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Implementation & Performance Evaluation of AODV Protocol in Ad-Hoc Network for Heavy Network Traffic using ns-2

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***Abstract*— Mobile Ad-Hoc network is a self configurable infrastructure less network of wireless mobile nodes [1]. Wireless Mobile nodes are attached dynamically in the network. Wireless Mobile nodes are capable of communicating with each other in the absence of a network infrastructure or any central administration System. With the ease of the infrastructure less nature of Wireless Mobile Ad-hoc Networks make them highly popular for the current multimedia communications, so there has been considerable research in routing area. Various researches show that Ad-Hoc on Demand Distance Vector Routing Protocol (AODV) performs better than any other protocol. Though AODV performs well but there must be a mechanism to analyze the performance by varying network size. In this paper, the comparison of Ad-hoc on demand Distance Vector routing (AODV) and Dynamic Source Routing (DSR) has been presented. The comparison is done on the basis of Packet Delivery Ratio (PDR) and Throughput. The varying traffic, number of nodes and routing protocols makes an important task for improving Quality of System (QoS) in Mobile Ad hoc Network. The QoS depends upon several parameters like throughput, network load, Packet Drop Ratio etc. Packet Delivery Ratio (PDR) and Throughput parameters have been considered for the simulation. For simulation Network Simulator (ns-2) has been used.**

***Keywords*— MANET, AODV, DSR, PDR, QoS**

I. INTRODUCTION

MANET is a self-organizing, self-configuring "multi-hop" network which does not require any fixed infrastructure and where the nature of the network changes dynamically [2]. This change in nature of network is due to node mobility which also affects the communication between the nodes. So routing procedures are required which are always ready to find a path between source and destination to forward the packets appropriately. Routing protocol can be classified as Proactive and Reactive routing protocols. Proactive protocols are Table based Protocols whereas Reactive Protocols are On-Demand based [2]. In AODV, Routes are discovered as on-demand basis and are maintained as long as they are required.

It captures a sequence number, which it increases each time it finds a change in the topology of its neighborhood. The sequence number ensures that the most recent route is selected for execution of the route discovery. AODV used for provide unicast, multicast and broadcast communication [5]. Route tables of AODV stores the destination and next hop IP addresses as well as the destination sequence number. AODV also provide quick deletion of invalid routes due to link breakage. If a node fails to receive three consecutive HELLO messages from a neighbor, it means that link is broken for the specific node and a RERR message is broadcasted to the upstream node [5]. AODV routing protocol known as the best among all protocols as it gives maximum throughput, lower end to end delay, and higher packet delivery ratio. There is always a problem with increasing number of nodes which results in packet duplication. So there requirement to enhance its performance increased nodes. A technique has to be incorporated to avoid packet duplication and a possible way to enhance the performance of AODV protocol. In this paper we have put forth the comparison between AODV and DSR Routing Protocols. The comparison is purely based on the Throughput and Packet Delivery Ratio (PDR) of Network using AODV and DSR.

II. PROPOSED METHODLOGY

Recent days the Mobile Ad-Hoc is more demanding in all user applications. Almost all online applications and e-marketing is done using Ad-Hoc Networks. The major bottleneck is the traffic in the Ad-Hoc network. With the varying load conditions the throughput & hence performance of the Ad-Hoc network degrades. The varying load conditions are efficiently handled by the AODV Protocol.

Methodology: Design of a simulation based model of Ad-Hoc network consisting of varying nodes of 50, 100, 200, 300, 400 and 500 using network simulator ns-2(version 2.35).

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Firstly, the networks are implemented using the Ad-Hoc on demand Distance Vector (AODV) Routing Protocol and the tthroughput and packet delivery ratio has been calculated. Secondly, the same node sized networks are implemented using Dynamic Source Routing (DSR) protocol and throughput and packet delivery ratio has been calculated. A comparative analysis of Throughput and Packet Delivery Ratio (PDR) has been presented.

Network Simulator "ns-2":

NS-2 is an event driven network simulator which is used to simulate a variety of IP networks, written in C++ and Otcl languages[8]. It is useful for simulating local and wide area networks. It implements various network protocols such as TCP and UDP etc. It also implements multicast and MAC layer protocols for LAN simulations. NS-2 is equipped with variety of development tools for simulation results display, analysis. The NS-2 simulation environment offers great flexibility in investigating the characteristics of sensor networks. It contains flexible energy-based models for wireless ad-hoc networks. In this environment a sensor network can be built with many of the same set of protocols and characteristics as those available in the real world. The mobile networking environment in NS-2 provides support for various parameters of the network. The wireless model also includes support for node movement and energy constraints. NS-2 has many and expanding features[8].

