Impact of Mobility Speed on Different Traffic Patterns in MANET

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Abstract – In this paper we have implemented the performance of three different routing protocols Ad-Hoc On-Demand Distance Vector Routing Protocol (AODV), Dynamic Source Routing Protocol (DSR) and Wireless routing protocol (WRP) of Mobile Ad-hoc Network based upon two different Mobility Models: Random Waypoint Model (RWP) and Reference Point Group Mobility Model (RPGM) with different Traffic Patterns. We have considered CBR and FTP Traffic Pattern. The implementation have been carried out by evaluating the value of Throughput, Average end to end delay and Packet Delivery Ratio (PDR). From the result we observe that AODV routing Protocol is better in all metrics, CBR traffic pattern and RPGM model is gives optimum result.

Index Terms – AODV, DSR, PDR, RWP, RPGM.

1. INTRODUCTION

In general, a Mobile Ad hoc Networks (MANET) [1, 2] is a collection of wireless nodes communicating with each other in the absence of any infrastructure. Due to the availability of small and inexpensive wireless communicating devices, the MANET research field has attracted a lot of attention from academia and industry in the recent years. In the near future, MANETs could potentially be used in various applications such as mobile classrooms, battlefield communication and disaster relief applications.

To thoroughly and systematically study a new Mobile Ad hoc Network protocol, it is important to simulate this protocol and evaluate its protocol performance. Protocol simulation has several key parameters, including mobility model and communicating traffic pattern, among others. In this chapter and the next chapter we focus on the analysis and modeling of mobility models. We are also interested in studying the impact of mobility on the performance of MANET routing protocols. We present a survey of the status, limitations and research challenges of mobility modeling in this chapter.

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. For example, the nodes in Random Waypoint model behave quite differently as compared to nodes moving in groups [3]. It is not appropriate to evaluate the applications where nodes tend to move together using Random Waypoint model. Therefore, there is a real need for developing a deeper understanding of mobility models and their impact on protocol performance.

One intuitive method to create realistic mobility patterns would be to construct trace-based mobility models, in which accurate information about the mobility traces of users could be provided. However, since MANETs have not been implemented and deployed on a wide scale, obtaining real mobility traces becomes a major challenge. Therefore, various researchers proposed different kinds of mobility models, attempting to capture various characteristics of mobility and represent mobility in a somewhat 'realistic' fashion. Much of the current research has focused on the so-called synthetic mobility models [3] that are not trace-driven.

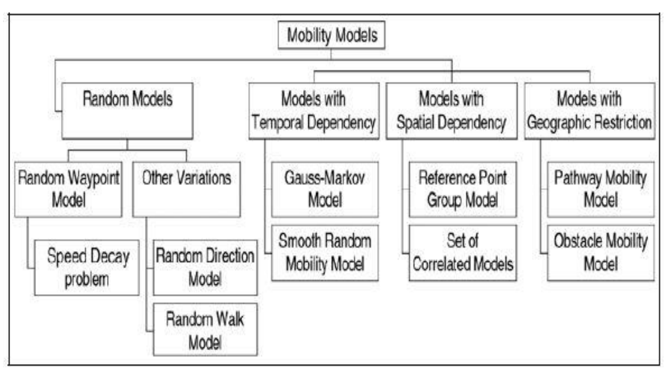

Fig.1. The categories of mobility models in Mobile Ad hoc Network

In Fig.1 we provide a categorization for various mobility models [4] into several classes based on their specific mobility characteristics. For some mobility models, the movement of a mobile node is likely to be affected by its movement history. We refer to this type of mobility model as mobility model with temporal dependency. In some mobility scenarios, the mobile nodes tend to travel in a correlated manner. We refer to such models as mobility models with spatial dependency. Another class is the mobility model with geographic restriction, where the movement of nodes is bounded by streets, freeways or obstacles.

2. MOBILITY MODELS

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.

