Comparative Study and Evolution of Multipath On Demand Routing Scheme in Wireless Environment

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Abstract - A Mobile ad hoc network is a group of wireless mobile nodes. Wireless ad-hoc networks are a collection of mobile nodes that make up a multi hop autonomous system. Their decentralized nature makes them suitable for various applications that do not rely on a central node. The nodes are free to move about and organize themselves into a network. These nodes change position frequently. Routing in MANET is difficult since mobility causes frequent network topology changes and requires more robust and flexible mechanism to search for and maintain the routes. When the network nodes move, the established paths may break and the routing protocols must dynamically search for other feasible routes. In MANET each node must be able to communicate with each other in order to connect and forward the data packets to the destination. The routing in MANET is done by using the routing protocols. This work compare the performance of multipath extensions AODV and AODV using various parameters like as packet delivery ratio, normalized routing load, packet loss and average throughput with varying pause time and speed. These simulations are carried out using the ns-2 Network simulator. The results presented in this work illustrate the importance in carefully evaluating and implementing routing protocols in an ad hoc environment.

Keywords- Multi path AODV, CBR, Mac/802.11, Simulation Performance, MANET, NS-2.

1. INTRODUCTION:

The internet engineering task force created a mobile ad-hoc network .Ad-hoc is a Latin word, which means "for this or for this only." A mobile ad-hoc network is formed by a group of mobile wireless nodes often without the assistance of fixed or existing network infrastructure. The nodes must cooperate by forwarding packets so that nodes beyond radio ranges can communicate with each other. These nodes change position frequently. 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.

The objective of this paper is to develop multiple routes in order to improve scalability. By finding multiple paths in a single route discovery, reduce the routing overhead .The secondary paths can be used to transmit data packets, in case the primary path fails due to node mobility or battery failure, which avoids extra overhead generated by a fresh route discovery. These multiple paths are more advantageous in larger networks, where he number of route breaks are high. When a source node needs to send data to destination and does not have a valid path to destination, it starts a timer and relays a route request (RREQ) for destination with unique route request identifier. When source node receives feasible reply for the destination, it updates its route table And starts sending a data packet.

Multipath routing can increase end-to-end throughput and provide load balancing in MANETs by the use of multiple paths. The concept of multipath routing motivated to design a multipath routing for mobile ad hoc networks.

1. To avoid the overhead of additional route discovery attempts.

2. To minimize the routing overhead by the use of secondary paths.

3. To reduce the route error transmission during route break recovery.

The rest of this paper is organized as follows; section 2 discusses the related work in the area of multipath routing. In section 4,5and 6 we present the details of performance matrices, simulation parameter and simulation model. We then evaluate our protocol and present the results in section 7. Finally, section 8 provides our conclusions and Future works and then last section 9 is References [13, 15].

2.Related Works:

Multipath routing establishes multiple routes between source and destination nodes. The Ad hoc On-demand Distance Vector Routing protocol, which was issued as RFC by the IETF MANET working group, is one of the most popular routing protocols for MANETs. Like other MANET routing protocols, AODV also has unstable routing paths which are dynamically changed and frequently broken due to mobile nodes and noisy environment. To incorporate multipath

routing to AODV, the multipath ad hoc on-demand distance vector routing protocol was proposed, in which multiple paths are guaranteed to be link-disjoint.

We propose a multi-path discovery scheme in this paper. This scheme is based on Ad hoc On-demand Distance Vector. In this protocol, a node broadcasts a route request (RREQ) packet to find a route to the destination. When one node in the ad hoc network first receives one RREQ packet, it setups a reverse route to the source node of the received RREQ packet, and then rebroadcasts the RREQ packet. The route discovery procedure has to broadcast RREQ packets, multi-path routing protocols to discover multiple paths from the source node to the destination one, so that the data could be sent via the alternate routes when the route path is broken. In this paper we introduced the multi path based AODV Routing discovery procedure.

The routing protocols are classified as follows on the basis of the way the network information is obtained in these routing protocols The main class of routing strategy reactive proactive and hybrid. We work on the reactive protocol Ad hoc on- demand Distance Vector (AODV) Routing; an attempt has been compare the performance analysis and simulation of prominent on demand reactive routing procedure for MANET [6].

