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PERFORMANCE EVALUATION OF DSR WITH MOBILITY MODELS

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ABSTRACT

Topology and mobility in a Mobile Ad Hoc Network (MANET) is a key factor that affects the performance of the protocol. Research in the field of MANET is usually done by using simulation. Among other simulation parameters, the model of mobility plays a very important role in determining the performance of the protocol in MANET. This research present Manhattan mobility model in reactive routing protocols DSR with Random Waypoint than that already exists in the network simulator NS2. Performance comparison was done with a variety of nodes, different simulation speed and area. QOS parameters used and analyzed included packet delivery ratio and average end-to-end delay. The research result shows that the performance of DSR routing protocol with mobility was affected two models vary across different mobility models showed with Packet Delivery Ratio fairly stable (between 90 to 100) and there were some improvements in certain simulations, and the value of Average End To End Delay increases and decreases in accordance with certain simulation models used mobility.

Keywords: MANET, DSR, mobility models, random waypoint, manhattan

INTRODUCTION

In mobile ad hoc network, nodes do not rely of any existing infrastructure.instead, the nodes themselves form the network and communicate through means of wireless communications. Mobility causes frequent topology changes and may break existing paths (M. Sreerama Murty, et al., 2011).

The mobility model is designed to describe the movement pattern of mobile users, and how their location, velocity and acceleration change over time. Since mobility patterns may play a significant role in determining the protocol performance, it is desirable for mobility models to emulate the movement pattern of targeted real life applications in a reasonable way. Otherwise, the observations made and the conclusions drawn from the simulation studies may be misleading. Thus, when evaluating MANET protocols, it is necessary to choose the proper underlying mobility model (F. Bai, et al., 2004).

This research discussed how to analyze the performance of DSR routing protocol to the effect of node mobility models that exist in mobile ad hoc network. Previously had much to discuss protocols The DSR routing but still does not give clear results on the subject DSR routing protocol discussion of the influence of node mobility model. In this case the parameters used are: packet delivery ratio and average end to end delay.

Mobility Model

Different mobility models can be differentiated according to their spatial and temporal dependencies.

Spatial dependency*:* It is a measure of how two nodes are dependent in their motion. If two nodes are moving in same direction then they have high spatial dependency.

Temporal dependency*:* It is a measure of how current velocity (magnitude and direction) are related to previous velocity. Nodes having same velocity have high temporal dependency (Bhavyesh Divecha, et al., 2007).

To evaluate the performance of a protocol for an adhoc network, it is necessary to test the protocol under realistic conditions, especially including the movement of the mobile nodes. Since not many MANETs have been deployed, most of this research is simulation based. These simulations have several parameters including the mobility models and the communicating traffic pattern. MANET protocol performance may vary drastically across different mobility models. In the literature, there are a lot of models used, mostly in simulations. Among the common one is the Random Waypoint Model, which is a simple model that may be applicable to some scenarios. However, there are other mobility models that may be used to capture the more important mobility characteristics of scenarios that MANETs may develop (Rajesh Deshmukh, et al., 2010).

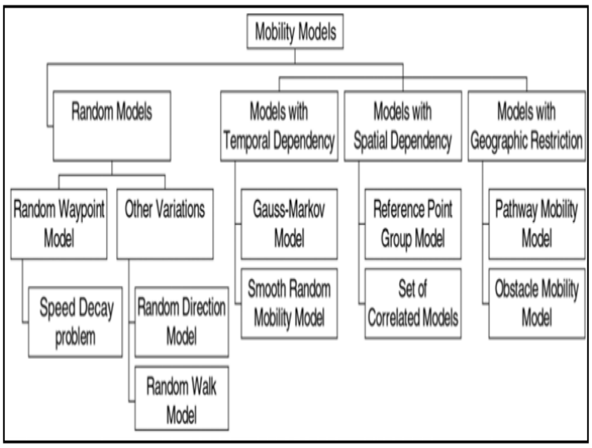

Figure-1. Category of mobility models

However, in the Figure-1, MANETs maybe used in different applications where complex mobility patterns exist. Hence, recent research has started to focus on the alternative mobility models with different mobility characteristics.

