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Effect of Mobility on Routing Protocols

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ABSTRACT: Routing in Mobile Ad-Hoc Networks (MANET) is a challenging task. Routing protocols used in mobile ad hoc networks (MANET) must adapt to frequent or continual changes of topology. These protocols have been extensively studied. It is established that the performance of reactive protocol outperforms that of table driven protocols. The effect of mobility on these routing protocols is an interesting area of research. The paper proposes the effect of mobility on reactive routing protocols. Results are validated through extensive simulations using Qualnet 6.1 version on the basis of performance such as throughput, network lifetime, end to end delay, packets dropped.

KEYWORDS: MANET, DYMO, AODV

I. INTRODUCTION

A "mobile ad hoc network" (MANET) is an autonomous system of mobile routers (and associated hosts) connected by wireless links. The routers are free to move randomly and organize themselves arbitrarily; thus, the network's wireless topology may change rapidly and unpredictably.

Routing in MANET depends on many factors including topology, selection of routers. Major challenge is that a node at least needs to know the reachability information to its neighbors to determine a packet route, while the network topology changes quite often in a MANET. They are suitable for large networks. The route discovery is done by using route request packets (RREQ) and RREP. They try to utilize network bandwidth by creating routes only when desired by the source node. Hence, route discovery becomes on-demand. Examples of reactive ad hoc network routing protocols include ad hoc on-demand distance vector (AODV), temporally ordered routing algorithm (TORA), dynamic source routing (DSR), Dynamic MANET On-demand (DYMO) routing protocol.

Further as number of network nodes change finding route to destination needs frequent change of routing control information among mobile MHs. Thus the amount of update traffic can be substantial and it is even higher when the nodes with increased mobility are present. As the network topology changes frequently because of node mobility and power limitations, efficient routing protocols are necessary to organize and maintain communication between the nodes.

RELATED WORK:
Routing protocols for ad hoc networks can be categorized as:

PROACTIVE:
It attempts to maintain consistent routing information to every node in the network. These are also referred to as table-driven. Routing information is kept in the routing table and periodically updated as the topology of network changes.

REACTIVE:
It is also called as on demand routing protocols as they don't maintain routing information at the network.

AODV (AD HOC ON-DEMAND DISTANCE-VECTOR):
Ad Hoc on-Demand Distance Vector (AODV) routing protocol is a reactive protocol. It has been derived from DSDV.DSDV issues broadcasts to announce every change in overall connectivity of ad hoc network and local movements have global effects. AODV avoid these problems. AODV is able to provide unicast, multicast and broadcast communication ability.

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(i) Route Discovery: AODV discovers routes as and when necessary &does not maintain routes from every node to every other. Routes are maintained just as long as necessary. When a node wishes to send a packet to some destination, it checks its routing table to determine if it has a current route to the destination

If yes, forwards the packet to next hop node

If No, it initiates a route discovery process

Route discovery process begins with the creation of a Route Request (RREQ) packet -> source node creates it. The packet contains – source nodes IP address, source node's current sequence number, destination IP address, destination sequence number and broadcast ID. Broadcasting is done via Flooding. When the RREQ is received by a node that is either the destination node or an intermediate node with a fresh enough route to the destination, it replies by unicasting the route reply (RREP) towards the source node. As the RREP is routed back along the reverse path, intermediate nodes along this path set up forward path entries to the destination in its route table and when the RREP reaches the source node, a route from source to the destination established.

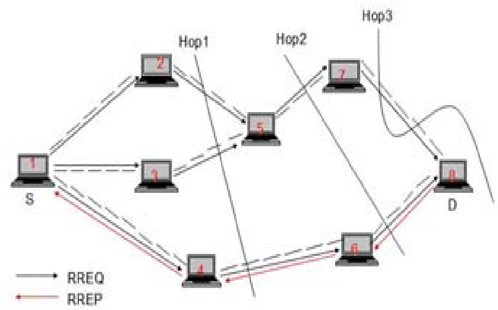

Fig.1. Propagation of Route Request (RREQ) packet & Route Reply (RREP) packet.

Source specifies the complete path to the destination in the packet header. All the intermediatory nodes simply forwards the packet to the next node as specified in the packet header. This means that intermediate nodes only need to keep track of their neighboring nodes to forward data packets.

