Energy Efficiency Routing Protocols in Ad hoc Network: A Review

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Abstract

A mobile ad hoc network (manet) is a structured network with different assembled nodes that connect with each other without any controller. A host and a router and communication between the nodes are present in the manet. usually, topology differs dynamically with the manet functionality, multi hop routing coupled with the free flow of the nodes in and out of the network.
The network nodes are mobile, so the topology of the network varies quickly, and they are arranged without restrictions. In manet, the different modes are detecting, processing, and communicating. The sensing node needs minimal battery energy, although more battery energy is required for the communication mode. The energy used by the network depends on the propagation range. The range of transmission expands exponentially with the propagation of the signal. The transmitting and receiving of data in wireless nodes are performed using a radio module. Energy is consumed to communicate between nodes. In crucial conditions, Manet's optimal configuration is the best way to utilize the device's lowest power.

Keywords: MANET's, Energy Efficiency, DSDV, GSR, DSR, AODV, ZRP

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1. Introduction

A remote, multi-hop, self-configuring network is a mobile ad-hoc network (manet). For nodes, Manets are rather flexible; this suggests that nodes will openly enter and exit the network. There is no main body capable of managing the nodes that enter and leave the network. Manet is an ad hoc network which does not require infrastructure assistance to transport data packets between two nodes. Manet is an ad hoc mobile network, or much more simply called an ad hoc mobile network, which is an ongoing self-ordered, wirelessly linked mobile device network without infrastructure. Low cost, quick node addition and flexibility are the advantages of Manet's. Any machine or computer in the manet architecture is node implies that every system is both a router and an end host. In general, nodes or devices in the manet architecture are self-contained. Manet has a complex architecture of topology that strongly encourages mobility. In the manet system, as they route packets, each node also acts as a router.

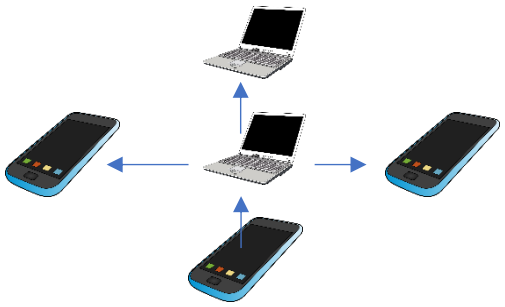

Figure 1: Ad hoc Network

The biggest benefit of using a handheld ad hoc network is to connect to the internet without any wireless router. Because of this, it could be more economical to operate an ad hoc network than a conventional network. Since routing and transmission protocols are designed to handle these conditions, manet supports link failures. In certain situations, manet may be more affordable as it lowers fixed infrastructure costs and reduces mobile node power consumption. The Manets are useful in areas where rapid development and dynamic self-configuration are important and wired networks are not available. These networks include emergency search, rescue sites, military searches, classrooms and conferences, battlefield. Where people exchange data using their cell phones to provide efficient connectivity and minimize overhead transmission, power machines, reliable routing protocols play a crucial role in manet consumption.

Manet consists of a peer-to-peer, self-forming, self-healing network that usually interacts at 30mhz-5ghz radio frequencies. This can be used in road safety, including environmental, home, health, disaster rescue, defense of air/land/navy, weapons, robots, sensors, etc. The advantage of this network is that it can connect to a large scale of the internet. There are two uses for the node in manet: it can be redirected by a different node and used as a router for other nodes. In a manet, nodes move freely and randomly and can leave and join at any time. Because of the mobile existence of nodes, the network topology is dynamically evolving. For the network to adapt to the changes in topology, an appropriate routing protocol is needed. For routing, there are two kinds of protocol.