Random Waypoint

In Random Waypoint each mobile node moves independently of others. Due to physical constraints of the mobile entity itself, the velocity of mobile node will change continuously and gently instead of abruptly, i.e. the current velocity is dependent on the previous velocity. However, intuitively, the velocities at two different time's slots are independent in the Random Waypoint model. In many cases the movement of a mobile node may be restricted along the street or afreeway. A geographic map may define these boundaries (Sunil Kumar Singh, et.al.,2013).

Manhattan

In the Figure-2. Manhattan models including mobility model Pathway or track. Force mobility model lines each mobile node to move along the shortest path to that destination. Similar behavior is also modeled in mobility models Freeway and the Manhattan mobility model in (F. Bai, et al., 2003). Manhattan mobility model is proposed to model the movement in urban areas. In the model of Manhattan, a mobile node is allowed to move along the horizontal or vertical on a city map. At the intersection of the horizontal and vertical road, the mobile node can turn left, right or straight. The probability of moving on the same road is 0.5, the probability of turning left is 0.25 and the probability of a right turn is 0.25. Speed mobile node at a time slot depends on the speed at the previous time slot. Also, the speed of the node is limited by the speed of the previous node in the same lane of the road.

Manhattan mobility model focuses on the node moves along horizontally or vertically, which is not enough to model the nodes move along the path of non-horizontal and non-vertical. In addition, Manhattan model is not suitable to model the movement occurred at the intersection of the highway system, is much more complex than a local road junction. Thus, Manhattan mobility model that is expected to have a high spatial dependence and high temporal dependence. On top of that, it also imposes restrictions on the mobility of nodes geographically, although giving flexibility to the node to change direction (Rajesh Deshmukh, et al., 2010)

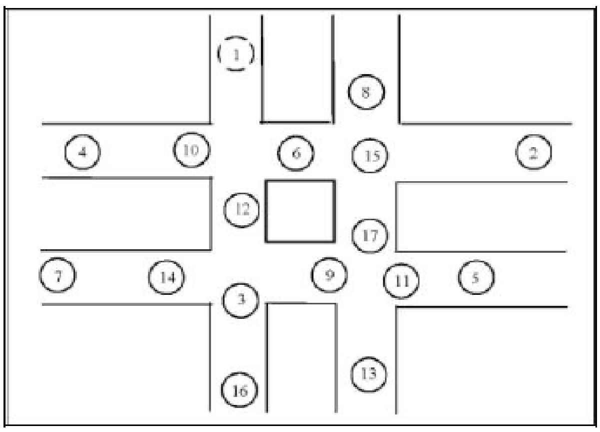

Figure-2. Topography showing the movement of nodes for Manhattan mobility model

DSR

The Dynamic Source Routing protocol is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. Using DSR, the network is completely self-organizing and self-configuring, requiring no existing network infrastructure or administration. Network nodes cooperate to forward packets for each other to allow communication over multiple "hops" between nodes not directly within wireless transmission range of one other (V.Ramesh, et al., 2010). In the Figure-3, 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

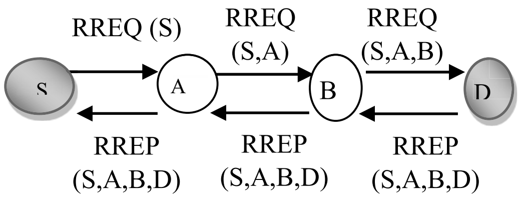

Figure-3. DSR protocol mechanism

The advantage of using DSR protocol are at intermediate nodes do not have to maintain it up to date information on the current routing packets skipped, because each packet always contains routing information in its header. Routing This type of process also removes also the route advertisement periodic and neighbor detection run by routing on other ad hoc networks. Compared with other on-demand routing protocol routing DSR has the best performance in terms of packet delivery ratio, Normalized Routing Load (on the package) and the average length of the path. Use of this would be optimal routing on a small number of nodes or less than 200 nodes.

