A novel comparative analysis on mobile adhoc network routing protocols performance based on ns2 simulator

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Abstract: The formation of Mobile Adhoc Network occurs (MANET), when the group of wireless mobile nodes dynamically forms a temporary network without the use of any existing network infrastructure.The nodes presented in network can move in any direction & acts as a router. To provide communication in such network, a routing protocol plays a vital role; routing protocols have been proposed, to set up proficient route among pair of nodes.
There are number of routing protocolsout of which essential protocols like Dynamic Source Routing (DSR), Ad Hoc-On Demand Distance Vector Routing (AODV), Destination Sequence Distance Vector (DSDV) are discussed.

In this paper performancecapability of two on demand reactive routing protocols for mobile ad hoc network: DSR and AODV along with the proactive routing protocol DSDVpresented. Both DSR and AODV are on demand protocols but the difference in the protocol mechanism leads a significant performance differentials. The performance differentials are analyzed using varying network size, load and mobility.

Keywords: Protocol, On-demand, DSR, AODV, DSDV.

I. INTRODUCTION

MANET is a wireless open network. It isa temporary meshed network formed by a group of mobile nodes. MANET never depends on any established infrastructure for the network initializationand operation;the nodes use the service of other nodes in the network to transmit packets to transmit packets to destinations that are out range[1]. MANET applications include Sensor Networks represent a special kind of ad hoc networks that consist of nodes having sensing communication and processing ability [3].

Due to the high cost involved in realization of a real ad hoc network, simulation is a research tool of choice for majority of the MANET research community. Network simulator ns2 has been used for the evaluation of routing protocols and network performance in the majority of the reported MANET studies [4].

The ad hoc networks are multi-hop wireless networks with dynamicallychanging network connectivity owing to mobility [5]. Whenever there is any change of this minim um distance because of link cost changes, the newminimum distance is reported to the neighboring nodes. If, as a result, a minim um distance to anyneighbor changes, this process is repeated. This technique is the classical distributed Bellman-Ford algorithm [6]. DSR Dynamic source routing or DSR [7] uses a technique where the source of a data packetdetermines the complete sequence of nodes through which to forward the packet; the source explicitly lists this route in the packet's header. DSR builds routes on demand
usingflooded query[8].
AODV is a destination based reactive protocol
[9].Indeed, the routing problem in a real ad hoc network may be more complicated than this example suggests, due to the inherent non uniform propagation characteristics of wireless transmissions and due to the possibility that any or all of the hosts involved may move at any time [10].

DSDV is a kindof prophetic routing protocol, it's cost has no relationshipwith the movement of nodes, and when the resourcenumber is increase, the number of routing package is notincreasing so much[11]. Because the character.

There are mainly three basic types of traffic in ad hoc network which are as follows[2]:
1) Peer-to-peer- Communication between two nodes which are within one hop. Network traffic is usually consistent.

2) Remote-to-remote- Communication between two nodes beyond a single hop but which maintains a stable route between them. It may be the result of several of several nodes staying within communication range of each other in a single area or possibly moving as a group.

3) Dynamic Traffic- This occurs when nodes are dynamic and moving around Routes must be reconstructed. This results in a poor connectivity and network activity in short bursts.

II. AD HOC NETWORK

All nodes in an adhoc network are mobile and they are connected dynamically. In order to transfer data between three nodes then either the nodes should move because we know that wireless range is limited. Otherwise it can take the help of other nodes to forward the packet. Then that node will act as packet forwarding function. The ad hoc routing protocol can be divided into two categories-

1) Table-Driven Routing Protocols: in this routing protocol up-to-date routing information is maintained at each node.

2) On-Demand Routing Protocols: In this in this routing protocol routes are created depending on required. When a source wants to send packets to the destination then it uses route discovery mechanism to find the path to destination.

III. AD-HOC ROUTING PROTOCOLS-

1) DestinationSequence Distance vector (DSDV):

It is a classical Bellman-Ford routing algorithm based pro-active routing protocol. Each node maintains a list of all destinations and number of hops to each destinations and number of hops to each destination. Each entry is marked with a sequence number.