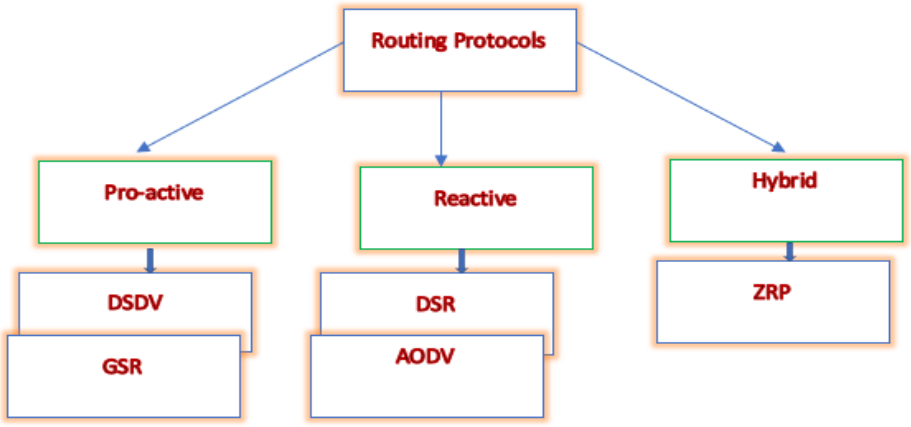

Figure 2: Classification of routing protocols

Pro-active

Proactive routing protocols maintain details regarding all routes on the network, even though they are not necessary, such that each node records routes to all other nodes on the network. These protocols also share control details between nodes, which for each node on the network maintains the routes updated. They often respond when a new node emerges, or another node is no longer inside the network's topology. A constructive approach to MANET routing aims to create a topology comprehension that is constantly modified. The whole network should be known to all nodes, in principle. This results in a clear overhead of the traffic being diverted, but no initial contact delay.

The most developed proactive protocols are:

DSDV (Destination Sequenced Distance Vector Routing Protocol)

DSDV routing table: each node will keep a table listing of routing information either directly or via certain neighbors of all the other nodes it has known. In the routing table, every node has a single entry. The entry would have details about the node IP address, the last known sequence number, and the number of hops to reach that node. The table also keeps track of the timestamp of the last update obtained for that node. There are three fields in the DSDV update message: destination address, sequence number, and hop count. The routing tables are sent via complete dump or incremental method to the neighbors. The entire table is sent in full dump mode, while only the entries that need changes are sent in incremental mode. Based on the metric for a specific node, the

updates are acknowledged. The sequence number is the first element evaluating the approval of an update. If the sequence number of the update message is higher, regardless of the metric, the update must be accepted. If the update with the same sequence number is issued, precedence is given to the update with the lowest metric (hop Count).

GSR (Global State Routing)

The fundamental principles of link state routing are the foundation of global state routing. In connection state routing (LSR), one of the nodes floods information to its neighbors from a single routing table and floods that table to more nodes from those neighbors. This method continues to take place until all the nodes in the network obtain the routing table. In the case of global state routing, however, the routing table of a single node is transmitted only to its immediate neighbors. And those neighboring nodes' initial tables are revised. These modified tables continue to be transmitted one by one, and this process continues until all nodes send their tables to each node.

RRP (Reactive routing protocols)

The reactive routing protocol is a bandwidth-efficient on-demand routing protocol for Manets (RRP). In this protocol, the originator node initiates the route search phase if it wishes to transfer data packets to the destination node. Thus, the need for a path activates the mechanism of route quest, hence the name of the reactive routing protocol. In layer 3 of the iso OSI reference model on the network layer of mobile nodes, RRP is planned to be introduced.

DSR (Dynamic Source Routing protocol)

Source routing is the technique through which a packet's sender decides the full sequence of nodes from which to send the packet; this path is specifically identified by the sender in the packet header, defining each forwarding method. The DSR protocol can detect and preserve the routing by storage of source routes in the ad hoc network just the dynamic exploration and discovery of route information. So, the network operator does not take network management. The packet is taken by all nodes process and serves as routers for forwarding. DSR embeds control information to normal packet flow by adding " DSR header"; the header is the header of the IP packet. It is comprised of two stages:

Discovery of Path

Discovery of paths helps any host in the ad hoc network to dynamically discover a route to any other host. In the ad hoc network, whether directly available inside the wireless transmission range or accessible via one or more intermediate network hops to other hosts. Within its wireless transmission range, a host that initiates a route discovery broadcasts a route request packet that can be received by those hosts. The route request packet specifies the host for which the route is determined, known as the route discovery goal. If the route discovery is successful, the initiating host gets a route reply packet listing a route response packet.

Maintenance of Routes

Conventional routing protocols integrate the discovery of routes with the management of routes by constantly sending frequent routing updates. If the state of the connection or router shifts, the status of the link or router is eventually displayed by periodic updates. Alternately, when a path is in operation, the mechanism of route management regulates the role of the route and notifies the sender. A route error packet (RERR) is obtained by the source at this point, and then the expired route is deleted from its cache to launch a fresh quest for a new route.

