Global Journal of Computer Science and Technology: E Network, Web & Security
Volume 18 Issue 2 Version 1.0 Year 2018
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 0975-4172 & Print ISSN: 0975-4350

A Novel Survey Analysis on Energy-Aware Routing Protocols for Manet Applications

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Abstract- MANET system applications in today situation consume large amount of energy. This energy becomes an important parameter and scarce resource in MANETS. This energy consumption has to be reduced and harvested in the communication devices for enhanced usage of energy. Different energy aware and harvesting strategies have been devised using various protocols to achieve the reduction in usage of the available energy and power resources.

This paper surveys and illustrates the differences of various Energy-aware Routing Protocol used in MANETS based on the matrices used. These protocols provide some awareness in optimizing the Energy and Power Resources and limit the consumption when nodes are idle. This increases the life-time sustenance of the node and improves the performance widely investigating the energy efficiency protocols for ad-hoc infrastructure less MANET environment.

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GJCST-E Classification: C.2.2

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A Novel Survey Analysis on Energy-Aware Routing Protocols for Manet Applications

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I. Introduction

Emerging wireless technology and the increasing demand for MANET based applications gave rise to the evolution of different energy management methods and an effective way to reduce the energy losses in the operation. MANETS are self-organized infrastructure less mobile networks and to handle these various energy-aware routing protocols have been proposed .the network performance highly depends on the routing methodology based on pro-active and energy- aware routing methods. The best way to achieve is by a broadcast process by minimizing energy and the broadcast time interval [1].

MANETS are wireless networks where all the nodes are usually routers which depend on a protocol associated with routes and discoveries. These are characterized based on the energy, bandwidth capacity of the links and their dynamic alignment.

The dependency of the battery life is an asset associated in MANETS which makes the capabilities deteriorate for the node to disappear. Thus many researchers are focussing on reducing the energy consumption and harvesting the power and energy by optimum usage and increase the life-time. The different Nodes have limited power resource and these in turn results in the network service degradation.

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The purpose of this survey is to identify an effective protocol which optimizes and thus improves the node and the network life-time .In this survey, the organization the paper is done as follows.

Section II gives the related literature review on Recent Energy-aware routing protocols with the enhanced energy optimizing strategies used for the optimizing energy consumption in various scenarios.

Section III comparative distinctions on energy optimization based on various protocols used.

Section IV simulation Analyses of the energy efficient routing and parameterization of metrics.

Section V Gives the conclusion and the future perspective uses and applications based on objectives.

II. Survey of Energy Efficient Protocols

Most of the energy-aware routing protocols reduce the consumed energy by using the routing metrics based on route table, where energy efficiency is calculated by the packet forwarding method. These methods route the information data using the path of maximum energy node or through the minimal end transmission packets, however the minimum transmission energy differs from the shortest path methods that are in use.

This will affect the life time and alternate paths have to be chosen. In the process alternate path selection Energy management principles have to support applications towards the demand for resources with respect to energy. Infrastructure and remote applications have to be catered to enhance the transmission rates and error detection and correction. With the IEEE 802.11 standard being introduced many protocols which helps in optimizing and enhancing the communication resources of the wireless systems are proposed.

This survey Adaptive Enhanced Distance Based Broadcasting Algorithm (AEDB), Optimized Link State Routing (OLSR) Protocol, Energy Ad-Hoc on-Demand Multi-Path Distance Vector Routing (EAOMDV) Protocol and Energy Aware Adaptive Restricted Access Window (EA-RAW).These techniques influence the transmission and energy efficiency of the IEEE 802.11 Standard system.

a) *Adaptive Enhanced Distance based Broadcasting Algorithm (AEDB)*

AEBD is used to save energy in dense as well as in the sparse networks which is based on broadcasting method used in traditional EDB[2] .This mechanism uses the cross-layer technique which informs the upper layers regarding the signal level strength of messages received. Here the nodes are the masters to forward the message based on distance. This forwarding is done if the source node energy is higher than a predefined threshold values called border thresholds.

The energy remained is calculated based on the received energy detected in the beacons exchanged. To get in touch with the awareness of the mobility of the nodes, we add an extra fixed amount of energy to the one estimated called the margin Threshold.

Critically when networks are dense, there is a possibility of high connectivity which in turn reduces the power transmissions. Thus, the broadcasting process minimizes the transmission power for some neighbors saving energy and increase the performance. On the other side if the network is sparse, the network connectivity has to be maintained by the node, if not done so this would induce more difficult in spreading the message through the network [3]

Here when a MANET node feels the operating network is denser the transmission power has to be decreased to the border threshold .Higher threshold makes more reduction in energy this increases the forwarding and gives an enhanced performance for lower energy usage. This algorithm optimizes some multiple objectives based on the energy used, the coverage and the broadcast time. To have good coverage, minimum energy and broadcast time we use different thresholds for AEDB.

b) *Optimized Link State Routing (OLSR) Protocol*

OLSR is a proactive type of energy routing protocol where the route information is available immediately at each node for all the destinations in the network. Here the energy metrics evaluate the energy at each level of transmission and idle condition. Optimization is based on route which is the open shortest path first concept .This induces multipoint relay (MRP) which reduces the overhead of control and flooding is minimal.