The objective of this paper is to develop multiple routes in order to improve scalability. By finding multiple paths in a single route discovery, reduce the routing overhead incurred in maintaining the connection between source and destination nodes. The secondary paths can be used to transmit data packets, in case the primary path fails due to Node mobility these multiple paths are more advantageous in larger networks, where he number of route breaks are high. When a source node needs to send data to destination and does not have a valid path to destination, it starts a timer and relays a route request (RREQ) for destination with Unique route request identifier. When source node receives a feasible reply for the destination, it updates its route table and starts sending a data packet. If the timer expires in between, then source node increments the route request identifier and initiates a new request for the destination. Multipath routing can increase end-to-end throughput and provide load balancing in MANETs by the use of multiple paths.. To avoid the overhead of additional route discovery attempts. To minimize the routing overhead by the use of secondary paths. To reduce the route error transmission during route break recovery.[8, 10, 12].

Multiple Route Discovery Procedure is the process by which multiple paths are discovered. When a source needs a route AODV begins by initiating a Route Discovery process by sending a RREQ packet. RREQ is flooded on all outgoing links. When this packet is received by an intermediate node, it checks whether it has a route to the destination. This is similar to the route discovery mechanism used in single path routing protocols viz. route discovery flood with the route replies backtracking to the source along the reverse routes established by the requests. Multiple paths. If so the intermediate node constructs a RREP packet and sends to the source else the intermediate node forwards the RREQ packet towards the destination. Duplicate RREQs are ignored by the intermediate nodes to constrain flooding process. Whenever a node receives a RREQ packet it copies the address of the node from which it received the packet forming a reverse route. On the arrival of a RREQ packet, a destination node unicasts a RREP packet to the source. An intermediate node that receives this packet records a forward route to the destination and forwards the packet to a neighbor node on the reverse route. The RREP packet finally returns back to the source node and a data transfer route is established. Our work tries to avoid route breaks. If the failure of a link can be predicted in advance, the routing protocol can switch to an alternate path preemptively and save the route discovery or route maintenance overhead. The performance of any routing protocol improves if it can decrease upon the amount of Route Discovery attempts and Route Maintenance attempts. This property is meaningful only when all the paths are used at the same time [7,914].

3. Ad-Hoc On-demand Distance Vector

The Adhoc On-Demand Distance-Vector Protocol (AODV) [12] is a distance vector routing for mobile ad-hoc networks. AODV is an on-demand routing approach, i.e. there are no periodical exchanges of routing information. It offers quick adaptation to dynamic link conditions, low processing and memory overhead, low network utilization, and determines unicast routes to destinations within the ad hoc network. AODV is capable of both unicast and multicast routing. It is an on demand algorithm, meaning that it builds routes between nodes only as desired by source nodes. It maintains these routes as long as they are needed by the sources.

The protocol consists of two phases:

i) Route Discovery, and

ii) Route Maintenance.

Route Discovery

A node wishing to communicate with another node first seeks for a route in its routing table. If it finds one the communication starts immediately, otherwise the node initiates a route discovery phase. The route discovery process

consists of a route-request message (RREQ) which is broadcasted. If a node has a valid route to the destination, it replies to the route-request with a route-reply (RREP) message. Additionally, the replying node creates a so called reverse route entry in its routing table which contains the address of the source node, the number of hops to the source, and the next hop's address, i.e. the address of the node from which the message was received. A lifetime is associated with each reverse route entry, i.e. if the route entry is not used within the lifetime it will be removed.

Route Maintenance

The second phase of the protocol is called route maintenance. It is performed by the source node and can be subdivided into: i) source node moves: source node initiates a new route discovery process, ii) destination or an intermediate node moves: a route error message (RERR) is sent to the source node. Intermediate nodes receiving a RERR update their routing table by setting the distance of the destination to infinity. If the source node receives a RERR it will initiate a new route discovery. To prevent global broadcast messages AODV introduces a local connectivity management. This is done by periodical exchanges of so called HELLO messages which are small RREP packets containing a node's address and additional information.

4. Performances matrices: [6, 7]

4.1 Packet delivery fraction: The ratio of the data packets delivered to the destinations to those generated by the traffic sources.

4.2 Normalized Routing Load: Normalized routing load is the ratio of the number of control packets propagated by every node in the network and the number of data packets received by the destination nodes.

Average End to end delay: The average time from the beginning of a packet transmission at a source node until packet delivery to a destination. This includes all possible delays caused by buffering during route discovery latency, queuing at the interface queue, re-transmission delays at the MAC, and propagation and transfer times of data packets. Calculate the send(S) time (t) and receive (R) time (T) and average it.

