International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 **Issue:** V **Month of publication:** May 2018

DOI: http://doi.org/10.22214/ijraset.2018.5304

Evaluation of Mobility Models with AODV & OLSR Protocol by Varying Node Speed in MANET

Smt. Rekha Shahapurkar[1], Dr. Umesh Kumar Singh[2], Sh. Yogesh Mishra[3]
[1]Reasearch Scholar, [2]Reader [3] Assistant ptofessor
[2]ICS, Vikram University, Ujjain
[3]Lokmanya Tilak Sc & Comm College

Abstract: A Mobile Ad-hoc Network (MANET) is a collection of mobile devices dynamically forming a communication network without any centralized control and pre-existing network infrastructure. Due to the presence of mobility in the MANET, the interconnections between stations are likely to change on a continual basis, resulting in frequent changes of network topology. Consequently, routing becomes a vital factor and a major challenge in such a network. This research aims to study the impact of mobility models with routing protocols on MANETs and thereby comprehensively analyzes their performance under varying node mobility rates. . In this research paper the main objective is to analyze, simulate and do a comparative analysis of different Mobility Model with MANET routing protocols namely AODV (Ad Hoc On Demand Distance Vector) and OLSR (Optimized Link State Routing). This paper will perform a comparison between these models considering the following performance metrics (Average End to End Delay, Throughput and Overheads with respect to different node Speed).
Keywords: MANET, AODV, OLSR

I. INTRODUCTION

In general, a Mobile Ad hoc Network (MANET) is a self-configuring network of mobile nodes connected by wireless links to form an arbitrary topology without the use of existing infrastructure. The nodes can move randomly at random speeds in random directions. Each node in the network acts as a router, forwarding data packets to other nodes. There are many routing protocols of MANET. Each routing protocols have their own pros and cons. But mobility of nodes in the MANET follows some movement models. These models are called as Node Mobility Models. The mobility model is mainly designed to describe the movement pattern of mobile users, and how their location, speed and acceleration change with respect to time. The movement pattern of MANET nodes is characterized by mobility models and each routing protocols exhibits specific characteristics for these models. The mobility model is the one that is used to describe the pattern in which mobile nodes move. Based on the mobility model being used, the performance of a routing protocol can varies. Relative performance of the protocol also gets affected with these models.

In [1] and [2], the performance of AODV, DSR, TORA and OLSR routing protocols were observed using random waypoint model for different area of networks and different network densities using simulators and they observe that AODV, DSR and OLSR were shown to have greater packet delay and network load in comparison of TORA, while TORA has lower throughput than AODV, DSR and OLSR. In heavy traffic environments and high congestion network scenarios, AODV works better than OLSR, DSR and TORA.

A simulation study on the performance of AODV and OLSR shows that both on-demand and table-driven routing protocols work well in networks with small traffic load. Scalability becomes a problem when the traffic load and the mobility increase in AODV. The proposed table-driven routing protocol OLSR, achieves better performance in terms of data packet delivery ratio, throughput, packet latency and routing overhead, under different traffic and mobility instances in [3]

In [4] routing protocols DSDV, OLSR and AODV are analyzed using network simulator Ns-2. The routing protocols were compared based on the packet delivery ratio, average end-to-end delay, routing load and routing overhead. Simulation results show that none of the protocol is a winner. Each protocol works best in certain network. At low network load, AODV performs better whereas OLSR achieves better packet delivery ration in high network load. Similarly, in high mobility networks, OLSR performs better for some metrics.

In [5] the comparison of AODV, TORA and OLSR routing protocols of MANET. Protocols are compared based on the performance metrics like packet delivery fraction, throughput and end to end delay. In this study, mobile ad ho c network has the ability to deploy a network where a traditional network infrastructure environment cannot possibly be deployed. With the importance of MANET comparative to its vast potential it has still many challenges left in order to overcome. Performance comparison of routing protocol in MANET is one of the important aspects. In these, the behavior and different performance matrices for MANETs using different protocols. (AODV, OLSR and TORA) are analyzed and compared their performance matrices, like End to end delay, Packet delivery Fraction and Throughput. For Throughput and PDF, AODV behaving the best and for End to End delay is concern TORA is taking less delay.

The performance evaluation of routing protocols AODV, DSDV, OLSR and TORA was done by simulator NS2. These routing protocols are compared based on the results of different parameters such as throughput, control overhead, packet delivery ratio and end to end delay [6]. It is concluded that DSR protocol is the best in terms of average packet delivery ratio. For high mobility conditions of nodes DSR gives a better packet delivery ratio than other protocols making it suitable for highly mobile random networks. Similarly for network size analysis it is observed that the DSR protocol outperforms other protocols if the network size is less. And if packet delivery ratio and throughput are the prime criteria, the OLSR protocol is the better solution for high mobility condition.

