REVISIÓN A LAS SOLUCIONES DEL PROBLEMA DE EFICIENCIA ENERGÉTICA EN REDES INALÁMBRICAS MANET Y WSN

REVIEW: SOLUTIONS TO THE PROBLEM OF ENERGY EFFICIENCY IN WIRELESS NETWORKS MANET AND WSN.

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RESUMEN

Las redes inalámbricas MANET (Mobile Ad-hoc NETwork) y WSN (Wireless Sensor Network) tienen topologías dinámicas las cuales no tienen un punto de acceso centralizado. En este tipo de redes, la preocupación fundamental es el alto consumo de energía, el cual es consecuencia de autoconfigurarse continuamente para garantizar conectividad entre los diferentes dispositivos que pertenecen a la red. Como solución al problema energético se utilizan algoritmos y protocolos de enrutamiento que se encargan de establecer comunicación entre sus dispositivos equilibrando la carga. En este documento se exponen diferentes clases de soluciones al problema de eficiencia energética para redes MANET y WSN.

Palabras Clave: *Energía eficiente, MANET, WSN.*

ABSTRACT

Wireless networks MANET (Mobile Ad-hoc Network) and WSN (Wireless Sensor Network) have dynamic topologies which do not have a centralized access point. In such networks, the main concern is the high energy consumption, which is a consequence of continually configure itself to ensure connectivity between different devices belonging to the network. As a solution to the energy problem algorithms and routing protocols that are responsible for establishing communication between load balancing devices are used. In this document, different kinds of solutions are exposed to the problem of energy efficiency for MANET and WSN networks.

Keywords: *Energy efficiency, MANET, WSN.*

INTRODUCTION

In general, routing protocols to MANET are classified as: table-driven and on-demand (Zanjireh & Larijani, 2015). When a protocol is based on table-driven, it requires that all mobile nodes have full network information through periodic updates, such protocols is also known as proactive so it keeps routes and destinations although they are not used. One of the limitations of proactive protocols is that they can waste bandwidth due to the control messages that are sent unnecessarily when there is no data traffic. However, proactive protocols are useful to increase the amount of information found in the type, it means to avoid loops and accelerate convergence protocol, besides achieving updates dynamically varying frequency and route. (Chawda & Gorana, 2015) (Venkatesan, Rajakumar, & Pitchaikkannu, 2014).

On-demand protocols, they are known as reagents, in this case, routing protocols drastically reduce routing overhead and therefore energy saving. The route between source and destination is used whenever required. When a source node needs to transmit data packets, it first checks if you have the destination in its routing table. If it is not found it begins the

discovery process, low demand route (Patel, Patel, Kothadiya, Jethwa, & Jhaveri, 2014). By not sending control messages it prevents network traffic and prevents consumption, however a delay in sending packets is presented as it should calculate the route when it is required.

Due to increase applications and increasing receiving nodes with complex types becomes more difficult to establish paths within a MANET network, it is why it is classified within the hierarchical routing algorithms reagents.(Habib, Saleem, & Saqib, 2015).

Moreover, some algorithms and protocols for WSN networks are included, the reason is because there are similarities with the MANET because both of them do not have a fixed infrastructure, so they are used each other, intermediate nodes to communicate. Therefore, one of the challenges they share in common WSN and MANET is to be energy efficient. However they are distinguished by the fact that the WSN networks are used as sensor nodes, as a result, the number of nodes presents higher density compared to MANET (Garcia & Gomez, 2007). To resolve this problem, a performing cluster for routing and effective monitoring have been proposed, the network is divided into groups that are coordinated by a cluster head (CH), which facilitates communication and improves energy efficiency within network [5].

This document routing protocols aimed at energy efficiency in MANET networks have been classified into two groups reactive and proactive. Given that, from the energy point of view reagents are more efficient protocols. Various modifications to AODV (Ad hoc On-Demand Distance Vector) protocol that significantly solve the load on a wireless network are presented. Furthermore, additional solutions algorithms and protocols that provide a way or another reactive and proactive measures to improve consumption and network quality.

The algorithms and routing protocols for WSN networks must minimize energy consumption because energy resources in these networks are limited, different solutions for energy improvement in WSN networks are set based on the ratings given routing (Hidalgo Lopez & Moreno Novella, 2011) (Al-Karaki & Kamal, 2004).

WIRELESS NETWORKS MANET

MANET networks are composed of mobile nodes connected wirelessly changing forming typologies. The nodes belonging to a network MANET are responsible for routing to establish communication there. Routing protocols are proactive and reactive use. The different solutions to the energy problem on the network exposed.

PROACTIVE PROTOCOLS IN MANET NETWORKS

One of the alternatives that are available for energy efficiency in a MANET network is the implementation of proactive algorithms as (Guo et al., 2007) looking for a suitable mechanism to conserve energy and thus it is integrated within a dynamic routing protocol. However such protocols are not effective for large-scale mobile networks. Contrary so as to provide robustness heavy traffic and have no additional routing overhead when a network requires. So it proposes a proactive MANET network with low power consumption for routing an evaluation scheme the cost of energy and transmission power, which are used as routing metrics. The residual energy of a node is calculated by ARIMA (Auto-Regressive Integrated Moving Average). OSLR (Optimized Link State Routing Protocol) algorithm is modified and called OSLR-EA (Energy Aware).

The mechanism of energy conservation is based on each node measures independently and autonomous continuous energy consumption in consecutive time intervals, samples of the energy consumption of each node are used to predict future energy consumption in intervals. After residual energy costs and power transmission are calculated. This mechanism implemented aims primarily to extend the network life and save energy MANET network. In conjunction with the NS-2 (Network Simulator) software simulations to evaluate the advantage of OSLR-EA on OSLR in terms of energy consumption they were made. As a result, it is evident that the OSLR-EA is able to prolong the life of the network and save energy scenarios in homogeneous and heterogeneous scenario even more.

Also in the following concerning, the OLSR protocol was used (Prajapati, Patel, & Patel, 2015) designed to work on mobile networks, this protocol has the ability to keep the routing table updated all the time what is known as proactive routing, one of the disadvantages of using this protocol is that to keep the tables updated at all times necessitates an additional charge of energy, OSLR protocol has the mechanism for selecting MPR (Multiple Point Relay), the MPR is responsible for advertising link state information by broadcasting control messages to its neighboring nodes. In other words, a methodology for optimizing the performance of OLSR protocol based on the selection of a better strategy was designed MPR. The simulations were performed using the software NS2, as a result, it was obtained in this way, it improves the lifetime of nodes in terms of energy. The solution to energy efficiency is also based on the consideration of energy for each node MPR, if the energy of the MPR nodes are equal then the hierarchy of the node is taken into account.