Limitations DSR protocol is to build and depend on the route that unipath for each data transmission. Whenever there is a path that fails on the route, the DSR routing protocol needs to do a new route search process. This leads to high routing load and has a delay which is bad for the search process for a new route. For larger quantities would result in collisions between packets and cause increasing delay at the time of going to establish a new connection.

METHODOLOGY

Simulations was carried out by the Network Simulator NS 2.35. In the simulations used two different network sizes are: 500x500 m^2 and 1000x1000 m^2. In the Table-1, the following parameters in the simulation more:

Table-1. Simulation parameters

Parameter	Value
Mobile nodes	20,30,40,50
Simulation time	240,500 sec
Pause Time	20 sec
Number of connections	10
Transmission range	250m
Traffic size	CBR
Packet Size	512 byte
Maximum Packet	50
Maximum movement speed	20 m/s

Parameter	Value
Packet rate	1 p/s
Antenna Type	Omnidirectional
Network Size	500x500m^2, 1000x1000m^2
Mobility model	Random Waypoint, Manhattan

We have used following two performance metrics :

Packet Delivery Ratio (PDR) - the ratio of total number of packet successfully received by the destination node to the number of packet generated by the source node. A high value of PDR indicates that most of the packets are being delivered and is a good indicator of the protocol performance.

$$PDR = (Pr/Ps) * 100 \quad (1)$$

Average End to End Delay - includes all possible delays caused by buffering during route discovery latency, queuing at the interface queue, and propagation and transfer times of data packets..

$$D = (Tr - Ts) \quad (2)$$

RESULTS

1. Comparison between the random waypoint and Manhattan with simulation time 240 sec.
   Random Waypoint
   Table-2. Random waypoint with area of 500x500 m^2

