

# Energy Efficient Consumption Techniques in MANET: A Survey

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**Abstract**—In MANET nodes are power constrained, for the reason that nodes has operated with limited battery energy or power. The nodes in network are not communicated with each other because of early depletion of mode energy. The nodes which are completely lost their energy in network are not possible to further communicate with other nodes without the replacement or charge the battery of node in dynamic network. Therefore, excessive consumption of nodes energy should be prevented by better utilization schemes. In reality, node energy utilization should be balanced in order to increase the energy awareness of networks. As we discussed the main constraints in mobile ad hoc networks is more possibility of node failure is due to energy uncertain depletion. So, if some nodes die early then these nodes are also affected to other nodes due to lack of energy also they cannot communicate with each other. In this paper actually we discuss the some recent and effective research work of authors that gives the contribution in research of energy efficient routing for improving the life time of MANET. The multipath routing protocol is provides the better and reliable communication. Each and every research has some drawbacks and performs also some new thing that helps new comers for innovative idea of work in field of energy. These proposed schemes are measures the different criteria of improvement in energy utilization for better life time.

**Index Terms**—Energy, Multipath, MANET, routing, survey

## I. INTRODUCTION

The wireless in dependent network that forming topology itself and nodes are behaves like sender, receiver and router. All the nodes in network working in limited area without any control of centralized administration [1, 2]. In MANET all the nodes are working in an open environment without any interference of any authority that's why security is sometimes also affected.

The wireless network is the networks in which hosts or users are communicate with each other without any physical link that means this network is cheaper than wired network. The wireless network is required to maintain devices like Wireless Access Points (WAP), Wireless Modems etc [3]. The Mobile Ad hoc Network is one of the type of wireless network in which the mobile devices are communicate with each other in an open environment not as under the supervision of any authority like as wireless network.

Mobile Ad hoc Networks (MANETs) consist of a assortment of wireless mobile hosts (called nodes), in recent times have received rising attention.

The figure 1 is represents the example of MANET with some nodes like sender S and receiver R. the number of nodes is in middle of s and R are the intermediate nodes. The sensor nodes are sensing the neighbors and established the path in between sender and receiver on the basis of by default shortest path mechanism. The path selected for communication is selected A-G-E-R and also are in the radio range. Rest of the path S-A-B-C-H-R and S-F-D-I-R are longer than the existing shortest path.

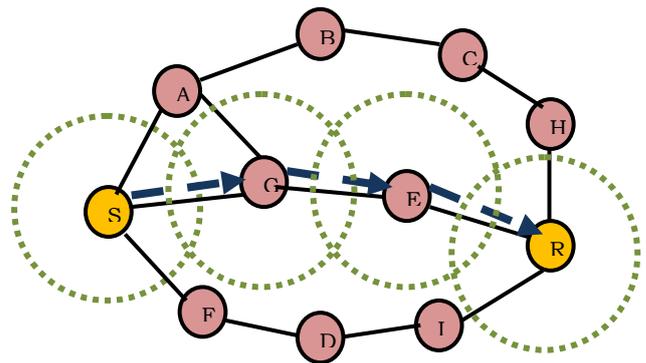


Fig.1 Example of MANET

Self-government from central network administration, capability for being self-configured, self-healing through uninterrupted reconfiguration, scalability and flexibility are the distinguished reasons to organize such networks [1]. MANET entails no fixed infrastructure or central supervision. The number of mobile nodes in MANET works not only as hosts but also as routers, and communicate with each other via packet radios. Since nodes in MANET are not connected to a power supply and battery replacement may be difficult, optimizing the energy consumption in these networks has a high priority and power management is one of the most challenging problems in ad hoc networking. Energy consumption in ad hoc node can be due to either useful or wasteful source [4, 5]. Useful energy consumption can be due to:-

- 1) Transmitting of data or Receiving of data.
- 2) Senders are processing query requests, and reply messages.
- 3) Forwarding queries/data to neighboring nodes.

