International Journal of Advanced Technology in Engineering and Science
Vol. No.3, Issue 11, November 2015
www.ijates.com
ijates
ISSN 2348 - 7550

ENERGY SAVING USING OPTIMAL ROUTE FOR MOBILE ADHOC NETWORKS

Deepika Gupta[1], Richa Singh[2]

[1]*Assistant Professor, Computer Science Department,*

Meerut Institute of Engineering and Technology, (India)

[2]*Assistant Professor, Computer Science Department, Modinagar Institute of Technology, (India)*

ABSTRACT

In this paper, There is a existing energy efficient routing protocol called Efficient Power Aware Routing Protocol (EPAR) that works on DSR. It minimizes the overhead of source by distributing its load among the intermediate nodes and giving its control of finding the best route between source and destination node. It also saves energy that is consumed in generating RERR by the destination node and then traversing to all intermediate nodes to source for rediscovering route from source to destination. It reduces network failure due to loss of node's energy and minimizes loss of data packets. It also balances the consumption of energy between utilized nodes and the underutilized nodes. During the route discovery phase, EPAR selects an optimal route by considering a set of parameters including energy, hop count but it does not consider the mobility factor in routing which reduces the performance of the network. Hence, a technique is contributed that considers node mobility as one of the factor along with energy, hop count for the selection of optimal route. Hence, the Improved EPAR outperforms the existing work in terms of normalized throughput, packet delivery loss ratio and Network Lifetime and decreases more than 30% energy consumption.

Keywords: EPAR; Mobile Adhoc Network; Mobility factor; Residual energy

I. INTRODUCTION

A mobile ad hoc network (MANET) is a continuously self-configuring, infrastructure-less network of mobile devices connected without wires. Ad hoc is Latin and means "for this purpose"[1]. Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently as shown in Figure.1. Each must forward traffic unrelated to its own use, and therefore be a router. The major concern in MANET is energy conservation due to the limited lifetime of mobile devices. It also impacts the network lifetime because they collectively form a network. MANET usually has a dynamic topology due to the mobility of the nodes and has limited bandwidth [2]. As mobile device is battery operated thus they suffer from limited energy level problems which cause breakage of the link between the nodes. If the battery power is high in all the mobile nodes in the MANET then the network lifetime can be increased.

1.1 Applications

With the increase of portable devices as well as progress in wireless communication, ad-hoc networking is gaining importance with the increasing number of widespread applications [3].

- **Military Scenarios:** MANET supports tactical network for military communications and automated battle fields.
- **Rescue Operations:** It provides Disaster recovery, means replacement of fixed infrastructure network in case of environment disaster.
- **Data Networks:** MANET provides support to the network for the exchange of data between mobile devices.
- **Device Networks:** Device networks support the wireless connections between various mobile devices so that they can communicate.
- **Free Internet Connection Sharing:** It also allows us to share the internet with other mobile devices.
- **Sensor Network:** It consists of devices that have capability of sensing, computation and wireless networking. Wireless sensor network combines the power of all three of them, like smoke detectors, electricity, and gas and water meters.

1.2 Routing Protocols

Routing is defined as the process of finding path from a source to every destination in the network. There are number of routing protocols for ad hoc networks, they are categorized into three: 1.Proactive routing protocol and 2.Reactive routing protocol and 3. Hybrid routing protocol as shown in Figure.3 while depending on the network structure these are classified as flat routing, hierarchical routing and geographic position assisted routing. Flat routing covers both routing protocols based on routing strategy.

