

# A Survey on energy efficient routing protocol LEACH in the mobile ad-hoc network

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**Abstract** — A mobile ad-hoc network (MANET) consists of a group of mobile nodes (MNs) that communicate with each other without the presence of infrastructure. MANET has a changing topology due to the movement of mobile nodes in the network. These mobile nodes are battery operated and require battery resources for communication purpose, also these resources are limited. So, some energy efficient routing protocols are used in MANET to provide battery resources to mobile nodes. This protocols help to reduce the power consumption of nodes and also lengthen the battery life to improve the life time of the network. In this paper, review on the energy efficient routing protocol i.e. LEACH (Low Energy Adaptive Clustering Hierarchy) is introduced, using this protocol, we can improve the network performance by reducing the power consumption of mobile nodes in the network.

**Index Terms**— MANET, LEACH, AODV, DSDV, Energy Efficient Routing Protocol, etc.

## I. INTRODUCTION

A **mobile ad hoc network (MANET)** is a continuously self-configuring, infrastructure-less network of mobile devices connected without wires. This network consists of a group of mobile nodes for communication purpose in the network. It is an infrastructure less networks means mobile nodes are connected dynamically in arbitrary manner and communicates in a point-to-point approach without linking central access points. Mobile ad-hoc network contains mobile nodes based on battery operated. And have very limited battery resources. Also topology of the mobile Ad-hoc network is dynamic and depends upon the movement of the nodes so accordingly it can change rapidly and unexpectedly. This changing topology affects the routing of packets which causes routing overhead, packet loss, and delay. For routing of packets and enhancing the network performance, conventional routing protocols do not work efficiently in MANET as expected therefore energy efficient routing protocols are used. These routing protocols are used to find out suitable routes between the communicating nodes. In Mobile ad-hoc network, the energy efficient routing protocols are divided into three categories: Proactive, Reactive, and Hybrid.

Proactive routing protocols are also called Table-Driven routing protocols. In this group of protocols routes to all the nodes are predefined. And routing information is maintained in the routing table at each node in the network, accordingly packets are transferred from source to the destination. Some examples of these routing protocols are: DSDV (Distance Sequence Distance Vector Routing) Protocol, OLSR (Optimized Link State Routing), and WRP (Wireless Routing Protocol).

Reactive routing protocols are also called On-Demand routing protocols. In this group of protocols, routes are established between the source and destination when required. When source node has a data packet to send then route discovery mechanism is perform to find out the routes to the destination nodes. Some examples of these routing protocols are: DSR (Dynamic Source Routing) Protocol, AODV (Ad-hoc On-demand Distance Vector Routing) Protocol, and TORA (Temporally Ordered Routing Algorithm).

A hybrid protocol means the combinations of reactive and proactive protocols and takes advantages of these two protocols and as a result, routes are found quickly in the routing zone. Example of this protocol is: ZRP (Zone Routing Protocol).

## II. REVIEW OF EXISTING ROUTING PROTOCOLS

### A. Distance Sequence Distance Vector (DSDV) Protocol

Destination Sequence Distance Vector (DSDV) is a proactive routing protocol. This protocol is based on the distance vector algorithm. DSDV is a table-driven routing scheme for ad-hoc mobile network, so each node constantly maintains up-to-date routes to every other node in the network. Routing information is periodically transmitted during the network in regulate to maintain routing table consistency. The routing table is updated at each node by finding the modification in routing information. Each entry in the routing table contains a sequence number which is provided by the destination node. In case, if a route has already existed before traffic arrives, transmission occurs with no delay. In case of failure of a route to the next node, the node instantly updates the sequence number and broadcasts the information to its neighbours. When a node receives routing information then it ensures in its routing table. If it does not find such entry into the routing table then bring up to dates the routing table with routing information it has found. In case, if the node finds that it has already entry into its routing table then it compares with the sequence number of the received information with the routing table entry and updates the information.

### B. Ad Hoc On-demand Distance Vector Routing (AODV) Protocol

The Ad-hoc On-Demand Distance Vector Routing (AODV) is a reactive routing protocol for MANET. It uses on-demand approach for finding the routes. It is reactive routing protocol therefore route discovery is source initiated and each nodes maintains the next hop routing information corresponding to each flow for data packet transmission.

In a route discovery process, the source node broadcasts a route request packet (RREQ). A route request carries the source identifier (SrcID), the destination identifier (DestID), the source sequence number (SrcSeqNum), the destination sequence number (DestSeqNum), the broadcast identifier (BcastID), and the Time-To-Live (TTL) field. RREQ packet contains destination sequence number which indicates the freshness of the route that is accepted by the source. When the destination or node that has a route to the destination receives the RREQ, it checks the destination sequence numbers it currently knows and one particular in the RREQ. To assurance the freshness of the routing information, a route reply (RREP) packet is created and forwarded back to the source node only if the destination sequence number is equal to or greater than the one specified in RREQ. It uses only symmetric links and RREP follows the reverse path of the respective RREQ. Upon receiving the route reply (RREP) packet, each intermediate node along the route information updates its next hop table entries with respect to the destination node. AODV protocol also find out link breakage in the network by sending the route error (RERR) message back to the source node following the reverse path on the link in the network.

