A Power Aware DSR Protocol for MANET

Bindu Sharma[1], Tarun Kumar[2]

[1]M.Tech. Scholar, Department of Computer Science & Engineering, GIMT, Haryana, India
[2]Asstt. Prof., Department of Computer Science & Engineering, GIMT, Haryana, India

ABSTRACT

The overall lifetime of the entire ad hoc network can be increased by improving the power consumption balance among nodes and the connection of the network. In most existing protocols, a mobile node may consume all its energy to participate in the operation without considering the remaining energy. In the proposed energy efficient DSR protocol each node will only use part of energy to transmit the data packets. This is done through a route discovery procedure. The new protocol uses a cost function to decide route selection instead of using the traditional shortest hop algorithm. The reason that DSR is used as our base model is mainly due to the fact that it is a typical on demand protocol with less bandwidth and energy use.

Keyword: - *MANET, AODV, RREQ, RREP, MPSR, MBCR, MMBCR ,CMMBCR, PSR.*

---

1. MOBILE ADHOC NETWORK

A mobile ad hoc network (MANET) is a collection of wireless mobile nodes which have the ability to communicate with each other without having fixed network infrastructure or any central base station. Since mobile nodes are not controlled by any other controlling entity, they have unrestricted mobility and connectivity to others. Routing and network management are done cooperatively by each other nodes. Due to its dynamic nature MANET has larger security issues than conventional networks. A MANET is a type of ad hoc network that can change locations and configure itself on the fly. Because MANETS are mobile, they use wireless connections to connect to various networks. This can be a standard Wi-Fi connection, or another medium, such as a cellular or satellite transmission.

Some MANETs are restricted to a local area of wireless devices (such as a group of laptop computers), while others may be connected to the Internet. For example, A VANET (Vehicular Ad Hoc Network), is a type of MANET that allows vehicles to communicate with roadside equipment. While the vehicles may not have a direct Internet connection, the wireless roadside equipment may be connected to the Internet, allowing data from the vehicles to be sent over the Internet. The vehicle data may be used to measure traffic conditions or keep track of trucking fleets. Because of the dynamic nature of MANETs, they are typically not very secure, so it is important to be cautious what data is sent over a MANET [5].

1.1 Dynamic Source Routing

Mobile networks have attracted significant interest in recent years because of their improved flexibility and reduced costs. Compared to wired networks, mobile networks have unique characteristics like frequent network topology changes, varying link capacity because of the impacts from transmission power, receiver sensitivity, noise, fading, and interference. Additionally, wireless mobile networks have a high error rate, power restrictions, and bandwidth limitations [5]. Routing is the process of selecting paths in a network along which network traffic can be sent [19] in a mobile ad hoc network arbitrarily motion of nodes results in unpredictable and frequent topology changes. Additionally, since nodes in a mobile ad hoc network normally have limited transmission ranges, nodes cannot communicate directly with each other. Hence, routing paths in mobile ad hoc networks contain multiple hops, and each node in mobile ad hoc networks has the responsibility to act as a router. Because of the importance of routing protocols in dynamic multihop networks, a lot of mobile ad hoc network routing protocols have been proposed in the last few years. Routing protocols of MANETs fall into two main categories. First are Proactive protocols which are also known as table driven routing protocol in which every node periodically exchange the routing information and maintain network topology information in form of tables. Nodes continuously evaluate routes by flooding routing information across the network to all other reachable nodes and attempt to maintain up-to-date and consistent routing information. Therefore, a source node immediately gets a routing path when it needs one. On the contrary, reactive protocols build paths on-demand and Dynamic Source Routing (DSR) is an on demand routing protocol. The routing protocols that fall under this category do not maintain the network topology information. They obtain the necessary path when required. Hence they do not periodically exchange any routing information. [13] A route discovery operation invokes a route determination procedure. This discovery procedure terminates either when a route has been found or no route is available after examination for all route permutations. In a mobile ad hoc network, active routes may be disconnected due to node mobility. Therefore, route maintenance is an important operation of reactive routing protocols [5]. So DSR employs flooding to discover paths (Section A). Then, to manage situations in which current routes are broken, DSR implements a separate route maintenance procedure (Section B). A. Route discovery Route discovery consists of two sub-procedures: Route Request (RREQ) and Route Replay (RREP). Route discovery is the mechanism by which a node wishing to send a packet to a destination node finds a route. Route discovery is used only when a node attempts to send a packet to another node and does not already know a route to that node. [6]

a) Let consider a node S which want to send packets to node D. S will check its "Route cache" if route is present. If no route is found, it will have to start a route discovery protocol to find a route to the destination. Else the cached route is used to send packet.

b) Now node S will initiate Route Request and will broadcast RouteRequest (RREQ) packet with a unique identification number. This RREQ is flooded throughout the network. Each node on receiving the RREQ packet rebroadcast the packet to neighbor nodes except some conditions like if the node has forwarded this packet already or if the node is destination node or time to live has exceeded. Each node before forwarding appends its own address to packet.

c) Now how the nodes will check if it has forwarded the packet already? Solution to this is also given that each RREQ packet has a unique identification number generated by source node and path it has traversed. A node on receiving the RouteRequest packet checks the sequence number in routing table to check the duplicate request. Duplicate request is discarded.