REACTIVE PROTOCOLS IN WIRELESS NETWORKS MANET

Reactive in protocols for determining communication with each other intermediate nodes used only when necessary. At the time efficiency in a MANET is improved service quality is also improved, in (Rahman & Gregory, 2014) processes apply QoS (quality of service) which is used to indicate the quality through specific parameters such as the loss of packets through the network, or delay. Specifically for this benchmark is to improve the limitation delay sending data and increased number of packages delivered. The proposed algorithm includes four main components: a) GPS (Global Positioning System) assistance based on routing: it considers the use of only 4 neighboring nodes of the destination node, it is independent of the limitations per quadrant and can use the shorter or more efficient distances, uses the protocol AODV. b) The association of IP addresses: The MANET nodes require an identity to be connected to the network with 48-bit MAC address and use private IP so you need to use address translation and a gateway for traffic Internet. When the MANET network starts, all nodes are assigned an

individual IP, when it leaves the network a node, the IP that has come c) is reused Selecting a subset of 4-node in the destination address: Use the location node destination to select 4 nodes multicast uses for it. d) Intelligent Power Control: Use an array of three criteria Intelligent Energy 1) value of reputation 2) Energy Level 3) Level of residual battery parameters 0 to 10, with which each node is qualified. The authors of (Rahman & Gregory, 2014) They conclude that the incorporation of this algorithm provides improved sending and receiving data and better use of bandwidth.

Other protocols used in MANET is the DSR (Dynamic Source Routing), DSR performs two basic operations mainly during whole process of routing 1) Discovery of the route. 2) Maintaining the route. In DSR if a node sends a packet to a destination first you have to check your own cache to see if there is any available existing route to destination, where there is no route to destination discovery process starts. The DSR is a protocol that is not aware of energy use on the network, so in (Baisakh, Patel, & Kumar, 2012) the modified energy conscious EDSR protocol is used, the main objective of this protocol is to select the specific path between source and destination node such that the intermediate nodes have a higher energy level given time. I.e. instead of selecting nodes by the recognition phase to establish communications between source and destination node, select those intermediate nodes where most energy is concentrated. If the selected path within a node has low energy levels ensures the ECDSR (Energy conscious-DSR) a new route in order to continue communication. In addition to introducing energy efficiency feature, also it integrates the characteristic energy for survival nodes with low energy levels. We used the software simulator-2.34 with 11 nodes in an area of 200x300m the results credited to ECDSR as a better communication tool compared to the basic DSR improves the lifetime of the network with a 60.6%, the package delivery increased 82.7% to 85.3%.

On the other hand, existing protocols algorithms and dynamic source for better network efficiency are used to implement a new routing algorithm in MANET networks with

improved energy efficiency. For the development of this new algorithm took into account the MTPR (Total Minimum Transmission Power Routing) this type of mechanism uses a simple metric represented by the total energy consumed to send the package by a specific route, however, it does not prolong the useful life in each node to not take into account the available energy that is the total network nodes. The DSR protocol which consists of two major operations such as the route discovery and route maintenance was also used, it uses RREQ packets to discover the route, each intermediate node adds the address to reach a destination, and finally destination node source node sends a response to the whole route of intermediate nodes. The maintenance phase starts when there is a problem at an intermediate node is removed so that the affected node cache, and starts again the route discovery process.

Then the implementation of a new EDSR (Efficient Dynamic Source Routing) protocol is performed (Varaprasad & Hosahalli Narayanagowda, 2014) to minimize power consumption per packet, maximize network lifetime and minimize the cost of a node. However, in some cases it may occur in the intermediate nodes behave selfishly to prolong its residual energy autonomous and consequently the loss of packet destination. The EDSR is a reactive protocol on demand balancing the total energy of the network determining weak and strong in terms of energy autonomous nodes. Also for the route discovery uses the modified DSR protocol by adding a timer which keeps the cost of the route to a minimum at a specific time, then add your own route. When there are duplicate RREQ packets, retransmits while time has not expired. Destination node also expects a response by sending the best route. When a lower cost route to get RREP packets is added, it is cached. The simulation results have been made with NS2 show an increase in packet delivery ratio in the network. The half-life of node EDSR proposed model is 45-60% longer than the model DSR.(Varaprasad & Hosahalli Narayanagowda, 2014)

Unlike other solutions that are set to enhance or prolong the use of battery in MANET networks (Bhattacharya, Chattopadhyay, & Chattopadhyay, 2014) by an addition of a

protocol algorithm currently used to improve energy efficiency in networks. The protocol that would amend is the ESAR (Energy Saving Routing Algorithm) (Utkarsh, Mishra, & Chinara, 2012) already concentrated bases in the OSPF (Open Shortest Path First), which has the ability to shut down some network links over short periods of time are with little traffic, the above is done through choice of nodes have the shortest path by Dijkstra algorithm, once the desired nodes are selected off and then again with new routes algorithms assets is calculated.

However, in (Bhattacharya et al., 2014) the algorithm called LP-ESAR (Lifetime Prediction based Energy Saving Routing Algorithm) proposed an improvement to the algorithm ESAR through accurate calculation on energy metric taking into account the predicted lifetime, so the concept of prediction energy time a node is used as a parameter to find the best route between origin and destination was created. RREQ (Route Request) broadcast messages AODV protocol is used as a key part to calculate the lifetime parameter considering the duplicate discovery messages that reach the node at a certain time. Simulations of this new protocol improves the energy efficiency of the network and was used as exclusive lifetime parameter, the LP-ESAR protocol is consistent in maximizing the lifetime of the network.

MODIFIED AODV REACTIVE PROTOCOLS

AODV is one of the most widely used protocols to improve energy efficiency. Within a MANET network the route setting mechanism and dynamic network topology is done under different types of protocols and algorithms, in most cases control packets are sent to establish and maintain routes destination. The energy consumption of these broadcast packets is high because it must maintain the life of the nodes. Routing algorithms differ primarily when there is consumption on demand or continuously.

Recently it has been proposed in (Touzene & Al-Yahyai, 2014) an algorithm and routing protocol which is entitled EGBB (Efficient Extended Grid Based Broadcast) which solves the problem of storm spread in MANET when there is a network with high demand nodes so a

redundancy RREQ packet is created, which work with the construction of the dynamic type which are in the MANET. THE EGBB sets the ground as a logical grid of 2D grids k rows by k columns, the main objective of this strategy algorithm to choose only certain nodes which retransmitted Gateway package is based. A node Gateway is dynamic and can be converted into a normal node, a normal node can become dynamic when you notice that receives certain information from master node. Additionally, a variant of routing algorithm AODV is proposed to contribute to the development of the algorithm EGBB does through tags within its protocol which calculates the address of the sender and its neighbors, when you remove the received packet to update their respective list of gateways which should be maximum 8. This type of protocol AODV EGBB-only is transmitted through Gateway nodes. The results obtained with the NS2 software revealed that parameters such as the total delay time (End to End Delay) is smaller as shown in Figure 1, thus prolonging the energy within the network. EGBB Algorithm can be applied mainly in routing protocols on demand.