Here the MRP reduces the number of transmissions based on broadcasting of messages containing neighbors, links and nodes [4]. In the process of the route calculation, the node fetches the information of its neighbor, and the topology information is refreshed periodically which enables each node to compute the routes to all of the known destinations using the shortest path algorithm [4].

The Route selection in OLSR uses the best path sorted order depending on the LSR and bandwidth. The maintenance of the route and energy efficiency is parameterized based on the energy value which is lesser then a fixed threshold else the link will be broken; a message route error request (RERR) is back sent indicating the route breakage where the discovery of route has to be reinitiated.

c) *Energy Ad-Hoc on-Demand Multi-Path Distance Vector Routing (EAOMDV) Protocol*

EAOMDV is an extension of AODV which is based on the multiple free loops, link and, paths that are disjoint. The list of next hop destinations and energy metrics have to be tabulated .The broad cast table , maximum hop count and alternate paths to the destinations have to be defined. The energy parameters are evaluated based on less hop count to reach the destination [5].

The node residual energy will be monitored during the path selection and the minimum energy shortest path is selected. The above method improves the life-time of the node and the network. Based on the residual amount energy the route is set in a descending manner, and node route will be set for the maximal energy residue node paths.

d) *Energy-Aware Adaptive Restricted Access Window (EA-RAW)*

Raw will use the collisions implementations, and the optimization methodology is being based on the consumption of overall energy states at the MANET node. Here in this approach the data rate and the optimal solution are derived using the hill climb approach. This new MAC is based on decreasing the collision and limits the set of device access to the channel at any instant. This method consists of assigning equal time slots in multiples, where each slot is a device selected to a group during transmission[6].

Here in this MANET network the nodes are awakened during RAW internal else are in off mode, if in on a long RAW interval the device is on for longer duration spending the Idle wake up left energy[7]. To cater this only calculated ways are made to activate and based on successful transmission probabilities based on the window algorithm. This window algorithm calculates the simultaneous contenders based on hill climbing approach which sets the optimal device number and RAW duration for energy efficiency. This RAW methodology is based on Hill climbing approach

III. Comparative Distinctions on Energy Awareness

Table 1: Comparisons and advantages associated

Protocol	Route Selection	Basis Strategy	Energy Awareness	Advantage
AEBD	Enhanced Distance based	Broadcast	Based on Energy Threshold	optimizes some multiple objectives
OLSR	Open shortest path first	Multipoint relay (MRP)	Best path sorted order with a fixed threshold energy	reduces the overhead of control and flooding
EAOMDV	Minimal energy shortest path is selected	Extension of AODV	The node residual energy are monitored	Improves the life-time of the node and the network
EA-RAW	Hill climb approach	Assigning equal time slots in multiple	Based on the consumption of overall energy states	simultaneous contenders can be known

Based on the literature review the above table of comparison is made among the routing methods for energy awareness with the strategies employed and distinct advantages have been compared, this provides a review for using these protocols for Energy based awareness and optimizing and increasing the life-time of the MANET nodes[1-7].

IV. Simulation Analysis and Results

Table 2: Simulation Parameters

Number of Nodes	120
Area	1000m*1000m
Mobility Model	Random Way Point
Traffic	CBR
Frequency	0.9 GHz
Initial Energy	40 J
Transmit Energy	1.346 J
Collision Energy	2.0 J
Idle listen Power	0.05J
Antenna	Omni directional
Packet size	512 Bytes
MAC Protocol	802.11 DCF
Simulation Time	500 sec
protocols	AEBD/OLSR/EAOMDV/EARAW

a) *Energy Variance and Consumption:* This gives the energy consumed on an average at each node to the total energy and its variance after transmission.

b) *Average life-time:* These projects the life-time of a node based on the total buffered, queuing and all possible delays induced during transmission

c) *Packets dropped Number:* The indicates the number of data packets that are dropped and are unsuccessfully transmitted to the destination.

The above - mentioned protocols have been analyzed using network simulator (NS-2) area considered is 1000m* 1000 m using CBR traffic for simulated for 80 sec time with the nodes varying from 40,80 and 120 at maximum speed 20 m/s and the different parameters assumed as below in table 2.