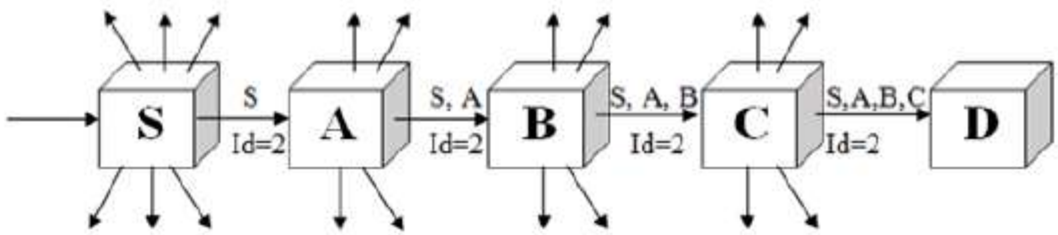

Figure 1.1: Route discovery- node S is the initiator, and node E is Destination

Destination node on receiving the RREQ packet replies the source node through the reverse path the RouteRequest has traversed by sending RouteReply (RREP) message and cache the route in nodes.

- **Route maintenance**

Route maintenance is the mechanism by which node S is able to detect, if the network topology has changed such that it can no longer use its route to D because a link along the route no longer works. When route maintenance indicates a source route is broken, S can attempt to use any other route it happens to know to D, or can invoke route discovery again to find a new route. Route maintenance is used only when S is actually sending packets to D.

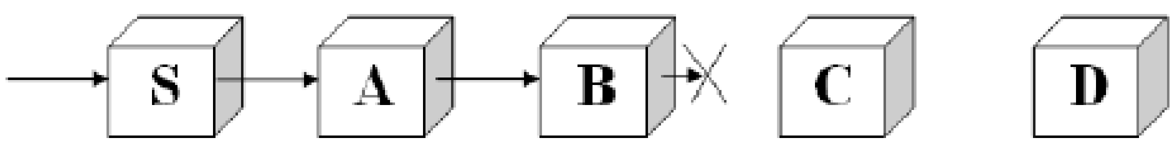

Figure 1.2: Route maintenance- node C is unable to forward a packet from S to D

Using route discovery S will get the RouteReply from D. Now there is a path from S to D and S can send packets to D via selected route. Now when S will send packets and if the intermediate node C moves from its position and cause wireless link breakage. RouteError (RERR) message will be sent by intermediate node B to initiator S. Then source node S reinitiate route discovery for reestablishment of new route. The entries cached at intermediate nodes are removed when they get RERR message.

Energy Efficient Routing Algorithms are not only to minimize the total energy consumption of the route but to maximize the lifetime of the network. In Ad hoc networks mobile nodes are powered by limited capacity batteries. Power failure of a mobile node affects not only the node but also its ability to forward packets and thus the overall network lifetime. In Ad hoc network energy consumption is done in two states. When nodes are transmitting or receiving packets called in active state and when a mobile node stays idle but listens to the wireless medium for any possible communication requests from other nodes called inactive state. In both state nodes consume some amount of energy. During active state energy consumption is more than inactive state. Active state protocols are divided into transmission power control approach which is to control energy consumed during transmission and receiving of packets. Second approach is load balancing used to balance the energy usage of all mobile nodes by selecting a route with underutilized nodes rather than the shortest route.

Further inactive state is when nodes are not doing anything just listening to other nodes so the approach used is to put nodes in sleep mode to retain it energy. Based on these different approaches many research works has been proposed. Energy efficient routing protocols proposed in [23], [24], [27] consider residual energy of nodes to increase lifetime of network.

2. RELATED WORK

[26] The purpose of this study is to suggest energy efficient routing for ad hoc networks which are composed of nodes with limited energy. There are diverse problems including limitation of energy supply of node, and the node energy management problem has been presented. And a number of protocols have been proposed for energy conservation and energy efficiency. In this study, the critical point of the EA-MPDSR, that is the type of energy efficient routing using only two paths, is improved and developed. The proposed TP-MESR uses multi-path routing technique and traffic prediction function to increase number of path more than 2. It also verifies its efficiency compared to EA-MPDSR using network simulator (NS-2).

[27] Mobile ad hoc networks (MANETs) are composed of mobile nodes that form complex distributed systems without any fixed infrastructure and are featured by limited battery recourses. It is known that energy failure of a node affects the node itself, affects its ability to forward data packets on behalf of other nodes and hence affects the overall MANETs lifetime. Consequently, Development of an efficient energy-aware protocol is the need of today's MANETs. Much research had been devoted to develop energy-aware routing protocols. This paper proposes two energy-aware routing algorithms: energy aware ad hoc on-demand distance vector (e-AODV) and an energy-aware dynamic source routing (e-DSR), and compares their performance with the well-known AODV and DSR routing algorithms. Glomosim is used to simulate and to compare the performance of the four routing algorithms (AODV, DSR, e- AODV and e-DSR) in terms of average energy consumption, average end-to-end delay and average drop packets. Results reveal that e-DSR is able to work best in terms of averaged energy consumption and averaged end-to-end delay over different mobility speeds.

[2] Low-Power Mode, in which mobile devices can support low-power sleeping mode. The main research challenges in low-power mode are that at what time mobile node can turn to sleeping mode, and at what time it should wake up. Corresponding issues are addressed in [23], [24], [25] and etc;

[12] Power control increases network capacity and reduces energy consumption by allowing nodes to determine the minimum transmit power level required to maintain network connectivity and forward traffic with least energy cost. Ad hoc wireless networks are power constrained since nodes operate with limited battery energy. To maximize the lifetime of these networks (defined by the condition that a fixed percentage of the nodes in the network "die out" due to lack of energy), network-related transactions through each mobile node must be controlled such that the power dissipation rates of all nodes are nearly the same. Assuming that all nodes start with a finite amount of battery capacity and that the energy dissipation per bit of data and control packet transmission or reception is known, this paper presents a new source-initiated (on-demand) routing protocol for mobile ad hoc networks that increases the network lifetime. Simulation results show that the proposed power-aware source routing protocol has a higher performance than other source initiated routing protocols in terms of the network lifetime.