Wasteful energy consumption can be due to:-

- 1) Idle listening or recognizing to the media for communication,
- 2) Retransmitting due to packet loss from any reason like congestion, early energy depletion etc.
- 3) Overhearing, and lack of interconnected nodes to each other for better communication.
- 4) Generating or handling control packets flooding for connection establishment

In general, radios in an ad hoc network node can operate in discrete modes of functioning like as transmit, receive, idle, sleep [6] and one of them is sense. Transmit and receive modes are for transmitting and receiving data. In the idle mode, the radio can switch to transmit or receive mode. Idle is the default mode for an ad hoc environment. The sleep mode has extremely low power consumption and at the sense mode nodes are finding the nearby nodes for sending request or data in dynamic network. Therefore, taking advantage of the sleep mode is very important in energy efficient protocols.

As noted above, energy conserving is important and necessary. Therefore it is imperative that at any moment some specific number of nodes be active and the rest remain in inactive mode. We keep number of active nodes in desirable way, so network lifetime will be prolonging by far. If active nodes can cover desirable level of network, less number of active nodes will be required in total network and will not be the empty space of active node. We balance energy consumption of nodes by means of replacing cluster heads and forwarding data. Therefore the number of active nodes and also network coverage by them can be main factors in improving QOS [7].

#### A. Determination of Network Topology

- The nodes are establish and observe the dynamics of network topology over time
- The routing protocol of MANET is needed to ensure that connection in the route has strongly associated.
- Must be ensuring that at least one path from any node to any other node to forward data or routing packets to destination.
- Must responsive of its nearby and its neighboring nodes with which it can be possible to communicate directly.
- Determining or identifying changing network topology
- Sustained network topology or connectivity between the nodes
- Scheduling of packet transmission and channel assignment for different users ant different time instant.
- Routing in dynamic topology.

## II. APPLICATIONS OF MANET

The MANET is the rapid growth area in recent technologies [8]. If their practical desired implementation is successful then this network is really cheaper than other network. Some of the typical applications are as follows:-

#### A. Area of military battlefield:

MANET would allow the military to take benefit of commonplace network technology to maintain a proper short range communication between the soldiers, tanks, and military head quarter.

#### B. Office or Business meetings:

Collaborative computing is required in business environments, the need for it may be more imperative for outside office environments than inside and where people do require outer meetings to cooperate and exchange important information on a given project.

#### C. Local or inadequate level:

MANET can autonomously forming link instantly and forming temporary to carve up and spread information among participants at conference hall and students class rooms In home networks, another inadequate level application is that devices can communicate directly to exchange information.

#### D. Personal Area Network (PAN) and bluetooth :

PAN is a short range, localized network where nodes are typically connected with a given someone. Short-range MANET also called as Bluetooth can abridge the inter communication between various mobile devices such as a PDA (Personal Digital Assistant), laptop, and mobile phones.

#### E. Industrial Sector:

The temporary network MANET is also used in emergency operations/rescue operations for disaster relief efforts, e.g. in fire, flood, or earthquake. Emergency rescue operations must take place where non-existing or smashed communications infrastructure and quick deployment of a communication network is needed.

## III. MANET SUSCEPTIBILITIES

Susceptibility is a weakness in security system. A meticulous system may be susceptible to illegal data manipulation because the system does not verify a user's distinctiveness before allowing data access [9]. MANET is more susceptible than wired network. Some of the susceptibilities are as follows:

#### A. Absence of centralized Authority

MANET doesn't have a centralized authority. The absence of centralized authority makes the detection of attacks difficult because it is not east to monitor the traffic in a vibrant and large scale MANET.

#### B. Lack of predefined Boundary

In MANET we cannot exactly identify a substantial boundary of the network. The nodes work in a itinerant environment where all nodes are free to join and leave the network at any instance of time. As soon as an opponent comes in the radio range of a node it will be able to communicate with that node.

#### C. Supportive in communication

The Routing protocol of MANETs usually assumes that mobile nodes are cooperative and reliable (not malicious). The routing misbehavior through malicious attacker can easily become disrupt network operation.

#### D. Limited power supply:

The nodes in MANER are completely performing energy or power dependent operations need to consider restricted power supply, which will cause several problems. A node in MANET may behave in a selfish manner when it is finding that there is only limited power supply.

#### E. Opponent inside the Network:

In MANET any new nodes can freely join and leave the network at any time instant. The suspected nodes within network may also behave maliciously. In dynamic network it is rigid to perceive that the behavior of the node is malicious attacker. Attack is harmful on that kind of network.