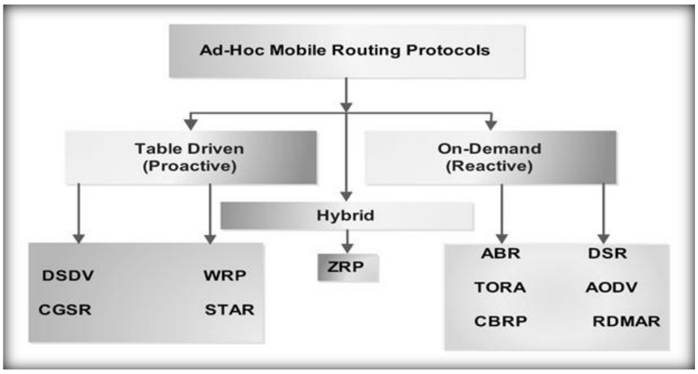

Figure 1. Classification of Routing Protocols in MANET's

a. Proactive (Table-Driven) Routing Protocol

In Proactive, each node maintains the network topology information in the form of routing tables by periodically exchanging routing information. Whenever a node requires a path to destination, it runs an appropriate path finding algorithm on the topology information it maintains. There are various types of table driven protocols: Destination Sequenced Distance Vector (DSDV), Fish eye State Routing (FSR) etc.

Destination-Sequenced Distance-Vector Routing Protocol (DSDV)

DSDV is developed on the basis of Bellman–Ford routing algorithm with some modifications. The main contribution of the algorithm was to solve the routing loop problem. In this routing protocol, each mobile node in the network keeps a routing table. Each of the routing table contains the list of all available destinations and the number of hops to each. Each table entry is tagged with a sequence number, which is originated by the destination node.

b. Reactive (On-Demand) Routing Protocol

Reactive routing protocol is also known as on-demand routing protocol. These protocols have no routing information at the network nodes if there is no communication. They do not maintain or constantly update their route tables with the latest route topology. They obtain the necessary path when it is required. If a node wants to send a packet to another node then this protocol searches for the route and establishes the connection in order to transmit or receive the packet. There are various types of on-demand routing protocols: Dynamic Source Routing (DSR), Ad-hoc On-demand Distance Vector routing (AODV) [10].

Dynamic Source routing (DSR)

DSR [4] is a type of reactive routing protocol. DSR is composed of two main mechanisms route discovery and route maintenance as shown in Figure.4. Route Discovery: It is the method in which the source node receives the end node source destination path. In DSR to further reduce the cost of route discovery, the RREQs are initially broadcasted to neighbours only by zero-ring search, and then to the entire network if no reply are received. When an intermediate node forwarding a packet detects through Route Maintenance that the next hop along the route for that packet is broken, if the node has another route to the packets´s destination it uses it to send the packet rather than discard it. Route maintenance: In route maintenance a routing entry contains all the intermediate nodes information not only the next node information. The source node has entire routing path, and the packet is sent through that routing path. If the source node does not have entire routing path, then it execute route discovery mechanism by sending the route request (RREQ) packets in the network. Then in reply the route reply (RREP) packet is send by the node which has path to destination node [11].

II. TECHNICAL ARCHITECTURE AND IMPLEMENTATION

This architecture shows how the path is selected for the transmission of data as EPAR algorithm is an on demand source routing protocol that uses battery lifetime prediction. In Figure.6, DSR selects the shortest path S-3-4-D or S-3-2-D. But proposed EPAR selects S-1-2-D only, because that selected path has the maximum lifetime of the network (1000s). It increases the network lifetime of the MANET. The objective of this routing protocol is to extend the service lifetime of MANET with dynamic topology. This protocol favors the path whose lifetime is maximum by using Min-Max formulation as given below.

$$\mathbf{Max}\ T_k(t) = \mathbf{Min}_{i€k}\ T_i(t)$$

where, T_k (t) – lifetime of the path k

T_i (t) –Predicated lifetime of node i in path k

k- set of available shortest path

The objective of this routing protocol is to extend the service lifetime of MANET with dynamic topology.