R. Rohankar, R. Bhatia, V. Shrivastava and D. K. Sharma analyzed the performance of various routing protocols for random mobility models of ad hoc networks. This analysis has been done with respect to end to end delay, packet delivery ratio and throughput. If mobility model is random waypoint, End to end delay for routing protocol AODV is less if number of nodes are less, but it increases with increases number of nodes. In second case if mobility mode random direction is used then the highest delay is generated for less number of nodes and delay decreases when the number of nodes is increases. Random waypoint model out performs both random direction and random walk in calculating the throughput which measured the hopes performed by each packet. The lowest throughput of random direction mobility model contributes the higher delay because of more number of hop. For packet delivery ratio random waypoint model perform better than other. All mobility models decreased significant with the increasing of number of nodes. For the next routing protocol DSR, when random waypoint mobility model and random walk is used end to end delay is lowest. And it decreases in random direction with the increases number of nodes. For the delivering of data packets to the destination random mobility model and random walk perform better than the random direction mobility model [7]. At the end for the proactive routing protocols random walk outperforms, random waypoint. For reactive routing protocol, they have slight variations in the performance between random waypoint and random walk. Random direction performance was poor in case of both proactive and reactive routing protocols because of its behavior to travel to the border of simulation area in chosen random direction.

The work in [8] describes the characteristics of ad hoc routing protocols such as AODV, OLSR, and TORA based on the performance metrics such as packet delivery ratio, end-to-end delay , routing overhead by increasing number of nodes in the network and it proves that AODV and TORA performs well in dense networks than OLSR in terms of packet delivery ratio.

In [9], [10] OPNET modeler 14.5 is used to investigate the performance of routing protocols OLSR, AODV, DSR and TORA for various network sizes, node mobility and traffic load. Experimental results show that TORA shows better performance in medium and large-sized networks under high traffic loads. DSR is well suited for lower node mobility in small size networks. It also performs better at high node mobility in large networks. AODV was discovered to perform well in medium-sized networks at high traffic load. OLSR also performs comparatively better in many cases than others, in similar scenario, TORA exhibit a decrement in throughput than AODV and OLSR. In AODV, the routing decision is taken based on the distance reported with respect to the reply-associated with the destination sequence numbers.

From previous work in this field it is concluded that different mobility models could lead to variation in the performance of protocol. Different parameters like throughput, overhead, data drop, delay etc. of a protocol can vary extensively when used with different mobility models.

A specific model captures only one of the many possible mobility characteristics. To evaluate protocols, it is inadequate to use only one model. Various models that span across all different mobility characteristics are needed. When evaluating a single protocol, this protocol is run on various models to see how its performance changes on different models. It is found

In [1], [2], [3] and [4] the difference in opinion we need to work on that and show above discussion leads us to believe that it is important to first understand and evaluate the performance of routing protocols in different mobility scenarios before selecting a protocol for a particular scenario.

II. MOBILITY MODELS

In MANETs, mobile nodes roam around the network area. It is hard to model the actual node mobility in a way that captures real life user mobility patterns. Mobility models are designed to evaluate the performance of ad-hoc networks and characterize the movements of real mobile node in which variation in speed and direction must occur during regular time interval. Therefore, many researchers attempted to design approximate mobility models to resemble real node movements in MANET. Mobility models are generally classified into five categories. They are random mobility models, mobility models with temporal dependency, mobility models with spatial dependency, mobility models with geographic restrictions and hybrid mobility models.

In random mobility models, the nodes move independently by choosing a random direction and speed. In the case of mobility models with temporal dependency, the movement of nodes is affected by their movement history. In the mobility models with spatial dependency, the movement of nodes is correlated in nature. If the mobility model limits the movement of nodes owing to streets or obstacles, then such models fall under mobility models with geographic restriction. In hybrid mobility models, mobility models with spatial dependencies, temporal dependencies and geographic restrictions are integrated.

A. Random Waypoint Mobility Model

The Random Waypoint Model was first proposed by Johnson and Maltz[11]. Soon, it became a 'benchmark' mobility model to evaluate the MANET routing protocols, because of its simplicity and wide availability. In this model, the position of each node is randomly selected within a fixed area and after that moves to the selected position in linear form with random speed. This movement has to stop by a certain period called pause time before starting the next movement.