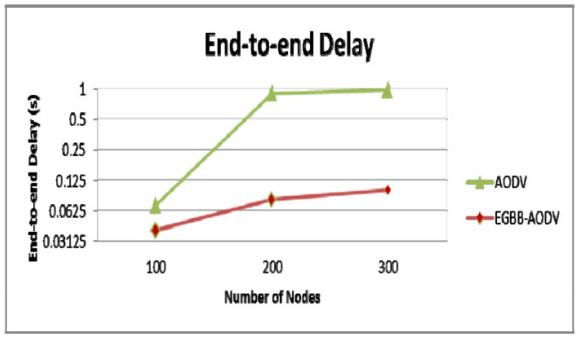

Figure 1. End-to-end Delay Vs Density. (Bhattacharya et al., 2014)

Energy savings in a MANET network is based on the AODV protocol set in the RREQ and RREP (Route Reply) packets (Touzene & Al-Yahyai, 2014)

Another major challenge to minimize the amount of route discovery processes is that the number of processes associated with a high cost in bandwidth of a network. One of the most efficient ways to solve the problem of bandwidth of the network is to select a suitable form of the process of timeout. The expiration time of a MANET network is related to the value which each node maintains active the current route. Current solutions for use arbitrary values

for the system regardless of the network size. Besides taking into account the time fixed expiration on a network, and timeouts that are related to its size, it is proposed in (Rios, 2015) Use VTOA (Variable Time Out Allocation). The method assigns VTOA expiration time of the route in proportion to the size, taking into account the probability of failure. With which it seeks to optimize performance in terms of high value in the QoS (Quality of Service). The probability of failure is determined considering the MANET represent mobile nodes which move at different speeds and in random directions, so previous model is used as shown in Figure 2, which explains that between nodes a and B, one is fixed and mobile respectively, then the coverage radius B is within range a, similar radios. In a random distance d it is in the range R. also takes into account the speed and movement of the nodes, where it was found that the speed of movement depends on the distance A and B. In other words this represents the probability model failure after a given link, i.e. when d exceeds R.(Rios, 2015)

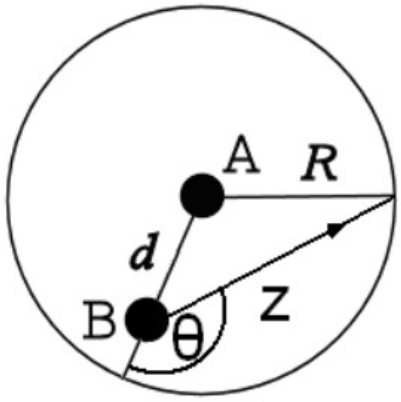

Figure 2. Model with node a static and node B dynamic. (Rios, 2015)

Through software NS2 several simulations resulting VTOA that offers improvements in the delay and overhead order of 21% and 8.5%, respectively, compared with the original AODV algorithm performed, Given a good choice of the probability of failure.

On the other hand to improve the energy efficiency of a network MANET authors (Sarkar & Datta, 2012) improve energy efficiency of mobile networks through trust. To design a trust-based protocol first thing to consider is an energy model to measure the energy found in each

node, i.e. a PEER (protocol for efficient routing of energy), the construction of this new type of protocol it is based on an energy level to achieve sent data through a low-power path between source and destination. Then confidence is now considered as the metric for the efficient routing. However when such algorithms are used, most often it entails that when a node with higher residual energy occurs, all adjacent nodes use to transfer data. By using only a node because of its high residual energy load network behaves from the energy point of view of not efficient because, no energy balances across the network. Simulation results show that packet delivery is improved due to efficient and reliable energy networks to the destination source. It also improves network quality by presenting fewer failures compared to other protocols such as AODV and DSR.

So far it has been suggested that taking into account the total energy of a MANET not always the nearest node is the most efficient. Similarly in (Bhatt, Jain, & Upadhyay, 2013) it is proposed to improve one of the most widely used algorithms within the AODV MANET networks and (Touzene & Al-Yahyai, 2014), where the metric is considered RSS signal strength of nearby nodes, the signal strength of nearby nodes can guarantee a better location relative to the source node because the environment is provided. To do this, the authors of (Bhatt et al., 2013) relevant characteristics compared with the algorithms AODV and EERP (Extended Enterprise Resource Planning), the latter algorithm proposed to improve the efficiency of a network.

The first parameter is: 1) Establishment of Route: In AODV generates the request for the route to find the shortest route which makes the process of generating and forwarding request. EERP differently in this phase is carried through the RSS (Received Signal Strength) threshold value of the received signal, it determines whether the node functions as captured transmitting node or not. 2) Management route: To AODV In this phase deals with requests

generated routes when a route is set all packages given generation route reply is sent. In addition to the route EERP and the changes that occur due to the threshold of RSS with which you have handled, if this value changes, i.e. they are closer, then you change routing. 3) Completion route. AODV when there is an error in the error path to the sender and intermediate nodes is sent to indicate the alternative route, this is a way to recover from the error. Finally at this stage to EERP expiration process performed when the transmit power of the node is restored. Simulations were performed in QualNet 5.0.2, EERP shows better efficiency in conclusion you have that if two nodes are close i.e. its signal strength is high it can reduce transmission power to ensure the level of battery.

Most of the modifications that have been made of AODV protocol as in previous works use mechanisms to select a single path that is coupled to the need for this network, so these protocols are not able to balance the traffic load due to establish a single path. Considering the above it is presented in (Jain & Kumar, 2014) a protocol load balancing Multipath which apart from improving energy efficiency, improves communication efficiency and promote service quality by using different paths simultaneously. On the other hand, it is also a robust algorithm and reduces overhead due to increasing the speed of data transmission and bandwidth of the network. Additionally, this algorithm is called EESM (Energy Efficient Secure Multipath AODV) integrates a routing protocol multipath means that each node is in the network has full knowledge of the adjacent nodes at any time in order to determine the available paths to reach their destination. Another important processes that have this algorithm is to adjust information between the intermediate nodes when a packet is sent. Each time a packet is forwarded intermediate nodes learn quickly. Simulations were performed using the NS-2 software with parameters package delivery percentage in relation to the envoys and energy levels. This compared to other protocols such as DSR, AODV DSVD it can be said that this algorithm energy efficiency can also be applied to DSR protocol to improve performance.