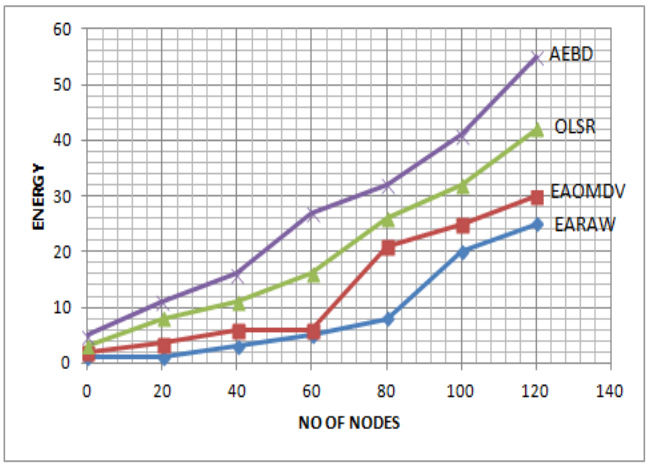

Figure 1: Comparison graph between Energy Variance versus Number of nodes

Figure.1. indicates the results for the energy variation and no of nodes for the various protocols using AEBD, OLSR, EAOMDV and EARAW. This gives a clear indication of the residual energy left at the node. On an average due to the induced awareness in the energy consumption the left over energy is conserved for future use and this gives clear enhanced representation for a higher optimization in harvesting for future.

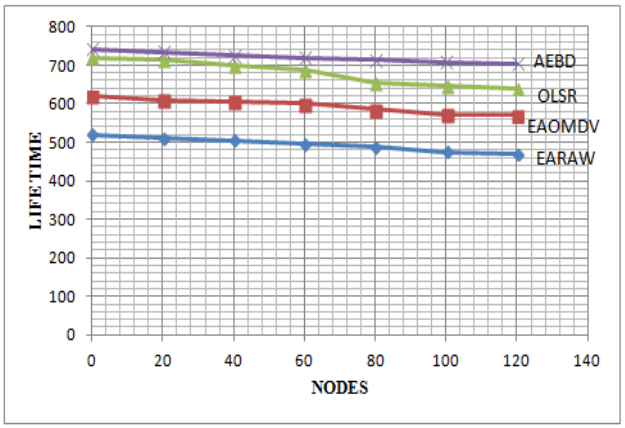

Figure 2: Comparison graph between life-time versus Number of nodes

Figure 2 depicts the average network lifetime using the different routing algorithms where the life-time has been increased due to the awareness and we see the network lifetime is prolonged in by using these algorithms compared to un-optimized routings. The life-time of the node has been increased making improvement in the performance widely investigating the energy efficiency.

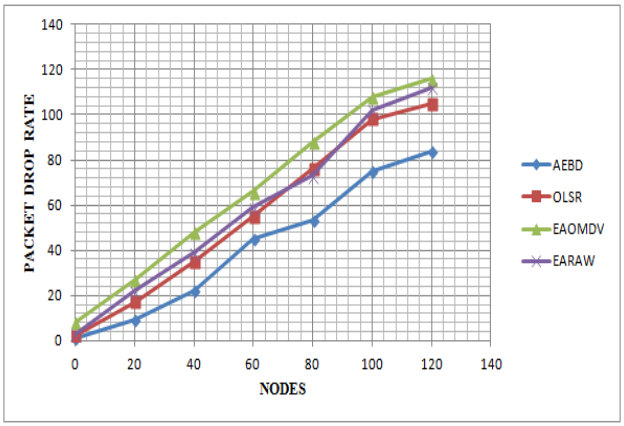

Figure 3: Comparison graph between Packet Drop Rate versus Number of nodes

Figure .3 Shows the comparison of packets dropped for AEBD, OLSR, EAOMDV and EARAW and this comparison shows that AEBD and the other three protocols show lesser packet drop which is necessary parameter to improve the efficiency of the network this clarifies that the packet drop is minimum for the energy-aware protocols. The energy efficiency of the system decreases upon reducing the number of devices.

V. Conclusion

In this article various energy aware routing algorithms have been explored towards minimal energy usage and conservation of the exhausting energy practically to prologue the lifetime of the MANET node.

The proposed protocols for energy optimization using routing mentions enhanced scope for harvesting the energy and increase the life-time of the MANET nodes. These results show better life -time and less packet drops rates and improved optimization for energy dissipation EA-RAW and EAOMDV based on the shortest paths, and hill climbing methods where the energy vested is lesser due to the broadcasting and multi-relaying strategies.

AEBD and OLSR are the existing methods where the energy variance is higher, and the gives scope for less optimization among the four protocols. These are selected to have reduced overheads, and the best of the shortest path with minimum delivered energy.

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