The pause time is determined by model initialization and its speed is uniformly distributed between [Min Speed, Max Speed]. The Random Waypoint Mobility Model is the most widely used mobility model. Many researchers use it to compare the performance of various mobile ad hoc network routing protocols. This model includes pause times between changes in direction and/or speed. Using the waypoint mobility model, each node starts the simulation by remaining stationary for pause-time seconds. Then, it randomly chooses a destination in the simulation area and moves towards that destination at a speed uniformly chosen between zero and maximum speed. When the node reaches the selected destination, it halts again for pause-time, selects another destination and starts to move towards the new destination.

This process is repeated for the duration of the simulation. In [12], it has been shown that the average speed of a mobile node decays with time. This is because of the fact that low speed nodes spend more time to reach their destinations than high speed nodes. It is also shown that increasing the speed of nodes results in increased network connectivity.

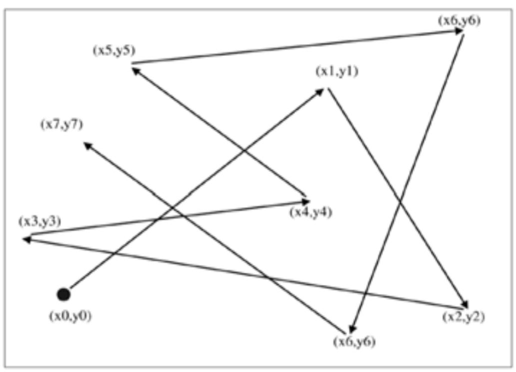


Figure 1: Node movement in the Random Waypoint Model

B. Reference Point Group Mobility Model

The whole group of mobile nodes moves randomly from one location to another. Then, the reference point of each node is determined based on the general movement of this group. Inside of this group, each node can offset some random vector to its predefined reference point. Represents the random motion of a group of mobile nodes as well as the random motion of each individual mobile node within the group.

1) Group movements are based upon the path traveled by a logical center of the group.
2) Individual MNs randomly move about their own pre-defined reference points.
3) The RPGM model uses a group motion vector GM to calculate each MN's new reference point, RP (t +1), at time t +1.
4) The length of RM is uniformly distributed within a specified radius centered at RP (t +1) and its direction is uniformly distributed between 0 and 2π.
5) Both the movement of the logical center for each group, and the random motion of each individual MN within the group are implemented via the Random Waypoint Mobility Model.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue V, May 2018- Available at www.ijraset.com

Individual MNs do not use pause times while the group is moving. Pause times are only used when the group reference point reaches a destination and all group nodes pause for the same period of time.

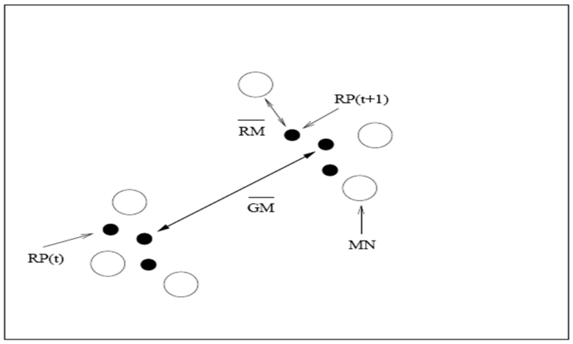


Figure 2: Movement of three nodes using RPGM model

C. Simulation Setup

The Simulation was set up to evaluate the effect of mobility model in performance of MANET routing protocols AODV and OLSR. We use OPNET Modeler version14.5. A Lokmanya Tilak campus network was modeled within an area of 1500m*1500m. The mobile nodes were spread within the area. We take the FTP traffic to analyze the effects on routing protocols. The nodes were wireless LAN mobile nodes with data rate of 11Mbps. Simulation time of each scenario was 300secs. We collected DES (global discrete event statistics) on each protocol. We examined average statistics of the delay, throughput and Routing Overhead for the MANET. Our key goal of our simulation was to evaluate the effect of mobility model in performance of MANET routing protocols.

In Table 1 we describe the simulation parameters that are used in this simulation in order to evaluate and compare the performance of selected routing protocols (AODV and OLSR) over a MANET network. Each and every scenario there is different numbers of mobile nodes. In the ad hoc network, we have simulated the following scenarios:

Node Speed with Random Way Point Mobility. Node Speed with Reference Point Group Mobility.