[16] Mobile ad hoc networks (MANETs) consist of a collection of wireless mobile nodes which dynamically exchange data among themselves without the reliance on a fixed base station or a wired backbone network. MANET nodes are typically distinguished by their limited power, processing, and memory resources as well as high degree of mobility. In such networks, the wireless mobile nodes may dynamically enter the network as well as leave the network. Due to the limited transmission range of wireless network nodes, multiple hops are usually needed for a node to exchange information with any other node in the network. Thus routing is a crucial issue to the design of a MANET. In this paper, the authors specifically examine the issues of multipath routing in MANETs. Multipath routing allows the establishment of multiple paths between a single source and single destination node. It is typically proposed in order to increase the reliability of data transmission (i.e., fault tolerance) or to provide load balancing. Load balancing is of special importance in MANETs because of the limited bandwidth between the nodes. The authors also discuss the application of multipath routing to support application constraints such as reliability, load-balancing, energy-conservation, and Quality-of-Service (QoS).

[1] Mobile Ad hoc Networks are characterized by multi-hop wireless links, without any infrastructure, and frequent host mobility. A plethora of routing protocols has been proposed. A class of routing protocols called on demand protocols has recently gained attention because of their efficiency and low routing overhead. As the mobile nodes in

the network work on low power batteries, the need to take into account their power consumption arises. This paper focuses on a particular on-demand routing protocol, called Dynamic Source Routing, and shows how an efficient heuristic based multipath technique can improve the mean time to node failure and maintain the variance in the power of all the nodes as low as possible. In the Multipath Power Sensitive Routing Protocol (MPSR) every node in the network is treated equally and the overall network is stable for a long time. An interesting feature of using this protocol is that the end-to-end packet delay does not increase significantly. The results of extensive simulation show that the performance of MPSR protocol is on an increasing trend as mobility increases when compared to the Dynamic Source Routing.

[5] The authors have shown the development of the efficient power aware protocol is the need of today's ad-hoc networks. Although developing battery efficient systems that have low cost and complexity, remains a crucial issue. In order to facilitate communication within a mobile ad-hoc network, an efficient routing protocol is required to discover routes between mobile nodes. Power is one of the most important design criteria for ad-hoc networks as batteries provide limited working capacity to the mobile nodes. Power failure of a mobile node not only affects the node itself but also its ability to forward packets on behalf of others and hence affects the overall network lifetime. Much research efforts have been devoted to develop energy aware routing protocols. In this paper the authors proposed an efficient algorithm, which maximizes the network lifetime by minimizing the power consumption during the source to destination route establishment. As a case study proposed algorithm has been incorporated along with the route discovery procedure of AODV and by simulation it is observed that proposed algorithm's performance very difficult to find and maintain an optimal power aware route. In this work a scheme has been proposed to maximize the network lifetime and minimizes the power consumption during the source to destination route establishment. Proposed work is aimed to provide efficient power aware routing considering real and non real time data transfer.

[14] Power save protocols attack the problem of high idle state energy consumption by maximizing the amount of time nodes spend in the sleep state. Other works like have combined both maximum lifetime routing and power control approaches.

[3] Power-Aware Routing: Other than the common shortest-hop routing protocols, such as DSDV [21], power-aware routing protocols take various power metrics or cost functions into account in route selection. [22] Maximum lifetime routing selects paths that maximize network lifetime by balancing energy consumption across the nodes of the network.

[25] An ad hoc network is a group of wireless mobile computers or nodes in which individual nodes cooperate by forwarding packets for each other to allow nodes to communicate beyond direct wireless transmission range. In this paper presented the design and performance evaluation of a new on demand ad hoc routing protocol, called SWARM. SWARM used mechanisms of swarm intelligence to based select good routes to destinations. SWARM was Scalable, Adaptable, autonomous and have good Fault tolerance capability. This paper presents the simulated performance comparison of SWARM with AODV and DSR in different CBR traffic flow. Performance evaluation of AODV, DSR and SWARM was evaluated on packet delivery ratio, network throughput, end-to-end latency and packet transmission rate.

[13] Mobile ad-hoc networks (MANETS) are prone to a number of security threats. The authors incorporate our distributed reputation protocol within DSR and perform extensive simulations using a number of scenarios characterized by high node mobility, short pause time and highly sparse network in order to evaluate each of the design choices of our system. The authors focus on single and multiple black hole attacks but this design principles and results are applicable to a wider range of attacks such as gray hole, flooding attacks. The author implementation of black hole comprises active routing misbehaviour and forwarding misbehaviour. The authors design and build our prototype over DSR and test it in NS-2 in the presence of variable active black hole attacks in highly mobile and sparse networks.

[10] Transmission Power Control: In wireless communication, transmission power has strong impact on transmission range, bit error rate and inter-radio interference, which are typically contradicting factors. By adjusting its transmission power, mobile node can select its immediate neighbours from others, thus the network topology can be controlled in this way. How to determine transmission power of each node so as to determine the best network topology has been addressed in [15], [20], [18] and etc;

[15] With recent performance increase in the area of wireless mobile communications, mobile ad-hoc networks are playing a wide spread usage in the areas of military and other applications. But this mobile ad-hoc network does not have any centralized authorities like an access-point or a router as in case of wireless and wired networks to control and take care of routing. Thus routing has become a greater challenge to these types of networks. This paper proposes a new reputation based routing protocol based on DSR (Dynamic Source Routing) and through simulation results proves that the proposed method performs well compared to normal DSR.

