Performance Analysis of AODV, DSR & LAR1 Routing Protocols for MANET

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Abstract- **The improvement in wireless technology in the current age have formed networks with low cost and low power consumption. One of such networks which exist is called as Mobile Ad-hoc network which is characterized by wirelessly connected nodes with frequent change in network topology. As the nodes are connected wirelessly a routing mechanism (routing protocols) is required for successful transmission of packets. Sometimes two or more nodes sending the information simultaneously results in collisions. Hence medium access controls (MAC protocols) are required for efficient transmission and avoiding collision. In this research work performance of various attributes like packet delivery ratio, end-to-end delay and throughput for three Routing protocols (AODV, DSR and LAR1) is analyzed by increasing the mobility of node, applying different MAC layer protocols (CSMA and MACA) and changing the type of scenario. The performance of these three routing protocols is done on Glomosim Simulator and we concluded that AODV and LAR1 perform well in increasing mobility. And DSR performs well with CSMA MAC Layer protocol.**

Keywords—AODV, CSMA, DSR, LAR1, MACA, MANET

I. INTRODUCTION

The Mobile Adhoc Network is described by random movement of mobile nodes in wireless scenario, in order to find the best possible path between sources to destination; routing protocols are used in wireless communication. As there is no dedicated path between the nodes a routing strategy is helpful in exploring the shortest path. The wireless networks are mainly composed of two types infrastructure based network and Ad-hoc network. In case of infrastructure based networks there is a central station called access point (AP) which provide a wireless link between AP and a mobile data terminal equipment having antenna (can be a laptop or notepad computer).The routing procedure is also controlled by these access points, in such environment range of transmission is fixed. While in case of Ad-hoc networks the base station or access point is absent. Every node present in the network performs all the functions of base station and routing decisions are also taken by them. MANET or the mobile ad-hoc network is a flexible and self configuring network containing large number of wirelessly connected independent nodes. The most widely used routing protocol in ad-hoc network is AODV, DSR and LAR1 due to their reactive nature in topology change may. A lot of works on this network is done by researchers in order to have energy efficient routing protocols [4]. This paper further extends the research work in different scenario as discussed below. Figure 1 shows a simple ad hoc network with three mobile hosts using wireless interfaces. Host A and C are out of range from each other's wireless transmitter. When exchanging packets, they may use the routing services of host B to forward packets since B is within the transmission range of both of them.

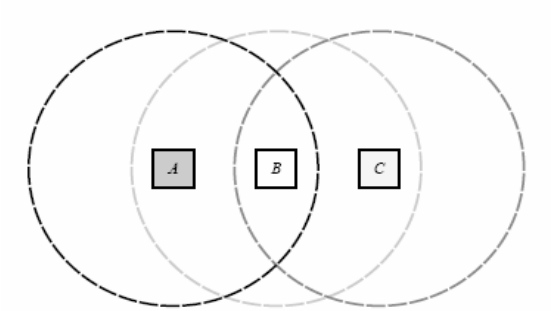

Fig 1. Mobile Ad hoc networks with 3 mobile nodes

II. DESCRIPTION OF THE PROTOCOLS

This section briefly explains the AODV, DSR and L A R 1 routing protocol that are being studied in this paper.

A. Ad-Hoc On Demand Distance Vector (AODV) Routing Protocol

The Ad hoc On-Demand Distance Vector (AODV) [3] is an on-demand routing protocol that enables dynamic, self- starting, multihop routing between participating mobile nodes wishing to establish and maintain an ad hoc network. AODV allows mobile nodes to obtain routes quickly for new destinations, and does not require nodes to maintain routes to destinations that are not in active communication. This protocol performs Route Discovery using control messages route request (RREQ) and route reply (RREP), whenever node wishes to send packet to destination. To control network wide broadcast of RREQs, the source node uses

an expanding ring search technique. The forward path sets up in intermediate nodes in its route table with a lifetime association using RREP. AODV allows mobile nodes to respond to link breakages and changes in network topology in a timely manner. When either destination or intermediate node moves, a route error (RERR) is sent to the affected source nodes. When a source node receives the (RERR), it can reinitiate the route discovery if the route is still needed. Neighborhood information is obtained from broadcast Hello packet.

B. Dynamic Source Routing (DSR) Protocol

The Dynamic Source Routing protocol (DSR) [1,5] is an on demand routing protocol. DSR is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. The DSR protocol is composed of two main mechanisms that work together to allow the discovery and maintenance of source routes in the ad hoc network:

- Route Discovery is the mechanism by which a node S wishing to send a packet to a destination node D obtains a source route to D using ROUTE REQUEST and ROUTE REPLY messages. It is used only when S attempts to send a packet to D and does not already know a route to D.
- Route Maintenance is the mechanism by which a node S is able to detect if the network topology has changed because a link along the route no longer works. On detecting link break, DSR sends ROUTE ERROR message to source node for finding a new route. In that case, S can attempt to use any other route it happens to know to D, or it can invoke Route Discovery again to find a new route for subsequent packets to D.