Simulation Parameters	
Examined Protocols	AODV and OLSR
Number of Nodes	40
Types of Nodes	Mobile
Simulation Area	1500*1500m
Simulation Time	300 seconds
Mobility	10,15, 20, 25 m/s
Pause Time	5 secs
Performance Parameters	Delay, Throughput and Routing Overhead
Traffic type	FTP
Mobility model used	Random Waypoint, Reference Point Group Mobility Model
Data Type	Constant Bit Rate (CBR)
Packet Size	512 bytes

Table 1: Simulation parameters

D. Performance Metrics

1) *Delay:* It is the time that a packet takes to go across the network. This time is expressed in sec. Hence all the delays in the network are called packet end-to-end delay, like buffer queues and transmission time. Mathematically it can be shown as equation

dend-end = N [dtrans + dprop + dproc]

Where, dend-end= End to end delay
dtrans = Transmission delay
dprop = Propagating delay
dproc = Processing delay

2) *Throughput:* It is the ratio of the total data reaches at the receiver from the sender, the time it takes by the receiver to receive the last message is called as throughput. Throughput is expressed as bytes or bits per sec (byte/sec or bit/sec). A high throughput is absolute choice in every network. Throughput can be represented mathematically as in equation;

$$\frac{\text{Number of delivered packet} * \text{Packet size} * 8}{\text{Total duration of simulation}}$$

Routing Overhead: Ad hoc networks are designed to be scalable. As the network grows, various routing protocols perform differently. The amount of routing traffic increases as the network grows. An important measure of the scalability of the protocol, and thus the network, is its routing overhead.

3)Results Analysis: Simulation Environment: We analyze and discuss the results of simulations we done. We begin the analysis of AODV and OLSR protocols by parameters such as delay, throughput and Routing Overhead. The results obtained in the form of graphs. Here in first scenario we used 40 mobile nodes and one fixed wlan server. The network size is of 1500*1500 meters. After that IPv4 addressing was assigned to all the nodes. All the settings must be done according to the requirement. The scenario is shown in Table 1. The protocols such as AODV OLSR are tested against parameters i.e. delay, throughput, Routing Overhead.

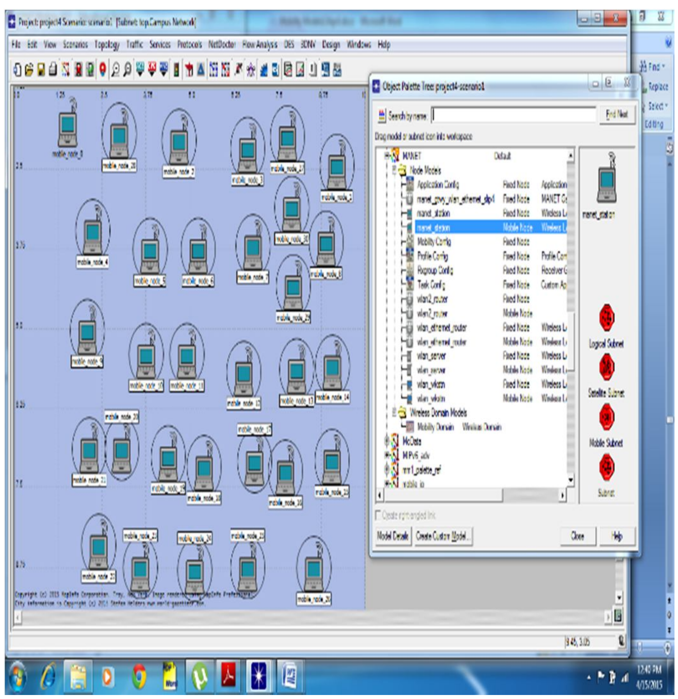


Figure 3: Simulation setup

E. Evaluation of Random Way Point Mobility Model with Varied Node Speed

1) *Average Delay:* Average end to end delay is the time a data packet takes in traversing from the time it is sent by the source node till the point it is received at the destination node. This metric is a measure of how efficient the underlying routing algorithm is, because primarily the delay depends upon optimality of path chosen, the delay experienced at the interface queues and delay caused by the retransmissions at the physical layer due to collisions.