[20] Ad-hoc network are composed of mobile devices, in other word it does not have fixed infrastructure, it means there is no time and space restriction compared to wired networks. So, ad hoc network is useful in any situation where difficult to set up the network such as disaster relief, rescue operations, and many other applications. One of character of ad hoc networks is mobility: all nodes in network are capable of movement and can be connected dynamically. Despite these advantages, wireless nodes have limitation related to energy supply. It means that network operation depend on node with limited energy. MBCR (Minimum Battery Cost Routing) [2], MMBCR(Min-Max Battery Cost Routing), CMMBCR(Conditional Max-Min Battery Cost routing), PSR(Power-aware Source Routing) are type of energy aware routing to use limited energy effectively. These protocols are developed in phase, and finally PSR is near complete energy aware algorithms using single path routing. Recently, after PSR, multi-path routing technique is developed so it can improve performance of nodes. Multi-path routing has effects on load balancing, fault-tolerance, higher aggregated bandwidth. Especially, the load balancing can reduce traffic overhead by dividing traffics. Also it can distribute energy consumption of nodes to nodes in other local network. The EA-MPDSR analyzes the strong point and a weak point of multi-path routing and applies it. Using two path methods leads to improving of energy efficiency than the existing protocols. But multi-path routing has a problem that related to overhead, radio interference, packet reassembly. Because it uses round-robin type that like almost a parallel transmission. The proposed TP-MESR uses multi-path routing technique and traffic prediction function to increase number of path more than 2. In this study, the authors confirmed, solution to problem that caused in multi-path routing is regular sequence packet transmission using one path. For this solution, traffic prediction function which is new load balancing framework was proposed.
[22] This paper presents a novel multipath energy aware routing for wireless ad hoc network. A deep analysis of different routing metrics such as MBCR, MMBCR and MDR have been led out and the Minimum Drain Rate metric has been selected as energy metric to integrate in the Multipath DSR protocol. Performance comparison with energy efficient DSR (DSR-MDR) has been presented showing the benefits of the multiple route selection. An update mechanism and a simple data packet scheduling among the energy efficient paths have also been implemented to update the source route cache and for improving the traffic and energy load balancing. Comparison of Multipath DSR with MDR, cache update and round robin scheduling (MEA-DSR) has been also compared with Multipath DSR with MDR metric without cache update mechanism (MDSR-MDR). Simulation results confirm the improvements associated to multipath extension with energy aware metric with respect to the MDR-DSR (unipath routing).
[11] analyzed the Minimum Battery Cost Routing (MBCR) to minimize the path battery cost so as to maximize the total remaining battery capacity. The cost function f in MBCR is defined such that the lower the remaining battery capacity c of a node i, the more reluctant the node is to receive and forward a packet. In this paper we proposed a new route discovery algorithm that considers the remaining energy for each node and uses a cost function to choose the best power saving route. And a new route maintenance algorithm that deals with the broken routes due to the nodal energy depletion and node mobility.
Routing protocols have to find routes for packet delivery and make sure the packets are delivered to the correct destinations. Therefore it is very difficult to find and maintain an optimal power aware route. In this thesis wok a scheme has been proposed to maximize the network lifetime by introducing concept of sniffer packets.

3. PROPOSED WORK

3.1 Problem Definition

The overall lifetime of the entire ad hoc network can be increased by improving the power consumption balance among nodes and the connection of the network. In most existing protocols, a mobile node may consume all its energy to participate in the operation without considering the remaining energy. In the proposed energy efficient protocol each node will only use part of energy to transmit the data packets. This is done through a route discovery procedure. The new protocol uses a cost function to decide route selection instead of using the traditional sho rtest hop algorithm.
Some of the problems analyzed from the past study are:
1. Route discovery - Route discovery consists of two sub-procedures: Route Request (RREQ) and Route Replay (RREP). Route discovery is the mechanism by which a node wishing to send a packet to a destination node finds a route. Route discovery is used only when a node attempts to send a packet to another node and does not already know a route to that node. [7]
2. Route maintenance - Route maintenance is the mechanism by which node S is able to detect, if the network topology has changed such that it can no longer use its route to D because a link along the route no longer works. When route maintenance indicates a source route is broken, S can attempt to use any other route it happens to know

to D, or can invoke route discovery again to find a new route. Route maintenance is used only when S is actually sending packets to D.

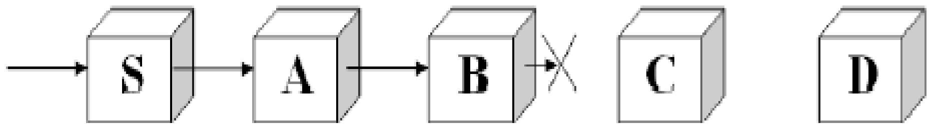

Figure 3.1: Route maintenance path

3. Maximizing Network Lifetime - The other protocol algorithm selects routes such that the transmission and reception of packets is distributed on the network so as to maximize battery lifetime and therefore network lifetime. The remaining battery capacity of a node or host is taken as our measure for determining the node’s lifetime. This in turn determines the network lifetime.

4. Power Aware - The authors have shown the development of the efficient power aware protocol is the need of today’s ad-hoc networks. Although developing battery efficient systems that have low cost and complexity, remains a crucial issue. In order to facilitate communication within a mobile ad-hoc network, an efficient routing protocol is required to discover routes between mobile nodes. Power is one of the most important design criteria for ad-hoc networks as batteries provide limited working capacity to the mobile nodes. Power failure of a mobile node not only affects the node itself but also its ability to forward packets on behalf of others and hence affects the overall network lifetime.

