Movement Evaluation of Mobility Models in Ad Hoc Networks

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***Abstract:*-Mobility is a normal behavior of Ad Hoc networks. A realistic simulation of user movement in Ad Hoc Network is an important to the network act. The difficult movement pattern of nodes is important in the study of Ad hoc Networks. As the existing mobility models cannot realistically model the recognized movement patterns of node and characteristics of node in any complex area scenarios, this manuscript proposes a personal area mobility model that realistically represents the movements of nodes in a personal area scenario. The plan of this study is to calculate the performance of different Mobility models for Ad Hoc Net work in realistic environments using the available open-source tools for simulating mobile networks. The routing protocols (AODV, DSR, DSDV), mobility models (Random Way Point (RWP), Tactical Indoor Mobility Model (TIMM)) and other aspects are explained and discussed in order to know how to use them properly to model real-life conditions. NS-2.34 and Bonnmotion-2.0 were used to create the networks, services and environment personality in common.**

In this manuscript we have used to different mobility model to analyze the effect of different mobility pattern in realistic environment such as campus, building, Shopping mall environment to get a realistic simulation. The routing protocol, mobility models and other aspects are explained and discussed in order to know how to use them properly to model real-life conditions. NS-2.34 and Bonnmotion-2.0 were used to create the networks, services and environment personality in common.Therefore, by using mobility a model, this is an important aspect in enhancing the self-confidence in the simulation result of the networks. The results show that realistic Mobility Models better the available mobility model for any site situation such as Shopping mall etc.

Keywords
Ad Hoc Network, Mobility models, Mobility patterns, ns 2.34, Performance parameters, Boonmotion[2.0].

1. INTRODUCTION

We An Ad Hoc Network to construct a self-configurable network without existing communication infrastructure; e.g. are search and rescue operations, military deployment in unfriendly environment, and several types of operations [7, 9, 10]. This instruction Individual mobility has been widely studied in many areas like urban planning, traffic forecasting and avoiding the spread of biological and mobile viruses [8, 13,15]. It's also an essential topic used to improve the Performance of wireless Ad Hoc network. Mobility is a natural character of Ad Hoc networks. A realistic simulation of user movement in Ad Hoc Network is very important to the network performance.

The frequently used mobility model is the Random Way point model. In this model, every node selects a random point in the simulation area as its destination, and a speed V from an input range [V_{min}, V_{max}]. The node then moves to its destination at its selected speed. When the node reaches its destination, it rests for a few silence times. At the end of this gap times, it selects a fresh destination and velocity and resumes movement. The properties of the random waypoint model have been extensively studied [1, 2 ,4,5]. One of the interesting results of these studies addresses the node spatial distribution of the random waypoint model. It is exposed that, due to the uniqueness of the model, the application of nodes follows a cyclical pattern through the lifetime of the network. The nodes have a tendency to assemble in the middle of the simulation area, resulting in non-uniform network density. The mobility model is the nodes movement, is the first step to perform mobility management. Different mobility models have different focuses and different application scenarios [1, 2, 3]. Moreover random mobility models, to get enhanced performance, some emerging mobility research papers have modified a method to organize the movement of a small part of elected nodes and develop this movement to improve the network's overall performance. Mobility pattern is a major factor that affects the performance of Ad Hoc Network and in turn it will affect the result obtained in the simulation of mobile network. Mobility in most Ad Hoc network simulation lack realism and do not reflect the user's movement behavior in such a place. Despite the fact that earlier models are credited with ease of understanding and implementation. They are often based on theoretical models rather than real world observation. Mobility pattern such as Random Way Point are not based on realistic movement behavior motivated by activity and path choice.

Some of the aforementioned models assume scenarios devoid of obstacles with a random user movement. Other are rather simplistic and do not really depict the movement behavior found in an indoor structure.Alhough, the movement pattern displayed by some models may be a reasonable assumption in outdoor situation, it is not applicable in indoor environment. For example, student on campus will go to place where they want perform an activates, such as attending a lecture or going to the canteen. This Choice influences their movement pattern which is influences the node density on both user mobility, path choice and user density can't be underestimated.