In some cases an additional route that has the same characteristics from this point of view, can occur (C. Jinshong, Ashwani, & Sunil, 2001) again amending the AODV algorithm which implements a virtual node that selects the best path available for communication taking into account the energy efficiency of the network. The objective of the proposed scheme is to provide an efficient service, i.e., a more stable and durable during travel between origin and destination sends data communication. This scheme is designed to MANET and additionally can be implemented to handle lots of traffic level. The modified protocol taking into account the scheme was named (efficient AODV) EAODV, however they are not taken into account intruders or malicious nodes. The proposed scheme integrates 3 major operations 1) The RREQ as route request. 2) The route RERR for error. 3) LRR (Localized Route Repair). Unlike the algorithm AODV in this case the RREQ is not used because in communication principle in a MANET network, all nodes possess a high amount of energy and have appropriate levels of energy, so in this case it reduces levels taking into account the delays, instead, as a replacement for the LRR used and RREQ in this new EAODV protocol. Enhanced simulations were performed with the NS-2 software with a scenario of 50 nodes in an area 1000x1000 meters. As a result, it is evident that the proposed scheme can be implemented in any routing protocol ad hoc on-demand and reduce costs by finding frequent routes, also provides robustness to mobility between network nodes, and increased energy level per node .

It is considered the AODV protocol used to implement load balancing. The modified algorithm is called EAODV (Energy-AODV) (Sharma, Chugh, & Jain, 2014) which conserves energy based on multipath energy factor as a parameter by which communication between source and destination defined set. It is considered that in a MANET energy between neighboring nodes affected node in common between them which is used more than the others. With common nodes showed that these were heavily involved with sending packages,

if the trend continues that way, this type of nodes will have a shorter life than their neighbors and resulted in a clear fall and disconnection of network nodes. Another key factor contributing to the construction of the algorithm EAODV was the routing protocol AODV does not take into account the total network traffic and its respective load balancing for all nodes, which adds more load to nodes and presents increased energy consumption. Given the above, a routing scheme that takes into account the conservation of energy and also to balance the network in an efficient manner, in other words, it involves the shortest path, the energy level and network traffic occurs. EAODV(Sharma et al., 2014) investigates its neighbors present energy levels to collect information and perform a ranking of nodes with high values, energy use in a specific node may indicate somewhat the amount of traffic passing through it. The simulations were performed with the NS2 software with an amount of 50 nodes and an area of 800x 800 meters. With the protocol EAODV the load is distributed correctly including the energy factor, in turn improves the lifetime of routing.

ALGORITHMS AND PROTOCOLS SOLUTIONS OF ENERGY EFFICIENCY

In this section, it is included work complement energy efficiency in MANET, in some cases, solutions hybrid between proactive and reactive algorithms are used, as in (Zhang, Anpalagan, & Guo, 2014) which improves performance of conscious energy, this routing algorithm by Xiaoping load balancing. The authors argue that most research has been developed to date on low energy consumption on MANET, only focus on consumption it is from the source node to the destination node, so it does not take into account traffic total of the entire network.

MANET networks has the advantage to form temporary networks for instant communication, for this reason, one of the challenges is energy consumption due to some connecting nodes can be used more than others. When a node is used in excess and without proper management of energy depletion, it is evident by what the QoS and adequate control be affected. Routing algorithm to prolong life by protecting the network nodes with low residual energy and thus

spread the burden fairly is proposed. To check the efficiency of this algorithm, some parameters were taken into account such as: a) Minimization of energy b) Maximizing the lifetime of the C) Red The total energy minimization and lifetime. Current algorithms for MANET such as AODV and DSR are also compared.

The proposed algorithm is EALB (Energy Aware Load Balanced), the discovery process begins regardless if you have a valid path or not, sending broadcast packets (RREQ) seeking the destination node. When intermediate nodes receive the message they are not allowed to respond although these have the response destination node route, so that congestion prevents possible nodes. The protocol works by assigning values to each discovered three intermediate node to calculate the energy consumed by the node and congestion this lever determining the best route to the destination node. Finally, the results show that the algorithm EALB mechanisms based load balancing energy consumption maximizes the lifetime of each of the nodes(Zhang et al., 2014). As shown in Figure 3

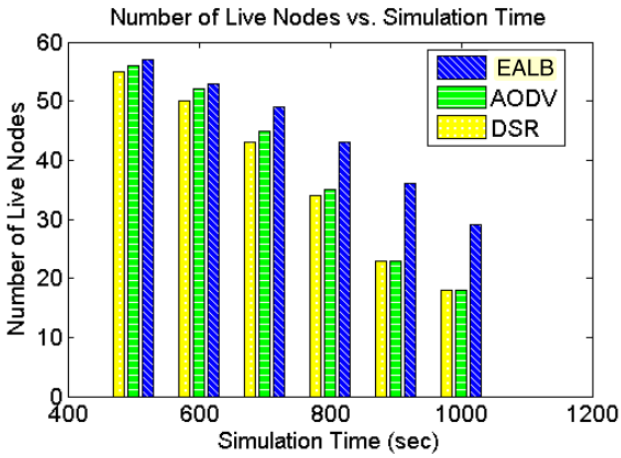

Figure 3. Number of live Nodes Vs Simulation Time. (Zhang et al., 2014)

In (Vanthana & Prakash, 2014) a comparison between reactive and proactive algorithms with NS2 software is done The authors conducted a comparison between the algorithms most commonly used in MANET as AODV, DSR and DSDV must face challenges such as rapid and frequent change of typologies in the network, also as the transmission power. The authors evaluated the following metrics (throughput, End to End Delay and packet loss) a)

Performance: which is measured as the ratio of amount of data received compared to simulation time, higher performance means better QoS, end delay to-end packet loss. B) End to End Delay data packets: The sum of all delay difference of packets sent and received on the network divided by the number of packets sent, the lower the better QoS parameter. C) Lost Packet Data: A data is lost when the buffer is full or when it exceeds the limit Ploss (Packet loss) is defined as the difference between the set of data sent and the average data set.

For each metric and comparing different scenarios protocols were performed using the program Ns -allinone-NS2 version 2.29 on the Ubuntu platform, scenarios take into account the following important parameters: Time Simulation Interface type, traffic type, size packet node speed, pause time and number of nodes. As a result of tests it is concluded that the AODV protocol shows better performance with its ability to maintain regular exchange of connection information for a TCP network. Also the AODV performs better when there are cases of packet loss in performance but the DSDV performs better.

