



Energy Efficient Multipath Routing in MANET

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Abstract- In mobile ad hoc networks, energy conservation is necessary due to increasing gap between the power consumption requirements and power availability. In a MANET, the energy depletion of a node does not affect the node itself only but the overall network lifetime. To maximise ad hoc networks lifetime traffic, algorithm is introduced which is the extension of DSR. Proposed algorithm works on Network layer. Energy consumption can be reduced by implementing multipath routing. The performance of proposed algorithm i.e of modified DSR is better than conventional DSR in terms of network lifetime.

Keywords— MANET, Network lifetime, DSR, MDSR, Energy consumption, NS2.

I. INTRODUCTION

1.1 MANET

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. As mobile nodes are not controlled by any other controlling entity therefore 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 have larger security issues than conventional networks. MANET is a type of ad hoc network that can change locations and configure itself on the fly. As MANETS are mobile therefore these use wireless connections to connect to various networks. It can be a standard Wi-Fi connection or another medium such as a satellite or cellular transmission.

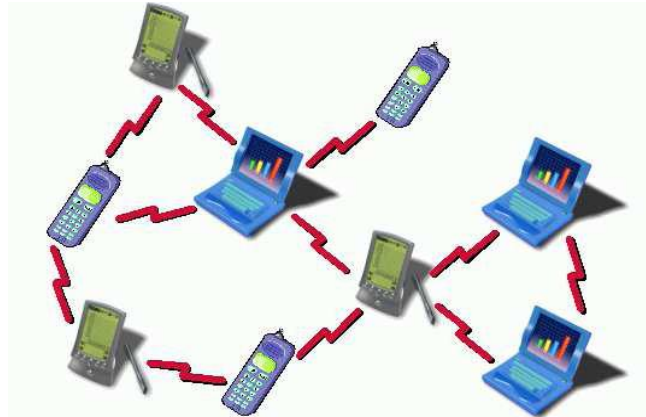


Fig. 1 Mobile Ad hoc Network

Some MANETs are restricted to a local area of wireless devices (such as a group of laptop computers) whereas others may be connected to the Internet. For example, A VANET (Vehicular Ad Hoc Network), is a type of MANET which allows vehicles to communicate with roadside equipment. However the vehicles may not have a direct internet connection then the wireless roadside equipment may be connected to the Internet to allow data from the vehicles to be sent over the Internet. The vehicle data may be used to keep track of trucking fleets or to measure traffic conditions. Because of the dynamic nature of MANETs, these are not very secure therefore it is important to be cautious what data is sent over a MANET.

The term MANET (Mobile Adhoc Network) refers to a multihop packet based wireless network composed of a set of mobile nodes that can communicate and move at the same time, without using any kind of fixed wired infrastructure. MANET are self organizing and adaptive networks that can be formed and deformed on-the-fly without the need of any centralized administration.

MANETs are dynamically created and maintained by the individual nodes comprising the network. Therefore these do not require a pre-existing architecture for communication purposes and do not rely on any type of wired infrastructure and in an ad hoc network all communication occurs through a wireless median.

MANET comprises a special subset of wireless networks, as they do not require the existence of a centralized message-passing device. The Simple wireless networks require the existence of access points or static base stations which are responsible for routing messages to and from mobile nodes within the specified transmission area.

It is a mesh of mobile hosts forming a temporary network without the aid of any established infrastructure, or support of any base station. A MANET has no central administration point. All the hosts work at the same time as routers and communicate with each other over wireless connections. The nodes may also be mobile; they can move freely, and organize themselves randomly i.e. each host can dynamically enter and leave the network. Thus, the network topology may change frequently and rapidly. This means that the network has to adapt itself to the current topology. A MANET may either work as a self-configured stand-alone network or may be connected to the Internet through gateway nodes we present protocol which support unipath traffic from the source node to the destination node, where the focus is on Dynamic Source Routing (DSR) protocol.

1.2 Types of MANET

1. Vehicular Ad-hoc Networks (VANETs)

Vehicular Ad-hoc Networks (VANETs) are used for communication among vehicles and between vehicles and roadside equipment

2. Intelligent vehicular ad-hoc networks (InVANETs)

Intelligent vehicular ad-hoc networks (InVANETs) are a kind of artificial intelligence that helps vehicles to behave in an intelligent manner during vehicle-to-vehicle collisions, accidents, drunken driving etc.

3. Internet Based Mobile Ad-hoc Networks (iMANET)

Internet Based Mobile Ad-hoc Networks (iMANET) are ad-hoc networks that link mobile nodes and fixed Internet-gateway nodes. In these networks, normal adhoc routing algorithms don't apply directly.

