Improving AODV Protocol to Support Multipath Routing

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Abstract- Frequent link failures are caused in MANET due to node's mobility and use of unreliable wireless channels. Due to this, multipath routing protocols become an important issue. However, the inter-path interference limits the gain of multipath routing in MANET. This paper propose a Node disjoint minimum interference multi-path (ND-MIM) routing protocol for MANETs based on AODV protocol. The main goal of the propose method is to determine all node-disjoint routes from source to destination with minimum routing overhead. When the route is broken, the data is transmitted continuously through other route .Simultaneously in selecting node-disjoint path, the protocol takes also into account the energy and distance of intermediate node in the path for extending the network lifetime.

Index Terms- AODV, energy efficient, interference avoidance, MANET, multipath routing, Node-disjoint

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.

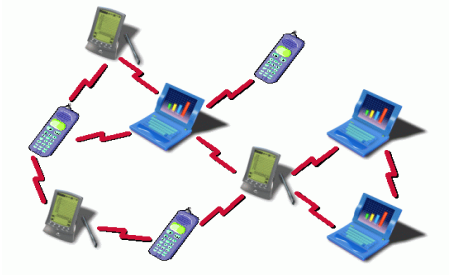


Figure 1 MANET

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. 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.

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 sourcerouting. 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 sourceto 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 involvedin 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.

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 lesscompare to DSR. Ad-Hoc On-Demand Distance Vector Routing Protocol (AODV) findsroute between nodes only when it is necessary. It does not maintain topology informationabout all other nodes in the network. When a source has data to transmit to an unknowndestination, it broadcasts a Route Request (RREQ) for that destination. At each intermediatenode, 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 currentroute to the destination, it generates a Route Reply (RREP). The RREP is unicast in a hop-by-hop fashion to the source.

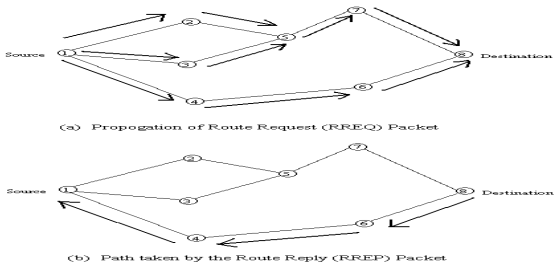


Figure 2 AODV Protocol

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 beginsending 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. 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 ad hoc 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. The proposed algorithm is simulated using network simulator NS-2 version 2.34 and the performance is of well known on demand protocols AODV is evaluated.

In the block diagram a workflow of propose approach is shown. In the propose approach the first work is done of node creation and cluster formation. After that propose mechanism will designed. In network cluster head selection is performed by applying LEACH algorithm. The propose scheme use the distance formula to calculate the distance between either the source or the destination and the intermediate nodes:

$d = \mathrm{Sqrt}((x2-x1)^2+(y2-y1)^2)$.

By applying propose algorithm stable path from source to destination will find .After that performance of AODV protocol will be evaluated.

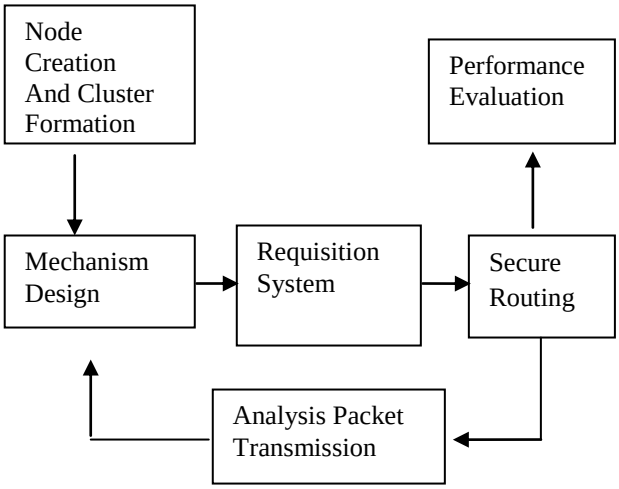


Figure 3 Workflow of Proposed Approach

III. IMPLEMENTATION DETAILS

Following are the modules in project:

1) Network Formation
2) Traffic generation
3) Application of Algorithm
4) Analysis and Results

III.1. Network Formation

1) The network stack for a mobile node consists of a link layer(LL), an ARP module connected to LL, an interface priority queue(IFq), a mac layer(MAC), a network interface(netIF), all connected to the channel. The mobile node is defined by the specifications required for its functions in a protocol stack.

