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Power Aware Multipath Dynamic Source Routing Protocols

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Abstract— In ad hoc networks mobile devices are battery operated and the battery technology has not been improving rapidly. Therefore power consumption is likely to remain an issue in Mobile Ad-hoc Network Routing Protocols. Conventional routing protocols do not consider the power budget where the routes between nodes are built by the shortest path routing algorithms, the most popular of which are the Multipath Dynamic Source Routing Protocols. When the same algorithm is used in MANETs it may lead to a quick depletion of the energy of a few nodes because Multipath Dynamic Source Routing Protocols used more than one path for the same transmission of packets. These multiple paths allow load balancing and faster delivery. So we propose an efficient algorithm, which maximizes the network lifetime by minimizing the power consumption during the source to destination route establishment in Multipath Dynamic Source Routing Protocols.
The scope of this thesis is to develop technique to check the remaining energy for each node and uses a cost function to choose the best power saving route and deals with the broken routes due to the nodal energy depletion and node mobility in MP-DSR.

Keywords— Ad hoc networks, MANETs, routing protocols, power aware, simulation.

I. INTRODUCTION

A. AD-HOC NETWORKS

In an Ad Hoc network, mobile nodes communicate with each other using multi-hop wireless links. There is no stationary infrastructure such as base stations. Each node in the network also acts as a router, forwarding data packets for other node. 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 [1]. Ad-hoc networks have no infrastructure where the nodes are free to join and leave the network. The nodes are connected with each other through a wireless link. A node can serve as a router to forward the data to the neighbour's node.
A mobile ad hoc network (MANET) [2] is an autonomous system of mobile nodes connected by wireless links. Each node operates not only as an end-system, but also as a node to forward the packets. The nodes are free to move about and organize themselves into a network. The main application of mobile ad hoc network is in emergency rescue operations and battlefields. Since nodes in mobile ad hoc network can move randomly, the topology may change arbitrarily and frequently at unpredictable times.

The important characteristics of MANET nodes are:
- Operating without a central coordinator
- Multi-hop radio relaying
- Frequent link breakage due to mobile nodes
- Constraint resources (bandwidth, computing power, battery lifetime)
- Instant deployment

MANETs are suitable for use in situations where any wired or wireless infrastructure is inaccessible, overloaded, damaged or destroyed such as emergency or rescue missions, disaster relief efforts and tactical battlefields, as well as civilian MANET situations, such as conferences and classrooms or in the research area like sensor networks. MANETs eliminate this dependence on a fixed network infrastructure where each station acts as an intermediate switch. In mobile ad hoc networks, nodes also perform the role of routers that discover and maintain routes to other nodes in the network.

B. CLASSIFICATION OF ROUTING PROTOCOLS IN MANET'S:

According to the routing strategy the routing protocols can be categorized as Table-driven and source initiated, while Depending on the network structure these are classified as flat routing, hierarchical routing and geographic position assisted routing. Both the Table-driven and source initiated protocols come under the Flat routing see.
These protocols are also called as proactive protocols since they maintain the routing information even before it is needed. Each and every node in the network maintains routing information to every other node in the network. Routes information is generally kept in the routing tables and is periodically updated as the network topology changes. Many of

these routing protocols come from the link-state routing. There exist some differences between the protocols that come under this category depending on the routing information being updated in each routing table. Furthermore, these routing protocols maintain different number of tables. The proactive protocols are not suitable for larger networks, as they need to maintain node entries for each and every node in the routing table of every node. This causes more overhead in the routing table leading to consumption of more bandwidth.

1) PROACTIVE (TABLE-DRIVEN) ROUTING PROTOCOLS:

Proactive Routing Protocols attempt to maintain consistent, up-to-date routing information between every pair of nodes in the network. In proactive routing, each node has one or more tables that contain the latest information of the routes from one node to any other node in the network. Each row has the next hop for reaching a node or subnet and the cost of this route. Various table-driven protocols differ in the way the information about a change in topology is propagated through all nodes in the network. Several proactive routing protocols are addressed in [3], **[**4] and [5].

2) ON DEMAND ROUTING PROTOCOLS (REACTIVE):

These protocols are also called reactive protocols since they don't maintain routing information or routing activity at the network nodes if there is no communication. If a node wants to send a packet to another node then this protocol searches for the route in an on-demand manner and establishes the connection in order to transmit and receive the packet. In recent years, a variety of new routing protocols targeted specifically at this environment have been developed. We consider a wireless on demand ad hoc network routing protocols that cover a range of design choices.

C. MULTIPATH DYNAMIC SOURCE ROUTING PROTOCOLS:

In the Multipath Dynamic Source Routing Protocols, the destination accepted at most first three route request packets from the same source for the same transmission (i.e. same ID). This gives the source, multiple paths from source to destination for transmission. It then utilizes all the discovered paths for data transmission. These multiple paths allow load balancing and faster delivery.

These multiple paths are node disjoint as the original DSR protocol is itself does not allow loops. In order to implement this concept, some changes are required in the protocol. They are:

1) *Destination Node:* allow at most 5 replies from 5 different paths without looping. Need to maintain a counter for that. And store these paths into the table, with the preferable sequence.
2) *Source Node:* Record at most three routes in the route cache. Structure of route cache need some change in order to incorporate this.
3) *Intermediate Node:* As through overhearing they are in a position to get aware of new paths, they also need to change route cache structure.
4) *Designing:* of load balancing process for faster delivery of packets through available path for new DSR.

The route maintenance activity will also be affected as now more than one path breaks can occur due to mobility. This generated great result as compare to MP-DSR.