Node	PDR	Delay
20	98.69	52.84
30	98.14	50.88
40	97.18	124.91
50	98.23	18.66

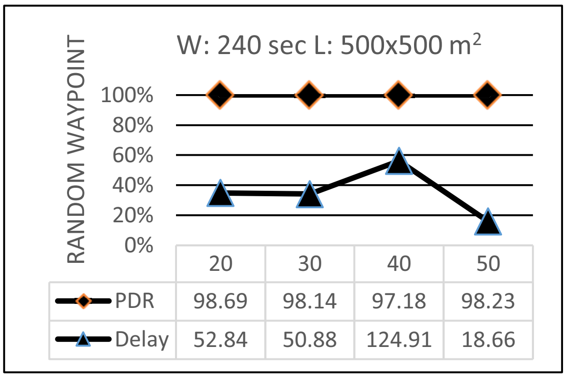

Figure-4. Random waypoint with simulation time 240 sec and area of 500x500 m^2

Table-3. Random waypoint with area of 1000x 1000 m^2

Node	PDR	Delay
20	90.83	2430.33
30	97.01	584.83
40	91.96	105.38
50	92.13	107.28

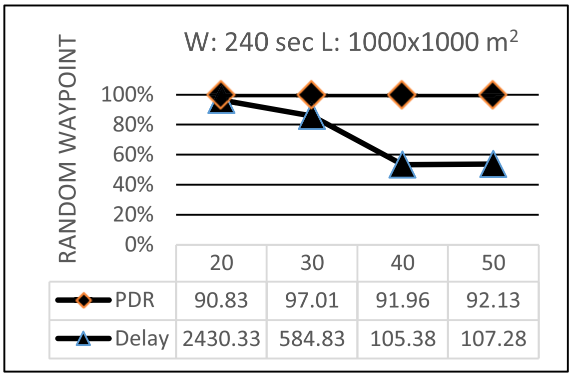

Figure-5. Random waypoint with simulation time 240 sec and area of 1000x1000 m^2

Manhattan
Table-4. Manhattan with area of 500x500 m^2

Node	PDR	Delay
20	99.53	282.13
30	99.95	9.45
40	100	11.49
50	99.90	9.23

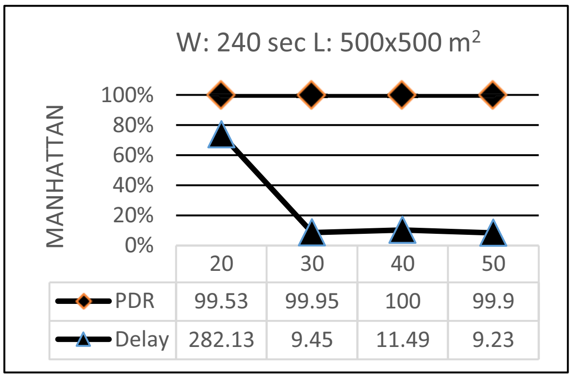

Figure-6. Manhattan with simulation time 240 sec and area of 500x500 m^2

Table-5. Manhattan with simulation time 240sec and area of 1000x1000 m^2.