Selection of path on other hand, is determined by obstruction such as staires,ramps and lifts with such a path, for this movement we uses TIMM mobility models for indoor movement. In a realistic mobility model the nodes movement is the first step to perform mobility management. Different mobility models have different focuses and different application scenarios [1, 2, 3]. Moreover random mobility models, to get enhanced performance, some emerging mobility research papers have modified a method to organize the movement of a small part of elected nodes and develop this movement to improve the network's overall performance. Mobility models are required to describe movement behavior on different scales. The most of the researchers resort to adding their own ad hoc mobility models to the traditional wired models. These ad hoc mobility models seldom reflect actual movement patterns. There are a few models for delineating the mobility of Mobile Users.

There are still some common facts that could be used to represent person movement pattern for site. Particular environments in the realistic world are studied. Accordingly, two environment-aware mobility models are introduced and simulated. The Random Waypoint model is used to model the movement in buildings in the simulation area. The TIMM model can be used to construct indoor movement of nodes such as in a Building area In this paper, we discuss various characteristics of individual mobility. Section Three and four discusses simulation results and finally paper is concluded in section five.

2. MOBILITY MODELS USED

In this part the mobility models used in the studies are presented, compared and explained for which situations is more suitable one than another and a combined model of TIMM mobility model and Random Waypoint, the movements of a node switch from one mobility model to another based on its location in the network and has been verify to be a good approximation of human walk in network environments.

In the Random Waypoint mobility model the movement of node environment is usually modeled by radio propagation and interferences phenomena simplifications. The user activities can be captured by his mobility and the travel where the node moves. In this sense, entity and group mobility models have been proposed. In the entity mobility pattern, movements of nodes are independent of the movements of the rest of the nodes that belongs to the same network. On the other hand, in the group mobility models, the travels of dissimilar nodes are associated. One of the most extended individual mobility models is the Random Way Point [17,18].According to this pattern, the nodes of an ad hoc network move along a straight line between two destination points placed in a finite space. In this paper, this gap is normally bi-dimensional and constrained to a rectangular area of dimensions x_{max} and y_{max}. Once a node reaches a destination point, a new one is homogeneously selected from this area. The speed for a movement is also chosen from a uniform distribution in the interval [v_{min}, v_{max}]. Both speeds and waypoints are generated independently of all the earlier destinations and speeds. In addition, the model allows nodes to pause between two successive trips for a certain period of time. This period (Pause Time) is habitually fixed to a constant value. By varying the values of x_{max}, y_{max}, v_{min}, and the pause time, it is possible to control the movement conditions of the simulated scenario [6,7,8,10].Two problems of the Random Way Point mobility model are sharp turn and sudden stop [6]. Sharp turn occurs whenever there is a direction change in the range [7, 8,9]. Sudden stop occurs whenever there is a change of speed that is not relative to the previous speed. These problems can be eliminated by allowing the past speed and direction to effect the upcoming speed and direction.

With the help of, TIMM mobility model can solve these problems to get more realistic movement of mobile nodes. This mobility model was mostly proposed for the movement in campus area, where the buildings are in a planned manner. The mobile nodes move in horizontal or vertical direction on an urban map [10, 11, 12, 18].

Tactical Indoor Mobility Model (TIMM) models the node movement according to a small rule set (Figure 1) with an underling graph representing the building.

In this manuscript, we limit the study to a campus scenario by using a TIMM and RWP mobility model.

3. ANALYZING THE RESULTS

NS-2.34 is an actually absolute network simulator, but it generates complex trace files and do not give the user any tool to extract results from the thousands of code lines generated. Thus, some scripts to examine the outcome were produced with AWK.

3.1 *Performance Parameters:*

Simulations have been carried out by the Network Simulation version 2.34 [4]. Hardware and operating system (ubunto 12.04 LTS) configuration for performing simulations is specified in Table 1. The basic mobility scenario generation tool is BONNMOTION 2.0 [5]. We have generated mobility scenarios for RWP and TIMM using the ns 2.34 are given below, so that they can be incorporated into TCL scripts. Random traffic associates of CBR can be setup between mobile nodes using a traffic-scenario generator script.