Simulation of MANETs in general, there are two ways to develop simulations of MANET. First one is to use a custom platform to develop the simulation using Network Simulators like OMNeT++, OPNET, NetSim or NS2. And the second option is to develop one's own simulation.

Data Monitoring and Mining Using MANETS can be used for facilitating the collection of sensor data for data mining for a variety of applications such as air pollution monitoring and different types of architectures can be used for such applications. A key characteristic of such applications is that nearby sensor nodes monitoring an environmental feature typically register similar values. The spatial correlation between sensor observations having data redundancy inspires the techniques for in-network data aggregation and mining. Wide range of specialized algorithms can be developed to develop more efficient routing strategies as well as more efficient spatial data mining algorithms by measuring the spatial correlation between data sampled by different sensors. Also many researchers have developed performance models for MANET by applying Queueing Theory.

1.3 Protocol requirements in MANET

- ✓ Self starting and self organizing
- ✓ Multi-hop, loop free paths
- ✓ Dynamic topology maintenance
- ✓ Low memory-bandwidth consumption
- ✓ Scalable to large networks
- ✓ Low overhead for data transmission

II. RELATED WORK

A. Modified Dynamic Source Routing Protocol

The Authors Alphonsa Xavier, S Perumal Sankar in 2015 [1] proposed a modified dynamic source routing (mDSR) protocol which select energy efficient path. Mobile ad hoc networks (MANETs) are infrastructure-less network of mobile devices. All the nodes involved in these type of networks are battery operated and the main limitation in this type of networks is Energy optimization. Therefore Energy Optimization plays a vital role in the successful operation of the networks. Dynamic Source Routing protocol is an on demand routing protocol which is based on the concept of source routing. It finds the route from source to destination only when the source initiates the route discovery process. The performance of the proposed protocol has been examined and evaluated with NS-2.34 Simulator in terms of packet delivery fraction, throughput and remaining energy.

B. Power Aware Routing Protocol

The Authors Ganesh Gupta, Madnesh Kumar Gupta in 2015 [2] presented review on energy efficient routing protocol for MANET (Mobile Ad-Hoc Network). In MANET nodes are mobile so routing and power management is critical issue. Power consumption can occur due to transmitting the data traffic, mobility, receiving the data etc. Mobile node power failure not only affects the node itself but also its ability to forward packets on behalf of others and hence overall network lifetime. Therefore, it is not possible to replace/recharge a mobile node that is powered by batteries. And to take full advantage of life time of nodes, traffic must be routed in a way that power consumption is minimized. Power Aware Routing is considered as to minimizes the energy consumption while routing the traffic, minimizing the overhead, aims at minimizing the total power consumption of all the nodes in the network etc and at maximizing the lifespan of the network using some Power Aware Routing Protocols. However, establishing correct and efficient routes is an important design issue in mobile ad hoc networks (MANETs), a more challenging goal is to provide power efficient routes because mobile nodes operation time is the most critical limiting factor. Each protocol has definite advantages/disadvantages and is well suited for certain situations. The aim of this paper is to facilitate the research efforts in combining the existing solutions to offer a more power efficient routing mechanism.

C. Energy Efficient Routing Protocol

Authors Prof.Sushil Kumara, Er. SonalRanab in 2014 [3] proposed energy efficient routing protocols for Mobile Ad-Hoc Network (MANET). Since the nodes in MANET are mobile, the power management and routing become critical issue. The Limited power supply is the biggest challenge of an Ad-hoc network so if we want to increase the network lifetime (time duration when the first node of the network runs out of energy) as well the node lifetime then we must have an efficient energy management protocol. An Adhoc routing protocol meet all these challenges to give the average performance in each and every case. Medium Access Control (MAC) protocols have a significant effect on the function and performance of networks. Currently, most MAC protocols use the same transmission power when nodes send packets. Deployment of the nodes is asymmetrical in mobile ad-hoc networks, which will bring unnecessary collisions and more energy consumption.

D. Network Coding

Authors Srinivas Kanakala, Venugopal Reddy Ananthula in 2014 [4] consider the issues of energy efficient communication in MANETs using network coding. In mobile ad hoc networks, all nodes are energy constrained. Therefore in such situations, it is important to reduce energy consumption. Network coding is an effective method to improve the performance of wireless networks. Network coding concept is implemented by COPE protocol that helps to reduce number of transmissions by mixing the packets at intermediate nodes. They incorporate COPE into cluster based routing protocol to further reduce the energy consumption. Energy-Efficient Coding-aware Cluster based Routing Protocol (ECCRP) scheme applies network coding at cluster heads to reduce number of transmissions. Authors also modify the queue management procedure of COPE protocol to further improve coding opportunities. They also use an energy efficient scheme while selecting the cluster head. These increases lifetime of the network. Then evaluate the performance of proposed energy efficient cluster based protocol using simulation. Results of simulation show that the proposed ECCRP algorithm reduces energy consumption and increases life time of the network.