In order to avoid loop sequence number is used so. With this routing information can always be readily available, regardless of whether the source node requires information or not. The stations periodically transmit their routing tables to their immediate neighbors. In this routing table updates can be sent in two ways:

i) Full Dump**:** The network traffic can be reduced by full dump and sends the full routing table tothe neighbors which can span many packets.

ii) Incremental Dump**:** In this only those entries from the routing table are sent that has a metric change since the last update & it must fit in the packet.

2) Ad-Hoc On Demand Distance Vector Routing (AODV):The Ad hoc On-Demand Distance Vector protocol is both an on-demand and a table-driven protocol.The packet size in AODV is uniform unlike DSR. Unlike DSDV, there is no need for system-wide broadcasts due to local changes. It uses traditional routing table one entry per destination. AODV shows sequence numbers prevent routing loops. All routing packets carry these sequence number.

AODV attempts to improve on DSR by maintaining routing tables at the nodes, so that data packets do not have to contain routes.AODV retains the desirable feature of DSR that routes are maintained only between nodes which need to communicatetimer based state in each node, regarding utilization of individual routing table entries is essential thing in AODV. A routing table entry expires if not use recently. The neighboring node uses the entry of the predecessor node. And the nodes are notified with the RERR packets when the next hop link breaks. Each predecessor node forwards the RERR to its own set of predecessor, thus effectively erasing all routes using broken link. In contrast to DSR RERR packets in AODV are used to inform all source using a link when failure occurs.

3) Dynamic Source Routing (DSR):

DSR doesn't need any network infrastructures. It is a Loop free routing. Dynamic source routing protocol are reactive protocol which utilizes source routing algorithm. Each node constructs a one-dimensional array (a vector) containing the "distance"(costs) to all other nodes and next hop id. Routers exchange their routing tables with immediate neighbors

It is composed of two main mechanisms. Route Discovery: it is mechanism by which source node send a packet to the destination node obtain a source route to destination. This mechanism is used only

when the source node is sending a packet to the destination an does not already know the route to the destination.

Route maintenance: It is a mechanism by which the node sends packet to the destination can able to detect, while using a source route to destination, if network topology has changed. In this case it must no longer use the route to the destination because link along the route is broken. Route maintenance for this route is used only when the source node is actually sending the packets to the destination.

A source node put the entire routing packet into data packet and the packet is send through intermediate nodes specified in the path, if the source does not have the route to destination then it follow the route discovery process by flooding the network with route request (RREQ) packet. Any node that has path to destination in question can reply RREQ by route reply (RREP) packet. The reply is sent using the route recorded in the RREQ packet.

IV. PERFORMANCE ANNALYSIS:

1) Simulation Environment:

The simulation is carried out in LINUX. The detailed simulation is based on NS2 is used in evaluation. The NS2 instructions can be used to define the topology structure of the network and the motion mode of the node, to configure the service source and the receiver to create to create the statistical data traffic file and so on.

2) Traffic Model:

Data traffic sources of continuous bit rate (CBR) are used. The network contains source destination pairs in a random basis. The total byte data packets are Only 512 byte .

3) Mobility Model:

in rectangular field, it uses the random waypoint model. The field configuration used is 500m x500m with 50 nodes. The nodes are capable to move. Once the destination is reached another random destination is started with a pause the pause time affect the relative speed of mobile, varied.

V. PERFORMANCE MATRICES:

1) NUMBER OF NODES VS THROUGHPUT

AODV has shown higher throughput than DSR and DSDV .the throughput was calculated at destination node during entire simulation period. The number of nodes was varied each time in fig1.

In terms of routing packets AODV has much more routing packets than DSR because the AODV avoids loop and freshness of routes while DSR uses stale routes. Its throughput is higher than other two routing protocols at high mobility. The table no.1. represents the throughput for no. of nodes with respect to MANET protocol. The graphical representation made in fig.no.2

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Fig.1 number nodes variation dynamically

MANET Protocol	Throughput for no. of nodes			
	5	10	15	20
DSDV	10.8	90.8	241.8	509.68
DSR	10.72	72.37	206.99	368.44
AODV	40.91	431.39	1639.73	3759.79