C. Location-Aided Routing (LAR1) Protocol

Ad hoc on-demand distance vector routing (AODV) [3] and distance vector routing (DSR) that have been previously described are both based on different variations of flooding. The goal of Location-Aided Routing (LAR1) described in is to reduce the routing overhead by the use of location information. Position information will be used by LAR1 for restricting the flooding to a certain area.

In the LAR1 routing technique, route request and route reply packets similar to DSR and AODV are being proposed. The implementation in the simulator follows the LAR1 algorithm similar to DSR.

III. PERFORMANCE PARAMETERS

In order to evaluate the performance of ad hoc network routing protocols, the following metrics were considered**:**

A. Packet delivery Ratio (PDR)

PDR [5] is the ratio of the number of data packets successfully delivered to the destinations to those generated by CBR sources.

B. *Average End-to-End delay*

It is the average time from the beginning of a packet transmission at a source node until packet delivery to a destination. This includes delays caused by buffering of data packets during route discovery, queuing at the interface queue, retransmission delays at the MAC, and propagation and transfer times.

C. Throughput

Throughput is the average rate of successful transmission of packet from source to destination.

Table 1. Parameters for simulation evaluation

Parameter	**Value**
Protocols	AODV, DSR and LAR1
Traffic Type	CBR
Simulation Duration	500 seconds
Packet Size	512 bytes
Pause Time	40 sec
Number of Nodes	50
TERRAI-DIMENSIONS	2000 * 2000
Mobility model	Random way point

IV. SIMULATION RESULTS

To analyses and simulate the different scenarios for comparison, the Glomosim network simulator [6] is being used. For this firstly the scenario is created then after simulation the results are analyses from the analyses option.

CASE 1 - Comparison of AODV, DSR & LAR1 by changing the node mobility.

In order to compare AODV, DSR & LAR1 on the basis of mobility, random waypoint mobility model is selected for a scenario having 50 nodes and the speed of nodes is gradually increased from 10m/s to 40m/s.

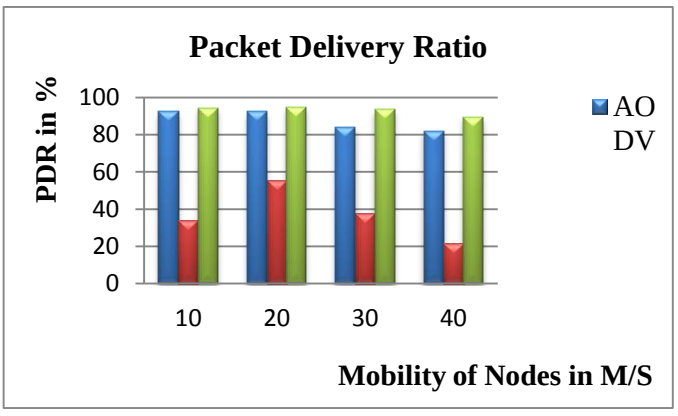

Fig 2. Packet Delivery Ratio vs. Speed

From the graph of packet delivery ratio verses mobility, in fig 2, it is seen that AODV and LAR1 has better PDR in comparison to DSR and it also seen that as the mobility increases the PDR decreases.

In fig 3, it is seen that AODV and DSR has minimum delay in comparison to LAR1. And the delay is increases as the mobility increases.
In fig 4, it is seen that LAR1 and AODV has higher throughput in comparison to DSR and it also seen that as the mobility increases the Throughput decreases.

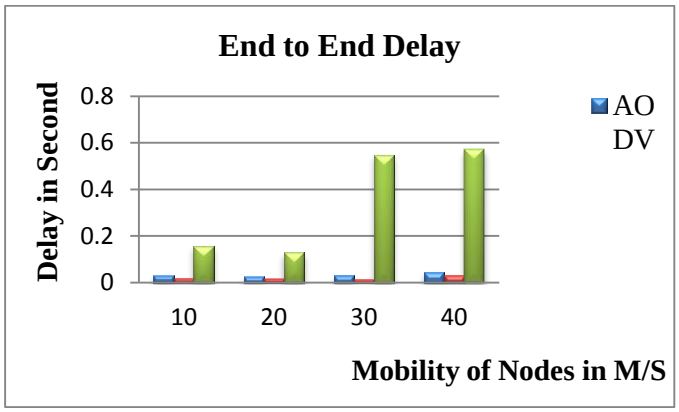

Fig 3. End to End Delay vs. Speed

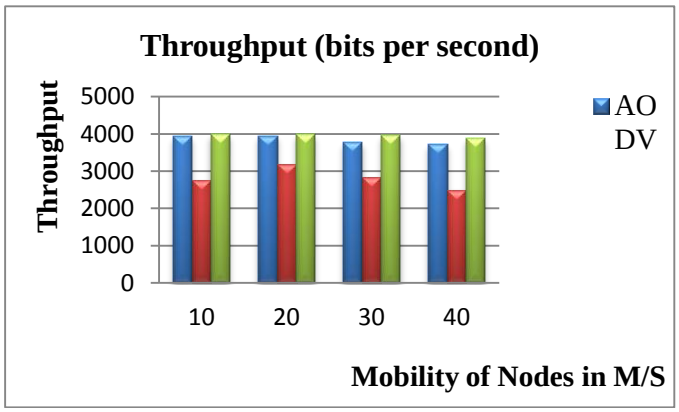

Fig 4. Throughput vs. Speed

CASE 2- Comparison of AODV, DSR & LAR1 by changing MAC layer Protocols.