DYMO (DYNAMIC MANET ON DEMAND) ROUTING PROTOCOL:
DYMO routing protocol has been proposed by Perkins & Chakeres as advancement to the existing AODV protocol. It is also defined to as successor of AODV or ADOVv2 and keeps on updating till date. DYMO operates similar to its predecessor i.e. AODV and does not add any extra modifications to the existing functionality but operation is moreover quite simpler. DYMO is a purely reactive protocol in which routes are computed on demand i.e. as and when required. It is a reactive routing protocol that computes unicast routes on demand or when required. It employs sequence numbers to ensure loop freedom. It enables on demand, multi-hop unicast routing among the nodes in a mobile ad hoc network. The basic operations are route discovery and maintenance. Route discovery is performed at source node to a destination for which it does not have a valid path. And route maintenance is performed to avoid the existing obliterated routes from the routing table and also to reduce the packet dropping in case of any route break or node failure.

(i) Route Discovery: The DYMO route discovery is very similar to that of AODV except for the path accumulation feature. Figure 2 shows the DYMO route discovery process. If a source has no route entry to a destination, it broadcasts a RREQ message to its immediate neighbors. If a neighbor has an entry to the destination, it replies with an RREP message else it broadcasts the RREQ message.

(ii)
When a node S wishes to communicate with a node T, it initiates a RREQ message. The sequence number maintained by the node is incremented before it is added to the RREQ. We illustrate the route discovery process using Fig. 2as an

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example. In the figure, node 2 wants to communicate with node 9 and thus, node 2 is S, the source, and node 9 is T, the target destination. In the RREQ message, the node 2 includes its own address and its sequence number, which is incremented before it is added to the RREQ. Finally, a hop count for the originator is added with the value 1. Then information about the target destination 9 is added. The most important part is the address of the target. If the originating node knows a sequence number and hop count for the target, these values are also included. The message is flooded using broadcast, in a controlled manner, throughout the network, i.e., a node only forwards an RREQ if it has not done so before. The sequence number is used to detect this. Each node forwarding an RREQ may append its own address, sequence number, prefix, and gateway information to the RREQ, similar to the originator node.

Upon sending the RREQ, the originating node will await the reception of an RREP message from the target. If no RREP is received within RREQ WAIT TIME, the node may again try to discover a route by issuing another RREQ. In fig-2, the nodes 4 and 6 append information to the RREQ when they propagate the RREQ from node 2. When a node receives an RREQ, it processes the addresses and associated information found in the message. An RREP message is then created as a response to the RREQ, containing information about node 9, i.e., address, sequence number, prefix, and gateway information, and the RREP message is sent back along the reverse path using unicast. Since replies are sent on the reverse path, DYMO does not support asymmetric links. The packet processing done by nodes forwarding the RREP is identical to the processing that nodes forwarding an RREQ perform, i.e., the information found in the RREP can be used to create forward routes to nodes that have added their address block to the RREP

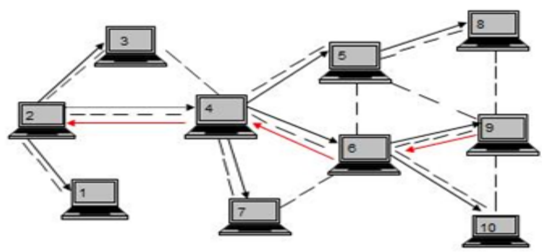

Fig 2. The DYMO route discovery process

(iii) Route Maintenance: During the routing operations each node has to continuously monitor the status of links and maintain the latest updates within the routing tables. The route maintenance process is actually accomplished with the help of RERR messages. The RERR message must be generated by a node if and when a link to any other node breaks.

The generating node multicasts the RERR message to only those nodes which are concerned with the link failure. Upon reception of a RERR message, the routing table is updated and the entry with the broken link is deleted. If any of the nodes face a packet to the same destination after deletion of the route entry, route discovery process needs to be initiated again.

II. PROPOSED MODEL

In the proposed scheme we have taken different readings for reactive protocol taking random mobility model and studied the effect of mobility on these routing protocols.

SIMULATION ANALYSIS:

The main objective of the simulation here is to study the effect of mobility on different routing protocols.

Fig 1 shows the network in an area of 100×100m² where we have deployed 100 nodes in a dynamic fashion.

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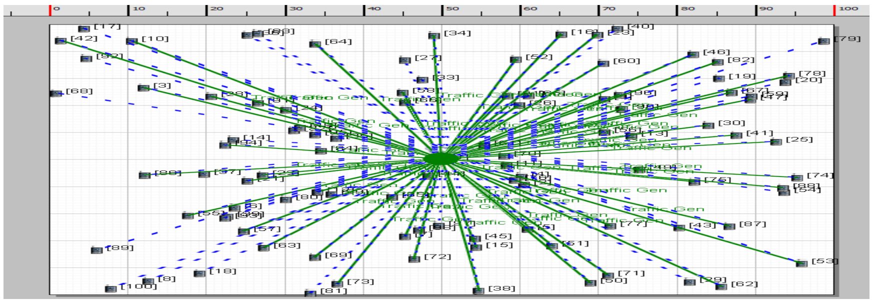

Fig 3 Network Scenario

Table 1 Enlists the simulation parameters.