3.2 Objectives

Main objective of this dissertation is to analyze Minimum Battery Cost Routing (MBCR) to develop Energy Efficient Power Aware Multipath Dynamic Source Routing based on DSR.

- To propose a new route discovery algorithm that considers the remaining energy for each node and uses a cost function to choose the best power saving route.
- To propose a new route maintenance algorithm that deals with the broken routes due to the nodal energy depletion and node mobility.

The key parameter of study is the network lifetime. We vary the different parameters and study their effects on this metric. The network lifetime can be defined in many ways:

1. It might be the time taken for the first node to die.
2. It can also be the time for all nodes in the network to die.
3. Network lifetime of DSR and PSR-DSR are compared.

3.2 Proposed Work

We will use Network simulator (NS-2) to analyze the simulation results. In DSR protocol, during route discovery the destination node after receiving first route request packet and replying to it, starts discarding other route request packets from the same source. The reason is that DSR is single path protocol and as soon as one route is discovered from source to destination, destination does not respond to other requests considering that a route is already successfully discovered and replied. Since the information on location, remaining energy, and available bandwidth of nodes fluctuates in MANET, it is important to keep such information up-to-date. There are two mechanisms implemented to update this information. The first one piggybacks the nodes’ information on the Ack packets of TCP flow transmitted along the reverse path. Or, if a data flow exists on the reverse path, the information may also be piggybacked on this data flow. This mechanism introduces hardly any control overhead and is feasible for most current applications which are based on TCP or have bi-directional information exchanges. But this mechanism is unable to update the backup routes because there are no data traffics on these routes. Therefore, we will use the second mechanism, in which a source node periodically sends out Sniffer Packets (SP), containing the route record information, along all the primary routes and backup routes. Upon receiving an SP, the destination node sends it back to the source following the reverse path on which it arrives. The SPs carry the information about the nodes along the route as they traverse the network. According to the information gathered by the SPs, the source node updates the routes’ weight and determines the interval of sending SPs. If the change of the route’s weight does not affect the composition of the primary and backup route set selected, the interval between two SPs will be expanded exponentially until it reaches a maximum; otherwise, the interval will be shortened until it reaches a minimum value. The minimum interval bounds the control overhead while keeping route information up-to-date

The key parameter of study is the network lifetime. We vary the different parameters and study their effects on this metric. The network lifetime can be defined in many ways:

1. It may be defined as the time taken for % of the nodes in a network to die.

2. It might be the time taken for the first node to die.
3. It can also be the time for all nodes in the network to die.

NS-2 simulator is used for performance evaluation. The network is a collection of 50 nodes deployed on square area of 1500mx1500m. Transmission range of each node is 250 m. The medium access control (MAC) protocol based on IEEE 802.11 with 2 Megabits per second raw capacity. For radio propagation model, a two-ray ground reflection model is used. In all simulations, we will use the RWP (Random waypoint) mobility model. Each node moves with a maximum speed randomly chosen from the interval [5 m/s, 15 m/s].

Communication between nodes is modelled by CBR (Constant Bit Rate) traffic over UDP. A source generates packets of 512 bytes with a rate of five packets per second. A total of 8 connections were generated. They start at a time randomly chosen from the interval [0s, 100s] and still active until the end of simulation.

In each transmission, the node uses only parts of the power to participate in the operation and leaves the remaining parts to participate in the future operations. By this method, the nodes avoid using too much energy at one time and this can guarantee that the node with more power will be used to transmit the large size packets and the node with the less power will be used to transmit the small size packets.

As the remaining energy level of a node decreases, the link cost of the node increases. This forces new routing decisions in the network by invalidating its own cache entries to various destinations. However, if a path was recently added to the cache table, the node will not force a new decision (route finding step) unless the node's remaining energy is depleted by a certain normalized amount due to messages passing through that path.

3.2.1 Battery status is divided into 3 categories

1. If (Battery Status < 15%)
Then Set B_S = 1
2. If (15% <= Battery Status < 90%)
Then Set B_S = 2
3. If (Battery Status > =90%)
Then Set B_S = 3.

3.2.2 Parameters to Concern during Route Search

At the time of route discovery, a route request (RREQ) packet broadcasted by the source. The header of the RREQ packet includes <source-id, destination-id, T_B_S (Total Battery Status), WNs (number of weak nodes) and Node IDs.

3.2.3 Calculation of Total Battery Status (T_B_S)

Initially T_B_S = 0 and WN=0 at source node. As RREQ packet propagates along the path, T_B_S is updated at each intermediate node i as follows:

If (B_Si == 3)
Then T_B_S = T_B_S + 3
Else-if (B_Si == 2)
Then T_B_S = T_B_S + 1
Else-if (B_Si == 1)
WN= WN + 1

Here WN represents a weak node which has the energy less than 10%.

This is achieved by adding Battery_cost() function to dsr_proto.cc

The main objective of our protocol is to maximize lifetime. This is critical in the mobile network since the death of small set of nodes can lead to the partition of the network, which renders the other live node unreachable. Energy Efficient DSR solves this problem by using route discovery algorithm based on cost function of routes. The route selection is controlled by the cost of the route .Our protocol prevent overuse of small set of nodes and reduce the energy level variance among nodes in the whole network.