2) Node configuration:

Link Layer: The link layer is attached to the actual transmittal of a packet. It converts IP addresses to MAC addresses and routing agent. All the links are created in the data of the link layer. This layer comes between the Network Layer and Physical layer.

IFq Priority Queue: The IFq is implemented to give priority to routing protocol packets by inserting them in the queue. It runs like a filter over the packets and removes those with a defined destination address. A few of queuing techniques are available such as DropTail, Priqueue, etc. The propose scheme uses PriQueue technique.

Mac Layer: The MAC mechanism is critical for communication. It utilizes the implementation of IEEE 802.11 distributed coordination function. Several 802.11 implementations are available in NS-2.

Network Interface: It is the physical interface that serves as a hardware interface. The network interface is used by the mobile node in order to access the channel. It is responsible for recording every transmitted packet with data connected with information like energy, power, wavelength, etc. This meta-data in the packet header is used by the propagation model in the receiving network interface. It determines, via the receiving node, if the packet has the minimum power to be received and/ or detected .

Radio Propagation Model: Network simulator NS-2 supports three propagation models which are:

a. Free-Space Model: When there is a direct line-of-sight path between the transmitter and the receiver. The type of network model is called a free space model. In circular formation, when the devices are placed in the operating space of the transmitter then all the packets are received.

b. Two-Ray Ground Model: If a ground reflection is also considered in the Free - Space model. This type of improved model is called a Two-Ray Ground Model. In this mode, if the distance between the transmitter and the receiver is long, then this model provides comparatively better and more accurate results.

c. Shadowing Model: The shadowing model is especially useful for longer distances. For short range models, the free space model and two-ray ground model work well, as in those two models, line-of sight is possible. If the distance between the transmitter and the receiver is longer, then shadowing model is used in simulations for wireless networks. The propose scheme uses Two-Ray Ground Model.

Antenna: An omni-directional antenna having a unity gain is used by mobile nodes.

Topology: Topology must be created before the node configuration for the nodes to run the simulation scenario. In NS-2, the topology is a flat grid model by default, which determines the width and length of the area to be simulated n x n or n x m.

III.2. Traffic Generation

Simulations are based on Constant Bit Rate (CBR) traffic can be made through the User Datagram Protocol (UDP). The interval between the packets is pre-set, and the data transmission is not reliable.NS-2 supports several classes of agents. The propose scheme use CBR traffic over UDP agent to examine the performance of the chosen protocol in MANETs. The traffic will be based on two nodes (source and destination) far away from the location of each other while the reliable mobile nodes are located in between and around.

III.3. Application of Algorithm

The project assumes that all of the nodes have the same communication range R. Each node has its location. We place the nodes randomly at different ranges in area n x m or n x n size. There is one source, S, and one destination, D. The propose scheme use the distance formula to calculate the distance between either the source or the destination and the intermediate nodes:

$d = Sqrt((x2-x1)^2+(y2-y1)^2)$.

In case of node breakage while sending data the propose scheme find the closest node from the source node to calculate the minimum interference path and send data

through that path so that the cost of that path is less as compared to the link failure path.

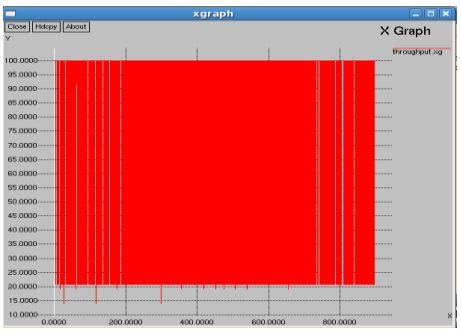
In order to reduce the routing overhead, the propose scheme limit that the maximum number of hops is 20. When the number of hops is greater than 20, the protocol break the path since routing is taking many hops.