There are various types of mobility model but in this work we have considered only two models i.e.:

2.1 Random Waypoint

The Random Waypoint model is the most commonly used mobility model in research community. 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 allowable velocity for every mobile node. After reaching the destination, the node stops for a duration defined by the 'pause time' parameter. After this duration, it again chooses a random destination and repeats the whole process until the simulation ends. Figures 2-3 illustrate examples of a topography showing the movement of nodes for Random Mobility Model.

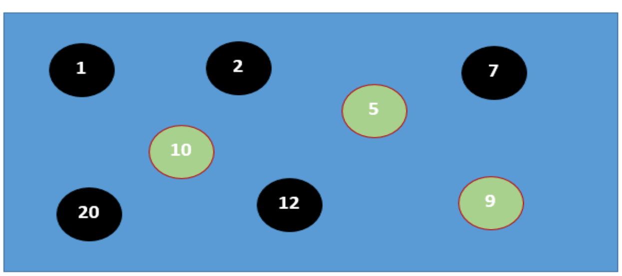

Fig. 2. Topography showing Random mobility model

2.2 Reference Point Group Mobility (RPGM)

Reference point group mobility can be used in military battlefield communication. Here each group has a logical center (group leader) that determines the group's motion behavior. Initially each member of the group is uniformly distributed in the neighborhood of the group leader. Subsequently, at each instant, every node has speed and direction that is derived by randomly deviating from that of the group leader. Given below is example topography showing the movement of nodes for Reference Point Group Mobility Model? The scenario contains various nodes with Node 1 and Node 9 as group leaders.

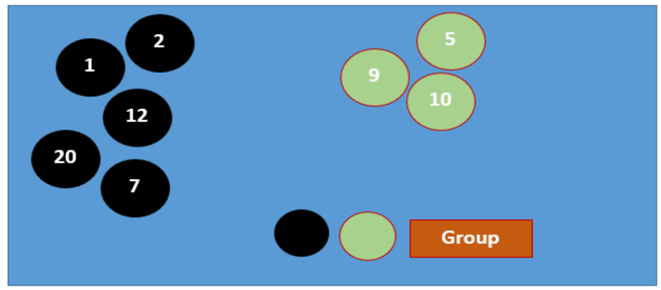

Fig. 3. Topography showing Reference point group mobility

3. DIFFERENT TRAFFIC PATTERNS

3.1 Constant Bit Rate (CBR) Traffic Pattern

It is the most popular traffic source in network simulation [5]. In this traffic, the data rate remains constant during the packet transmission. It does not accommodate the specific features of multimedia applications and not useful for simulation of real time multimedia traffic generated on demand and video-conferencing services.

CBR simulates a constant bit rate generator. In order to use CBR, the following format is needed:

CBR <src> <dest> <items to send> <item size> <interval> <start time> <end time>

Where <src> is the client node. <dest> is the server node. <items to send> is how many application layer items to send. <item size> is size of each application layer item. <interval> is the interdeparture time between the application layer items. <start time> is when to start CBR during the simulation. <end time> is when to terminate CBR during the simulation.

EXAMPLE:

a) CBR 0 1 10 1460 1S 0S 600S

Node 0 sends node 1 ten items of 1460B each at the start of the simulation up to 600 seconds into the simulation. The interdeparture time for each item is 1 second. If the ten items are sent before 600 seconds elapsed, no other items are sent.

b) CBR 0 1 0 1460 1S 0S 600S

Node 0 continuously sends node 1 items of 1460B each at the start of the simulation up to 600 seconds into the simulation. The interdeparture time for each item is 1 second.

c) CBR 0 1 0 1460 1S 0S 0S

Node 0 continuously sends node 1 items of 1460B each at the start of the simulation up to the end of the simulation. The interdeparture time for each item is 1 second.

3.2 FTP Traffic Pattern

FTP uses tcplib to simulate the file transfer protocol. In order to use FTP, the following format is needed:

FTP <src> <dest> <items to send> <start time>

Where <src> is the client node. <dest> is the server node. <items to send> is how many application layer items to send. <start time> is when to start FTP during the simulation.