Since the information on location, remaining energy fluctuates in MANET, it is important to keep such information up-to-date. A mechanism is used in which a source node periodically sends out Sniffer Packets (SP), containing the route record information, along all the primary routes and backup routes. Upon receiving an SP, the destination node sends it back to the source following the reverse path on which it arrives. The SPs carry the information about the nodes along the route as they traverse the network. According to the information gathered by the SPs, the source node updates the routes' weight and determines the interval of sending SPs. If the change of the route's weight does not affect the composition of the primary and backup route set selected, the interval between two SPs will be expanded exponentially until it reaches a maximum; otherwise, the interval will be shortened until it reaches a minimum value. The minimum interval bounds the control overhead while keeping route information up-to-date.

This is achieved by adding sniffer.c in DSR protocol. This will pass the information about weak nodes as well as the weaker nodes and avoid them in participating the route discovery and route maintenance.

3.4 Implementation

NS-2 simulator is used for performance evaluation. The network is a collection of 50 nodes deployed on square area of 1500mx1500m. Transmission range of each node is 250 m. The medium access control (MAC) protocol based on IEEE 802.11 with 2 Megabits per second raw capacity. For radio propagation model, a two-ray ground reflection model is used. In all simulations, we will use the RWP (Random waypoint) mobility model . Each node moves with a maximum speed randomly chosen from the interval [5 m/s, 15 m/s]. The duration of every simulation is 0-1200 seconds, executed with different mobility scenarios characterized by different pause times.

Communication between nodes is modeled by CBR (Constant Bit Rate) traffic over UDP. A source generates packets of 512 bytes with a rate of five packets per second. A total of 8 connections were generated. They start at a time randomly chosen from the interval [0s, 100s] and still active until the end of simulation.

As the remaining energy level of a node decreases, the link cost of the node increases. This forces new routing decisions in the network by invalidating its own cache entries to various destinations. However, if a path was recently added to the cache table, the node will not force a new decision (route finding step) unless the node's remaining energy is depleted by a certain normalized amount due to messages passing through that path.

The key parameter of study is the network lifetime. We vary the different parameters and study their effects on this metric. The network lifetime can be defined in many ways:

1. It may be defined as the time taken for % of the nodes in a network to die.
2. It might be the time taken for the first node to die.
3. It can also be the time for all nodes in the network to die.

For analysis the first & third definition is adopted. Network lifetime of DSR and DSR-PASR are compared.

4 RESULTS

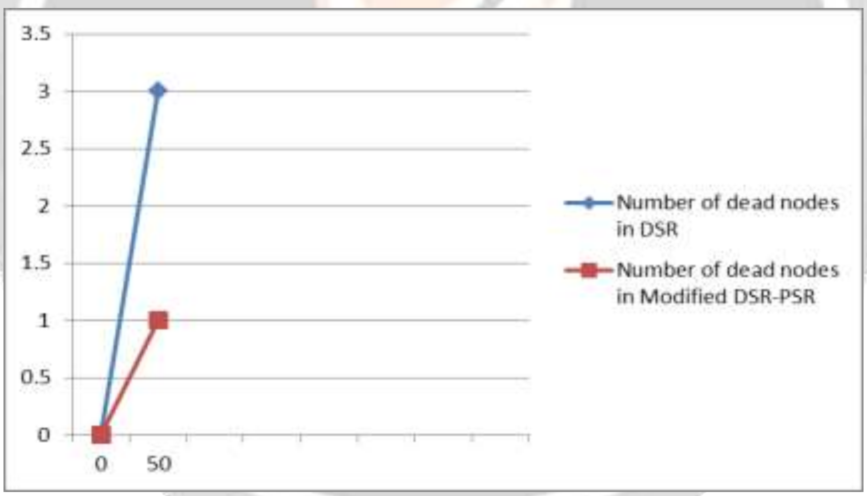

Figure 4.1: Graph for First dead nodes with simulation time

The figure 4.1 depicts the graphical view of comparing of number of dead nodes between the old i.e simple DSR and the modified DSR-PSR.

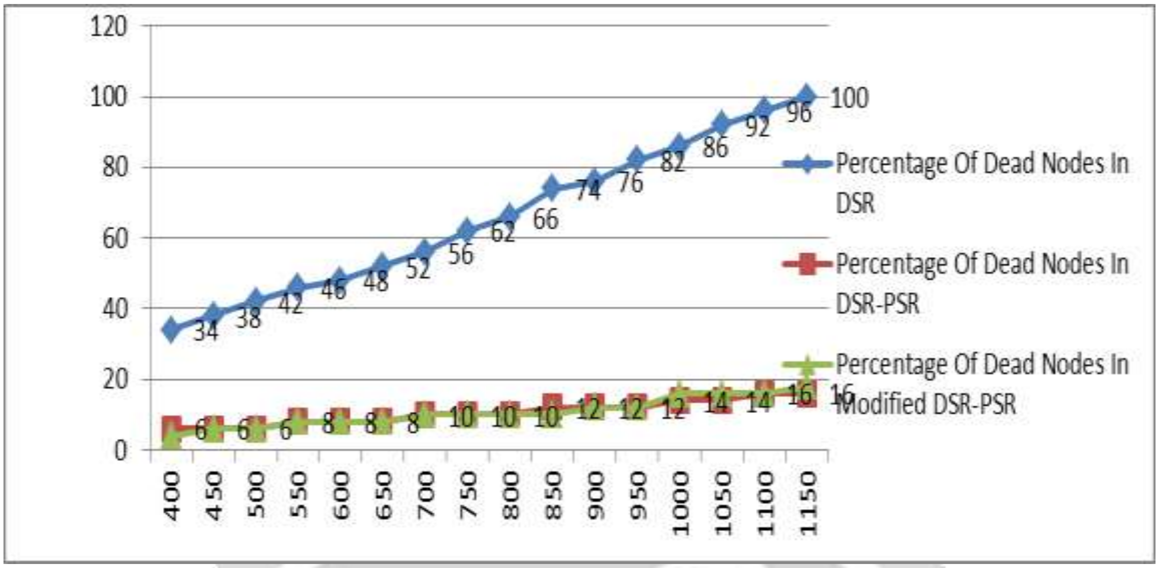

Figure 4.2: Graph for all dead nodes with simulation time

The figure 4.2 depicts the graphical view of comparing of number of all dead nodes between the old i.e simple DSR and the modified DSR-PSR taken for simulating 50 nodes for the system.