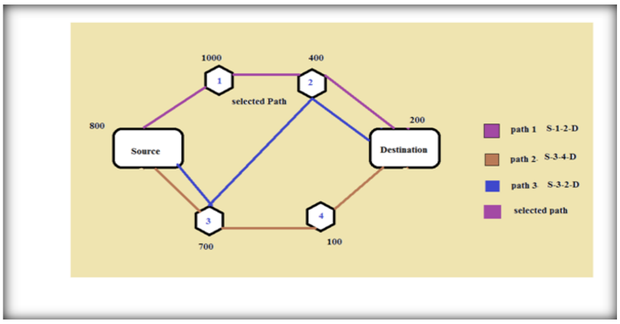

Figure 2.Technical Architecture

III. PROBLEM DISCUSSION AND SOLUTION

The main drawback of the EPAR [12] protocol is that it does not consider the frequent movement of the nodes and hence, mobility is not determined and also no alternative paths are provided for the transmission of data packets in case of depletion of nodes in the original path. So, in this paper, the proposed work is designed for mobile ad hoc networks, it is necessary to consider the hop count and mobility in addition to energy during an optimal route selection. The destination selects the best route on the basis of different parameters like max Energy, min Mobility and min Hop Count among the entire route requests arrived. The RREP packet goes along the reverse hop sequence of the best route and also contains the Final Route Table. The Final Route Table is saved by each intermediate node and the source node in its route cache. Through the contribution negligible delay only is incurred due to hop count consideration and the source's overhead of finding the alternate path gets minimized. The node may have max energy, and min hop count, but, if it has high mobility, there is a high probability for link failure due to its mobility. An effective solution can be provided to overcome the link breakage during an ongoing communication by the addition of mobility factor. Neighbor status is checked for periodically and if the router is not within range then alternate path which is having stability is selected [5].

Mobility Model:

Random way point mobility model is used in which nodes move to random location. The random waypoint model is a random model for the movement of mobile users, and how their location, velocity and acceleration change over time.

Mobility Factor:

Mobility factor determines the stability of the node. It means that source node will check the distance between own location and router location in two different instances (t and t+T). If the distance is less than transmission range in two different instances it means that the router is stable one. When the stable routers are selected for routing, link disconnections can be avoided thereby packet loss due to mobility is reduced in the network [9]

Modules

1. Shortest path identification
2. Energy based path identification
3. Data transmission over selected path
4. Stability checking
5. Data transmission over stable path
6. Performance evaluation

IV. PERFORMANCE METRICS FOR THE IMPROVED EPAR PROTOCOL

1. Residual battery power

The remaining battery power is calculated by the difference between the initial battery energy and the transmission or reception energy between the nodes. On the bases of residual energy each node lifetime is estimated [6] [7].

Initial energy=Residual energy + transmission power or reception power

2. Packet Delivery Ratio

The packet delivery ratio is the total number of data packets received by the destination over the total number of data packets transmitted or generated by the CBR source. The PDR shows how successful a protocol performs delivering packets from source to destination. The higher for the value give the better results. This metric characterizes both the completeness and correctness of the energy efficient routing protocol.

3. Delay

The average time taken by a data packet to arrive at the destination is referred as delay. It also includes the delay caused by route discovery process and the queue in the data packet transmission. Only the data packets that successfully delivered to destination are counted. Once the time difference between every CBR packet sent and received was recorded, dividing the total time difference over the total number of CBR packets received gave delay for the received packets.

4. Network Life Time

Network lifetime is the time at which the first network node runs out of energy to send a packet, because to lose a node could mean that the network could loss some functionality or it is the time span from the deployment to the instant when the network is considered nonfunctional. When a network should be considered nonfunctional is, however, application-specific. It can be, for example, the instant when the first mobile node dies, a percentage of mobile nodes die, the network partitions, or the loss of coverage occurs. It effects on the whole network performance. If the battery power is high in all the mobile nodes in the MANET, network lifetime is increased.

V. SIMULATION SETUP AND RESULT

Table 1 Simulation Parameters

Number of nodes	**100**
Area size	**600*600**
Mobility model	Random Way point
Traffic type	CBR
Transmit power	1.0J
Receive power	0.5J
Idle power	0.5J
Initial energy	0.5J
Routing protocol	DSR
Simulation time	100s

The result is shown by the comparative graphs. In figure 3. Packet Delivery Ratio of EPAR is higher than DSR. The EPAR protocol selects the highly honest nodes and the nodes having high energy to deliver the packets to destination. But DSR protocol randomly selects the intermediate nodes. So it contains low honest nodes and the hence nodes having low energy delivers the packets to destination.

