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Simulation Based Performance Comparison of MANET Routing Protocols Using Different Mobility Models and Node Density

Renu Bahuguna *
Department of Computer Science & Engg.
Doon Institute of Engg. & Technology
Rishikesh, India

Hardwari Lal Mandoria
Department of Information Technology
G. B. Pant University of A&T
Pantnagar, India

Abstract - A variety of routing protocols for MANET have been developed by network researchers and designers primarily to improve the performance of MANETs with respect to correct and efficient route establishment between a pair of nodes for message delivery. In this paper, a performance comparison of routing protocols DSDV, DSR and AODV is presented, which is focused on metrics such as packet delivery ratio, throughput, and end to end delay. Three mobility models (Random Waypoint Mobility Model, Gauss Markov Mobility Model and Manhatton Mobility Model) were used for performance analysis under varying number of nodes. From the simulation results it is clear that in terms of throughput and end to end delay results are vary, according to routing protocols, mobility models and number of nodes and in terms of Packet Delivery Ratio overall performance of DSR is better than DSDV and AODV using varying number of nodes and mobility models. We simulate protocols with NS2 simulator and based on observations, we make recommendations about when the performance of either protocol can be best.

Keywords: MANET, Mobility model, Routing Protocols, Bonn motion, NS2.

I. INTRODUCTION

The ability to communicate with people on the move has evolved remarkably since Guglielmo Marconi first demonstrated radio's ability in 1897, to provide continuous contact with ships sailing the English Channel. Wireless communication is one of the most active areas of technology development of our time. MANET [1] is a self-organizing and self-configuring multi-hop wireless network. The nodes in MANET move randomly, resulting in rapid and unpredictable changes in network topology.

Routing protocols use several metrics as a standard measurement to calculate the best path for routing the packets to its destination that could be number of hops, which are used by the routing algorithm to determine that optimal path for the packet to its destination.[3,4]

II. GENERATION OF MOBILITY MODEL

Bonn Motion [2] is a Java based tool which creates mobility scenarios. It is developed within the Communication Systems group at the Institute of Computer Science IV of the University of Bonn, Germany, where it serves as a tool for the investigation of mobile ad hoc network characteristics.

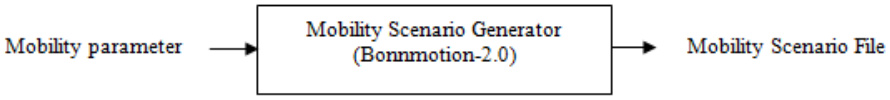

Fig. 1 mobility scenario generation

A. Syntax: Random Waypoint, Manhattan Grid and Gauss Markov Scenario generation[2]

$ bm -f rwp Random Waypoint -n 20 -d 900 -i 3600 –x 2000 –y 2000 …(1)
$ bm -f manht Manhattan Grid -n 20 -d 900 -i 3600 –x 2000 –y 2000 –u 2 –v 3 …(2)
$ bm -f gmm GaussMarkov -n 20 -d 900 -i 3600 –x 2000 –y 2000 …(3)

Switches

-n	number of nodes
-d	mobility duration
-i	initial phase to be skipped
-x and –y	mobility area

This creates a Random Waypoint scenario with 20 nodes and duration of 900 seconds. An initial phase of 3600 seconds is cut off. As a result following two files are created:

(1) "rwp.params" (Contains mobility parameter)
(2) "rwp.movements.gz" (contains the (gzipped) movement data)

Similarly we have implemented Random Waypoint, Manhattan Grid and Gauss Markov Mobility Models for node density 30 and 40 as shown in equation (1),(2),(3) and resultant mobility scenario files are shown below in TABLE I

TABLE I Mobility Scenario files

Mobility Model	Resultant Mobility scenario files
Random Waypoint	rwp.params rwp.movements.gz
Manhattan Grid	manht .params manht.movements.gz
Gauss Markov	gmm.params gmm.movements.gz

As the above mentioned files are not compatible with NS-2, they need to be converted according to NS-2.

B. Converting scenarios for NS-2.34 [2]

$ bm NSFile -f rwp –b 100 …(4)

$ bm NSFile -f manht –b 100 …(5)

$ bm NSFile -f gmm –b 100 …(6)

-b 100 adds an additional margin around the simulation area, because ns-2 versions up to 2.34 crash when nodes move at the border of the simulation area. As we are using ns2 for simulation so using equation (4), (5) and (6) we get the Converted scenario files which is compatible with used simulator.

TABLE II NS-2 Compatible Scenario Files

Mobility Model	Converted scenario files
Random Waypoint	rwp.ns_params rwp.ns_movements
Manhattan Grid	manht .ns_params manht.ns_movements
Gauss Markov	gmm.ns_params gmm.ns_movements

III. SIMULATION TOOLS AND PARAMETER

Simulation tool NS2 we are using for simulation.we used different node density for the simulation and all the required parameters which we are using into the simulation work are listed below in the table.

