ENERGY EFFICIENT ROUTING PROTOCOL TO INCREASE MANET LIFE TIME USING CLUSTER

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ABSTRACT

Mobile Ad Hoc Networks (MANETs) also called mesh networks are self-configuring networks of mobile devices connected by wireless links. MANETs is infrastructure less network. To improve the lifetime of these networks can be improving the energy levels of the individual nodes of the network. There are various powers aware routing protocol likes aodv, dsr, dsdv etc. Based on this we will focus on aodv and we will modified aodv protocol with some new features. The performance metrics used for evaluation are packet delivery ratio, throughput, network lifetime and average energy consumed. The simulation will be done using NS2 network simulator.

Keywords: Manet, energy efficient, aodv, network lifetime, throughput, cluster, cluster head.

I. INTRODUCTION

Mobile Ad hoc Network (MANET) is one that comes together as needed, not necessarily with any support from the existing Internet infrastructure or any other kind of fixed stations. A mobile ad hoc network is formed by mobile hosts. Some of these mobile hosts are willing to forward packets for neighbors. These networks have no fixed routers, every node could be router. All nodes are capable of moving and can be connected dynamically in an arbitrary manner. The responsibilities for organizing and controlling the network are distributed among the terminals themselves. The entire network is mobile, and the individual terminals are allowed to move freely. In, some pairs of terminals may not be
able to communicate directly with each other and have to rely on some other terminals so that
the messages are delivered to their destinations. Such networks are often referred to as multi-
hop networks. Multi-hop or ad hoc, wireless networks use two or more wireless hops to
convey information from a source to a destination.

A Mobile Ad-Hoc Network (figure 1) where:
- The mobile routers are free to move randomly and organize themselves arbitrarily
- The network’s wireless topology may change rapidly and unpredictably

Ad hoc networks can divide according to the network topology. There are two different
classes: flat and hierarchical ad hoc networks.

In flat ad hoc networks, all nodes carry the same responsibility and there is no distinction
between the individual nodes. The scalability decreases when the number of nodes increases
significantly.

Hierarchical ad hoc networks consist in this case of several clusters, each one represents a
network and all are linked together as indicated in Figure 2. The nodes in hierarchical ad hoc
networks can be differentiated into two types:
- Master nodes (Cluster Head): administer the cluster and are responsible for passing the data
  on to other cluster.
- Normal nodes (Cluster Members): Communicate within the cluster directly together and
  with nodes in other clusters with the help of the master node. Normal nodes are called also
  slave nodes.

Figure 1 MANET

Figure 2 Hierarchical Architecture of MANET
In a cluster, the number of hops between any two nodes is no more than two. In the whole network, there is no direct connection between cluster heads. Fig. 2 is an illustration of clustering architecture. In Fig. 2, node 0, 1, 3, and 5 are cluster heads, node 8, 10, and 11 are gateways, and the rest are cluster members.

There are 3 Types of routing protocols:
1. Proactive routing protocols
2. Reactive Routing Protocols
3. Hybrid routing protocol. Based on this I focus on Reactive Protocol because Reactive (on demand) routing protocol does not maintain their route tables with the latest route topology. If a node wants to send any packet then protocol searches for the route and establishes the connection in order to transmit and receive the packet.

The on-demand routing protocols have two major components:

Route discovery: In this Route Reply message containing path information is sent back to the source either by the destination, or intermediate nodes that have a route to the destination, Reverse the order of the route record, and include it in Route Reply. It has unicast source routing. Each node maintains a Route Cache which records routes it has learned and overheard over time Source nodes consults its route cache for the available route from source to destination otherwise if the route is not present it initiates route discovery.

Route maintenance: Route maintenance performed only while route is in use. Route maintenance is done because of dynamic topology of the network cases of the route failure between the nodes arises due to link breakage etc. Route maintenance is possible due to acknowledgement mechanism of reactive protocols. Because of the route discovery mechanism, reactive protocols add latency to the network. Each intermediate node involved in the route discovery process adds latency. These protocols decrease the routing overhead but at the cost of increased latency in the network. So these protocols are suitable where low routing overhead is required.

There are various types of well known reactive routing protocols in MANET like AODV, DSR, TORA, ABR, RDMAR, and CBRP.

**AODV Overview**

Ad hoc on demand distance vector (AODV) protocol in which source node only includes the address of its neighbour in the packet so overhead in this protocol is less compare to DSR. Ad-Hoc On-Demand Distance Vector Routing Protocol (AODV) finds route between nodes only when it is necessary. It does not maintain topology information about all other nodes in the network. When a source has data to transmit to an unknown destination, it broadcasts a Route Request (RREQ) for that destination. At each intermediate node, when a RREQ is received a route to the source is created. If the receiving node has not received this RREQ before, is not the destination and does not have a current route to the destination, it rebroadcasts the RREQ. If the receiving node is the destination or has a current route to the destination, it generates a Route Reply (RREP). The RREP is unicast in a hop-by-hop fashion to the source.
Figure 3 AODV protocol

As the RREP propagates, each intermediate node creates a route to the destination. When the source receives the RREP, it records the route to the destination and can begin sending data. If multiple RREPs are received by the source, the route with the shortest hop count is chosen. As data flows from the source to the destination, each node along the route updates the timers associated with the routes to the source and destination, maintaining the routes in the routing table. If a route is not used for some period of time, a node cannot be sure whether the route is still valid; consequently, the node removes the route from its routing table. If data is flowing and a link break is detected, a Route Error (RERR) is sent to the source of the data in a hop-by-hop fashion. As the RERR propagates towards the source, each intermediate node invalidates routes to any unreachable destinations. When the source of the data receives the RERR, it invalidates the route and reinitiates route discovery if necessary. The main advantage of AODV protocol is that routes are established on demand and destination sequence numbers are used to find the latest route to the destination. The connection setup delay is less. The HELLO messages supporting the routes maintenance are range limited, so they do not cause unnecessary overhead in the network.