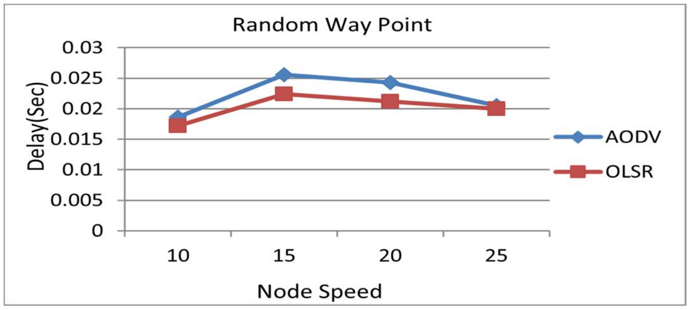


Figure 4: Average Delay with respect to nodes density in Random Way Point Mobility Model

The figure 4 shows the delay of AODV and OLSR protocol with respect to number of nodes. To analyze the delay of AODV and OLSR protocol against varying speed of nodes from 10, 15, 20 and 25 m/s in Random Way Point Mobility model. Above graph shows that when speed increase from 10 to 15 delay is increased but when speed goes 20, 25 it was decreased with both protocols.

2) *Throughput:* Throughput is the time the total size of useful packets that received at all the destination nodes. It is the total number of bits (in bits/sec) forwarded from wireless LAN layers to higher layers in all WLAN nodes of the network.

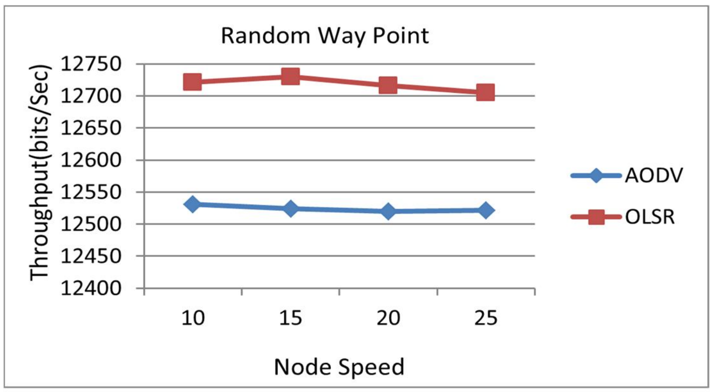


Figure 5: Throughput with respect to nodes density in Random Way Point Mobility Model

The figure 5 shows the throughput of AODV and OLSR protocol with respect to speed of nodes. To analyze the delay of AODV and OLSR protocol against varying speed of nodes from 10, 15, 20 and 25 m/s in Random Way Point Mobility model. OLSR had a higher throughput when the nodes were moving at lower speed in the network whereas it had lower throughput at higher speed in the networks. AODV had a consistent throughput at both speeds.

3) *Routing Overhead:* The total number of routing packets transmitted during the simulation. For packets sent over multiple hops, each transmission of the packet (each hop) counts as one transmission. Routing packets are those that are originated by the routing protocol and do not also include user data.

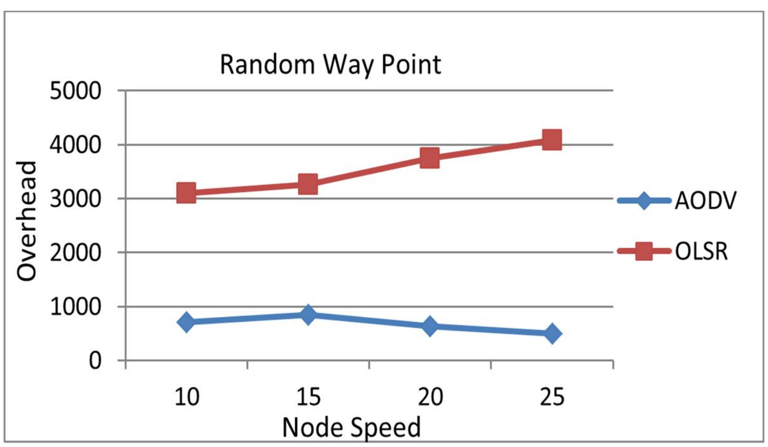


Figure 6: Routing Overhead with respect to nodes density in Random Way Point Mobility Model

The figure 6 shows the routing overhead of AODV and OLSR protocol with respect to speed of nodes. To analyze the delay of AODV and OLSR protocol against varying speed of nodes from 10, 15, 20 and 25 m/s in Random Way Point Mobility model. OLSR had a slightly higher routing overhead when the nodes were moving at lower speed in the network whereas it had higher overhead at higher speed. It is concluded from the observations that AODV performs better in networks with relatively higher node speed. AODV had a consistent decrease in overhead with increase in node speed.

F. Evaluation of Reference Point Group Mobility Model

1) *Average Delay:* The packet end-to-end delay is the time of generation of a packet by the source up to the destination reception. So this is the time that a packet takes to go across the network. This time is expressed in sec. Hence all the delays in the network are called packet end-to-end delay. Sometimes this delay can be called as latency; it has the same meaning as delay.