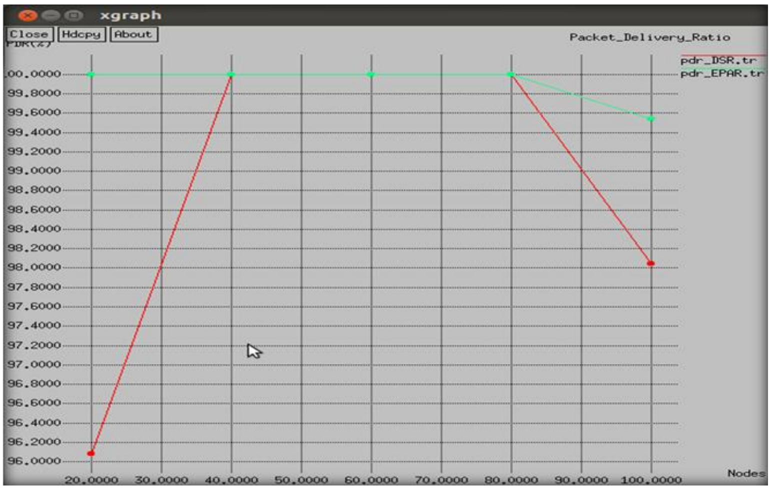

Figure 3. Nodes Versus Packet Delivery Ratio

In Figure 4, Delay of EPAR is lower than DSR. The EPAR protocol selects the highly honest nodes and the nodes having high energy to deliver the packets to destination so that no node is died due to power exhaustion that automatically reduces delay. But DSR protocol randomly selects the intermediate nodes. So it contains low honest nodes and the hence nodes having low energy delivers the packets to destination [8].

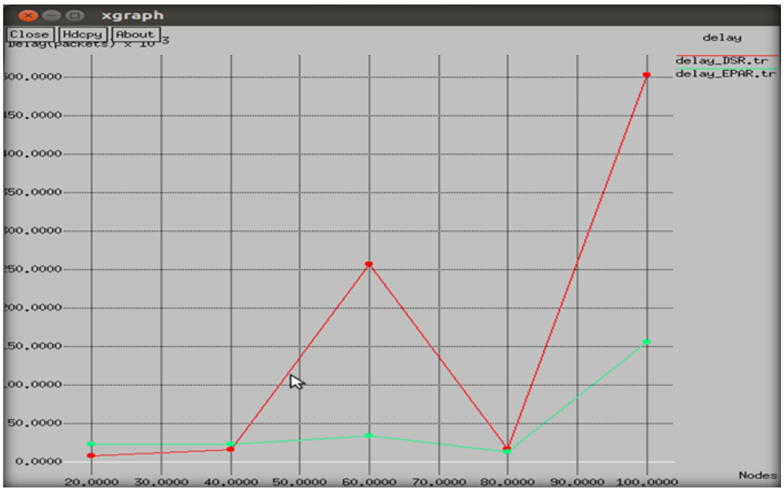

Figure 4. Nodes Versus Delay

In figure 5, energy consumption of EPAR is lower than DSR that is consumed power of networks using EPAR decreases significantly when the number of nodes exceeds 80. The EPAR protocol selects the highly honest nodes and the nodes having high energy to deliver the packets to destination. But DSR protocol randomly selects the intermediate nodes. So it contains low honest nodes and the hence nodes having low energy delivers the packets to destination.