II. PROBLEM STATEMENT

Mobile Ad Hoc networks have few Problems like Limited wireless transmission range, broadcast nature of the wireless medium, hidden terminal and exposed terminal problems, packet losses due to transmission errors and mobility, stimulated change of route, Battery constraints and security problem.

One of the most critical issues in mobile ad hoc networks (MANETs) is energy conservation since mobile nodes will be powered by batteries with limited capacity. Nodes in MANET are always portable devices powered by battery. Energy consuming also should be considered in routing in MANET. The power level basically affects many features of the operation in the network including the throughput of the network. However, multi-hop routing, random movement of mobile nodes and other features unique to MANET lead to enormous control overhead for route discovery and maintenance. Power control also affects the conflict for the medium and the number of hops in turn it will affect the delay time. Transmission power also influences the important metric of energy consumptions. All of these make routing in MANET a very challenging Problem. Therefore the energy efficient protocol is must to increase the lifetime of node as well as the lifetime of network.
III. RELATED WORK

Here, we present a brief description of the some relevant power-aware routing algorithms proposed recently. There has been some study on power aware routing protocols for MANETs. Presented below is a brief review of some of them.

1. Making MANET Energy Efficient - propose a scheme to improve existing on demand routing protocols by introducing the power aware virtual node scheme in whole scenario. This scheme uses the concept of power awareness among route selection nodes. Source node broadcast RREQ message containing Threshold value (Th) and distance from source to destination. After then based on neighbor node having energy level greater then threshold and less distance from destination, has been selected for forwarding data.

2. Performance Evaluation of Energy Consumption for AODV and DSR Routing Protocols in MANET - A performance comparison of Dynamic Source Routing (DSR) and Ad hoc On-Demand Distance Vector (AODV) routing protocols with respect to average energy consumption and routing energy consumption are explained thoroughly. Then, an evaluation of how the varying metrics in diverse scenarios affect the power consumption in these two protocols is discussed. Finally, an evaluation of these routing protocols based on energy consumption is presented.

3. An Optimized Power Reactive Routing Based on AODV Protocol for Mobile Ad-hoc Network - Here, an optimized power reactive routing protocol introduced which describes the concepts of cognitive function and AODV protocol. It ensures that data packet is transferred in the shortest path and also in reliable mode. It will improve the data transmission with an energy efficient manner. Proposed protocol avoids new route discovery process in AODV with low power consumption and maintains stability of network.

Capability Aware AODV Algorithm in NS-2 Environment - The routing protocol proposed in this paper is an extension of AODV, but has a different objective. Unlike the previous protocols, it focuses on capability aware route selection. Moreover, in CSA the destination is not known in advance. To our knowledge this is the novel implementation of a capability aware ad-hoc routing protocol based on several attribute-value pairs, which are used to select a node.

IV. PROPOSED APPROACH

The main goal is to improve the performance and throughput of existing on-demand routing protocols. The two common on-demand routing protocols are dynamic source routing (DSR) protocol and ad-hoc on demand distance vector routing (AODV) protocol. So from them, we select AODV protocol to implement our proposed scheme because AODV is an efficient routing protocol which removes any unnecessary and outmoded information quickly, and does not create traffic unless necessary. So that’s why AODV can react to topological changes that have an effect on active routes in a timely and quick manner. AODV performs better in scenarios with extra load and/or higher node mobility; as a result it’s more scalable than DSR.

In our proposed protocol, a hierarchical network model consists of partitioning the network into clusters in which certain numbers of nodes are periodically selected to assume the role of the Cluster Head (CH). Each cluster contains one CH node. Cluster head will periodically gathers the battery related information from its group nodes and also they all the

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nodes will send their THRESHOLD value to the cluster head. The proposed algorithm is simulated using network simulator NS-2 version 2.34 and the performance is compared with well known on demand protocols AODV and advanced existing AODV protocols.

In the block diagram a workflow of proposed approach is shown. In our proposed approach the first work is done of node creation and cluster formation. After that proposed mechanism will designed. In network cluster head selection is performed by applying leader election algorithm. By applying our proposed algorithm we will get stable path to destination. After that performance of protocol will be evaluated and is compared with well known AODV and advanced existing AODV protocols.

![Image of block diagram showing workflow of proposed approach]

**Figure 4 Workflow of Proposed Approach**

V. ALGORITHM

Steps of Implementation methodology:
1. For periodical time interval, all CH will send control packets to all its group members.
2. CH receives Battery information and THRESHOLD value from all group members and having updated information.
3. Source S send RREQ packets to its CH by selecting optimal path.
4. CH will send packet to all other CH in network where periodically all CH exchange information.
5. CH select best path to communicate with its group member based on THRESHOLD values of nodes. After receiving packet from Source S, Destination node D replies to its CH.
6. After that, that particular CH will reply to CH of Source S about stable path to destination.
7. At the end, Source S will send data packets to destination D from selected stable path.

If energy greater then threshold value, send packet to node those having maximum energy and less distance otherwise drop packet. After this update routing table and broadcast route request to all nodes.
VI. CONCLUSION

We will apply our proposed algorithm to AODV that works on a reactive approach and make use of alternate paths by satisfying a set of energy and distance based threshold area. So we can achieve the following:

1. To extend the life time of ad hoc networks through implementing power aware routing protocol.
2. Improvement in the lifetime of the entire network.
3. We will find out success of packet delivery by preventing nodes from killing out due to energy losses.

Our proposed scheme picks the nodes based on their energy level; this may also help in solving the problem of asymmetric links.

REFERENCES