In order to compare AODV, DSR and LAR1 by correlating the MAC layer protocols [1], a scenario is created having 4 different wireless subnets sending packets to a single destination node.
The above comparison is done on a scenario having multiple wireless zones and single destination. That is way the packet traffic on this destination node is very high and the rate of collision is also increased so a medium access is required to improve the performance hence MAC layer protocol is considered for comparison.

In case of CSMA [1], DSR has better PDR in comparison to AODV and LAR1 and it seen that CSMA has better performance than MACA.

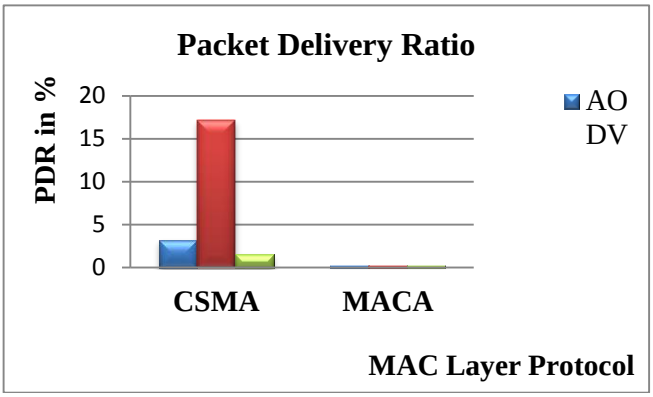

Fig 5. Packet Delivery Ratio vs. MAC Layer Protocol

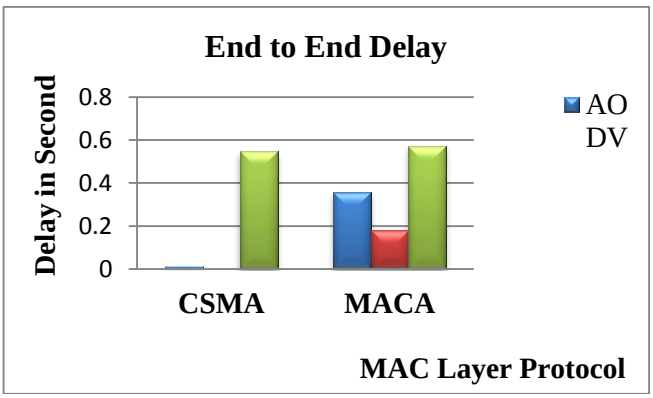

Fig 6. End to End Delay vs. MAC Layer Protocol

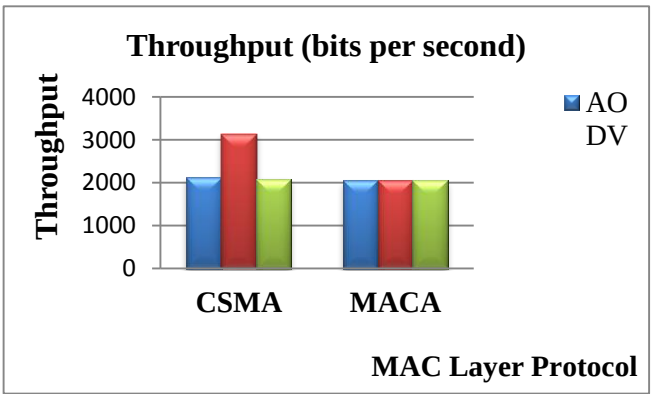

Fig 7. Throughput vs. MAC Layer Protocol

From fig 6, it is seen that AODV and DSR has minimum delay in comparison to LAR1. CSMA has minimum delay in comparison to MACA MAC layer protocol [2].
From fig 7, it seen that DSR has better Throughput in comparison to AODV and LAR1 and CSMA has higher throughput than MACA.

V. CONCLUSION

In this paper, analysis of AODV, DSR & LAR1 routing protocols is done to understand that which one performs well in which set of conditions. Focus is mainly done on the network parameters like packet delivery ratio, end to end delay and throughput. By changing the mobility, scenario & MAC protocol it is seen that as the mobility is increased AODV and LAR1 performs well in comparison to DSR. And it is also observe that as the mobility increases their PDR and Throughput decreases and their delay increases. Secondly, in the scenario with multiple zones & single destination for CSMA & MACA MAC layer protocols, DSR is far better. In the scenario with single source & multiple destinations, DSR outperforms, hence AODV and LAR1 performs well in increasing mobility. And DSR performs well with CSMA MAC Layer protocol.

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