AODV (Ad-Hoc On-Demand Vector routing protocol)

The Ad-Hoc On-Demand Distance Vector Routing Protocol is another form of reactive routing protocol that does not preserve routes but builds the routes as needed. AODV is used to resolve the disadvantages of the Protocol for Complex Source Routing and Distance Vector Routing, i.e.

Dynamic Source Routing can preserve data that allows things sluggish on the routes between source and destination. If the network comprising several routes from source to destination is quite wide, it is difficult for the data packet header to carry all of the route details. Multiple routes are required for sending a packet from source to destination in the case of Complex Source Routing, but AODV still overcomes this downside. In AODV, two counters including sequence number (SEQ NO) and broadcast ID are also retained along with routing tables for each node. AODV describes three types of communications: Path Requests (RREQs) are used to begin the process of locating a connection, Route Responses (RREPs) are used to finalize the paths, Route Errors (RERRs) are used, and RREP messages are used to inform the network about an active route connection split.

Hybrid routing protocol

Ideally, in a hybrid routing protocol, there should be the following properties:

(1) Adaptive: the protocol should be able to dynamically adjust the spectrum of and variable in order to meet various target output targets under different network conditions; such adaptation mechanisms usually require a clear mapping between performance metrics and parameters of hybridization.
(2) Simple: It should be lightweight to hybridize to avoid needless overhead power.

(3) Efficient: The protocol should pick suitable basic components and organically integrate them in order to obtain better efficiency than any single component.

2. Literature Survey

A flooding scheme with the usage of the residual power of each node, satoshi et.al [1] proposed to transmit RREQ messages. As the node density decreases, the proposed scheme's throughput becomes smaller than that of traditional methods, while the proposed scheme's throughput rises as the node density in the evaluated setting becomes greater than nearly 40. In the proposed system, energy consumption has been minimized regardless of the node density.

Rajendra Prasad et.al [2] has decreased the overall energy use in the proposed protocol with improvements to the current DSR, in terms of all the parameters of the network. From the simulation result it is observed that the algorithm having the very less energy minimization reduction. The algorithm introduced has low energy exhaustion to define the route paths between mobile nodes in the network to facilitate connectivity within the network.

S. Vinod Kumar, Dr. V. Anuradha [3] proposes an Energy Efficient EE-OHRA route discovery is the version that designed to cope with the problems pertaining to curtailing the intake of energy and maximizing the course lifetime. Proposed course discovery procedure considers the life of the course because the metric at the same time as choosing the route, the routing failure is minimized. This reduces the variety of methods of route discovery and also the overhead calculation of each node concerned in the technique of path discovery that affects the overall performance of the routing protocol.

An on-demand routing protocol, expanded by AODV for MANETs, named EEMA, was suggested by Vu Khanh Quy and Le Ngoc Hung[4].The EEMA protocol uses a hybrid method to choose the best route based on the EEMA hops-number and cost feature. In other words, this protocol selects the route that combines the delay with the minimal remaining battery power for a longer network life and boosts the MANETs' efficiency.

E. Edwin Lawrence, R.Latha[5] suggest a MANET Protocol for Shortest and Energy Efficient Routing (SEERP). It describes a strategy for selecting an energy-efficient path, taking into account that limited resources are available in MANET, channel and energy power. Based on residual energy and number of hops, SEERP chooses a routing path from source to destination. To measure the minimum energy of the nodes, the standard route request packet is updated.
For the energy effective routing of MANET data packets, Rafi U. Zaman and Juvaria Fatima Siddiqui[6] have implemented a new scheme focused on a load energy metric algorithm. During data transfer, the suggested protocol defines the energy-draining nodes. The energy level of each node is calculated and the path that is least loaded is selected by the nodes to transfer data to the destination. A residual energy threshold value on each node is used to choose the safest route among the available routes to achieve the aim of transmitting energy-efficient data.

Bava Rinku K, Patel Manish M and Patel Megha B[7] suggested the energy routing approach for MANET and signal intensity dependent routing. The gap between two nodes was determined by Obtained Signal Intensity (RSS).If the value of RSS is greater than Th-RSS then the intermediate node, the value of RSS and Th-RSS is compared, so the agreed RREQ packet would otherwise drop the packet and send node energy to the next node.If the RSS value is higher than Th RSS than the intermediate node, the remaining energy RE value would be correlated with the energy threshold and the queue duration QLen value with the squeue length Th QLen threshold, so give the next node RREQ packet otherwise drop the packet.