On the other hand, when the pause time parameter was changed in the simulations performed better DSDV the AODV. As for the environment typology and high mobility nodes rapidly changing the AODV protocol can easily be adapted to these changes, however for real-time traffic in the preferred networks is DSDV. To summarize the best performing protocol research done is the AODV to use in real-time traffic and TCP networks, according to metrics and parameters used by authors. (Vanthana & Prakash, 2014)

The solution to problems of energy efficiency and MANET (Varaprasad & Hosahalli Narayanagowda, 2014; Zhang et al., 2014) It uses different methods and mechanisms for load balancing across the network. Identify nodes where traffic is used more than assign new routes to adjacent nodes for proper energy balance. Similarly in (Kumar, Mishra, Singh, & Kushwaha, 2014) it is proposed to use the PageRank algorithm used by search engines on the World Wide Web which determines the importance of a page relative to their weight, i.e. the hierarchy with respect to another page, also the algorithm VOL (Visits Of Links) PageRank is

based on visited links, the above algorithms are used to calculate the numerical weight or relative importance of mobile nodes in MANET.

When packets are in the node is calculated, the proposed algorithm VOL-RAM ensures equal access to the source node according to the number of packets that pass through the node. Finally, we conclude that this new algorithm behaves as a new system for measuring the MANET routing. This new metric that gives VOL-RAM allows be more efficient from the energy point of view as it shows the total consumption of all nodes on a MANET network.

Considering the work done in (Rios, 2015; Varaprasad & Hosahalli Narayanagowda, 2014; Zhang et al., 2014) where it is stated that energy efficiency can be increased in the MANET when upgrading or balances traffic on major nodes, similarly is needed when a MANET network is connected to internet algorithm load balancing is required as It sets forth in (Yan, Ci, Zhang, & Wang, 2014), because it is a hybrid network as shown in Figure 4 there is a lot of traffic load that can concentrate on some nodes and gateways so a congestion occurs eminent.

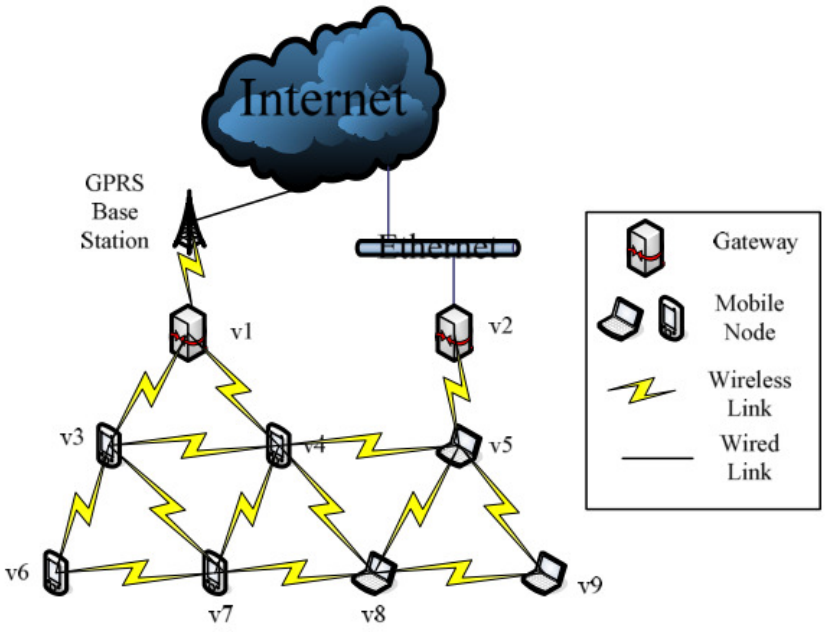

Figure 4. Example of connection between a network and the Internet MANET

To solve the problem of congestion proposed in (Yan et al., 2014) an algorithm called LIBRA (load balancing routing algorithm) used in MANET networks to distribute traffic load that can at gateways, as well as it reduces concentration effects that are associated with the connections between various mobile host. The LBRA works by calculating the shortest path between source node and gateway considering the remaining bandwidth in each gateway and load factor, thus determining an appropriate balance between interconnected to the MANET network nodes link, Through the simulation shows that the proposed algorithm can evenly distribute the traffic load among multiple gateways and suppress the increase of the length of the path routing at most 20% compared to the shortest path routing.

In particular, algorithms have been developed for energy efficiency using mathematical modeling processes to make decisions, and (Maleki, Hakami, & Dehghan, 2014) which uses the mathematical model called MDP (Markov decision process) which provides a framework to find a causal result in problems where optimization is sought, the MDP is a process of discrete-time stochastic control. Reinforcement learning which has the ability to adapt to changes in their environment are also used.

Thus, a routing algorithm which adapts to the circumstances to manage the efficient flow of traffic in a MANET network is exposed, mainly is aimed at reducing the delay from end to end (end to end delay) what it means reducing the energy cost of routing paths, taking into account the energy and delay which are additive measures it is possible to break down the cost of single-hop and accumulated and then send it to the next node and calculate the total cost of jumping through mathematical models. Simulations were performed considering nodes as homogeneous, i.e., with the same energy capacity and power transmission. The result shows that the algorithm converges correctly and is optimal compared to statistical algorithm iteration.

Due to the increase of mobile devices worldwide and the use of MANET technology for military applications and (Arya & Saxena, 2015) It aims to improve energy efficiency considering the IDS (Intrusion Detection Service) (Sabat & Kadam, 2014) through the election of a leader node in a MANET network which provides a cluster. Currently prevention techniques of attack by intruders have mechanisms such as authentication and encryption, these mechanisms are not sufficient to protect a MANET network. IDS services detect the presence of an intruder and gives response element within the network to prevent system damage, the above is done through a node, the drawback occurs when the energy resources of a node may become insufficient to act IDS services, it is where the election is considered a leader. a model of leader election based on adaptive energy is also proposed, namely to adapt the transmission power according to the maximum distance within the cluster (Bhatt et al., 2013). After the election of the leader, this needs to identify each cluster node and perform the MANET network IDS. When the energy level of a leader node decreases to a set range are penalized for not to be a leader and as a result is required the election of another leader and new cluster node. By using this type of scheme the energy level of the network is guaranteed.(Sabat & Kadam, 2014)

The use of military applications MANET nodes are required anonymity because it can be dangerous external entities observe data traffic. Current protocols provide that solution by the anonymity of the source and destination node, however, such solutions can be vulnerable to malicious activity between neighboring nodes in the network. In (Arya & Saxena, 2015) the authors present a MANET with military applications can receive type attacks (Black hole attack), the identity of a malicious node on the network.

The Black hole attack is defined as black holes where traffic entering or leaving is discarded without responding to the source and destination node, in a nutshell the complete packet loss. The MANET has no centralized management mechanisms, i.e. each node acts as a router to

forward traffic to the destination node and taking into account the types of malicious attacks such as those mentioned is necessary to hide all network nodes.