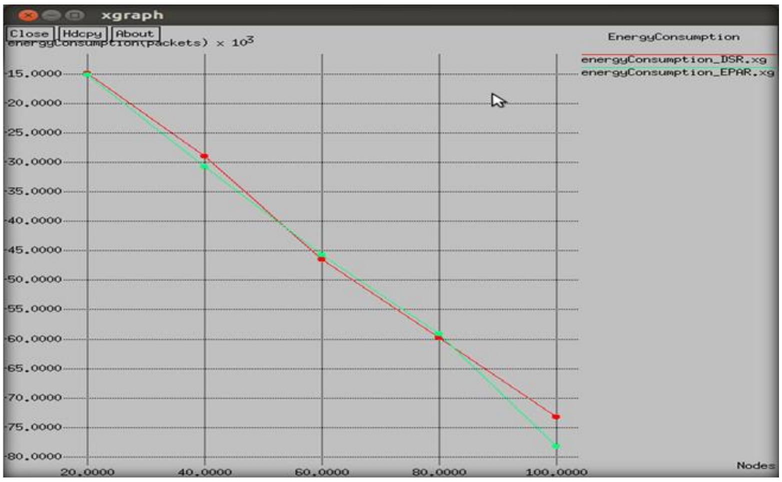

Figure5. Nodes Versus Energy Consumption

VI. CONCLUSION

In this research paper, This proposed work mainly deals with the problem of maximizing the network lifetime of a MANET that is the time period during which the network is fully working. An original solution called EPAR is presented which is basically an improvement on DSR and considered the mobility factor due to which packet loss ratio decreases and increases the throughput in the network. This work is evaluated by including different nodes into consideration and network lifetime, packet delivery ratio and delay is measured. From the various graphs, we can successfully prove that our proposed factor quite outperforms the traditional energy efficient algorithms in an obvious way. The Improved EPAR algorithm outperforms the original DSR algorithm by 80%.

REFERENCES

[1] R. K. Yadav, D. Gupta, and R.Singh," Literature Survey on Energy Efficient Routing Protocols for Mobile Adhoc Networks," In proc. IJIACS, vol. 4, pp. 644-652, Mar. 2015.

[2] S. L. Wu, Y.-C. Tseng, and J.-P. Sheu, "Intelligent medium access for mobile ad hoc networks with busy tones and power control," IEEE J. Sel. Areas Commun., vol. 18, no. 9, pp. 1647-1657, Sep. 2000.

[3] P. Goyal, V. Parmar, and R. Rishi,"MANET: Vulnerabilities, challenges, attacks, application," Int. J. Comput. Eng. Manag., vol. 11, pp.32-37, Jan. 2011.

[4 D. Kim, J. J. Garcia-Luna-Aceves, K.Obraczka, J.-C. Cano, and P. Manzoni, "Routing mechanisms for mobile ad hoc networks based on the energy drain rate," IEEE Trans. Mobile Comput., vol. 2, no. 2, pp. 161-173, Jun. 2006.

[5] V. Srivastava and M. Motani, "Cross-layer design: A survey and the road ahead," IEEE Commun. Mag., vol. 43, no. 12, pp. 112-119, Dec. 2005

[6] S. Shankar, B. Sivakumar, and G. Varaprasad, ``Implementing a new algo-rithm for analysis of protocol ef_ciency using stability and delay tradeoffin MANET," *Int. J. Comput. Technol.*, vol. 2. no. 3, pp. 11_17, 2001.

[7] D. Kim, J. J. Garcia-Luna-Aceves, K. Obraczka, J.-C. Cano, and P. Manzoni, ``Routing mechanisms for mobile ad hoc networks based onthe energy drain rate," *IEEE Trans. Mobile Comput.*, vol. 2, no. 2,pp. 161_173, Apr./Jun. 2006.

[8] S. Shakkottai, T. S. Rappaport, and P. C. Karlsson, ``Cross-layer design for wireless networks," *IEEE Commun. Mag.*, vol. 41, no. 10, pp. 74_49,Oct. 2003.

[9] M. Izuan and M. Saad,"Performance analysis of random-based mobility models in MANET routing protocol," Eur. J. Sci. Res., vol. 32, no. 4, pp. 444_454, 2009.

[10] A. Odeh, E. A. Fattah, and M. Alshowkan,"Performance Evaluation Of AODV And DSR Routing Protocols In Manet Networks," International Journal of Distributed and Parallel Systems (IJDPS), vol.3, No.4, Jul. 2012.

[11] S. Mishra and B. K. Pattanayak," Power Aware Routing in Mobile Ad Hoc Networks: A Survey," ARPN Journal of Engineering and Applied Sciences, vol.8, no.3, Mar. 2013.

[12] S. Shankar, H. N. Suresh, G. Varaprasad, and G. Jayanthi," Designing Energy Routing Protocol With Power Consumption Optimization in MANET*",IEEE Trans*.,July 2014.