EXAMPLE:

a) FTP 0 1 10 0S

Node 0 sends node 1 ten items at the start of the simulation, with the size of each item randomly determined by tcplib.

b) FTP 0 1 0 100S

Node 0 sends node 1 the number of items randomly picked by tcplib after 100 seconds into the simulation. The size of each item is also randomly determined by tcplib.

4. SIMULATION RESULTS

To analyses and simulate the different scenarios for comparison, the Glomosim network simulator is being used. We have taken 25 mobile nodes moving in an area of 1250m × 1250m for period of 500sec. This section presents analysis of the performance metrics under various traffic patterns; we have used End-to-End Delay, Packet Delivery Ratio (PDR) [6] and Throughput [7]. For this firstly the scenario is created then after simulation the results are analyses from the analyses option. Simulation parameter is shown in table 1.

Table 1. Parameters for simulation evaluation

Parameter	Value
Protocols	AODV, DSR and WRP
Traffic Type	CBR, FTP
Simulation Duration	500 seconds
Packet Size	512 bytes
Pause Time	40 sec
Number of Nodes	25
TERRAI-DIMENSIONS	12500 * 1250
Mobility model	Random way point, RPGM

CASE 1 – Impact of RWP Mobility Model

In order to compare AODV, DSR & WRP on the basis of mobility, random waypoint mobility model is selected for a scenario having 25 nodes have been used.

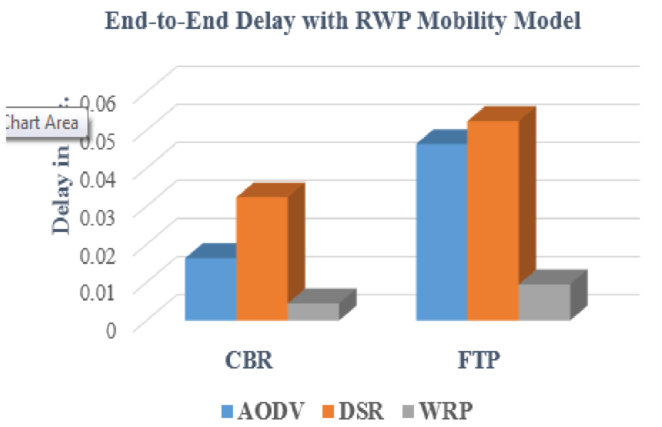

Fig 4. End to End Delay vs. Different Traffic Pattern for RWP Model

Figure 4 shows the graph of end to end delay with different traffic pattern for Random way point mobility model. Graph shows that WRP has minimum delay in both traffic pattern, DSR has maximum delay and CBR traffic pattern has minimum delay in comparison to FTP traffic pattern.

Figure 5 shows the graph of packet delivery ratio with different traffic pattern for Random way point mobility model. Graph shows that AODV has maximum PDR in both traffic pattern, DSR has minimum PDR and CBR traffic pattern has maximum PDR in comparison to FTP traffic pattern.

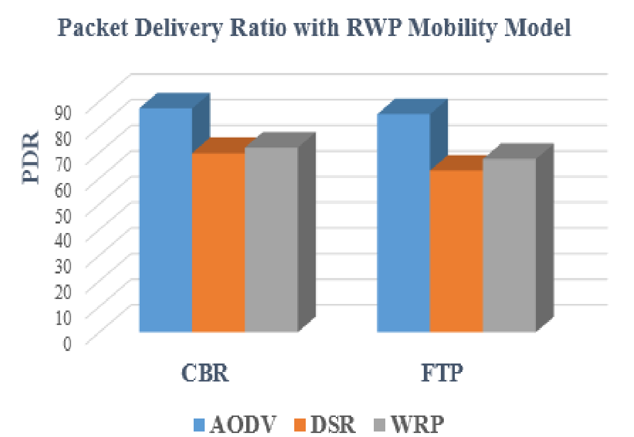

Fig 5. Packet Delivery Ratio vs. Different Traffic Pattern for RWP Model

Figure 6 shows the graph of throughput with different traffic pattern for Random way point mobility model. Graph shows that AODV has maximum throughput in both traffic pattern, DSR has minimum throughput and CBR traffic pattern has maximum throughput in comparison to FTP traffic pattern.

