link status between nodes along with the incorporation of Dynamic On Demand Routing Protocol to reduce the energy consumption of mobile nodes to certain extent. RAODV [21] routing approach has proposed to achieve energy efficiency, flexible scalability, adaptability and good network performance. The proposed approach makes a endeavor to improve Packet Delivery Ratio (PDR). However approach enhance the performance in some situations but overall due to huge like failure approach have not present any significant results in comparisons of other existing algorithms.

A novel energy aware and Adaptive Cross Layer Routing Protocol, EACLRP [22] has presents to prolonging the network lifetime and to efficiently route the packets across the network. It makes use of cross layering approach to improve network parameters such as throughput, packet delivery ratio and end-to-end delay of the network. In same context a Ant Colony Optimization based method is used in [23] to find good paths which will consume less energy and less hop count. The efficiency of the proposed protocol is more with respect to the AntHocNet. The protocol is tested and compared under different time intervals.

The researchers enhanced the routing mechanism of Dynamic Source Routing (DSR) Protocol by proposing a new approach O-DSR [24]. The aim behind the proposed enhancement is to find the best route in acceptable time limit without having broadcast storm. Moreover, O-DSR enables network not only to overcome congestion but also maximize the lifetime of mobile nodes. Some simulations results show that the Route Request (RREQ) and the Control Packet Overhead decrease by 15% when O-DSR is used, consequently. Also the global energy consumption in O-DSR is lower until to 60 % , which leads to a long lifetime of the network.

The papers [25-28] has presents the numerous accessible energy aware routing approaches with the merits and demerits. However the proposed approaches enhance the network lifetime and trim down the energy consumption ratio of network but each and every routing algorithm has face its own limitation. Several to issues still are associated with the current routing algorithms present in the next section.

4. ISSUES ASSOCIATED WITH ON-HAND ROUTING PROTOCOLS

Over the past years a good number of routing approaches have been proposed by authors in order to overcome the problem of discovering and maintaining the efficient and effective route for the data transmission over wireless network but still there is scope of modernization in the direction to condense energy consumption. However, a good number of approaches has propose more efficient routing mechanism and achieve the improve results in comparisons of traditional approaches but still not a single algorithm is efficient to work in each and every scenario of MANETs and face several of issues in finding and maintaining correct routes. Additionally they consume more energy in different network scenario except to scenario in which they trained. Number of approaches uses a reserved path concept which indirectly increases the issues of network overheads. The associated issues of current routing mechanisms can be present as

- The current accessible routing approaches behave differently in diverse scenario of MANETs which presents the non flexibilities of proposed algorithms.
- They are effective only in the scenario which is builds with the small amount of host or with a limited area.
- Most of the approach maintain backbone/ reserved pathway cause to enhance overheads and energy of host.
- Use flooding process and are source initiated to establish a pathway cause to consume huge energy.
- Low scalability, where network can go from scarce to dense in a very short time.
- They consume huge bandwidth and generates high end to end delays.

The above inadequacies of current on-hand routing algorithms evidently present their ineffectiveness in the environment of MANETs and motivates to researchers to design a more competent routing mechanism because energy is always vital resource for wireless networks.

5. CONCLUSIONS & FUTURE WORK

Over the past years MANETs has attains huge growth of researchers to design an efficient routing mechanism for high dynamic environment. Since the age of network power aware routing mechanism is a hot and challenging topic of research. This paper presents a modern investigation on the accessible energy efficient routing mechanisms for the environment of MANETs. However, a number of power aware routing approaches have been proposed for MANETs but still no one single algorithm satisfy all requirements in each and every situation of such network. Different approaches work in a different way according to the assumptions and employs mechanisms. Therefore the approaches have different strengths and drawbacks.

These inadequacies of on hand routing mechanism motivates us to makes an endeavor in future to design a new procedure that reduces the energy consumption and increases the energy utilization of nodes in network.

REFERENCES

[1] Wei Liu, Ming Yu "AASR: Authenticated Anonymous Secure Routing for MANETs in Adversarial Environments" Ieee Transactions on Vehicular Technology, Vol. 63, No. 9, November 2014.

[2] Ze Li, and Haiying Shen "A QoS-Oriented Distributed Routing Protocol for Hybrid Wireless Networks" Ieee Transactions on Mobile Computing, Vol. 13, No. 3, March 2014

[3] Xin Ming Zhang, En Bo Wang, Jing Jing Xia, and Dan Keun Sung "A Neighbor Coverage-Based Probabilistic Rebroadcast for Reducing Routing Overhead in Mobile Ad Hoc Networks" Ieee Transactions on Mobile Computing, Vol. 12, No. 3, March 2013.

[4] Y. Xiao, X. Shen, and D.-Z. Du, "A Survey on Attacks and Countermeasures in Mobile Ad Hoc Networks", Wireless/Mobile Network Security, 2006 Springer.