For this study, we have used the Chain Models and random waypoint mobility model for the node having pause time of 2± 3 sec. and speed varying between 0-100 m/sec with minimum speed of 5m/s and maximum speed of 20m/s for simulation time of 300Sec. Here the Table .1 Shows the performance parameters.

Parameter	**Value**
Channel type	Wireless channel
Simulator	NS 2 (Version 2.34)
Protocols	AODV,DSDV,DSR
Simulation duration	300s
Number of nodes	20,40,60
Transmission range	250m
Movement Model	Random Waypoint, Tactical Indoor Mobility Model
MAC Layer Protocol	802.11
Pause Time (s)	15 ± 3 s
Maximum speed	25
Minimum speed	0.5
Packet Rate	4 packet/s
Traffic type	CBR(Constant Bit Rate)
Data Payload	512 bytes/packet
Max of CBR connections	10,20,40,60
Environment Size	700m * 700m

Table.1

For each simulation, the position and movements of the nodes are put randomly as well as the traffic between them. BONNMOTION is the responsible for the random properties of the positions and movements of the nodes and for the traffic NS-2.34 random variables are used. Setting the random variables accurately is a key point because if this is done incorrect, some simulations can be connected and we can come up with bad results even if we think we have performed a sufficient amount simulation to describe a general case.

The presentation of routing protocols is using the following important Quality of Services (QoS) metrics:

3.1.1. ***Packet Delivery Ratio (PDR):*** It is the ratio of data packets delivered to the destination to those generated from the sources. It is calculated by dividing the number of packets received by destination through the number packet originated from the source[8,9].

PDF = (Pr /Ps)*100

Where Pr is total Packet received & Ps is the total Packet sent.

3.1.2. *Throughput:*

It is the average number of messages successfully delivered per unit time number of bits delivered per second [6,9,10].

$$\text{Throughput} = \frac{\text{Total Received Packets}}{\text{Total Simulation Time}} \quad \text{(kbits/sec)}$$

Where N is the number of data sources.

3.1.3. *Average End-to-End Delay:* This includes all possible delays caused by buffering during route discovery latency, queuing at the interface queue, retransmission delays at the MAC, and propagation and transfer times. It is defined as the time taken for a data packet to be transmitted across an Ad Hoc from source to destination [8,9,10].

D = (Tr –Ts), Where Tr is receive Time and Ts is sent Time.

4. RESULT ANALYSIS

Here in case of performance analysis we have consider above performance parameters. In Figure1, 2, 3, 4, 5, 6 the simulations are focusing in analyzing the performance on routing overhead, throughput and packet delivery ratio. The results also compared with two mobility models that we had chosen .The result will show the performance for mobility models with respect to protocols that had been selected under different mobility models, which is shown in fig. 1-4.

5.2.1 Average end to end delays:

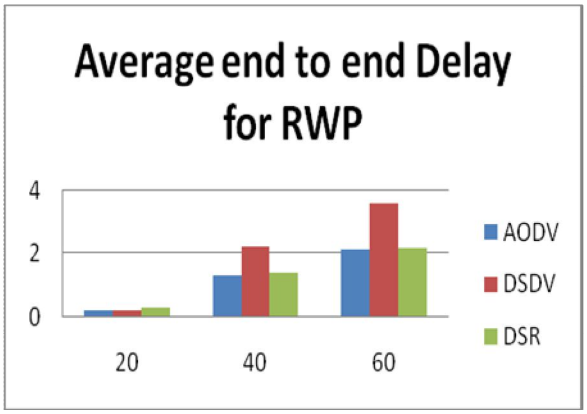

Figure 1: Average End to End Delay Vs Number Nodes for Random Waypint mobility model