### C. Zone Routing Protocol (ZRP)

Zone Routing Protocol (ZRP) is a hybrid routing protocol that uses both proactive and reactive routing protocols when sending information over the network. If a packet's destination is in the same zone as the origin, the proactive protocol using an already stored routing table is used to deliver the packet immediately. If the route extends outside the packet's originating zone, a reactive protocol takes over to check each successive zone in the route to see whether the destination is inside that zone. This reduces the processing overhead for those routes.

## III. HIERARCHICAL ROUTING PROTOCOL

Using Hierarchical type of routing protocol, the choice of proactive and of reactive routing depends on the hierarchic level in which a node resides. The routing is initially established with some proactively prospected routes and then serves the demand from additionally activated nodes through reactive flooding on the lower levels. The choice for one or the other method requires proper attribution for respective levels.

### LEACH (Low Energy Adaptive Clustering Hierarchy) Protocol

LEACH is based on a hierarchical clustering structure model and energy efficient cluster-based routing protocols for sensor networks. In this routing protocol, nodes self-organize themselves into several local clusters, each of which has one node serving as the cluster-head. In order to prolong the overall lifetime of the sensor networks, LEACH changes cluster heads periodically. LEACH has two main steps: the set-up phase and the steady-state phase. In the set-up phase, there are two parts, the cluster-head electing part and the cluster constructing part. After the cluster-heads have been decided on, sensor nodes (which are chosen as cluster-heads) broadcast an advertisement message that includes their node ID as the cluster-head ID to inform non-cluster sensor nodes that the chosen sensor nodes are new cluster-heads in the sensor networks. They use the carrier-sense multiple access (CSMA) medium access control (MAC) protocol to transmit this information. The non-cluster sensor nodes that receive it choose the most suitable cluster-head according to the signal strength of the advertisement message, and send a join request message to register on the chosen cluster-head. After receiving the join message, the cluster-heads make a time division multiple-access (TDMA) schedule for data exchange with non-cluster sensor nodes. Then, the cluster head informs the sensor nodes of its own cluster and the sensor nodes then start sending their data to the base station via their cluster-head during the steady-state phase. The balance of energy consumption between all nodes in this manner does not ensure that the sensing coverage is preserved sufficiently.

LEACH is the hierarchical routing protocol that use cluster based routing in order to minimize the energy consumption and further increase the network performance in MANET.

## IV. LITERATURE REVIEW

In 2014, Swapnil Singh, Sanjoy Das survey the energy efficient routing protocols in MANET and classified them according to the approaches employed by each of them for minimizing the energy consumption. The transmission control should be employed when the communication between the nodes take place at regular intervals whereas the load distribution approach is used where the node density or the traffic density is not uniform and hence need is to employ the equal distribution of load to minimize the energy consumption. The Sleep/Power down approach should be used where the communication between the nodes is low and hence, they can utilize their energy when there is energy imbalance problem. Since energy is a constrained resource in MANET, and also more research is to be done to find energy efficient protocols. [7]

In 2013, Bhabani Sankar Gouda, Ashish Kumar Das, K. Lakshmi Narayana had compared the performance analysis of the energy efficient proactive and reactive routing protocols i.e. EAODV, AODV, DSDV, DSR, TORA in MANET considering parameters load, node mobility, delay, packet sending rate and energy consumption for enhancing the network performance of different routing protocols, when frequent link failure occurs in network due to mobility of the nodes in the network. Where routing protocol DSDV uses proactive "table driven" routing strategy, while EAODV, AODV, TORA and DSR use "on-demand" routing strategy. From the results obtained from this paper it is conclude that in low mobility and low load scenarios, all the protocols react in a similar way, while with mobility or load increasing DSR outperforms EAODV, AODV, TORA and DSDV routing protocols. TORA and DSR routing protocol gives poor performance when mobility or load are increased. [1]

In 2009, M. Mohammed proposed an Energy Efficient Location Aided Routing Protocol (EELAR) that is an optimization to the Location Aided Routing (LAR). EELAR makes significant reduction in the energy consumption of the mobile nodes batteries through limiting the area of discovering a new route to a smaller zone. Thus, EELAR protocol makes an improvement in the control

packet overhead and delivery ratio compared to AODV, LAR, and DSR protocols using NS2 simulation and thus the mobile nodes life time is increased. [6]

In 2008, S. Shah Compares the performance analysis of three routing protocols i.e. DSDV, AODV, DSR for better network performance in MANET without much packet loss using simulation on NS2 based on parameters mobility, load and size of the ad hoc network. In this paper both AODV and DSR perform better under high mobility simulations than DSDV. And also DSR, however, consistently generates less routing load than AODV. [2]