### IV. OVERVIEW OF ROUTING PROTOCOLS IN MANET

Routing is the procedure required to deliver data in between sender to receiver in network. The sender and receivers are not possible to deliver data directly. The nodes in MANET have fixed communication range, if their distance is more than the rage of communication then sender and receiver nodes are communicate through intermediate nodes but selection of intermediate node is possible through different routing protocols in MANET. Each and every protocol has different selection procedure of neighbors for deliver data to destination steadily. The MANET routing protocols are completely different from routing protocols are used for traditional wireless and wired network. The topology creation and isolation is totally unpredictable by that the protocols are also designed for that network where only the nodes/stations/routers are communicate with each other in a limited communication range. The types of routing protocols [10, 11] classification are as follows:-

1. Proactive or Table driven routing protocols
2. Reactive or On demand routing protocols.
3. Hybrid routing protocols.

These protocols are further classified in different types of routing protocols like DSDV, AODV and ZRP. The whole classification is mentioned in

#### A. Proactive Routing Protocols:-

The proactive routing protocols are established connection and maintain the record of every node that are in earlier period sending data to intermediate nodes in dynamic network. The meaning is that the history of path of all connected or nearby nodes is maintained by each and every node. If the any node only one time participating in communication then in that case their record is present to every through which node is connected. The proactive routing protocols are very efficient if every time node position is not changed. That means, if previous node does exist then no need to flood request packets for establishment of connection in dynamic network but in MANET that kind of possibility chances is very less. DSDV (Dynamic Source Distance Vector) protocol is the example of proactive routing protocol.

#### B. Reactive Routing Protocols

The reactive routing protocol is not maintaining the record history of nodes in previous that they are participating in routing procedure. In this kind of protocol the nodes sender is established connection in On demand manner. That means instant node available then forward request to next available node till the destination is not found this procedure is call it again and again. No record of nodes is maintained on each node after completion of data delivery in dynamic network. The example of Reactive Routing Protocol is AODV (Ad Hoc On demand Routing) protocol.

#### C. Hybrid Routing Protocol

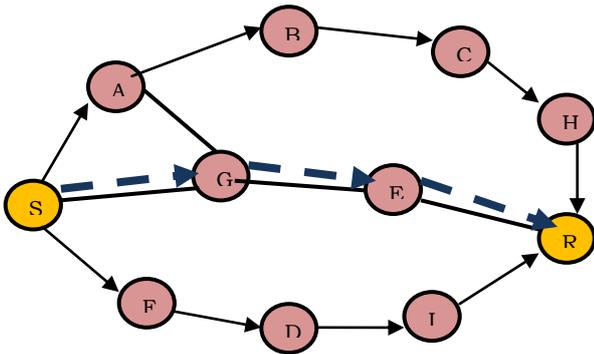
The hybrid routing protocol is the combination of proactive and reactive routing protocol. This protocol is based on the different strategy of routing. In this type of routing the different routing procedure is performing on the different area in the same network and the different area of communication in the network are called zone in the network. The communication in between the different zones is possible through hybrid routing protocol. The example of hybrid routing protocol is the ZRP (Zone Routing Protocol).

These are the actual classification of routing protocols of MANET but routing protocols are further divided into different on the basis of multiple paths and group communication based routing establishment procedure. Actually the matter is here about multipath routing and multicast routing. As we discuss above about single path and unicast routing the description of both the routing technique is mentioned below:-

### V. MULTIPATH ROUTING

The multipath routing is the vast field for discussion and this routing technique is superior to the unipath routing technique [12].

The major difference in unipath and multipath is that in multipath routing multiple path are selected in between sender and receiver for reliable data delivery in MANET. The routing procedure of multipath routing in mentioned in figure 2. Here the sender has established multiple paths but at time only one path is selected for communication.



**Fig.1 Example of Multipath Routing**

If the existing one is break then the next path is instantly available and reduces the overhead of connection reestablishment because of link breakage.

The reactive routing or on demand protocol is AODV and their enhancement is AOMDV [13, 14]. The AOMDV (Ad hoc On demand Multipath Distance Vector) routing protocol is the example of multipath routing protocol and work on same strategy of On demand routing.