TABLE III Scenario for NS-2 topology

Parameter	Value
Simulation Time	1500 s
No. of simulated Nodes	20,30,40
Area size of topography x(m) X Y(m)	2000 x 2000 m
Traffic type	FTP
Packet size	40-1500 Bytes
Simulated Routing Protocols	AODV,DSDV and DSR
MAC Layer Protocol	IEEE 802.11
TCP source	Node(1)
TCP destination	Node(20),(30),(40)

IV. RESULTS AND ANALYSIS

In this section we present our simulation efforts to evaluate and observations that compare the performance of MANET routing protocols.

A. Performance Metrics

While comparing the protocols, we chose the following metrics :

- **Throughput:** It is defined as total number of packets received by the destination.

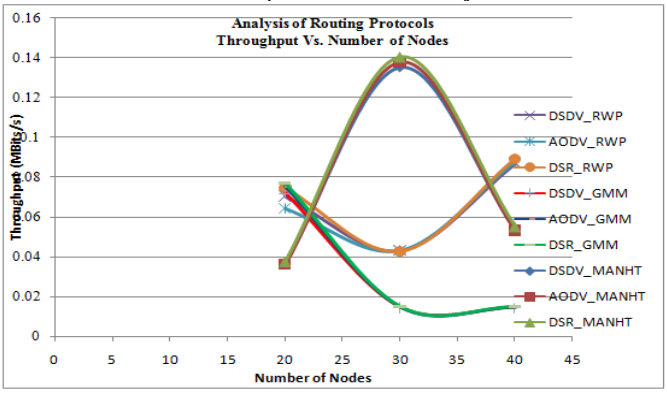

Fig. 2 analysis of throughput of dsdv, aodv and dsr (throughput vs. number of nodes)

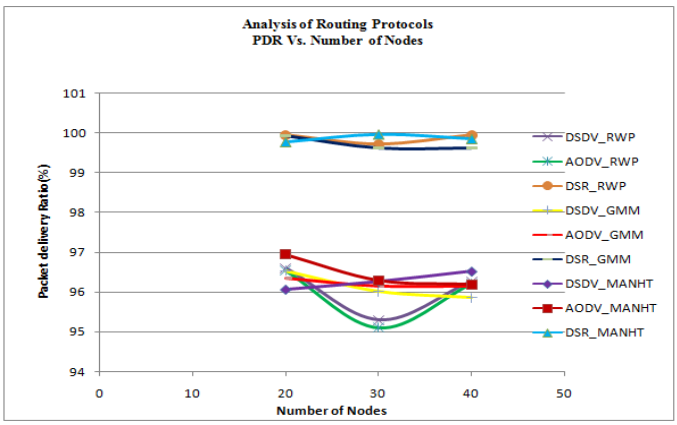

Fig. 3 analysis of pdr of dsdv, aodv and dsr (pdr vs. number of nodes)

- **Average Delay:** Average amount of time taken by a packet to go from source to destination.
- **Packet Delivery Ratio**

It is the ratio of data packets delivered to the destination to those generated by the sources. It is calculated by dividing the number of packet received by destination through the number packet originated from source.

PDF = (Pr/Ps)*100, Where Pr is total Packet received & Ps is the total Packet sent.

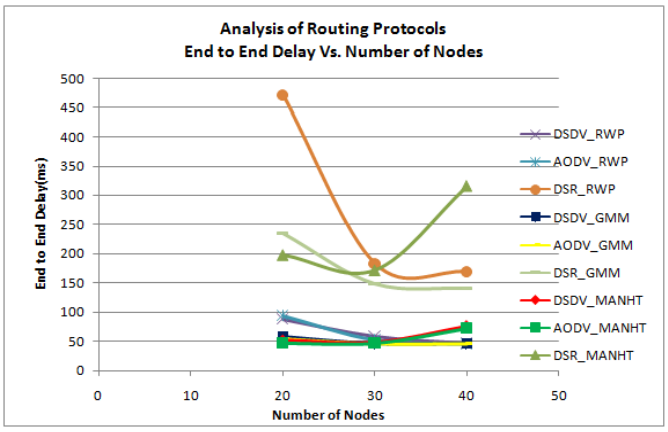

Fig. 4 analysis of end to end delay of dsdv, aodv and dsr (end to end delay vs. number of nodes)

V. CONCLUSION

We presented a comparison of AODV, DSDV and DSR(as shown in fig. 2 to 4). The performance of these protocols is analyzed with NS2 simulator using scenario of 20, 30, 40 nodes. The observations are made with three different mobility models. After analysis in different situations of network that in terms of throughput and end to end delay results are vary, according to routing protocols, mobility models and number of nodes , while DSR is proved to be best in case of Packet delivery ratio. Fig. 2 to 4 shown the performance of routing protocols (AODV, DSDV and DSR) using throughput, packet delivery ratio and end to end delay (different performance matrices). Future work should compare other routing protocols also.

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