The ALERT (Secure Anonymous Location-Based Efficient Routing proTocol) protocol that provides complete anonymity origin-destination-route is currently used. The ALERT protocol randomly selected nodes in the area and used as intermediate retransmission, i.e., it chooses first a node and sends it to a node that is in its perimeter that is closest to it, which form nodes transmission cannot be traced(Arya & Saxena, 2015). Yet this protocol is vulnerable to malicious ALERT nodes as (Black hole attack).

For the above reasons the protocol S-ALERT (anonymous location-based secure efficient routing protocol) systems use prevention and early detection of intruders is implemented. (IPS IDS), the routing table is modified by a new entry with the name "Is Malicious" to identify a node is malicious. the broadcast message RREQ and RREP is modified in a way(Zhang et al., 2014) (Arya & Saxena, 2015)(Touzene & Al-Yahyai, 2014) for the proposed solution, in this case, two algorithms were implemented, the first message sent RREQ where every neighbor will respond with an RREP with a set time. If you receive a RREP is not neighbor, marks it as "is Malicious" then the source node sends a packet to confirmation by RREP to possible malicious nodes if it responds with ACK (Acknowledge) updates the table unchecking as malicious, in the event that no respond with ACK is confirmed to be malicious. The second algorithm works the same way, but it adds an identification by the id HELLO malicious node to not receive or accept messages from that node. The tests were performed using the software NS2, conclude that S-ALERT improves performance and reduces network Black hole attack type attacks.

II. WSN WIRELESS NETWORKS

The power consumption of the communication WSN mainly decided by three factors: the distance routing, the interference signal, and the cost of routing calculation. Several

algorithms have been proposed routing designed for energy efficiency or avoidance of interference. The solutions are set considering the classification given by (Hidalgo Lopez & Moreno Novella, 2011) (Al-Karaki & Kamal, 2004).

ROUTING BASED ON CLUSTER.

Clustering techniques for protocols that you implement in WSN networks was taken into account, such as the realization of clusters which contribute largely to do a better load balance and a stable consumption it is evident at nodes in this way, decentralized conglomerations forms and hierarchies that occur in the network. Similarly in (Abolfazli & Mahdavi, 2014) cluster techniques were used to reduce energy costs. The algorithm used develops three main stages 1) leveling phase where nodes are scattered randomly in an area with specific size, the master station divides the network into different levels considering data transmission in relation to the power. As a first process, the central station transmits with low power nodes receiving this message are referred to as level 1, in the same way, the central station increases its power nodes now receive their message are classified in Level 2 trend continues in proportion to the number of nodes. 2) Phase cluster: nodes are grouped dynamically during a given through a pattern that imposes the master node in the cluster period. To avoid energy costs groupings according to the needs are made. 3) Phase of data: Each node transmits data to the head cluster in certain time, as an example if the cluster is at level 1, the node transmits data to the main head of the cluster and this Station base. If it is located in higher groups, communication and data transmission is performed between each main cluster head. The results were compared with BMR (Beaconless Multihop Routing Protocol) it is a protocol grouping with static areas. Works choosing a CH, then divides networks taking into account the transmission power. When zoned unlike other protocols these cannot be changed grouping. (Nawaz, Hussain, Abid, & Shafi, 2011) and EELBCRP (An Energy Efficient Level Based Clustering Routing Protocol For Wireless Sensor Networks) This article aims,

minimize the number of dead nodes energy consumption and extend the life of the network. The algorithm takes into account a model where all sensors form a network. Homogeneously grouped nodes with the total stored energy. (Diwakar, 2012), it is evident that considerably increases the total energy of the WSN network.

By grouping (Abolfazli & Mahdavi, 2014) It has chosen other techniques to improve the efficiency of a WSN network when a network is not properly group receivers or hubs have an overload and result in the loss of energy quickly. That is why in (Jannu & Jana, 2015) CH is used as the main solution to reduce energy consumption and prolonging the life of the network, however, the algorithm CH bases its energy model in the maximum residual energy load, in other words a sensor node having power becomes maximum residual CH consequently causes an overload of data traffic on the CH. So as proposed solution a division of groups exposed in unequal sizes based clustering angle and optimal distance from the station sink. The size closest to sink with respect to groups that are far is smaller groups. In each group, a sensor node to become CH that has the minimum distance between neighboring nodes and high residual energy is selected. Whenever a CH reaches a low level of residual charge, it will become a normal node and another node will as CH, In order to maintain good data transmission CHs communicate with sink and among themselves. Simulation and testing of the algorithm was tested in MATLAB (version 7.5) and the programming language C. The proposed algorithm is demonstrated an energy improvement compared to the algorithms that are confronted in (Jannu & Jana, 2015).

Continuing algorithms that use energy efficiency for cluster development and use CH as in (Prerna & Kumar, 2015), To reduce the consumption of energy and increase network connectivity algorithm for WSN based on static and selection CHs group dynamically like which divides the entire area of the network in a beings cluster arises which are selected from 1) Proportion: number of residual energy utility power, 2) Hierarchy: That is the number of sensors around 3 nodes) Distance: Distance between the sensor node and sink. The EECA

(Energy Efficient Clustering Algorithm) algorithm works under the concept already mentioned static clusters and selected from CH dynamically also divided into regions segmented known that provide a better understanding of the location and help improve problems that arise when this not completely, covers the sensor network nodes. Clustering is performed through vector routing based on the distance of the base station which is divided by the communication range of the node. Simulations were made with Matlab. Simulation results show that our protocol of outperforming its protocol routing protocols counterpart LEACH (Low Energy Adaptive Clustering Hierarchy) (Heinzelman, Chandrakasan, & Balakrishnan, n.d.) in terms of connectivity and low power consumption WSN network.

One of the drawbacks that occur within the WSN network is that the sensor nodes that are near the receiving node sink are receiving increased traffic information and consequently higher energy consumption, so that the time energy life rushes to be segmented into small groups. Such problems of WSN networks known as hot spots. In (Jannu & Jana, 2014) an algorithm is proposed to balance the load consumption power sensor nodes and also a grouping is by grid, called GCMRA (Grid Based Clustering And Routing Algorithms). The basic idea of the algorithm is the grouping and routing. First, the region is divided into several networks each of equal size. This division is based on the transmission range of the sensor node. Each division form a cluster. Normal to become CH which must have the minimum distance from the other sensor nodes within the cluster node is selected. To avoid delays in communication between nodes CH communicate with receiving node sink that are closest to this. The GCMRA works in phases: 1) Initialization phase 2) Phase configuration. 3) Routing phase. Simulations have been done with MATLAB (Matlab place), El GCMRA over other algorithms as LPGCRA (Yan Jin et al., 2009) improved lifetime, power consumption and the number of sensor nodes uncharged.