The tone-based REEDDRE model is suggested by Bander H. AlQarni and Ahmad S. AlMogren[8] as a way of addressing the drawbacks of enormous distance energy usage and ensuring congestion management and stability in multicast transmissions

over mobile ad hoc networks (MANETs).A secure multicast transmission over the MAC layer is the REEDDRE model.

Santosh Kumar Das, Sachin Tripathi[9] suggest an Effective Routing Intelligent Energy-aware Protocol for MANET (IE2R).In IE2R, the Multi Criteria Decision Making (MCDM) approach is used to evaluate the appropriate route based on the Enrichment of Evaluations-II (PROMETHEE-II) method of entropy and Choice Rating Organization method.The MCDM approach is coupled with an intelligent method, namely the Intuitionistic Fuzzy Soft Set (IFSS), which eliminates mobile node ambiguity and provides an energy-efficient path. To provide multipath discovery, Pooja AD [10] suggested an enhancement of the Route Discovery Multipath Routing Protocol (EMPRR). A appropriate amount of bandwidth was used for this protocol. The EMPRR raises the packet's transmission ratio and decreases the end-to-end delay, but the issue is that data confidentiality is not centralized control in the multi-hop delivery application.

3. Different Energy Consumption Methods comparison

S. No	Authors	Algorithm	Merits	Demerits
1	HidekiMizuno ,Satoshi Yamazaki, Yu Abiko[1]	A rapid flooding system for transmitting a path request (RREQ) message based on its own node's remaining power without using control packets and dynamic calculations based on the ad hoc on-demand distance vector routing protocol (AODV)	With regard to energy efficiency (bits/J), in terms of throughput the planned device and energy consumption was shown to	The network lifetime in the suggested scheme reduces as the nodes are dynamic.
2	Rajendra Prasad P Shiva Shankar[2]	This research paper proposes a novel and energy-efficient shortest path routing scheme named the energy-aware demand routing protocol. The protocol maximizes the MANET's lifetime based on the routing circumstance and provides an economically viable routing system for the packets.	The protocol has made improvements in terms of its low energy consumption for network data transmission, and the results suggest a difference between the new protocol and the current DSR and CMMBCR protocols.	When two different nodes execute the EA-DRP, a node is common for two neighborhoods and applies the algorithm to the various forms of attacks in the MANET.
3	S. Vinod Kumar, Dr. V. Anuradha [3]	Introduce the Energy Efficient Structured Hierarchical Routing Algorithm (EE-OHRA) to establish a higher and extra-stable strength-based routing direction for the features of comparable nodes in a network context. In that network, a connected node discovery series of rules is	Reduce the computing overhead of each node involved in the exploration of path	Unable to distinguish malicious nodes that have an influence on overall results.

		designed, which is conducted to pick a precise path routing node with identical or related nodes with their capacity and characteristics. Predictable packet transmission in a particular direction is easy to have.		
4	Vu Khanh Quy, and Le Ngoc Hung[4]	Propose an energy-efficient routing protocol using a cost feature combining the hop count and the energy states of the node as a parameter for route selection decision-making.	The protocol increases network lifespan, higher than the AODV and AERP protocols, the average packet distribution ratios.	The efficiency estimation of the EEMA procedure with differing degrees of mobility is lower.
5	E. Edwin Lawrence, R.Latha[5]	A MANET Shortest and Energy Effective Routing Protocol is suggested for (SEERP).SEERP efficiency is measured on the basis of the network's energy lifespan and total energy usage.Compared to the current routing protocols such as DSR, the theme is to address the effects of SEERP and its efficiency.	Compared to DSR, SEERP produces great outcomes, where SEERP shows excellent efficiency in the form of improving the lifespan of the network (by reducing energy consumption) and network throughput.	Unable to distinguish suspicious nodes impacting overall output
6	Rafi U. Zaman and Juvaria Fatima Siddiqui[6]	Two methods are used in the suggested scheme: The first strategy is to measure the queue duration of each node to reduce the normalized routing load. In order to ensure effective transmission to the endpoint, the second strategy is to pick the path dependent on a threshold value. The suggested protocol uses a metric load energy algorithm that maintains node	In contrast to current methods, the suggested protocol demonstrates improved efficiency with respect to QoS parameters such as PDR and throughput.	The emphasis should be on reducing congestion and energy usage.
7	Bava Rinku K, Patel Manish M and Patel Megha B[7]	Suggested energy approach for routing in MANET and dependent on signal power. The gap between two nodes was determined by Obtained Signal Intensity (RSS).	This strategy improves the lifespan of the network.	End-to-end latency is dependent on the lifetime of the