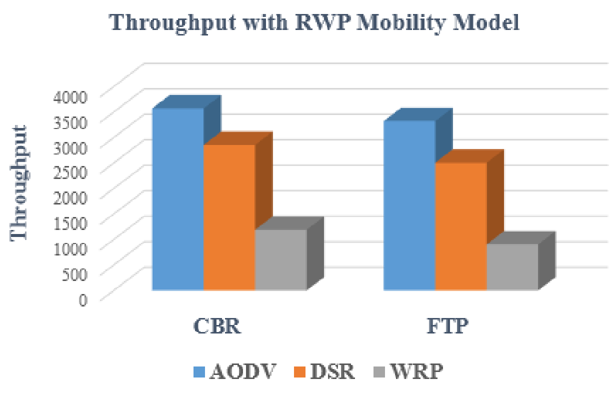

Fig 6. Throughput vs. Different Traffic Pattern for RWP Model

CASE 2 – Impact of RPGM Mobility Model

In order to compare AODV, DSR & WRP on the basis of mobility model, in this scheme reference point group mobility model is selected for a scenario having 25 nodes have been used.

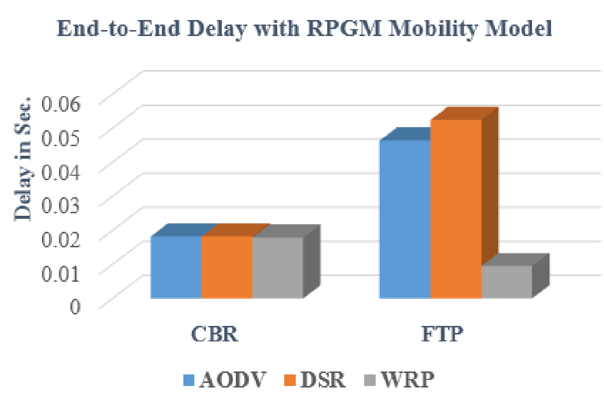

Fig 7. End to End Delay vs. Different Traffic Pattern for RPGM Model

From the graph of end to end delay with different traffic pattern for Reference point group mobility model shown in the fig 7, it is seen that WRP has minimum delay in both traffic pattern, DSR has maximum delay and CBR traffic pattern has minimum delay in comparison to FTP traffic pattern.

From the graph of packet delivery ratio different traffic pattern for Reference point group mobility model shown in the fig 8, it is seen that AODV has maximum PDR in both traffic pattern, WRP has minimum PDR and CBR traffic pattern has maximum PDR in comparison to FTP traffic pattern.

Figure 9 shows the graph of throughput with different traffic pattern for Reference point group mobility model. Graph shows that AODV has maximum throughput in both traffic pattern, WRP has minimum throughput and CBR traffic pattern has maximum throughput in comparison to FTP traffic pattern.