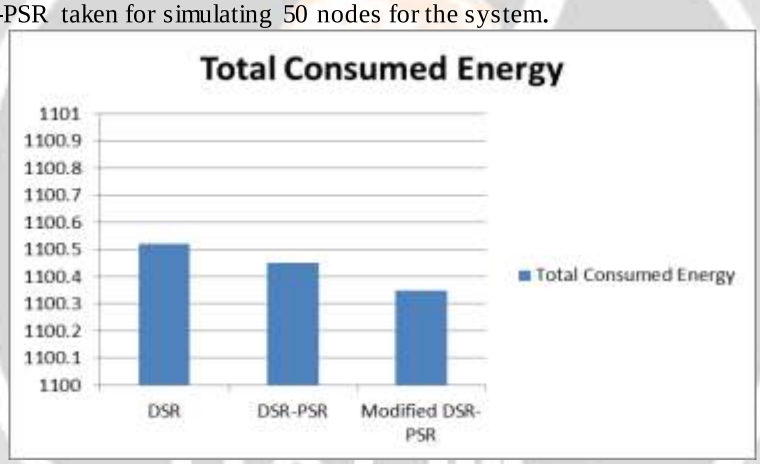

Figure 4.3: Energy consumption of DSR, DSR-PSR and Modified DSR-PSR

The figure 4.3 depicts the graphical view of comparing of total consumed energy of simple DSR and the modified Modified DSR-PSR.

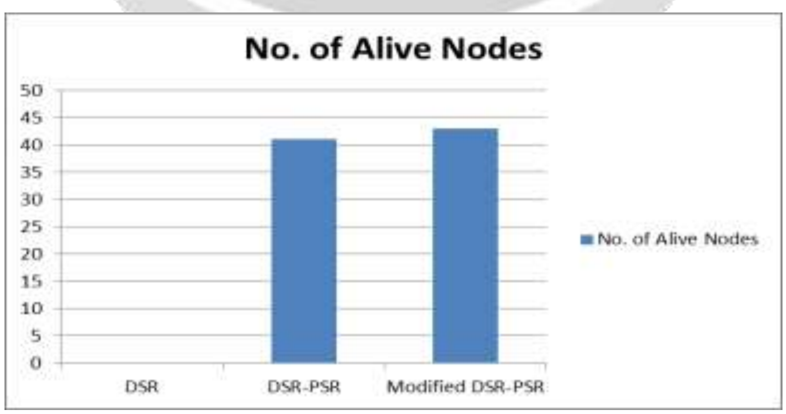

Figure 5.4: Alive Nodes of DSR, DSR-PSR and Modified DSR-PSR

The figure 5.4 depicts the graphical view of comparing of No. of Alive Nodes of simple DSR and the Modified DSR-PSR.

5 CONCLUSIONS AND FUTURE SCOPE

5.1 Conclusion

A MANET is a kind of ad hoc network that can change locations and framing itself on the fly. Routing in MANET is challenging due to the restrictions existing on the transmission bandwidth battery power and CPU time and the requirement to manage with the recurrent topological changes resulting from the mobility of the nodes.The overall lifetime of the complete ad hoc network can be increased by improving the power utilization balance among nodes and the connection of the network. In most existing protocols, a mobile node may utilize all its energy to take part in the operation without considering the remaining energy. In the proposed energy efficient DSR protocol each node will only use part of energy to dispatch the data packets. This is done through a route discovery procedure. The new protocol uses a cost function to decide path selection instead of using the traditional shortest hop algorithm. The cause that DSR is used as our base model is basically due to the fact that it is a typical on demand protocol with less bandwidth and energy use.

5.2 Future Work

In future the work can be implemented on any of on demand protocols and we can save the energy.

6. REFERENCES

[1] Mohammad Abbas, B.N.Jain, "Mitigating Overheads and Path Correlation in Node-Disjoint Multipath Routing for Mobile Ad hoc Networks" in Proc. of 1st IEEE COMSWARE, New Delhi, January 8-12, 2006.

[2] Abolhasan, M., Wysocki, T.A., Dutkiewicz, E.: 'A review of routing protocols for mobile ad hoc networks', Elsevier J. Ad hoc Netw., 2004, 2, pp. 1–22

[3] Asokan, R., Natarajan, A.M., Nivetha, A.: 'A swarm-based distance vector routing to support multiple quality of service (QoS) metrics in mobile ad hoc networks', J. Comput. Sci., 2007, 3, pp. 700–707, doi: 10.3844/jcssp.2007.700.707

[4] B. Chen, K. Jamieson, H. Balakrishnan, R. Morris,"Span: an energy-efficient coordination algorithm for topology maintenance in ad hoc wireless networks",ACM Wireless Networks Journal, vol. 8, no. 5, pp. 481–494, 2002.

[5] Breed. G, "Wireless ad hoc networks: Basic concepts. In High Frequency Electronics", pages 4446, 2007.

[6] C. F. Chiasserini and R. R. Rao, "A Distributed Power Management Policy for Wireless Ad Hoc Networks", IEEE Wireless Communication and Networking Conference, 2000, pp. 1209–1213.

