Evaluation of Mobility Model with MANET Routing Protocols

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ABSTRACT
MANET is class of an emerging technology of ad hoc networks. Ad hoc networks can be built around any wireless technology, including infrared, global positioning system (GPS), radio frequency (RF) and so on. Each node in a MANET is free to move freely in any direction, and therefore it will change its links to other devices frequently. Mobility model shows how the speed and direction of a node changed over the time according to given pattern of mobility. In this paper, various mobility model with routing protocols of ad hoc networks are studied.

General Terms
Ad hoc Network

Keywords
Manet, Routing protocols, RWPMM, RWMM, RDMM.

1. INTRODUCTION
During the last decades, there has been a rapidly increasing interest in communication technologies of wireless networks. Manet is one of the most popular wireless networks. MANET is a collection of communication nodes that wish to communicate with each other, but it has no fixed infrastructure and no predetermined topology of wireless links.

Even though a WSN is usually considered as an ad hoc network in which nodes are extended with sensing capability, a mobile WSN and a mobile ad hoc network (MANET) are basically different. Mobility in a MANET is often arbitrary, whereas mobility in a mobile WSN should be intentional. In other words, the movement of mobile sensors to conduct different missions can be controlled [2].

2. ROUTING PROTOCOLS
Routing is the process of transferring information from a source to a destination in an internetwork. At least one intermediate node within the internetwork is found during the transfer of information. Basically two activities are involved in the concept: determining optimal routing paths and transferring the packets through an internetwork. The transferring of packets via an internetwork is called as packet switching which is straight forward, and the path determination could be very complex.

According to routing strategy routing protocol can be classified as Table Driven Source Initiated and Hybrid.

Table 1. Comparison Of Protocols

Comparative Study of Basic Protocols		
Protocols	**Merits**	**Demerits**
Proactive	Predefine Routes are always available.	Use large portion of networks (Overhead is high).
Reactive	Overhead is low and use small portion of network capacity	Long Delay and excessive control traffic
Hybrid	Provide features of both Proactive and Reactive (Use full for Large Network)	Increase Complexity.

3. MOBILITY MODEL
Mobility models are used to simulate and calculate the performance of mobile wireless systems and the algorithms and protocols on the basis of them. [4] Two types of mobility models are used in the simulation of networks: Realistic and nonrealistic models. Realistic are the mobility patterns that are observed in real life systems. It is also known as group/traces model. They provide accurate information when they involve a large number of nodes and an appropriately lengthy observation time. Whereas, new network environments like ad hoc networks are not easily modeled if traces have not yet been created. In this type of application it is necessary to use nonrealistic models. Generally known as Random mobility models .These models attempt to realistically represent the behaviors of MNs without the use of traces [5]. In this, routing protocols from reactive, proactive as well as hybrid categories for comparison of performance of routing protocols is observed in non-realistic mobility model are used.

3.1 Classification of Mobility Model
Mobility models are classified from different aspects. In a popular classification, they are divided into two categories of Realistic and Nonrealistic (random), based on the similarity of node movement to its movement in real environment.

3.2 Realistic Mobility Model
Unlike Nonrealistic models, in realistic models some limitations are imposed on node movement. The restrictions may be due to environmental obstacles, such as buildings, or to the rules made for node movement such as moving in fixed pathways. The rules are made to make node movement more similar to real nodes. [6]

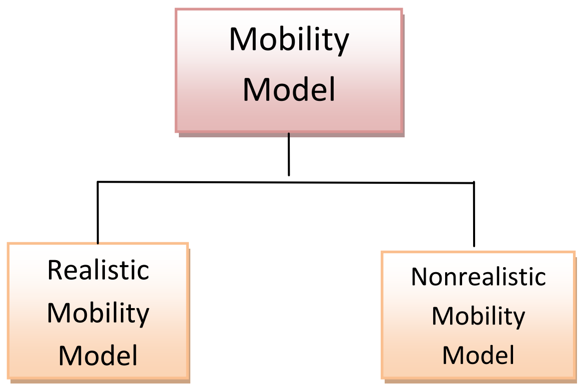

Fig1. Hierarchy of Mobility Model

3.2.1 Column Mobility Model (Cm)
This model represents a set of MNs that have formed a line and are uniformly moving forward in a particular direction. Let as consider a row of soldiers marching together towards their enemy. Each soldier stands next to his acquaintances while marching in a uniform manner [7].

3.2.1.1 Pursue Mobility Model (Pm)
Pursue Mobility Model attempts to represent MNs tracking a particular target. For example, this model represents police officers attempting to catch an absconded criminal or a swarm of bees attempting to attack a careless camper who inadvertently disturbed their dwelling.

3.2.1.2 Nomadic Community Mobility Model (Nm)
Nomadic Community Mobility Model, is useful for representing both agricultural and military situations. Just as ancient nomadic societies moved from position to position, this model represents groups of MNs that collectively move from one position to another [8].

3.2.1.3 Reference Point Group Mobility Model (Rpgm)
Reference Point Group Mobility (RPGM) model, which represents a random motion of a group of MNs furthermore a random motion of each individual MN within the group. Path traveled by a logical center choose the movements of MN in group, which may be pre-defined a group motion vector, GM represents this motion of group nodes. Reference points movements depend on the group movement. [9]

3.2.1.3.1 In-Place Mobility Model
The In-place Mobility Model is used to partition a given geographical area. Each and every subset of the original area is assigned to a specific group, each group operates only within their geographic subset. This model is useful for simulating situations in which groups of people, that have similar goals, are assigned to restricted areas.

3.2.1.3.2 Overlap Mobility Model
The second variation of the RPGM model is the Overlap Mobility Model. The Overlap Mobility Model simulates several different groups; each of them has different tasks, working in the same geographic area. Each group within this model may have varying characteristics than other groups within the similar geographical boundary.

3.2.1.3.3 Convention Mobility Model
The last variation of the RPGM model described in is the convention scenario. In this scenario, both the conference attendees and the revelations are represented. In addition, different revelations are housed in different rooms. These rooms are connected to offer travel between exhibits. Also, the Convention Mobility Model divides a given area into smaller subsets and allows the groups to transfer in a similar pattern throughout each subset.

3.3 Nonrealistic Mobility Model
This group of models considers node movement completely randomly. Neither environmental factors, such as buildings, nor non-environmental factors like movement rules can limit the node mobility. Mobility Models that are used commonly is non-realistic environments are Random Waypoint, Random walk, Random Direction Different Nonrealistic entity mobility models for adohc networks are:

3.3.1 Random Way Point Mobility Model (Rwpm)
A model that includes pause times between changes in destination and speed. The Random Waypoint Model was proposed by Johnson and Maltz [10]. It is very popular model in modern research. At every instant, a node randomly chooses a destination and moves towards it with a velocity chosen randomly from a uniform distribution [0,V_max], where V_ max is the maximum acceptable speed for every mobile node .The node take pause for a duration defined by the 'pause time' though reached at the destination. After this session, it again select a random destination and repeats the whole process until the simulation ends [11].

3.3.2 Random Walk Mobility Model (Rwm)
In this mobility model, a mobile node moves from its current location to a new location by randomly selecting a direction and speed in which to travel. The new speed and direction are both selected from pre-defined ranges, respectively *[min-speed, max-speed]* and *[0, 2*pi]* respectively. Each AND every movement in the Random Walk Mobility Model occurs in either a constant time interval *t* or a constant traveled distance d, at the end of this; a new direction and speed are calculated. If the node moves according to the above rules and reaches the boundary of simulation field, the leaving node is send back to the simulation field. [12] This effect is called border effect.

3.3.3 Random Direction Mobility Model (Rdm)
A model that forces MNs to travel to the edge of the simulation area before changing direction and speed. This model was created to overcome the problem i.e. clustering of nodes in one part of the simulation area, that was produced by Random way point model. Random Direction model has many similarities with Random walk model. Selection of random direction to which MNs travel similar to the Random walk mobility model. [13]

3.3.4 Gauss-Markov Mobility Model (Gmm)
A model that uses one tuning parameter to vary the degree of randomness in the mobility pattern. The Gauss-Markov Mobility Model was first introduced by Liang and Has and widely utilized. In this model, the velocity of mobile node is assumed to be correlated over time and modeled as a Gauss-Markov stochastic process. When the node is going to travel beyond the boundaries of the simulation field, the direction of node is forced to flip 180 degree. This way, the nodes are repelled from the boundary of simulation field [14].

3.3.5 Manhattan Grid Mobility Model (Mgm)
Manhattan model used to emulate the movement pattern of mobile nodes on streets defined by maps. It can be useful in

modeling movement in an urban area where a pervasive computing service between portable devices is provided. Maps are used in this model too. However, the map is composed of a number of horizontal and vertical streets. The mobile node is allowed to move along the grid of horizontal and vertical streets on the map. At an intersection of a horizontal and a vertical street, the mobile node can turn left, right or go straight with certain probability. Except the above difference, the inter-node and intra-node relationships involved in the Manhattan model are very similar to the Freeway model.

4. EXPERIMENTAL SETUP

The simulations models are developed and used are performed in four routing protocols DSDV,AODV,TORA and DSR. The simulation is performed for both routing protocol with Non Realistic mobility models In these models 50 Nodes and various parameter metrics in terms of packet delivery ratio, end to end delay, throughput and packet loss are taken for simulation.

Table 2. Simulation Parameter for NS2 Simulators

Parameter	Value
Terrain Region	1000 m X 1000 m
Routing Protocol	AODV, DSR, DSDV, TORA
Mobility Model	RWPM,RWM,RDM,GMM,MGM
Simulation Time	300 sec.
Pause Time	2 sec.
No. of Nodes	50
Traffic	CBR
Tool	Bonnmotion 2.0
Simulator	NS 2.35
O.S.	Fedora
Antenna	Omni Antenna
Network Interface	Phy/wirelessphy
MAC Protocol	MAC/802.11

The analyzed results from the particular trace file of the Non-realistic models over AODV,TORA, DSDV and DSR are assessed on the basis of some diligent metrics of routing protocol PDR, throughput, Average E2E Delay and Packet loss.

Table 3. Result for Random Way Point Mobility Model

Random Way Point Mobility Model				
Parameter → / Protocols ↓	PDR	Throughput	End to End Delay	Packet Loss
AODV	99.90	6917.49	10.60	0
DSR	100.00	7622.94	6.01	0
DSDV	100.00	7066.08	6.04	0
TORA	100.00	7053.88	6.05	0

Table 4. Result for Random Walk Mobility Model

Random Walk Mobility Model				
Parameter → / Protocols ↓	PDR	Throughput	End to End Delay	Packet Loss
AODV	99.70	7353.94	13.81	3
DSR	99.90	7593.79	6.04	1
DSDV	99.61	6880.38	5.97	4
TORA	97.53	7352.28	13.19	9

Table 5. Result for Random Direction Mobility Model

Random Direction Mobility Model				
Parameter → / Protocols ↓	PDR	Throughput	End to End Delay	Packet Loss
AODV	99.70	7353.94	13.81	3
DSR	99.90	7593.79	6.04	1
DSDV	99.61	6880.38	5.97	4
TORA	97.53	7352.28	13.19	9

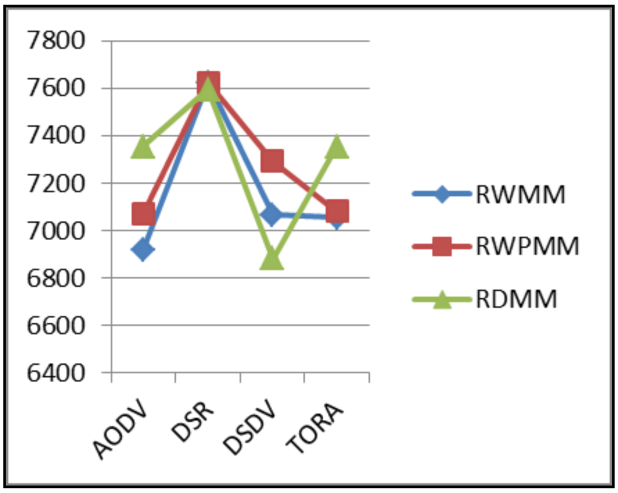

Fig2. Graph for Throughput

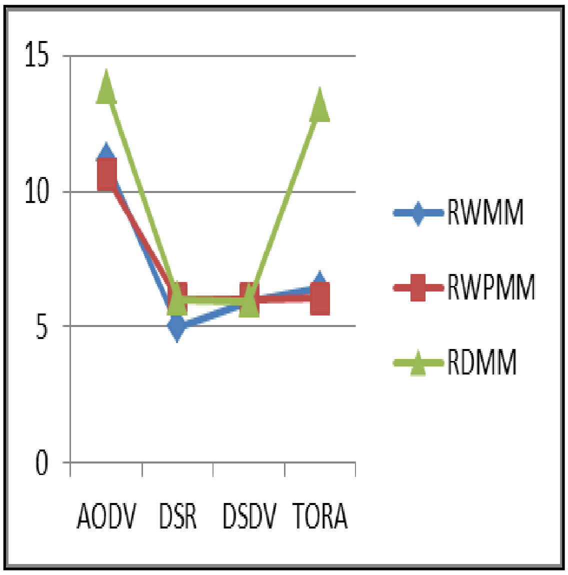

Fig3. Graph for E2E delay

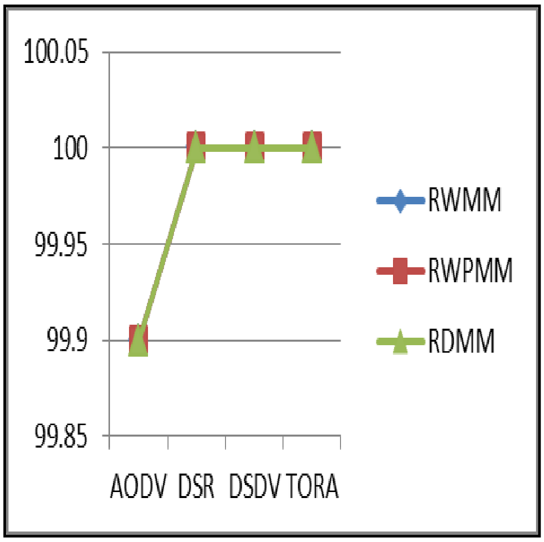

Fig4. Graph for PDR

5. CONCLUSION

In this paper performance of protocols measure individually over various type of Non-realistic Mobility Models. The observable percentage of parameters in non-realistic mobility models are quiet acceptable by DSR in terms of throughput. The results generated by AODV routing protocol is mostly similar to DSR but it suffer from End to End Delay .Performance of TORA is declined sharply as compared to others. The Average End-to-End Delay is observed very low by DSDV compared to other protocol results which are still is acceptable. On the basis of throughput and E2E, DSR perform better than others. In future, this study can be done to compare protocols performance in mobility models and performance of some other routing protocols of WSN. This work is also extends with other simulator tools of other networks like NS3, OPNET etc. The other progress of regular and continuing approach of future work can be Quality of Services (QoS) issues.

6. REFERENCES

[1] I. F. Akyildiz, W. Su, Y. Sankarasubramaniam, and E. Cayirci, (2002). "A sur- vey on sensor networks" IEEE Communications Magazine, vol. 40, no. 8, pp. 102–114.

[2] J. Rezazadeh, M. Moradi, and A. S. Ismail,(2012) "Mobile Wireless Sensor Networks Overview," IJCCN International Journal of Computer Communications and Networks, vol. 2, no. 1, pp. 17-22.

[3] A.G.A. Elrahim, H. A. Elsayed, S. H. Elramly, S. Member, M. M. Ibrahim, (2011). "A new Routing Protocol for Mobility in Wireless Sensor Networks," Multidisciplinary Journals in Science and Technology, Journal of Selected Areas in Telecommunications (JSAT), pp. 1-8.

[4] Muhammad Zaheer Aslam,Dr. Abdur Rashid, (2011). "Comparison of Random Waypoint & Random Walk Mobility Model under DSR, AODV & DSDV MANET Routing Protocols", International Journal of Advanced Research in Computer Science (IJARCS) ,pp. 381-386, ISSN 0976 – 5697, Volume 2 Issue1 Jan-Feb 2011.

[5] B.A.S Roopa Devi, Dr.J.V.R Murthy, Dr.G.Narasimha, (2014). " Impact of Different Mobility Models on AODV Protocol in MANET with NS-2.35 and Bonnmotion-2.1a" , International Journal of Advanced Research in Computer and Communication Engineering,pp. 8227-8231, ISSN (Online) : 2278-1021 ISSN (Print) : 2319-5940 Vol. 3, Issue 10, October 2014.

[6] V B Kute, Dr. M U Kharat, (2014). "Quality of Service Assessment of AOMDV for Random Waypoint and Random Walk Mobility Models" , International Journal of Computer Science and Mobile Computing,pp.199-203, ISSN 2320–088X,Vol.3 Issue.1, January 2014.

[7] R. Mohan,C. Rajan , Dr. N. Shanthi, (2015) "A Stable Mobility Model Evaluation Strategy for MANET Routing Protocols" , International Journal of Advanced Research in Computer Science and Software Engineering,pp. 58-65, ISSN: 2277 128X , Volume 2, Issue 12, December 2012.

[8] L Raja, Dr. S Santhosh Baboo, (2014). "Performance Analysis and Simulation of Reactive Routing Protocols (AODV, DSR and TORA) in MANET using NS-2", International Journal of Advance Research in Computer Science and Management Studies,pp. 256-263, ISSN:2327782(Online),Volume 2, Issue 8, August 2014.

[9] Pragya Gupta and Sudha Gupta, (2013). "Performance Evaluation of MANET Routing Protocols in Random Waypoint Mobility Model" , International Journal of Computer Applications, International Conference and Workshop on Emerging Trends in Technology,pp.25-30,ISSN : 0975 –8887 ,2013.

[10] M.K.Jeya Kumar and R.S.Rajesh, (2009). "Performance Analysis of MANET Routing Protocols in Different Mobility Models" , IJCSNS International Journal of Computer Science and Network Security, pp. 23-29, ISSN : 1738-7906, VOL.9 No.2, February 2009.

[11] Upneet Singh Kalra, Mohinder Singh, Shanu Malhotra, (2014). "Effect of Varying Mobility Model on routing protocols under different scalability and offered load over Wireless ad-hoc network" , International Journal of Advance Research in Computer Science and

Management Studies, ISSN: 2321-7782 (Online), Volume 2, Issue 5, May 2014.

[12] Towsley, D.," Mobility Models for Wireless Networks: Challenges, Pitfalls, and Successes",(2008). Published in: Principles of Advanced and Distributed Simulation, 2008. PADS '08. 22nd Workshop on, ISSN:1087-4097 , ISBN: 978-0-7695-3159-5, Publisher: IEEE, June 2008.

[13] M.K. Jeya Kumar and R.S.Rajesh," Performance Analysis of MANET Routing Protocols in Different Mobility Models", IJCSNS International Journal of Computer Science and Network

[14] B.A.S Roopa Devi1, Dr.J.V.R Murthy, G.Narasimha3, (2014) ." Impact of Different Mobility Models on AODV Protocol in MANET with NS-2.35 and Bonnmotion-2.1a", International Journal of Advanced Research in Computer and Communication Engineering, pp. 8227-8231, ISSN (Online) : 2278-1021 ISSN (Print) : 2319-5940 Vol. 3, Issue 10, October 2014.