AODV and DSR:

Ad-Hoc On-Demand Distance Vector is a routing protocol for ad-hoc mobile networks. AODV and DSR are the two most widely used ad-hoc routing protocols. AODV belongs to the class of Distance Vector Routing Protocols (DV) [5]. AODV is a reactive routing protocol which executes a route discovery process whenever data packets are available to transmit, if it does not have any route path towards the destination node. Thus the route discovery in AODV is called as on-demand. AODV allows wireless mobile nodes to respond to breakages of links and changes in network topology in a timely manner. Ad hoc networks routing protocols are classified broadly in two categories: reactive protocols and proactive routing protocols. Proactive protocols, such as OLSR track the changes in topology of the network to keep route information between source and destination available updated [2]. Reactive protocols such as AODV or DSR, initiate a new route as needed, at the time of creating the connection. Proactive protocols are better suited for low mobility environment, while re- active protocols focus fit dynamic networks better. A main operation in a reactive ad hoc network protocol is for a source node to discover a route to its destination.

Each mobile host in the network acts as a specialized router and routes are obtained as required, making the network self-starting. Each node in the network maintains a routing table which holds the routing information entries for its neighboring nodes, and two separate counters for node sequence number and a broadcast-id. Whenever node has to communicate with another, it increments its broadcast-id and broadcasting a route request packet RREQ to its neighbors for path discovery [5].

AODV is consists of three mechanisms:

Route Discovery Process: In AODV, a node initiates a route discovery process throughout the network, only when it wants to send packets to its destination. AODV uses routing tables with one entry per destination. When a source node requires a route to a destination, it executes a route discovery process to locate the destination node. The source node broadcasts a query packet requesting a route to be set up to the destination. A reply is sent back directly to the source node. The destination itself sends back the reply or any other intermediate node that has a current route to the destination. Receiving a route request (RREQ), all the intermediate nodes update their routing table for updating the reverse route to the source. Similarly, the forward route to the destination is updated on receiving a route reply (RREP) packet [5].

Route Message Generation: Link failures are propagated by a route error (RERR) message from the site of a link break to the source node for that route [5]. If a link break occurs while the route is active; the node upstream of the break propagates a route error (RERR) message to the source node to inform it of the now unreachable destinations.

Route Maintenance: When the next hop link breaks, RERR packets are sent to a set of neighboring nodes that communicate through the broken link with the destination. This recursive process erases all broken entries in the routing table. As nodes reply to the first arriving RREQ, AODV favors the least congested route instead of the shortest route. The AODV protocol minimizes routing table information [5].

III. Experiment And Results

The simulation of Ad-hoc network has been done using network simulator "ns-2.35". The OTcl scripting language has been used to design the Ad-hoc network. The designed network has been visualized using Network Animator "nam". The throughput has been observed using trace files and the throughput graphs are prepared using x-graph utility.

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TABLE I:
SIMULATION PARAMETERS

Network Parameters	Values
Number of Nodes	50, 100, 200, 300, 400 & 500
Simulation Time	10
Simulation Area	500 m x 400m
Routing Protocols	AODV and DSR
Node Movement	Random
Traffic Source	FTP, CBR
Simulator	ns-2.35