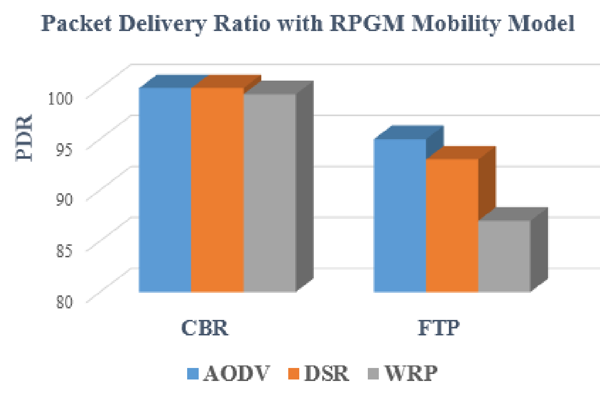

Fig 8. Packet Delivery Ratio vs. Different Traffic Pattern for RPGM Model

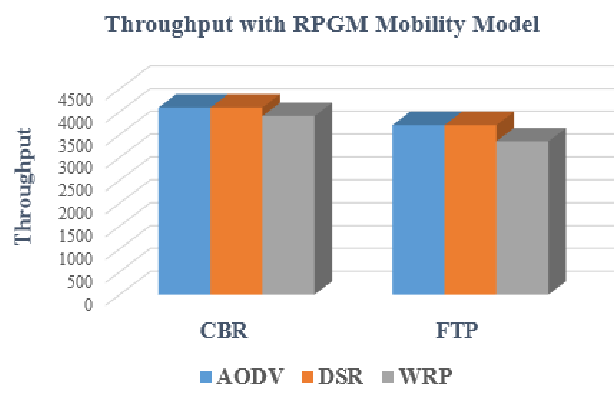

Fig 9. Throughput vs. Different Traffic Pattern for RPGM Model

5. CONCLUSION

In this paper, analysis of AODV, DSR & WRP routing protocols is done to understand that which one performs well in which set of conditions. Focus is mainly done on the network parameters like packet delivery ratio, end to end delay and throughput. By changing the mobility model with different traffic patterns. WRP has minimum delay in both traffic pattern and both mobility model while DSR has maximum delay in both models and CBR traffic pattern has minimum delay and random way point mobility model has minimum delay. AODV has maximum PDR in both CBR and FTP traffic patterns and RWP and RPGM mobility model. RPGM model has higher PDR in comparison to RWP. And DSR has minimum PDR in RWP model while WRP in RPGM model in comparison to AODV. AODV has maximum throughput in both traffic pattern while DSR has minimum throughput in RWP model and WRP has minimum throughput in RPGM model. CBR has maximum throughput in comparison to FTP pattern. And RPGM model has maximum throughput.

In future work we can use different routing protocols, different traffic pattern like FTP/GENRIC, TELNET, HTTP and so on and different mobility models like Freeway Mobility model, Manhattan mobility model etc. We can use other performance metrics.

REFERENCES

[1] Shweta Tripathi, Ajay Kumar, Shailesh Kumar Patel, "A Study of Mobility Speed on Different Traffic Patterns in MANET" in International Journal of Emerging Technologies in Engineering Research (IJETER) Volume 4, Issue 5, May (2016), pp. 117-120.

[2] Mittal, Poonam, Sanjay Batra, and C. K. Nagpal. "Implementation of a novel protocol for Coordination of nodes in Manet." International Journal of Computer Networks and Applications 2.2 (2015): 99-105.

[3] Harpal, Sandeep Kaushal, Gursharan Singh, "Performance Evaluation of Mobility Speed on Different Traffic Patterns in MANET" in International Journal of Advanced Research in Computer Science and Software Engineering in Volume 4, Issue 10, October 2014 pp. 702-706.

[4] Arindrajit Pal, Jyoti Prakash Singh, Paramartha Dutta, "The Effect of speed variation on different Traffic Patterns in Mobile Ad Hoc Network" Published by Elsevier Ltd. Selection and/or peer-review under responsibility of C3IT. Procedia Technology 4 2012 pp. 743 – 748 doi:10.1016/jprotcy.2012.05.121.

[5] Malarkodi, P. Gopal B. Venkataramani, "Performance Evaluation of Adhoc Networks with Different Multicast Routing Protocols and Mobility Models", International Conference on Advances in Recent Technologies in Communication and Computing, pp.81-84, 2009.

[6] Bhavyesh Divecha, Ajith Abraham, et. al., "Impact of Node Mobility on MANET Routing Protocols Models" IJNC (International journal of Network and Communication) Vol.5, No.2, pp.121-131, Dec 2011.

[7] A. Al-Maashri, M. Ould-Khaoua, Performance analysis of Manet Routing protocols in the presence of self-similar traffic, in: 31st IEEE Conference on Local Computer Networks, Tampa, Florida, USA, 2006, pp. 811–818.