E. Power Aware Routing Algorithm

In this paper, Author G.Varaprasad proposed a model [5] called a power-aware routing algorithm for MANET using gateway node. Mobile Adhoc Network(MANET) is a collection of wireless mobile nodes. Each node in a network works as a router and forms a dynamic topology. As every node has equipped with limited battery-power therefore energy is an important resource in the MANET. Focus of this work is to increases the throughput, energy consumption and minimize number of control message packets.

III. PROPOSED WORK

Since mobile devices are battery operated and this limited energy resource motivate to identify the low power consumption directions to maximize network lifetime. Proposed algorithm works on Network layer. Energy consumption can be reduced by implementing multipath routing. It mainly focusing on congestion control to avoid the retransmission and packet drop as well as packet loss. We can conserve energy and maximize the network lifetime. Proposed algorithm is enhancement of DSR. For the implementation of defined problem, I have used Network Simulator 2 (NS2).

Table 3.1: Simulation Parameters

No of Nodes	50
Routing Protocol	DSR
Area	1600*1600
No of Mobile Nodes	4
CBR Connection	4
Radio Propogation Model	TwoRay Ground
Channel Type	Wireless Channel

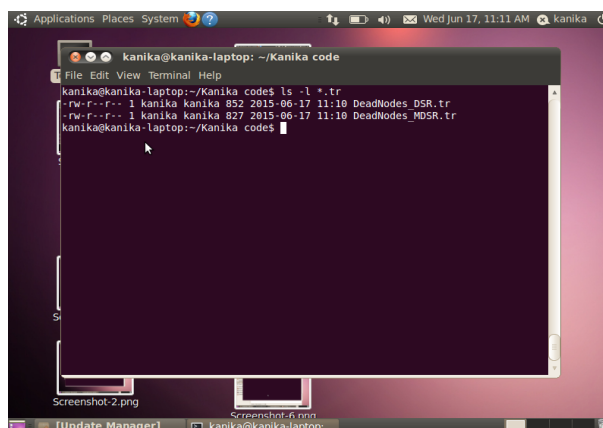


Fig 3.2: Two Trace files

In the above screenshot, the two trace files are shown. The file DeadNodes_DSR.tr contains the information about dead nodes in DSR and the file DeadNodes_MDSR.tr contains the information about dead nodes in MDSR.

IV. RESULTS AND DISCUSSION

Table 4.1: Simulation Time Vs DeadNode DSR&MDSR

DSR		MDSR	
Simulation Time	DeadNodes DSR	Simulation Time	Dead Nodes MDSR
0	0	0	0
0.2	0	0.2	0
0.4	0	0.4	0
0.6	10	0.6	0
0.8	14	0.8	0
1	14	1	0
1.25	14	1.25	0
1.4	14	1.4	0
1.6	14	1.6	0
1.8	14	1.8	4
1.95	14	1.95	13

In the above table, Simulation Time and Dead Node in DSR&MDSR is shown. It can be seen that at simulation time 1.8 the no of dead nodes in MDSR are 4 while at the same time dead nodes in DSR are 14. At the end, at time 1.95 dead nodes in MDSR are 13 while in DSR these are 14. It concludes that network lifetime of MDSR is better.

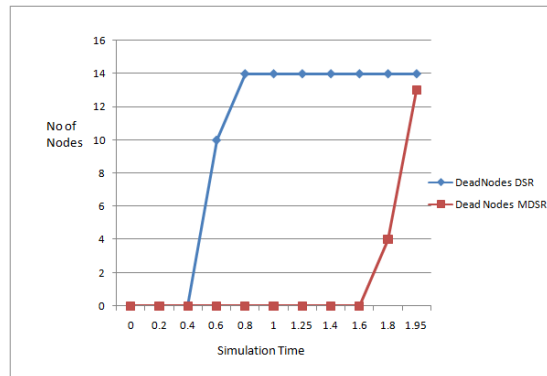


Figure 4.2: shows the graph between Dead Node DSR and Dead Node MDSR

V. CONCLUSION

The major design challenge in MANET is energy. We concluded that there is no single protocol which can give the best performance in adhoc networks. Performance of routing protocols varies according to the variation in network parameters as position of nodes in mobile infrastructure networks continuously varies. We evaluated that network lifetime of MDSR is better. We studied and analysed DSR and proposed that MDSR is better in terms of saving energy which leads to increase in network lifetime.

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