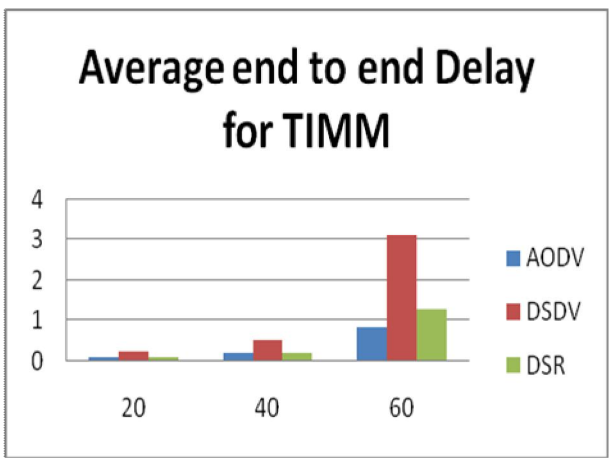

Figure 2: Average End to End Delay Vs Number Nodes for TIMM model

5.2.2. Packet delivery ratio (PDR):

Figure3: Packet Delivery Ratio Vs Number Nodes for Random Waypint Mobility models

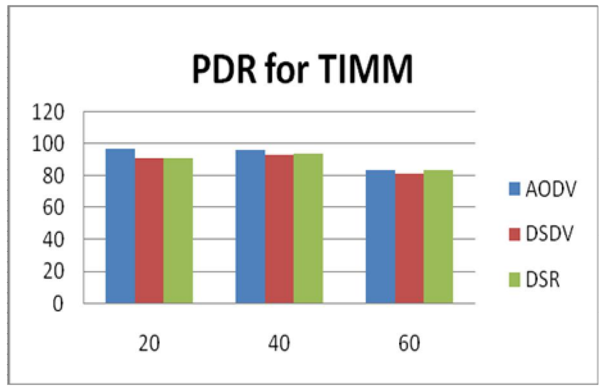

Figure 4: Packet Delivery Ratio Vs Number Nodes for TIMM Mobility models

5.2.3. Throughput:

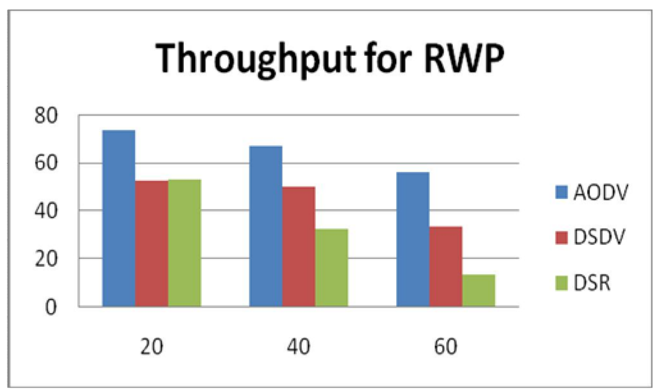

Figure5: Throughput Vs Number of Nodes for Random Waypint mobility models

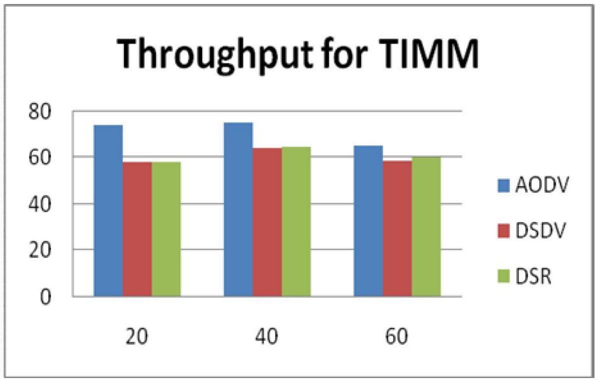

Figure 6: Throughput Vs Number of Nodes for TIMM mobility models

5. CONCLUSION

In this work, we have visualized the application of Mobile Ad-Hoc Routing protocols like DSDV, AODV and DSR for nodes. We have measured Manhattan and Freeway mobility models. The performance of a mobility models can vary significantly with different ad hoc network protocols. The experimental results illustrate the good performance of ad hoc network routing protocol with different mobility models. Per experimental results, the performance of the protocol is really affected by the mobility model. The performance of mobility models should be evaluated with the ad hoc network protocol that most closely matches the expected real-world circumstances. In this paper comparison has been made on three parameters (a) PDR (b) Throughput (c) Average End to End delay. The routing protocols consider for this comparative study are AODV, DSDV and DSR. TIMM mobility model is performed better as compare to Random way mobility model on given parameters for indoor mobility pattern. It has been observed that in comparison of all three models.

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