In 2003, R.V.Biradar, V.C.Patil, Dr. S.Sawant, and Dr.R.R.Mudholkar analyse the design issues of sensor networks and present a classification and comparison of routing protocols in wireless sensor network. Design issues of routing protocols consists of fault tolerance, scalability, production costs, operating environment, power consumption, data delivery models, data aggregation/fusion, quality of service, data latency and overhead, node deployment and classification of protocol based on flat, hierarchical, data centric, location centric, power usages, data aggregation, scalability, overhead, data delivery model, and quality of service. [4]

In 2002, T. Camp, J. Boleng, B. Williams, L. Wilcox, and W. Navidi gives the result of performance comparison of both LAR (Location Aided routing) and DREAM (Distance Routing Effect Algorithm For Mobility) protocols with the DSR(Dynamic Source Routing) protocol and a protocol that floods all data packets. From this paper first conclusion is that the added protocol complexity of DREAM does not appear to provide benefits over a flooding protocol. And Second conclusion is that adding location information to DSR increases both the network load and the data packet delivery ratio. [5]

## V. PROBLEM DEFINATION

MANET consists of many mobile nodes, communicating with each other in the network. These mobile nodes are powered by battery. The resource constrained nature of MANET suffer from many challenges in its design and operation, which degrades its performance and also the major fact that mobile nodes run out of energy quickly, has been an issue.

Many energy efficient routing, power management and data dissemination protocols have been specially designed for MANET, where energy consumption is an essential design issue for preserving the longevity of the network. Energy efficiency is the major concern in the mobile ad-hoc network.

## VI. OBJECTIVE OF THE PROPOSED SYSTEM

From the above discussion, this paper analyzed that, in MANET problems arises due to the power consumption factor which degrades the network performance. To overcome the above review problems, the hierarchical routing protocol i.e. LEACH (Low Energy Adaptive Clustering Hierarchy) is used in this paper. LEACH protocol is based on the hierarchical clustering algorithm, which contains approach of cluster head selection and data aggregation. Using these approaches we can reduce the problem of energy consumption by mobile nodes and thus, improves the network performance in MANET. And finally evaluating the result and comparing the performance analysis of this protocol with the other existing reactive and proactive routing protocol in the MANET using NS2 tool for several chosen scenario.

## VII. CONCLUSION

In Mobile ad-hoc network the main purpose of designing energy efficient routing protocol is to efficiently use the energy of the network so that the network lifetime get increased. In mobile ad-hoc network many energy efficient routing protocols are available now-a-days. One of the most efficient routing algorithms everyone uses is the LEACH routing protocol. The ultimate objective behind the routing protocol design is to keep the sensors operating for as long as possible, thus extending the network lifetime. The energy consumption of the sensors is dominated by data transmission and reception. Therefore, routing protocols designed for MANET should be as energy efficient as possible to prolong the lifetime of individual sensors, and hence the network lifetime. Because of this reason LEACH protocol selected. It gives better performance in energy efficiency and network life time. We can say the advantage of LEACH overcomes the problem of MANET and So LEACH modified further for future work. This modified or improved LEACH gives better result than normal LEACH. This paper also gives the study of different energy efficient routing protocols in MANET.

## REFERENCES

- [1] A Comprehensive Performance Analysis of Energy Efficient Routing Protocols in different traffic based Mobile Ad-hoc Networks" Bhabani Sankar Gouda, Ashish Kumar Das, K. Lakshmi Narayana, 2013 IEEE Transactions
- [2] S.Shah,et al," Performance Evaluation of Ad Hoc Routing Protocols Using NS2 Simulation," Proceeding of the National Conference on Mobile and pervasive Computing (CoMPC 2008), Chennai,India,August 2008.
- [3] K . Gorantala," Routing Protocols in Mobile Ad Hoc Networks," Master Thesis, Department of Computing Science, Umeoa University, Sweden, June 2006.
- [4] R.V.Biradar, V.C.Patil, Dr. S.Sawant, and Dr.R.R.Mudholkar," Classification and comparison of routing protocols in wireless sensor networks", UbiCC Journal, Vol.4.
- [5] T. Camp, J. Boleng, B. Williams, L. Wilcox, and W. Navidi, Performance Comparison of Two Location-based Routing Protocols for Ad hoc Networks, Proceedings of the IEEE INFOCOM Conference, pp. 1678-1687, 2002.
- [6] M. Mohammed, Energy Efficient Location Aided Routing Protocol for Wireless MANETs, International Journal of Computer Science and Information Security, vol. 4, no. 1 & 2, 2009.
- [7] Swapnil Singh, Sanjoy Das, "Survey on Energy Efficient Routing Protocols in Mobile Ad Hoc Networks", International Journal of Computer, Information, Systems and Control Engineering Vol:8 No:2, 2014