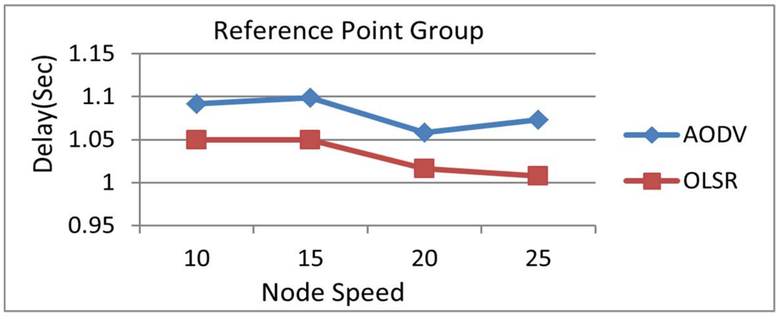


Figure 7: Average Delay with respect to nodes density in Reference Point Group Mobility Model

The figure 7 shows the delay of AODV and OLSR protocol with respect to speed of nodes. To analyze the delay of AODV and OLSR protocol against varying speed of nodes from 10, 15, 20 and 25 m/s in Reference Point Group Mobility model. Above graph shows that when speed increase from 10 to 15 delay is slightly increased but when speed goes from 20 to 25 it was decreased in OLSR and increased in AODV protocols.

2) *Throughput:* Throughput is the time the total size of useful packets that received at all the destination nodes. It is the total number of bits (in bits/sec) forwarded from wireless LAN layers to higher layers in all WLAN nodes of the network.

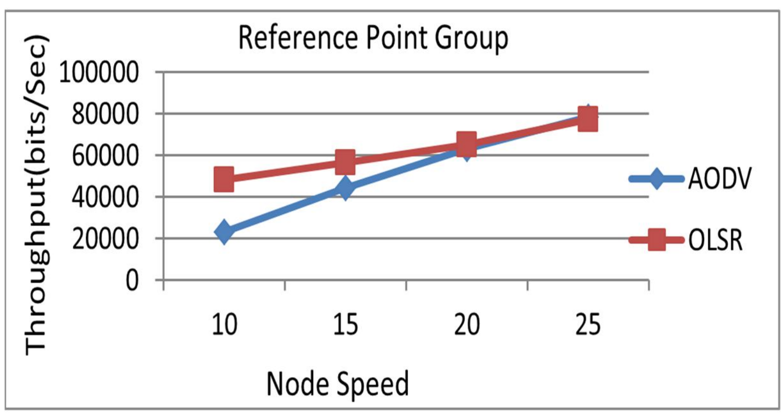


Figure 8: Throughput with respect to nodes density in Reference Point Group Mobility Model

The figure 8 shows the throughput of AODV and OLSR protocol with respect to speed of nodes. To analyze the delay of AODV and OLSR protocol against varying speed of nodes from 10, 15, 20 and 25 m/s in Reference Point Group Mobility model. OLSR had a higher throughput when the nodes were moving at lower speed in the network and increase throughput at higher speed in the networks. AODV had a consistent increased throughput with increase in nodes speeds.

a) *Routing Overhead:* The total number of routing packets transmitted during the simulation. For packets sent over multiple hops, each transmission of the packet (each hop) counts as one transmission. Routing packets are those that are originated by therouting protocol and do not also include user data.

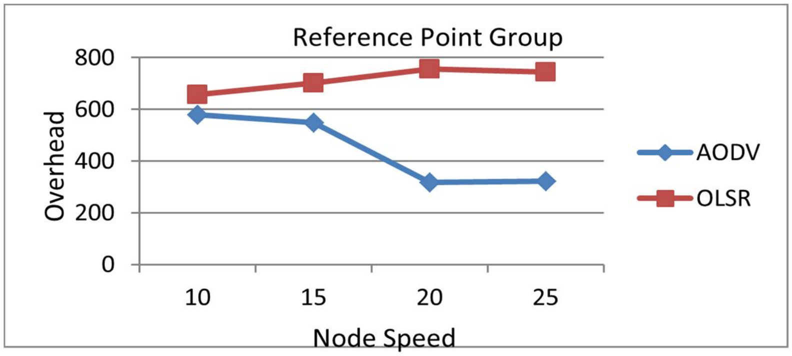


Figure 9: Fig. 9 Routing Overhead with respect to nodes density in Random Point Group Mobility Model

The figure 9 shows the routing overhead of AODV and OLSR protocol with respect to speed of nodes. To analyze the delay of AODV and OLSR protocol against varying speed of nodes from 10, 15, 20 and 25 m/s in Reference Point Group Mobility model. OLSR had a higher routing overhead with higher node speed in the network. AODV had a consistent decrease in overhead with increase in node speed.