Parameter	**Value**	**Parameter**	**Value**
Terrain	100×100 m²	Energy model	Generic
Nodes	100	Transmit Circuitry	24.75 mW
Application Type	Traffic Gen	Receive Circuitry Power Consumption	13.5mW
Data Rate	1packet per sec	Idle Circuitry Power Consumption	13.5mW
Message Size	38 bytes	Sleep Circuitry Power Consumption	0.02mW
Simulation time	101 sec	Routing Protocol	AODV, DYMO
Mobility	Random	Seed Value	1

Throughput defines the efficiency with which packets are delivered to the destination. Figure 2 shows the variations in throughput of the network. When the network becomes mobile the performance of DYMO is better than that of AODV.

Network Lifetime demonstrates the extent of existence of a node's battery capacity. In order to increase the capacity network lifetime has to be increased. It is observed from figure 3 that the lifetime of the network increases when DYMO is selected as the routing protocol.

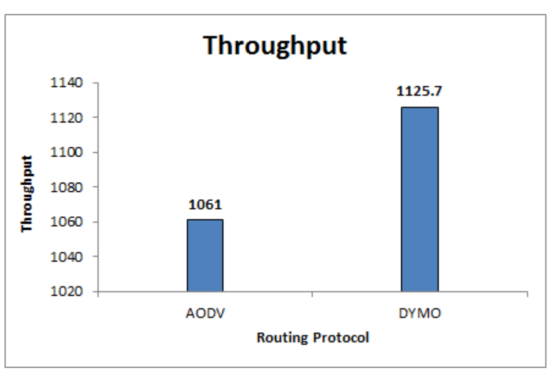

Fig 4Throughput

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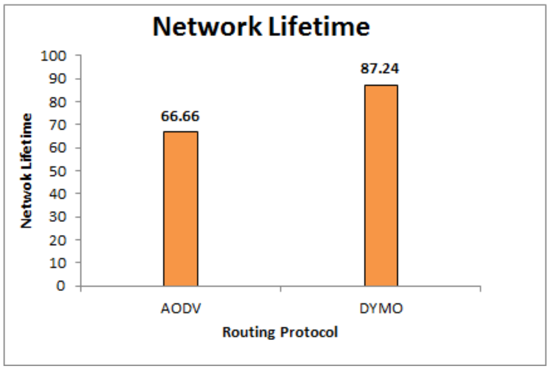

Fig 5 Network Lifetime

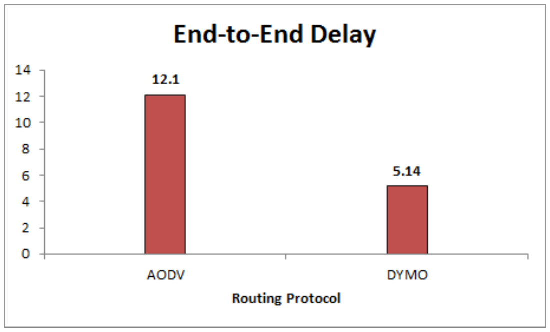

Fig 5 End to End Delay

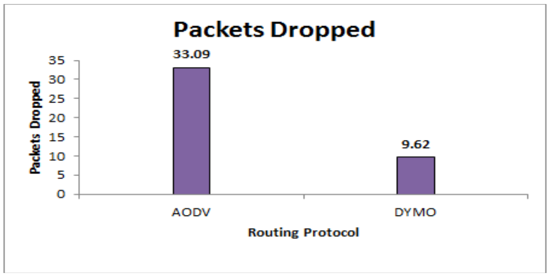

Fig 6 Packets Dropped

End to End delay is defined as the delay encountered in reception of packet by the receiver nodes. Figure 4 shows that end to end delay decreases when DYMO is selected as the routing protocol. Figure 5 illustrates the numbers of packets dropped as we increase the noise factor. Number of packets dropped increase when DYMO is selected as the routing protocol.

III. CONCLUSION

In this paper we have successfully made a comparative analysis of two reactive protocols routing protocols AODV, DYMO in terms of messages received, throughput, network lifetime and end to end delay and arrived at a result that DYMO gives a better performance than AODV.

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IV. FUTURE SCOPE

The results are simulated using only a small number of nodes. In future the scenario may be subjected to testing by increasing the node density.

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