Routing for flat networks or data-centric routing.

Although WSN have become an important technology and applicability to any field, from the energy point of view has not been achieved a breakthrough, power capacity in a WSN network has become key to developing new technologies within that field. Considering the above in (Zeng & Dong, 2014) a new approach to routing WSNs called EEHSBR (Energy Efficient Harmony Search Based Routing) which uses the method of memory Harmony which determines best path between the sensor node and the receiving node is exposed. The aims EEHSBR make the best path taking energy consumption and the length of the path into consideration. By a number of iterations the EEHSBR is able to obtain a near optimal route, which is efficient in energy also it helps to maximize the life of the WSN. The basic implementation of EEHSBR first is that the receiving node informs each node to record the number of hops by sensor messages.

While neighboring nodes are identified, then the residual energy of each sensor node to the sink node are sent. When each node change is detected ambient sensor processes the event and sends it to the receiving node. The receiving node receives the packets with the information of the nodes and calculated by the algorithm overall residual energy. The simulation for testing was performed on the C ++ platform and compared with the algorithm EEABR (Hutchison et al., 2008) . Experimental results show that the algorithm has a better performance HSBC in the balance of power consumption and the lifetime extends networks.

Most protocols for WSN is classified into two main groups: the routing protocol based on the tree and the protocol on cluster-based routing to send data to the receiving node. In (Menaria, Soni, Nagaraju, & Jain, 2014) routing algorithm based on tree is used. One of the disadvantages is when working such algorithms is that a node either receiver or sensor may be compromised for several attacks, i.e., a node when it is committed can inject false data or you can alter data exist within WSN network. That COOL (Compromised Node Locator protocol) was used to provide security and energy efficient routing. By using such protocols it is guaranteed to improve battery levels of nodes and overcome the problems of nodes that are

committed or are malicious. COOL has the ability to remove a node that has an incorrect network behavior. By using the routing protocol based on tree it means that each node on that path, is a unique route for sending data to the receiver. COOL protocol information ensures all nodes in the path. In the simulation results conducted it shows that the COOL protocol finds and removes malicious nodes in the network.

This document aims to add the possibility that each sensor node within a WSN network can extend your life through cargo vehicles as set forth in (T. Y. Chen, Wei, Cheng, Shih, & Chen, 2015). The sensor nodes in a WSN network is the case mandatorily need to be recharged. Wireless charging a vehicle which is equipped with a higher capacity battery compared to nodes that is the case with a magnetic field is proposed. Your vehicle must have sufficient autonomy to achieve move along the sensor network to the respective load. The case where no node need to recharge, the vehicle can wait at the central station to recharge its battery. So that each vehicle should consider the total life of the network and its own autonomy in this DPG-Scheme (e Dynamic Path Generation) Figure 5, developed on the basis of the solution to the implementation of a curve that fills the space to find a way proposed minimizing energy consumption and vehicle maximizes the life of the sensor network. As shown in the Figure, it converts the environment into grids and each grid size can be served by a WCV (Wireless Charging Vehicle), technical filling space is a curve, the range contains the nearby sensor nodes. After the network topology becomes a DPG-scheme which uses the curve of Moore calculate the route. Such applications improves and extends the lifetime of the network nodes in a WSN.

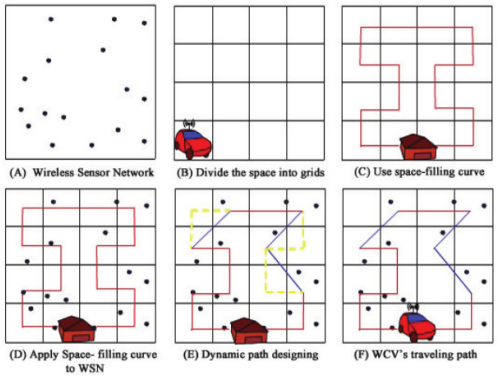

Figure 5. Generation scheme Dynamic route. (T. Y. Chen et al., 2015)

In (Dong & Yu, 2014) a new definition arises from the energy point of view, i.e., not taken into account the lifetime of the node, instead of considering the lifetime of the flow. Stated otherwise, it arises as main objective prolong the life of a flow between source and destination. The life of the network is defined when the first flow dies. Furthermore, a new link cost function is designed taking into account parameters such as transmission speed, distance and total energy level network. In raising this new definition of energy the algorithm is the ability to take into account the current level of energy. Also considers the characteristics of the node. Thus, the algorithm focuses more on the condition of the network flow. Simulations were performed through Matlab, it shows that the lifetime of the application flows can be prolonged for about 10%. In addition to different update intervals, the method maintains the lifetime of the stable network.

A distributed algorithm which is fault-tolerant, that is when routing paths between nodes are established, this algorithm can support sudden failures that occur within the WSN network is presented. The working mechanism of EEBR (Singh, Kuila, & Jana, 2014) (Energy Efficient and Balanced Routing) in principle, it works with a process by which all nodes, using a counter, indicate the value of jump (hop). The indicator is one start, when it receives a packet, the sensor node stores the value in the counter and this in turn increases by one. These indicators jump (hop) they are also transmitted to neighboring nodes. So that when a sensor node receives a new packet, compares this autonomous information are stored. If at the time

of comparing the value received is lower, the information will be updated and rebroadcast, on the contrary case, it will ignore the received packets. Therefore to dismiss this kind of information that may be unnecessary for the network, it prevents redundant information exists and creating loops. The results were performed with Matlab, it is evident that not creating loops, balances and improves the life time of energy network. However in experiments mobility nodes was not considered.

Routing based on location

To maintain the quality of communication in terms of energy consumption, the stronger is the signal increased consumption occurs, the energy efficiency of an algorithm is to find multiple hops to determine the connection between source and destination taking into account a minimum load. The connection between nodes in WSN wireless networks is prone to radio signals attenuation, the signal interference, noise signal is why for the realization of the algorithm EEGRA (Energy Efficient Geographic Routing Algorithms)(T.-Y. Chen et al., 2012) It is mainly decided by three factors 1) the distance routing 2) interference signal 3) routing cost calculation. The EEGRA integrates geographic routing algorithms which decide a jump destination node (destination hop-by-hop), where the Euclidean distance is measured from the line sensor transmitting node to the destination node.

The model used is the SNIR model (Signal-to-interference-plus-noise ratio) which only takes into account the interference caused by communication in its environment, on the other hand, the proposed algorithm considers the need to minimize both the distance routing, such as energy consumption. EEGRA this algorithm is distributed as it uses other geographic routing algorithms to find the best route based on the minimum cost. EEGRA algorithm works as follows 1) Blocks communication point whose energy consumption is greater than a set level. 2) Use the geographic routing algorithm to find the path default using only viable edges. 3) If

there is a route for. EEGRA has been compared with other algorithms theoretically, the result shows a better ability to establish routings.