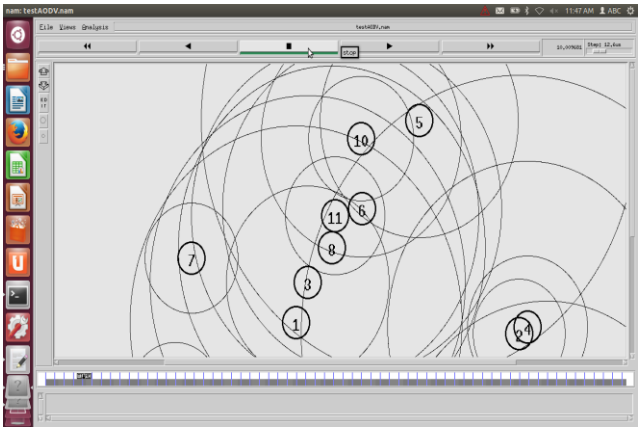

Figure 1: Network of 50 Nodes-"nam" Output

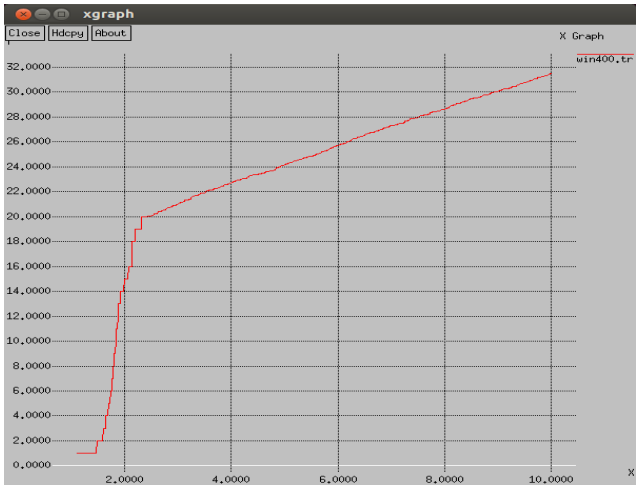

Figure 2: Throughput (DSR) for 400 nodes using "x-graph" utility

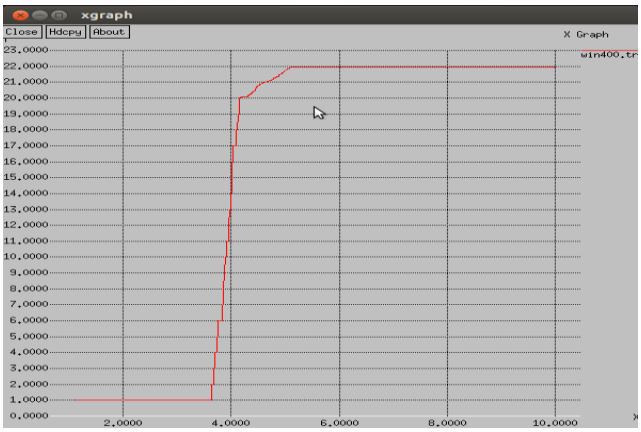

Figure 3: Throughput (AODV) for 400 Nodes using "x-graph" utility

TABLE II
EXPERIMENT RESULT: THROUGHPUT COMPARISON

No. of Nodes	Throughput (kbps)	
	DSR	AODV
50	672.22	365.68
100	671.5	676.75
200	655.42	676.63
300	328.41	671.31
400	361.82	672.38
500	314.85	662.14
Average	**500.7033**	**620.8150**

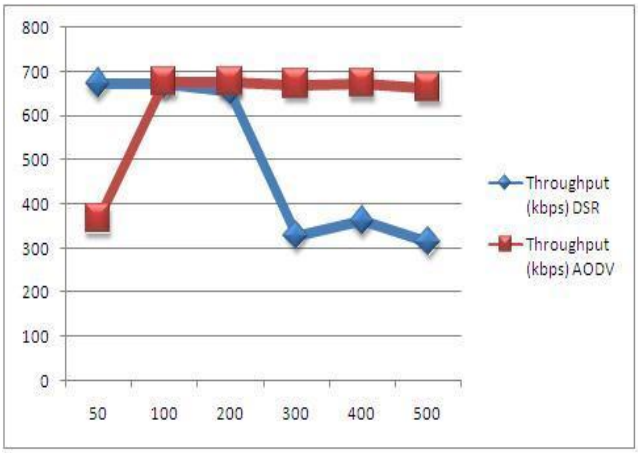

Figure 4: Throughput Comparison

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TABLE III:
EXPERIMENT RESULT – PACKET DELIVERY RATIO (PDR) COMPARISON

No. of Nodes	Packet Delivery Ratio(PDR)	
	DSR	AODV
50	97.31	93.37
100	97.31	97.36
200	97.25	97.29
300	94.65	98.21
400	94.87	97.32
500	92.65	97.03
Average	**95.6733**	**96.7633**

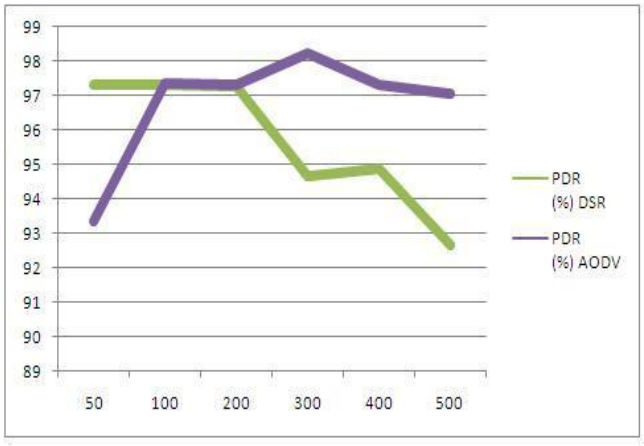

Figure 5: Packet Delivery Ratio Comparison

Above experimental results shows that the Average Throughput and Average Packet Delivery Ratio (PDR) is better in Ad-hoc On Demand Distance Vector Routing (AODV) Protocol as compared to Dynamic Source Routing (DSR) Protocol.

IV. CONCLUSION

In this paper, we have evaluated the performances of AODV under heavy traffics. The observations are made with variation in network intermediate nodes. After analysis of network with different number of nodes, and varying traffic, we came at the conclusion that AODV performs better in terms of Throughput and Packet Delivery Ratio (PDR) as compared to DSR. From the simulation results, good results are obtained with AODV as compared to DSR. Hence, AODV can be used in wireless networks with higher traffics.

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