III. CONCLUSION

Table. 2 Comparison of Mobility with Matrices

Mobility	Protocol	Average Delay	Throughput	Routing Overhead
RWP	AODV`	Low	Avg	Low
	OLSR	Low	Low	High
RPGM	AODV`	Avg.	High	Low
	OLSR	Low	High	High

In this Paper performance evaluation of various mobility models with respect to routing protocols from reactive category Ad-hoc On-demand Distance Vector (AODV), from proactive category Optimized Link State Routing (OLSR) with different performance metrics is evaluated using OPNET simulator under the fix traffic size in FTP. In this work, a number of simulation experiments are performed by using OPNET simulator to evaluate the performance of mobility models (Random waypoint mobility and Reference Point Group mobility model) is used as pattern of mobility. As performance metrics average throughput, average network load and average delay are examined in different number of nodes. In the first part of simulation the number of nodes is varied from 40 to 100 with file size 512 bytes and node speed 10 m/s.

It has been observed that the mobility pattern influences the performance of MANET routing protocols. It has been observed that OLSR achieve the highest throughput and least overhead with RWPM when compared to RPG mobility models. This is because with similar relative speed, between random waypoint and RPGM, high degree of spatial dependence for RPGM means higher link duration and correspondingly higher path duration, which in turn will result in higher throughput and lower routing overhead. From the results, it is analyzed that AODV has better throughput and less delay in RPGM model when compared to RWP model. Random Way Point Model outperforms than Reference Point Group Mobility model.

The average values are taken from the graphs. From the above given graph it is shown clearly that the OLSR gives the outstanding results in delay and throughput in RWP model in MANET according to our simulation results but it is not necessary that OLSR with Random waypoint mobility model performs always better in all the networks, its performance may vary by varying the network.

REFERENCES

[1] S. Ali, and A. Ali, “Performance Analysis of AODV, DSR and OLSR in MANET”, Master Thesis, M.10:04, COM/School of Computing, BTH, 2010. [Online] Availableat:http://www.bth.se/fou/cuppsats.nsf/all/252aefb4936b9db3c12576b20053b8a5/$file/Performa

[2] M.K. J. Kumara and R.S. Rajesh, “Performance Analysis of MANET Routing Protocols in different Mobility Models” IJCSNS International Journal of Computer Science and Network 22 Security, VOL.9 No.2, February2009.

[3] J.-W. Chen, Y.-Z. Lee, D. Maniezzo, and M. Gerla, “Performance comparison of aodv and oflsr in wireless mesh networks," in IFIP MEDHOCNET, Lipari,Italy, June 2006.

[4] S. Azad, A. Rahman and F. Anwar, “A Performance Comparison of Proactive and Reactive Routing Protocols of Mobile Ad-hoc NETwork (MANET),” Journal of Engineering and Applied Sciences 2(5), 2007, pp 891-896

[5] M. Gupta and S. Kaushik, “Performance Comparison Study of AODV, OLSR and TORA Routing Protocols for MANETS”, International Journal Of Computational Engineering Research, vol. 2, no. 3, pp. 704-711, 2012.

[6] R. Kumar, P. Singh, “Performance analysis of AODV, TORA, OLSR and DSDV Routing Protocols using NS2 Simulation”, International Journal of Innovative Research in Science, Engineering and Technology, vol. 2, no. 8, pp. 3857-3864, 2013.6

[7] R. Rohankar, R. Bhatia, V. Shrivastava and D. K. Sharma, “Performance Analysis of Various Routing Protocols for Random Mobility Models of Ad hoc Networks”, IEEE International Conference on Recent Advances in Information Technology, pp. 331-335 2012.