8	Bander H. AlQarni and Ahmad S. AlMogren[8]	In conjunction with ARQ and FEC, the suggested model utilizes RMBPM, utilizing a tone-based framework to provide data stability and performance.	In contrast with well-known protocols such as AODV, OLSR, and DSRR, improved outcomes in terms of latency, efficiency, energy usage, and throughput	Focus mostly on distance-related energy use.
9	Santosh Kumar Das, Sachin Tripathi[9]	Suggest an Effective Routing Protocol for MANET Intelligent Energy-aware (IE2R).In IE2R, the Multi Criteria Decision Making (MCDM) methodology is used to evaluate an optimal route based on the Enrichment of Evaluations-II (PROMETHEE-II) system of entropy and Choice Rating Organisation.	For a real-world application, such as military search and rescue activities, the suggested study may be a suggestive method.	This protocol's drawback is that this protocol is reactive in design, meaning it can not explore a path before the flow is started. The latency of path exploration is also strong for large networks.
10	Pooja ad[10]	Enhancement of the route discovery multipath routing protocol (EMPRR)	Increased the distribution ratio of packets and decreased the end-to-end Postponement	Data protection in the framework for multi-hop delivery is not Centralized Access Control

3.1 Energy efficiency issues in MANET

The real errand is energy utilization estimation and as indicated by limit energy level new course revelation process. Ad hoc remote networks are energy obliged since nodes work with restricted battery energy. On the off chance that a few nodes bite the dust ahead of schedule because of absence of energy, they cannot speak with one another. In this manner, exorbitant utilization of nodes energy ought to be anticipated. Conservation of energy by regulating the power of transmission: The aim of energy conservation is to reduce the overall consumption of energy and increasing the life of the network by increasing the residual battery capacity. The Techniques for power control are used to reduce power Consumption of mobile devices powered by batteries. The Main principle behind this method is to activate mobile devices to the low Power mode, which is high power node sleep mode, when they not used in either inactive mode or idle mode.

The key target of the Routing System in MANET is aimed at optimizing energy efficiency, network output, Energy efficiency, and network lifetime and delay minimization. The Main Distinguishing functions for Routing Structures conscious of control the use of energy for each entry on the road. A requesting node is needed for one route to a specific destination, select one with the highest and most active energy status that is Energy-constrained optimization. So, power-conscious routing in MANET, it is the most useful problem since it has been the best energy saving strategies has been proven.

4. Proposed System

The primary objective of the suggested algorithm is to improve awareness of network energy.

The architecture of energy-efficient protocols is generated by variating the communication range of nodes. Variable Transmitting Range implies controlling the power level for each packet in a dispersed manner. Choosing a larger transmitting range eliminates the number of nodes required to meet the destination, however, causes considerable interference, requiring additional transmission numbers to limit the range of transmission. As a key challenge, we need to conserve power from the machines because of the energy restriction in a MANET that allows to reduce energy usage in the transfer of packets between source and destination. In our approach, we would suggest a basic scheme that uses power routing to primarily focus on reducing energy usage. We concentrate on minimizing the resource usage in the transmission, reception, idle period, and overhearing phase by utilizing power-conscious routing. Mobile nodes are free to transmit in the proposed system, i.e., to send or receive data packets to or from other nodes respectively and use power only for those operations. Through using efficiency parameters in ns2 environments such as delay, throughput, and energy consumption, the proposed approach was extended to MANET routing AODV and compared to traditional scheme. The suggested approach guarantees that all nodes take essentially the same battery maintenance period. Thus, the life period in the proposed scheme does not decline while the nodes are unchanged.

5. Conclusion

Various kinds of protocol and modifications that are required to preserve the energy of the nodes in the MANET network have been discussed in this paper. In this one, Paper, we surveyed and categorized a variety of Energy-aware schemes for routing. Energy is depending on the various parameters of the network like the efficiency of each protocol etc. We would like to infer from the above discussion that energy is one of the MANETs' critical tools. There are several methods for saving energy. In certain instances, it is difficult to explicitly compare them because each process with multiple assumptions and goals, it has a different purpose. It utilizes numerous means to accomplish the objective. When the transmitting power is controllable, it is necessary to optimally change the level of power not only for the conservation of energy, but also for Regulation of Interferences. Accordingly, there is a need for further study to combine and integrate, some of the protocols provided in this paper to operate for a longer period.

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