The multipath routing protocol is also efficient in term of better energy utilization. In single path the energy is wasted for retransmission of data due to link breakage but in multipath routing this kind of possibilities are negligible. The multiple possibilities of data transmission are definitely improves the life time of dynamic network.

## VI. LITERATURE SURVEY

The energy efficient consumption of mobile sensors is enhancing the life of network and for more time communication is possible. In this section some latest work in field of energy or power is highlighted with their description and drawbacks from our point of view in MANET.

**Shivashankar, H.NSuresh, Varaprasad Golla, G. Jayanthi** In this research [15], mainly deals with the problem of maximizing the network lifetime of a MANET, i.e. the time period during which the network is fully working. We presented an original solution called EPAR which is basically an improvement on DSR. This study has evaluated three power-aware ad hoc routing protocols in different network environment taking into consideration network lifetime and packet delivery ratio. This paper evaluates three ad hoc network routing protocols (EPAR, MTPR and DSR) in different network scales taking into consideration the power consumption.

### *Draw backs of research*

In the base paper high mobility nodes are not selected for routing.

Each nodes of energy cost is not calculated.

Routing overhead and no. of quantity of packets is not mention (means how many packets received, send and drop).

Higher energy of nodes is selected but mobility criteria are not mention.

**Thamizhmaran Krishnamoorthy, Akshaya Devi Arivazhagan** in this paper [16] proposed a system that focus on the problem of maximizing the lifetime of a Mobile ad hoc network where the mobile nodes communicate with the sink by delivering the sensed data across multiple hops with different transmission energy requirements. That is, there is flexibility of transmitter power adjustment and the energy consumption rate per unit information transmission is not the same for all neighbors of a mobile, but depends on the choice of the next hop node. The lifetime of the network is defamed as the time until a mobile node drains out of battery energy for the first time, a definition commonly used in the literature. Proposed system implements the energy saving routing protocol in the battery limited Mobile ad-hoc network in order the lifetime of the network.

### *Drawbacks*

- 1) Work on EAODV is also done in various papers so, work with other protocol is possible like DSR.
- 2) TCP end and UDP performance is not evaluated.

Sheetal Si, sodia, Sandeep Raghwanishi, in this paper [17] are trying to remove the problem of conserve battery usage within a mobile ad hoc network. Previous other work has gone in different energy conserving strategies spanning different network layers. At network layer to minimize total power needed to route the packet and to maximize the lifetime of the nodes, routing algorithms must select the best path. In this work simulation we take number of test simulation and conclude that E-DSDV routing is efficient if node motion is very slow and energy utilization is also efficient but E-DSR gives better result in any situation as compare to E-DSDV protocol.

### *Drawbacks*

- Only performance comparison of two protocols is compare on the basis of energy factor.
- No New work is done.

Mu'ath Obaidat, M. A. Ali Ihsan Shahwan, In this paper [18] proposed O-QMRP technique. The O-QMRP protocol establishes multiple nodedisjoint paths that will experience the lowest delay. Most delay-aware routing protocols use the current estimate of the End-to-End (ETE) delay whether it's the current queue size or the history in addition to the current experienced delay along a path.

However, this is not an accurate measure of the delay that is going to be experienced by the node requesting a path, since such node will increase the total network load. Once the network load increases, ETE delay that was obtained through a Route-REQuest (RREQ) is no longer accurate. However, by introducing the projected increase in load into the computation of ETE delay, this obtained ETE delay reflects the accurate channel state.

#### Drawbacks

In this paper the QoS of multipath protocol is improves and their performance is compare with AODV, AOMDV, QMRP and O-QMRP protocol.

The energy calculations and utilization factor is not included in this research.

Phu Hung Le in this paper [19], presents two interference-aware multipath protocols named Node-disjoint Interference-Aware Multi-path Routing protocol (NIA-MPOLSR) and the Linkdisjoint Interference-Aware Multi-path Routing protocol (LIA-MPOLSR). These protocols are simply implemented, the computational complexity is only in polynomial time but achieve a very high efficiency for mobile ad hoc network. To address these works, we first specify an interference area of a link including all nodes that can interfere with the link. Then, we evaluate interference level of a link based on the number of nodes impacting on the link and the geographic distance between nodes.