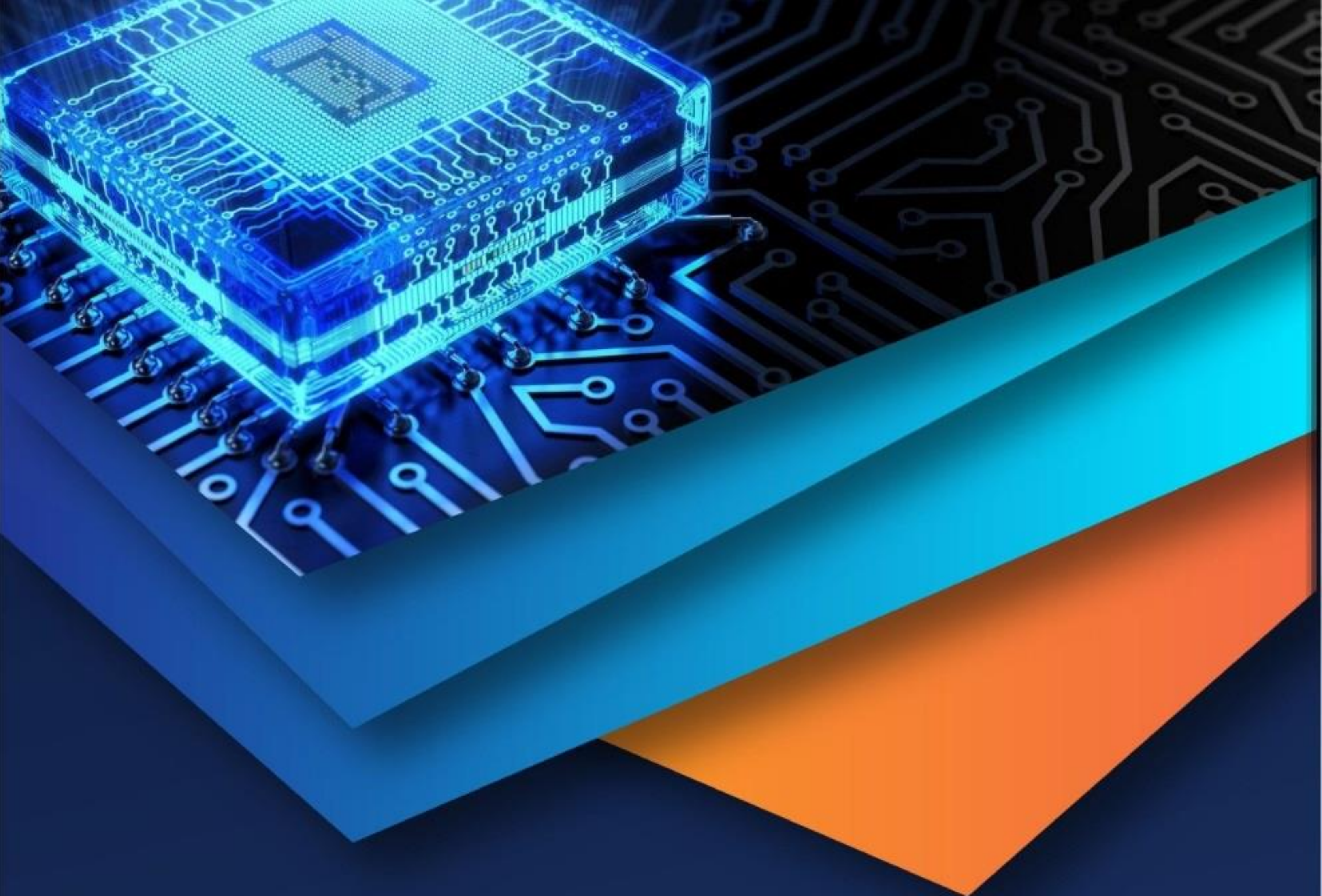
[8] Kuppusamy P., Thirunavukkarasu K., Kalavathi B., A study and Comparison of OLSR, AODV, and TORA Routing Protocols in Ad Hoc Networks. 2011 IEEE.

[9] N Vetrivelan, and A.V. Reddy, “Performance Analysis of Three Routing Protocols for Varying MANET Size” Proceedings of International M. Conference of Eng. & Computer Scientists, Hong Kong, Vol. II IMECS 2008.

[10] A. Shrestha, and F. Tekiner, “Investigation of MANET routing protocols for mobility and scalability” Int. Conference on Parallel and Distributed Computing, Applications and Technologies, Higashi Hiroshima, 2009.

[11] J. Broch, D. A. Maltz, D. B. Johnson, Y.-C. Hu, and J. Jetcheva, A performance comparison of multi-hop wireless ad hoc network routing protocols, in Proceedings of the Fourth Annual ACM/IEEE International Conference on Mobile Computing and Networking(Mobicom98), ACM, October 1998.

[12] Manijeh Keshtgary and Vahide Babaiyan in “Performance Evaluation of Reactive, Proactive and Hybrid Routing Protocols in MANET” International Journal on Computer Science and Engineering (IJCSE) vol. 4, pp. 248-254 Feb 2012.



10.22214/IJRASET

INDEX COPERNICUS 45.98

IMPACT FACTOR: 7.129

TOGETHER WE REACH THE GOAL

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY