Review Paper on Energy Efficient Zone Routing Protocol

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Abstract— **Energy management in wireless networks deals with the process of managing energy resources by having a control over the battery dissemination , adjustment of the transmission power, and managing of electricity and power sources so that the lifetime of the nodes can be increased of an ad hoc wireless network. The high mobility of nodes results in rapid changes in the routes, thus requiring some mechanism for determining new routes with minimum overheads and bandwidth consumption. This paper classifies the energy aware routing protocols proposed for MANETs. They minimize either the active communication energy required to transmit or receive packets or the inactive energy consumed when a mobile node stays idle but listens to the wireless medium for any possible communication requests from other nodes. Transmission power control approach and load distribution approach belong to the former category, and sleep/power-down mode approach belongs to the latter category. This paper presents a protocol called Improved Energy Efficient Multicast Routing Protocol (EEMRP) by which has extended the life time of each mobile node by evenly utilization of energy and by eliminating above factors in the network . The purpose of this paper is to facilitate the research efforts in combining the existing solutions to offer a more energy efficient routing mechanism.**

***Index Terms*— Wireless networks, ad hoc networks, energy consumption, multicast routing.**

1. INTRODUCTION

1.1 Introduction

MANET is a group of mobiles that are connected together to form a network which is independent of any infrastructure. It means there is no base station required in MANET. So the nodes can communicate with other nodes which are in the range of network only. MANET is a kind of wireless ad hoc network that has a routable networking environment on the top of a link layer .Here each node in a network can act as a router at the same time, and these nodes are independent to move freely. "Flooding" is used to forward the data from one node to other one. So because of this the topology changes frequently and suddenly. MANET, the data should be routed via intermediate nodes, and these intermediate nodes will act as a router. Each node can be switched ON/OFF without identify other nodes. For communication single hoping and multi-hopping is used. MANET is a self-configuring infrastructure. Each device in a MANET is free to move alone in any direction, and will therefore change its links to other devices repeatedly. Each node must forward traffic distinct to its own use, and therefore be a router.The primary challenge in building a MANET is equip each device to incessantly maintain the information necessary to accurately route traffic. MANET is a collection of independent mobile nodes that can communicate to each other via radio waves. The mobile nodes that are in radio range of each other can directly communicate, while others need the support of intermediate nodes to route their packets.

In ad hoc networks, nodes communicate with each other by way of radio signals, which are broadcast in nature. Broadcast is a unique case of multicast, wherein all nodes in the network should get the broadcast message. Multicasting is a communication process in which the transmission of packets (message) is initiated by a single user and the message is received by one or more end users of the network. Multicasting in wired and wireless networks has been advantageous and used as a vital technology in many applications such as audio/ video conferencing, corporate communications, collaborative and groupware applications, stock quotes, distribution of software, news and etc. Under multicast communications, a single stream of data can be shared with multiple recipients and data is only duplicated when required.

1.2 CHARACTERISTICS OF MANET

- They are easy to deploy.
- Do not need backbone infrastructure support.
- Useful when infrastructure is absent, destroyed or unreasonable.
- Flexible.
- In MANET each node acts like a router and host.
- Nodes have less memory, power and light weight features.
- MANET is distributed in nature.
- Dynamic network topology.

1.3 APPLICATIONS OF MANET

- *Local Level*: MANET may be used at local level for example at home networks where devices can

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communicate directly to exchange information between them.

- *Military environments*: Military equipment consists of some sort of computer equipments. Ad-hoc network can be used in military to maintain the information network between the soldiers, vehicles, and military information head-quarters.

- *Commercial Sector*: In rescue or emergency operations mobile ad hoc network can be used, e.g. flood, earthquake or in fire.

- *Wireless sensor Networks*: Mobile nodes contain small sized sensors that can be used to collect real time data i.e. pressure, temperature, etc.

1.4 MANETs Routing Protocols

One of the most important and a difficult method to maintain in ad hoc networking is the routing mechanism. An ad hoc routing protocol is nothing but a concurrence between nodes as to how they control routing packets in the middle of themselves. The nodes in an ad hoc network discover routes as they do not have any previous knowledge about the network topology. Routing protocols in MANETs are classified into three different categories.

Reactive protocols: It is On Demand routing protocol. Route only create when it required. If a node needs to transmit a packet to another node first check route through on demand and after that create the connection between the nodes. The source node initiates the route discovery segment. There are mainly two stages in reactive routing mechanism after the node needs to send data to the destination. The source node broadcasts Route Request messages and is extend across the complete network. Routes are added to the list one time the Route Reply packets derive from the destination reach the source using different forwarders. Reactive protocols such as DSR, AODV.

***Proactive Protocols*: -** It preserves the route data when it is needed. It uses an already existing route. These protocols maintain routes to all possible destinations even while a few of the routes may not be required. Every node in the network maintains tables of routes and when the network topology changes, updates are sending across the network. These protocols require nodes to send control packets sometimes to maintain the routes. To maintain all possible routes in a network is difficult because the control packets for route preservation use a lot of bandwidth on links where there is no need of data transfers. These protocols invite a lot of routing overhead. Proactive Protocols are DSDV, OLSR.

***Hybrid protocols*:** It is association of proactive and of reactive routing. ZRP and TORA are Hybrid Protocols.

1.5 Zone Routing Protocol

The Zone Routing Protocol is based on the concept of zones. A routing zone is defined for each and every node separately. It is also defined for the zones of neighboring nodes which overlap. Proactive routing uses excess bandwidth in order to maintain routing information. The whole network is flooded by reactive routing for determination of route. The ZRP Protocol defines various problems by combining the best properties we can classify ZRP as hybrid or reactive/proactive routing protocol, in an ad-hoc network the longest part of the traffic would be directed to nearby nodes. Therefore, in ZRP the scope of the proactive is minimized to a zone which is centered on each node. The maintenance of routing information can be done easily. Therefore, the overhead which is related to hierarchical protocols can be easily discarded. These protocols are dependent on the strategic assignment of gateways, so that all levels can be accessed by nodes, mainly the top level. Nodes that should send their belonging to communication to a subnet that is common to both nodes. Congestion may occur in the parts of the network. We can categorize ZRP can be as a flat protocol because different zones overlap each other. Hence, routes can be detected and congestion in the network can be reduced. Further, ZRP has adaptive nature. The behavior basically depends on the recent configuration of the network and the behavior of the various users.

1.6 Energy Efficiency in MANETs

In this section, some of the energy efficient schemes developed by researchers in the field have been described. Energy is the scarcest resource and nodes spend energy during transmission and reception of data. Four modes that must be considered for the total energy consumed are:

Transmission mode : Transmission energy is the energy spent to transmit a message, and is dependent on the size of the packet.

$$T_X = \frac{(330 * Plength)}{2 * 10^6}$$

$$P_T = \frac{T_X}{T_t}$$

Reception mode : Energy spent to receive a packet is Reception energy.

$$R_X = \frac{(230 * Plength)}{2 * 10^6}$$

$$P_R = \frac{R_X}{T_X}$$

R_X is the reception energy.

T_X is a time taken to receive data packet,

$Plength$ is length of data packet in Bits.

Idle mode : In this mode, the node is neither transmitting nor receiving any packet. But energy is spent because the nodes have to listen to the network for any incoming packet. The node then has to move from idle mode to reception mode.

$$P_I = P_R$$

. P_I is energy consumed in Idle Mode.

Overhearing mode : Energy spent by the node when it receives the packet that is destined to it. Unnecessary receiving of such packets consumes energy

$$P = P_R$$

P is power consumed in Overhearing Mode

In contrast to simply establishing correct and efficient routes between pair of nodes, one important goal of a routing protocol is to keep the network functioning as long as possible. This goal can be accomplished by minimizing mobile nodes energy not only during active communication but also when they are inactive. *Transmission power control* and *load distribution* are two approaches to minimize the active communication energy, and *sleep/power-down mode* is used to minimize energy during inactivity.

Energy-related metrics that have been used to determine energy efficient routing path instead of the shortest one are discussed. They are:
· Energy consumed/packet,
· Time to network partition,
· Variance in node power levels,
· Cost/packet, and
· Maximum node cost.

The first metric is useful to provide the *min-power path* through which the overall energy consumption for delivering a packet is minimized. Here, each wireless link is annotated with the link cost in terms of transmission energy over the link and the min-power path is the one that minimizes the sum of the link costs along the path. However, a routing algorithm using this metric may result in unbalanced energy spending among mobile nodes. When some particular mobile nodes are unfairly burdened to support many packet-relaying functions, they consume more battery energy and stop running earlier than other nodes disrupting the overall functionality of the ad hoc network. Thus, maximizing the network lifetime (the second metric shown above) is a more fundamental goal of an energy efficient routing algorithm: Given alternative routing paths, select the one that will result in the longest network operation time.

However, network lifetime is practically difficult to estimate, the next three metrics have been proposed to achieve the goal indirectly. Variance of residual battery energies of mobile nodes is a simple indication of energy balance and can be used to extend network lifetime. Cost-per-packet metric is similar to the energy-per-packet metric but it includes each node's residual battery life in addition to the transmission energy. The corresponding energy-aware routing protocol prefers the wireless link requiring low transmission energy, but at the same time avoids the node with low residual energy whose node cost is considered high. With the last metric, each path candidate is annotated with the maximum node cost among the intermediate nodes (equivalently, the minimal residual battery life), and the path with the minimum path cost, *min-max path*, is selected. This is also referred to as *max-min path* in some protocols because they use nodes' residual battery life rather than their node cost.

2. LITERATURE REVIEW

There are several researches that have been done for energy efficient routing protocols in wireless mobile ad hoc network. In this section, we discuss some related works relevant to our paper.

The author in the paper [1] proposed that battery life of the nodes in IEE_AODV protocol has been efficiently utilized by choosing a path with maximum energy. It has also been analytically proved that, the amount of remaining energy helps to probabilistically determine an efficient path. Further to the proposed work, the algorithm has been implemented and is evaluated using performance metrics like throughput, network lifetime, packet delivery ratio and end to end delay. The results are statistically analyzed using network simulation tools such as NS2 by varying the node density from 10 to 50 in steps of 20, and pause time of 3s, 5s and 8s. It is noted that energy of each node is monitored to choose an efficient path.

In Paper [2], the author proposed protocol whose aim is to discover the minimum power-limitation route. The power limitation of a route is decided by the node which has the minimum energy in that route. So compared with the minimum node energy in any other route, the minimum node energy in the minimum power-limitation route has more energy. They have also proposed a more accurate analysis to track the energy consumptions due to various factors, and improve the performance during path discovery and in mobility scenarios. The proposed protocol is evaluated with object oriented discrete event simulator environment. Simulation results shows that the ODBEERP achieves good throughput, less delay, high packet delivery ratio and good energy efficiency than the existing protocol PEER.

In Paper [3], the author proposed that energy aware routing protocols proposed for MANETs. They minimize either the active communication energy required to transmit or receive packets or the inactive energy consumed when a mobile node stays idle but listens to the wireless medium for any possible communication requests from other nodes. Transmission power control approach and load distribution approach belong to the former category , and sleep/power-down mode approach belongs to the latter category . While it is not clear that any particular algorithm or a class of algorithms is the best for all scenarios, each protocol has definite advantages/ disadvantages and is well-suited for certain situations. The purpose of this paper is to facilitate the research efforts in combining the existing solutions to offer a more energy efficient routing mechanism.

Paper [4] presents a survey on the art of energy efficient routing protocols for Mobile Ad-Hoc Network (MANET). Since the nodes in MANET are mobile, the routing and power management become critical issue. In this widely used

field, considering both protocols and analytical frameworks for efficient energy routing. The main focus on motivation, research challenges, recent development and modifications in existing straight routing protocols to make them as energy efficient. Moreover the latest development, industry effort and the future directions for further research are identified.

In Paper [5], the author proposed that MANET might have colluding nodes in the network environment. The colluding nodes cause internal attacks in the wireless network. These results in security problems in the network and finally the MANET performance will go down or even the network breaks down. To overcome this problem, this paper presents mechanisms to detect colluding nodes and defend them. The proposed algorithm works on route detection trust management for the purpose of detecting colluding nodes and defending them from causing internal attacks. The local forwarding nodes discover routes and also involved in calculating trust. In order to calculate trust value of each node the trust of its one-hop neighbors is calculated. In cluster heads the information such as trust and route discovery is stored and maintained. The simulation results revealed that the proposed algorithm is effective in secure routing in MANETs.

In Paper [6], the author proposed a new Hybrid Energy-Efficient (HEE) routing protocol is proposed. HEE uses Direct Transmission (DT) and Minimum Energy Transmission (MTE) which are two of the simplest methods in terms of computational complexity. However the design of routing techniques is highly dependent on the application and the performance may vary based on environmental parameters. The novel proposed method is applicable for different networks regardless of the size and distances between the nodes and also with different parameters such as number of nodes and message length. Simulation results show how HEE performs more efficiently in terms of energy consumption when comparing to DT and MTE.

In paper [7] proposed that they presented the ad hoc connections, which opens many opportunities for MANET applications. In ad hoc network nodes are movable and there is no centralized management. Routing is an important factor in mobile ad hoc network which not only works well with a small network, but also it can also work well if network get expanded dynamically. Routing in Manets is a main factor considered among all the issues. Mobile nodes in Manet have limited transmission capacity, they intercommunicate by multi hop relay. Multi hop routing have many challenges such as limited wireless bandwidth, low device power, dynamically changing network topology, and high vulnerability to Failure. To answer those challenges, many routing algorithms in Manets were proposed. But one of the problems in routing algorithm is congestion which decreases the overall performance of the network so in this paper we are trying to identify the best routing algorithm which will improve the congestion control mechanism among the entire Multipath routing protocols

3. PROPOSED WORK

3.1 Energy consumption in MANET:-

Energy management is defined as the process of managing the sources and consumes of energy in a node or in the network as a whole for enhancing the lifetime of the network. An energy efficient routing is a critical problem in wireless networks due to the severe power constraint of wireless nodes . Each node in the network has batteries attached to it, which is inspired during the process of transmission i.e. during transmission, reception and overhearing and many other reasons. It is very difficult to replace batteries or to re-charge them. So to increase the long life of the network; the available battery power must be sensibly used. There is need to reduce the energy consumption and handle the available energy for a long network connection. If power goes down, network connection will not be present, and will influence our transmission also. So there is requirement of different strategies to reduce the wastage of energy consumption at different levels.

Mobile devices are often deployed in wireless networks, whereas most of them operate on batteries such as cellular phones, portable digital assistants (PDAs), and laptops in situations with no available power supply. Energy efficiency is of particular interest in the design of wireless networks due to limited battery capacity. Along with the increasing trend of using mobile devices as a means of communication, the battery life of a mobile terminal becomes one of the bottlenecks to supporting high-quality multimedia services or huge data transmission, even affects roaming capability.

3.2 Research Methodology

In a MANET, a collection of mobile hosts with wireless network interfaces form a temporary network without the aid of any fixed infrastructure or centralized administration. Due to its characteristics like dynamic topology, resource constraints, No infrastructure and limited physical security, it is vulnerable to a number of attacks. When the path from source to destination is selected, source node starts sending to destination. This will leads to load balancing in the network. In the established path, if some of nodes have less number of resources in terms of queue. Then problem of congestion may arise in the network which leads to load unbalancing. Also, each node has batteries attached to it, which is inspired during the process of transmission i.e. during transmission, reception and overhearing and many other reasons. It is very difficult to replace batteries or to re-charge them during any mission. If power goes down, network connection will not be present, and will influence our transmission. When load is unbalanced in the network or the battery of the node goes down, packet loss happened in the network. This problem increase energy consumption of the network. In this work, enhancement in zone routing protocol will be proposed which reduce energy consumption in the network and increases the network lifetime of the network by eliminating the drained nodes in the network.

4. CONCLUSION

The MANET is the mobile ad hoc networks which is the self configuring type of network. The self configuring means that any mobile nodes can join or leave the network when they want. The nodes are deployed in the network and path is established according to ZRP from source to destination. Each node has limited batteries attached to it, which is inspired during the process of transmission i.e. during transmission, reception and overhearing and many other reasons. Due to some drained nodes, if power goes down of the network, network connection will not be present and link failure problem occurs; and It will influence our transmission. So they are responsible for performance degradation and low reliability of the network. In the proposed technique, energy of each node is monitored to choose an efficient path with no drained nodes.

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