Performance analysis of on demand multipath routing scheme in wireless environment

Dinesh Kumar Sen, Prof. Umesh Barahdiya, Prof. S.M. Khare
Electronics and Communication Engineering
Nagaji Institute of Technology and Science, Gwalior, India

Abstract- **This paper tries to explain the architectural performance issues of Multipath AODV over Single path AODV communication in the term of wireless network design and management. The challenges in wireless networks include issue like path failure protection. We have used multipath extensions of Ad hoc on- demand Distance Routing for Mobile Ad hoc network. AODV is one of the most popular routing protocols for mobile ad hoc networks .In this work used in multiple path in On-demand routing protocols and this protocol single path failure then create the alternate path and data packet forward continuously from source to destination. These advantages over single path routing make the application of Multipath routing in MANET an attractive and alternate. 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.**

Index Terms- **AODV, Multipath AODV, MANET, Performance Parameters, NS-2.**

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. MANET is a self-organized, decentralized wireless network with mobility as core functionality. The network is ad hoc because it is built spontaneously as devices are connected, and so the determination of which nodes forward data is made dynamically based on the network connectivity. This is in contrary to wired networks where routers perform the task of routing. It is also different from managed wireless networks, in which a special node known as an access point manages communication among other nodes.

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 of single path Vs multipath simulation of prominent on demand reactive routing procedure for MANET.

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].

II. 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, this 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 due to mobile nodes and noisy environment. To incorporate multipath routing was proposed, in which multiple paths are guaranteed to be link-disjoint.

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 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]

III. AD HOC ON DEMAND DISTANCE VECTOR

The AODV routing protocol is a reactive routing protocol; therefore, routes are determined only when needed. Ad hoc On Demand Distance Vector routing algorithm is designed for ad hoc mobile networks. 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. The protocol consists of two parts:route discovery and route.

AODV discovers routes on an as needed basis via a similar route discovery process. AODV relies on routing table entries to propagate an RREP back to the source and, subsequently, to route data packets to the destination. AODV uses sequence numbers maintained at each destination to determine freshness of routing information and to prevent routing loops. All routing packets carry these sequence numbers.

Whenever a packet is to be sent by a node, it first checks with its routing table to determine whether a route to the destination is already available. If so, it uses that route to send the packets to the destination. If a route is not available or the previously entered route is inactivated, then the node initiates a route discovery[3] process. A RREQ (Route Request)[4] packet is broadcasted by the node. Every node that receives the RREQ packet first checks whether it is the destination for that packet and if so, it sends back an RREP (Route Reply) packet.

An important feature of AODV is the maintenance of timer-based states in each node, regarding utilization of individual routing table entries. A routing table entry is expired if not used recently. A set of predecessor nodes is maintained for each routing table entry, indicating the set of neighboring nodes which use that entry to route data packets.

Once the route is established, a route maintenance protocol is used to provide feedback about the links of the route and to allow the route to be modified in case of any disruption due to movement of one or more nodes along the route. Maintenance of the discovered/established route is necessary for two main advantages, first to achieve stability in the network and secondly to reduce the excessive overhead required in discovering new route[10]. Each time the route is used to forward a data packet, its expiry time is updated to be the current time plus ACTIVE_ROUTE_TIMEOUT (ART) and it is set to 3000 milliseconds [5, 11]. ART is a constant value that defines as to how long a new discovered route is to be kept in the routing table of a node after the last transmission of a

packet on that route. ART is defined for both the source and intermediate nodes in the network. If a route is not used for this predefined period, a source or intermediate node cannot be sure whether the route is still valid or not and removes the route from its routing table, this is to ensure no unnecessary packet loss.

IV. PERFORMANCES MATRICES[6, 7]

4.1 Packet Delivery Fraction: This is the fraction of number of packets received at the destination to the number of packets sent from the source multiply by 100.

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.

4.3 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 Packet loss (%): Packet loss is the failure of one or more transmitted packets to arrive at their destination.

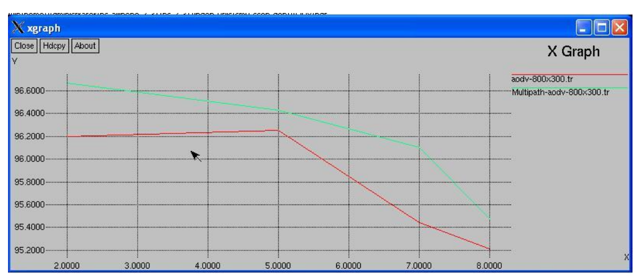
V. SIMULATION PARAMETER

PARAMETERS	**VALUE**
Simulator	NS-2
Routing protocol	AODV, Multipath AODV
Number of Nodes	20
Area	800mX300m
Packet size	512byte
Simulation time	100
Pause time	2.0 to 8.0
Traffic type	CBR
Mac protocol	Mac/802.11
Rate	2

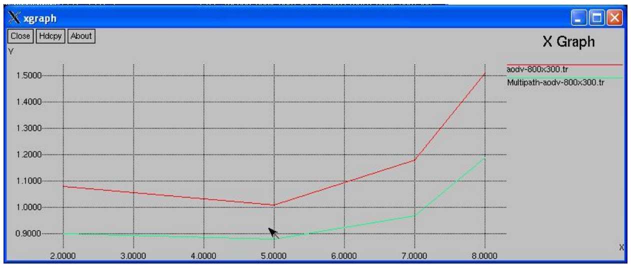
VI. SIMULATION MODEL

In this section our simulation study, *ns*-2 is used. It is assumed that 20 mobile nodes move over a area of 600 × 800 , we apply the random way-point model in ns-2 to emulate node mobility patterns where randomly 50 mobile nodes are placed. A source and a destination is selected randomly. Data sources generate data according to Constant bit rate (CBR) traffic pattern. A packet size of 512 bytes is used. Mobility pattern of the mobile nodes is generated using Random waypoint model .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 pause time. Data rate of 2Mbps is used [6,9].

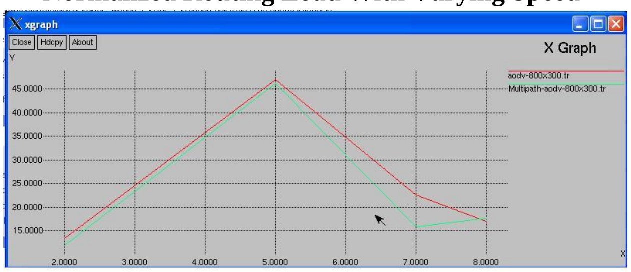
VII. SIMULATION AND RESULTS:



Packet Delivery Fraction With Varying Speed



Normalized Routing Load With Varying Speed



End to End Delay With varying speed

Packet Loss (%) With Varying Speed

VIII. CONCLUSION AND FUTURE WORK

Through the analysis and comparison of network simulation results, we can conclude that, in the circumstance of non-active movement, AODV protocol is most available as

its packet loss rate and end-to-end time delay are both low; while in the circumstance of active movement, Multipath AODV protocol is more favorable as the packet delivery fraction is high and end-to-end time delay is low.

In the future we will optimize our trusted routing algorithm and establish some fast response mechanisms when malicious behaviors of attackers are detected.

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