[5] Said EL KAFHALI, Abdelkrim HAQIQ " Effect of Mobility and Traffic Models on the Energy Consumption in MANET Routing Protocols" International Journal of Soft Computing and Engineering (IJSCE) ISSN: 2231-2307, Volume-3, Issue-1, March 2013

[6] A. Kumaravel , Dr. M.Chandrasekaran "A Complete Study On Power Aware Routing Protocol For Mobile Adhoc Network" International Conference on Advances in Engineering & Technology – 2014 (ICAET-2014)

[7] A. Samuel Chellathurai, E.George Dharma Prakash Raj "A Strategic Review of Routing Protocols for Mobile Ad Hoc Networks" International Journal of Engineering Trends and Technology (IJETT) – Volume 10 Number 8 - Apr 2014

[8] Srinivas Kanakala, Venugopal Reddy Ananthula, and Prashanthi Vempaty "Energy-Efficient Cluster Based Routing Protocol in Mobile Ad Hoc Networks Using Network Coding" Hindawi Publishing Corporation Journal of Computer Networks and Communications Volume 2014

[9] Mehran Abolhasan, Tadeusz Wysocki, Eryk Dutkiewicz "A Review of Routing Protocols for Mobile Ad hoc Networks", Ad Hoc Networks 2 (2004) 1–22, Elsevier.

[10] Alex Hinds, Michael Ngulube, Shaoying Zhu, and Hussain Al-Aqrabi "A Review of Routing Protocols for Mobile Ad-Hoc NETworks (MANET)" International Journal of Information and Education Technology, Vol. 3, No. 1, February 2013

[11] Harjeet Kaur, Varsha Sahni, Dr. Manju Bala "A Survey of Reactive, Proactive and Hybrid Routing Protocols in MANET: A Review" International Journal of Computer Science and Information Technologies, Vol. 4 (3) , 2013, 498-500

[12] Vinay Rishiwal, S. Verma, and S.K.Bajpai. "QoS Based Power Aware Routing in MANETs", International Journal of Computer Theory and Engineering, Vol. 1, No. 1, April 2009.

[13] Sanjay Kumar Dhurandher, Sudip Misra, "An Energy-Efficient On-Demand Routing Algorithm for Mobile Ad-Hoc Networks", 15th IEEE International Conference on Electronics, Circuits and Systems, 2008.

[14] Mohammad A. Mikki "Energy Efficient Location Aided Routing Protocol for Wireless MANETs",(IJCSIS) International Journal of Computer Science and Information Security Vol. 4, No. 1 & 2, 2009.

[15] Sujatha P Terdal, Dr. V.D.Mytri, Dr. A.Damodaram, "A Load Aware Routing Mechanism for Improving Energy Efficiency in Mobile Ad Hoc Networks", International Journal of Computer Applications, November 2010.

[16] P.Srinivasan & K.Kamalakkannan, "Signal Strength And Energy Aware Reliable Route Discovery In MANET", International Journal of Communication Network Security ISSN: 2231 – 1882, Volume-1, Issue-4, 2012.

[17] Kai,A.A. and Jan,H.,R. "Adaptive Topology Control for MobileAd Hoc Networks" IEEE transaction on parallel and distributed system,Vol. 22 Issue 12, pp. 1960-1963, 2011.

[18] Liu, W.,Zhang, C., Yao,G.,Fang, Y."DELAR: A Device-Energy-Load Aware Relaying Framework for Heterogeneous Mobile Ad Hoc Networks" IEEE journal on selected areas in communications,Vol. 29 Issue 8, pp.1572-1584,2011.

[19] S. S. Beheshtiha, H.-P. Tan, and M. Sabaei, "Opportunistic routing with Adaptive Harvesting-aware Duty Cycling in energy harvestingWSN," in Proceedings of the 15th International Symposium on Wireless Personal Multimedia Communications (WPMC '12), pp. 90–94, Taipei, Taiwan, September 2012.

[20] K.Sumathia, A.Priyadharshinib "Energy Optimization In Manets Using Ondemand Routing Protocol" Procedia Computer Science, Elsevier (2015) 460 – 470

[21] Kanwal Deep Kaur, Manish Bhardwaj "Effective Energy Constraint Routing with on-Demand Routing Protocols in MANET" American Journal of Networks and Communications 2015; 4(2): 21-24

[22] Deepthy J "Energy Aware and Adaptive Cross Layer Routing Protocol (EACLRP) for MANETs" International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 4, Issue 9, September 2015

[23] Neha Patil, S. B. Takale "Implementation of Ant Colony Based Energy Aware Routing Protocol in MANET" International Journal of Innovative Research in Science, Engineering and Technology, Vol. 4, Issue 7, July 2015

[24] Rjab Hajlaoui, Sami Touil and Wissem achour "O-DSR: Optimized Dsr Routing Protocol For Mobile Ad Hoc Network" International Journal of Wireless & Mobile Networks (IJWMN) Vol. 7, No. 4, August 2015

[25] Rakesh Kumar, Piush Verma, Yaduvir Singh "Mobile Ad Hoc Networks and It' s Routing Protocols" International Journal of Computer, Electrical, Automation, Control and Information Engineering Vol:7, No:8, 2013

[26] Neha Agarwal, Neeraj Manglani "A Survey on Energy Efficient Routing In MANETs Using Multi-Objective Genetic Algorithm" International Journal on Recent and Innovation Trends in Computing and Communication, April 2015.

[27] Nazila Majdkhyavi, Raziyeh Hassanpour "A Survey of Existing Mechanisms in Energy-Aware Routing In MANETs" International Journal of Computer Applications Technology and Research Volume 4–Issue 9, 673 - 679, 2015, ISSN: 2319–8656

[28] Ganesh Gupta " Energy Efficient Routing Protocol for MANET: A Survey" International Journal of Emerging Technologies in Computational and Applied Sciences, 11(1), December 2014- February 2015, pp. 30-37