Node	PDR	Delay
20	49.29	732.09
30	63.98	412.14
40	95.69	906.13
50	98.85	31.81

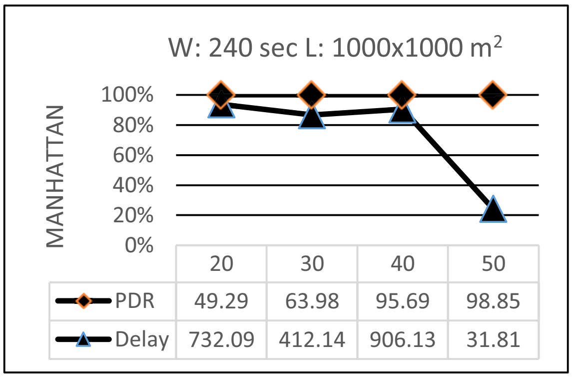

Figure-7. Manhattan with simulation time 240 sec and area of 1000x1000 m^2

2. Comparison between the random waypoint and Manhattan with simulation time 500 sec.
   Random Waypoint

Table-6. Random waypoint with area of 500x500 m^2

Node	PDR	Delay
20	98.89	53.70
30	99.31	57.43
40	98.73	25.03
50	99.58	117.33

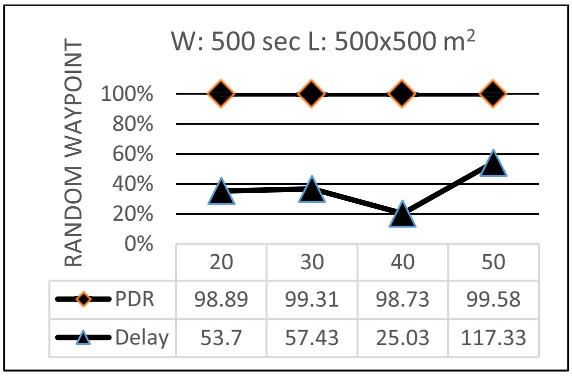

Figure-8. Random waypoint with simulation time 500 sec and area of 500x500 m^2

Table-7. Random waypoint with area of 1000x 1000 m^2

Node	PDR	Delay
20	94.98	2605.51
30	94.23	775.57
40	96.46	314.48
50	94.69	307.68

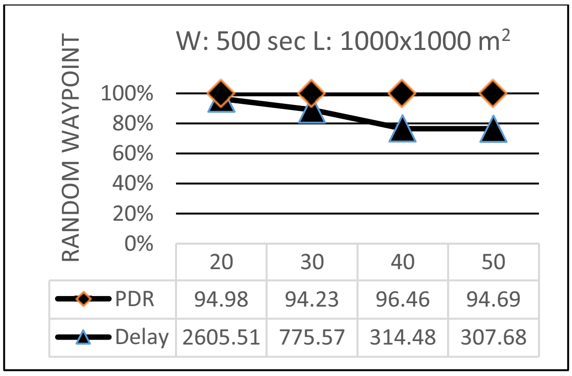

Figure-9. Random waypoint with simulation time 500 sec and area of 1000x1000 m^2

Manhattan

Table-8. Manhattan with area of 500x500 m^2

Node	PDR	Delay
20	100	12.10
30	99.91	11.99
40	99.93	8.25
50	99.39	19.15

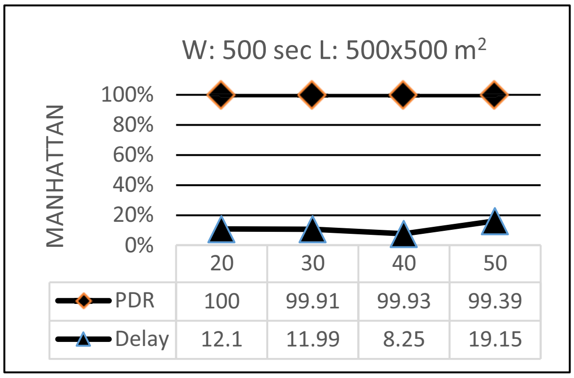

Figure-10. Manhattan with simulation time 500 sec and area of 500x500 m^2

Table-9. Manhattan with area of 1000x1000 m^2.

Node	PDR	Delay
20	77.74	1542.79
30	62.39	2466.67
40	91.96	1068.68
50	99.15	103.36

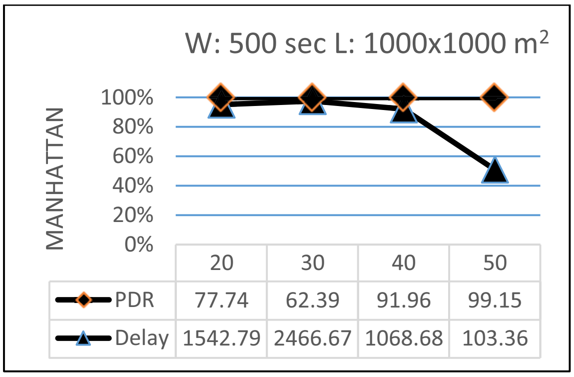

Figure-11. Manhattan with simulation time 500 sec and area of 1000x1000 m^2

DISCUSSIONS

By the time of 240 sec, random waypoint (Tables 2 and 3) and manhattan (Table 4 and 5) PDR greater mobility of manhattan is 99.84 compared with the random waypoint mobility in the area 500x500m^2. With a time of 500 sec, random waypoint (Table 6 and 7) and manhattan (Tables 8 and 9) PDR greater mobility of manhattan is 99.82 compared with the random waypoint mobility is on the area 500x500m^2 and the average delay is the smallest 12.87. The average delay is most likely in the area of mobility manhattan at 1000x1000 m^2 with a time of 500 sec that in 1295, 38.

This research by DSR experiences the lowest routing protocol overhead, on the count of higher average delays, particularly with Manhattan models, at higher node speeds. This protocol performs best with the random waypoint model.

CONCLUSIONS

In this paper we performed the simulation to evaluate the performance of DSR routing protocols on different performance metrics i.e. packet delivery ratio and end to end delay under the different mobility models with varying of mobile nodes number and network size.

From the different analysis of graph and simulations it can be conclude that performs of DSR in Manhattan mobility model is better than Random Waypoint. Under Manhattan mobility model, DSR experience the highest Packet Delivery Ratio and the lowest average end to end delay with the increase of mobile nodes number, simulation time, and network size.

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