II. RELATED WORK (SURVEY)

On-demand routing protocols generally perform well for wireless ad-hoc networks. In On-demand routing protocols power is one of the most important design criteria for ad-hoc networks. Many research efforts have been devoted for developing power aware routing protocols. A lot of research has been done in the past in the area of Ad hoc network.

Vinay-Mano Yadav et al. [6] showed that 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.

In [7] Sarala.P and Kalaiselvi.D stated that mobile ad-hoc networks are the temporary wireless networks. All the routing information managed by the node itself. Mobile ad-hoc network routing operations are categorized into two types proactive and reactive routing. The multipath routing mechanisms are used to discover multiple paths under the nodes. Multipath dynamic source routing protocol (MPDSR) is used to discover multipath route under MANET nodes. The MPDSR protocol uses the local link information for the route discovery process. The MPDSR protocol is enhanced with ant colony optimization method to provide multipath route information using global link information. EMPDSR provides QoS factors such as end to end reliability. Network traffic, bandwidth and battery power factors make an influence over the route discovery process. Cost enabled route discovery is one of the considerable routing methods that enable the cost estimation with different metrics. The multipath routing protocols concentrates on the route discovery with end to end

reliability factors. The EMPDSR protocol is integrated with fuzzy cost estimation techniques. Distance, network traffic, bandwidth and battery power metrics are used in the fuzzy cost enabled multipath dynamic source routing protocol. In [8] P.S. Patheja stated that Ad-hoc networks is a wireless network where multiple nods move within a network and they communicate to each other in network range, its performance showing on the value of different parameters, like number of nodes and Mobile connections. And analysis and get results for maximum throughput for hues ad hoc network. Many routing protocols for such networks have been proposed so far, the most popular of which are the Dynamic Source Routing Protocols (DSR In the proposed work, the destination will accept at most first three route request packets from the same source for the same transmission (i.e. same ID). This gives the source, multiple paths from source to destination for transmission. It then utilizes all the discovered paths for data transmission. These multiple paths allow load balancing and faster delivery. Roy Leung, Jilei Liu et al. [9] mentioned that Routing in wireless ad-hoc networks has received significant attention from recent literature due to the fact that the dynamic behaviour of these networks poses many technical challenges on the design of an effective routing scheme. Though on-demand routing approaches have been shown to perform well, they generally lack the support for Quality-of-Service (QoS) with respect to data transmission. In order to select a subset of end to- end paths to provide increased stability and reliability of routes, a new QoS metric, end-to-end reliability, is defined and emphasized in this paper. The authors present a distributed multi-path dynamic source routing protocol (MP-DSR) for wireless ad-hoc networks to improve QoS support with respect to end-to-end reliability. The Author's protocol forwards outgoing packets along multiple paths that are subject to a particular end-to-end reliability requirement. A simulation study is performed to demonstrate the effectiveness of proposed protocol, particularly the fact that MP-DSR achieves a higher rate of successful packet delivery than existing best-effort ad-hoc routing protocols, such as the Dynamic Source Routing (DSR). In [10] Morteza Maleki proposed an idea 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.

Dr. A. Rajaram et al. [11] mentioned that the energy in mobile ad-hoc networks is of much important. Similarly shortest path from source to destination is also important for routing. To address these issues a routing protocol is proposed which gives an optimum between these issues. Power aware ad-hoc on-demand multipath distance vector (PAAOMDV) is proposed to overcome the issue of energy and shortest path in a single routing protocol. This protocol helps in updating the routing table with both the node route list and their corresponding energies. As this is a multipath protocol, it shifts the route without further overhead, delay and loss of packets. Simulation results shows that PAAOMDV performs well compared to ad-hoc on-demand multipath distance vector (AOMDV) routing protocol even after introducing energy related fields in PAAOMDV. Floriano De Rango et al [12] presented a novel multipath energy aware routing for wireless ad hoc network. Which showA 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).

The major goal of this study is to analyse the performance of well known MANETs routing protocol. Previous work in DSR for ad-hoc wireless networks focuses on guarantees with respect to end to end delay and increase the network lifetime. One of such routing protocols is the Power Aware Routing [6]. Then the idea of Multipath-DSR in [8] have been proposed in 2012, which stated that the destination will accept at most first three route request packets from the same source for the same transmission (i.e. same ID). This gives the source, multiple paths from source to destination for transmission. It then utilizes all the discovered paths for data transmission. These multiple paths allow load balancing and faster delivery. Control overhead can be reduced by creating a route maintenance mechanism between only those nodes which needs the services to transmit. But a problem occur in this literature is of power consumption. In this paper the authors propose an efficient algorithm, which maximizes the network lifetime by minimizing the power consumption during the source to destination route establishment in Multipath -DSR.

III. Simulation Model

To test the modification, Network Simulator (NS2) will be used. The simulation will be run for existing MP-DSR and under same environment it will again be run for Power Aware Multipath DSR (PAMPDSR) to see the performance differences against mobility variations. The metrics that will be tested are end-to-end delay and packet delivery ratio (PDR).

IV. Conclusion

In this report, we have described new efforts providing in wireless ad hoc networks. We developed an efficient algorithm for determining the remaining energy of a node for an end-to-end connection. Conventional routing protocols (MP-DSR)

do not consider the power budget where the routes between nodes are built by the shortest path routing algorithm. When the same algorithm is used in MANET it may lead to a quick depletion of the energy of a few nodes overused in the path. In this approach we use Power Aware Multipath Dynamic Source Routing Protocol (PAMPDSR) to improve the network lifetime. The PAMPDSR protocol uses a cost function to decide route selection instead of using the traditional shortest hop algorithm. 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 in Multipath DSR.

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