[7] C.F. Chiasserini and R. R. Rao, "Routing Protocols to Maximize Battery Efficiency," Proc. 21st Century Military Commun. Conf., vol. 1, Oct. 2000, pp. 496–500.

[8] Chen. Y. S, Tseng. Y. C, Sheu. J. P and Kuo. P. H. "An on demand, link state, multipath QoS routing in a wireless mobile ad-hoc network". In European Wireless, 2002.

[9] D. Kim, J.J. G.L. Aceves, K. Obraczka, J-C. Cano, P. Manzoni, "Routing Mechanisms for Mobile Ad Hoc Networks based on the Energy Drain Rate", IEEE Transactions on Mobile Computing, vol. 2, no. 2, pp.161 – 173, 2003.

[10] Deepalakshmi, P., Radhakrishnan, S.: 'Ant colony based QoS routing algorithm for mobile ad hoc networks', Int. J. Recent Trends Eng., 2009, 1, (1), pp. 459–462

[11] Deepika Thakral, Neha Dureja, "An Enhanced Energy Efficient Multipath DSR Protocol for MANET", in International Journal for Scientific Research & Development, Vol. 2, Issue 01, 2014, ISSN (online): 2321-0613, pp. 159- 162

[12] Di Caro, G.: 'Ant colony optimization and its application to adaptive routing in telecommunication networks'. PhD thesis, Faculte´des Sciences Applique´es, Universities Libre de Bruxelles, Brussels, Belgium, Forthcoming, 2004

[13] Ehsan Khosrowshahi Asl, Morteza Damanafshan, Maghsoud Abbaspour Majid Noorhosseini, Kamran Shekoufandeh "EMPDSR: An Enhanced Multipath Dynamic Source Routing Algorithm for MANETs Based on Ant Colony Optimization" 2009 Third Asia International Conference on Modelling & Simulation IEEE.

[14] G. Breed. Wireless ad hoc networks: Basic concepts. In High Frequency Electronics, pages 44–46, 2007.

[15] Kavita Sharma,vivek Sharma," Energy Efficient Power Aware Multipath Dynamic Source Routing", Volume 77– No.4, September 2013.

[16] M. Tarique, K.E. Tepe, M. Naserian ,"Energy saving dynamic source routing for ad hoc wireless networks", Third Int. Symp. on Modeling and Optimization in Mobile Ad Hoc and Wireless Networks, WIOPT ,pp.305 – 310,2005.

[17] Marina, M.K., Das, S.R, “On-demand Multipath Distance Vector Routing in Ad Hoc Networks,” Proceedings of ICNP, 2001

[18] Md Shahid Akhter, Vijay Prakash Singh,” MODIFIED POWER SAVING DSR PROTOCOL FOR MANET”, Vol. 2, Issue 6, June 2013.

[19] Mueller. S, Tsang. R. P and Ghosal. D. "Multipath routing in mobile ad hoc networks: Issues and challenges". In MASCOTS Tutorials, pages 209234, 2003.

[20] Nandini Prasad K S, Puttamadappa C,” Design and Performance Analysis of Energy Aware Routing Protocol for Delay Sensitive Applications for Wireless Sensor Networks”, VOL. 1, NO. 2, JULY 2013, 46–53.

[21] P.S. Patheja , Akhilesh A. Waoo , Lokesh Malviya,” Multipath Dynanic Source Routing Protocol for Ad-Hoc Network”, Volume 2, Issue 3, March 2012.

[22] Palak, Nasib Singh Gill,”Study of Energy Consumption in DSR using NS2”, Vol. 3, Issue. 7, July 2014, pg.531 – 535.

[23] R. Ramanathan and R. Rosales-Hain, “Topology Control of Multihop Wireless Networks using Transmit Power Adjustment”, Proc. of IEEE Infocom, Tel Aviv, Israel, March 2000, pp. 404–413.

[24] R. Wattenhofer, L. Li, P. Bahl, and Y. M. Wang, “Distributed Topology Control for Power Efficient Operation in Multihop Wireless Ad Hoc Net-works”, Proc. of IEEE Infocom, Anchorage, Alaska, April 2001, pp. 1388–1397. Cancum, Mexico, 2000, pp. 371–376.

[25] S. Harous, M. Aldubai and Q. Nasir, “An Energy Aware Multi-Path Routing Algorithm for Mobile Ad Hoc Networks”, Int. Journal of Business Data Communications and Networking, Vol. 4(Issue 2), 2008.

[26] S. Mueller, R. P. Tsang, and D. Ghosal. Multipath routing in mobile ad hoc networks: Issues and challenges. In MASCOTS Tutorials, pages 209–234, 2003.

[27] S. Mueller, R.P.Tsang, D.Ghosal, “Multipath Routing in Mobile Ad Hoc Networks: Issues and Challenges,” Invited paper in Lecture Notes in Computer Science, Edited by Maria Carla Calzarossa and Erol Gelenbe, 2004.

[28] Tsirigos, A and Haas. Z. "Multipath routing in the presence of frequent topological changes", IEEE Communications Magazine, 39(11), 2001.

[29] V.Loscrì, F. De Rango, S. Marano, “Ad Hoc On Demand Distance Vector Routing (AOMDV) over a Distributed TDMA MAC Protocol for QoS support in Wireless Ad Hoc Networks: Integration Issues and Performance Evaluation,” ETT Journal, Vol.18, Issue 2, 2007.

[30] Valera. A. C, Seah. W. K. G, and Rao. S. V. "Cooperative packet caching and shortest multipath routing in mobile ad hoc networks", In INFOCOM IEEE Computer Society, 2003.