Routing algorithm based on radar chart EERC (Energy Efficient Routing Algorithm Based on Radar Chart) is proposed (Sen Feng & Hao, 2014), which adopts multiple metrics. Therefore, a comprehensive evaluation model to intuitively determine the next hop in a route WSN is proposed, this model provides comprehensive solution to energy problems within a network. Determining the next hop for an energy efficient routing system, it does so through the following parameters: 1) Power residual node 2) the distance from the node to sink and the distance between the node and its neighbors. The above factors are used as indicators for evaluating next selection jump. After determining the evaluation facings, now the weights for each indicator are allocated taking into account the AHP (analytic hierarchy process). It is a mechanism making multiple decisions. In other words, when a complex problem is decomposed into different levels adopt simple sub problems is obtained. Where these sub problems are weighted according to their relative importance for the application. The lower levels are alternative solutions. Functions as the following steps. Like in (Jannu & Jana, 2015) MATLAB is used as a simulator, ERC this algorithm performs better than the VPFBR (JianSheng, 2009) in terms of energy efficiency and improved lifetime for the WSN networks. Considering the different applications can be found for WSN networks, there are cases when mobile nodes are, most viewed references are based on fixed nodes, (Das & Roy, 2015) propose models and special solutions for WSN nodes on networks that are mobile. As the main objective is to minimize energy consumption, the model presented is aimed at events, i.e., when mobile nodes for some reason are static while adjusting the orientation to reach the desired goal is the time to exchange important information among them. The exchange of information at appropriate times minimizes energy consumption per node and thus extends the total lifetime of the network. It should be stressed that the presented model is applied initially considering all mobile nodes have the same initial charge of energy and the same

physical capacity to be able to mobilize, i.e., speed and displacement: vertical, horizontal and diagonal. Each node also has GPS support and can communicate with nearby nodes. In addition to the energy model it is known that consumption is primarily due to mobility and retransmit your order and receive messages. The lifetime of the network is defined as the life time of initial charge less time remaining of wireless sensors, such as short time to live on the network is the goal is that the nodes are deployed as quickly possible so as to maintain communication without mobility of some nodes. In other words, the network has the ability to further prolong the lifetime of the network preventing the sensors move.

Routing based on negotiation.

In (Khatana & Manju, 2014) an algorithm is a new way to improve the energy efficiency of a WSN network, the main objective of the algorithm states that wireless networks can become efficient if it enables or disables the sensor nodes arises. The heuristic is to find the maximum number of routes so that the total lifetime of the network can be increased. Needless to say, the nodes are not activated or deactivated via the receiving node sink, however several alternative routing low-power are designed to prolong the energy load sensors. An important process of this algorithm EER (Energy Efficient Routing) is observing the parameter of total lifetime of the net and find the optimal solution. In the first phase of EER creates a cover which selects nodes that guarantee gentlemen cover all the objectives. After selecting the route generates a sensor that is present on the cover and builds the path between sensors having high priority to the base station. When receiving node it obtains this information and builds the shortest route. Finally, he decides to build other routes taking into account the energy consumption of the sensor nodes. The simulations were performed with the C language and compared with (Fonoage, Cardei, & Ambrose, 2010) , as a result evidenced longer life of the network.

Routing with QoS (Quality of Service).

a mechanism that is based on confidence which selects clusters and CH, which is performed through traditional routing protocol cluster is exposed, the CH are chosen similarly to (Jannu & Jana, 2015). The clustering process is performed once have been selected CH nodes, each of which sends a packet transmission with delay information between them in relation to the transmitted power, thus each normal node decide to cluster belong to base on trust and the power received from the CH nodes. After nodes CH adopt the TDMA (time division multiple access) strategy, i.e. a time interval assigned packets are sent, the remaining time will be in the sleep state to reduce power consumption. To ensure credibility ACK transmission is used, the increase of ACK messages from one node increase the confidence thereof. Simulations were performed through software Ns-2 300 nodes in an area of 10 x 10 meters. It is concluded that the proposed algorithm is feasible and effective.

Multipath routing.

In (Khiani, Dethe, & Thakare, 2014) a mechanism disjoint routing nodes, with a secure and reliable system is proposed. So that, these three conditions are met 1) Safety multipath 2) Attacks that occur between the multiple paths. 3) Security data being transmitted. In other words, the main objective is to provide protection Multipath routing for better protection, better quality of data transmitted and load balancing by selecting different paths. Also ensures a reduction in the delay from end to end and improves the energy of a WSN network. A selective encryption scheme is also introduced to encrypt data in order to improve safety and as allocation strategy is used to forward data based on a power consumption of the nodes in the network path. This algorithm is based on disjoint multipath nodes where each node is part of a unique way, it is why every route has no common nodes. In principle, each sensor node transmits a message to keep its routing table. Each message compiles information about the node as the energy level, number of hops. Whenever the node receives the message updates it with their own data, that way the routing table is updated. So the different classes are chosen

path with different types of security and also the route selects the receiving node is why greater security is provided.

CONCLUSIONS

Actually it increased the use of wireless devices such as PDAs, laptops, smartphones, sensors etc., which have increased the use of wireless networks therefore necessary routing protocols to be responsible for communication between each device are made. The algorithms and protocols currently used for MANET and WSN wireless networks are deficient energy because they do not consider the number of messages that are used for communication between its nodes.

An investigation of some algorithms and routing protocols for MANET and WSN networks that solve the problem of energy efficiency that occurs is presented. For networks they were classified MANET solutions with proactive routing protocols as OSLR, DSDV and reagents as AODV and DSR.

Furthermore, for WSN using wireless nodes is greater compared to MANET, the use of sensors to gather accurate information, necessary that the number of nodes having high demand. Therefore most solutions focus on the performance of clusters, cluster solutions in WSN networks agree a good choice of CH with his possible replacement and how the clusters are segmented on the network.

To improve energy efficiency in MANET and WSN networks are not always the shortest path between nodes is the most appropriate to prolong the charging time on a wireless network. Most consulted regarding simulators have been used to check the efficiency of a new algorithm or protocol, considering parameters such as simulation time, distance and mobility between nodes, number of connected devices, initial energy load simulation and packet size. The most relevant results of simulation are considered to check the energy improvement are: The lifetime of the network, overall network delay.

It is proposed to implement a database with all the algorithms and protocols mentioned, where the general and specialized public contribution to energy increasingly improvement in MANET and WSN networks.

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