Tabel.1. Throughput for no of nodes

No of nodes Vs Throughput

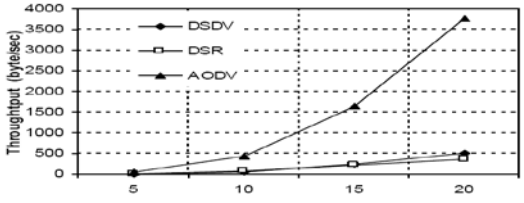

Fig 2. Nodes Vs throughput

NO. OF NODES VS PACKET DROP

A packet is dropped in two cases: the buffer is full when the packet needs to be buffered and the time that the packet has been buffered exceeds the limit. Packet dropping was observed for several nodes and varied the nodes each time and the dropped was counted at destination node during entire simulation period. The comparison of nodes vs packet drop shown in table no.2.

MANET Protocol	Packet drop for no. of nodes			
	5	10	15	20
AODV	13	12	12	11
DSR	10	8	9	10
DSDV	11	17	6	12

Tabel.2. Packet drop for no. of nodes

Packet dropped at different nodes

Efficient protocols can wisely find out routing direction thus packets dropping rate reduces for them. The packet dropped for DSR is less than that of DSDV and AODV as it outperforms with fewer nodes and no periodic update is maintained in DSR.

The fig 3 shows the graph of packet dropped at different nodes.

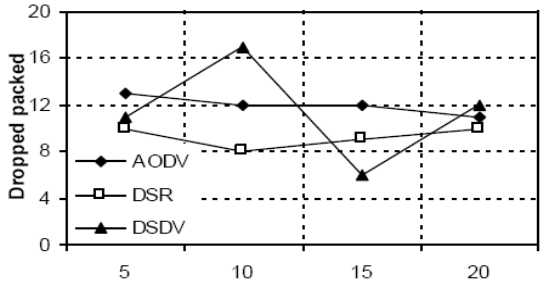

Fig 3.Packet drop over of node

THROUGHPUT VS SIMULATION TIME

Throughput was gained at destination node against various dimension of network and varied the simulation time uniformly for each protocol whose measure was as in fig Throughput is the average rate of successful message deliver over a communication channel. This data may be deliveredover a physical or logical link, or pass through a certainnetwork node. The throughput is usually measured in bits persecond (byte/sec), and sometimes in data packets per secondor data packets per time slot. This is the measure of how soonan end user is able to receive data. It is determined as the ratioof the total data received to required propagation time. Ahigher throughput will directly impact the user's perceptionof the quality of service. The table 3.shows throughput at different delays.

MANET Protocol	**Throughput at delay**						
	10 ms	20 ms	30 ms	40 ms	50 ms	60 ms	70 ms
AODV	0	53	68	68	68	84	84
DSR	0	37	56	80	80	80	80
DSDV	12	52	79	99	114	150	183

Table 3.Throughput at different simulation delays

DSDV has higher throughput than AODV and DSR because of avoiding the formation of loops and it uses stale routes in case of broken links. The rate of packet received for AODV is better than the DSDV because this periodic broadcast also add a large overhead into the network. For AODV, the routing overhead is not likely affected as generated in DSDV. For AODV, it shows significant dependence on route stability, thus its throughput is lower when the time decreased. Throughput vs simulation time is represented in graphically in fig.3.

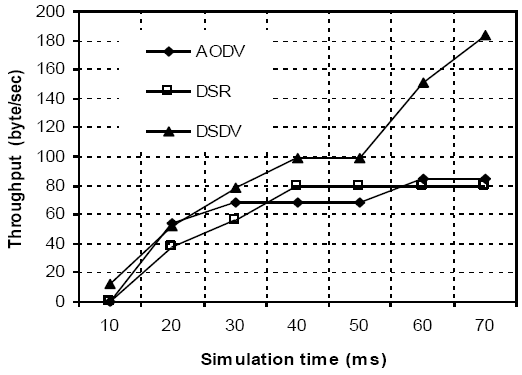

Fig 3. Throughput Vs simulation time

VI. CONCLUSION:

Performance of routing protocols has carried out on DSDV and on demand AODV and DSR. Both AODV and DSR perform better than the DSDV protocol. AODV and DSR are on demand protocols but their mechanism varies and thus performance also. AODV use routing table where as DSR use source routing and route catch.

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