Wei Liu, Chi Zhang, Guoliang Yao, and Yuguang Fang In this paper [20], proposed a Device-Energy-Load Aware Relaying framework, namely DELAR, to achieve energy conservation in heterogeneous mobile ad hoc networks. DELAR utilizes the device heterogeneity inherent in ad hoc networks and features the cross-layer protocol design methodology. To take better advantage of powerful nodes (P nodes) while mitigating their interference to the ongoing communications, a hybrid transmission scheduling mechanism is used to schedule and coordinate the transmission activities among P-nodes and B-nodes (normal nodes). In addition, in order to support reliable transmissions in the presence of unidirectional links between P-nodes and B-nodes, we introduce the “minirouting” technique and the novel Asymmetric MAC (A-MAC) protocol, which demonstrates that A-MAC can effectively enable the MAC layer acknowledgements over unidirectional links.

Ajay Jangra, Nitin Goel, Priyanka In this paper [21] proposed the simulation analysis of EPSAR and check their feasibility whether the protocol is suitable and reliable for maximum number of networks. RMECR is not primarily an energy-efficient routing algorithm like RMER, FRENDA and EPSAR were designed by the same authors and done little amendments to FRENDA to make EPSAR i.e. highly secure, efficient and adaptive as well for the selection of farthest node that would also be reliable one.

For packet forwarding th proposed algorithm select the next node with respect to its distance from sender node, power backup and reliability, which reduces the overall communication head and improves the reliability of communication in a multi-hop environment.

Martin M. Mhlanga, Thomas O. Olwal, Murimo B Mutanga, Mathew O. Adigun in this paper [22] proposed an energy optimization based path selection algorithm for the IEEE 802.11s HWMP. The proposed algorithm will result in an unbiased energy spending among the nodes which also maximizes the network lifespan. When given multiple paths to choose from during the routing process, choose the path that will help prolong the network lifetime. In order to ensure that networks with low-energy nodes are kept alive. The HWMP protocol does not use the one good path it has discovered for every transmission; instead a set of good paths are kept in its routing table and one good path is chosen among the many available paths based on a probabilistic fashion. Therefore, different paths are used at different times instead of using the single path for all the transmissions in the network and in return energy depletion in certain nodes is avoided to avoid network partitioning.

AL-Gabri Malek, Chunlin Li, Li Layuan, WangBo, In this paper [23] proposed a new energy consumption model and a new routing algorithm in wireless Ad-hoc Networks, especially for the Ad-hoc Networks clients. The network node energy-limited routing protocol research is a central issue in this paper. EA\_AODV avoids invalid routing discovering, reduces the probability of link breaking after routing is discovered, and protects. low-energy nodes, achieves longer network lifetime and minimizes network energy consumption compared to the traditional AODV protocols.

Peyman Arebi in this paper [24] an analyze the link break problem, the influence of the problem on each categories of routing protocol, and the incurred routing table update to them. in this paper, attempt to investigate the decrease of energy in nods as an influencing factor on link break and suggest a new method to estimate the energy and prevention of link break. Hardware interface was suggested in this study predict the time of link break using node energy estimation through electronic circuits and provide the network with on time alarming. After that, network tries to replace the paths with those have not broken link and prevent disorder in data transferring.

## VII. CONCLUSION

The Mobile Ad hoc Network is really effective but for long range or communication between the two far range sender and receiver the communication is only possible through internet. The nodes are free to move in the network or outside the network. The mobile nodes are continuously moves in different mobility and forming dynamic connection in between senders and receivers.

The main consumption source of energy is transmission then receiving in network. The proper energy of mobile nodes are should not exhaust until and unless without any problem in internal circuit. The energy efficient routing is the major issue in dynamic network and this problem is possible to resolve by modifying the routing strategy of communication. In this paper the survey of different research in this field is provides the basic ideas of innovative research in field of MANET. These research work is provides the knowledge about the work in field of energy efficient issue. Every research contribution in field of energy is effective and enhancement and modification also may be provides better results as compare to existing one. In this paper we also discussed about routing protocols and some other small factors. The proper energy efficient routing provides the less dropping of data packers and by that the retransmission of data packets are minimizes and energy is utilized properly.

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