4.4 Packets loss: Packet loss is a measure of the number of packets dropped by the routers due to various reasons.

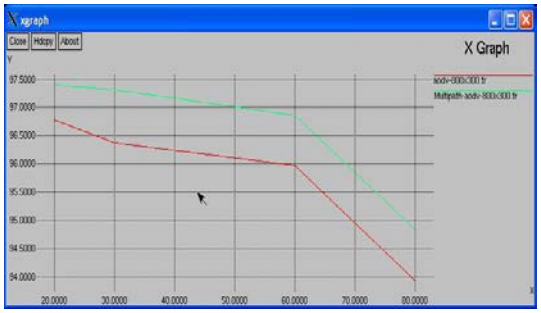
5. Simulation parameter:

PARAMETERS	VALUE
Simulator	NS-2
Routing protocol	AODV, Multipath AODV
Number of Nodes	50
Area	800mX300m
Packet size	512byte
Simulation time	100
Pause time	1.0
Traffic type	CBR
Mac protocol	Mac/802.11
Speed	20 to 80 m/s

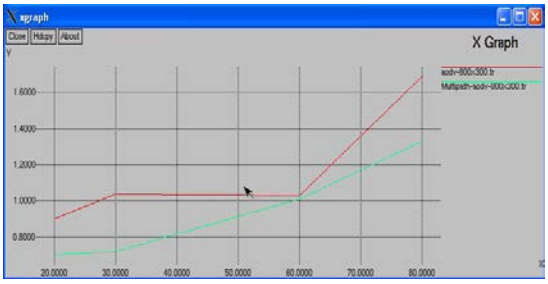
6. Simulation Model:

In this section, The Simulation environment consists of an area of 800x300, where randomly 50 mobile nodes are placed. A source and a destination is selected randomly. Data sources generate data according to Constant bit rate traffic pattern. Source destination pairs are spread randomly over the network. A packet size of 512 bytes is used. Mobility pattern of the mobile nodes is generated using Random waypoint model. A mobile selects another node in the network and constantly moves towards it at a given velocity. Once it reaches there, it waits for some pause time and selects another node and again starts moving. By observing the performance of the network under mobility we can test the stability of design in real time scenario with varying speed. Data rate of 2Mbps is used [6,9].

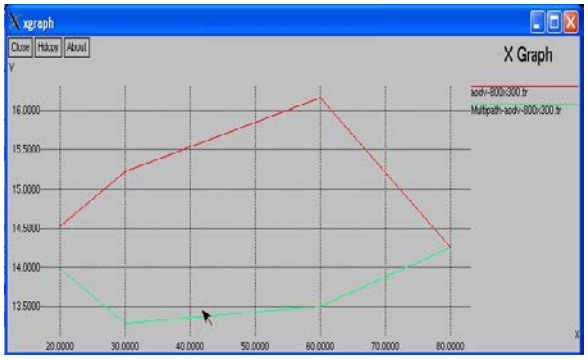
7. Simulation and Results:



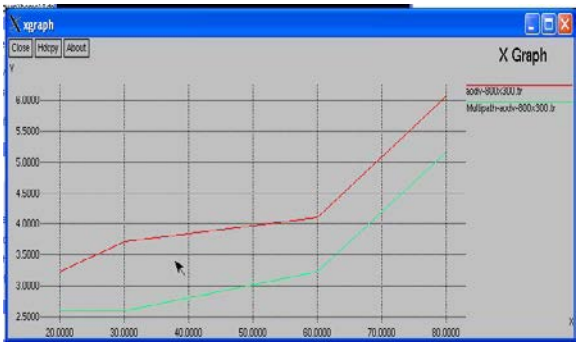
Packet Delivery Fraction With Varying Maximum Speed



Normalized Routing Load With Varying Maximum Speed



End to End Delay With Varying Maximum Speed



Packet Loss (%) With Varying Maximum Speed

8. Conclusion and Future Work:

In this paper, we present a multipath approach

for mobile ad hoc networks. The primary characteristic of this approach is that it dynamically adapts to varying network topology by monitoring the quality of each path to the destination and always using the best path. It is able to eliminate stale routes and thereby reduce the number of data packets dropped due to the

use of these invalid paths. Our results show that the performance of Multipath is better than single path AODV. In preferred protocol in networks that offer multiple node-disjoint paths. However, in networks where very few multiple paths exist. This was proposed to enhance the benefits of multipath routing protocols by reducing the Route Discovery overhead. The performance of the proposed protocol is better than AODV even when the mobility of the nodes is high.

In future implement multipath strategy for congestion control mechanism and suggest multicast strategy for new routing scheme.

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