III.4. Analysis and Results

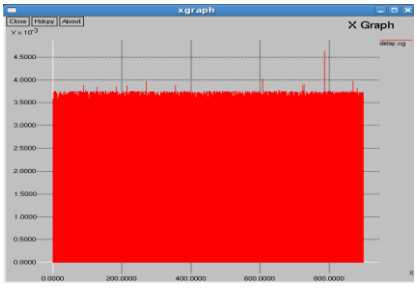
In a wireless, ad hoc multi-hop network, small movements of the nodes can lead to changes in network topology and therefore affect the performance of high layer protocols, such as throughput, delay and energy.

Performance Metrics:

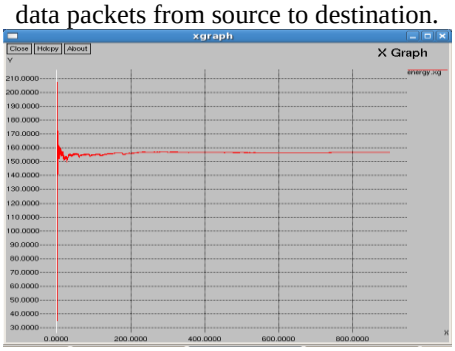
Throughput: The average number of data packets transmitted through a channel with successful delivery.



Delay: Delay caused by data packets to reach from source to destination.



Energy: Energy consumed by nodes while transmitting data packets from source to destination.



IV. CONCLUSION

This paper propose a node-disjoint multipath routing protocol to overcome the shortcomings of ondemand unipath routing protocols like AODV.

This paper will apply propose algorithm to AODV that works on a reactive approach and make use of alternate paths by satisfying a set of energy and distance based thresholdarea. So the propose scheme can achieve the following:

1. To extend the life time of ad hoc networks.
2. Improvement in the lifetime of the entire network.
3. The propose scheme will find out success of packet delivery due to energy losses.

REFERENCES

[1] Shunli Ding, Liping Liu: " A node-disjoint multipath routing protocol based on AODV": 2010 Ninth International Symposium on Distributed Computing and Applications to Business, Engineering and Science

[2] Chhagan Lal, V.Laxmi, M.S.Gaur, "A Node-Disjoint Multipath Routing Method based on AODV protocol for MANETs": 2012 26th IEEE International Conference on Advanced Information Networking and Applications.

[3] Yang Wenjing, Xinyu Yang, Guozheng Lu, Wei Yu, "An Interference Avoidance Multipath Routing protocol based on greedy forwarding in MANETS" IEEE International conference on Wireless Communications, Networking and Information Security (WCNIS), June 25-27, 2010.

[4] Jailani Kadir, Osman Ghazali, Mohamed Firdhous, Suhaidi Hassan, "Node Selection Based On Energy Consumption in Mobile Ad Hoc Networks": InterNetWorks Research Group, School of Computing, University Utara Malaysia, Malaysia , Sep 15, 2011.

[5] Ashok Kumar, Vinod Kumar, Narottam Chand," Energy Efficient Clustering & Cluster Head Rotation Scheme for Wireless Sensor Networks": International Journal of Advanced Computer Science and Applications, Vol. 3, No. 5.

[7] Chang-Woo Ahn, Sang-Hwa Chung, Tae-Hun Kim, Su-Young Kang, "A Node-Disjoint Multipath Routing Protocol Based on AODV in Mobile Ad-hoc Networks", International Conference on Information Technology, IEEE, 2010.

[8] Tsung-Chuan Huang, Sheng-Yu Huang and Lung Tang, "AODV-Based Backup Routing Scheme in Mobile Ad Hoc Networks": 2010 International Conference on Communications and Mobile Computing.

[9] Zangeneh, S. Mohammadi, "New Multipath Node-Disjoint Routing Based on AODV Protocol": World Academy of Science, Engineering and Technology 76 2011.

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